Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Blast Impact Analysis
Milton Quarry East Extension
Part of Lots 11 and 12, Concession 1
Town of Halton Hills
Regional Municipality of Halton

Submitted to:

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EXECUTIVE SUMMARY

Explotech Engineering Ltd. was retained in September 2020 to provide a Blast Impact Analysis for the proposed Milton Quarry East Extension located on Part of Lots 11 and 12, Concession 1 (former geographic Township of Esquesing), Town of Halton Hills, Regional Municipality of Halton.

Vibration levels assessed in this report are based on the Ministry of the Environment, Conservation, and Parks Model Municipal Noise Control By-law (NPC119) with regard to Guidelines for Blasting in Mines and Quarries. We have assessed the area surrounding the proposed Aggregate Resources Act licence with regard to potential damage from blasting operations and compliance with the aforementioned by-law document.

We have inspected the site and reviewed the available site plans. Explotech Engineering Ltd. is of the opinion that the planned aggregate extraction extension on the site can be carried out safely and within Ministry of the Environment, Conservation, and Parks guidelines as set out in NPC 119 of the By-Law.

Recommendations are included in this report to advocate for blasting operations which are carried out in a safe and productive manner and to suitably manage and mitigate the possibility of damage to any buildings, structures or residences surrounding the property.

EXPLOTECH

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INTRODUCTION

Dufferin Aggregates, a division of CRH Canada Group Inc. (CRH) has applied for a Class A Licence for the property legally described as Part of Lots 11 and 12, Concession 1 (former geographic Township of Esquesing), Town of Halton Hills, Regional Municipality of Halton. The proposed name for the operation is the Milton Quarry East Extension.

This Blast Impact Analysis is based on the Ministry of the Environment, Conservation and Parks (MECP) Model Municipal Noise Control By-law (NPC 119) with regard to guidelines for blasting in mines and quarries. We have additionally assessed the area surrounding the proposed license with regard to potential damage from blasting operations. It is a recommendation of this report that the ongoing vibration monitoring program be continued on the existing licenced site as well as on the proposed Milton Quarry East Extension lands and that this monitoring program be maintained for the duration of all blasting activities to permit timely adjustment to blast parameters as required.

While not specifically required as part of the scope of the Blast Impact Analysis under the Aggregate Resources Act, this report also touches on the topics of flyrock, fish habitat, and residential water wells for general informational purposes only. Exhaustive details related to residential water wells and fish habitat shall be addressed in the hydrogeological report and natural environment report respectively while specific flyrock control is addressed at the operational level given significant influences related to blast design, geology and field accuracy.

Recommendations are included in this report to advocate for blasting operations to be carried out in a safe and productive manner at the Milton Quarry East Extension and to suitably manage and mitigate the possibility of damage to any buildings, structures or residences surrounding the property.

EXISTING CONDITIONS

The current operating licensed area for the Dufferin Aggregates Milton Quarry is operated under two separate licences: The Main and North Quarry (ARA Licence No. 5481), and the Milton Extension Quarry (ARA Licence No. 608621). The Main and North Quarry is described as Part of Lots 7 to 13, Concession 7, Town of Milton, and Part of Lots 8 to 10, Concession 1, Town of Halton Hills. The Milton Extension Quarry is described as Part of Lots 13 and 14, Concession 1, Town of Halton Hills, and Part of Lots 12 to 14, Concession 7, Town of Milton. The quarry area in its entirety is bound by Nassagaweya Sixth Line to the West, 15 Side Road and Nassagaweya Esquesing Townline to the North, Regional Road 25, Dublin Line to the East and Campbellville Road to the South. The lands immediately surrounding the existing and proposed licences are bound by mostly wetlands and woodlots and are sparsely populated.

The proposed Milton Quarry East Extension is located immediately South of the Milton Extension Quarry and will utilize existing quarry infrastructure. The proposed East Extension lands are bound by Regional Road 25 and Dublin Line to the East, and the existing Milton Quarry in the remaining cardinal directions (North, South, and West).

The licenced area for the proposed Milton Quarry East Extension lands encompasses a total area of approximately 30.2HA. The associated extraction area is approximately 15.9HA when allowing for setbacks.

The closest sensitive receptors located to the existing Milton Quarry licence boundary and the proposed Milton East Quarry Extension licence boundaries are listed in Table 1 below as well as on the Sensitive Receptor Overview contained in Appendix A:

Table 1:Sensitive Receptors In the Vicinity of the Milton East Quarry Extension			
Receptor Number	Sensitive Receptor	Straight Line Distance from Milton Quarry Extraction Limit to Receptor (m)	Straight Line Distance from proposed Milton Quarry East Extension Extraction Limit to Receptor (m)
R1	10272 Regional Road 25	1163	1624
R2	10270 Regional Road 25	1371	1763
R3	10162 Regional Road 25	1052	1620
R4	9689 Dublin Line*	409	1599
R5	9640 Dublin Line	390	1809
R6	9606 Dublin Line	447	1897
R7	9346 Dublin Line	998	2641
R8	9315 Tremaine Road	810	2706
R9	9519 Sixth Line Nassagaweya	45	2103
R10	10314 Sixth Line Nassagaweya	212	1364
R11	10350 Sixth Line Nassagaweya	293	1452
R12	10388 Sixth Line Nassagaweya	295	1475
R13	10401 Sixth Line Nassagaweya	90	1274
R14	10449 Sixth Line Nassagaweya	214	1297
R15	10499 Sixth Line Nassagaweya	324	1146
R16	10589 Sixth Line Nassagaweya	691	1575
R17	10580 Nassagaweya-Esquesign Townline	306	1246
R18	10664 Nassagaweya Esquesing Townline	666	1516
R19	10670 Nassagaweya Esquesing Townline	723	1574
R20	10649 Nassagaweya-Esquesign Townline	559	1401
R21	6190 15 Side Road	902	1699
R22	6452 15 Side Road	1022	1736

Table 1:Sensitive Receptors In the Vicinity of the Milton East Quarry Extension			
Receptor Number	**Sensitive Receptor**	**Straight Line Distance from Milton Quarry Extraction Limit to Receptor (m)**	**Straight Line Distance from proposed Milton Quarry East Extension Extraction Limit to Receptor (m)**
R23	6390 15 Side Road	1105	1809
R24	6419 15 Side Road	1216	1929

* Commercial properties or Non-Sensitive Receptors

As noted above in Table 1, all adjacent sensitive receptors are located closer to the existing Milton Quarry operations (Licences 5481 and 608621) then the proposed Milton Quarry East Extension.

PROPOSED AGGREGATE EXTRACTION

The proposed Milton Quarry East Extension operations for Phase 1 will commence as a continuation of the existing Milton Quarry and eliminate the requirement for a sinking cut. Initial blasting will be located approximately 1100m from the closest sensitive receptor, namely R15 (10499 Nassagaweya Sixth Line). Extraction will retreat in a general Site South direction (actual cardinal retreat is Southeast) to a proposed maximum extraction depth of 302.5masl.

Extraction in Phase 2 will commence at the Phase 1 / Phase 2 interface, thereby eliminating the need for a sinking cut. Extraction will retreat in a general Site East direction (actual cardinal retreat Northeast) to a proposed maximum extraction depth of 302.5masl.

As quarry operations advance across the property, the closest sensitive receptors to the extraction perimeter will vary with the governing structures and approximate closest separation distances being as follows:

Northwest corner: R15 - 10499 Sixth Line Nassagaweya – 1146m
Southeast corner: R3 - 10162 Regional Road 25 – 1620m
Southwest corner: R13 - 10401 Nassagaweya Sixth Line – 1274m

Current practice at the Milton Quarry employs between 89mm and 114mm diameter blast holes with a typical load per delay of between 50kg and 210kg per period. Calculations contained within this report suggest blast designs currently being used at the Milton Quarry will remain compliant at the closest adjacent sensitive receptors.

It is a recommendation of this report that all blasts shall, at a minimum, be monitored at the nearest sensitive receptors, or closer, in front and behind any given blast in order to ensure constant compliance with MECP guideline limits and to permit timely adjustment to blast designs as required.

BLAST VIBRATION AND OVERPRESSURE LIMITS

The Ontario MECP guidelines for blasting in quarries are among the most stringent in North America.

Studies by the U.S. Bureau of Mines have shown that normal temperature and humidity changes can cause more damage to residences than blast vibrations and overpressure in the range permitted by the MECP. The limits suggested by the MECP are as follows.

***Vibration*___________** 12.5mm/sec Peak Particle Velocity (PPV)

***Overpressure*_______** 128 dB Peak Sound Pressure Level (PSPL)

The above guidelines apply when blasts are being monitored. It is a recommendation of this report that all blasts at the operation be monitored to quantify and record ground vibration and overpressure levels employing a minimum of two (2) digital seismographs, one installed at the closest sensitive receptor in front of the blast, or closer, and one installed at the closest sensitive receptor behind the blast, or closer.

BLAST MECHANICS AND DERIVATIVES

The detonation of explosives within a borehole results in the development of very high gas and shock pressures. This energy is transmitted to the surrounding rock mass, crushing the rock immediately surrounding the borehole (approximately 1 borehole radius) and permanently distorts the rock to several borehole diameters (5-25, depending on the rock type, prevalence of joint sets, etc).

The intensity of this stress wave decays quickly so that there is no further permanent deformation of the rock mass. The remaining energy from the detonation travels through the unbroken material in the form of a pressure wave or shock front which, although it causes no plastic deformation of the rock mass, is transmitted in the form of vibrations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. As such, for the purposes this report, ground vibration units have been listed in mm/s.

In addition to the ground vibrations, overpressure, or air vibrations are generated through the direct action of the explosive venting through cracks in the rock or through the indirect action of the rock movement. In either case, the result is a pressure wave which travels though the air, measured in decibels (or dB) for the purposes of this report.

VIBRATION AND OVERPRESSURE THEORY

Transmission and decay of vibrations and overpressure can be estimated by the development of attenuation relations. These relations utilize empirical data relating measured velocities at specific separation distances from the vibration source to predict particle velocities at variable distances from the source. While the resultant prediction equations are reliable, divergence of data occurs as a result of a wide variety of variables, most notably site-specific geological conditions and blast geometry and design for ground vibrations and local prevailing climatic conditions for overpressure.

In order to circumvent this scatter and improve confidence in forecast vibration levels, probabilistic and statistical modeling is employed to increase conservatism built into prediction models, usually by the application of 95% confidence lines to attenuation data.

The attenuation relations are not designed to conclusively predict vibrations levels at a specific location as a result of a specific blast design, application of this probabilistic model creates confidence that for any given scaled distance, 95% of the resultant velocities will fall below the calculated 95% regression line.

While the data still provides insight into probable vibration intensities, attenuation relations for overpressure tends to be less reliable and precise than results for ground vibrations. This is due primarily to wider variations in variables outside of the influence of the blast design which impact propagation of the vibrations. Atmospheric factors such as temperature gradients and prevailing winds (refer to Appendix B) as well as local topography can all serve to significantly alter overpressure attenuation characteristics.

Our experience and analysis demonstrates that blast overpressure is greatest when blasting toward receptors, and blast vibrations are greatest when retreating in the direction of the receptor.

GROUND VIBRATION AND OVERPRESSURE ATTENUATION STUDY

A comprehensive network of seismographs was installed by Explotech to measure ground vibration and air overpressure intensities at four (4) blasts conducted in October 2020 at the existing Milton Quarry in Milton, Ontario. Monitor locations were established in linear arrays emanating from the blast site to assess the rate of decay of the ground vibration and overpressure. All ground vibration data was plotted using square root scaling from blast vibration data collected (refer to Appendix C). Overpressure data was plotted employing cube root scaling (refer to Appendix C).

It should again be noted that given the high dependence on local environmental conditions, overpressure prediction is far less reliable as a means of blast control.

VIBRATION LEVELS AT THE NEAREST SENSITIVE RECEPTOR

The most commonly used formula for predicting PPV is known as Bureau of Mines (BOM) prediction formula or Propagation Law. We have used this formula to predict the PPV's at the closest house for the initial operations.

$$PPV = k\left(\frac{d}{\sqrt{w}}\right)^{e}$$

Where, PPV = the calculated peak particle velocity (mm/s)

K, e = site factors

d = distance from receptor (m)

w = maximum explosive charge per delay (kg)

The value of K is variable and is influenced by many factors (i.e. rock type, geology, thickness of overburden, etc.). As such, these site factors are developed empirically through the measurement of vibration characteristics at the specific operations of interest.

Based on the vibration data collected from the October 2020 attenuation study, the values for “e” and “K” have been established at -1.523 and 1290.4 respectively for receptors falling behind the blast at the Milton Quarry site.

For a distance of 1146m (the standoff distance to the closest sensitive receptor for the initial Phase 1 blasting, namely R15 – 10499 Nassagaweya Sixth Line) and a maximum explosive load per delay of 190kg, 114.3mm diameter hole, 18.6m hole deep, 3m surface collar and 1 hole per delay), we can calculate the maximum PPV as follows:

$$PPV = 1290.4\left(\frac{1146}{\sqrt{190}}\right)^{-1.523} = 1.54mm/s$$

As discussed in previous sections of this report, the MECP guideline for blast-induced vibration is 12.5mm/s (0.5in/s). The calculated 95% predicted PPV (based on a standoff distance to the closest sensitive receptor for the initial Phase 1 blasting) would be 1.54mm/s, below the MECP guideline limit. It is understood that adjustments to blast designs are available at the blasters disposal should the monitoring program deem changes necessary.

Similarly, the above equation used to calculate PPV can be reformatted to find an approximation of the distance at which a vibration velocity of 12.5mm/s would occur at a receptor behind the blast if all blasting parameters are kept the same as used in the example above:

$$12.5 = 1290.4\,(\frac{d}{\sqrt{190}})^{-1.523} = 289.5m$$

The above result suggests that design modifications to the above preliminary design would be required once blasting operations encroach to within 289.5m of sensitive receptors surrounding the quarry extraction operations. Given the minimum separation distance to the closest sensitive receptor is in excess of 1km, the above blast design could be utilized over the life of the proposed licence. Furthermore, as a result of the advanced separation distance between blasting operations and sensitive receptors at this particular location, blast designs could be adjusted to employ significantly higher loads per delay in comparison to current designs employed at the existing licences. Vibration data will be continually collected and analyzed as part of the Compliance Monitoring Program as the sensitive receptors are approached in order to confirm the requirement for any design modifications.

Given the separation distances that will be involved with the proposed Milton Quarry East Extension, Table 2 below provides initial guidance on maximum loads per delay based on various separation distances. The following maximum loads per delay were derived from the equation developed through the October 2020 attenuation study and are based on a maximum intensity of 12.5mm/s:

Table 2: Maximum Loads per Delay to Maintain 12.5mm/s at Various Separation Distances

Separation distance between sensitive receptor and closest borehole (meters)	Maximum recommended explosive load per delay (Kilograms)
1500	5100
1400	4440
1300	3830
1200	3250
1100	2740
1000	2260

It is noteworthy that the above values are typically conservative and are intended as a guideline only as the ground vibration attenuation equitation is based on a calculated 95% regression line. Actual loads employed shall be based on the results of the monitoring program in place and adjusted as necessary.

OVERPRESSURE LEVELS AT THE NEAREST SENSITIVE RECEPTOR

It is unusual for overpressure to reach damaging levels, and when it does, the evidence is immediate and obvious in the form of broken windows in the area. However, overpressure remains of interest due to its ability to travel further distances as well as cause audible sounds and excitation in windows and walls.

Air overpressure decays in a known manner in a uniform atmosphere, however, a uniform atmosphere is not a normal condition. As such, air overpressure attenuation is far more variable due to its intimate relationship with environmental influences. Air vibrations decay slower than ground vibrations with an average decay rate of 6dBL for every doubling of distance.

Air overpressure levels are analyzed using cube root scaling based on the following equation:

$$P = k\left(\frac{d}{\sqrt[3]{w}}\right)^{e}$$

Where, P = the peak overpressure level (dB)
K, e = site factors
d = distance from receptor (m)
w = maximum explosive charge per delay (kg)

The value of K and e are variable and are influenced by many factors (i.e. rock type, geology, thickness of overburden, etc.). As such, these site factors are developed empirically through the measurement of overpressure characteristics at the specific operations of interest.

Based on the overpressure data collected from the October 2020 attenuation study, the values for “e” and “K” have been established at -0.123 and 222.3 respectively for receptors falling in front of the blast at the Milton Quarry East Extension site.

As discussed in previous sections, the MECP guideline for blast-induced overpressure is 128dBL. For a distance of 1146m (i.e. the standoff distance to the closest sensitive receptor for the initial Phase 1 blasting, (namely R15 – 10499 Nassagaweya Sixth Line) and a maximum explosive load of 190kg (114.3mm diameter hole, 18.6m hole depth, 3.0m surface collar and 1 hole per delay), we can calculate the maximum overpressure at the nearest receptor in front of the blast as follows:

$$P = 222.3\left(\frac{1146}{\sqrt[3]{190}}\right)^{-0.123} = 115.90\ dB(L)$$

We reiterate that air overpressure attenuation is far more variable due to its intimate relationship with environmental influences and as such, the equation employed is less reliable than that developed for ground vibration. Overpressure monitoring performed on site shall be used to guide blast design as it pertains to the control of blast overpressures.

Similarly, the above equation used to calculate PSPL can be reformatted to find an approximation of the distance at which an overpressure of 128 dB(L) would occur. If all blasting parameters are kept the same as the example above, a distance of 500m from the closest sensitive receptor in front of the blast would have a calculated overpressure of 128dB(L). Once again, the on-site monitoring program will accurately delineate the overpressure intensities and provide guidance for the timing for any design changes.

Given the intimate correlation between overpressure and environmental conditions as stated previously, care must be taken to avoid blasting on days when weather patterns are less favourable. Extraction directions have been selected so as to minimize overpressure impacts on adjacent receptors.

Table 3 below can be used as an initial guide showing maximum loads per delay based on various separation distances for receptors in front of the blast face. The following maximum loads per delay are derived from the air overpressure equation above and are based on a peak overpressure level of 128dB(L):

Table 3: Maximum Loads per Delay to Maintain 128dB(L) at Various Separation Distances for Receptors in Front of the Face

Separation distance between sensitive receptor and closest blasthole (meters)	Maximum recommended explosive load per delay (Kilograms)
1500	4800
1400	3900
1300	3100
1200	2450
1100	1850
1000	1400

We note that the above values are conservative and are intended as a guideline only as the air overpressure attenuation equation is based on a calculated 95% regression line. Actual loads employed shall be based on the results of the monitoring program in place.

ADDITIONAL CONSIDERATIONS OUTSIDE OF THE BLAST IMPACT ANALYSIS SCOPE

The following headings are addressed for general information purposes and are not strictly required as part of the scope of the Blast Impact Analysis as required under the ARA to ensure compliance with MECP NPC-119 guidelines. The hydrogeological study prepared as part of the licence application will address residential water wells in detail. The Natural Environment study prepared as part of the licence application will address fish habitat in detail. Flyrock control is addressed at the operational level given significant influences related to blast design, geology and field accuracy which render concrete recommendations related to control inappropriate at the licencing phase.

FLYROCK

Flyrock is the term used to define rocks which are propelled from the blast area by the force of the explosion. This action is a predictable and necessary component of a blast and requires that every blast have an exclusion zone established within which no persons or property which may be harmed are permitted.

Government regulations strictly prohibit the ejection of flyrock off of a quarry property. The regulations regarding flyrock are enforced by the Ministries of Natural Resources and Forestry, Environment, Conservation and Parks and Labour. In the event of an incident where flyrock does leave a site, the punitive measures include suspension / revocation of licences and fines to both the blaster and quarry owner / operator. Fortunately, flyrock incidents are extremely rare due to the possible serious consequences of such an event. It is in the best interest of all, stakeholders and non-stakeholders, to ensure that dangerous flyrock does not occur. Through proper blast planning and design, it is possible to control and mitigate the possibility for flyrock.

THEORETICAL HORIZONTAL FLYROCK CALCULATIONS

Flyrock occurs when explosives in a hole are poorly confined by the stemming or rock mass and the high pressure gas breaks out of confinement and launches rock fragments into the air. The three primary sources of fly rock are as follows:

- **Face burst:** Lack of confinement by the rock mass in front of the blast hole results in fly rock in front of the face.

- **Cratering:** Insufficient stemming height or weakened collar rock results in a crater being formed around the hole collar with rock projected in any direction.

- **Stemming Ejection:** Poor stemming practice can result in a high angle throw of the stemming material and loose rocks in the blasthole wall and collar.

The horizontal distance flyrock can be thrown (L_H) from a blast hole is determined using the expression:

$$L_H = \frac{V_o^{\,2} Sin 2\theta_0}{g} \qquad [1]$$

where: V_o = launch velocity (m/s)

θ_0 = launch angle (degrees)

g = gravitational constant (9.8 m/s^2)

The theoretical maximum horizontal distance fly rock will travel occurs when θ_0 = 45 degrees, thereby yielding the equation:

$$L_{H\max} = \frac{V_o^{\,2}}{g} \qquad [2]$$

The normal range of launch velocity for blasting is between 10m/s - 30m/s. To calculate the launch velocity of a blast the following formula is used:

$$V_o = k\left(\frac{\sqrt{m}}{B}\right)^{1.3} \qquad [3]$$

where: k = a constant

m = charge mass per meter (kg/m)

B = burden (m)

By combining equations 2 and 3 and taking into account the different sources of fly rock, the following equations can be used to calculate the maximum fly rock thrown from a blast:

Face burst: $$L_{H\max} = \frac{k^2}{g} * \left(\frac{\sqrt{m}}{B}\right)^{2.6}$$

Cratering: $$L_{H\max} = \frac{k^2}{g} * \left(\frac{\sqrt{m}}{SH}\right)^{2.6}$$

Stemming Ejection: $$L_{H\max} = \frac{k^2}{g} * \left(\frac{\sqrt{m}}{SH}\right)^{2.6} Sin2\theta$$

where:
θ = drill hole angle
L_{hmax} = maximum flyrock throw (m)
m = charge mass per meter (kg/m)
B = burden (m)
SH = stemming height (m)
g = gravitational constant
k = a constant

For flyrock calculation purposes, we have applied the current blasting parameters used in the Milton Quarry which utilize 114.3mm (4.5”) diameter holes on a 4m x 4m (13’x 13’) pattern, with total depths of up to 20m (’) and a collar length of 3m (10’).

The range for the constant k is 13.5 for soft rocks and 27 for hard rocks. Given the proposed licence area is predominantly limestone, we have applied a k value of 21. The explosive density is assigned to be 1.2 g/cc for emulsion products and the drill hole angles are assumed to be 90 degrees (i.e. vertical).

Based on a free face blast, maximum anticipated horizontal flyrock projection distances are calculated as follows in Table 4:

Table 4 – Maximum Flyrock Horizontal

***Collar* Lengths** (m)	**Maximum Throw Face Burst** (m)	**Maximum Throw Cratering and Stemming Ejection** (m)
2.0	32	193
2.5	32	108
3.0	32	67
3.5	32	45
4.0	32	32

Different collar lengths are displayed in the table above to account for over or under loaded holes. As demonstrated with these various collar lengths, any deviation, no matter how slight, can greatly affect these maximum values.

Through proper blast design and diligence in inspecting the geology before every blast, flyrock can readily be maintained within the quarry limits. It may be necessary to increase collars and adjust designs accordingly when blasting along the perimeter to accommodate the reduced distance to receptors and to ensure flyrock remains within the property limit.

RESIDENTIAL WATER WELLS

Possible impacts to the water quality and production capacity of groundwater supply wells is a common concern for residents near blasting operations. Complaints related to changes in water quality often include the appearance of turbidity, water discolouration and changes in water characteristics (including nitrate, e-coli, and coliform contamination). Complaints regarding water production most often involve loss of quantity production, air in water and damage to well screens and casings. A review of research and common causes of these problems indicates that most of these concerns are not related to blasting and can be shown to be the direct impact of environmental factors and poor well construction and maintenance.

There is an intuitive belief that blasting operations have dramatic and disastrous impacts on residential water wells for large distances around such operations. Unfortunately, there is no scientific basis for such claims. Outside of the immediate radius of approximately 20-25 blasthole diameters from a loaded hole, there is no permanent ground displacement. As such, barring blasting activity within several meters of an existing well, the probability of damage to residential wells is essentially non-existent.

Despite the scientific support for the above conclusion, numerous studies have been performed to verify the validity of this statement. These studies have investigated the effects of blasting on varied well configurations and in varied geological mediums to ensure results could be readily extrapolated to all blasting operations. The conclusion of these studies has confirmed that with the exception of possible temporary increases in turbidity, blasting operations did not result in any permanent impact on wells outside of the immediate blast zone of the blast until vibrations levels reached exceedingly high intensities. Applying universally accepted threshold levels for ground vibrations eliminates the possibility for any long term adverse effects on wells in the vicinity of blasting operations.

In a study by Froedge (1983), blast vibration levels of up to 32.3mm/s were recorded at the bottom of a shallow well located at a distance of 60 meters (200 feet) from an open pit blast. There was no report of visible damage to the well nor was there any change in the water pumping flow rate. This study concluded that the commonly accepted limit of 50mm/s PPV level is adequate to protect wells from any damage. We reiterate, the current guideline limit for vibrations from quarry and mining operations is 12.5mm/s.

Rose et al. (1991) studied the effect of blasting in close proximity to water wells near an open pit mine in Nevada, USA. Blasts of up to 70 kilograms of explosives per delay period were detonated at a distance of 75 meters (245 feet) from a deep water well. There was no reported visible damage to the well. Fluctuations in water level and flow rate were evident immediately after the blast. However, the well water level and flow rate quickly stabilized.

The U.S. Bureau of Mines conducted a study (Robertson et al., 1990) to determine the changes in well capacity and water quality. This involved pumping from wells before and after nearby blasting. One experiment with a well in sandstone showed no change in well capacity after blasts induced PPV's at the surface of 84mm/s and there was no change in water level after PPV's of 141mm/s, well above the current guideline limit of 12.5mm/s.

Matheson et al. (1997) brought together available information on the most common complaints, the possible causes of the complaints and the relation between blasting and the complaint causes. This study yet again reaffirmed the fact that the attribution of well problems to blast sources are unfounded.

The MECP vibration limit of 12.5mm/s effectively excludes any possibility of damage to residential water wells. Based on available research and our extensive experience in Ontario quarry blasting, blasting at the Milton Quarry East Extension will induce no permanent adverse impacts on the residential water wells on properties surrounding the site.

BLAST IMPACT ON ADJACENT WATERCOURSES

The detonation of explosives in or near water can produce compressive shock waves which initiate damage to the internal organs of fish in close proximity, ultimately resulting in the death of the organism. Additionally, ground vibrations imparted on active spawning beds have the ability to adversely impact the incubating eggs and spawning activity. In an effort to alleviate adverse impacts on fish populations as a result of blasting, the Department of Fisheries and Oceans (DFO) developed the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (1998). This publication establishes limits for water overpressure and ground vibrations which are intended to mitigate impacts on aquatic organisms while providing sufficient flexibility for blasting to proceed. Specifically, water overpressures are to be limited to 100kPa and, in the presence of active spawning beds, ground vibrations at the bed are to be limited to 13mm/s.

The Natural Environment study prepared for the application indicated that there was no direct fish habitat within the Natural Environment study area. The nearest location where fish are present are approximately 1.3km removed from the proposed extraction area. Based on this separation distance, water overpressures and ground vibration generated by the blasting will reside below the DFO 100kPa and 13mm/s guideline limit and will have no impact on the fish populations present.

REVIEW OF HISTORICAL MILTON QUARRY DATA

A vibration and overpressure monitoring program has been in place for all blasts conducted at the Milton Quarry in recent years. As part of this analysis, Explotech reviewed the vibration data collected from 2017 through 2020 inclusive. For continuity, the monthly vibration monitoring reports prepared by Explotech are included in Appendix C to this report.

2017-2020 DATA

Vibration monitoring conducted over the course of the 2017 – 2020 blasting campaigns have included the installation of seismographs at the following locations:

- 10664 Nassagaweya Esquesing Townline Road
- 10401 6th Line
- 6390 15 Sideroad
- 10366 Highway 25
- 10454 Highway 25

All vibration monitoring was performed by Explotech. A review of the data supplied confirms that for the four year period from 2017 through 2020 inclusive, all blasts remained compliant with the MECP guideline limit of 12.5mm/s for ground vibrations and air overpressure.

RECOMMENDATIONS

It is recommended that the following conditions be applied for all blasting operations at the proposed Milton Quarry East Extension:

1. All blasts shall be monitored for both ground vibration and overpressure by an independent Blast Consultant at the closest privately owned sensitive receptors adjacent the site, or at a location that is closer than a sensitive receptor, with a minimum of two (2) instruments – one installed in front of the blast and one installed behind the blast.

2. The guideline limits for vibration and overpressure shall adhere to standards as outlined in the MECP Model Municipal Noise Control By-law publication NPC 119 (1978) or any such document, regulation or guideline which supersedes this standard.

3. In the event of an exceedance of NPC 119 limits or any such document, regulation or guideline which supersedes this standard, blast designs and protocols shall be reviewed prior to any subsequent blasts and revised accordingly in order to return the operations to compliant levels.

4. Orientation of the aggregate extraction operation will be designed and maintained so that the direction of the overpressure propagation will be away from structures as much as possible.

5. Blast designs shall be continually reviewed with respect to fragmentation, ground vibration and overpressure. Blast designs shall be modified as required to ensure compliance with applicable guidelines and regulations.

6. Blasting procedures such as drilling and loading shall be reviewed on a yearly basis and modified as required to ensure compliance with industry standards.

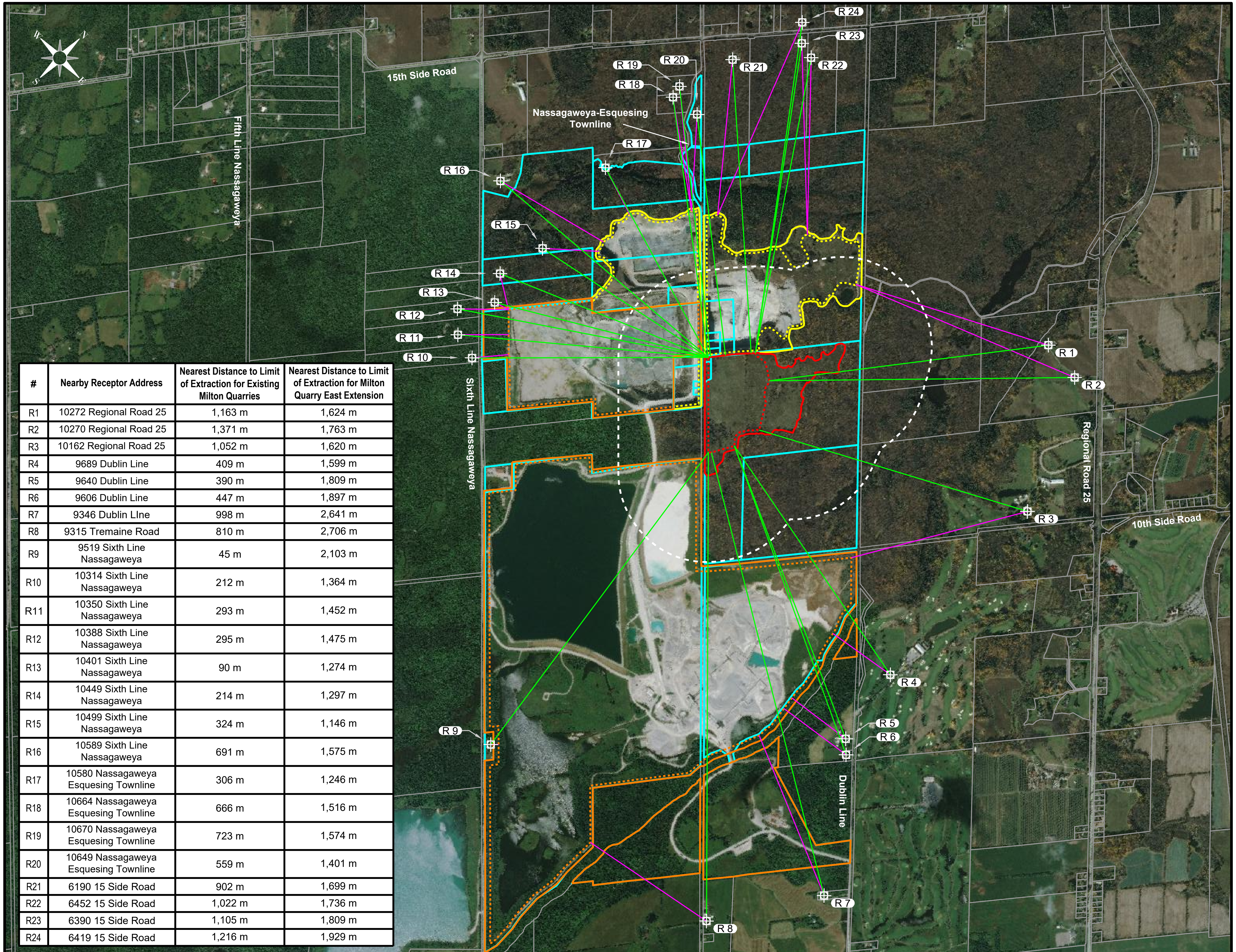
7. Detailed blast records shall be maintained in accordance with current industry best practices.

CONCLUSION

Blasting operations required for mineral extraction at the proposed Milton Quarry East Extension lands can be carried out safely and within governing guidelines set by the Ministry of the Environment, Conservation and Parks.

Modern blasting techniques will permit blasting to take place with explosives charges below allowable charge weights ensuring that blast vibrations and overpressure will remain minimal at the nearest receptors and compliant with applicable guideline limits.

Appendix A



#	Nearby Receptor Address	Nearest Distance to Limit of Extraction for Existing Milton Quarries	Nearest Distance to Limit of Extraction for Milton Quarry East Extension
R1	10272 Regional Road 25	1,163 m	1,624 m
R2	10270 Regional Road 25	1,371 m	1,763 m
R3	10162 Regional Road 25	1,052 m	1,620 m
R4	9689 Dublin Line	409 m	1,599 m
R5	9640 Dublin Line	390 m	1,809 m
R6	9606 Dublin Line	447 m	1,897 m
R7	9346 Dublin LIne	998 m	2,641 m
R8	9315 Tremaine Road	810 m	2,706 m
R9	9519 Sixth Line Nassagaweya	45 m	2,103 m
R10	10314 Sixth Line Nassagaweya	212 m	1,364 m
R11	10350 Sixth Line Nassagaweya	293 m	1,452 m
R12	10388 Sixth Line Nassagaweya	295 m	1,475 m
R13	10401 Sixth Line Nassagaweya	90 m	1,274 m
R14	10449 Sixth Line Nassagaweya	214 m	1,297 m
R15	10499 Sixth Line Nassagaweya	324 m	1,146 m
R16	10589 Sixth Line Nassagaweya	691 m	1,575 m
R17	10580 Nassagaweya Esquesing Townline	306 m	1,246 m
R18	10664 Nassagaweya Esquesing Townline	666 m	1,516 m
R19	10670 Nassagaweya Esquesing Townline	723 m	1,574 m
R20	10649 Nassagaweya Esquesing Townline	559 m	1,401 m
R21	6190 15 Side Road	902 m	1,699 m
R22	6452 15 Side Road	1,022 m	1,736 m
R23	6390 15 Side Road	1,105 m	1,809 m
R24	6419 15 Side Road	1,216 m	1,929 m

Nearby Receptors

Milton Quarry East Extension

Part of Lots 11 and 12, Concession 1
(former Geographic Township of Esquesing)
Town of Halton Hills
Regional Municipality of Halton

Legend

- Proposed Milton Quarry East Extension - Licence Boundary
- Proposed Milton Quarry East Extension - Limit of Extraction
- Milton Quarry (1962) - Licence Boundary
- Milton Quarry (1962) - Limit of Extraction
- Milton Quarry Extension (2007) - Licence Boundary
- Milton Quarry Extension (2007) - Limit of Extraction
- Land Owned by Dufferin
- 500m Offset from Proposed Milton Quarry East Extension (white)
- Existing Parcel Fabric
- Receptor's Nearest Distance to Limit of Extraction Existing Milton Quarries
- Receptor's Nearest Distance to Limit of Extraction Milton Quarry East Extension

Date July 2021

Sources
Microsoft Corporation Bing Imagery, date unknown
Licence boundaries and limits of extraction are from existing/proposed site plans
Parcel fabric from Municipal Property Assessment Corporation - Last updated prior to 2010

Scale - 1:20,000 ±

0 300 600 Meters

N:\Brian\9061DJ Dufferin - Milton Quarry East Extension\Drawings - Must be in NAD 27\Nearby Receptors\CAD\9061DJ - Nearby Receptors - July 2021.dwg

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
113 COLLIER STREET, BARRIE, ON, L4M 1H2
P: 705.728.0045 F: 705.728.2010 | WWW.MHBCPLAN.COM

Appendix B

Milton Quarry East Extension

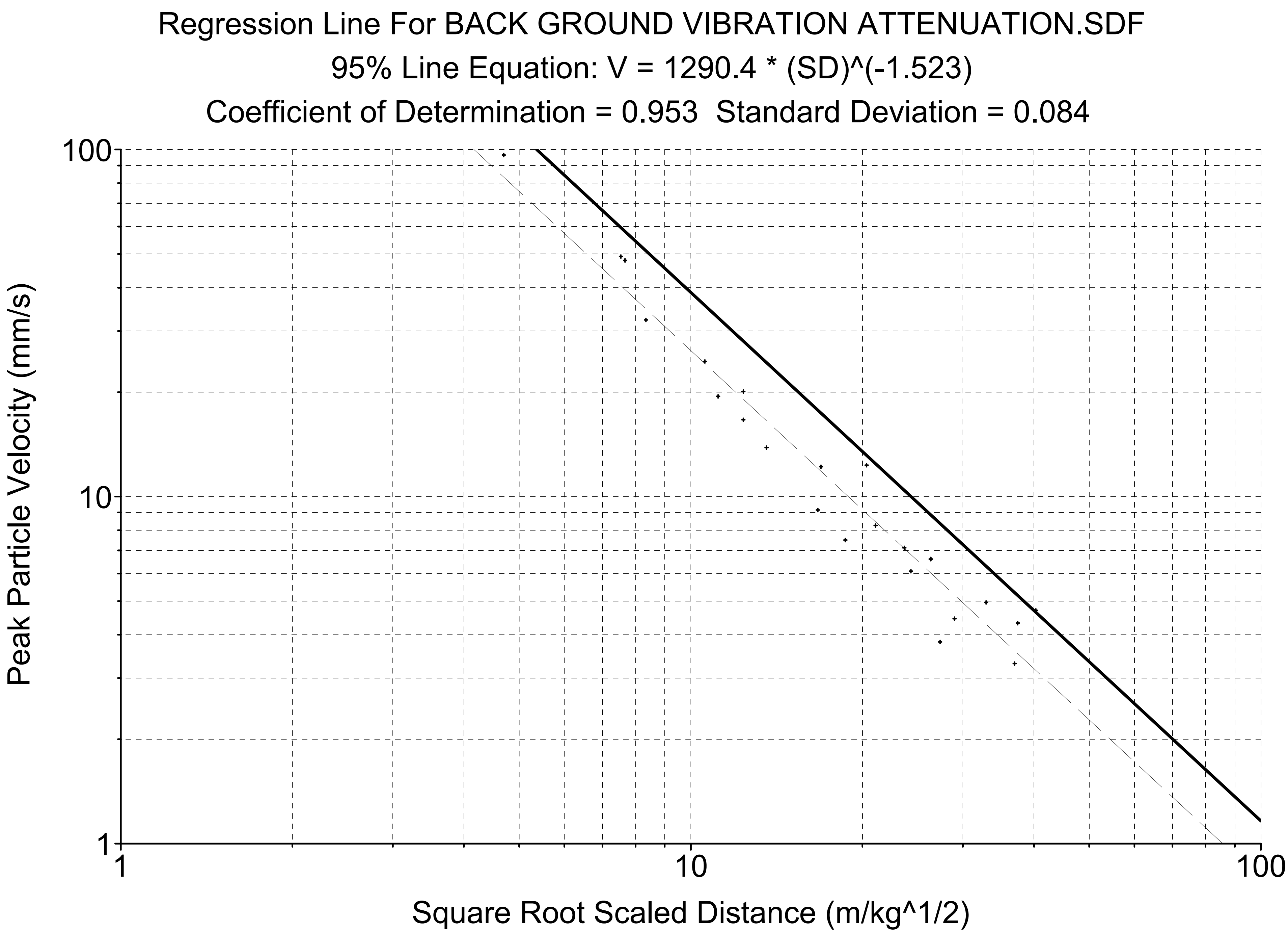
PREVAILING METEOROLOGICAL CONDITIONS

Medians provided by Environment Canada

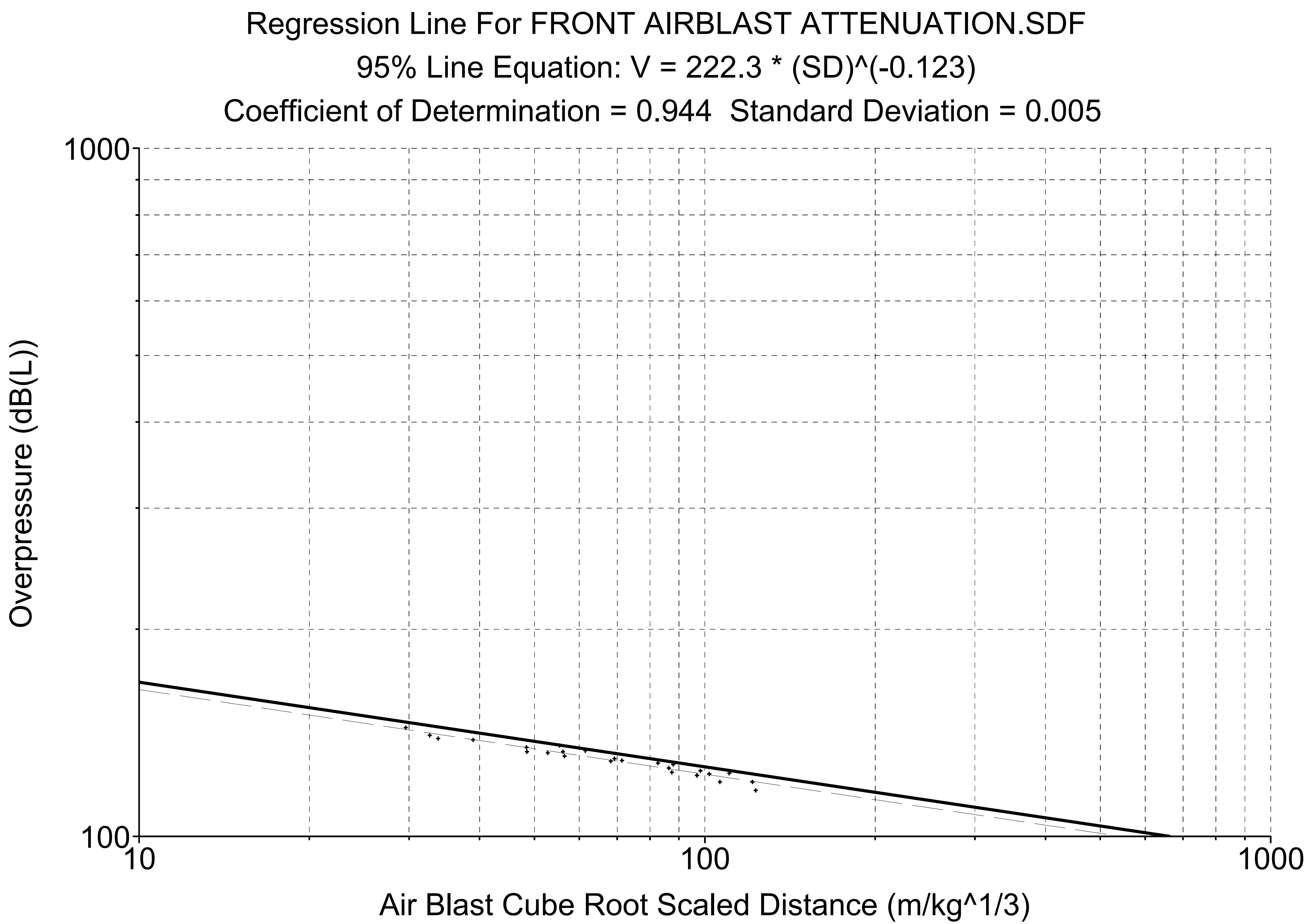
Date	Wind Direction	Wind Velocity Km/h	Temperature (Deg Celsius)
January	W	17.6	- 5.5
February	W	17.0	- 4.5
March	N	16.9	0.1
April	N	16.8	7.1
May	N	14.4	13.1
June	N	13.2	18.6
July	W	12.9	21.5
August	N	11.9	20.6
September	W	12.7	16.2
October	W	14.0	9.5
November	W	15.7	3.7
December	W	16.7	- 2.2

** Data is not available specifically for the proposed quarry location.
Nearest weather station is Toronto Pearson International Airport
** Data is based on averaged climate normals gathered 1981 – 2010.

Appendix C



Regression Line For BACK GROUND VIBRATION ATTENUATION.SDF
95% Line Equation: V = 1290.4 * (SD)^(-1.523)
Coefficient of Determination = 0.953 Standard Deviation = 0.084
Peak Particle Velocity (mm/s)
100
10
1
1
10
100
Square Root Scaled Distance (m/kg^1/2)


Regression Line For FRONT AIRBLAST ATTENUATION.SDF
95% Line Equation: V = 222.3 * (SD)^(-0.123)
Coefficient of Determination = 0.944 Standard Deviation = 0.005
1000
100
10
100
1000
Overpressure (dB(L))
Air Blast Cube Root Scaled Distance (m/kg^1/3)

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

February 10, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

January 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of January 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between January 1, 2017 and January 31, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)
9-Jan	15:40	North Quarry	0.079	104.2
16-Jan	14:18	West Cell	0.270	101.9
24-Jan	16:16	North Quarry	0.190	112.3
26-Jan	16:17	West Cell	0.270	110.2
30-Jan	13:15	East Cell	0.37	111.7
30-Jan	13:30	North Quarry	4.53	113.5

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in January 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Encl.

February 7, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

January 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of January 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between January 1, 2017 and January 31, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)
9-Jan	15:40	North Quarry	0.159	106.5
16-Jan	14:18	West Cell	0.159	95.9
24-Jan	16:16	North Quarry	0.143	95.9
26-Jan	16:17	West Cell	0.143	107.0
30-Jan	13:15	East Cell	0.317	107.5
30-Jan	13:30	North Quarry	0.159	108.4

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in January 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Encl.

February 7, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

January 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of January 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

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We have reviewed the vibration records for the monitoring period between January 1, 2017 and January 31, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)
9-Jan	15:40	North Quarry	0.095	100.0
16-Jan	14:18	West Cell	0.270	100.0
24-Jan	16:16	North Quarry	0.127	93.9
26-Jan	16:17	West Cell	0.175	102.7
30-Jan	13:15	East Cell	0.293	109.5
30-Jan	13:30	North Quarry	0.190	101.0

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. As such, we are confident that vibrations and air overpressure generated from blasting operations in January 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Encl.

March 10, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

February 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

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As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2017 and February 28, 2017 and cross referenced with the blasting records provided to confirm that there were seven (7) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Feb	13:17	North Quarry	0.143	117.78	DNQF1703
10-Feb	13:13	West Cell	0.175	98.84	DWCF1703
15-Feb	13:19	North Quarry	0.095	115.56	DNQF1704
21-Feb	13:09	West Cell	0.159	109.17	DWCF1704
22-Feb	13:18	North Quarry	0.143	97.5	WCNQ1701 B
24-Feb	13:26	West Cell	0.29	108.78	DWCF1705
28-Feb	12:17	West Cell	0.159	107.95	DWCF1706

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in February 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

March 10, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

February 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

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EXPLOTECH

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

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EXPLOTECH

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Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Feb	13:17	North Quarry	0.127	102.77	DNQF1703
10-Feb	13:13	West Cell	0.206	109.17	DWCF1703
15-Feb	13:19	North Quarry	0.095	101.02	DNQF1704
21-Feb	13:09	West Cell	0.206	106.02	DWCF1704
22-Feb	13:18	North Quarry	0.238	100.00	WCNQ1701 B
24-Feb	13:26	West Cell	0.270	106.02	DWCF1705
28-Feb	12:17	West Cell	0.159	102.77	DWCF1706

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. As such, we are confident that vibrations and air overpressure generated from blasting operations in February 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

March 10, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

February 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of Febraury 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2017 and February 28, 2017 and cross referenced with the blasting records provided to confirm that there were seven (7) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Feb	13:17	North Quarry	0.079	109.87	DNQF1703
10-Feb	13:13	West Cell	0.238	107.96	DWCF1703
15-Feb	13:19	North Quarry	0.270	114.4	DNQF1704
21-Feb	13:09	West Cell	0.38	101.94	DWCF1704
22-Feb	13:18	North Quarry	4.147	113.3	WCNQ1701 B
24-Feb	13:26	West Cell	0.43	104.86	DWCF1705
28-Feb	12:17	West Cell	0.37	101.02	DWCF1706

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in February 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

April 4, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

<u>March 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2017 and March 31, 2017 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Mar	14:25	North Quarry	0.095	81.94	WCNQ1702
6-Mar	14:12	East Cell	0.739	112.8	ECTB1702
9-Mar	13:19	West Cell	0.665	110.57	DWCBB1701
10-Mar	13:51	East Cell	0.524	0.49	ECTB1703
10-Mar	13:24	East Cell	0.079	112.04	ECTB1706 (TOE)
15-Mar	13:18	West Cell	0.705	107.04	DWCBB1702
16-Mar	16:44	North Quarry	0.095	113.06	WCNQ1602 MF-1
22-Mar	13:15	East Cell	0.310	109.17	ECTB1704
23-Mar	16:16	East Cell	0.493	122.8	ECTB1705
24-Mar	16:13	West Cell	0.885	114.6	DWCBB1703
27-Mar	16:21	West Cell	0.945	113.3	DWCBB1704
28-Mar	16:11	East Cell	0.898	113.8	ECTB1708
29-Mar	10:41	North Quarry	0.079	91.48	WCNQ1704 TOE
29-Mar	13:19	East Cell	0.079	95.92	ECTB1713 TOE
30-Mar	16:06	East Cell	0.175	119.1	ECTB1707
30-Mar	16:27	East Cell	0.810	120.0	ECBB1701

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. As such, we are confident that vibrations and air overpressure generated from blasting operations in March 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

April 4, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

March 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2017 and March 31, 2017 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Mar	14:25	North Quarry	4.62	113.5	WCNQ1702
6-Mar	14:12	East Cell	0.671	108.4	ECTB1702
9-Mar	13:19	West Cell	0.628	110.24	DWCBB1701
10-Mar	13:51	East Cell	0.579	117.65	ECTB1703
10-Mar	13:24	East Cell	0.08	113.06	ECTB1706 (TOE)
15-Mar	13:18	West Cell	0.773	121.8	DWCBB1702
16-Mar	16:44	North Quarry	0.079	107.96	WCNQ1602 MF-1
22-Mar	13:15	East Cell	0.655	121.94	ECTB1704
23-Mar	16:16	East Cell	0.807	117.5	ECTB1705
24-Mar	16:13	West Cell	0.724	118.33	DWCBB1703
27-Mar	16:21	West Cell	0.762	118.3	DWCBB1704
28-Mar	16:11	East Cell	0.744	108.38	ECTB1708
29-Mar	10:41	North Quarry	1.08	106.5	WCNQ1704 TOE
29-Mar	13:19	East Cell	0.079	101.94	ECTB1713 TOE
30-Mar	16:06	East Cell	0.6	108.8	ECTB1707
30-Mar	16:27	East Cell	0.713	110.88	ECBB1701

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in March 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Encl.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

April 4, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

March 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2017 and March 31, 2017 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Mar	14:25	North Quarry	0.143	101.94	WCNQ1702
6-Mar	14:12	East Cell	0.875	109.5	ECTB1702
9-Mar	13:19	West Cell	0.762	109.9	DWCBB1701
10-Mar	13:51	East Cell	0.429	123.45	ECTB1703
10-Mar	13:24	East Cell	0.079	115.7	ECTB1706 (TOE)
15-Mar	13:18	West Cell	0.646	116.9	DWCBB1702
16-Mar	16:44	North Quarry	0.079	117.65	WCNQ1602 MF-1
22-Mar	13:15	East Cell	0.365	112.31	ECTB1704
23-Mar	16:16	East Cell	0.365	115.2	ECTB1705
24-Mar	16:13	West Cell	1.04	101.94	DWCBB1703
27-Mar	16:21	West Cell	1.36	107.0	DWCBB1704
28-Mar	16:11	East Cell	0.869	112.8	ECTB1708
29-Mar	10:41	North Quarry	0.079	95.9	WCNQ1704 TOE
29-Mar	13:19	East Cell	0.063	110.57	ECTB1713 TOE
30-Mar	16:06	East Cell	0.35	121.94	ECTB1707
30-Mar	16:27	East Cell	1.07	117.79	ECBB1701

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in March 2017 have had no detrimental effect on the homes and structures in the vicinity of the

CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

May 3, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

April 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2017 and April 30, 2017 and cross referenced with the blasting records provided to confirm that there were fifteen (15) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Apr	13:12	East Cell	0.60	113.1	ECTB1710
3-Apr	13:51	North Quarry	5.92	115.4	WCNQ1703
4-Apr	16:11	East Cell	0.62	105.5	ECTB1712
5-Apr	16:13	East Cell	0.62	110.2	ECTB1709
6-Apr	13:17	West Cell	0.62	124.3	DWCBB1705
7-Apr	16:16	East Cell	0.43	110.6	ECTB1711
11-Apr	13:09	East Cell	0.62	105.5	ECTB1715
12-Apr	13:12	East Cell	1.32	113.8	ECTB1714
18-Apr	16:12	East Cell	0.83	114.6	ECTB1716
18-Apr	13:14	East Cell	1.24	106.5	ECBB1702
19-Apr	13:21	West Cell	0.95	106.0	DWCBB1706
21-Apr	13:13	East Cell	0.52	105.5	ECTB1718
24-Apr	13:17	West Cell	0.94	124.2	DWCBB1707
25-Apr	13:13	East Cell	0.51	107.9	ECTB1719
26-Apr	13:10	East Cell	0.48	104.9	ECTB1720

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in April 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Encl.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

May 3, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

April 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2017 and April 30, 2017 and cross referenced with the blasting records provided to confirm that there were fifteen (15) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Apr	13:12	East Cell	0.413	116.3	ECTB1710
3-Apr	13:51	North Quarry	0.127	114.2	WCNQ1703
4-Apr	16:11	East Cell	0.87	115.0	ECTB1712
5-Apr	16:13	East Cell	0.33	118.6	ECTB1709
6-Apr	13:17	West Cell	1.51	101.9	DWCBB1705
7-Apr	16:16	East Cell	0.317	121.3	ECTB1711
11-Apr	13:09	East Cell	0.89	111.8	ECTB1715
12-Apr	13:12	East Cell	1.15	104.9	ECTB1714
18-Apr	16:12	East Cell	0.29	118.7	ECTB1716
18-Apr	13:14	East Cell	0.98	115.6	ECBB1702
19-Apr	13:21	West Cell	1.10	114.4	DWCBB1706
21-Apr	13:13	East Cell	N/A**	N/A**	ECTB1718
24-Apr	13:17	West Cell	N/A**	N/A**	DWCBB1707
25-Apr	13:13	East Cell	N/A**	N/A**	ECTB1719
26-Apr	13:10	East Cell	N/A**	N/A**	ECTB1720

**Power loss to the unit resulting in lack of data during the last week of April. Attempts to work with the homeowner to remotely return power to the unit proved ineffective. On May 2, 2017 Explotech personnel visited the installation at 6390 15 Sideroad and restored power to the unit.

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in April 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

May 3, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

April 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2017 and April 30, 2017 and cross referenced with the blasting records provided to confirm that there were fifteen (15) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Apr	13:12	East Cell	0.33	124.4	ECTB1710
3-Apr	13:51	North Quarry	0.17	104.9	WCNQ1703
4-Apr	16:11	East Cell	0.86	87.9	ECTB1712
5-Apr	16:13	East Cell	0.48	119.4	ECTB1709
6-Apr	13:17	West Cell	0.76	120.8	DWCBB1705
7-Apr	16:16	East Cell	0.32	102.8	ECTB1711
11-Apr	13:09	East Cell	1.19	109.9	ECTB1715
12-Apr	13:12	East Cell	0.90	109.2	ECTB1714
18-Apr	16:12	East Cell	0.22	124.8	ECTB1716
18-Apr	13:14	East Cell	0.98	115.6	ECBB1702
19-Apr	13:21	West Cell	0.70	119.6	DWCBB1706
21-Apr	13:13	East Cell	0.41	87.9	ECTB1718
24-Apr	13:17	West Cell	0.75	123.1	DWCBB1707
25-Apr	13:13	East Cell	0.286	115.4	ECTB1719
26-Apr	13:10	East Cell	0.46	111.5	ECTB1720

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. As such, we are confident that vibrations and air overpressure generated from blasting operations in April 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

June 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

May 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2017 and May 31, 2017 and cross referenced with the blasting records provided to confirm that there were twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-May	13:10	East Cell	N/A**	N/A**	ECBB1703
1-May	13:31	East Cell	N/A**	N/A**	ECTB1717
2-May	13:16	West Cell	0.990	112.3	DWCBB1708
3-May	13:15	North Quarry	0.175	107.5	WCNQ1705
4-May	13:10	East Cell	0.627	116.7	ECTB1721
5-May	16:14	East Cell	0.395	101.9	ECTB1722
8-May	16:25	West Cell	0.995	106.0	DWCBB1709
9-May	13:31	East Cell	0.107	93.9	ECTB1726 TOE
9-May	13:09	East Cell	0.798	109.9	ECTB1723
10-May	13:17	West Cell	0.680	114.4	DWCBB1710
11-May	13:14	East Cell	0.543	114.4	ECTB1725
12-May	13:10	East Cell	0.403	112.6	ECTB1722B
12-May	13:27	West Cell	0.983	111.5	DWCBB1711
15-May	13:07	East Cell	0.584	110.6	ECTB1728
17-May	16:12	East Cell	0.425	110.9	ECTB1724
18-May	13:10	East Cell	0.912	113.8	ECTB1727
19-May	13:18	East Cell	0.824	103.5	DWCBB1712
24-May	16:12	East Cell	1.29	119.6	ECBB1704
25-May	16:16	West Cell	0.756	110.2	DWCBB1713
26-May	16:12	West Cell	0.918	102.8	DWCTB1701
30-May	13:13	East Cell	1.14	109.5	ECTB1729
31-May	13:11	East Cell	0.130	91.5	ECTB1737 TOE

**Power loss to the unit resulting in lack of data during the last week of April. Attempts to work with the homeowner to remotely return power to the unit proved ineffective. On May 2, 2017 Explotech personnel visited the installation at 6390 15 Sideroad and restored power to the unit.

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in May 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

June 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

<u>May 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2017 and May 31, 2017 and cross referenced with the blasting records provided to confirm that there were twenty two (22) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-May	13:10	East Cell	1.264	120.5	ECBB1703
1-May	13:31	East Cell	1.169	113.5	ECTB1717
2-May	13:16	West Cell	0.589	118.6	DWCBB1708
3-May	13:15	North Quarry	0.311	106.0	WCNQ1705
4-May	13:10	East Cell	0.599	117.9	ECTB1721
5-May	16:14	East Cell	0.424	110.2	ECTB1722
8-May	16:25	West Cell	0.772	111.8	DWCBB1709
9-May	13:31	East Cell	0.128	103.5	ECTB1726 TOE
9-May	13:09	East Cell	0.880	109.9	ECTB1723
10-May	13:17	West Cell	0.618	122.4	DWCBB1710
11-May	13:14	East Cell	0.692	113.8	ECTB1725
12-May	13:10	East Cell	0.376	113.9	ECTB1722B
12-May	13:27	West Cell	1.086	123.9	DWCBB1711
15-May	13:07	East Cell	0.660	107.9	ECTB1728
17-May	16:12	East Cell	0.493	107.0	ECTB1724
18-May	13:10	East Cell	0.894	112.3	ECTB1727
19-May	13:18	East Cell	1.49	114.4	DWCBB1712
24-May	16:12	East Cell	1.99	121.9	ECBB1704
25-May	16:16	West Cell	0.838	122.2	DWCBB1713
26-May	16:12	West Cell	1.71	109.9	DWCTB1701
30-May	13:13	East Cell	1.09	108.0	ECTB1729
31-May	13:11	East Cell	1.10	101.9	ECTB1737 TOE

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. As such, we are confident that vibrations and air overpressure generated from blasting operations in May 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

June 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

May 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2017 and May 31, 2017 and cross referenced with the blasting records provided to confirm that there were twenty two (22) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-May	13:10	East Cell	1.34	107.5	ECBB1703
1-May	13:31	East Cell	0.589	109.9	ECTB1717
2-May	13:16	West Cell	0.887	113.8	DWCBB1708
3-May	13:15	North Quarry	6.850	116.1	WCNQ1705
4-May	13:10	East Cell	0.694	112.6	ECTB1721
5-May	16:14	East Cell	0.753	111.5	ECTB1722
8-May	16:25	West Cell	1.036	115.7	DWCBB1709
9-May	13:31	East Cell	0.127	112.6	ECTB1726 TOE
9-May	13:09	East Cell	0.734	112.8	ECTB1723
10-May	13:17	West Cell	0.726	115.4	DWCBB1710
11-May	13:14	East Cell	0.820	112.6	ECTB1725
12-May	13:10	East Cell	0.477	110.6	ECTB1722B
12-May	13:27	West Cell	0.990	116.7	DWCBB1711
15-May	13:07	East Cell	0.514	110.2	ECTB1728
17-May	16:12	East Cell	0.534	114.6	ECTB1724
18-May	13:10	East Cell	0.743	110.6	ECTB1727
19-May	13:18	East Cell	1.05	110.8	DWCBB1712
24-May	16:12	East Cell	1.49	112.3	ECBB1704
25-May	16:16	West Cell	0.877	122.4	DWCBB1713
26-May	16:12	West Cell	1.35	115.0	DWCTB1701
30-May	13:13	East Cell	0.762	107.5	ECTB1729
31-May	13:11	East Cell	0.119	109.2	ECTB1737 TOE

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in May 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Encl.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

July 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

June 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between June 1, 2017 and June 30, 2017 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Jun	16:15	East Cell	0.08	108.8	ECTB1732
2-Jun	16:30	West Cell	1.22	113.8	DWCTB1702
7-Jun	13:08	East Cell	1.13	115.2	ECBB1705
8-Jun	13:12	East Cell	0.44	111.5	ECTB1730
8-Jun	13:19	West Cell	0.08	106.0	DWCTB1703
12-Jun	13:06	North Quarry	7.52	117.2	WCNQ1706
13-Jun	13:10	East Cell	1.22	112.8	ECBB1706
15-Jun	13:12	East Cell	0.89	117.8	ECTB1738
15-Jun	16:16	West Cell	0.71	116.4	DWCBB1714
16-Jun	16:18	West Cell	1.73	111.5	DWCTB1704
20-Jun	13:09	East Cell	1.08	109.2	ECBB1707
21-Jun	13:11	East Cell	0.51	110.2	ECTB1731
22-Jun	13:21	West Cell	0.94	112.6	DWCBB1715
23-Jun	13:22	West Cell	2.16	108.0	DWCTB1705
26-Jun	13:13	East Cell	0.95	110.2	ECTB1741
27-Jun	16:12	East Cell	1.92	111.2	ECBB1709
29-Jun	13:11	East Cell	0.54	114.4	ECTB1739 (A)
30-Jun	13:13	West Cell	1.33	115.4	DWCTB1706

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in June 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

M Kehoe

Mike Kehoe

July 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

June 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2017 and June 30, 2017 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Jun	16:15	East Cell	0.08	98.8	ECTB1732
2-Jun	16:30	West Cell	1.41	101.0	DWCTB1702
7-Jun	13:08	East Cell	1.29	117.5	ECBB1705
8-Jun	13:12	East Cell	0.71	110.6	ECTB1730
8-Jun	13:19	West Cell	1.00	106.0	DWCTB1703
12-Jun	13:06	North Quarry	0.11	98.8	WCNQ1706
13-Jun	13:10	East Cell	0.94	116.7	ECBB1706
15-Jun	13:12	East Cell	0.60	102.8	ECTB1738
15-Jun	16:16	West Cell	0.73	104.9	DWCBB1714
16-Jun	16:18	West Cell	0.79	102.8	DWCTB1704
20-Jun	13:09	East Cell	1.10	103.5	ECBB1707
21-Jun	13:11	East Cell	1.05	105.5	ECTB1731
22-Jun	13:21	West Cell	0.81	116.7	DWCBB1715
23-Jun	13:22	West Cell	0.71	113.1	DWCTB1705
26-Jun	13:13	East Cell	1.16	104.2	ECTB1741
27-Jun	16:12	East Cell	1.51	107.0	ECBB1709
29-Jun	13:11	East Cell	0.49	108.8	ECTB1739 (A)
30-Jun	13:13	West Cell	0.71	107.5	DWCTB1706

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in June 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

M Kehoe

Mike Kehoe

July 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

June 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2017 and June 30, 2017 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Jun	16:15	East Cell	0.40	102.8	ECTB1732
2-Jun	16:30	West Cell	1.84	107.5	DWCTB1702
7-Jun	13:08	East Cell	1.13	122.2	ECBB1705
8-Jun	13:12	East Cell	0.90	110.6	ECTB1730
8-Jun	13:19	West Cell	1.81	114.4	DWCTB1703
12-Jun	13:06	North Quarry	0.18	102.8	WCNQ1706
13-Jun	13:10	East Cell	0.54	121.5	ECBB1706
15-Jun	13:12	East Cell	0.94	110.6	ECTB1738
15-Jun	16:16	West Cell	0.57	116.1	DWCBB1714
16-Jun	16:18	West Cell	1.62	109.9	DWCTB1704
20-Jun	13:09	East Cell	1.02	107.0	ECBB1707
21-Jun	13:11	East Cell	0.89	104.9	ECTB1731
22-Jun	13:21	West Cell	0.87	127.1	DWCBB1715
23-Jun	13:22	West Cell	0.65	118.7	DWCTB1705
26-Jun	13:13	East Cell	1.81	107.5	ECTB1741
27-Jun	16:12	East Cell	1.29	112.6	ECBB1709
29-Jun	13:11	East Cell	0.24	115.2	ECTB1739 (A)
30-Jun	13:13	West Cell	1.10	113.5	DWCTB1706

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We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. As such, we are confident that vibrations and air overpressure generated from blasting operations in June 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

M Kehoe

Mike Kehoe

August 4, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

<u>July 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario</u>

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2017 and July 31, 2017 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Jul	13:12	East Cell	1.274	112.6	ECBB1708
6-Jul	13:10	East Cell	0.76	108.8	ECTB1745
7-Jul	13:13	East Cell	0.70	108.8	ECTB1739
7-Jul	13:24	West Cell	2.192	113.1	DWCTB1707
10-Jul	13:14	East Cell	0.571	113.1	ECTB1736
12-Jul	16:11	East Cell	0.95	109.9	ECBB1710
13-Jul	16:16	West Cell	1.246	119.9	DWCTB1708
18-Jul	13:10	East Cell	**NA	**NA	ECBB1712
19-Jul	16:12	East Cell	0.476	110.8	ECTB1749
21-Jul	13:16	West Cell	2.154	113.1	DWCTB1709
24-Jul	13:11	East Cell	0.619	118.8	ECTB1750
25-Jul	16:14	East Cell	0.508	114.6	ECTB1740
25-Jul	16:25	East Cell	0.508	114.6	ECTB1746
26-Jul	16:12	East Cell	0.89	108.8	ECBB1713
27-Jul	13:15	East Cell	0.667	107.5	ECTB1733
28-Jul	13:20	West Cell	0.21	107.9	DWCT1701

** unit recorded an anomalous waveform immediately prior to the blast that caused the unit to miss the blast

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in July 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH

Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

August 4, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

July 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2017 and July 31, 2017 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Jul	13:12	East Cell	1.229	110.9	ECBB1708
6-Jul	13:10	East Cell	1.101	104.9	ECTB1745
7-Jul	13:13	East Cell	0.75	107.9	ECTB1739
7-Jul	13:24	West Cell	0.83	112.0	DWCTB1707
10-Jul	13:14	East Cell	0.698	110.2	ECTB1736
12-Jul	16:11	East Cell	1.933	115.4	ECBB1710
13-Jul	16:16	West Cell	1.464	102.8	DWCTB1708
18-Jul	13:10	East Cell	1.413	109.2	ECBB1712
19-Jul	16:12	East Cell	0.365	104.2	ECTB1749
21-Jul	13:16	West Cell	0.83	102.8	DWCTB1709
24-Jul	13:11	East Cell	0.83	107.9	ECTB1750
25-Jul	16:14	East Cell	0.063	95.9	ECTB1740
25-Jul	16:25	East Cell	0.714	116.4	ECTB1746
26-Jul	16:12	East Cell	1.159	108.4	ECBB1713
27-Jul	13:15	East Cell	0.397	111.8	ECTB1733
28-Jul	13:20	West Cell	0.079	91.5	DWCT1701

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. As such, we are confident that vibrations generated from blasting operations in July 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

EXPLOTECH
Specialists in Explosives, Blasting and Vibration
Consulting Engineers

August 4, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

<u>July 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2017 and July 31, 2017 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Jul	13:12	East Cell	1.212	114.0	ECBB1708
6-Jul	13:10	East Cell	0.83	106.0	ECTB1745
7-Jul	13:13	East Cell	0.40	115.7	ECTB1739
7-Jul	13:24	West Cell	1.143	115.6	DWCTB1707
10-Jul	13:14	East Cell	0.52	115.7	ECTB1736
12-Jul	16:11	East Cell	0.97	119.3	ECBB1710
13-Jul	16:16	West Cell	1.137	113.1	DWCTB1708
18-Jul	13:10	East Cell	1.319	111.5	ECBB1712
19-Jul	16:12	East Cell	0.44	108.8	ECTB1749
21-Jul	13:16	West Cell	1.147	106.5	DWCTB1709
24-Jul	13:11	East Cell	1.218	117.8	ECTB1750
25-Jul	16:14	East Cell	0.08	97.5	ECTB1740
25-Jul	16:25	East Cell	0.71	123.7	ECTB1746
26-Jul	16:12	East Cell	0.95	109.2	ECBB1713
27-Jul	13:15	East Cell	0.429	110.6	ECTB1733
28-Jul	13:20	West Cell	0.127	107.9	DWCT1701

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. As such, we are confident that vibrations and air overpressure generated from blasting operations in July 2017 have had no detrimental effect on the homes and structures in the vicinity of the CRH Milton Quarry. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

September 7, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

August 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2017 and August 31, 2017 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Aug	16:18	East Cell	0.97	112.3	ECTB1747
1-Aug	16:12	East Cell	0.981	112.3	ECTB1751
2-Aug	16:16	East Cell	0.415	102.8	ECTB1746
3-Aug	16:00	East Cell	1.62	111.2	ECBB1714
8-Aug	13:10	East Cell	0.374	108.0	ECTB1734
10-Aug	16:12	East Cell	0.774	108.4	ECTB1748
11-Aug	13:06	East Cell	0.94	114.2	ECTB1752
15-Aug	14:12	East Cell	0.063	91.5	ECTB1735
15-Aug	16:25	West Cell	0.429	102.8	DWCT1702
16-Aug	13:08	East Cell	1.22	108.0	ECBB1715
18-Aug	13:14	East Cell	1.05	106.5	ECTB1753
22-Aug	16:12	East Cell	0.40	104.9	ECTB1742
23-Aug	16:12	East Cell	0.78	105.5	ECTB1754
24-Aug	13:08	East Cell	1.18	107.5	ECBB1716
25-Aug	13:07	East Cell	0.49	106.5	ECTB1747
29-Aug	13:10	East Cell	0.37	109.2	ECTB1744
30-Aug	13:08	East Cell	0.84	104.9	ECTB1757
31-Aug	13:10	East Cell	0.84	98.8	ECBB1717

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

September 7, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

August 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2017 and August 31, 2017 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Aug	16:18	East Cell	0.56	115.9	ECTB1747
1-Aug	16:12	East Cell	0.70	118.5	ECTB1751
2-Aug	16:16	East Cell	0.333	107.5	ECTB1746
3-Aug	16:00	East Cell	1.352	109.2	ECBB1714
8-Aug	13:10	East Cell	0.381	106.5	ECTB1734
10-Aug	16:12	East Cell	0.429	114.2	ECTB1748
11-Aug	13:06	East Cell	0.51	119.7	ECTB1752
15-Aug	14:12	East Cell	0.079	91.5	ECTB1735
15-Aug	16:25	West Cell	0.413	103.5	DWCT1702
16-Aug	13:08	East Cell	0.81	91.5	ECBB1715
18-Aug	13:14	East Cell	0.76	112.0	ECTB1753
22-Aug	16:12	East Cell	0.381	104.2	ECTB1742
23-Aug	16:12	East Cell	0.48	110.9	ECTB1754
24-Aug	13:08	East Cell	0.87	108.8	ECBB1716
25-Aug	13:07	East Cell	0.365	116.6	ECTB1747
29-Aug	13:10	East Cell	0.254	110.6	ECTB1744
30-Aug	13:08	East Cell	0.73	112.8	ECTB1757
31-Aug	13:10	East Cell	0.9	110.2	ECBB1717

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

September 7, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

<u>August 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario</u>

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2017 and August 31, 2017 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Aug	16:18	East Cell	0.98	114.6	ECTB1747
1-Aug	16:12	East Cell	0.98	114.6	ECTB1751
2-Aug	16:16	East Cell	0.270	106.5	ECTB1746
3-Aug	16:00	East Cell	0.73	108.4	ECBB1714
8-Aug	13:10	East Cell	0.60	107.5	ECTB1734
10-Aug	16:12	East Cell	0.62	107.9	ECTB1748
11-Aug	13:06	East Cell	0.57	115.4	ECTB1752
15-Aug	14:12	East Cell	0.10	103.5	ECTB1735
15-Aug	16:25	West Cell	0.46	107.5	DWCT1702
16-Aug	13:08	East Cell	1.024	111.5	ECBB1715
18-Aug	13:14	East Cell	0.75	112.3	ECTB1753
22-Aug	16:12	East Cell	0.56	105.5	ECTB1742
23-Aug	16:12	East Cell	0.44	111.5	ECTB1754
24-Aug	13:08	East Cell	0.75	112.6	ECBB1716
25-Aug	13:07	East Cell	0.46	114.8	ECTB1747
29-Aug	13:10	East Cell	0.54	107.5	ECTB1744
30-Aug	13:08	East Cell	0.73	113.8	ECTB1757
31-Aug	13:10	East Cell	1.511	112.0	ECBB1717

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits.. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

October 3, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

September 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2017 and September 30, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Sep	16:11	East Cell	0.206	117.2	ECTB1748 Part B
11-Sep	13:15	West Cell	1.337	114.0	DWCTB1710
12-Sep	13:14	East Cell	0.60	113.8	ECTB1758
14-Sep	13:08	East Cell	1.185	110.6	ECBB1718
20-Sep	13:13	East Cell	1.757	111.8	ECBB1711
25-Sep	11:19	West Cell	0.56	101.0	DWCTB1711

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits.. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

October 3, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

September 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

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set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2017 and September 30, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Sep	16:11	East Cell	0.68	109.2	ECTB1748 Part B
11-Sep	13:15	West Cell	1.422	110.2	DWCTB1710
12-Sep	13:14	East Cell	0.71	109.5	ECTB1758
14-Sep	13:08	East Cell	1.271	106.5	ECBB1718
20-Sep	13:13	East Cell	0.78	114.4	ECBB1711
25-Sep	11:19	West Cell	0.063	91.5	DWCTB1711

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

October 3, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Hannan Arshad

September 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Hannan Arshad,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2017 and September 30, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Sep	16:11	East Cell	0.413	119.2	ECTB1748 Part B
11-Sep	13:15	West Cell	1.206	115.4	DWCTB1710
12-Sep	13:14	East Cell	0.67	115.9	ECTB1758
14-Sep	13:08	East Cell	0.97	106.5	ECBB1718
20-Sep	13:13	East Cell	0.92	117.4	ECBB1711
25-Sep	11:19	West Cell	0.079	81.9	DWCTB1711

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

November 2, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

October 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

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The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2017 and October 31, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Oct	16:12	East Cell	1.292	112.8	ECTB1760
6-Oct	13:13	East Cell	1.231	108.4	ECBB1719
12-Oct	13:10	East Cell	1.380	108.4	ECB1720
17-Oct	13:15	East Cell	**NA	**NA	ECBB1723
19-Oct	16:21	East Cell	**NA	**NA	ECBB1722
30-Oct	13:11	East Cell	**NA	**NA	ECBB1721

**missing data due to power loss at the monitor location

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

November 2, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

October 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

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The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between October 1, 2017 and October 31, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Oct	16:12	East Cell	1.381	121.5	ECTB1760
6-Oct	13:13	East Cell	0.86	111.2	ECBB1719
12-Oct	13:10	East Cell	0.76	111.8	ECB1720
17-Oct	13:15	East Cell	0.97	114.4	ECBB1723
19-Oct	16:21	East Cell	0.97	104.2	ECBB1722
30-Oct	13:11	East Cell	1.011	102.8	ECBB1721

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

November 2, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

October 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2017 and October 31, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Oct	16:12	East Cell	1.002	118.7	ECTB1760
6-Oct	13:13	East Cell	1.398	111.8	ECBB1719
12-Oct	13:10	East Cell	1.495	118.9	ECB1720
17-Oct	13:15	East Cell	1.894	109.5	ECBB1723
19-Oct	16:21	East Cell	1.400	107.5	ECBB1722
30-Oct	13:11	East Cell	1.208	113.3	ECBB1721

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits.. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett

December 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

November 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2017 and November 30, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Nov	13:19	West Cell	**NA	**NA	DWCTB1712
3-Nov	13:21	East Cell	**NA	**NA	ECBB1724
14-Nov	13:10	East Cell	1.806	110.2	ECBB1726
22-Nov	16:15	East Cell	0.65	111.8	ECTB1755
23-Nov	16:21	East Cell	0.87	118.6	ECBB1725 A
29-Nov	13:12	East Cell	1.183	108.0	ECBB1725 B

**missing data due to power loss at the monitor location

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

December 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

November 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between November 1, 2017 and November 30, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Nov	13:19	West Cell	0.52	116.3	DWCTB1712
3-Nov	13:21	East Cell	0.81	106.5	ECBB1724
14-Nov	13:10	East Cell	1.315	111.5	ECBB1726
22-Nov	16:15	East Cell	0.238	104.9	ECTB1755
23-Nov	16:21	East Cell	1.017	117.1	ECBB1725 A
29-Nov	13:12	East Cell	0.67	109.9	ECBB1725 B

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

December 6, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

November 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between November 1, 2017 and November 30, 2017 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Nov	13:19	West Cell	0.84	112.6	DWCTB1712
3-Nov	13:21	East Cell	1.170	116.9	ECBB1724
14-Nov	13:10	East Cell	1.708	119.8	ECBB1726
22-Nov	16:15	East Cell	0.413	122.4	ECTB1755
23-Nov	16:21	East Cell	1.074	120.5	ECBB1725 A
29-Nov	13:12	East Cell	1.072	116.6	ECBB1725 B

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits.. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

January 3, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

December 2017 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of December 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between December 1, 2017 and December 31, 2017 and cross referenced with the blasting records provided to confirm that there were three (3) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
6-Dec	13:12	East Cell	2.762	101.9	ECBB1727
13-Dec	13:13	East Cell	1.269	115.2	ECBB1730
14-Dec	14:14	West Cell	0.063	120.5	DWCBB1716

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

January 3, 2017

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

December 2017 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of December 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between December 1, 2017 and December 31, 2017 and cross referenced with the blasting records provided to confirm that there were three (3) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
6-Dec	13:12	East Cell	1.752	103.5	ECBB1727
13-Dec	13:13	East Cell	0.67	118.1	ECBB1730
14-Dec	14:14	West Cell	0.079	100.0	DWCBB1716

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

January 3, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

December 2017 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of December 2017. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between December 1, 2017 and December 31, 2017 and cross referenced with the blasting records provided to confirm that there were three (3) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
6-Dec	13:12	East Cell	1.948	118.3	ECBB1727
13-Dec	13:13	East Cell	1.043	120.7	ECBB1730
14-Dec	14:14	West Cell	0.095	117.8	DWCBB1716

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

February 2, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

<u>January 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of January 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been

set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between January 1, 2018 and January 31, 2018 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
9-Jan	13:38	North Quarry	0.063	97.5	NQBB1801
16-Jan	13:18	North Quarry	0.095	100.0	NQBB1802
18-Jan	12:17	North Quarry	0.095	107.0	NQBB1803
23-Jan	12:21	North Quarry	0.079	122.4	NQBB1804
26-Jan	12:20	West Cell	0.190	101.0	WCBB1802
30-Jan	15:17	West cell	0.175	106.0	WCBB1803

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

February 2, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

January 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of January 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between Janaury 1, 2018 and January 31, 2018 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
9-Jan	13:38	North Quarry	0.095	101.0	NQBB1801
16-Jan	13:18	North Quarry	0.143	100	NQBB1802
18-Jan	12:17	North Quarry	0.111	121.3	NQBB1803
23-Jan	12:21	North Quarry	0.127	109.9	NQBB1804
26-Jan	12:20	West Cell	0.206	108.0	WCBB1802
30-Jan	15:17	West cell	0.238	107.5	WCBB1803

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

February 2, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

January 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of January 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between January 1, 2018 and Janaury 31, 2018 and cross referenced with the blasting records provided to confirm that there were six (6) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification when the readings are attenuated to the closest sensitive receptor.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
9-Jan	13:38	North Quarry	0.095	105.5	NQBB1801
16-Jan	13:18	North Quarry	0.270	106.0	NQBB1802
18-Jan	12:17	North Quarry	0.190	108.4	NQBB1803
23-Jan	12:21	North Quarry	0.240	115.9	NQBB1804
26-Jan	12:20	West Cell	0.430	104.9	WCBB1802
30-Jan	15:17	West cell	0.27	113.3	WCBB1803

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

March 6, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

February 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between February 1, 2018 and February 28, 2018 and cross referenced with the blasting records provided to confirm that there were five (5) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Feb	15:13	East Cell	0.254	113.1	ECTB1801
13-Feb	12:20	West Cell	0.127	108.8	WCBB1804
15-Feb	12:19	West Cell	0.143	117.4	WCBB05
20-Feb	12:19	West Cell	0.127	116.3	WCBB09
23-Feb	12:17	West Cell	0.190	116.4	WCBB1807

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Peter Kuncic

Peter Kuncic, B.Eng.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

March 6, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

February 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

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The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2018 and February 28, 2018 and cross referenced with the blasting records provided to confirm that there were five (5) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Feb	15:13	East Cell	0.38	106.6	ECTB1801
13-Feb	12:20	West Cell	0.33	101.9	WCBB1804
15-Feb	12:19	West Cell	0.32	106.0	WCBB05
20-Feb	12:19	West Cell	0.29	113.8	WCBB09
23-Feb	12:17	West Cell	0.27	125.6	WCBB1807

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Peter Kuncic

Peter Kuncic, B.Eng.
Explotech Engineering Ltd.

March 6, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

February 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between February 1, 2018 and February 28, 2018 and cross referenced with the blasting records provided to confirm that there were five (5) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
5-Feb	15:13	East Cell	0.270	107.5	ECTB1801
13-Feb	12:20	West Cell	0.238	102.8	WCBB1804
15-Feb	12:19	West Cell	0.175	108.4	WCBB05
20-Feb	12:19	West Cell	0.175	113.0	WCBB09
23-Feb	12:17	West Cell	0.222	114.0	WCBB1807

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Peter Kuncic

Peter Kuncic, B.Eng.
Explotech Engineering Ltd.

April 4, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

March 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.
As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2018 and March 31, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
7-Mar	15:50	East Cell	1.113	120.2	ECBB18-01
13-Mar	13:16	East Cell	0.518	106.5	ECTB18-02
16-Mar	13:16	East Cell	2.143	112.0	ECBB2018-02
20-Mar	13:12	East Cell	0.903	120.8	ECBB18-03
22-Mar	13:18	East Cell	2.549	101.0	ECBB18-05/06
23-Mar	16:26	East Cell	0.408	107.0	ECTB1803
26-Mar	13:13	East Cell	2.347	113.5	ECBB18-07
27-Mar	13:10	East Cell	0.65	109.2	ECTB18-04
28-Mar	13:11	East Cell	0.783	114.8	ECBB18-04

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

April 4, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

March 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2018 and March 31, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
7-Mar	15:50	East Cell	0.63	121.9	ECBB18-01
13-Mar	13:16	East Cell	0.286	113.1	ECTB18-02
16-Mar	13:16	East Cell	0.84	116.6	ECBB2018-02
20-Mar	13:12	East Cell	0.46	117.8	ECBB18-03
22-Mar	13:18	East Cell	1.098	106.0	ECBB18-05/06
23-Mar	16:26	East Cell	0.29	113.5	ECTB1803
26-Mar	13:13	East Cell	1.333	116.7	ECBB18-07
27-Mar	13:10	East Cell	0.29	106.0	ECTB18-04
28-Mar	13:11	East Cell	0.75	116.6	ECBB18-04

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

April 4, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

March 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2018 and March 31, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
7-Mar	15:50	East Cell	0.9	115.7	ECBB18-01
13-Mar	13:16	East Cell	0.302	107.9	ECTB18-02
16-Mar	13:16	East Cell	0.62	107.9	ECBB2018-02
20-Mar	13:12	East Cell	0.78	107.9	ECBB18-03
22-Mar	13:18	East Cell	1.462	106.5	ECBB18-05/06
23-Mar	16:26	East Cell	0.222	116.1	ECTB1803
26-Mar	13:13	East Cell	0.849	114.4	ECBB18-07
27-Mar	13:10	East Cell	0.35	110.2	ECTB18-04
28-Mar	13:11	East Cell	0.761	105.5	ECBB18-04

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

April 4, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

March 2018 Vibration Summary: 10366 Highway 25– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2018 and March 31, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
7-Mar	15:50	East Cell	**	**	ECBB18-01
13-Mar	13:16	East Cell	**	**	ECTB18-02
16-Mar	13:16	East Cell	0.959	119.1	ECBB2018-02
20-Mar	13:12	East Cell	0.933	123.6	ECBB18-03
22-Mar	13:18	East Cell	0.933	119.1	ECBB18-05/06
23-Mar	16:26	East Cell	0.889	116.9	ECTB1803
26-Mar	13:13	East Cell	0.833	124.5	ECBB18-07
27-Mar	13:10	East Cell	0.421	112.8	ECTB18-04
28-Mar	13:11	East Cell	0.596	100.0	ECBB18-04

**unit installed on March 15, 2018

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

May 7, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

<u>April 2018 Vibration Summary: 10366 Highway 25– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

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The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2018 and April 30, 2018 and cross referenced with the blasting records provided to confirm that there were ten (10) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Apr	13:18	East Cell, Bottom Bench	0.76	120	ECBB18-10
4-Apr	16:10	East Cell, Bottom Bench	1.03	119.7	ECBB18-11
11-Apr	13:18	East Cell, Top Bench	0.76	118.8	ECTB 18-05
12-Apr	16:11	East Cell, Bottom Bench	0.89	124.4	ECBB18-12
18-Apr	13:09	East Cell, Bottom Bench	0.76	118.2	ECBB 18-15
19-Apr	13:12	East Cell, Top Bench	0.51	124.5	ECTB 18-06
20-Apr	16:12	East Cell, Bottom Bench	0.51	117.8	East Cell Floor Sump
23-Apr	16:18	East Cell, Bottom Bench	0.76	112.3	ECBB2018-16
24-Apr	13:08	East Cell, Bottom Bench	0.63	115.6	ECBB 18-13
27-Apr	16:18	East Cell, Bottom Bench	0.76	113.1	ECBB2018-14

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

May 7, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

April 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.
As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2018 and April 30, 2018 and cross referenced with the blasting records provided to confirm that there were ten (10) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Apr	13:18	East Cell, Bottom Bench	0.63	113.5	ECBB18-10
4-Apr	16:10	East Cell, Bottom Bench	1.34	125.4	ECBB18-11
11-Apr	13:18	East Cell, Top Bench	0.37	110.9	ECTB 18-05
12-Apr	16:11	East Cell, Bottom Bench	0.62	119.2	ECBB18-12
18-Apr	13:09	East Cell, Bottom Bench	1.33	117.9	ECBB 18-15
19-Apr	13:12	East Cell, Top Bench	0.57	104.8	ECTB 18-06
20-Apr	16:12	East Cell, Bottom Bench	1.40	101.0	East Cell Floor Sump
23-Apr	16:18	East Cell, Bottom Bench	0.59	115.6	ECBB2018-16
24-Apr	13:08	East Cell, Bottom Bench	0.62	115.2	ECBB 18-13
27-Apr	16:18	East Cell, Bottom Bench	1.22	111.2	ECBB2018-14

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

May 7, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

April 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2018 and April 30, 2018 and cross referenced with the blasting records provided to confirm that there were ten (10) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Apr	13:18	East Cell, Bottom Bench	0.65	116.9	ECBB18-10
4-Apr	16:10	East Cell, Bottom Bench	0.70	119.4	ECBB18-11
11-Apr	13:18	East Cell, Top Bench	0.22	112.6	ECTB 18-05
12-Apr	16:11	East Cell, Bottom Bench	0.37	115.7	ECBB18-12
18-Apr	13:09	East Cell, Bottom Bench	0.84	118.6	ECBB 18-15
19-Apr	13:12	East Cell, Top Bench	0.46	108.4	ECTB 18-06
20-Apr	16:12	East Cell, Bottom Bench	0.92	108.0	East Cell Floor Sump
23-Apr	16:18	East Cell, Bottom Bench	0.54	114.6	ECBB2018-16
24-Apr	13:08	East Cell, Bottom Bench	0.57	115.4	ECBB 18-13
27-Apr	16:18	East Cell, Bottom Bench	0.52	113.5	ECBB2018-14

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

May 7, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

April 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

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Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2018 and April 30, 2018 and cross referenced with the blasting records provided to confirm that there were ten (10) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Apr	13:18	East Cell, Bottom Bench	0.29	114.2	ECBB18-10
4-Apr	16:10	East Cell, Bottom Bench	0.11	121.0	ECBB18-11
11-Apr	13:18	East Cell, Top Bench	0.24	110.2	ECTB 18-05
12-Apr	16:11	East Cell, Bottom Bench	0.68	114.6	ECBB18-12
18-Apr	13:09	East Cell, Bottom Bench	0.84	111.8	ECBB 18-15
19-Apr	13:12	East Cell, Top Bench	0.40	105.5	ECTB 18-06
20-Apr	16:12	East Cell, Bottom Bench	0.49	101.9	East Cell Floor Sump
23-Apr	16:18	East Cell, Bottom Bench	0.67	105.5	ECBB2018-16
24-Apr	13:08	East Cell, Bottom Bench	0.54	108.0	ECBB 18-13
27-Apr	16:18	East Cell, Bottom Bench	0.54	109.5	ECBB2018-14

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

June 5, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

May 2018 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2018 and May 31, 2018 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-May	16:18	East Cell, Bottom Bench	1.60	122.4	ECBB 18-18
2-May	16:25	East Cell, Bottom Bench	2.47	115.2	ECBB 18-19
8-May	13:15	East Cell, Bottom Bench	3.28	113.8	ECBB 18-20
9-May	16:14	East Cell, Top Bench	2.10	118.2	ECTB 18-08
10-May	13:15	East Cell, Bottom Bench	1.80	114.4	ECBB 18-21
11-May	13:15	East Cell, Top Bench	5.31	116.7	ECTB 18-09
14-May	13:13	East Cell, Bottom Bench	4.51	111.5	ECBB 19-09
16-May	13:17	East Cell, Bottom Bench	2.32	120.9	ECBB 18-23
17-May	13:11	East Cell, Bottom Bench	3.53	111.5	ECBB 18-08
24-May	9:21	East Cell, Bottom Bench	1.08	105.5	ECBB 18-22
24-May	13:11	East Cell, Bottom Bench	1.97	122.2	ECBB 18-25
25-May	13:17	East Cell, Top Bench	2.25	111.5	ECTB2018-10
28-May	16:11	East Cell, Bottom Bench	5.00	110.6	ECBB 18-24
29-May	13:20	East Cell, Bottom Bench	1.99	123.7	ECBB 18-27
30-May	13:16	East Cell, Bottom Bench	0.54	102.8	WCF 18-01
31-May	13:16	East Cell, Top Bench	2.54	114.4	ECTB 18-11

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

June 5, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

May 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2018 and May 31, 2018 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-May	16:18	East Cell, Bottom Bench	1.69	113.3	ECBB 18-18
2-May	16:25	East Cell, Bottom Bench	1.69	113.3	ECBB 18-19
8-May	13:15	East Cell, Bottom Bench	0.97	108.8	ECBB 18-20
9-May	16:14	East Cell, Top Bench	0.51	111.8	ECTB 18-08
10-May	13:15	East Cell, Bottom Bench	0.63	114.6	ECBB 18-21
11-May	13:15	East Cell, Top Bench	0.68	106.5	ECTB 18-09
14-May	13:13	East Cell, Bottom Bench	0.79	108.0	ECBB 19-09
16-May	13:17	East Cell, Bottom Bench	1.16	113.5	ECBB 18-23
17-May	13:11	East Cell, Bottom Bench	0.98	105.5	ECBB 18-08
24-May	9:21	East Cell, Bottom Bench	1.26	102.8	ECBB 18-22
24-May	13:11	East Cell, Bottom Bench	0.84	112.3	ECBB 18-25
25-May	13:17	East Cell, Top Bench	0.67	104.2	ECTB2018-10
28-May	16:11	East Cell, Bottom Bench	1.50	103.5	ECBB 18-24
29-May	13:20	East Cell, Bottom Bench	1.03	117.2	ECBB 18-27
30-May	13:16	East Cell, Bottom Bench	0.35	100	WCF 18-01
31-May	13:16	East Cell, Top Bench	0.75	109.2	ECTB 18-11

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

June 5, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

May 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2018 and May 31, 2018 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-May	16:18	East Cell, Bottom Bench	0.94	114.4	ECBB 18-18
2-May	16:25	East Cell, Bottom Bench	0.94	114.4	ECBB 18-19
8-May	13:15	East Cell, Bottom Bench	***	***	ECBB 18-20
9-May	16:14	East Cell, Top Bench	0.29	118.2	ECTB 18-08
10-May	13:15	East Cell, Bottom Bench	0.65	108.4	ECBB 18-21
11-May	13:15	East Cell, Top Bench	0.57	112.3	ECTB 18-09
14-May	13:13	East Cell, Bottom Bench	0.84	107.0	ECBB 19-09
16-May	13:17	East Cell, Bottom Bench	0.44	113.3	ECBB 18-23
17-May	13:11	East Cell, Bottom Bench	0.71	112.8	ECBB 18-08
24-May	9:21	East Cell, Bottom Bench	1.08	105.5	ECBB 18-22
24-May	13:11	East Cell, Bottom Bench	0.48	110.9	ECBB 18-25
25-May	13:17	East Cell, Top Bench	0.29	109.2	ECTB2018-10
28-May	16:11	East Cell, Bottom Bench	0.92	109.5	ECBB 18-24
29-May	13:20	East Cell, Bottom Bench	0.68	116.3	ECBB 18-27
30-May	13:16	East Cell, Bottom Bench	0.41	106.6	WCF 18-01
31-May	13:16	East Cell, Top Bench	0.33	111.5	ECTB 18-11

*** Power loss at the unit

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

June 5, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

May 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2018 and May 31, 2018 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-May	16:18	East Cell, Bottom Bench	0.92	116.4	ECBB 18-18
2-May	16:25	East Cell, Bottom Bench	0.92	116.4	ECBB 18-19
8-May	13:15	East Cell, Bottom Bench	0.56	112.0	ECBB 18-20
9-May	16:14	East Cell, Top Bench	0.16	104.9	ECTB 18-08
10-May	13:15	East Cell, Bottom Bench	0.67	107.5	ECBB 18-21
11-May	13:15	East Cell, Top Bench	0.43	112.3	ECTB 18-09
14-May	13:13	East Cell, Bottom Bench	0.92	109.9	ECBB 19-09
16-May	13:17	East Cell, Bottom Bench	0.57	101.9	ECBB 18-23
17-May	13:11	East Cell, Bottom Bench	0.83	109.5	ECBB 18-08
24-May	9:21	East Cell, Bottom Bench	0.71	110.9	ECBB 18-22
24-May	13:11	East Cell, Bottom Bench	0.62	100.0	ECBB 18-25
25-May	13:17	East Cell, Top Bench	0.35	101.0	ECTB2018-10
28-May	16:11	East Cell, Bottom Bench	1.02	109.5	ECBB 18-24
29-May	13:20	East Cell, Bottom Bench	0.75	109.9	ECBB 18-27
30-May	13:16	East Cell, Bottom Bench	0.54	102.8	WCF 18-01
31-May	13:16	East Cell, Top Bench	0.33	98.8	ECTB 18-11

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

July 9, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

June 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2018 and June 30, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Jun	13:14	East Cell Top Bench	0.333	101.9	ECTB 18-13
6-Jun	13:12	East Cell Bottom Bench	0.51	115.2	ECBB 18-29
6-Jun	16:14	East Cell Bottom Bench	0.87	104.2	ECBB 18-28
7-Jun	13:16	East Cell Top Bench	0.286	106.0	ECTB 18-12
8-Jun	13:13	West Cell Top Bench	0.90	112.8	WCTB 18-01
11-Jun	13:15	West Cell Floor	0.57	97.5	WCF 18-02
12-Jun	13:12	East Cell Bottom Bench	0.49	112.0	ECBB 18-30
13-Jun	13:34	East Cell Top Bench	0.44	98.8	ECTB 18-07/Toe
13-Jun	13:22	East Cell Bottom Bench	0.67	106.0	ECBB 18-26
14-Jun	16:19	East Cell Top Bench	0.254	104.9	ECTB 18-15
18-Jun	13:19	West Cell Floor	0.302	97.5	WCF 18-03
19-Jun	16:18	East Cell Bottom Bench	0.86	104.9	ECBB 18-31
20-Jun	16:15	West Cell Top Bench	1.201	114.2	WCTB 18-02
22-Jun	13:12	East Cell Bottom Bench	0.65	114.4	ECBB 18-32
25-Jun	13:12	West Cell Floor	0.41	107.0	WCF 18-06
25-Jun	13:32	East Cell Top Bench	0.46	117.2	ECTB 18-14
27-Jun	13:14	West Cell Top Bench	1.268	107.5	WCTB 18-03
28-Jun	16:11	East Cell Bottom Bench	0.63	100.0	ECBB 18-33
29-Jun	13:12	West Cell Floor	0.27	97.5	WCF 18-05
29-Jun	13:24	East Cell Bottom Bench	0.59	109.2	ECBB 18-34

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

July 9, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

June 2018 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2018 and June 30, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Jun	13:14	East Cell Top Bench	0.63	124.1	ECTB 18-13
6-Jun	13:12	East Cell Bottom Bench	0.76	102.8	ECBB 18-29
6-Jun	16:14	East Cell Bottom Bench	1.276	109.2	ECBB 18-28
7-Jun	13:16	East Cell Top Bench	1.283	97.5	ECTB 18-12
8-Jun	13:13	West Cell Top Bench	0.63	106.5	WCTB 18-01
11-Jun	13:15	West Cell Floor	0.25	124.0	WCF 18-02
12-Jun	13:12	East Cell Bottom Bench	0.51	114.8	ECBB 18-30
13-Jun	13:34	East Cell Top Bench	0.38	117.1	ECTB 18-07/Toe
13-Jun	13:22	East Cell Bottom Bench	0.63	113.1	ECBB 18-26
14-Jun	16:19	East Cell Top Bench	0.51	111.5	ECTB 18-15
18-Jun	13:19	West Cell Floor	0.38	119.1	WCF 18-03
19-Jun	16:18	East Cell Bottom Bench	0.89	107.0	ECBB 18-31
20-Jun	16:15	West Cell Top Bench	0.89	106.5	WCTB 18-02
22-Jun	13:12	East Cell Bottom Bench	0.63	115.6	ECBB 18-32
25-Jun	13:12	West Cell Floor	0.25	108.8	WCF 18-06
25-Jun	13:32	East Cell Top Bench	0.89	109.2	ECTB 18-14
27-Jun	13:14	West Cell Top Bench	0.381	100.0	WCTB 18-03
28-Jun	16:11	East Cell Bottom Bench	0.89	106.0	ECBB 18-33
29-Jun	13:12	West Cell Floor	0.38	101.9	WCF 18-05
29-Jun	13:24	East Cell Bottom Bench	0.63	108.4	ECBB 18-34

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

July 10, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

June 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.
As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2018 and June 30, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Jun	13:14	East Cell Top Bench	0.62	108.8	ECTB 18-13
6-Jun	13:12	East Cell Bottom Bench	1.150	106.5	ECBB 18-29
6-Jun	16:14	East Cell Bottom Bench	1.256	115.2	ECBB 18-28
7-Jun	13:16	East Cell Top Bench	0.67	107.5	ECTB 18-12
8-Jun	13:13	West Cell Top Bench	1.892	100.0	WCTB 18-01
11-Jun	13:15	West Cell Floor	0.317	103.5	WCF 18-02
12-Jun	13:12	East Cell Bottom Bench	1.764	109.9	ECBB 18-30
13-Jun	13:34	East Cell Top Bench	0.54	102.8	ECTB 18-07/Toe
13-Jun	13:22	East Cell Bottom Bench	1.397	101.9	ECBB 18-26
14-Jun	16:19	East Cell Top Bench	0.89	108.4	ECTB 18-15
18-Jun	13:19	West Cell Floor	0.222	112.3	WCF 18-03
19-Jun	16:18	East Cell Bottom Bench	0.90	112.8	ECBB 18-31
20-Jun	16:15	West Cell Top Bench	1.396	100.0	WCTB 18-02
22-Jun	13:12	East Cell Bottom Bench	1.407	109.5	ECBB 18-32
25-Jun	13:12	West Cell Floor	0.30	95.9	WCF 18-06
25-Jun	13:32	East Cell Top Bench	1.116	111.2	ECTB 18-14
27-Jun	13:14	West Cell Top Bench	1.223	104.2	WCTB 18-03
28-Jun	16:11	East Cell Bottom Bench	0.48	105.5	ECBB 18-33
29-Jun	13:12	West Cell Floor	0.27	101.0	WCF 18-05
29-Jun	13:24	East Cell Bottom Bench	1.677	100.0	ECBB 18-34

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

July 9, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

June 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2018 and June 30, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Jun	13:14	East Cell Top Bench	0.52	108.4	ECTB 18-13
6-Jun	13:12	East Cell Bottom Bench	0.79	113.3	ECBB 18-29
6-Jun	16:14	East Cell Bottom Bench	0.89	112.8	ECBB 18-28
7-Jun	13:16	East Cell Top Bench	0.413	109.2	ECTB 18-12
8-Jun	13:13	West Cell Top Bench	1.735	111.5	WCTB 18-01
11-Jun	13:15	West Cell Floor	0.349	105.5	WCF 18-02
12-Jun	13:12	East Cell Bottom Bench	0.76	110.9	ECBB 18-30
13-Jun	13:34	East Cell Top Bench	0.35	98.8	ECTB 18-07/Toe
13-Jun	13:22	East Cell Bottom Bench	0.57	106.0	ECBB 18-26
14-Jun	16:19	East Cell Top Bench	0.44	107.9	ECTB 18-15
18-Jun	13:19	West Cell Floor	0.317	104.9	WCF 18-03
19-Jun	16:18	East Cell Bottom Bench	0.79	114.6	ECBB 18-31
20-Jun	16:15	West Cell Top Bench	2.203	107.0	WCTB 18-02
22-Jun	13:12	East Cell Bottom Bench	0.75	116.4	ECBB 18-32
25-Jun	13:12	West Cell Floor	0.22	104.9	WCF 18-06
25-Jun	13:32	East Cell Top Bench	0.59	114.8	ECTB 18-14
27-Jun	13:14	West Cell Top Bench	1.176	113.1	WCTB 18-03
28-Jun	16:11	East Cell Bottom Bench	0.48	104.2	ECBB 18-33
29-Jun	13:12	West Cell Floor	0.27	97.5	WCF 18-05
29-Jun	13:24	East Cell Bottom Bench	1.048	109.9	ECBB 18-34

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

July 10, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

June 2018 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2018 and June 30, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Jun	13:14	East Cell Top Bench	**	**	ECTB 18-13
6-Jun	13:12	East Cell Bottom Bench	**	**	ECBB 18-29
6-Jun	16:14	East Cell Bottom Bench	**	**	ECBB 18-28
7-Jun	13:16	East Cell Top Bench	**	**	ECTB 18-12
8-Jun	13:13	West Cell Top Bench	**	**	WCTB 18-01
11-Jun	13:15	West Cell Floor	**	**	WCF 18-02
12-Jun	13:12	East Cell Bottom Bench	**	**	ECBB 18-30
13-Jun	13:34	East Cell Top Bench	**	**	ECTB 18-07/Toe
13-Jun	13:22	East Cell Bottom Bench	**	**	ECBB 18-26
14-Jun	16:19	East Cell Top Bench	**	**	ECTB 18-15
18-Jun	13:19	West Cell Floor	**	**	WCF 18-03
19-Jun	16:18	East Cell Bottom Bench	**	**	ECBB 18-31
20-Jun	16:15	West Cell Top Bench	**	**	WCTB 18-02
22-Jun	13:12	East Cell Bottom Bench	0.80	97.8	ECBB 18-32
25-Jun	13:12	West Cell Floor	0.3	104.8	WCF 18-06
25-Jun	13:32	East Cell Top Bench	0.55	98.8	ECTB 18-14
27-Jun	13:14	West Cell Top Bench	0.49	94.3	WCTB 18-03
28-Jun	16:11	East Cell Bottom Bench	0.87	100.5	ECBB 18-33
29-Jun	13:12	West Cell Floor	0.97	96.4	WCF 18-05
29-Jun	13:24	East Cell Bottom Bench	0.97	96.4	ECBB 18-34

**Unit Offline – Installation Completed June 21, 2018

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

August 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

July 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2018 and July 31, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Jul	16:20	East Cell Top Bench	0.477	107.5	ECTB1816
4-Jul	13:12	West Cell Floor	0.298	98.8	WCF 18-07
5-Jul	13:20	East Cell Top Bench	0.365	101.9	ECTB 2018-18
6-Jul	16:10	East Cell Top Bench	0.288	113.9	ECTB 18-17
9-Jul	16:25	East Cell Bottom Bench	0.827	100.0	ECBB 2018-35
10-Jul	16:12	West Cell Floor	0.52	102.8	WCF 2018-10
10-Jul	16:30	West Cell Top Bench	1.452	124.5	WCTB 2018-04
12-Jul	13:10	East Cell Bottom Bench	1.183	112.3	ECBB2018-36
16-Jul	13:13	West Cell Top Bench	1.643	103.5	WCTB 18-05
17-Jul	13:11	West Cell Floor	0.530	100.0	WCF 18-12
18-Jul	16:04	East Cell Bottom Bench	0.821	103.5	ECBB 18-37
19-Jul	16:07	East Cell Top Bench	0.407	108.4	ECTB 18-20
20-Jul	13:12	West Cell Floor	0.382	97.5	WCF 18-11
23-Jul	13:09	West Cell Floor	0.302	101.0	WCF 18-13
24-Jul	13:06	West Cell Top Bench	1.745	112.0	WCTB 18-06
25-Jul	13:06	East Cell Bottom Bench	1.206	106.0	ECBB 18-38
25-Jul	13:14	West Cell Floor	0.403	98.8	WCF 18-14
27-Jul	13:05	West Cell Floor	0.692	101.9	WCF 18-15
30-Jul	13:06	East Cell Top Bench	0.51	106.5	ECTB 18-21
30-Jul	13:18	East Cell Bottom Bench	1.291	105.5	ECBB 18-39

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

August 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

July 2018 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2018 and July 31, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Jul	16:20	East Cell Top Bench	0.992	109.2	ECTB1816
4-Jul	13:12	West Cell Floor	0.38	106.0	WCF 18-07
5-Jul	13:20	East Cell Top Bench	0.51	121.1	ECTB 2018-18
6-Jul	16:10	East Cell Top Bench	0.76	111.5	ECTB 18-17
9-Jul	16:25	East Cell Bottom Bench	0.783	115.7	ECBB 2018-35
10-Jul	16:12	West Cell Floor	0.38	112.6	WCF 2018-10
10-Jul	16:30	West Cell Top Bench	1.656	111.8	WCTB 2018-04
12-Jul	13:10	East Cell Bottom Bench	1.283	95.9	ECBB2018-36
16-Jul	13:13	West Cell Top Bench	0.76	118.1	WCTB 18-05
17-Jul	13:11	West Cell Floor	0.25	117.4	WCF 18-12
18-Jul	16:04	East Cell Bottom Bench	0.880	118.1	ECBB 18-37
19-Jul	16:07	East Cell Top Bench	0.933	100.0	ECTB 18-20
20-Jul	13:12	West Cell Floor	0.254	108.8	WCF 18-11
23-Jul	13:09	West Cell Floor	**	**	WCF 18-13
24-Jul	13:06	West Cell Top Bench	**	**	WCTB 18-06
25-Jul	13:06	East Cell Bottom Bench	**	**	ECBB 18-38
25-Jul	13:14	West Cell Floor	**	**	WCF 18-14
27-Jul	13:05	West Cell Floor	0.254	109.5	WCF 18-15
30-Jul	13:06	East Cell Top Bench	0.63	102.8	ECTB 18-21
30-Jul	13:18	East Cell Bottom Bench	0.933	106.0	ECBB 18-39

**Missing data – Unit offline July 20, 2018 – July 25, 2018 due to power loss

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

August 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

July 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2018 and July 31, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Jul	16:20	East Cell Top Bench	0.929	108.4	ECTB1816
4-Jul	13:12	West Cell Floor	0.143	97.5	WCF 18-07
5-Jul	13:20	East Cell Top Bench	0.65	109.2	ECTB 2018-18
6-Jul	16:10	East Cell Top Bench	1.392	104.2	ECTB 18-17
9-Jul	16:25	East Cell Bottom Bench	0.49	110.2	ECBB 2018-35
10-Jul	16:12	West Cell Floor	0.17	108.8	WCF 2018-10
10-Jul	16:30	West Cell Top Bench	1.327	101.0	WCTB 2018-04
12-Jul	13:10	East Cell Bottom Bench	2.406	101.9	ECBB2018-36
16-Jul	13:13	West Cell Top Bench	1.349	106.5	WCTB 18-05
17-Jul	13:11	West Cell Floor	0.281	107.0	WCF 18-12
18-Jul	16:04	East Cell Bottom Bench	0.52	114.8	ECBB 18-37
19-Jul	16:07	East Cell Top Bench	0.65	108.8	ECTB 18-20
20-Jul	13:12	West Cell Floor	0.212	101.9	WCF 18-11
23-Jul	13:09	West Cell Floor	0.147	101.9	WCF 18-13
24-Jul	13:06	West Cell Top Bench	1.344	108.0	WCTB 18-06
25-Jul	13:06	East Cell Bottom Bench	1.547	102.8	ECBB 18-38
25-Jul	13:14	West Cell Floor	0.144	97.5	WCF 18-14
27-Jul	13:05	West Cell Floor	0.273	101.0	WCF 18-15
30-Jul	13:06	East Cell Top Bench	0.57	112.8	ECTB 18-21
30-Jul	13:18	East Cell Bottom Bench	0.90	114.4	ECBB 18-39

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECC NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

August 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

July 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2018 and July 31, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Jul	16:20	East Cell Top Bench	0.491	115.7	ECTB1816
4-Jul	13:12	West Cell Floor	0.293	104.2	WCF 18-07
5-Jul	13:20	East Cell Top Bench	0.447	112.3	ECTB 2018-18
6-Jul	16:10	East Cell Top Bench	0.567	109.2	ECTB 18-17
9-Jul	16:25	East Cell Bottom Bench	0.429	102.8	ECBB 2018-35
10-Jul	16:12	West Cell Floor	0.22	100.0	WCF 2018-10
10-Jul	16:30	West Cell Top Bench	2.611	108.0	WCTB 2018-04
12-Jul	13:10	East Cell Bottom Bench	0.95	116.1	ECBB2018-36
16-Jul	13:13	West Cell Top Bench	1.342	108.4	WCTB 18-05
17-Jul	13:11	West Cell Floor	0.222	100.0	WCF 18-12
18-Jul	16:04	East Cell Bottom Bench	0.43	109.5	ECBB 18-37
19-Jul	16:07	East Cell Top Bench	0.397	117.5	ECTB 18-20
20-Jul	13:12	West Cell Floor	0.225	107.0	WCF 18-11
23-Jul	13:09	West Cell Floor	0.206	105.5	WCF 18-13
24-Jul	13:06	West Cell Top Bench	1.667	113.1	WCTB 18-06
25-Jul	13:06	East Cell Bottom Bench	0.397	106.0	ECBB 18-38
25-Jul	13:14	West Cell Floor	0.397	106.0	WCF 18-14
27-Jul	13:05	West Cell Floor	0.264	105.5	WCF 18-15
30-Jul	13:06	East Cell Top Bench	0.54	118.1	ECTB 18-21
30-Jul	13:18	East Cell Bottom Bench	0.70	109.9	ECBB 18-39

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

August 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Cody Carey

July 2018 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Cody Carey,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment and Climate Change guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECC *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECC criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2018 and July 31, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECC NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
3-Jul	16:20	East Cell Top Bench	0.889	98.8	ECTB1816
4-Jul	13:12	West Cell Floor	0.284	93.6	WCF 18-07
5-Jul	13:20	East Cell Top Bench	0.654	93.8	ECTB 2018-18
6-Jul	16:10	East Cell Top Bench	0.509	95.8	ECTB 18-17
9-Jul	16:25	East Cell Bottom Bench	0.583	105.0	ECBB 2018-35
10-Jul	16:12	West Cell Floor	1.02	94.9	WCF 2018-10
10-Jul	16:30	West Cell Top Bench	1.166	88.0	WCTB 2018-04
12-Jul	13:10	East Cell Bottom Bench	1.109	96.8	ECBB2018-36
16-Jul	13:13	West Cell Top Bench	0.842	98.3	WCTB 18-05
17-Jul	13:11	West Cell Floor	0.221	97.1	WCF 18-12
18-Jul	16:04	East Cell Bottom Bench	0.623	96.9	ECBB 18-37
19-Jul	16:07	East Cell Top Bench	0.583	93.3	ECTB 18-20
20-Jul	13:12	West Cell Floor	0.244	98.1	WCF 18-11
23-Jul	13:09	West Cell Floor	0.85	100.8	WCF 18-13
24-Jul	13:06	West Cell Top Bench	0.920	98.9	WCTB 18-06
25-Jul	13:06	East Cell Bottom Bench	1.225	93.1	ECBB 18-38
25-Jul	13:14	West Cell Floor	0.229	105.4	WCF 18-14
27-Jul	13:05	West Cell Floor	0.229	96.2	WCF 18-15
30-Jul	13:06	East Cell Top Bench	0.654	95.0	ECTB 18-21
30-Jul	13:18	East Cell Bottom Bench	0.685	98.8	ECBB 18-39

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECC NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

September 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.
As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2018 and August 31, 2018 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Aug	13:11	North Quarry Floor	0.079	100.0	NCF 18-01
3-Aug	13:15	East Cell Bottom Bench	1.792	105.5	ECBB 18-41
8-Aug	13:36	East Cell Top Bench	0.381	103.5	ECTB 18-19
8-Aug	13:11	West Cell Floor	0.063	87.9	WCF 18-17
9-Aug	13:09	West Cell Top Bench	1.305	108.0	WCTB 18-07
13-Aug	13:13	East Cell Bottom Bench	0.996	108.4	ECBB 18-42
14-Aug	13:13	North Quarry Floor	0.127	93.9	NCF 18-02
15-Aug	13:17	East Cell Top Bench	0.618	104.2	ECTB 18-22
16-Aug	13:12	East Cell Bottom Bench	2.445	109.9	ECBB 18-40-43
20-Aug	13:34	West Cell Floor	0.811	109.2	WCF 18-18
20-Aug	13:14	East Cell Top Bench	0.811	109.2	ECTB 18-23
22-Aug	13:24	North Quarry Floor	0.16	104.9	NCF 18-03
22-Aug	13:07	East Cell Bottom Bench	1.488	92.9	ECBB 18-44
24-Aug	13:07	West Cell Top Bench	2.102	103.4	WCTB 18-08
27-Aug	13:18	North Quarry Floor	0.150	93.3	NCF 18-04
28-Aug	16:09	East Cell Bottom Bench	1.933	93.2	ECBB 18-46
29-Aug	16:09	East Cell Bottom Bench	0.741	103.9	ECBB 18-48
30-Aug	16:09	East Cell Top Bench	1.005	104.2	ECTB 18-24

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECP NPC 119 guideline limits. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

September 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>August 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2018 and August 31, 2018 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below), all of which were within the allowable limits of the MOECP NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Aug	13:11	North Quarry Floor	0.079	102.8	NCF 18-01
3-Aug	13:15	East Cell Bottom Bench	0.943	115.0	ECBB 18-41
8-Aug	13:36	East Cell Top Bench	0.410	102.8	ECTB 18-19
8-Aug	13:11	West Cell Floor	0.159	111.2	WCF 18-17
9-Aug	13:09	West Cell Top Bench	1.794	109.5	WCTB 18-07
13-Aug	13:13	East Cell Bottom Bench	0.493	111.5	ECBB 18-42
14-Aug	13:13	North Quarry Floor	0.095	95.9	NCF 18-02
15-Aug	13:17	East Cell Top Bench	0.371	102.8	ECTB 18-22
16-Aug	13:12	East Cell Bottom Bench	1.338	117.6	ECBB 18-40-43
20-Aug	13:34	West Cell Floor	0.17	104.9	WCF 18-18
20-Aug	13:14	East Cell Top Bench	0.501	113.1	ECTB 18-23
22-Aug	13:24	North Quarry Floor	0.08	102.8	NCF 18-03
22-Aug	13:07	East Cell Bottom Bench	0.743	108.4	ECBB 18-44
24-Aug	13:07	West Cell Top Bench	1.739	113.1	WCTB 18-08
27-Aug	13:18	North Quarry Floor	0.127	98.8	NCF 18-04
28-Aug	16:09	East Cell Bottom Bench	1.241	109.9	ECBB 18-46
29-Aug	16:09	East Cell Bottom Bench	0.48	103.5	ECBB 18-48
30-Aug	16:09	East Cell Top Bench	0.554	115.0	ECTB 18-24

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with

MOECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

September 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2018 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2018 and August 31, 2018 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Aug	13:11	North Quarry Floor	0.244	92.8	NCF 18-01
3-Aug	13:15	East Cell Bottom Bench	0.866	95.5	ECBB 18-41
8-Aug	13:36	East Cell Top Bench	0.221	104.0	ECTB 18-19
8-Aug	13:11	West Cell Floor	0.321	99.2	WCF 18-17
9-Aug	13:09	West Cell Top Bench	0.58	104.0	WCTB 18-07
13-Aug	13:13	East Cell Bottom Bench	0.55	95.9	ECBB 18-42
14-Aug	13:13	North Quarry Floor	0.229	95.5	NCF 18-02
15-Aug	13:17	East Cell Top Bench	0.50	93.3	ECTB 18-22
16-Aug	13:12	East Cell Bottom Bench	1.584	98.9	ECBB 18-40-43
20-Aug	13:34	West Cell Floor	0.134	96.1	WCF 18-18
20-Aug	13:14	East Cell Top Bench	0.404	90.6	ECTB 18-23
22-Aug	13:24	North Quarry Floor	0.12	100.1	NCF 18-03
22-Aug	13:07	East Cell Bottom Bench	0.61	106.8	ECBB 18-44
24-Aug	13:07	West Cell Top Bench	0.57	98.9	WCTB 18-08
27-Aug	13:18	North Quarry Floor	0.126	94.7	NCF 18-04
28-Aug	16:09	East Cell Bottom Bench	1.254	93.2	ECBB 18-46
29-Aug	16:09	East Cell Bottom Bench	0.60	103.6	ECBB 18-48
30-Aug	16:09	East Cell Top Bench	0.82	91.6	ECTB 18-24

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with

MOECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

September 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2018 and August 31, 2018 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below), all of which were within the allowable limits of the MOECP NPC 119 specification.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Aug	13:11	North Quarry Floor	0.14	103.5	NCF 18-01
3-Aug	13:15	East Cell Bottom Bench	1.377	106.0	ECBB 18-41
8-Aug	13:36	East Cell Top Bench	0.57	103.5	ECTB 18-19
8-Aug	13:11	West Cell Floor	0.674	102.8	WCF 18-17
9-Aug	13:09	West Cell Top Bench	2.294	110.6	WCTB 18-07
13-Aug	13:13	East Cell Bottom Bench	0.84	105.5	ECBB 18-42
14-Aug	13:13	North Quarry Floor	0.270	101.9	NCF 18-02
15-Aug	13:17	East Cell Top Bench	0.48	104.9	ECTB 18-22
16-Aug	13:12	East Cell Bottom Bench	1.894	112.3	ECBB 18-40-43
20-Aug	13:34	West Cell Floor	0.44	101.0	WCF 18-18
20-Aug	13:14	East Cell Top Bench	0.40	106.5	ECTB 18-23
22-Aug	13:24	North Quarry Floor	0.212	97.5	NCF 18-03
22-Aug	13:07	East Cell Bottom Bench	1.109	104.2	ECBB 18-44
24-Aug	13:07	West Cell Top Bench	1.874	112.8	WCTB 18-08
27-Aug	13:18	North Quarry Floor	0.349	102.8	NCF 18-04
28-Aug	16:09	East Cell Bottom Bench	1.621	102.8	ECBB 18-46
29-Aug	16:09	East Cell Bottom Bench	1.028	102.8	ECBB 18-48
30-Aug	16:09	East Cell Top Bench	0.564	112.0	ECTB 18-24

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECP NPC 119 guideline limits. Should you have any questions or concerns related to the information

contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

September 13, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2018 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2018 and August 31, 2018 and cross referenced with the blasting records provided to confirm that there were eighteen (18) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
2-Aug	13:11	North Quarry Floor	0.25	116.4	NCF 18-01
3-Aug	13:15	East Cell Bottom Bench	0.933	109.2	ECBB 18-41
8-Aug	13:36	East Cell Top Bench	0.38	109.5	ECTB 18-19
8-Aug	13:11	West Cell Floor	0.38	97.5	WCF 18-17
9-Aug	13:09	West Cell Top Bench	0.38	111.5	WCTB 18-07
13-Aug	13:13	East Cell Bottom Bench	0.63	102.8	ECBB 18-42
14-Aug	13:13	North Quarry Floor	0.381	101.0	NCF 18-02
15-Aug	13:17	East Cell Top Bench	1.178	98.8	ECTB 18-22
16-Aug	13:12	East Cell Bottom Bench	1.356	105.5	ECBB 18-40-43
20-Aug	13:34	West Cell Floor	0.25	113.8	WCF 18-18
20-Aug	13:14	East Cell Top Bench	0.63	112.3	ECTB 18-23
22-Aug	13:24	North Quarry Floor	0.421	118.2	NCF 18-03
22-Aug	13:07	East Cell Bottom Bench	1.078	105.5	ECBB 18-44
24-Aug	13:07	West Cell Top Bench	0.63	109.5	WCTB 18-08
27-Aug	13:18	North Quarry Floor	0.25	107.0	NCF 18-04
28-Aug	16:09	East Cell Bottom Bench	1.309	106.5	ECBB 18-46
29-Aug	16:09	East Cell Bottom Bench	0.783	109.5	ECBB 18-48
30-Aug	16:09	East Cell Top Bench	0.907	97.5	ECTB 18-24

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECP NPC 119 guideline. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

October 9, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.
As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2018 and September 30, 2018 and cross referenced with the blasting records provided to confirm that there were fourteen (14) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.134	87.9	NCF 18-06
5-Sep	13:05	East Cell Bottom Bench	1.655	98.1	ECBB 18-50
7-Sep	13:06	North Quarry Floor	0.209	89.8	NCF 18-07
11-Sep	13:09	East Cell Bottom Bench	1.474	98.3	ECBB 18-47
12-Sep	13:05	East Cell Bottom Bench	0.879	107.1	ECBB 18-49
13-Sep	13:08	East Cell Top Bench	0.530	109.9	ECTB 18-25
14-Sep	13:06	North Quarry Floor	0.126	96.3	NCF 18-05
17-Sep	13:06	East Cell Bottom Bench	1.383	102.4	ECBB 18-51
18-Sep	13:11	East Cell Top Bench	0.449	98.0	ECTB 18-26
19-Sep	13:09	West Cell Floor	0.236	98.8	WCF 18-19
20-Sep	16:09	East Cell Bottom Bench	1.060	107.5	ECBB 18-52
24-Sep	13:09	East Cell Top Bench	0.799	107.3	ECTB 18-27
25-Sep	13:09	East Cell Bottom Bench	1.210	113.0	ECBB 18-53
27-Sep	13:10	West Cell Floor	0.273	95.9	WCF 18-20

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MOECP NPC 119 guideline limits. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

October 9, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>September 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2018 and September 30, 2018 and cross referenced with the blasting records provided to confirm that there were fourteen (14) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.143	97.5	NCF 18-06
5-Sep	13:05	East Cell Bottom Bench	1.132	111.5	ECBB 18-50
7-Sep	13:06	North Quarry Floor	0.127	100.0	NCF 18-07
11-Sep	13:09	East Cell Bottom Bench	1.055	111.8	ECBB 18-47
12-Sep	13:05	East Cell Bottom Bench	0.49	112.3	ECBB 18-49
13-Sep	13:08	East Cell Top Bench	0.300	118.5	ECTB 18-25
14-Sep	13:06	North Quarry Floor	0.127	108.0	NCF 18-05
17-Sep	13:06	East Cell Bottom Bench	1.200	115.9	ECBB 18-51
18-Sep	13:11	East Cell Top Bench	0.302	101.0	ECTB 18-26
19-Sep	13:09	West Cell Floor	0.127	102.8	WCF 18-19
20-Sep	16:09	East Cell Bottom Bench	0.561	119.7	ECBB 18-52
24-Sep	13:09	East Cell Top Bench	0.537	117.4	ECTB 18-27
25-Sep	13:09	East Cell Bottom Bench	0.477	108.8	ECBB 18-53
27-Sep	13:10	West Cell Floor	0.175	105.5	WCF 18-20

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECP NPC 119 guideline. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

October 9, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>September 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2018 and September 30, 2018 and cross referenced with the blasting records provided to confirm that there were fourteen (14) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.46	103.5	NCF 18-06
5-Sep	13:05	East Cell Bottom Bench	2.608	107.0	ECBB 18-50
7-Sep	13:06	North Quarry Floor	0.334	108.4	NCF 18-07
11-Sep	13:09	East Cell Bottom Bench	2.026	108.0	ECBB 18-47
12-Sep	13:05	East Cell Bottom Bench	1.172	106.0	ECBB 18-49
13-Sep	13:08	East Cell Top Bench	0.389	109.5	ECTB 18-25
14-Sep	13:06	North Quarry Floor	0.256	103.5	NCF 18-05
17-Sep	13:06	East Cell Bottom Bench	2.394	110.9	ECBB 18-51
18-Sep	13:11	East Cell Top Bench	1.047	97.5	ECTB 18-26
19-Sep	13:09	West Cell Floor	0.573	100.0	WCF 18-19
20-Sep	16:09	East Cell Bottom Bench	1.067	115.4	ECBB 18-52
24-Sep	13:09	East Cell Top Bench	0.382	113.5	ECTB 18-27
25-Sep	13:09	East Cell Bottom Bench	1.005	103.5	ECBB 18-53
27-Sep	13:10	West Cell Floor	0.430	101.0	WCF 18-20

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECP NPC 119 guideline limits. Should you have any questions or concerns related to the information

contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

October 9, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2018 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2018 and September 30, 2018 and cross referenced with the blasting records provided to confirm that there were fourteen (14) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.102	92.6	NCF 18-06
5-Sep	13:05	East Cell Bottom Bench	1.258	99.2	ECBB 18-50
7-Sep	13:06	North Quarry Floor	0.110	104.5	NCF 18-07
11-Sep	13:09	East Cell Bottom Bench	1.214	89.8	ECBB 18-47
12-Sep	13:05	East Cell Bottom Bench	0.847	96.9	ECBB 18-49
13-Sep	13:08	East Cell Top Bench	0.536	106.9	ECTB 18-25
14-Sep	13:06	North Quarry Floor	0.11	96.9	NCF 18-05
17-Sep	13:06	East Cell Bottom Bench	1.645	90.1	ECBB 18-51
18-Sep	13:11	East Cell Top Bench	0.334	100.3	ECTB 18-26
19-Sep	13:09	West Cell Floor	0.158	97.1	WCF 18-19
20-Sep	16:09	East Cell Bottom Bench	1.129	92.6	ECBB 18-52
24-Sep	13:09	East Cell Top Bench	0.427	101.6	ECTB 18-27
25-Sep	13:09	East Cell Bottom Bench	0.539	105.2	ECBB 18-53
27-Sep	13:10	West Cell Floor	0.17	93.1	WCF 18-20

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECP NPC 119 guideline. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

October 9, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2018 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2018 and September 30, 2018 and cross referenced with the blasting records provided to confirm that there were fourteen (14) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.254	100.0	NCF 18-06
5-Sep	13:05	East Cell Bottom Bench	1.276	105.5	ECBB 18-50
7-Sep	13:06	North Quarry Floor	0.254	101.0	NCF 18-07
11-Sep	13:09	East Cell Bottom Bench	1.032	107.0	ECBB 18-47
12-Sep	13:05	East Cell Bottom Bench	1.178	104.9	ECBB 18-49
13-Sep	13:08	East Cell Top Bench	0.696	115.9	ECTB 18-25
14-Sep	13:06	North Quarry Floor	0.254	105.5	NCF 18-05
17-Sep	13:06	East Cell Bottom Bench	1.157	108.9	ECBB 18-51
18-Sep	13:11	East Cell Top Bench	0.381	115.2	ECTB 18-26
19-Sep	13:09	West Cell Floor	0.254	107.5	WCF 18-19
20-Sep	16:09	East Cell Bottom Bench	1.000	103.5	ECBB 18-52
24-Sep	13:09	East Cell Top Bench	0.475	115.6	ECTB 18-27
25-Sep	13:09	East Cell Bottom Bench	0.648	109.9	ECBB 18-53
27-Sep	13:10	West Cell Floor	0.254	106.5	WCF 18-20

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MOECP NPC 119 guideline. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

November 6, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2018 and October 31, 2018 and cross referenced with the blasting records provided to confirm that there were fifteen (15) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Oct	13:09	East Cell Bottom Bench	0.981	118.6	ECBB 15-55
2-Oct	13:08	North Quarry Floor	0.111	97.5	NCF 18-09
4-Oct	13:07	East Cell Bottom Bench	1.388	106.0	ECBB 18-54
9-Oct	13:13	East Cell Top Bench	0.367	114.4	ECTB 18-28
10-Oct	13:10	East Cell Bottom Bench	0.397	105.5	ECBB 18-56
11-Oct	16:27	West Cell Top Bench	1.403	105.5	WCTB 18-10
15-Oct	13:10	North Quarry Floor	0.111	100.0	NQF 18-10
16-Oct	13:10	East Cell Bottom Bench	1.332	108.8	ECBB 18-57
18-Oct	13:07	East Cell Top Bench	0.614	107.0	ECTB 18-29
23-Oct	13:10	East Cell Bottom Bench	0.51	104.2	ECBB 18-59
24-Oct	13:13	West Cell Floor	0.11	101.9	WCF 18-21
24-Oct	13:21	West Cell Top Bench	1.588	113.5	WCTB 18-11
23-Oct	13:25	North Quarry Floor	0.13	101.9	NQF 18-11
29-Oct	13:06	East Cell Bottom Bench	1.551	105.5	ECBB 18-58
30-Oct	13:09	East Cell Top Bench	0.321	112.6	ECTB 18-30

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

November 6, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2018 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2018 and October 31, 2018 and cross referenced with the blasting records provided to confirm that there were fifteen (15) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Oct	13:09	East Cell Bottom Bench	0.878	100.7	ECBB 15-55
2-Oct	13:08	North Quarry Floor	0.205	95.3	NCF 18-09
4-Oct	13:07	East Cell Bottom Bench	1.913	93.4	ECBB 18-54
9-Oct	13:13	East Cell Top Bench	0.680	106.2	ECTB 18-28
10-Oct	13:10	East Cell Bottom Bench	0.590	104.4	ECBB 18-56
11-Oct	16:27	West Cell Top Bench	0.888	98.3	WCTB 18-10
15-Oct	13:10	North Quarry Floor	0.210	103.5	NQF 18-10
16-Oct	13:10	East Cell Bottom Bench	1.330	94.7	ECBB 18-57
18-Oct	13:07	East Cell Top Bench	0.575	103.8	ECTB 18-29
23-Oct	13:10	East Cell Bottom Bench	0.562	101.9	ECBB 18-59
24-Oct	13:13	West Cell Floor	0.20	92.8	WCF 18-21
24-Oct	13:21	West Cell Top Bench	0.777	99.6	WCTB 18-11
23-Oct	13:25	North Quarry Floor	0.20	98.8	NQF 18-11
29-Oct	13:06	East Cell Bottom Bench	2.077	101.5	ECBB 18-58
30-Oct	13:09	East Cell Top Bench	0.620	95.5	ECTB 18-30

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

November 6, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2018 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2018 and October 31, 2018 and cross referenced with the blasting records provided to confirm that there were fifteen (15) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Oct	13:09	East Cell Bottom Bench	1.94	102.6	ECBB 15-55
2-Oct	13:08	North Quarry Floor	0.254	98.8	NCF 18-09
4-Oct	13:07	East Cell Bottom Bench	1.709	100.0	ECBB 18-54
9-Oct	13:13	East Cell Top Bench	0.907	113.1	ECTB 18-28
10-Oct	13:10	East Cell Bottom Bench	0.813	119.1	ECBB 18-56
11-Oct	16:27	West Cell Top Bench	0.684	114.2	WCTB 18-10
15-Oct	13:10	North Quarry Floor	0.254	115.6	NQF 18-10
16-Oct	13:10	East Cell Bottom Bench	1.244	105.5	ECBB 18-57
18-Oct	13:07	East Cell Top Bench	0.51	122.9	ECTB 18-29
23-Oct	13:10	East Cell Bottom Bench	0.684	114.4	ECBB 18-59
24-Oct	13:13	West Cell Floor	0.254	115.7	WCF 18-21
24-Oct	13:21	West Cell Top Bench	0.524	113.1	WCTB 18-11
23-Oct	13:25	North Quarry Floor	0.25	116.4	NQF 18-11
29-Oct	13:06	East Cell Bottom Bench	1.550	109.2	ECBB 18-58
30-Oct	13:09	East Cell Top Bench	0.51	110.9	ECTB 18-30

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with

MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

November 6, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.
As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2018 and October 31, 2018 and cross referenced with the blasting records provided to confirm that there were fifteen (15) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Oct	13:09	East Cell Bottom Bench	1.937	102.6	ECBB 15-55
2-Oct	13:08	North Quarry Floor	0.173	88.6	NCF 18-09
4-Oct	13:07	East Cell Bottom Bench	2.044	96.4	ECBB 18-54
9-Oct	13:13	East Cell Top Bench	0.533	112.4	ECTB 18-28
10-Oct	13:10	East Cell Bottom Bench	0.987	108.8	ECBB 18-56
11-Oct	16:27	West Cell Top Bench	1.602	98.8	WCTB 18-10
15-Oct	13:10	North Quarry Floor	0.231	114.1	NQF 18-10
16-Oct	13:10	East Cell Bottom Bench	2.437	101.9	ECBB 18-57
18-Oct	13:07	East Cell Top Bench	1.088	110.7	ECTB 18-29
23-Oct	13:10	East Cell Bottom Bench	0.991	111.4	ECBB 18-59
24-Oct	13:13	West Cell Floor	0.20	108.1	WCF 18-21
24-Oct	13:21	West Cell Top Bench	1.746	98.1	WCTB 18-11
23-Oct	13:25	North Quarry Floor	0.186	102.2	NQF 18-11
29-Oct	13:06	East Cell Bottom Bench	1.785	97.6	ECBB 18-58
30-Oct	13:09	East Cell Top Bench	0.702	106.8	ECTB 18-30

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the

information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

November 6, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2018 and October 31, 2018 and cross referenced with the blasting records provided to confirm that there were fifteen (15) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Oct	13:09	East Cell Bottom Bench	1.016	111.5	ECBB 15-55
2-Oct	13:08	North Quarry Floor	0.35	91.5	NCF 18-09
4-Oct	13:07	East Cell Bottom Bench	1.385	108.8	ECBB 18-54
9-Oct	13:13	East Cell Top Bench	0.434	101.9	ECTB 18-28
10-Oct	13:10	East Cell Bottom Bench	0.779	101.0	ECBB 18-56
11-Oct	16:27	West Cell Top Bench	1.273	112.0	WCTB 18-10
15-Oct	13:10	North Quarry Floor	0.283	105.5	NQF 18-10
16-Oct	13:10	East Cell Bottom Bench	1.161	103.5	ECBB 18-57
18-Oct	13:07	East Cell Top Bench	0.459	103.5	ECTB 18-29
23-Oct	13:10	East Cell Bottom Bench	0.614	107.0	ECBB 18-59
24-Oct	13:13	West Cell Floor	0.21	101.9	WCF 18-21
24-Oct	13:21	West Cell Top Bench	1.165	117.1	WCTB 18-11
23-Oct	13:25	North Quarry Floor	0.27	100.0	NQF 18-11
29-Oct	13:06	East Cell Bottom Bench	1.251	108.8	ECBB 18-58
30-Oct	13:09	East Cell Top Bench	0.317	104.9	ECTB 18-30

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECP NPC 119 guideline limits. Should you have any questions or concerns related to the information

contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

December 14, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>November/December 2018 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November/December 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2018 and December 3, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Nov	13:22	East Cell Bottom Bench	0.673	111.9	ECBB 18-61
5-Nov	13:16	East Cell Bottom Bench	1.625	111.7	ECBB 18-60
7-Nov	16:08	East Cell Top Bench	0.566	114.7	ECTB 18-31
13-Nov	13:32	East Cell Top Bench	0.797	104.1	ECTB 18-32
16-Nov	14:08	East Cell Bottom Bench	0.994	111.3	ECBB 18-63
20-Nov	13:13	East Cell Bottom Bench	1.209	103.5	ECBB 18-62
26-Nov	13:22	East Cell Top Bench	0.248	100.3	ECTB 18-34
28-Nov	13:14	West Cell Top Bench	1.548	101.0	WCTB 18-12
3-Dec	13:08	East Cell Top Bench	0.728	105.4	ECTB 18-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

December 14, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November/December 2018 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November/December 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MOECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MOECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2018 and December 3, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Nov	13:22	East Cell Bottom Bench	0.643	107.5	ECBB 18-61
5-Nov	13:16	East Cell Bottom Bench	0.699	109.5	ECBB 18-60
7-Nov	16:08	East Cell Top Bench	0.350	105.5	ECTB 18-31
13-Nov	13:32	East Cell Top Bench	0.384	118.3	ECTB 18-32
16-Nov	14:08	East Cell Bottom Bench	0.630	108.4	ECBB 18-63
20-Nov	13:13	East Cell Bottom Bench	0.964	112.3	ECBB 18-62
26-Nov	13:22	East Cell Top Bench	0.081	108.0	ECTB 18-34
28-Nov	13:14	West Cell Top Bench	1.797	118.2	WCTB 18-12
3-Dec	13:08	East Cell Top Bench	0.292	115.7	ECTB 18-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MOECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

December 14, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November/December 2018 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November/December 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2018 and December 3, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Nov	13:22	East Cell Bottom Bench	0.420	112.0	ECBB 18-61
5-Nov	13:16	East Cell Bottom Bench	0.888	118.2	ECBB 18-60
7-Nov	16:08	East Cell Top Bench	0.434	116.7	ECTB 18-31
13-Nov	13:32	East Cell Top Bench	0.441	112.6	ECTB 18-32
16-Nov	14:08	East Cell Bottom Bench	0.403	106.0	ECBB 18-63
20-Nov	13:13	East Cell Bottom Bench	1.585	109.2	ECBB 18-62
26-Nov	13:22	East Cell Top Bench	0.112	97.50	ECTB 18-34
28-Nov	13:14	West Cell Top Bench	1.333	112.6	WCTB 18-12
3-Dec	13:08	East Cell Top Bench	0.439	111.8	ECTB 18-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

December 14, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>November/December 2018 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November/December 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2018 and December 3, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Nov	13:22	East Cell Bottom Bench	0.781	105.1	ECBB 18-61
5-Nov	13:16	East Cell Bottom Bench	0.790	102.6	ECBB 18-60
7-Nov	16:08	East Cell Top Bench	0.647	111.6	ECTB 18-31
13-Nov	13:32	East Cell Top Bench	0.594	95.96	ECTB 18-32
16-Nov	14:08	East Cell Bottom Bench	0.708	107.1	ECBB 18-63
20-Nov	13:13	East Cell Bottom Bench	1.811	99.6	ECBB 18-62
26-Nov	13:22	East Cell Top Bench	0.198	93.92	ECTB 18-34
28-Nov	13:14	West Cell Top Bench	0.796	108.2	WCTB 18-12
3-Dec	13:08	East Cell Top Bench	0.506	96.48	ECTB 18-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

December 14, 2018

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November/December 2018 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November/December 2018. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between November 1, 2018 and December 3, 2018 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
1-Nov	13:22	East Cell Bottom Bench	0.539	109.9	ECBB 18-61
5-Nov	13:16	East Cell Bottom Bench	0.992	108.0	ECBB 18-60
7-Nov	16:08	East Cell Top Bench	0.539	117.8	ECTB 18-31
13-Nov	13:32	East Cell Top Bench	0.730	111.8	ECTB 18-32
16-Nov	14:08	East Cell Bottom Bench	0.660	114.4	ECBB 18-63
20-Nov	13:13	East Cell Bottom Bench	1.047	119.1	ECBB 18-62
26-Nov	13:22	East Cell Top Bench	0.311	107.5	ECTB 18-34
28-Nov	13:14	West Cell Top Bench	0.751	124.5	WCTB 18-12
3-Dec	13:08	East Cell Top Bench	0.458	113.5	ECTB 18-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

March 4, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2019 Vibration Summary: CV307– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the CV307 building, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2019 and February 28, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below). CV307 does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
22-Feb-19	12:05	East Cell Bottom Bench	2.43	112.0	ECBB 19-01

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

March 5, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2019 and February 28, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
22-Feb-19	12:05	East Cell Bottom Bench	0.90	108.4	ECBB 19-01

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

March 5, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2019 and February 28, 2019 and cross referenced with the blasting records provided to confirm that there were one (1) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
22-Feb-19	12:05	East Cell Bottom Bench	0.813	106.5	ECBB 19-01

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

March 5, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.
As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2019 and February 28, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
22-Feb-19	12:05	East Cell Bottom Bench	1.103	106.9	ECBB 19-01

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations, and air overpressure levels, have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

March 5, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2019 Vibration Summary: CV312– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the CV312 building, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 2.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2019 and February 28, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blasts (see table below). CV312 does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
22-Feb-19	12:05	East Cell Bottom Bench	0.78	113.3	ECBB 19-01

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

March 5, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2019 and February 28, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
22-Feb-19	12:05	East Cell Bottom Bench	0.991	108.8	ECBB 19-01

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

March 5, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2019 and February 28, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blasts (see table below).

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Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
22-Feb-19	12:05	East Cell Bottom Bench	1.25	97.0	ECBB 19-01

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

April 11, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

March 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2019 and March 31, 2019 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
04-Mar	12:08	East Cell	1.508	104.9	ECBB 19-02
07-Mar	13:07	East Cell	0.89	119.8	ECBB 19-05
13-Mar	13:13	East Cell	0.582	114.6	ECTB 19-01
19-Mar	13:15	East Cell	0.852	116.1	ECBB 19-04
22-Mar	13:23	East Cell	0.933	122.9	ECTB 19-02
25-Mar	13:10	East Cell	2.314	97.5	ECBB 19-03
27-Mar	13:13	East Cell	0.813	116.1	ECTB 19-03
28-Mar	13:21	East Cell	0.861	117.2	ECBB 19-06
29-Mar	16:13	East Cell	1.062	113.3	ECTB 19-04

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

April 11, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

March 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2019 and March 31, 2019 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
04-Mar	12:08	East Cell	1.483	99.1	ECBB 19-02
07-Mar	13:07	East Cell	1.121	95.2	ECBB 19-05
13-Mar	13:13	East Cell	0.688	110.8	ECTB 19-01
19-Mar	13:15	East Cell	1.238	111.9	ECBB 19-04
22-Mar	13:23	East Cell	0.580	111.1	ECTB 19-02
25-Mar	13:10	East Cell	1.269	99.5	ECBB 19-03
27-Mar	13:13	East Cell	1.351	110.6	ECTB 19-03
28-Mar	13:21	East Cell	2.036	104.4	ECBB 19-06
29-Mar	16:13	East Cell	0.893	105.9	ECTB 19-04

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels, have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

April 11, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

March 2019 Vibration Summary: CV307– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the CV307 building, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2019 and March 31, 2019 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blast (see table below). CV307 does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
04-Mar	12:08	East Cell	5.706	109.5	ECBB 19-02
07-Mar	13:07	East Cell	3.294	114.2	ECBB 19-05
13-Mar	13:13	East Cell	2.319	121.9	ECTB 19-01
19-Mar	13:15	East Cell	2.739	115.0	ECBB 19-04
22-Mar	13:23	East Cell	3.379	118.1	ECTB 19-02
25-Mar	13:10	East Cell	6.740	110.6	ECBB 19-03
27-Mar	13:13	East Cell	4.363	119.9	ECTB 19-03
28-Mar	13:21	East Cell	3.331	119.6	ECBB 19-06
29-Mar	16:13	East Cell	2.530	123.5	ECTB 19-04

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

April 11, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

March 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2019 and March 31, 2019 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
04-Mar	12:08	East Cell	1.194	102.8	ECBB 19-02
07-Mar	13:07	East Cell	1.729	102.8	ECBB 19-05
13-Mar	13:13	East Cell	0.590	111.5	ECTB 19-01
19-Mar	13:15	East Cell	0.661	104.9	ECBB 19-04
22-Mar	13:23	East Cell	0.408	117.4	ECTB 19-02
25-Mar	13:10	East Cell	1.201	112.0	ECBB 19-03
27-Mar	13:13	East Cell	0.643	111.5	ECTB 19-03
28-Mar	13:21	East Cell	0.987	112.3	ECBB 19-06
29-Mar	16:13	East Cell	0.406	113.1	ECTB 19-04

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

April 11, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

March 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location. As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2019 and March 31, 2019 and cross referenced with the blasting records provided to confirm that there were nine (9) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
04-Mar	12:08	East Cell	1.201	100.3	ECBB 19-02
07-Mar	13:07	East Cell	0.992	98.4	ECBB 19-05
13-Mar	13:13	East Cell	0.542	107.2	ECTB 19-01
19-Mar	13:15	East Cell	0.804	101.7	ECBB 19-04
22-Mar	13:23	East Cell	0.688	109.3	ECTB 19-02
25-Mar	13:10	East Cell	1.37	90.3	ECBB 19-03
27-Mar	13:13	East Cell	0.512	95.0	ECTB 19-03
28-Mar	13:21	East Cell	0.900	107.0	ECBB 19-06
29-Mar	16:13	East Cell	0.52	94.9	ECTB 19-04

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

April 11, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

March 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of March 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between March 1, 2019 and March 31, 2019 and cross referenced with the blasting records provided to confirm that there was nine (9) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration Level (mm/s)	Peak Air Over-pressure Level dB(L)	Blast No.
04-Mar	12:08	East Cell	1.049	107.9	ECBB 19-02
07-Mar	13:07	East Cell	0.810	107.9	ECBB 19-05
13-Mar	13:13	East Cell	0.541	105.5	ECTB 19-01
19-Mar	13:15	East Cell	1.051	107.0	ECBB 19-04
22-Mar	13:23	East Cell	0.505	116.1	ECTB 19-02
25-Mar	13:10	East Cell	0.862	114.2	ECBB 19-03
27-Mar	13:13	East Cell	0.41	107.9	ECTB 19-03
28-Mar	13:21	East Cell	0.771	105.5	ECBB 19-06
29-Mar	16:13	East Cell	0.337	108.4	ECTB 19-04

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

May 7, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2019 and April 30, 2019 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
02-Apr	16:11	East Cell	1.535	97.50	ECBB 19-08
03-Apr	13:12	East Cell	0.907	123.7	ECTB 19-05
04-Apr	16:10	East Cell	1.032	109.5	ECBB 19-07
09-Apr	13:10	East Cell	0.976	126.2	ECBB 19-09
09-Apr	13:24	East Cell	1.426	107.0	ECTB 19-07
12-Apr	13:13	East Cell	0.254	117.9	ECTB 19-08
15-Apr	13:08	East Cell	1.178	103.5	ECBB 19-10
16-Apr	13:15	East Cell	1.308	108.4	ECTB 19-09
18-Apr	13:09	East Cell	1.171	112.3	ECTB 19-12
22-Apr	13:10	East Cell	1.024	102.8	ECBB 19-11
24-Apr	13:11	East Cell	0.959	119.4	ECTB 19-14
25-Apr	13:12	East Cell	1.122	106.0	ECTB 19-10
26-Apr	13:34	East Cell	1.362	101.9	ECTB 19-13
26-Apr	13:21	East Cell	1.276	102.8	ECBB 19-12
29-Apr	13:15	East Cell	1.350	104.2	ECTB 19-15
30-Apr	16:10	West Cell	0.284	93.98	WCF 19-02

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

May 7, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>April 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2019 and April 30, 2019 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
02-Apr	16:11	East Cell	1.987	110.3	ECBB 19-08
03-Apr	13:12	East Cell	0.805	117.0	ECTB 19-05
04-Apr	16:10	East Cell	1.407	101.2	ECBB 19-07
09-Apr	13:10	East Cell	1.662	113.5	ECBB 19-09
09-Apr	13:24	East Cell	0.718	119.0	ECTB 19-07
12-Apr	13:13	East Cell	0.215	99.01	ECTB 19-08
15-Apr	13:08	East Cell	2.568	104.8	ECBB 19-10
16-Apr	13:15	East Cell	0.728	113.7	ECTB 19-09
18-Apr	13:09	East Cell	0.844	118.1	ECTB 19-12
22-Apr	13:10	East Cell	1.261	101.3	ECBB 19-11
24-Apr	13:11	East Cell	1.163	105.5	ECTB 19-14
25-Apr	13:12	East Cell	0.923	119.5	ECTB 19-10
26-Apr	13:34	East Cell	1.063	101.9	ECTB 19-13
26-Apr	13:21	East Cell	2.423	104.7	ECBB 19-12
29-Apr	13:15	East Cell	1.212	118.0	ECTB 19-15
30-Apr	16:10	West Cell	0.480	97.79	WCF 19-02

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

May 7, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2019 and April 30, 2019 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
02-Apr	16:11	East Cell	1.172	115.7	ECBB 19-08
03-Apr	13:12	East Cell	0.463	117.2	ECTB 19-05
04-Apr	16:10	East Cell	1.019	109.9	ECBB 19-07
09-Apr	13:10	East Cell	0.551	116.9	ECBB 19-09
09-Apr	13:24	East Cell	0.484	112.0	ECTB 19-07
12-Apr	13:13	East Cell	0.108	97.50	ECTB 19-08
15-Apr	13:08	East Cell	1.180	106.0	ECBB 19-10
16-Apr	13:15	East Cell	0.426	118.3	ECTB 19-09
18-Apr	13:09	East Cell	0.799	120.5	ECTB 19-12
22-Apr	13:10	East Cell	0.838	112.6	ECBB 19-11
24-Apr	13:11	East Cell	0.647	113.1	ECTB 19-14
25-Apr	13:12	East Cell	0.442	122.9	ECTB 19-10
26-Apr	13:34	East Cell	0.589	110.9	ECTB 19-13
26-Apr	13:21	East Cell	0.752	109.2	ECBB 19-12
29-Apr	13:15	East Cell	0.736	121.9	ECTB 19-15
30-Apr	16:10	West Cell	0.236	104.9	WCF 19-02

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

May 7, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2019 and April 30, 2019 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
02-Apr	16:11	East Cell	1.710	105.6	ECBB 19-08
03-Apr	13:12	East Cell	0.663	112.0	ECTB 19-05
04-Apr	16:10	East Cell	1.307	95.18	ECBB 19-07
09-Apr	13:10	East Cell	0.873	113.2	ECBB 19-09
09-Apr	13:24	East Cell	0.794	111.7	ECTB 19-07
12-Apr	13:13	East Cell	0.113	92.11	ECTB 19-08
15-Apr	13:08	East Cell	1.411	96.88	ECBB 19-10
16-Apr	13:15	East Cell	0.728	103.8	ECTB 19-09
18-Apr	13:09	East Cell	0.464	99.59	ECTB 19-12
22-Apr	13:10	East Cell	0.703	95.41	ECBB 19-11
24-Apr	13:11	East Cell	0.886	115.5	ECTB 19-14
25-Apr	13:12	East Cell	0.692	103.2	ECTB 19-10
26-Apr	13:34	East Cell	1.188	110.1	ECTB 19-13
26-Apr	13:21	East Cell	1.558	98.14	ECBB 19-12
29-Apr	13:15	East Cell	0.807	115.4	ECTB 19-15
30-Apr	16:10	West Cell	0.188	101.5	WCF 19-02

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

May 7, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2019 and April 30, 2019 and cross referenced with the blasting records provided to confirm that there was sixteen (16) recorded blasts (see table below).

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Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
02-Apr	16:11	East Cell	0.895	109.9	ECBB 19-08
03-Apr	13:12	East Cell	0.353	118.5	ECTB 19-05
04-Apr	16:10	East Cell	0.846	113.1	ECBB 19-07
09-Apr	13:10	East Cell	1.056	121.1	ECBB 19-09
09-Apr	13:24	East Cell	0.408	109.2	ECTB 19-07
12-Apr	13:13	East Cell	0.090	125.1	ECTB 19-08
15-Apr	13:08	East Cell	1.460	113.3	ECBB 19-10
16-Apr	13:15	East Cell	0.291	111.2	ECTB 19-09
18-Apr	13:09	East Cell	0.286	106.5	ECTB 19-12
22-Apr	13:10	East Cell	0.999	108.0	ECBB 19-11
24-Apr	13:11	East Cell	0.486	110.6	ECTB 19-14
25-Apr	13:12	East Cell	0.223	113.3	ECTB 19-10
26-Apr	13:34	East Cell	0.288	93.98	ECTB 19-13
26-Apr	13:21	East Cell	0.524	91.48	ECBB 19-12
29-Apr	13:15	East Cell	0.335	117.4	ECTB 19-15
30-Apr	16:10	West Cell	0.306	104.2	WCF 19-02

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

June 6, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2019 and May 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
01-May	13:16	East Cell Top	1.150	101.9	ECTB 19-11
01-May	13:22	East Cell Top	1.150	101.9	ECTB 19-17
02-May	13:11	East Cell Top	1.106	109.5	ECTB 19-16
06-May	13:16	East Cell Top	0.992	121.5	ECTB 19-18
08-May	13:13	East Cell Bottom	1.332	100.0	ECBB 19-13
09-May	13:11	East Cell Top	0.89	113.9	ECTB 19-20
10-May	13:12	East Cell Bottom	0.925	117.6	ECBB 19-15
14-May	13:12	East Cell Bottom	1.157	91.5	ECBB 19-16
15-May	16:12	East Cell Top	1.024	100.0	ECTB 19-23
16-May	13:11	East Cell Bottom	1.171	93.8	ECBB 19-14
21-May	13:07	East Cell Top	0.63	107.0	ECTB 19-21
22-May	13:12	West Cell Highwall	0.51	100.0	WCTB 19-01
23-May	9:28	West Cell Floor	0.25	101.9	WCF 19-03
27-May	13:07	East Cell Bottom	1.032	91.5	ECBB 19-18
27-May	13:13	East Cell Top	1.408	95.9	ECTB 19-24
29-May	13:22	East Cell Bottom	1.332	102.8	ECBB 19-17
29-May	13:15	East Cell Top	0.76	98.8	ECTB 19-25
30-May	13:12	West Cell Highwall	0.76	124.3	WCTB 19-02
31-May	16:15	East Cell Top	0.898	106.5	ECTB 19-22

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

June 10, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2019 and May 30, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
01-May	13:16	East Cell Top	1.299	115.5	ECTB 19-11
01-May	13:22	East Cell Top	1.009	114.7	ECTB 19-17
02-May	13:11	East Cell Top	1.542	105.4	ECTB 19-16
06-May	13:16	East Cell Top	0.711	115.7	ECTB 19-18
08-May	13:13	East Cell Bottom	2.418	112.1	ECBB 19-13
09-May	13:11	East Cell Top	1.237	109.2	ECTB 19-20
10-May	13:12	East Cell Bottom	1.675	101.5	ECBB 19-15
14-May	13:12	East Cell Bottom	3.095	104.4	ECBB 19-16
15-May	16:12	East Cell Top	0.792	109.8	ECTB 19-23
16-May	13:11	East Cell Bottom	1.935	104.9	ECBB 19-14
21-May	13:07	East Cell Top	0.913	105.9	ECTB 19-21
22-May	13:12	West Cell Highwall	1.528	108.8	WCTB 19-01
23-May	9:28	West Cell Floor	0.244	104.0	WCF 19-03
27-May	13:07	East Cell Bottom	3.479	103.9	ECBB 19-18
27-May	13:13	East Cell Top	0.800	108.9	ECTB 19-24
29-May	13:22	East Cell Bottom	1.894	104.7	ECBB 19-17
29-May	13:15	East Cell Top	1.466	109.2	ECTB 19-25
30-May	13:12	West Cell Highwall	1.479	104.2	WCTB 19-02
31-May	16:15	East Cell Top	0.971	105.3	ECTB 19-22

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

June 10, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2019 and May 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
01-May	13:16	East Cell Top	0.773	124.8	ECTB 19-11
01-May	13:22	East Cell Top	0.773	124.8	ECTB 19-17
02-May	13:11	East Cell Top	0.752	108.8	ECTB 19-16
06-May	13:16	East Cell Top	0.340	116.3	ECTB 19-18
08-May	13:13	East Cell Bottom	1.111	116.4	ECBB 19-13
09-May	13:11	East Cell Top	0.805	121.3	ECTB 19-20
10-May	13:12	East Cell Bottom	0.756	100.0	ECBB 19-15
14-May	13:12	East Cell Bottom	1.064	110.6	ECBB 19-16
15-May	16:12	East Cell Top	0.650	114.4	ECTB 19-23
16-May	13:11	East Cell Bottom	1.139	113.9	ECBB 19-14
21-May	13:07	East Cell Top	0.461	112.3	ECTB 19-21
22-May	13:12	West Cell Highwall	1.068	114.8	WCTB 19-01
23-May	9:28	West Cell Floor	0.255	102.8	WCF 19-03
27-May	13:07	East Cell Bottom	1.377	115.0	ECBB 19-18
27-May	13:13	East Cell Top	0.795	115.0	ECTB 19-24
29-May	13:22	East Cell Bottom	0.991	111.8	ECBB 19-17
29-May	13:15	East Cell Top	0.57	119.4	ECTB 19-25
30-May	13:12	West Cell Highwall	0.870	108.8	WCTB 19-02
31-May	16:15	East Cell Top	0.606	110.2	ECTB 19-22

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

June 6, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2019 and May 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
01-May	13:16	East Cell Top	0.73	114.6	ECTB 19-11
01-May	13:22	East Cell Top	0.73	114.6	ECTB 19-17
02-May	13:11	East Cell Top	0.80	109.8	ECTB 19-16
06-May	13:16	East Cell Top	0.46	114.7	ECTB 19-18
08-May	13:13	East Cell Bottom	1.978	116.8	ECBB 19-13
09-May	13:11	East Cell Top	0.75	112.9	ECTB 19-20
10-May	13:12	East Cell Bottom	0.83	112.6	ECBB 19-15
14-May	13:12	East Cell Bottom	1.53	98.1	ECBB 19-16
15-May	16:12	East Cell Top	*	*	ECTB 19-23
16-May	13:11	East Cell Bottom	*	*	ECBB 19-14
21-May	13:07	East Cell Top	0.47	113.3	ECTB 19-21
22-May	13:12	West Cell Highwall	0.40	99.2	WCTB 19-01
23-May	9:28	West Cell Floor	0.50	97.9	WCF 19-03
27-May	13:07	East Cell Bottom	*	*	ECBB 19-18
27-May	13:13	East Cell Top	*	*	ECTB 19-24
29-May	13:22	East Cell Bottom	1.851	93.4	ECBB 19-17
29-May	13:15	East Cell Top	0.80	93.4	ECTB 19-25
30-May	13:12	West Cell Highwall	0.35	106.6	WCTB 19-02
31-May	16:15	East Cell Top	0.605	104.5	ECTB 19-22

*Unit offline due to interference

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

June 6, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2019 and May 31, 2019 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
01-May	13:16	East Cell Top	0.348	117.2	ECTB 19-11
01-May	13:22	East Cell Top	0.348	117.2	ECTB 19-17
02-May	13:11	East Cell Top	0.710	109.9	ECTB 19-16
06-May	13:16	East Cell Top	0.302	106.5	ECTB 19-18
08-May	13:13	East Cell Bottom	0.947	110.9	ECBB 19-13
09-May	13:11	East Cell Top	0.684	118.7	ECTB 19-20
10-May	13:12	East Cell Bottom	0.873	106.5	ECBB 19-15
14-May	13:12	East Cell Bottom	0.971	114.8	ECBB 19-16
15-May	16:12	East Cell Top	0.214	106.5	ECTB 19-23
16-May	13:11	East Cell Bottom	1.033	109.2	ECBB 19-14
21-May	13:07	East Cell Top	0.272	109.2	ECTB 19-21
22-May	13:12	West Cell Highwall	0.936	113.1	WCTB 19-01
23-May	9:28	West Cell Floor	0.272	101.9	WCF 19-03
27-May	13:07	East Cell Bottom	0.728	113.3	ECBB 19-18
27-May	13:13	East Cell Top	0.728	113.3	ECTB 19-24
29-May	13:22	East Cell Bottom	1.131	109.9	ECBB 19-17
29-May	13:15	East Cell Top	0.25	112.0	ECTB 19-25
30-May	13:12	West Cell Highwall	1.366	110.9	WCTB 19-02
31-May	16:15	East Cell Top	0.37	109.2	ECTB 19-22

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Erik Hunnisett
Explotech Engineering Ltd.

July 12, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2019 and June 30, 2019 and cross referenced with the blasting records provided to confirm that there was twenty (20) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
3-Jun	13:11	East Cell Top	0.222	108.8	ECTB 19-26
4-Jun	13:11	East Cell Top	0.561	112.8	ECTB 19-24(b)
5-Jun	13:21	East Cell Bottom	0.930	121.3	ECBB 19-19
5-Jun	13:12	West Cell Floor	0.398	122.1	WCF 19-03
10-Jun	13:07	East Cell Bottom	1.084	110.9	ECBB 19-20
11-Jun	13:13	East Cell Bottom	0.629	107.5	ECBB 19-21
12-Jun	13:15	East Cell Top	0.406	112.0	ECTB 19-28
12-Jun	13:09	East Cell Top	0.406	112.0	ECTB 19-19
13-Jun	13:11	West Cell Floor	0.259	104.2	WCF 19-04
17-Jun	13:09	East Cell Top	0.506	114.4	ECTB 19-30
17-Jun	13:13	East Cell Top	0.506	114.4	ECTB 19-27
18-Jun	13:10	East Cell Bottom	0.878	112.0	ECBB 19-23
19-Jun	13:12	West Cell Floor	0.348	102.8	WCF 19-05
20-Jun	13:15	East Cell Top	0.228	108.4	ECTB 19-29/TOE
21-Jun	13:09	East Cell Bottom	0.990	113.5	ECBB 19-22
24-Jun	16:46	East Cell Top	0.495	110.9	ECTB 19-31
25-Jun	16:10	West Cell Floor	0.106	101.0	WCF 19-06
26-Jun	13:15	East Cell Top	0.671	101.0	ECTB 19-32
26-Jun	13:05	East Cell Top	0.338	93.98	ECTB 19-34
27-Jun	13:10	East Cell Top	0.367	104.2	ECTB 19-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

July 12, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2019 and June 30, 2019 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
3-Jun	13:11	East Cell Top	1.024	119.3	ECTB 19-26
4-Jun	13:11	East Cell Top	1.032	103.5	ECTB 19-24(b)
5-Jun	13:21	East Cell Bottom	1.486	97.5	ECBB 19-19
5-Jun	13:12	West Cell Floor	0.220	118.7	WCF 19-03
10-Jun	13:07	East Cell Bottom	1.157	95.9	ECBB 19-20
11-Jun	13:13	East Cell Bottom	0.554	104.9	ECBB 19-21
12-Jun	13:15	East Cell Top	0.783	106.5	ECTB 19-28
12-Jun	13:09	East Cell Top	0.976	107.5	ECTB 19-19
13-Jun	13:11	West Cell Floor	0.220	87.96	WCF 19-04
17-Jun	13:09	East Cell Top	0.925	104.2	ECTB 19-30
17-Jun	13:13	East Cell Top	0.773	100.0	ECTB 19-27
18-Jun	13:10	East Cell Bottom	1.350	98.8	ECBB 19-23
19-Jun	13:12	West Cell Floor	0.381	104.9	WCF 19-05
20-Jun	13:15	East Cell Top	0.842	91.48	ECTB 19-29/TOE
21-Jun	13:09	East Cell Bottom	1.535	100.0	ECBB 19-22
24-Jun	16:46	East Cell Top	0.660	101.9	ECTB 19-31
25-Jun	16:10	West Cell Floor	0.381	112.0	WCF 19-06
26-Jun	13:15	East Cell Top	0.823	112.6	ECTB 19-32
26-Jun	13:05	East Cell Top	0.568	112.3	ECTB 19-34
27-Jun	13:10	East Cell Top	0.773	101.0	ECTB 19-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

EXPLOTECH
Specialists in Explosives, Blasting and Vibration
Consulting Engineers

July 12, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2019 and June 30, 2019 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
3-Jun	13:11	East Cell Top	0.765	109.2	ECTB 19-26
4-Jun	13:11	East Cell Top	1.284	108.7	ECTB 19-24(b)
5-Jun	13:21	East Cell Bottom	1.972	105.4	ECBB 19-19
5-Jun	13:12	West Cell Floor	1.972	105.4	WCF 19-03
10-Jun	13:07	East Cell Bottom	2.024	107.9	ECBB 19-20
11-Jun	13:13	East Cell Bottom	1.647	93.5	ECBB 19-21
12-Jun	13:15	East Cell Top	1.229	106.9	ECTB 19-28
12-Jun	13:09	East Cell Top	1.171	114.1	ECTB 19-19
13-Jun	13:11	West Cell Floor	0.353	100.1	WCF 19-04
17-Jun	13:09	East Cell Top	0.759	107.7	ECTB 19-30
17-Jun	13:13	East Cell Top	1.846	103.8	ECTB 19-27
18-Jun	13:10	East Cell Bottom	2.020	107.9	ECBB 19-23
19-Jun	13:12	West Cell Floor	0.205	101.7	WCF 19-05
20-Jun	13:15	East Cell Top	0.813	107.7	ECTB 19-29/TOE
21-Jun	13:09	East Cell Bottom	2.686	101.3	ECBB 19-22
24-Jun	16:46	East Cell Top	1.076	103.4	ECTB 19-31
25-Jun	16:10	West Cell Floor	0.249	93.06	WCF 19-06
26-Jun	13:15	East Cell Top	1.163	98.5	ECTB 19-32
26-Jun	13:05	East Cell Top	0.853	97.97	ECTB 19-34
27-Jun	13:10	East Cell Top	0.880	101.7	ECTB 19-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

July 12, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2019 and June 30, 2019 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
3-Jun	13:11	East Cell Top	0.398	105.5	ECTB 19-26
4-Jun	13:11	East Cell Top	0.866	116.6	ECTB 19-24(b)
5-Jun	13:21	East Cell Bottom	1.094	112.8	ECBB 19-19
5-Jun	13:12	West Cell Floor	0.310	104.9	WCF 19-03
10-Jun	13:07	East Cell Bottom	0.704	119.2	ECBB 19-20
11-Jun	13:13	East Cell Bottom	0.846	104.2	ECBB 19-21
12-Jun	13:15	East Cell Top	0.577	110.6	ECTB 19-28
12-Jun	13:09	East Cell Top	0.689	117.5	ECTB 19-19
13-Jun	13:11	West Cell Floor	0.176	108.0	WCF 19-04
17-Jun	13:09	East Cell Top	0.598	114.8	ECTB 19-30
17-Jun	13:13	East Cell Top	0.579	115.6	ECTB 19-27
18-Jun	13:10	East Cell Bottom	0.858	116.4	ECBB 19-23
19-Jun	13:12	West Cell Floor	0.166	113.8	WCF 19-05
20-Jun	13:15	East Cell Top	0.456	117.4	ECTB 19-29/TOE
21-Jun	13:09	East Cell Bottom	1.183	110.2	ECBB 19-22
24-Jun	16:46	East Cell Top	0.446	110.9	ECTB 19-31
25-Jun	16:10	West Cell Floor	0.209	95.92	WCF 19-06
26-Jun	13:15	East Cell Top	0.904	104.2	ECTB 19-32
26-Jun	13:05	East Cell Top	0.516	101.0	ECTB 19-34
27-Jun	13:10	East Cell Top	0.325	112.3	ECTB 19-33

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

July 12, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2019 and June 30, 2019 and cross referenced with the blasting records provided to confirm that there were twenty (20) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
3-Jun	13:11	East Cell Top	0.652	111.0	ECTB 19-26
4-Jun	13:11	East Cell Top	1.033	101.4	ECTB 19-24(b)
5-Jun	13:21	East Cell Bottom	1.680	106.6	ECBB 19-19
5-Jun	13:12	West Cell Floor	0.169	93.21	WCF 19-03
10-Jun	13:07	East Cell Bottom	1.354	92.9	ECBB 19-20
11-Jun	13:13	East Cell Bottom	0.620	104.4	ECBB 19-21
12-Jun	13:15	East Cell Top	0.549	101.2	ECTB 19-28
12-Jun	13:09	East Cell Top	0.707	101.5	ECTB 19-19
13-Jun	13:11	West Cell Floor	0.108	90.26	WCF 19-04
17-Jun	13:09	East Cell Top	0.817	99.73	ECTB 19-30
17-Jun	13:13	East Cell Top	0.714	95.18	ECTB 19-27
18-Jun	13:10	East Cell Bottom	1.732	98.5	ECBB 19-23
19-Jun	13:12	West Cell Floor	0.203	96.78	WCF 19-05
20-Jun	13:15	East Cell Top	0.081	94.70	ECTB 19-29/TOE
21-Jun	13:09	East Cell Bottom	1.837	94.2	ECBB 19-22
24-Jun	16:46	East Cell Top	0.551	100.8	ECTB 19-31
25-Jun	16:10	West Cell Floor	0.114	112.0	WCF 19-06
26-Jun	13:15	East Cell Top	0.913	99.66	ECTB 19-32
26-Jun	13:05	East Cell Top	0.448	111.6	ECTB 19-34
27-Jun	13:10	East Cell Top	0.623	95.30	ECTB 19-33

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

August 6, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2019 and July 31, 2019 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
2-Jul	13:09	East Cell Bottom	1.048	108.8	ECBB 19-25
3-Jul	16:08	East Cell Bottom	0.970	104.2	ECBB 19-26(A)
4-Jul	16:10	East Cell Top	0.474	106.5	ECTB 19-35
5-Jul	13:04	West Cell Floor	0.417	119.3	WCF 19-06
8-Jul	13:10	East Cell Top	0.307	110.6	ECTB 19-36
9-Jul	16:07	East Cell Bottom	0.558	107.5	ECBB 19-26(B)
10-Jul	13:09	East Cell Bottom	1.104	104.9	ECBB 19-27
11-Jul	13:07	East Cell Top	0.590	101.0	ECTB 19-38
12-Jul	13:08	East Cell Bottom	0.792	114.0	ECBB 19-24
16-Jul	13:05	East Cell Top	0.337	103.5	ECTB 19-37
17-Jul	16:07	East Cell Top	0.299	106.0	ECTB 19-39
18-Jul	13:05	East Cell Bottom	0.683	106.0	ECBB 19-26©
19-Jul	12:59	East Cell Bottom	0.725	106.5	ECBB 19-29
22-Jul	13:12	East Cell Bottom	0.803	107.5	ECBB 19-30
24-Jul	13:10	West Cell Floor	0.398	103.5	WCF 19-08
25-Jul	13:04	East Cell Bottom	1.124	108.0	ECBB 19-28
26-Jul	13:06	East Cell Bottom	1.056	104.9	ECBB 19-31
29-Jul	13:08	West Cell Floor	0.452	101.0	WCF 19-10
31-Jul	13:05	East Cell Bottom	0.840	105.5	ECBB 19-32

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

August 6, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2019 and July 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
2-Jul	13:09	East Cell Bottom	0.823	107.5	ECBB 19-25
3-Jul	16:08	East Cell Bottom	1.283	101.0	ECBB 19-26(A)
4-Jul	16:10	East Cell Top	0.889	102.8	ECTB 19-35
5-Jul	13:04	West Cell Floor	0.359	111.2	WCF 19-06
8-Jul	13:10	East Cell Top	0.684	97.5	ECTB 19-36
9-Jul	16:07	East Cell Bottom	1.078	91.5	ECBB 19-26(B)
10-Jul	13:09	East Cell Bottom	1.454	107.0	ECBB 19-27
11-Jul	13:07	East Cell Top	0.959	106.5	ECTB 19-38
12-Jul	13:08	East Cell Bottom	1.350	97.5	ECBB 19-24
16-Jul	13:05	East Cell Top	0.783	124.2	ECTB 19-37
17-Jul	16:07	East Cell Top	0.898	98.84	ECTB 19-39
18-Jul	13:05	East Cell Bottom	0.813	100.0	ECBB 19-26©
19-Jul	12:59	East Cell Bottom	1.178	109.2	ECBB 19-29
22-Jul	13:12	East Cell Bottom	1.308	98.8	ECBB 19-30
24-Jul	13:10	West Cell Floor	0.475	102.8	WCF 19-08
25-Jul	13:04	East Cell Bottom	1.178	101.9	ECBB 19-28
26-Jul	13:06	East Cell Bottom	1.212	107.0	ECBB 19-31
29-Jul	13:08	West Cell Floor	0.440	113.1	WCF 19-10
31-Jul	13:05	East Cell Bottom	1.164	102.8	ECBB 19-32

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

August 6, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2019 and July 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
2-Jul	13:09	East Cell Bottom	2.475	100.5	ECBB 19-25
3-Jul	16:08	East Cell Bottom	2.314	100.5	ECBB 19-26(A)
4-Jul	16:10	East Cell Top	1.253	102.8	ECTB 19-35
5-Jul	13:04	West Cell Floor	0.390	98.05	WCF 19-06
8-Jul	13:10	East Cell Top	1.218	103.2	ECTB 19-36
9-Jul	16:07	East Cell Bottom	1.161	104.4	ECBB 19-26(B)
10-Jul	13:09	East Cell Bottom	2.276	98.5	ECBB 19-27
11-Jul	13:07	East Cell Top	1.685	102.8	ECTB 19-38
12-Jul	13:08	East Cell Bottom	3.116	104.4	ECBB 19-24
16-Jul	13:05	East Cell Top	0.928	98.78	ECTB 19-37
17-Jul	16:07	East Cell Top	0.968	104.5	ECTB 19-39
18-Jul	13:05	East Cell Bottom	2.214	105.4	ECBB 19-26©
19-Jul	12:59	East Cell Bottom	2.205	99.2	ECBB 19-29
22-Jul	13:12	East Cell Bottom	3.645	104.6	ECBB 19-30
24-Jul	13:10	West Cell Floor	0.279	90.66	WCF 19-08
25-Jul	13:04	East Cell Bottom	2.260	96.5	ECBB 19-28
26-Jul	13:06	East Cell Bottom	2.371	102.0	ECBB 19-31
29-Jul	13:08	West Cell Floor	0.388	99.0	WCF 19-10
31-Jul	13:05	East Cell Bottom	1.637	97.9	ECBB 19-32

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

August 2, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2019 and July 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
2-Jul	13:09	East Cell Bottom	1.119	107.0	ECBB 19-25
3-Jul	16:08	East Cell Bottom	1.051	107.5	ECBB 19-26(A)
4-Jul	16:10	East Cell Top	0.767	107.5	ECTB 19-35
5-Jul	13:04	West Cell Floor	0.341	105.5	WCF 19-06
8-Jul	13:10	East Cell Top	0.448	115.4	ECTB 19-36
9-Jul	16:07	East Cell Bottom	0.663	108.0	ECBB 19-26(B)
10-Jul	13:09	East Cell Bottom	1.384	107.5	ECBB 19-27
11-Jul	13:07	East Cell Top	0.747	108.4	ECTB 19-38
12-Jul	13:08	East Cell Bottom	0.986	109.9	ECBB 19-24
16-Jul	13:05	East Cell Top	0.524	108.0	ECTB 19-37
17-Jul	16:07	East Cell Top	0.397	112.0	ECTB 19-39
18-Jul	13:05	East Cell Bottom	0.923	109.5	ECBB 19-26©
19-Jul	12:59	East Cell Bottom	0.913	113.1	ECBB 19-29
22-Jul	13:12	East Cell Bottom	1.141	115.6	ECBB 19-30
24-Jul	13:10	West Cell Floor	0.221	100.0	WCF 19-08
25-Jul	13:04	East Cell Bottom	1.277	104.2	ECBB 19-28
26-Jul	13:06	East Cell Bottom	1.662	110.6	ECBB 19-31
29-Jul	13:08	West Cell Floor	0.343	105.5	WCF 19-10
31-Jul	13:05	East Cell Bottom	1.067	102.8	ECBB 19-32

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

August 6, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2019 and July 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
2-Jul	13:09	East Cell Bottom	0.825	102.7	ECBB 19-25
3-Jul	16:08	East Cell Bottom	1.339	95.1	ECBB 19-26(A)
4-Jul	16:10	East Cell Top	0.606	100.3	ECTB 19-35
5-Jul	13:04	West Cell Floor	0.381	102.2	WCF 19-06
8-Jul	13:10	East Cell Top	0.522	97.97	ECTB 19-36
9-Jul	16:07	East Cell Bottom	0.826	93.36	ECBB 19-26(B)
10-Jul	13:09	East Cell Bottom	1.457	101.8	ECBB 19-27
11-Jul	13:07	East Cell Top	0.719	110.6	ECTB 19-38
12-Jul	13:08	East Cell Bottom	1.659	99.2	ECBB 19-24
16-Jul	13:05	East Cell Top	0.612	103.6	ECTB 19-37
17-Jul	16:07	East Cell Top	0.674	98.05	ECTB 19-39
18-Jul	13:05	East Cell Bottom	1.134	102.1	ECBB 19-26©
19-Jul	12:59	East Cell Bottom	1.470	108.9	ECBB 19-29
22-Jul	13:12	East Cell Bottom	1.545	101.4	ECBB 19-30
24-Jul	13:10	West Cell Floor	0.133	96.58	WCF 19-08
25-Jul	13:04	East Cell Bottom	1.048	114.1	ECBB 19-28
26-Jul	13:06	East Cell Bottom	1.845	107.4	ECBB 19-31
29-Jul	13:08	West Cell Floor	0.208	103.3	WCF 19-10
31-Jul	13:05	East Cell Bottom	0.773	100.8	ECBB 19-32

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with

MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

September 16, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2019 and August 31, 2019 and cross referenced with the blasting records provided to confirm that there was twenty-three (23) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Aug	13:06	East Cell Bottom	1.255	108.4	ECBB 19-35
2-Aug	13:12	East Cell Toe	0.157	106.0	ECTOE 19-02
6-Aug	13:15	East Cell Bottom	1.444	109.9	ECBB 19-34
7-Aug	13:08	East Cell Top	0.885	101.0	ECTB 19-40
7-Aug	13:16	West Cell Floor	0.420	108.0	WCF 19-11
8-Aug	13:10	East Cell Top	0.337	123.8	ECTB 19-41
9-Aug	13:11	East Cell Top	0.474	106.5	ECTB 19-42
13-Aug	13:11	East Cell Top	0.594	125.9	ECTB 19-43 (CAVE)
14-Aug	13:09	East Cell Bottom	1.240	113.3	ECBB 19-36
14-Aug	13:16	West Cell Floor	0.307	102.8	WCF 19-12
15-Aug	13:12	East Cell Top	0.354	107.0	ECTB 19-45
16-Aug	13:10	East Cell Top	0.477	107.5	ECTB 19-46
19-Aug	13:09	East Cell Bottom	0.835	104.9	ECBB 19-38
20-Aug	13:43	East Cell Top	0.412	98.84	ECTB 19-44
21-Aug	13:16	North Quarry Floor	1.365	104.2	NCF 19-01
21-Aug	13:09	East Cell Bottom	1.365	107.0	ECBB 19-40
22-Aug	13:26	East Cell Top	0.695	115.4	ECTB 19-47
23-Aug	13:25	East Cell Top	1.021	105.5	ECTB 19-48
26-Aug	13:09	East Cell Bottom	1.397	109.5	ECBB 19-39
27-Aug	13:53	East Cell Top	0.587	111.2	ECTB 19-49
28-Aug	13:13	West Cell Floor	0.417	112.3	WCF 19-13
29-Aug	16:08	East Cell Top	0.748	97.5	ECTB 19-50
30-Aug	13:09	East Cell Bottom	0.926	112.0	ECBB 19-41

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

September 16, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2019 and August 31, 2019 and cross referenced with the blasting records provided to confirm that there were twenty-three (23) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Aug	13:06	East Cell Bottom	0.959	103.5	ECBB 19-35
2-Aug	13:12	East Cell Toe	0.381	101.9	ECTOE 19-02
6-Aug	13:15	East Cell Bottom	1.257	107.5	ECBB 19-34
7-Aug	13:08	East Cell Top	0.524	102.8	ECTB 19-40
7-Aug	13:16	West Cell Floor	0.381	101.0	WCF 19-11
8-Aug	13:10	East Cell Top	0.751	109.2	ECTB 19-41
9-Aug	13:11	East Cell Top	0.421	104.9	ECTB 19-42
13-Aug	13:11	East Cell Top	0.648	102.8	ECTB 19-43 (CAVE)
14-Aug	13:09	East Cell Bottom	1.055	95.9	ECBB 19-36
14-Aug	13:16	West Cell Floor	0.381	101.9	WCF 19-12
15-Aug	13:12	East Cell Top	0.421	111.2	ECTB 19-45
16-Aug	13:10	East Cell Top	0.783	98.8	ECTB 19-46
19-Aug	13:09	East Cell Bottom	1.550	102.8	ECBB 19-38
20-Aug	13:43	East Cell Top	1.055	109.5	ECTB 19-44
21-Aug	13:16	North Quarry Floor	1.092	102.8	NCF 19-01
21-Aug	13:09	East Cell Bottom	0.381	109.9	ECBB 19-40
22-Aug	13:26	East Cell Top	1.171	104.9	ECTB 19-47
23-Aug	13:25	East Cell Top	0.381	101.0	ECTB 19-48
26-Aug	13:09	East Cell Bottom	*	*	ECBB 19-39
27-Aug	13:53	East Cell Top	*	*	ECTB 19-49
28-Aug	13:13	West Cell Floor	*	*	WCF 19-13
29-Aug	16:08	East Cell Top	0.852	109.2	ECTB 19-50
30-Aug	13:09	East Cell Bottom	0.813	114.4	ECBB 19-41

* Unit offline due to power loss at the unit

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

September 16, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2019 and August 31, 2019 and cross referenced with the blasting records provided to confirm that there were twenty-three (23) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Aug	13:06	East Cell Bottom	2.211	108.6	ECBB 19-35
2-Aug	13:12	East Cell Toe	0.279	103.7	ECTOE 19-02
6-Aug	13:15	East Cell Bottom	2.352	98.1	ECBB 19-34
7-Aug	13:08	East Cell Top	0.854	100.3	ECTB 19-40
7-Aug	13:16	West Cell Floor	0.121	96.7	WCF 19-11
8-Aug	13:10	East Cell Top	1.293	99.5	ECTB 19-41
9-Aug	13:11	East Cell Top	1.018	94.3	ECTB 19-42
13-Aug	13:11	East Cell Top	1.054	110.1	ECTB 19-43 (CAVE)
14-Aug	13:09	East Cell Bottom	1.358	97.5	ECBB 19-36
14-Aug	13:16	West Cell Floor	0.292	87.3	WCF 19-12
15-Aug	13:12	East Cell Top	0.193	85.8	ECTB 19-45
16-Aug	13:10	East Cell Top	2.070	103.2	ECTB 19-46
19-Aug	13:09	East Cell Bottom	2.139	98.38	ECBB 19-38
20-Aug	13:43	East Cell Top	0.948	99.01	ECTB 19-44
21-Aug	13:16	North Quarry Floor	1.787	95.64	NCF 19-01
21-Aug	13:09	East Cell Bottom	0.138	87.90	ECBB 19-40
22-Aug	13:26	East Cell Top	1.454	102.0	ECTB 19-47
23-Aug	13:25	East Cell Top	0.142	90.66	ECTB 19-48
26-Aug	13:09	East Cell Bottom	2.335	111.2	ECBB 19-39
27-Aug	13:53	East Cell Top	2.388	110.6	ECTB 19-49
28-Aug	13:13	West Cell Floor	0.364	93.21	WCF 19-13
29-Aug	16:08	East Cell Top	1.288	96.98	ECTB 19-50
30-Aug	13:09	East Cell Bottom	2.387	98.38	ECBB 19-41

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

September 16, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2019 and August 31, 2019 and cross referenced with the blasting records provided to confirm that there were twenty-three (23) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Aug	13:06	East Cell Bottom	1.245	114.2	ECBB 19-35
2-Aug	13:12	East Cell Toe	0.163	107.0	ECTOE 19-02
6-Aug	13:15	East Cell Bottom	1.268	108.0	ECBB 19-34
7-Aug	13:08	East Cell Top	0.689	100.0	ECTB 19-40
7-Aug	13:16	West Cell Floor	0.295	104.2	WCF 19-11
8-Aug	13:10	East Cell Top	0.660	94.0	ECTB 19-41
9-Aug	13:11	East Cell Top	0.518	101.9	ECTB 19-42
13-Aug	13:11	East Cell Top	0.479	118.8	ECTB 19-43 (CAVE)
14-Aug	13:09	East Cell Bottom	1.232	108.4	ECBB 19-36
14-Aug	13:16	West Cell Floor	0.251	98.8	WCF 19-12
15-Aug	13:12	East Cell Top	0.622	110.9	ECTB 19-45
16-Aug	13:10	East Cell Top	0.529	110.2	ECTB 19-46
19-Aug	13:09	East Cell Bottom	1.015	102.8	ECBB 19-38
20-Aug	13:43	East Cell Top	0.681	101.9	ECTB 19-44
21-Aug	13:16	North Quarry Floor	1.295	101.0	NCF 19-01
21-Aug	13:09	East Cell Bottom	0.085	91.48	ECBB 19-40
22-Aug	13:26	East Cell Top	0.899	110.2	ECTB 19-47
23-Aug	13:25	East Cell Top	0.093	87.96	ECTB 19-48
26-Aug	13:09	East Cell Bottom	0.805	116.7	ECBB 19-39
27-Aug	13:53	East Cell Top	0.095	87.96	ECTB 19-49
28-Aug	13:13	West Cell Floor	0.310	102.8	WCF 19-13
29-Aug	16:08	East Cell Top	0.563	98.84	ECTB 19-50
30-Aug	13:09	East Cell Bottom	0.947	101.0	ECBB 19-41

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

September 16, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2019 and August 31, 2019 and cross referenced with the blasting records provided to confirm that there were twenty-three (23) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Aug	13:06	East Cell Bottom	1.101	95.5	ECBB 19
2-Aug	13:12	East Cell Toe	0.158	101.1	ECTOE 19
6-Aug	13:15	East Cell Bottom	1.621	106.0	ECBB 19
7-Aug	13:08	East Cell Top	0.494	101.4	ECTB 19
7-Aug	13:16	West Cell Floor	0.201	102.4	WCF 19
8-Aug	13:10	East Cell Top	0.725	107.6	ECTB 19
9-Aug	13:11	East Cell Top	0.508	113.3	ECTB 19
13-Aug	13:11	East Cell Top	0.534	107.1	ECTB 19
14-Aug	13:09	East Cell Bottom	1.126	104.1	ECBB 19
14-Aug	13:16	West Cell Floor	0.167	99.9	WCF 19
15-Aug	13:12	East Cell Top	0.364	102.4	ECTB 19
16-Aug	13:10	East Cell Top	0.683	95.6	ECTB 19
19-Aug	13:09	East Cell Bottom	1.438	103.5	ECBB 19
20-Aug	13:43	East Cell Top	1.035	109.6	ECTB 19
21-Aug	13:16	North Quarry Floor	1.291	101.9	NCF 19
21-Aug	13:09	East Cell Bottom	0.095	100.9	ECBB 19
22-Aug	13:26	East Cell Top	0.933	104.2	ECTB 19
23-Aug	13:25	East Cell Top	0.075	97.88	ECTB 19
26-Aug	13:09	East Cell Bottom	1.301	99.59	ECBB 19
27-Aug	13:53	East Cell Top	1.291	102.0	ECTB 19
28-Aug	13:13	West Cell Floor	0.157	103.3	WCF 19
29-Aug	16:08	East Cell Top	1.471	103.6	ECTB 19
30-Aug	13:09	East Cell Bottom	1.440	116.1	ECBB 19

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2019 and September 30, 2019 and cross referenced with the blasting records provided to confirm that there were seventeen (17) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.475	115.0	NCF 19-02
6-Sep	13:11	East Cell Top	1.178	103.5	ECTB 19-51
9-Sep	16:13	East Cell Bottom	1.100	101.9	ECBB 19-42
11-Sep	13:13	East Cell Top	0.898	107.5	ECTB 19-52
12-Sep	13:13	West Cell Floor	0.381	98.84	WCF 19-14
13-Sep	11:37	East Cell Top	0.925	101.9	ECTB 19-52(B) & 54
16-Sep	13:17	East Cell Top	0.684	103.5	ECTB 19-53
16-Sep	13:10	East Cell Bottom	1.773	97.50	ECBB 19-43/44
17-Sep	13:06	East Cell Bottom	1.032	97.50	ECBB 19-45
19-Sep	13:07	East Cell Top	0.861	106.0	ECTB 19-55
20-Sep	13:07	East Cell Bottom	1.000	97.50	ECBB 19-46
23-Sep	13:08	West Cell Floor	0.381	113.1	WCF 19-15
24-Sep	13:18	East Cell Top	0.773	109.5	ECTB 19-56
25-Sep	13:18	East Cell Bottom	0.925	114.8	ECBB 19-48(A)
26-Sep	13:10	East Cell Bottom	0.992	121.0	ECBB 19-48(B)
26-Sep	13:18	East Cell Top	0.959	116.7	ECTB 19-57
30-Sep	13:10	West Cell Floor	0.440	116.1	WCF 19-16

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2019 and September 30, 2019 and cross referenced with the blasting records provided to confirm that there were seventeen (17) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.463	101.4	NCF 19-02
6-Sep	13:11	East Cell Top	1.990	116.3	ECTB 19-51
9-Sep	16:13	East Cell Bottom	2.659	107.1	ECBB 19-42
11-Sep	13:13	East Cell Top	1.573	100.8	ECTB 19-52
12-Sep	13:13	West Cell Floor	0.385	98.78	WCF 19-14
13-Sep	11:37	East Cell Top	1.268	103.7	ECTB 19-52(B) & 54
16-Sep	13:17	East Cell Top	0.863	100.5	ECTB 19-53
16-Sep	13:10	East Cell Bottom	2.637	104.0	ECBB 19-43/44
17-Sep	13:06	East Cell Bottom	2.024	104.0	ECBB 19-45
19-Sep	13:07	East Cell Top	1.409	112.7	ECTB 19-55
20-Sep	13:07	East Cell Bottom	1.495	99.59	ECBB 19-46
23-Sep	13:08	West Cell Floor	0.372	93.36	WCF 19-15
24-Sep	13:18	East Cell Top	1.134	102.6	ECTB 19-56
25-Sep	13:18	East Cell Bottom	1.432	100.1	ECBB 19-48(A)
26-Sep	13:10	East Cell Bottom	0.714	105.1	ECBB 19-48(B)
26-Sep	13:18	East Cell Top	1.374	108.1	ECTB 19-57
30-Sep	13:10	West Cell Floor	0.326	95.64	WCF 19-16

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2019 and September 30, 2019 and cross referenced with the blasting records provided to confirm that there were seventeen (17) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.142	102.8	NCF 19-02
6-Sep	13:11	East Cell Top	0.613	123.1	ECTB 19-51
9-Sep	16:13	East Cell Bottom	1.161	114.8	ECBB 19-42
11-Sep	13:13	East Cell Top	0.820	101.0	ECTB 19-52
12-Sep	13:13	West Cell Floor	0.318	108.0	WCF 19-14
13-Sep	11:37	East Cell Top	0.663	109.5	ECTB 19-52(B) & 54
16-Sep	13:17	East Cell Top	0.571	106.0	ECTB 19-53
16-Sep	13:10	East Cell Bottom	1.145	117.2	ECBB 19-43/44
17-Sep	13:06	East Cell Bottom	1.016	109.2	ECBB 19-45
19-Sep	13:07	East Cell Top	0.557	119.0	ECTB 19-55
20-Sep	13:07	East Cell Bottom	1.088	109.5	ECBB 19-46
23-Sep	13:08	West Cell Floor	0.238	102.8	WCF 19-15
24-Sep	13:18	East Cell Top	0.712	100.0	ECTB 19-56
25-Sep	13:18	East Cell Bottom	1.030	101.0	ECBB 19-48(A)
26-Sep	13:10	East Cell Bottom	0.623	104.9	ECBB 19-48(B)
26-Sep	13:18	East Cell Top	0.552	111.5	ECTB 19-57
30-Sep	13:10	West Cell Floor	0.247	105.5	WCF 19-16

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2019 and September 30, 2019 and cross referenced with the blasting records provided to confirm that there were seventeen (17) recorded blasts (see table below).

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Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.168	112.1	NCF 19-02
6-Sep	13:11	East Cell Top	0.972	105.1	ECTB 19-51
9-Sep	16:13	East Cell Bottom	1.578	102.9	ECBB 19-42
11-Sep	13:13	East Cell Top	0.939	105.4	ECTB 19-52
12-Sep	13:13	West Cell Floor	0.144	99.08	WCF 19-14
13-Sep	11:37	East Cell Top	0.777	103.3	ECTB 19-52(B) & 54
16-Sep	13:17	East Cell Top	0.509	102.8	ECTB 19-53
16-Sep	13:10	East Cell Bottom	2.735	102.2	ECBB 19-43/44
17-Sep	13:06	East Cell Bottom	1.202	96.48	ECBB 19-45
19-Sep	13:07	East Cell Top	1.003	105.2	ECTB 19-55
20-Sep	13:07	East Cell Bottom	1.188	97.44	ECBB 19-46
23-Sep	13:08	West Cell Floor	0.262	99.52	WCF 19-15
24-Sep	13:18	East Cell Top	0.671	105.6	ECTB 19-56
25-Sep	13:18	East Cell Bottom	1.260	106.0	ECBB 19-48(A)
26-Sep	13:10	East Cell Bottom	1.106	110.8	ECBB 19-48(B)
26-Sep	13:18	East Cell Top	1.249	107.5	ECTB 19-57
30-Sep	13:10	West Cell Floor	0.153	104.6	WCF 19-16

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>September 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2019 and September 30, 2019 and cross referenced with the blasting records provided to confirm that there was seventeen (17) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
4-Sep	13:14	North Quarry Floor	0.549	108.0	NCF 19-02
6-Sep	13:11	East Cell Top	0.477	118.3	ECTB 19-51
9-Sep	16:13	East Cell Bottom	1.155	108.8	ECBB 19-42
11-Sep	13:13	East Cell Top	0.822	102.8	ECTB 19-52
12-Sep	13:13	West Cell Floor	0.567	104.9	WCF 19-14
13-Sep	11:37	East Cell Top	0.336	109.2	ECTB 19-52(B) & 54
16-Sep	13:17	East Cell Top	0.408	106.0	ECTB 19-53
16-Sep	13:10	East Cell Bottom	2.964	109.5	ECBB 19-43/44
17-Sep	13:06	East Cell Bottom	1.104	109.9	ECBB 19-45
19-Sep	13:07	East Cell Top	0.439	109.2	ECTB 19-55
20-Sep	13:07	East Cell Bottom	1.229	108.8	ECBB 19-46
23-Sep	13:08	West Cell Floor	0.605	106.0	WCF 19-15
24-Sep	13:18	East Cell Top	0.477	109.2	ECTB 19-56
25-Sep	13:18	East Cell Bottom	0.855	109.2	ECBB 19-48(A)
26-Sep	13:10	East Cell Bottom	0.469	102.8	ECBB 19-48(B)
26-Sep	13:18	East Cell Top	0.415	112.3	ECTB 19-57
30-Sep	13:10	West Cell Floor	0.659	106.0	WCF 19-16

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2019 and October 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Oct	13:08	East Cell Bottom	0.967	115.0	ECBB 19-49
3-Oct	13:14	East Cell Bottom	1.591	94.0	ECBB 19-50
4-Oct	13:08	East Cell Top	1.087	101.9	ECTB 19-58
7-Oct	13:17	East Cell Bottom	1.528	101.9	ECBB 19-47
9-Oct	13:10	East Cell Top	0.893	101.0	ECTB 19-59
10-Oct	13:10	West Cell Floor	1.382	98.8	WCF 19-17
10-Oct	13:21	East Cell Bottom	1.382	98.8	ECBB 19-51 (a)
11-Oct	13:08	East Cell Top	0.716	109.2	ECTB 19-60
16-Oct	13:09	East Cell Bottom	1.267	98.8	ECBB 19-51 (b)
17-Oct	13:08	East Cell Top	1.116	112.0	ECTB 19-61
18-Oct	13:13	East Cell Top	1.157	104.9	ECTB 19-62
18-Oct	13:18	East Cell Bottom	0.856	109.9	ECBB 19-54
22-Oct	13:14	East Cell Bottom	1.241	94.0	ECBB 19-53
24-Oct	13:11	East Cell Top	1.424	108.0	ECTB 19-63
25-Oct	13:14	East Cell Top	0.878	107.5	ECTB 19-64
25-Oct	13:14	East Cell Top	0.878	107.5	ECTB 19-62(b)
29-Oct	13:13	East Cell Top	0.986	118.3	ECTB 19-65
30-Oct	13:11	North Quarry Floor	0.223	103.5	NCF 19-05
30-Oct	16:13	East Cell Bottom	1.722	91.5	ECBB 19-55

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2019 and October 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Oct	13:08	East Cell Bottom	1.701	96.0	ECBB 19-49
3-Oct	13:14	East Cell Bottom	**	**	ECBB 19-50
4-Oct	13:08	East Cell Top	**	**	ECTB 19-58
7-Oct	13:17	East Cell Bottom	**	**	ECBB 19-47
9-Oct	13:10	East Cell Top	**	**	ECTB 19-59
10-Oct	13:10	West Cell Floor	**	**	WCF 19-17
10-Oct	13:21	East Cell Bottom	**	**	ECBB 19-51 (a)
11-Oct	13:08	East Cell Top	**	**	ECTB 19-60
16-Oct	13:09	East Cell Bottom	5.517	116.3	ECBB 19-51 (b)
17-Oct	13:08	East Cell Top	4.323	106.0	ECTB 19-61
18-Oct	13:13	East Cell Top	5.045	102.8	ECTB 19-62
18-Oct	13:18	East Cell Bottom	3.986	103.2	ECBB 19-54
22-Oct	13:14	East Cell Bottom	4.903	96.58	ECBB 19-53
24-Oct	13:11	East Cell Top	4.106	99.52	ECTB 19-63
25-Oct	13:14	East Cell Top	4.418	110.3	ECTB 19-64
25-Oct	13:14	East Cell Top	4.418	110.3	ECTB 19-62(b)
29-Oct	13:13	East Cell Top	4.229	103.5	ECTB 19-65
30-Oct	13:11	North Quarry Floor	3.632	105.2	NCF 19-05
30-Oct	16:13	East Cell Bottom	4.938	108.3	ECBB 19-55

**Unit Offline

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2019 and October 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Oct	13:08	East Cell Bottom	1.234	102.8	ECBB 19-49
3-Oct	13:14	East Cell Bottom	1.783	115.9	ECBB 19-50
4-Oct	13:08	East Cell Top	0.970	104.2	ECTB 19-58
7-Oct	13:17	East Cell Bottom	0.855	107.5	ECBB 19-47
9-Oct	13:10	East Cell Top	0.940	120.1	ECTB 19-59
10-Oct	13:10	West Cell Floor	0.176	91.48	WCF 19-17
10-Oct	13:21	East Cell Bottom	1.159	109.2	ECBB 19-51 (a)
11-Oct	13:08	East Cell Top	0.811	116.9	ECTB 19-60
16-Oct	13:09	East Cell Bottom	1.004	119.3	ECBB 19-51 (b)
17-Oct	13:08	East Cell Top	0.956	119.3	ECTB 19-61
18-Oct	13:13	East Cell Top	1.283	107.5	ECTB 19-62
18-Oct	13:18	East Cell Bottom	0.730	102.8	ECBB 19-54
22-Oct	13:14	East Cell Bottom	1.326	112.0	ECBB 19-53
24-Oct	13:11	East Cell Top	0.683	108.0	ECTB 19-63
25-Oct	13:14	East Cell Top	0.556	114.6	ECTB 19-64
25-Oct	13:14	East Cell Top	0.556	114.6	ECTB 19-62(b)
29-Oct	13:13	East Cell Top	0.895	109.9	ECTB 19-65
30-Oct	13:11	North Quarry Floor	0.147	101.0	NCF 19-05
30-Oct	16:13	East Cell Bottom	1.536	115.9	ECBB 19-55

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2019 and October 31, 2019 and cross referenced with the blasting records provided to confirm that there were nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Oct	13:08	East Cell Bottom	0.983	110.7	ECBB 19-49
3-Oct	13:14	East Cell Bottom	2.797	98.0	ECBB 19-50
4-Oct	13:08	East Cell Top	1.105	100.8	ECTB 19-58
7-Oct	13:17	East Cell Bottom	1.490	103.0	ECBB 19-47
9-Oct	13:10	East Cell Top	1.187	102.6	ECTB 19-59
10-Oct	13:10	West Cell Floor	0.209	108.7	WCF 19-17
10-Oct	13:21	East Cell Bottom	1.408	98.0	ECBB 19-51 (a)
11-Oct	13:08	East Cell Top	0.532	103.9	ECTB 19-60
16-Oct	13:09	East Cell Bottom	1.726	111.3	ECBB 19-51 (b)
17-Oct	13:08	East Cell Top	1.496	103.8	ECTB 19-61
18-Oct	13:13	East Cell Top	0.932	101.1	ECTB 19-62
18-Oct	13:18	East Cell Bottom	0.735	111.2	ECBB 19-54
22-Oct	13:14	East Cell Bottom	2.011	106.3	ECBB 19-53
24-Oct	13:11	East Cell Top	0.969	111.1	ECTB 19-63
25-Oct	13:14	East Cell Top	0.966	108.3	ECTB 19-64
25-Oct	13:14	East Cell Top	0.966	108.3	ECTB 19-62(b)
29-Oct	13:13	East Cell Top	0.812	119.7	ECTB 19-65
30-Oct	13:11	North Quarry Floor	0.159	92.28	NCF 19-05
30-Oct	16:13	East Cell Bottom	1.320	94.4	ECBB 19-55

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

November 13, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2019 and October 31, 2019 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Oct	13:08	East Cell Bottom	1.611	101.9	ECBB 19-49
3-Oct	13:14	East Cell Bottom	1.930	108.8	ECBB 19-50
4-Oct	13:08	East Cell Top	0.655	110.9	ECTB 19-58
7-Oct	13:17	East Cell Bottom	0.743	106.0	ECBB 19-47
9-Oct	13:10	East Cell Top	0.572	119.8	ECTB 19-59
10-Oct	13:10	West Cell Floor	0.434	111.2	WCF 19-17
10-Oct	13:21	East Cell Bottom	1.133	113.5	ECBB 19-51 (a)
11-Oct	13:08	East Cell Top	0.350	104.9	ECTB 19-60
16-Oct	13:09	East Cell Bottom	0.561	104.2	ECBB 19-51 (b)
17-Oct	13:08	East Cell Top	0.335	116.7	ECTB 19-61
18-Oct	13:13	East Cell Top	0.653	114.6	ECTB 19-62
18-Oct	13:18	East Cell Bottom	0.418	108.8	ECBB 19-54
22-Oct	13:14	East Cell Bottom	1.293	104.9	ECBB 19-53
24-Oct	13:11	East Cell Top	0.422	104.9	ECTB 19-63
25-Oct	13:14	East Cell Top	0.394	109.2	ECTB 19-64
25-Oct	13:14	East Cell Top	0.394	109.2	ECTB 19-62(b)
29-Oct	13:13	East Cell Top	0.579	104.2	ECTB 19-65
30-Oct	13:11	North Quarry Floor	0.501	109.5	NCF 19-05
30-Oct	16:13	East Cell Bottom	1.176	116.1	ECBB 19-55

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 3, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2019 and November 30, 2019 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Nov	13:14	East Cell Top	4.442	104.2	ECTB 19-66
1-Nov	13:14	East Cell Top	4.442	104.2	ECTB 19-67
5-Nov	13:13	East Cell Bottom	6.301	103.1	ECBB 19-56
6-Nov	13:12	East Cell Top	4.786	116.4	ECTB 19-68
7-Nov	13:13	East Cell Top	3.776	108.0	ECTB 19-69
8-Nov	13:14	East Cell Bottom	4.739	108.9	ECBB 19-57
12-Nov	13:10	East Cell Bottom	2.634	102.8	ECBB 19-58/59
15-Nov	16:10	East Cell Top	1.000	112.3	ECTB 19-72A
15-Nov	16:10	East Cell Top	1.000	112.3	ECTB 19-71
20-Nov	13:08	East Cell Bottom	2.222	108.4	ECBB 19-58B
20-Nov	13:08	East Cell Bottom	2.222	108.4	ECBB 19-60
22-Nov	13:07	East Cell Top	1.191	113.5	ECTB 19-72B
26-Nov	13:10	East Cell Top	1.251	107.5	ECTB 19-73
27-Nov	13:07	East Cell Top	0.813	93.98	ECTB 19-70
28-Nov	13:10	East Cell Top	1.661	113.3	ECTB 19-74
28-Nov	13:10	East Cell Bottom	1.661	113.3	ECBB 19-61

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 3, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2019 and November 30, 2019 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Nov	13:14	East Cell Top	0.819	106.5	ECTB 19-66
1-Nov	13:14	East Cell Top	0.819	106.5	ECTB 19-67
5-Nov	13:13	East Cell Bottom	1.377	112.3	ECBB 19-56
6-Nov	13:12	East Cell Top	0.725	108.0	ECTB 19-68
7-Nov	13:13	East Cell Top	0.471	113.8	ECTB 19-69
8-Nov	13:14	East Cell Bottom	0.749	110.9	ECBB 19-57
12-Nov	13:10	East Cell Bottom	1.129	104.9	ECBB 19-58/59
15-Nov	16:10	East Cell Top	0.681	113.8	ECTB 19-72A
15-Nov	16:10	East Cell Top	0.681	113.8	ECTB 19-71
20-Nov	13:08	East Cell Bottom	1.349	110.9	ECBB 19-58B
20-Nov	13:08	East Cell Bottom	1.349	110.9	ECBB 19-60
22-Nov	13:07	East Cell Top	0.395	102.8	ECTB 19-72B
26-Nov	13:10	East Cell Top	0.584	110.2	ECTB 19-73
27-Nov	13:07	East Cell Top	0.408	109.2	ECTB 19-70
28-Nov	13:10	East Cell Top	0.961	113.1	ECTB 19-74
28-Nov	13:10	East Cell Bottom	0.961	113.1	ECBB 19-61

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 3, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

EXPLOTECH

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2019 and November 30, 2019 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Nov	13:14	East Cell Top	1.473	108.2	ECTB 19-66
1-Nov	13:14	East Cell Top	1.473	108.2	ECTB 19-67
5-Nov	13:13	East Cell Bottom	1.215	108.0	ECBB 19-56
6-Nov	13:12	East Cell Top	0.897	103.9	ECTB 19-68
7-Nov	13:13	East Cell Top	0.714	108.0	ECTB 19-69
8-Nov	13:14	East Cell Bottom	1.189	102.2	ECBB 19-57
12-Nov	13:10	East Cell Bottom	1.318	101.7	ECBB 19-58/59
15-Nov	16:10	East Cell Top	0.879	111.3	ECTB 19-72A
15-Nov	16:10	East Cell Top	0.879	111.3	ECTB 19-71
20-Nov	13:08	East Cell Bottom	1.122	100.5	ECBB 19-58B
20-Nov	13:08	East Cell Bottom	1.122	100.5	ECBB 19-60
22-Nov	13:07	East Cell Top	*	*	ECTB 19-72B
26-Nov	13:10	East Cell Top	1.325	98.0	ECTB 19-73
27-Nov	13:07	East Cell Top	0.642	102.2	ECTB 19-70
28-Nov	13:10	East Cell Top	1.244	100.5	ECTB 19-74
28-Nov	13:10	East Cell Bottom	1.244	100.5	ECBB 19-61

*Unit offline while uploading previous data to Explotech servers

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 3, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2019 and November 30, 2019 and cross referenced with the blasting records provided to confirm that there was sixteen (16) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Nov	13:14	East Cell Top	0.763	105.5	ECTB 19-66
1-Nov	13:14	East Cell Top	0.763	105.5	ECTB 19-67
5-Nov	13:13	East Cell Bottom	0.835	109.2	ECBB 19-56
6-Nov	13:12	East Cell Top	0.434	107.0	ECTB 19-68
7-Nov	13:13	East Cell Top	0.222	97.50	ECTB 19-69
8-Nov	13:14	East Cell Bottom	0.779	112.3	ECBB 19-57
12-Nov	13:10	East Cell Bottom	0.747	115.6	ECBB 19-58/59
15-Nov	16:10	East Cell Top	0.514	115.2	ECTB 19-72A
15-Nov	16:10	East Cell Top	0.514	115.2	ECTB 19-71
20-Nov	13:08	East Cell Bottom	1.091	114.4	ECBB 19-58B
20-Nov	13:08	East Cell Bottom	1.091	114.4	ECBB 19-60
22-Nov	13:07	East Cell Top	0.274	114.0	ECTB 19-72B
26-Nov	13:10	East Cell Top	0.461	106.5	ECTB 19-73
27-Nov	13:07	East Cell Top	0.242	87.96	ECTB 19-70
28-Nov	13:10	East Cell Top	0.492	115.2	ECTB 19-74
28-Nov	13:10	East Cell Bottom	0.492	115.2	ECBB 19-61

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 3, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2019 and November 30, 2019 and cross referenced with the blasting records provided to confirm that there were sixteen (16) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
1-Nov	13:14	East Cell Top	0.907	108.0	ECTB 19-66
1-Nov	13:14	East Cell Top	0.907	108.0	ECTB 19-67
5-Nov	13:13	East Cell Bottom	1.415	4.467	ECBB 19-56
6-Nov	13:12	East Cell Top	1.015	109.5	ECTB 19-68
7-Nov	13:13	East Cell Top	0.622	103.5	ECTB 19-69
8-Nov	13:14	East Cell Bottom	1.527	101.0	ECBB 19-57
12-Nov	13:10	East Cell Bottom	1.294	107.0	ECBB 19-58/59
15-Nov	16:10	East Cell Top	1.056	106.0	ECTB 19-72A
15-Nov	16:10	East Cell Top	1.056	106.0	ECTB 19-71
20-Nov	13:08	East Cell Bottom	1.554	101.0	ECBB 19-58B
20-Nov	13:08	East Cell Bottom	1.554	101.0	ECBB 19-60
22-Nov	13:07	East Cell Top	0.495	106.0	ECTB 19-72B
26-Nov	13:10	East Cell Top	0.947	97.50	ECTB 19-73
27-Nov	13:07	East Cell Top	0.548	95.92	ECTB 19-70
28-Nov	13:10	East Cell Top	1.436	97.50	ECTB 19-74
28-Nov	13:10	East Cell Bottom	1.436	97.50	ECBB 19-61

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 18, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

December 2019 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of December 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between December 1, 2019 and December 12, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
10-Dec	10:08	East Cell Bottom	0.463	109.2	ECTB 19-63A

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

EXPLOTECH
Specialists in Explosives, Blasting and Vibration
Consulting Engineers

December 18, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

December 2019 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of December 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between December 1, 2019 and December 12, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
10-Dec	10:08	East Cell Bottom	0.896	101.9	ECTB 19-63A

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 18, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

December 2019 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of December 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between December 1, 2019 and December 12, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
10-Dec	10:08	East Cell Bottom	1.326	101.9	ECTB 19-63A

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 18, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

December 2019 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of December 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between December 1, 2019 and December 12, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
10-Dec	10:08	East Cell Bottom	0.600	106.5	ECTB 19-63A

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

December 18, 2019

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

December 2019 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of December 2019. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between December 1, 2019 and December 12, 2019 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
10-Dec	10:08	East Cell Bottom	0.894	111.5	ECTB 19-63A

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

April 6, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2020 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2020 and February 29, 2020 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
21-Feb	13:09	East Cell Top	0.967	109.2	ECTB 19-76

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

April 6, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2020 and February 29, 2020 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
21-Feb	13:09	East Cell Top	0.736	110.2	ECTB 19-76

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

April 6, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 1 – 315Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2020 and February 29, 2020 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
21-Feb	13:09	East Cell Top	0.673	112.4	ECTB 19-76

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

April 6, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2020 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2020 and February 29, 2020 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
21-Feb	13:09	East Cell Top	0.482	111.8	ECTB 19-76

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

April 6, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

February 2020 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of February 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between February 1, 2020 and February 29, 2020 and cross referenced with the blasting records provided to confirm that there was one (1) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure dB(L)	Blast No.
21-Feb	13:09	East Cell Top	0.875	112.0	ECTB 19-76

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

May 8, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2020 and April 30, 2020 and cross referenced with the blasting records provided to confirm that there was eleven (11) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Apr-2020	13:07	East Cell Bottom	0.812	115.6	ECBB 20-05
3-Apr-2020	13:11	East Cell Floor	0.199	101.0	ECF 20-03
8-Apr-2020	13:06	East Cell Top	0.508	112.8	ECTB 20-04
9-Apr-2020	13:09	East Cell Bottom	1.438	104.2	ECBB 20-06
15-Apr-2020	13:09	East Cell Floor	0.241	118.2	ECF 20-02
20-Apr-2020	11:20	East Cell Top	0.514	113.5	ECTB 20-05
21-Apr-2020	13:11	East Cell Bottom	1.209	97.5	ECBB 20-07
22-Apr-2020	13:10	East Cell Floor	0.239	111.2	ECF 20-04
23-Apr-2020	13:10	East Cell Floor	0.258	103.5	ECF 20-05
24-Apr-2020	13:09	East Cell Top	0.309	119.6	ECTB 20-06
28-Apr-2020	13:13	East Cell Bottom	1.546	113.1	ECBB 20-08

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

May 8, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2020 and April 30, 2020 and cross referenced with the blasting records provided to confirm that there was eleven (11) recorded blasts (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Apr-2020	13:07	East Cell Bottom	1.509	98.0	ECBB 20-05
3-Apr-2020	13:11	East Cell Floor	0.245	105.2	ECF 20-03
8-Apr-2020	13:06	East Cell Top	0.778	116.6	ECTB 20-04
9-Apr-2020	13:09	East Cell Bottom	1.171	105.4	ECBB 20-06
15-Apr-2020	13:09	East Cell Floor	0.237	113.6	ECF 20-02
20-Apr-2020	11:20	East Cell Top	0.543	107.7	ECTB 20-05
21-Apr-2020	13:11	East Cell Bottom	*	*	ECBB 20-07
22-Apr-2020	13:10	East Cell Floor	0.412	120.9	ECF 20-04
23-Apr-2020	13:10	East Cell Floor	0.155	117.8	ECF 20-05
24-Apr-2020	13:09	East Cell Top	0.672	110.2	ECTB 20-06
28-Apr-2020	13:13	East Cell Bottom	1.011	112.7	ECBB 20-08

*Unit offline due to uploading data to Explotech server

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

May 8, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2020 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2020 and April 30, 2020 and cross referenced with the blasting records provided to confirm that there was eleven (11) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Apr-2020	13:07	East Cell Bottom	0.604	119.6	ECBB 20-05
3-Apr-2020	13:11	East Cell Floor	0.206	110.2	ECF 20-03
8-Apr-2020	13:06	East Cell Top	0.329	109.9	ECTB 20-04
9-Apr-2020	13:09	East Cell Bottom	0.674	114.6	ECBB 20-06
15-Apr-2020	13:09	East Cell Floor	0.203	112.6	ECF 20-02
20-Apr-2020	11:20	East Cell Top	0.356	106.5	ECTB 20-05
21-Apr-2020	13:11	East Cell Bottom	0.477	119.9	ECBB 20-07
22-Apr-2020	13:10	East Cell Floor	0.203	116.3	ECF 20-04
23-Apr-2020	13:10	East Cell Floor	0.189	108.4	ECF 20-05
24-Apr-2020	13:09	East Cell Top	0.366	109.2	ECTB 20-06
28-Apr-2020	13:13	East Cell Bottom	0.942	116.1	ECBB 20-08

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

May 8, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2020 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 1 – 315Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2020 and April 30, 2020 and cross referenced with the blasting records provided to confirm that there was eleven (11) recorded blast (see table below).

EXPLOTECH

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Apr-2020	13:07	East Cell Bottom	1.356	97.5	ECBB 20-05
3-Apr-2020	13:11	East Cell Floor	0.221	101.0	ECF 20-03
8-Apr-2020	13:06	East Cell Top	0.904	111.8	ECTB 20-04
9-Apr-2020	13:09	East Cell Bottom	1.549	104.2	ECBB 20-06
15-Apr-2020	13:09	East Cell Floor	0.305	109.5	ECF 20-02
20-Apr-2020	11:20	East Cell Top	0.852	100.0	ECTB 20-05
21-Apr-2020	13:11	East Cell Bottom	1.276	104.9	ECBB 20-07
22-Apr-2020	13:10	East Cell Floor	0.230	116.7	ECF 20-04
23-Apr-2020	13:10	East Cell Floor	0.196	113.1	ECF 20-05
24-Apr-2020	13:09	East Cell Top	0.644	108.0	ECTB 20-06
28-Apr-2020	13:13	East Cell Bottom	1.513	98.8	ECBB 20-08

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

May 8, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

April 2020 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of April 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between April 1, 2020 and April 30, 2020 and cross referenced with the blasting records provided to confirm that there was eleven (11) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Apr-2020	13:07	East Cell Bottom	1.732	110.9	ECBB 20-05
3-Apr-2020	13:11	East Cell Floor	0.660	95.92	ECF 20-03
8-Apr-2020	13:06	East Cell Top	1.225	106.0	ECTB 20-04
9-Apr-2020	13:09	East Cell Bottom	2.453	101.9	ECBB 20-06
15-Apr-2020	13:09	East Cell Floor	0.622	107.0	ECF 20-02
20-Apr-2020	11:20	East Cell Top	1.350	109.5	ECTB 20-05
21-Apr-2020	13:11	East Cell Bottom	2.940	103.5	ECBB 20-07
22-Apr-2020	13:10	East Cell Floor	0.660	113.5	ECF 20-04
23-Apr-2020	13:10	East Cell Floor	0.660	112.8	ECF 20-05
24-Apr-2020	13:09	East Cell Top	0.907	116.4	ECTB 20-06
28-Apr-2020	13:13	East Cell Bottom	3.694	108.8	ECBB 20-08

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B.A.Sc.
Explotech Engineering Ltd.

June 11, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between May 1, 2020 and May 31, 2020 and cross referenced with the blasting records provided to confirm that there was sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-May-2020	13:08	East Cell Top	0.315	114.6	ECTB 20-07
5-May-2020	11:12	East Cell Bottom	0.683	114.8	ECBB 20-09
6-May-2020	11:08	East Cell Bottom	1.036	107.0	ECBB 20-10
7-May-2020	13:08	East Cell Top	0.465	111.2	ECTB 20-08/09
8-May-2020	13:11	East Cell Top	0.970	106.0	ECTB 20-10
11-May-2020	13:11	East Cell Top	0.407	101.9	ECTB 20-09B
12-May-2020	13:11	East Cell Bottom	1.498	102.8	ECBB 20-11
13-May-2020	13:13	East Cell Top	0.774	105.5	ECTB 20-11/12
14-May-2020	13:11	East Cell Top	0.371	117.5	ECTB 20-13
19-May-2020	13:10	East Cell Top	0.439	117.8	ECTB 20-14
21-May-2020	13:09	East Cell Bottom	1.044	108.8	ECBB 20-12
22-May-2020	16:14	Lower Yard Top	0.160	106.0	LY 20-01
26-May-2020	13:14	East Cell Top	0.962	108.0	ECTB 20-16
27-May-2020	13:11	East Cell Floor	0.232	98.84	ECF 20-06
28-May-2020	13:11	East Cell Top	0.667	109.2	ECTB 20-15
29-May-2020	13:12	East Cell Top	0.519	113.5	ECTB 20-18

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

June 11, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five or fifteen minute interval, depending on the setup, the unit reviewed the 307,200 or 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five or fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2020 and May 31, 2020 and cross referenced with the blasting records provided to confirm that there was sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-May-2020	13:08	East Cell Top	0.626	111.5	ECTB 20-07
5-May-2020	11:12	East Cell Bottom	0.694	102.7	ECBB 20-09
6-May-2020	11:08	East Cell Bottom	0.830	104.6	ECBB 20-10
7-May-2020	13:08	East Cell Top	0.628	117.1	ECTB 20-08/09
8-May-2020	13:11	East Cell Top	0.706	108.5	ECTB 20-10
11-May-2020	13:11	East Cell Top	0.476	111.0	ECTB 20-09B
12-May-2020	13:11	East Cell Bottom	1.303	106.0	ECBB 20-11
13-May-2020	13:13	East Cell Top	0.704	106.4	ECTB 20-11/12
14-May-2020	13:11	East Cell Top	0.661	103.6	ECTB 20-13
19-May-2020	13:10	East Cell Top	0.729	119.7	ECTB 20-14
21-May-2020	13:09	East Cell Bottom	0.957	107.3	ECBB 20-12
22-May-2020	16:14	Lower Yard Top	0.247	98.22	LY 20-01
26-May-2020	13:14	East Cell Top	1.035	97.88	ECTB 20-16
27-May-2020	13:11	East Cell Floor	0.287	92.76	ECF 20-06
28-May-2020	13:11	East Cell Top	0.595	104.9	ECTB 20-15
29-May-2020	13:12	East Cell Top	1.268	103.1	ECTB 20-18

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

June 11, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2020 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2020 and May 31, 2020 and cross referenced with the blasting records provided to confirm that there was sixteen (16) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-May-2020	13:08	East Cell Top	0.332	110.9	ECTB 20-07
5-May-2020	11:12	East Cell Bottom	0.466	113.1	ECBB 20-09
6-May-2020	11:08	East Cell Bottom	0.560	113.3	ECBB 20-10
7-May-2020	13:08	East Cell Top	0.502	106.0	ECTB 20-08/09
8-May-2020	13:11	East Cell Top	0.455	115.2	ECTB 20-10
11-May-2020	13:11	East Cell Top	0.277	87.96	ECTB 20-09B
12-May-2020	13:11	East Cell Bottom	0.613	109.9	ECBB 20-11
13-May-2020	13:13	East Cell Top	0.581	114.2	ECTB 20-11/12
14-May-2020	13:11	East Cell Top	0.572	107.5	ECTB 20-13
19-May-2020	13:10	East Cell Top	0.371	113.1	ECTB 20-14
21-May-2020	13:09	East Cell Bottom	0.604	110.6	ECBB 20-12
22-May-2020	16:14	Lower Yard Top	0.206	110.2	LY 20-01
26-May-2020	13:14	East Cell Top	0.763	116.4	ECTB 20-16
27-May-2020	13:11	East Cell Floor	0.256	98.84	ECF 20-06
28-May-2020	13:11	East Cell Top	0.091	122.2	ECTB 20-15
29-May-2020	13:12	East Cell Top	0.591	108.4	ECTB 20-18

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

June 11, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2020 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 1 – 315Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2020 and May 31, 2020 and cross referenced with the blasting records provided to confirm that there was sixteen (16) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-May-2020	13:08	East Cell Top	0.581	101.9	ECTB 20-07
5-May-2020	11:12	East Cell Bottom	1.160	95.92	ECBB 20-09
6-May-2020	11:08	East Cell Bottom	0.930	108.8	ECBB 20-10
7-May-2020	13:08	East Cell Top	0.944	114.6	ECTB 20-08/09
8-May-2020	13:11	East Cell Top	0.480	108.4	ECTB 20-10
11-May-2020	13:11	East Cell Top	0.659	110.2	ECTB 20-09B
12-May-2020	13:11	East Cell Bottom	1.584	104.9	ECBB 20-11
13-May-2020	13:13	East Cell Top	0.746	109.2	ECTB 20-11/12
14-May-2020	13:11	East Cell Top	0.695	101.9	ECTB 20-13
19-May-2020	13:10	East Cell Top	0.908	114.8	ECTB 20-14
21-May-2020	13:09	East Cell Bottom	1.269	98.84	ECBB 20-12
22-May-2020	16:14	Lower Yard Top	0.368	100.0	LY 20-01
26-May-2020	13:14	East Cell Top	0.819	98.84	ECTB 20-16
27-May-2020	13:11	East Cell Floor	0.365	97.50	ECF 20-06
28-May-2020	13:11	East Cell Top	0.613	115.4	ECTB 20-15
29-May-2020	13:12	East Cell Top	1.242	108.8	ECTB 20-18

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

June 11, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2020 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2020 and May 31, 2020 and cross referenced with the blasting records provided to confirm that there was sixteen (16) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-May-2020	13:08	East Cell Top	0.596	111.2	ECTB 20-07
5-May-2020	11:12	East Cell Bottom	2.133	110.6	ECBB 20-09
6-May-2020	11:08	East Cell Bottom	2.304	101.9	ECBB 20-10
7-May-2020	13:08	East Cell Top	0.933	109.2	ECTB 20-08/09
8-May-2020	13:11	East Cell Top	1.636	104.2	ECTB 20-10
11-May-2020	13:11	East Cell Top	0.660	108.4	ECTB 20-09B
12-May-2020	13:11	East Cell Bottom	2.250	104.2	ECBB 20-11
13-May-2020	13:13	East Cell Top	1.535	103.5	ECTB 20-11/12
14-May-2020	13:11	East Cell Top	0.684	117.6	ECTB 20-13
19-May-2020	13:10	East Cell Top	1.055	115.9	ECTB 20-14
21-May-2020	13:09	East Cell Bottom	1.943	106.0	ECBB 20-12
22-May-2020	16:14	Lower Yard Top	0.596	106.5	LY 20-01
26-May-2020	13:14	East Cell Top	2.174	104.9	ECTB 20-16
27-May-2020	13:11	East Cell Floor	0.440	98.84	ECF 20-06
28-May-2020	13:11	East Cell Top	1.047	125.6	ECTB 20-15
29-May-2020	13:12	East Cell Top	1.198	116.4	ECTB 20-18

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

June 11, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May 2020 Vibration Summary: Old Office House– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the Old Office House, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations. Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking.

While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between May 1, 2020 and May 31, 2020 and cross referenced with the blasting records provided to confirm that there was sixteen (16) recorded blasts (see table below). The Old Office House does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-May-2020	13:08	East Cell Top	*	*	ECTB 20-07
5-May-2020	11:12	East Cell Bottom	*	*	ECBB 20-09
6-May-2020	11:08	East Cell Bottom	*	*	ECBB 20-10
7-May-2020	13:08	East Cell Top	*	*	ECTB 20-08/09
8-May-2020	13:11	East Cell Top	*	*	ECTB 20-10
11-May-2020	13:11	East Cell Top	*	*	ECTB 20-09B
12-May-2020	13:11	East Cell Bottom	*	*	ECBB 20-11
13-May-2020	13:13	East Cell Top	*	*	ECTB 20-11/12
14-May-2020	13:11	East Cell Top	*	*	ECTB 20-13
19-May-2020	13:10	East Cell Top	*	*	ECTB 20-14
21-May-2020	13:09	East Cell Bottom	*	*	ECBB 20-12
22-May-2020	16:14	Lower Yard Top	2.874	106.0	LY 20-01
26-May-2020	13:14	East Cell Top	0.297	101.0	ECTB 20-16
27-May-2020	13:11	East Cell Floor	0.136	103.5	ECF 20-06
28-May-2020	13:11	East Cell Top	0.237	104.2	ECTB 20-15
29-May-2020	13:12	East Cell Top	0.518	105.5	ECTB 20-18

*Unit not installed

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

June 9, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

May/June 2020 Vibration Summary: 6419 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of May/June 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the 6419 15 Sideroad property. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismograph was programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded a pre-set trigger level set at 1.00mm/s or air overpressure intensities exceeding 128 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law publication* section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between May 28, 2020 (install date) and June 8, 2020 (removal date) and cross referenced with the blasting records provided to confirm that there was seven (7) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
28-May-2020	13:11	East Cell Top	1.078	101.9	ECTB 20-15
29-May-2020	13:14	East Cell Top	0.604	113.1	ECTB 20-18
1-Jun-2020	13:10	East Cell Bottom	1.362	100.0	ECBB 20-13
1-Jun-2020	17:10	Lower Yard Top	0.103	106.5	LY 20-02
2-Jun-2020	13:20	East Cell Top	0.859	101.9	ECTB 20-17
4-Jun-2020	13:14	East Cell Top	0.621	104.9	ECTB 20-20
5-Jun-2020	13:14	East Cell Top	1.475	98.84	ECTB 20-19/21

Predictable and measured vibration levels attributable to the blasting operations at the Milton Quarry during the intermittent monitoring period from May 28, 2020 to June 8, 2020 demonstrate intensities well below threshold levels for probable direct adverse impact to surrounding structures. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

July 14, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between June 1, 2020 and June 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty (20) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-Jun	13:10	East Cell Bottom	1.005	98.84	ECBB 20-13
1-Jun	17:10	Lower Yard	0.209	98.84	LY 20-02
2-Jun	13:20	East Cell Top	0.827	101.0	ECTB 20-17
4-Jun	13:14	East Cell Top	0.362	107.5	ECTB 20-20
5-Jun	13:14	East Cell Top	0.838	104.9	ECTB 20-19/21
8-Jun	13:08	East Cell Bottom	1.205	110.2	ECBB 20-14
9-Jun	13:11	East Cell Front	0.305	97.50	ECF 20-07
10-Jun	13:08	East Cell Top	0.536	107.0	ECTB 20-22
11-Jun	13:08	East Cell Bottom	1.338	101.0	ECBB 20-15
12-Jun	13:08	East Cell Top	0.382	104.9	ECTB 20-23
15-Jun	13:14	East Cell Top	0.690	114.0	ECTB 20-24/25
16-Jun	13:10	East Cell Front	0.272	98.84	ECF 20-08
18-Jun	13:11	East Cell Top	0.490	116.7	ECTB 20-26
19-Jun	13:15	East Cell Bottom	1.880	108.0	ECBB 20-16
19-Jun	16:11	Lower Yard	0.208	106.0	LY 20-03
23-Jun	13:14	East Cell Top	0.364	110.9	ECTB 20-27
24-Jun	13:11	East Cell Top	0.497	101.0	ECTB 20-30
25-Jun	13:11	East Cell Front	0.199	93.98	ECF 20-09
26-Jun	13:12	East Cell Bottom	1.065	103.5	ECBB 20-17
30-Jun	11:11	East Cell Top	0.603	113.5	ECTB 20-31

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

July 14, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five or fifteen minute interval, depending on the setup, the unit reviewed the 307,200 or 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five or fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2020 and June 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty (20) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-Jun	13:10	East Cell Bottom	1.10	96.10	ECBB 20-13
1-Jun	17:10	Lower Yard	0.189	108.5	LY 20-02
2-Jun	13:20	East Cell Top	0.793	112.9	ECTB 20-17
4-Jun	13:14	East Cell Top	0.683	100.8	ECTB 20-20
5-Jun	13:14	East Cell Top	0.857	103.4	ECTB 20-19/21
8-Jun	13:08	East Cell Bottom	1.385	91.00	ECBB 20-14
9-Jun	13:11	East Cell Front	0.269	101.9	ECF 20-07
10-Jun	13:08	East Cell Top	0.933	101.8	ECTB 20-22
11-Jun	13:08	East Cell Bottom	1.648	108.8	ECBB 20-15
12-Jun	13:08	East Cell Top	0.792	107.9	ECTB 20-23
15-Jun	13:14	East Cell Top	0.595	99.87	ECTB 20-24/25
16-Jun	13:10	East Cell Front	0.215	94.70	ECF 20-08
18-Jun	13:11	East Cell Top	0.732	99.73	ECTB 20-26
19-Jun	13:15	East Cell Bottom	0.843	98.22	ECBB 20-16
19-Jun	16:11	Lower Yard	0.163	105.5	LY 20-03
23-Jun	13:14	East Cell Top	0.768	106.6	ECTB 20-27
24-Jun	13:11	East Cell Top	1.480	99.70	ECTB 20-30
25-Jun	13:11	East Cell Front	0.264	100.3	ECF 20-09
26-Jun	13:12	East Cell Bottom	1.437	104.8	ECBB 20-17
30-Jun	11:11	East Cell Top	1.320	97.70	ECTB 20-31

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

July 14, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2020 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2020 and June 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty (20) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-Jun	13:10	East Cell Bottom	0.674	107.0	ECBB 20-13
1-Jun	17:10	Lower Yard	0.125	101.9	LY 20-02
2-Jun	13:20	East Cell Top	0.817	102.8	ECTB 20-17
4-Jun	13:14	East Cell Top	0.231	109.5	ECTB 20-20
5-Jun	13:14	East Cell Top	0.832	110.9	ECTB 20-19/21
8-Jun	13:08	East Cell Bottom	0.692	112.3	ECBB 20-14
9-Jun	13:11	East Cell Front	0.242	98.84	ECF 20-07
10-Jun	13:08	East Cell Top	0.388	101.0	ECTB 20-22
11-Jun	13:08	East Cell Bottom	1.020	102.8	ECBB 20-15
12-Jun	13:08	East Cell Top	0.241	103.5	ECTB 20-23
15-Jun	13:14	East Cell Top	0.669	117.8	ECTB 20-24/25
16-Jun	13:10	East Cell Front	0.228	101.9	ECF 20-08
18-Jun	13:11	East Cell Top	0.360	111.5	ECTB 20-26
19-Jun	13:15	East Cell Bottom	0.849	108.4	ECBB 20-16
19-Jun	16:11	Lower Yard	0.186	106.5	LY 20-03
23-Jun	13:14	East Cell Top	0.322	120.7	ECTB 20-27
24-Jun	13:11	East Cell Top	0.862	101.0	ECTB 20-30
25-Jun	13:11	East Cell Front	0.223	93.98	ECF 20-09
26-Jun	13:12	East Cell Bottom	0.508	108.0	ECBB 20-17
30-Jun	11:11	East Cell Top	0.437	108.8	ECTB 20-31

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

July 14, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2020 Vibration Summary: 10366 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10366 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 1 – 315Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2020 and June 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty (20) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-Jun	13:10	East Cell Bottom	1.111	102.8	ECBB 20-13
1-Jun	17:10	Lower Yard	0.270	104.2	LY 20-02
2-Jun	13:20	East Cell Top	0.871	114.8	ECTB 20-17
4-Jun	13:14	East Cell Top	0.753	104.2	ECTB 20-20
5-Jun	13:14	East Cell Top	0.860	112.0	ECTB 20-19/21
8-Jun	13:08	East Cell Bottom	*	*	ECBB 20-14
9-Jun	13:11	East Cell Front	*	*	ECF 20-07
10-Jun	13:08	East Cell Top	*	*	ECTB 20-22
11-Jun	13:08	East Cell Bottom	*	*	ECBB 20-15
12-Jun	13:08	East Cell Top	*	*	ECTB 20-23
15-Jun	13:14	East Cell Top	*	*	ECTB 20-24/25
16-Jun	13:10	East Cell Front	*	*	ECF 20-08
18-Jun	13:11	East Cell Top	*	*	ECTB 20-26
19-Jun	13:15	East Cell Bottom	*	*	ECBB 20-16
19-Jun	16:11	Lower Yard	*	*	LY 20-03
23-Jun	13:14	East Cell Top	*	*	ECTB 20-27
24-Jun	13:11	East Cell Top	*	*	ECTB 20-30
25-Jun	13:11	East Cell Front	*	*	ECF 20-09
26-Jun	13:12	East Cell Bottom	*	*	ECBB 20-17
30-Jun	11:11	East Cell Top	*	*	ECTB 20-31

*Unit Removed

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

July 14, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2020 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between June 1, 2020 and June 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty (20) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-Jun	13:10	East Cell Bottom	1.836	101.0	ECBB 20-13
1-Jun	17:10	Lower Yard	0.596	98.84	LY 20-02
2-Jun	13:20	East Cell Top	1.576	104.9	ECTB 20-17
4-Jun	13:14	East Cell Top	0.950	111.2	ECTB 20-20
5-Jun	13:14	East Cell Top	1.426	101.9	ECTB 20-19/21
8-Jun	13:08	East Cell Bottom	2.584	106.5	ECBB 20-14
9-Jun	13:11	East Cell Front	0.596	97.50	ECF 20-07
10-Jun	13:08	East Cell Top	0.833	118.5	ECTB 20-22
11-Jun	13:08	East Cell Bottom	1.670	103.5	ECBB 20-15
12-Jun	13:08	East Cell Top	1.205	108.8	ECTB 20-23
15-Jun	13:14	East Cell Top	1.391	109.2	ECTB 20-24/25
16-Jun	13:10	East Cell Front	0.596	97.50	ECF 20-08
18-Jun	13:11	East Cell Top	1.301	116.4	ECTB 20-26
19-Jun	13:15	East Cell Bottom	2.727	107.0	ECBB 20-16
19-Jun	16:11	Lower Yard	*	*	LY 20-03
23-Jun	13:14	East Cell Top	*	*	ECTB 20-27
24-Jun	13:11	East Cell Top	*	*	ECTB 20-30
25-Jun	13:11	East Cell Front	*	*	ECF 20-09
26-Jun	13:12	East Cell Bottom	*	*	ECBB 20-17
30-Jun	11:11	East Cell Top	*	*	ECTB 20-31

*Unit offline

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

July 14, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

June 2020 Vibration Summary: Old Office House– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of June 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the Old Office House, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations. Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking.

While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

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We have reviewed the vibration records for the monitoring period between June 1, 2020 and June 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty (20) recorded blasts (see table below). The Old Office House does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
1-Jun	13:10	East Cell Bottom	0.366	109.5	ECBB 20-13
1-Jun	17:10	Lower Yard	1.569	111.5	LY 20-02
2-Jun	13:20	East Cell Top	0.290	106.5	ECTB 20-17
4-Jun	13:14	East Cell Top	0.175	106.0	ECTB 20-20
5-Jun	13:14	East Cell Top	0.335	101.0	ECTB 20-19/21
8-Jun	13:08	East Cell Bottom	0.425	101.0	ECBB 20-14
9-Jun	13:11	East Cell Front	0.147	101.9	ECF 20-07
10-Jun	13:08	East Cell Top	0.334	103.5	ECTB 20-22
11-Jun	13:08	East Cell Bottom	0.387	116.3	ECBB 20-15
12-Jun	13:08	East Cell Top	0.236	108.4	ECTB 20-23
15-Jun	13:14	East Cell Top	0.279	106.0	ECTB 20-24/25
16-Jun	13:10	East Cell Front	0.094	103.5	ECF 20-08
18-Jun	13:11	East Cell Top	0.362	98.84	ECTB 20-26
19-Jun	13:15	East Cell Bottom	0.339	97.50	ECBB 20-16
19-Jun	16:11	Lower Yard	1.910	114.8	LY 20-03
23-Jun	13:14	East Cell Top	0.120	104.2	ECTB 20-27
24-Jun	13:11	East Cell Top	0.217	113.8	ECTB 20-30
25-Jun	13:11	East Cell Front	0.097	98.84	ECF 20-09
26-Jun	13:12	East Cell Bottom	0.420	114.4	ECBB 20-17
30-Jun	11:11	East Cell Top	0.239	100.0	ECTB 20-31

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

September 15, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2020 and July 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty one (21) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Jul	13:20	East Cell Bottom	2.214	102.8	ECBB 20-18/19
2-Jul	13:20	East Cell Top	2.214	102.8	ECTB 20-28/29
3-Jul	16:15	Lower Yard Top	0.178	106.0	LY 20-04
6-Jul	13:10	East Cell Floor	0.204	104.2	ECF 20-10
7-Jul	13:15	East Cell Top	0.858	107.5	ECTB 20-32/28B
8-Jul	13:09	East Cell Bottom	1.226	104.2	ECBB 20-20A
9-Jul	13:09	East Cell Top	0.569	109.9	ECTB 20-33
10-Jul	13:11	East Cell Bottom	1.325	113.1	ECBB 20-20B
13-Jul	17:08	Lower Yard Top	0.192	104.9	LY 20-05
15-Jul	11:53	East Cell Top	0.559	108.8	ECTB 20-34 35
17-Jul	10:10	East Cell Bottom	1.031	100.0	ECBB 20-21
20-Jul	13:10	East Cell Floor	*	*	ECF 20-10
21-Jul	13:33	East Cell Top	0.472	110.9	ECTB 20-36
22-Jul	13:33	East Cell Bottom	1.430	108.0	ECBB 20-22
23-Jul	16:11	East Cell Top	0.338	103.5	ECTB 20-37
24-Jul	16:13	Lower Yard Top	0.132	103.5	LY 20-06
27-Jul	12:11	East Cell Top	0.455	101.0	ECTB 20-38
28-Jul	12:25	East Cell Bottom	1.644	98.8	ECBB 20-24
29-Jul	13:08	East Cell Bottom	1.049	103.5	ECBB 20-25
30-Jul	13:08	East Cell Floor	0.194	97.50	ECF 20-11

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31-Jul	13:11	East Cell Bottom	1.003	114.2	ECBB 20-26 24B

*Unit offline

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

September 15, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2020 and July 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty one (21) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Jul	13:20	East Cell Bottom	1.935	108.4	ECBB 20-18/19
2-Jul	13:20	East Cell Top	1.935	108.4	ECTB 20-28/29
3-Jul	16:15	Lower Yard Top	0.147	94.82	LY 20-04
6-Jul	13:10	East Cell Floor	0.232	91.05	ECF 20-10
7-Jul	13:15	East Cell Top	0.733	108.2	ECTB 20-32/28B
8-Jul	13:09	East Cell Bottom	0.778	96.98	ECBB 20-20A
9-Jul	13:09	East Cell Top	1.633	102.6	ECTB 20-33
10-Jul	13:11	East Cell Bottom	1.514	100.7	ECBB 20-20B
13-Jul	17:08	Lower Yard Top	0.260	94.19	LY 20-05
15-Jul	11:53	East Cell Top	1.360	95.2	ECTB 20-34 35
17-Jul	10:10	East Cell Bottom	1.003	97.97	ECBB 20-21
20-Jul	13:10	East Cell Floor	0.289	102.1	ECF 20-10
21-Jul	13:33	East Cell Top	2.078	95.4	ECTB 20-36
22-Jul	13:33	East Cell Bottom	1.350	100.9	ECBB 20-22
23-Jul	16:11	East Cell Top	0.797	97.07	ECTB 20-37
24-Jul	16:13	Lower Yard Top	0.215	95.30	LY 20-06
27-Jul	12:11	East Cell Top	1.127	98.3	ECTB 20-38
28-Jul	12:25	East Cell Bottom	1.015	99.45	ECBB 20-24
29-Jul	13:08	East Cell Bottom	0.752	108.9	ECBB 20-25
30-Jul	13:08	East Cell Floor	0.221	97.44	ECF 20-11
31-Jul	13:11	East Cell Bottom	1.027	95.75	ECBB 20-26 24B

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

September 15, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2020 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2020 and July 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty one (21) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Jul	13:20	East Cell Bottom	1.771	112.0	ECBB 20-18/19
2-Jul	13:20	East Cell Top	1.771	112.0	ECTB 20-28/29
3-Jul	16:15	Lower Yard Top	0.124	100.0	LY 20-04
6-Jul	13:10	East Cell Floor	0.159	100.0	ECF 20-10
7-Jul	13:15	East Cell Top	0.623	101.0	ECTB 20-32/28B
8-Jul	13:09	East Cell Bottom	1.128	104.9	ECBB 20-20A
9-Jul	13:09	East Cell Top	0.489	108.0	ECTB 20-33
10-Jul	13:11	East Cell Bottom	1.114	111.8	ECBB 20-20B
13-Jul	17:08	Lower Yard Top	0.242	97.50	LY 20-05
15-Jul	11:53	East Cell Top	0.827	104.9	ECTB 20-34 35
17-Jul	10:10	East Cell Bottom	0.921	103.5	ECBB 20-21
20-Jul	13:10	East Cell Floor	0.247	101.0	ECF 20-10
21-Jul	13:33	East Cell Top	0.659	105.5	ECTB 20-36
22-Jul	13:33	East Cell Bottom	1.004	102.8	ECBB 20-22
23-Jul	16:11	East Cell Top	0.281	104.2	ECTB 20-37
24-Jul	16:13	Lower Yard Top	0.166	107.0	LY 20-06
27-Jul	12:11	East Cell Top	0.574	97.50	ECTB 20-38
28-Jul	12:25	East Cell Bottom	0.864	101.0	ECBB 20-24
29-Jul	13:08	East Cell Bottom	0.793	107.5	ECBB 20-25
30-Jul	13:08	East Cell Floor	0.330	97.50	ECF 20-11
31-Jul	13:11	East Cell Bottom	1.225	115.0	ECBB 20-26 24B

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

September 15, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2020 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2020 and July 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty one (21) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Jul	13:20	East Cell Bottom	*	*	ECBB 20-18/19
2-Jul	13:20	East Cell Top	*	*	ECTB 20-28/29
3-Jul	16:15	Lower Yard Top	*	*	LY 20-04
6-Jul	13:10	East Cell Floor	0.311	103.5	ECF 20-10
7-Jul	13:15	East Cell Top	1.276	107.5	ECTB 20-32/28B
8-Jul	13:09	East Cell Bottom	1.420	102.8	ECBB 20-20A
9-Jul	13:09	East Cell Top	1.024	112.3	ECTB 20-33
10-Jul	13:11	East Cell Bottom	2.376	109.5	ECBB 20-20B
13-Jul	17:08	Lower Yard Top	0.311	107.5	LY 20-05
15-Jul	11:53	East Cell Top	2.546	108.4	ECTB 20-34 35
17-Jul	10:10	East Cell Bottom	2.290	98.8	ECBB 20-21
20-Jul	13:10	East Cell Floor	0.381	93.98	ECF 20-10
21-Jul	13:33	East Cell Top	2.222	110.6	ECTB 20-36
22-Jul	13:33	East Cell Bottom	2.102	108.8	ECBB 20-22
23-Jul	16:11	East Cell Top	0.813	101.9	ECTB 20-37
24-Jul	16:13	Lower Yard Top	0.311	101.0	LY 20-06
27-Jul	12:11	East Cell Top	1.581	101.0	ECTB 20-38
28-Jul	12:25	East Cell Bottom	2.174	101.0	ECBB 20-24
29-Jul	13:08	East Cell Bottom	1.809	101.9	ECBB 20-25
30-Jul	13:08	East Cell Floor	0.359	98.84	ECF 20-11
31-Jul	13:11	East Cell Bottom	2.543	107.0	ECBB 20-26 24B

*Unit offline

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

September 15, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

July 2020 Vibration Summary: Old Office House– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of July 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the Old Office House, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations. Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking.

While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between July 1, 2020 and July 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty one (21) recorded blasts (see table below). The Old Office House does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
2-Jul	13:20	East Cell Bottom	0.387	107.5	ECBB 20-18/19
2-Jul	13:20	East Cell Top	0.387	107.5	ECTB 20-28/29
3-Jul	16:15	Lower Yard Top	1.146	112.8	LY 20-04
6-Jul	13:10	East Cell Floor	0.116	101.0	ECF 20-10
7-Jul	13:15	East Cell Top	0.137	101.9	ECTB 20-32/28B
8-Jul	13:09	East Cell Bottom	0.325	101.9	ECBB 20-20A
9-Jul	13:09	East Cell Top	0.291	100.0	ECTB 20-33
10-Jul	13:11	East Cell Bottom	0.501	102.8	ECBB 20-20B
13-Jul	17:08	Lower Yard Top	2.300	111.5	LY 20-05
15-Jul	11:53	East Cell Top	0.261	101.0	ECTB 20-34 35
17-Jul	10:10	East Cell Bottom	0.274	114.0	ECBB 20-21
20-Jul	13:10	East Cell Floor	0.122	109.9	ECF 20-10
21-Jul	13:33	East Cell Top	0.262	100.0	ECTB 20-36
22-Jul	13:33	East Cell Bottom	0.389	101.0	ECBB 20-22
23-Jul	16:11	East Cell Top	0.117	100.0	ECTB 20-37
24-Jul	16:13	Lower Yard Top	1.822	106.5	LY 20-06
27-Jul	12:11	East Cell Top	0.128	107.0	ECTB 20-38
28-Jul	12:25	East Cell Bottom	0.408	108.0	ECBB 20-24
29-Jul	13:08	East Cell Bottom	0.228	105.5	ECBB 20-25

30-Jul	13:08	East Cell Floor	0.114	101.9	ECF 20-11
31-Jul	13:11	East Cell Bottom	0.581	101.0	ECBB 20-26 24B

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

September 16, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2020 and August 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
04-Aug	13:17	East Cell RAMP	1.068	107.5	RAMP 20-01
04-Aug	13:17	East Cell Top	1.068	107.5	ECTB 20-39
05-Aug	13:16	East Cell Top	0.908	102.8	ECTB 20-40
05-Aug	13:16	East Cell Bottom	0.908	102.8	ECBB 20-26B
05-Aug	13:16	East Cell RAMP	0.908	102.8	TB -RAMP-01
06-Aug	17:12	Lower Yard Top	0.154	104.2	LY 20-07
07-Aug	13:12	East Cell Bottom	0.999	113.3	ECBB 20-27
10-Aug	13:18	East Cell Top	0.276	95.92	ECTB 20-41
11-Aug	13:12	East Cell Top	0.480	108.0	ECTB 20-42
12-Aug	13:07	East Cell Bottom	1.054	107.5	ECBB 20-28
14-Aug	10:12	East Cell Bottom	1.011	116.4	ECBB 20-29 29B
17-Aug	13:13	East Cell Top	0.380	109.9	ECTB 20-44
18-Aug	13:11	East Cell Top	0.299	105.5	ECTB 20-43
19-Aug	13:08	East Cell Bottom	1.418	103.5	ECBB 20-30
20-Aug	17:14	Lower Yard Top	0.177	95.92	LY 20-08
21-Aug	13:12	East Cell Bottom	1.019	108.8	ECBB 20-31
24-Aug	13:14	East Cell RAMP	1.089	101.0	RAMP 20-02
26-Aug	13:09	East Cell Bottom	0.868	110.9	ECBB 20-32
27-Aug	13:18	East Cell Top	0.521	101.9	ECTB 20-46
28-Aug	13:14	East Cell Bottom	1.051	117.2	ECBB 20-33

EXPLOTECH

31-Aug	13:12	East Cell Floor	0.893	114.4	ECF 20-12
31-Aug	13:12	East Cell Floor	0.893	114.4	ECTB 20-47

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

September 16, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2020 and August 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
04-Aug	13:17	East Cell RAMP	1.110	99.45	RAMP 20-01
04-Aug	13:17	East Cell Top	1.110	99.45	ECTB 20-39
05-Aug	13:16	East Cell Top	1.770	104.0	ECTB 20-40
05-Aug	13:16	East Cell Bottom	1.770	104.0	ECBB 20-26B
05-Aug	13:16	East Cell RAMP	1.770	104.0	TB -RAMP-01
06-Aug	17:12	Lower Yard Top	0.217	96.18	LY 20-07
07-Aug	13:12	East Cell Bottom	1.362	97.26	ECBB 20-27
10-Aug	13:18	East Cell Top	0.500	100.5	ECTB 20-41
11-Aug	13:12	East Cell Top	1.664	99.66	ECTB 20-42
12-Aug	13:07	East Cell Bottom	1.153	104.9	ECBB 20-28
14-Aug	10:12	East Cell Bottom	1.570	93.64	ECBB 20-29 29B
17-Aug	13:13	East Cell Top	0.987	96.48	ECTB 20-44
18-Aug	13:11	East Cell Top	0.424	103.4	ECTB 20-43
19-Aug	13:08	East Cell Bottom	1.524	98.38	ECBB 20-30
20-Aug	17:14	Lower Yard Top	0.169	99.45	LY 20-08
21-Aug	13:12	East Cell Bottom	1.703	97.88	ECBB 20-31
24-Aug	13:14	East Cell RAMP	1.940	106.0	RAMP 20-02
26-Aug	13:09	East Cell Bottom	1.408	103.5	ECBB 20-32
27-Aug	13:18	East Cell Top	1.153	111.7	ECTB 20-46
28-Aug	13:14	East Cell Bottom	2.323	95.75	ECBB 20-33

31-Aug	13:12	East Cell Floor	0.855	102.1	ECF 20-12
31-Aug	13:12	East Cell Floor	0.855	102.1	ECTB 20-47

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

September 16, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>August 2020 Vibration Summary: 10401 6th Sideroad– CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between August 1, 2020 and August 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
04-Aug	13:17	East Cell RAMP	1.08	<88	RAMP 20-01
04-Aug	13:17	East Cell Top	1.08	<88	ECTB 20-39
05-Aug	13:16	East Cell Top	0.88	103.5	ECTB 20-40
05-Aug	13:16	East Cell Bottom	0.88	103.5	ECBB 20-26B
05-Aug	13:16	East Cell RAMP	0.88	103.5	TB -RAMP-01
06-Aug	17:12	Lower Yard Top	0.26	104.9	LY 20-07
07-Aug	13:12	East Cell Bottom	0.65	109.5	ECBB 20-27
10-Aug	13:18	East Cell Top	0.24	97.50	ECTB 20-41
11-Aug	13:12	East Cell Top	0.50	97.50	ECTB 20-42
12-Aug	13:07	East Cell Bottom	0.70	101.9	ECBB 20-28
14-Aug	10:12	East Cell Bottom	1.49	117.9	ECBB 20-29 29B
17-Aug	13:13	East Cell Top	0.38	101.0	ECTB 20-44
18-Aug	13:11	East Cell Top	0.34	104.9	ECTB 20-43
19-Aug	13:08	East Cell Bottom	1.03	113.1	ECBB 20-30
20-Aug	17:14	Lower Yard Top	0.15	101.0	LY 20-08
21-Aug	13:12	East Cell Bottom	0.67	105.5	ECBB 20-31
24-Aug	13:14	East Cell RAMP	1.72	101.0	RAMP 20-02
26-Aug	13:09	East Cell Bottom	1.62	109.2	ECBB 20-32
27-Aug	13:18	East Cell Top	0.46	97.50	ECTB 20-46
28-Aug	13:14	East Cell Bottom	0.92	113.1	ECBB 20-33

31-Aug	13:12	East Cell Floor	0.79	119.6	ECF 20-12
31-Aug	13:12	East Cell Floor	0.79	119.6	ECTB 20-47

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air over pressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

September 16, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2020 Vibration Summary: 6390 15 Sideroad– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2020 and August 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
04-Aug	13:17	East Cell RAMP	1.71	103.5	RAMP 20-01
04-Aug	13:17	East Cell Top	1.71	103.5	ECTB 20-39
05-Aug	13:16	East Cell Top	2.09	106.0	ECTB 20-40
05-Aug	13:16	East Cell Bottom	2.09	106.0	ECBB 20-26B
05-Aug	13:16	East Cell RAMP	2.09	106.0	TB -RAMP-01
06-Aug	17:12	Lower Yard Top	0.36	104.2	LY 20-07
07-Aug	13:12	East Cell Bottom	1.77	110.9	ECBB 20-27
10-Aug	13:18	East Cell Top	0.83	98.84	ECTB 20-41
11-Aug	13:12	East Cell Top	1.42	108.4	ECTB 20-42
12-Aug	13:07	East Cell Bottom	1.57	107.0	ECBB 20-28
14-Aug	10:12	East Cell Bottom	2.53	116.7	ECBB 20-29 29B
17-Aug	13:13	East Cell Top	0.783	112.0	ECTB 20-44
18-Aug	13:11	East Cell Top	0.48	104.2	ECTB 20-43
19-Aug	13:08	East Cell Bottom	1.68	101.9	ECBB 20-30
20-Aug	17:14	Lower Yard Top	0.31	98.84	LY 20-08
21-Aug	13:12	East Cell Bottom	2.58	109.9	ECBB 20-31
24-Aug	13:14	East Cell RAMP	1.50	103.5	RAMP 20-02
26-Aug	13:09	East Cell Bottom	1.20	107.0	ECBB 20-32
27-Aug	13:18	East Cell Top	0.93	107.0	ECTB 20-46
28-Aug	13:14	East Cell Bottom	2.23	116.1	ECBB 20-33
31-Aug	13:12	East Cell Floor	1.49	110.2	ECF 20-12
31-Aug	13:12	East Cell Floor	1.49	110.2	ECTB 20-47

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

September 16, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

August 2020 Vibration Summary: Old Office House– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of August 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the Old Office House, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations. Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking.

While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between August 1, 2020 and August 31, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below). The Old Office House does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
04-Aug	13:17	East Cell RAMP	0.281	100.0	RAMP 20-01
04-Aug	13:17	East Cell Top	0.281	100.0	ECTB 20-39
05-Aug	13:16	East Cell Top	0.390	108.4	ECTB 20-40
05-Aug	13:16	East Cell Bottom	0.390	108.4	ECBB 20-26B
05-Aug	13:16	East Cell RAMP	0.390	108.4	TB -RAMP-01
06-Aug	17:12	Lower Yard Top	3.219	110.2	LY 20-07
07-Aug	13:12	East Cell Bottom	0.292	101.9	ECBB 20-27
10-Aug	13:18	East Cell Top	0.085	108.4	ECTB 20-41
11-Aug	13:12	East Cell Top	0.169	107.5	ECTB 20-42
12-Aug	13:07	East Cell Bottom	0.279	107.0	ECBB 20-28
14-Aug	10:12	East Cell Bottom	0.534	107.5	ECBB 20-29 29B
17-Aug	13:13	East Cell Top	0.128	102.8	ECTB 20-44
18-Aug	13:11	East Cell Top	0.128	108.4	ECTB 20-43
19-Aug	13:08	East Cell Bottom	0.171	103.5	ECBB 20-30
20-Aug	17:14	Lower Yard Top	2.267	109.2	LY 20-08
21-Aug	13:12	East Cell Bottom	0.554	106.0	ECBB 20-31
24-Aug	13:14	East Cell RAMP	0.212	108.4	RAMP 20-02
26-Aug	13:09	East Cell Bottom	0.296	101.9	ECBB 20-32
27-Aug	13:18	East Cell Top	0.132	109.2	ECTB 20-46

28-Aug	13:14	East Cell Bottom	0.453	98.84	ECBB 20-33
31-Aug	13:12	East Cell Floor	0.187	103.5	ECF 20-12
31-Aug	13:12	East Cell Floor	0.187	103.5	ECTB 20-47

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

October 7, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2020 Vibration Summary: 10862 Regional Road 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10862 Regional Road 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five* minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2020 and September 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Sep	13:12	East Cell RAMP	*	*	RAMP 20-03
02-Sep	13:12	East Cell Bottom	*	*	ECBB 20-35
03-Sep	17:18	Lower Yard Top	*	*	LY 20-09
04-Sep	13:12	East Cell Top	*	*	ECTB 20-49
08-Sep	13:11	East Cell Bottom	*	*	ECBB 20-34
09-Sep	13:11	East Cell Bottom	*	*	ECBB 20-36
10-Sep	13:12	East Cell Top	*	*	ECTB 20-51
10-Sep	13:12	East Cell TOE	*	*	ECTB 20-50 TOE
11-Sep	13:11	East Cell Top	*	*	ECTB 20-48a 49b
14-Sep	13:14	East Cell Bottom	*	*	ECBB 20-38
14-Sep	13:14	West Cell Floor	*	*	WCF 20-01
15-Sep	13:12	East Cell Bottom	*	*	ECBB 20-37
16-Sep	13:09	East Cell Top	*	*	ECTB 20-52
17-Sep	17:10	Lower Yard Top	*	*	LY 20-10
18-Sep	13:07	East Cell Top	0.339	101.4	ECTB 20-53
21-Sep	13:12	East Cell Bottom	0.692	100.0	ECBB 20-39 40
22-Sep	13:13	West Cell Floor	0.095	87.34	WCF 20-02
23-Sep	13:13	East Cell Top	0.377	108.5	ECTB 20-54 55
24-Sep	13:09	East Cell Top	0.196	100.1	ECTB 20-56
28-Sep	13:12	East Cell Bottom	0.796	108.6	ECBB 20-41 42

29-Sep	13:12	East Cell Top	0.324	100.9	ECTB 20-57
30-Sep	17:07	Lower Yard Top	0.127	107.5	LY 20-11

*Unit installed September 18th

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

October 7, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2020 and September 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Sep	13:12	East Cell RAMP	0.944	102.8	RAMP 20-03
02-Sep	13:12	East Cell Bottom	1.163	113.3	ECBB 20-35
03-Sep	17:18	Lower Yard Top	0.147	101.9	LY 20-09
04-Sep	13:12	East Cell Top	0.541	97.50	ECTB 20-49
08-Sep	13:11	East Cell Bottom	0.851	106.5	ECBB 20-34
09-Sep	13:11	East Cell Bottom	1.087	115.2	ECBB 20-36
10-Sep	13:12	East Cell Top	0.445	106.5	ECTB 20-51
10-Sep	13:12	East Cell TOE	0.445	106.5	ECTB 20-50 TOE
11-Sep	13:11	East Cell Top	0.476	110.6	ECTB 20-48a 49b
14-Sep	13:14	East Cell Bottom	1.082	108.0	ECBB 20-38
14-Sep	13:14	West Cell Floor	1.082	108.0	WCF 20-01
15-Sep	13:12	East Cell Bottom	0.961	109.9	ECBB 20-37
16-Sep	13:09	East Cell Top	0.467	101.9	ECTB 20-52
17-Sep	17:10	Lower Yard Top	0.178	100.0	LY 20-10
18-Sep	13:07	East Cell Top	0.611	110.2	ECTB 20-53
21-Sep	13:12	East Cell Bottom	1.503	111.8	ECBB 20-39 40
22-Sep	13:13	West Cell Floor	0.117	91.48	WCF 20-02
23-Sep	13:13	East Cell Top	0.463	104.9	ECTB 20-54 55
24-Sep	13:09	East Cell Top	0.469	101.0	ECTB 20-56
28-Sep	13:12	East Cell Bottom	1.296	112.3	ECBB 20-41 42

29-Sep	13:12	East Cell Top	0.440	98.84	ECTB 20-57
30-Sep	17:07	Lower Yard Top	0.166	104.9	LY 20-11

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

October 7, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2020 and September 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Sep	13:12	East Cell RAMP	0.918	101.4	RAMP 20-03
02-Sep	13:12	East Cell Bottom	1.908	101.8	ECBB 20-35
03-Sep	17:18	Lower Yard Top	0.258	103.3	LY 20-09
04-Sep	13:12	East Cell Top	0.675	111.3	ECTB 20-49
08-Sep	13:11	East Cell Bottom	1.265	88.68	ECBB 20-34
09-Sep	13:11	East Cell Bottom	2.155	97.07	ECBB 20-36
10-Sep	13:12	East Cell Top	1.268	102.7	ECTB 20-51
10-Sep	13:12	East Cell TOE	1.268	102.7	ECTB 20-50 TOE
11-Sep	13:11	East Cell Top	0.741	98.93	ECTB 20-48a 49b
14-Sep	13:14	East Cell Bottom	1.807	92.60	ECBB 20-38
14-Sep	13:14	West Cell Floor	1.807	92.60	WCF 20-01
15-Sep	13:12	East Cell Bottom	2.102	103.5	ECBB 20-37
16-Sep	13:09	East Cell Top	1.162	108.5	ECTB 20-52
17-Sep	17:10	Lower Yard Top	0.311	95.52	LY 20-10
18-Sep	13:07	East Cell Top	0.689	99.38	ECTB 20-53
21-Sep	13:12	East Cell Bottom	1.987	99.01	ECBB 20-39 40
22-Sep	13:13	West Cell Floor	0.118	94.05	WCF 20-02
23-Sep	13:13	East Cell Top	0.985	109.5	ECTB 20-54 55
24-Sep	13:09	East Cell Top	0.463	101.7	ECTB 20-56
28-Sep	13:12	East Cell Bottom	1.958	101.4	ECBB 20-41 42

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29-Sep	13:12	East Cell Top	0.761	103.9	ECTB 20-57
30-Sep	17:07	Lower Yard Top	0.233	107.2	LY 20-11

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

October 7, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2020 Vibration Summary: 10401 6th Sideroad – CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2020 and September 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blast (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Sep	13:12	East Cell RAMP	1.603	98.84	RAMP 20-03
02-Sep	13:12	East Cell Bottom	0.859	104.9	ECBB 20-35
03-Sep	17:18	Lower Yard Top	0.177	101.9	LY 20-09
04-Sep	13:12	East Cell Top	0.709	98.84	ECTB 20-49
08-Sep	13:11	East Cell Bottom	1.091	112.0	ECBB 20-34
09-Sep	13:11	East Cell Bottom	0.823	113.8	ECBB 20-36
10-Sep	13:12	East Cell Top	0.428	109.2	ECTB 20-51
10-Sep	13:12	East Cell TOE	0.428	109.2	ECTB 20-50 TOE
11-Sep	13:11	East Cell Top	0.334	105.5	ECTB 20-48a 49b
14-Sep	13:14	East Cell Bottom	0.641	110.6	ECBB 20-38
14-Sep	13:14	West Cell Floor	0.641	110.6	WCF 20-01
15-Sep	13:12	East Cell Bottom	0.794	101.9	ECBB 20-37
16-Sep	13:09	East Cell Top	0.489	97.50	ECTB 20-52
17-Sep	17:10	Lower Yard Top	0.254	105.5	LY 20-10
18-Sep	13:07	East Cell Top	0.671	114.2	ECTB 20-53
21-Sep	13:12	East Cell Bottom	0.923	103.5	ECBB 20-39 40
22-Sep	13:13	West Cell Floor	0.446	98.84	WCF 20-02
23-Sep	13:13	East Cell Top	0.583	105.5	ECTB 20-54 55
24-Sep	13:09	East Cell Top	1.062	95.92	ECTB 20-56
28-Sep	13:12	East Cell Bottom	1.241	106.5	ECBB 20-41 42

29-Sep	13:12	East Cell Top	0.636	100.0	ECTB 20-57
30-Sep	17:07	Lower Yard Top	0.199	101.9	LY 20-11

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

EXPLOTECH
Specialists in Explosives, Blasting and Vibration
Consulting Engineers

October 7, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2020 Vibration Summary: 6390 15 Sideroad – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2020 and September 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Sep	13:12	East Cell RAMP	1.122	101.0	RAMP 20-03
02-Sep	13:12	East Cell Bottom	2.222	101.9	ECBB 20-35
03-Sep	17:18	Lower Yard Top	0.311	101.9	LY 20-09
04-Sep	13:12	East Cell Top	0.916	103.5	ECTB 20-49
08-Sep	13:11	East Cell Bottom	1.150	103.5	ECBB 20-34
09-Sep	13:11	East Cell Bottom	1.646	133.5	ECBB 20-36
10-Sep	13:12	East Cell Top	0.916	108.4	ECTB 20-51
10-Sep	13:12	East Cell TOE	0.916	108.4	ECTB 20-50 TOE
11-Sep	13:11	East Cell Top	0.783	110.2	ECTB 20-48a 49b
14-Sep	13:14	East Cell Bottom	1.470	101.9	ECBB 20-38
14-Sep	13:14	West Cell Floor	1.470	101.9	WCF 20-01
15-Sep	13:12	East Cell Bottom	1.732	112.8	ECBB 20-37
16-Sep	13:09	East Cell Top	1.024	103.5	ECTB 20-52
17-Sep	17:10	Lower Yard Top	0.311	100.0	LY 20-10
18-Sep	13:07	East Cell Top	1.458	101.8	ECTB 20-53
21-Sep	13:12	East Cell Bottom	2.419	107.0	ECBB 20-39 40
22-Sep	13:13	West Cell Floor	0.201	88.92	WCF 20-02
23-Sep	13:13	East Cell Top	0.905	103.6	ECTB 20-54 55
24-Sep	13:09	East Cell Top	0.806	102.1	ECTB 20-56
28-Sep	13:12	East Cell Bottom	2.638	108.6	ECBB 20-41 42
29-Sep	13:12	East Cell Top	1.117	94.82	ECTB 20-57
30-Sep	17:07	Lower Yard Top	0.254	103.9	LY 20-11

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

October 7, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

September 2020 Vibration Summary: Old Office House– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of September 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the Old Office House, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations. Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking.

While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between September 1, 2020 and September 30, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below). The Old Office House does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Sep	13:12	East Cell RAMP	0.213	104.2	RAMP 20-03
02-Sep	13:12	East Cell Bottom	0.503	110.9	ECBB 20-35
03-Sep	17:18	Lower Yard Top	1.984	114.6	LY 20-09
04-Sep	13:12	East Cell Top	0.112	107.0	ECTB 20-49
08-Sep	13:11	East Cell Bottom	0.147	104.9	ECBB 20-34
09-Sep	13:11	East Cell Bottom	0.340	101.9	ECBB 20-36
10-Sep	13:12	East Cell Top	0.203	104.9	ECTB 20-51
10-Sep	13:12	East Cell TOE	0.203	104.9	ECTB 20-50 TOE
11-Sep	13:11	East Cell Top	0.136	101.0	ECTB 20-48a 49b
14-Sep	13:14	East Cell Bottom	0.199	104.2	ECBB 20-38
14-Sep	13:14	West Cell Floor	0.199	104.2	WCF 20-01
15-Sep	13:12	East Cell Bottom	0.349	106.5	ECBB 20-37
16-Sep	13:09	East Cell Top	0.196	115.2	ECTB 20-52
17-Sep	17:10	Lower Yard Top	2.398	110.6	LY 20-10
18-Sep	13:07	East Cell Top	0.209	107.5	ECTB 20-53
21-Sep	13:12	East Cell Bottom	0.372	102.8	ECBB 20-39 40
22-Sep	13:13	West Cell Floor	0.091	98.84	WCF 20-02
23-Sep	13:13	East Cell Top	0.164	113.5	ECTB 20-54 55

24-Sep	13:09	East Cell Top	0.097	104.2	ECTB 20-56
28-Sep	13:12	East Cell Bottom	0.401	108.0	ECBB 20-41 42
29-Sep	13:12	East Cell Top	0.117	107.5	ECTB 20-57
30-Sep	17:07	Lower Yard Top	2.890	111.5	LY 20-11

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

November 5, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2020 Vibration Summary: 10862 Regional Road 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10862 Regional Road 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five* minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 0.75mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2020 and October 31, 2020 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Oct	13:12	East Cell Top	0.277	105.9	ECTB 20-60
02-Oct	13:11	West Cell Floor	0.113	101.5	WCF 20-03
05-Oct	13:11	East Cell Bottom	0.733	100.5	ECBB 20-43
06-Oct	13:08	East Cell Top	0.360	112.3	ECTB 20-59
07-Oct	13:16	East Cell Top	0.312	105.6	ECTB 20-61/62
08-Oct	13:08	East Cell Floor	0.101	97.71	ECF 20-11
09-Oct	13:17	East Cell Bottom	1.086	<88	ECBB 20-44
13-Oct	17:12	Lower Yard Top	0.154	94.94	LY 20-12
14-Oct	13:11	East Cell Top	0.541	108.6	ECTB 20-63
15-Oct	13:11	East Cell Top	0.265	116.6	ECTB 20-64
19-Oct	13:10	East Cell Bottom	0.534	100.1	ECBB 20-45
20-Oct	13:14	East Cell Top	0.443	103.1	ECTB 20-65
22-Oct	13:10	East Cell Top	0.305	99.94	ECTB 20-66
23-Oct	16:08	Lower Yard Top	0.118	106.1	LY 20-13
26-Oct	12:08	East Cell Bottom	0.700	101.8	ECBB 20-46
27-Oct	13:08	East Cell Top	0.437	107.9	ECTB 20-67
28-Oct	13:09	East Cell Top	0.536	110.3	ECTB 20-68
29-Oct	13:08	East Cell Bottom	0.756	100.1	ECBB 20-47
30-Oct	13:11	East Cell Top	0.403	102.7	ECTB 20-69

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

November 5, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between October 1, 2020 and October 31, 2020 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Oct	13:12	East Cell Top	0.657	101.9	ECTB 20-60
02-Oct	13:11	West Cell Floor	0.208	108.0	WCF 20-03
05-Oct	13:11	East Cell Bottom	1.315	108.4	ECBB 20-43
06-Oct	13:08	East Cell Top	0.353	103.5	ECTB 20-59
07-Oct	13:16	East Cell Top	0.870	104.2	ECTB 20-61/62
08-Oct	13:08	East Cell Floor	0.117	95.92	ECF 20-11
09-Oct	13:17	East Cell Bottom	0.962	108.4	ECBB 20-44
13-Oct	17:12	Lower Yard Top	0.146	101.0	LY 20-12
14-Oct	13:11	East Cell Top	0.369	104.9	ECTB 20-63
15-Oct	13:11	East Cell Top	0.752	109.2	ECTB 20-64
19-Oct	13:10	East Cell Bottom	1.353	124.1	ECBB 20-45
20-Oct	13:14	East Cell Top	0.316	114.0	ECTB 20-65
22-Oct	13:10	East Cell Top	0.766	113.3	ECTB 20-66
23-Oct	16:08	Lower Yard Top	0.151	111.2	LY 20-13
26-Oct	12:08	East Cell Bottom	1.172	116.4	ECBB 20-46
27-Oct	13:08	East Cell Top	0.506	108.8	ECTB 20-67
28-Oct	13:09	East Cell Top	0.793	113.1	ECTB 20-68
29-Oct	13:08	East Cell Bottom	0.753	117.1	ECBB 20-47
30-Oct	13:11	East Cell Top	0.496	106.0	ECTB 20-69

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

November 5, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2020 and October 31, 2020 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Oct	13:12	East Cell Top	1.159	104.5	ECTB 20-60
02-Oct	13:11	West Cell Floor	0.166	103.1	WCF 20-03
05-Oct	13:11	East Cell Bottom	2.402	92.76	ECBB 20-43
06-Oct	13:08	East Cell Top	1.000	116.2	ECTB 20-59
07-Oct	13:16	East Cell Top	0.859	112.1	ECTB 20-61/62
08-Oct	13:08	East Cell Floor	0.155	103.7	ECF 20-11
09-Oct	13:17	East Cell Bottom	2.628	106.7	ECBB 20-44
13-Oct	17:12	Lower Yard Top	0.401	100.0	LY 20-12
14-Oct	13:11	East Cell Top	1.122	108.9	ECTB 20-63
15-Oct	13:11	East Cell Top	0.834	102.5	ECTB 20-64
19-Oct	13:10	East Cell Bottom	1.433	101.4	ECBB 20-45
20-Oct	13:14	East Cell Top	0.980	102.2	ECTB 20-65
22-Oct	13:10	East Cell Top	0.946	95.75	ECTB 20-66
23-Oct	16:08	Lower Yard Top	0.320	108.4	LY 20-13
26-Oct	12:08	East Cell Bottom	2.141	104.8	ECBB 20-46
27-Oct	13:08	East Cell Top	0.902	109.7	ECTB 20-67
28-Oct	13:09	East Cell Top	0.885	113.4	ECTB 20-68
29-Oct	13:08	East Cell Bottom	2.113	103.2	ECBB 20-47
30-Oct	13:11	East Cell Top	1.339	107.5	ECTB 20-69

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

November 5, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2020 Vibration Summary: 10401 6th Sideroad – CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

EXPLOTECH

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2020 and October 31, 2020 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Oct	13:12	East Cell Top	0.687	104.2	ECTB 20-60
02-Oct	13:11	West Cell Floor	0.529	107.0	WCF 20-03
05-Oct	13:11	East Cell Bottom	0.875	104.9	ECBB 20-43
06-Oct	13:08	East Cell Top	0.497	106.5	ECTB 20-59
07-Oct	13:16	East Cell Top	0.719	111.2	ECTB 20-61/62
08-Oct	13:08	East Cell Floor	0.098	91.48	ECF 20-11
09-Oct	13:17	East Cell Bottom	1.076	108.4	ECBB 20-44
13-Oct	17:12	Lower Yard Top	0.258	102.8	LY 20-12
14-Oct	13:11	East Cell Top	0.499	104.2	ECTB 20-63
15-Oct	13:11	East Cell Top	0.704	109.2	ECTB 20-64
19-Oct	13:10	East Cell Bottom	0.834	117.8	ECBB 20-45
20-Oct	13:14	East Cell Top	0.371	112.3	ECTB 20-65
22-Oct	13:10	East Cell Top	0.624	115.6	ECTB 20-66
23-Oct	16:08	Lower Yard Top	0.273	108.8	LY 20-13
26-Oct	12:08	East Cell Bottom	0.727	116.3	ECBB 20-46
27-Oct	13:08	East Cell Top	0.352	109.5	ECTB 20-67
28-Oct	13:09	East Cell Top	1.088	109.5	ECTB 20-68
29-Oct	13:08	East Cell Bottom	0.738	110.2	ECBB 20-47
30-Oct	13:11	East Cell Top	0.601	108.0	ECTB 20-69

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

November 5, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2020 Vibration Summary: 6390 15 Sideroad – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between October 1, 2020 and October 31, 2020 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Oct	13:12	East Cell Top	1.152	97.53	ECTB 20-60
02-Oct	13:11	West Cell Floor	0.320	93.92	WCF 20-03
05-Oct	13:11	East Cell Bottom	1.935	97.71	ECBB 20-43
06-Oct	13:08	East Cell Top	0.160	93.92	ECTB 20-59
07-Oct	13:16	East Cell Top	2.040	96.07	ECTB 20-61/62
08-Oct	13:08	East Cell Floor	0.197	86.42	ECF 20-11
09-Oct	13:17	East Cell Bottom	2.030	113.7	ECBB 20-44
13-Oct	17:12	Lower Yard Top	0.298	97.53	LY 20-12
14-Oct	13:11	East Cell Top	0.740	101.4	ECTB 20-63
15-Oct	13:11	East Cell Top	1.738	108.1	ECTB 20-64
19-Oct	13:10	East Cell Bottom	1.676	114.0	ECBB 20-45
20-Oct	13:14	East Cell Top	0.907	103.7	ECTB 20-65
22-Oct	13:10	East Cell Top	1.346	106.0	ECTB 20-66
23-Oct	16:08	Lower Yard Top	0.230	109.4	LY 20-13
26-Oct	12:08	East Cell Bottom	1.970	103.2	ECBB 20-46
27-Oct	13:08	East Cell Top	0.671	121.5	ECTB 20-67
28-Oct	13:09	East Cell Top	1.535	104.8	ECTB 20-68
29-Oct	13:08	East Cell Bottom	1.744	104.5	ECBB 20-47
30-Oct	13:11	East Cell Top	1.001	100.7	ECTB 20-69

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

November 5, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

October 2020 Vibration Summary: Old Office House– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of October 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the Old Office House, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations. Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking.

While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between October 1, 2020 and October 31, 2020 and cross referenced with the blasting records provided to confirm that there was nineteen (19) recorded blasts (see table below). The Old Office House does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
01-Oct	13:12	East Cell Top	0.144	103.5	ECTB 20-60
02-Oct	13:11	West Cell Floor	0.116	110.6	WCF 20-03
05-Oct	13:11	East Cell Bottom	0.377	101.0	ECBB 20-43
06-Oct	13:08	East Cell Top	0.142	113.8	ECTB 20-59
07-Oct	13:16	East Cell Top	0.100	120.5	ECTB 20-61/62
08-Oct	13:08	East Cell Floor	0.091	107.5	ECF 20-11
09-Oct	13:17	East Cell Bottom	0.438	103.5	ECBB 20-44
13-Oct	17:12	Lower Yard Top	2.921	116.7	LY 20-12
14-Oct	13:11	East Cell Top	0.117	110.9	ECTB 20-63
15-Oct	13:11	East Cell Top	0.143	113.1	ECTB 20-64
19-Oct	13:10	East Cell Bottom	0.276	101.9	ECBB 20-45
20-Oct	13:14	East Cell Top	0.162	104.9	ECTB 20-65
22-Oct	13:10	East Cell Top	0.116	100.0	ECTB 20-66
23-Oct	16:08	Lower Yard Top	2.794	115.6	LY 20-13
26-Oct	12:08	East Cell Bottom	0.277	113.1	ECBB 20-46
27-Oct	13:08	East Cell Top	0.125	104.2	ECTB 20-67
28-Oct	13:09	East Cell Top	0.217	113.3	ECTB 20-68
29-Oct	13:08	East Cell Bottom	0.271	106.5	ECBB 20-47
30-Oct	13:11	East Cell Top	0.169	110.2	ECTB 20-69

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

B Lavoie

Bradley Lavoie, B.Eng.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

December 17, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November and December 2020 Vibration Summary: 10862 Regional Road 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November and December 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10862 Regional Road 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five* minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 0.75mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2020 and December 16, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
02-Nov	13:09	East Cell Top	0.372	115.1	ECTB 20-70
03-Nov	17:01	Lower Yard Top	0.144	98.14	LY 20-14
05-Nov	13:09	East Cell Top	0.937	94.30	ECTB 20-71
05-Nov	13:09	East Cell Bottom	0.937	94.30	ECBB 20-48
06-Nov	16:05	East Cell Top	0.711	101.8	ECTB 20-58
09-Nov	13:09	East Cell Top	0.437	107.2	ECTB 20-72
11-Nov	13:10	East Cell Bottom	0.760	105.0	ECBB 20-49
12-Nov	13:12	East Cell Top	0.498	105.0	ECTB 20-73
13-Nov	16:04	Lower Yard Top	0.185	102.3	LY 20-15
16-Nov	12:04	East Cell Ramp	0.213	108.6	RAMP EX 20-01
17-Nov	13:07	East Cell Top	0.379	111.6	ECTB 20-74
18-Nov	13:08	East Cell Bottom	0.869	91.05	ECBB 20-50
19-Nov	13:08	East Cell Top	0.575	111.8	ECTB 20-75
20-Nov	16:08	Lower Yard Top	0.196	105.5	LY 20-16
24-Nov	13:08	East Cell Top	0.305	101.3	ECTB 20-77
25-Nov	13:15	East Cell Bottom	0.643	107.7	ECBB 20-51
26-Nov	13:11	East Cell Ramp	0.287	104.2	RAMP EX 20-02
30-Nov	16:09	East Cell Top	0.347	103.6	ECTB 20-76/78
02-Dec	13:09	East Cell Bottom	0.881	90.5	ECBB 20-53
04-Dec	13:05	East Cell Top	0.437	103.9	ECTB 20-79
08-Dec	13:06	East Cell Top	0.229	99.08	ECTB 20-80
09-Dec	13:05	East Cell Bottom	0.778	102.9	ECBB 20-54

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

December 17, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November and December 2020 Vibration Summary: 10664 Townline Road– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November and December 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10664 Townline Road. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2020 and December 16, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
02-Nov	13:09	East Cell Top	0.951	115.2	ECTB 20-70
03-Nov	17:01	Lower Yard Top	0.160	107.5	LY 20-14
05-Nov	13:09	East Cell Top	1.189	114.6	ECTB 20-71
05-Nov	13:09	East Cell Bottom	1.189	114.6	ECBB 20-48
06-Nov	16:05	East Cell Top	0.485	112.6	ECTB 20-58
09-Nov	13:09	East Cell Top	0.672	113.3	ECTB 20-72
11-Nov	13:10	East Cell Bottom	0.944	112.6	ECBB 20-49
12-Nov	13:12	East Cell Top	0.589	110.6	ECTB 20-73
13-Nov	16:04	Lower Yard Top	0.145	104.9	LY 20-15
16-Nov	12:04	East Cell Ramp	0.248	116.1	RAMP EX 20-01
17-Nov	13:07	East Cell Top	0.724	113.5	ECTB 20-74
18-Nov	13:08	East Cell Bottom	0.874	117.5	ECBB 20-50
19-Nov	13:08	East Cell Top	0.513	115.2	ECTB 20-75
20-Nov	16:08	Lower Yard Top	0.164	102.8	LY 20-16
24-Nov	13:08	East Cell Top	0.505	121.6	ECTB 20-77
25-Nov	13:15	East Cell Bottom	1.081	112.8	ECBB 20-51
26-Nov	13:11	East Cell Ramp	0.457	100.0	RAMP EX 20-02
30-Nov	16:09	East Cell Top	0.532	111.8	ECTB 20-76/78
02-Dec	13:09	East Cell Bottom	1.066	112.3	ECBB 20-53
04-Dec	13:05	East Cell Top	0.460	114.4	ECTB 20-79
08-Dec	13:06	East Cell Top	0.395	108.4	ECTB 20-80
09-Dec	13:05	East Cell Bottom	0.882	105.5	ECBB 20-54

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

December 17, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November and December 2020 Vibration Summary: 10454 Highway 25 – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November and December 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10454 Highway 25. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between November 1, 2020 and December 16, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
02-Nov	13:09	East Cell Top	0.868	114.5	ECTB 20-70
03-Nov	17:01	Lower Yard Top	0.251	94.44	LY 20-14
05-Nov	13:09	East Cell Top	2.108	108.0	ECTB 20-71
05-Nov	13:09	East Cell Bottom	2.108	108.0	ECBB 20-48
06-Nov	16:05	East Cell Top	0.926	101.1	ECTB 20-58
09-Nov	13:09	East Cell Top	0.905	109.6	ECTB 20-72
11-Nov	13:10	East Cell Bottom	2.044	112.2	ECBB 20-49
12-Nov	13:12	East Cell Top	1.004	104.2	ECTB 20-73
13-Nov	16:04	Lower Yard Top	0.257	106.5	LY 20-15
16-Nov	12:04	East Cell Ramp	0.382	105.7	RAMP EX 20-01
17-Nov	13:07	East Cell Top	0.747	118.1	ECTB 20-74
18-Nov	13:08	East Cell Bottom	1.861	103.9	ECBB 20-50
19-Nov	13:08	East Cell Top	1.331	113.3	ECTB 20-75
20-Nov	16:08	Lower Yard Top	0.210	103.1	LY 20-16
24-Nov	13:08	East Cell Top	1.725	103.5	ECTB 20-77
25-Nov	13:15	East Cell Bottom	1.662	109.1	ECBB 20-51
26-Nov	13:11	East Cell Ramp	0.732	108.9	RAMP EX 20-02
30-Nov	16:09	East Cell Top	1.282	101.8	ECTB 20-76/78
02-Dec	13:09	East Cell Bottom	2.577	109.5	ECBB 20-53
04-Dec	13:05	East Cell Top	1.403	106.5	ECTB 20-79
08-Dec	13:06	East Cell Top	0.549	112.5	ECTB 20-80
09-Dec	13:05	East Cell Bottom	0.935	110.9	ECBB 20-54

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure levels have remained compliant with MECP NPC 119 guideline. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

December 17, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November and December 2020 Vibration Summary: 10401 6th Sideroad – CRH Canada Group Inc. – Dufferin Aggergates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November and December 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property located at 10401 6th Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

EXPLOTECH

We have reviewed the vibration records for the monitoring period between November 1, 2020 and December 16, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
02-Nov	13:09	East Cell Top	0.926	113.3	ECTB 20-70
03-Nov	17:01	Lower Yard Top	0.162	109.9	LY 20-14
05-Nov	13:09	East Cell Top	0.600	108.8	ECTB 20-71
05-Nov	13:09	East Cell Bottom	0.600	108.8	ECBB 20-48
06-Nov	16:05	East Cell Top	0.281	101.9	ECTB 20-58
09-Nov	13:09	East Cell Top	0.856	105.5	ECTB 20-72
11-Nov	13:10	East Cell Bottom	0.637	108.0	ECBB 20-49
12-Nov	13:12	East Cell Top	0.538	109.2	ECTB 20-73
13-Nov	16:04	Lower Yard Top	0.194	101.0	LY 20-15
16-Nov	12:04	East Cell Ramp	0.212	106.5	RAMP EX 20-01
17-Nov	13:07	East Cell Top	0.569	122.3	ECTB 20-74
18-Nov	13:08	East Cell Bottom	0.614	111.2	ECBB 20-50
19-Nov	13:08	East Cell Top	0.462	109.5	ECTB 20-75
20-Nov	16:08	Lower Yard Top	0.165	98.84	LY 20-16
24-Nov	13:08	East Cell Top	0.243	108.4	ECTB 20-77
25-Nov	13:15	East Cell Bottom	0.598	87.96	ECBB 20-51
26-Nov	13:11	East Cell Ramp	0.546	100.0	RAMP EX 20-02
30-Nov	16:09	East Cell Top	0.536	110.2	ECTB 20-76/78
02-Dec	13:09	East Cell Bottom	0.536	115.7	ECBB 20-53
04-Dec	13:05	East Cell Top	0.297	116.7	ECTB 20-79
08-Dec	13:06	East Cell Top	0.262	102.8	ECTB 20-80
09-Dec	13:05	East Cell Bottom	0.559	101.0	ECBB 20-54

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibrations and air overpressure have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

December 17, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

<u>November and December 2020 Vibration Summary: 6390 15 Sideroad – CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario</u>

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November and December 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with the Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the property at 6390 15 Sideroad. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 254mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each five minute interval, the unit reviewed the 307,200 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent five minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s. This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations.

Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking. While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment and Climate Change has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2020 and December 16, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below).

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
02-Nov	13:09	East Cell Top	1.297	103.7	ECTB 20-70
03-Nov	17:01	Lower Yard Top	0.230	99.31	LY 20-14
05-Nov	13:09	East Cell Top	2.296	107.6	ECTB 20-71
05-Nov	13:09	East Cell Bottom	2.296	107.6	ECBB 20-48
06-Nov	16:05	East Cell Top	1.234	109.4	ECTB 20-58
09-Nov	13:09	East Cell Top	1.262	105.3	ECTB 20-72
11-Nov	13:10	East Cell Bottom	2.003	96.10	ECBB 20-49
12-Nov	13:12	East Cell Top	0.928	104.3	ECTB 20-73
13-Nov	16:04	Lower Yard Top	0.260	99.66	LY 20-15
16-Nov	12:04	East Cell Ramp	0.345	111.4	RAMP EX 20-01
17-Nov	13:07	East Cell Top	1.392	102.4	ECTB 20-74
18-Nov	13:08	East Cell Bottom	2.367	104.8	ECBB 20-50
19-Nov	13:08	East Cell Top	1.010	106.6	ECTB 20-75
20-Nov	16:08	Lower Yard Top	0.170	96.78	LY 20-16
24-Nov	13:08	East Cell Top	1.312	119.5	ECTB 20-77
25-Nov	13:15	East Cell Bottom	2.673	108.7	ECBB 20-51
26-Nov	13:11	East Cell Ramp	0.522	103.7	RAMP EX 20-02
30-Nov	16:09	East Cell Top	0.879	105.8	ECTB 20-76/78
02-Dec	13:09	East Cell Bottom	1.873	101.8	ECBB 20-53
04-Dec	13:05	East Cell Top	1.412	114.9	ECTB 20-79
08-Dec	13:06	East Cell Top	0.571	103.6	ECTB 20-80
09-Dec	13:05	East Cell Bottom	2.055	107.3	ECBB 20-54

EXPLOTECH

We have continuously reviewed the data over the latest monitor period and confirm that all recorded blast induced vibration and air overpressure levels have remained compliant with MECP NPC 119 guideline limits. Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

December 17, 2020

CRH Canada Group Inc.
Dufferin Aggregates – Milton Quarry
9410 Dublin Line, Milton, ON L9T 2X7

Attention: Mr. Conor McGucken

November and December 2020 Vibration Summary: Old Office House– CRH Canada Group Inc. – Dufferin Aggregates – Milton Quarry, Milton, Ontario

Mr. Conor McGucken,

Below please find a table of recorded data from the CRH Milton Quarry during the month of November and December 2020. This monitoring program was implemented to record vibrations present at this location in order to ascertain possible impacts of the CRH Canada Group Inc. quarrying operations on nearby structures and to ensure compliance with Ministry of Environment Conservation and Parks guidelines (NPC 119).

The seismograph unit was installed at the Old Office House, on the Milton Quarry site. The installed monitor unit consisted of a tri-directional digital seismograph capable of measuring vibration intensities up to 31.75mm/s at a frequency response of 2 – 250Hz. The seismographs were programmed to measure all vibration levels continuously at a sampling rate of 1024 samples per second. Following each fifteen minute interval, the unit reviewed the 921,600 recorded vibrations and permanently recorded the peak particle velocity for that time interval while deleting all subordinate vibration intensities. This process was repeated for all subsequent fifteen minute time intervals thereby providing maximum vibration intensities experienced at the monitoring location throughout the day on the unit. Such a configuration permits continuous monitoring of vibration levels and provides complete coverage of all vibrations, blast induced or otherwise, experienced at the monitored location.

As an additional analytical tool, the unit was configured to record more detailed waveform data when vibration intensities exceeded pre-set trigger levels set at 1.00mm/s or air overpressure intensities exceeded 127 dB(L). This additional capability permits advanced analysis of the data in the event that more intense vibrations are experienced. It should be noted that the seismograph does not distinguish between blast induced and localized induced vibrations. Additionally, the microphone does not distinguish between background ambient overpressures, such as the wind, and the air blast associated with quarry blasting operations. Particle velocity is the descriptor of choice when dealing with vibrations because of its superior correlation with the appearance of cosmetic cracking.

While particle velocities provide one measurement statistic, structural responses to varied frequency necessitates the inclusion of frequency analysis in all vibration measurement. As such, the United States Bureau of Mines has developed a set of criteria utilizing a graded scale incorporating reduced permissible particle velocities at reduced dominant frequencies. This set of criteria is now almost universally accepted as the basis for controlling blast and construction induced vibrations. While the graded scale represents the most accurate application of the findings of the study, as a simplification, some regulatory departments have chosen to implement particle velocity limits of 50mm/s at high dominant frequencies (in excess of 40 Hz) and 20mm/s for low frequency vibrations (less than 40Hz). This is not to say that damage automatically occurs once these levels are breached and, in fact, threshold damage would not occur in the average residence until ground vibrations reached significantly higher intensities than those listed above.

The Ministry of Environment Conservation and Parks has recommended even stricter guidelines than those accepted by the OSM, limiting ground vibrations to 12.5 mm/s and overpressure to 128dB (Refer to MECP *Model Municipal Noise Control By-Law* publication section NPC 119). The MECP criteria have been set at very conservative levels in an effort to restrict adverse public response as opposed to strictly alleviating possibility for structural and cosmetic damage.

We have reviewed the vibration records for the monitoring period between November 1, 2020 and December 16, 2020 and cross referenced with the blasting records provided to confirm that there was twenty two (22) recorded blasts (see table below). The Old Office House does not represent a sensitive receptor and it is owned by the quarry, therefore MECP NPC 119 is not applicable.

Date	Time	Location	Peak Ground Vibration (mm/s)	Peak Air Overpressure (dB(L))	Blast No.
02-Nov	13:09	East Cell Top	0.214	121.4	ECTB 20-70
03-Nov	17:01	Lower Yard Top	0.3425	113.3	LY 20-14
05-Nov	13:09	East Cell Top	0.309	108.0	ECTB 20-71
05-Nov	13:09	East Cell Bottom	0.309	108.0	ECBB 20-48
06-Nov	16:05	East Cell Top	0.160	100.0	ECTB 20-58
09-Nov	13:09	East Cell Top	0.243	104.2	ECTB 20-72
11-Nov	13:10	East Cell Bottom	0.314	114.0	ECBB 20-49
12-Nov	13:12	East Cell Top	0.166	101.0	ECTB 20-73
13-Nov	16:04	Lower Yard Top	2.307	119.0	LY 20-15
16-Nov	12:04	East Cell Ramp	0.104	120.8	RAMP EX 20-01
17-Nov	13:07	East Cell Top	0.079	128.1	ECTB 20-74
18-Nov	13:08	East Cell Bottom	0.356	104.9	ECBB 20-50
19-Nov	13:08	East Cell Top	0.081	128.1	ECTB 20-75
20-Nov	16:08	Lower Yard Top	0.081	115.6	LY 20-16
24-Nov	13:08	East Cell Top	0.162	104.9	ECTB 20-77
25-Nov	13:15	East Cell Bottom	0.288	101.0	ECBB 20-51
26-Nov	13:11	East Cell Ramp	0.113	119.1	RAMP EX 20-02
30-Nov	16:09	East Cell Top	0.177	118.7	ECTB 20-76/78
02-Dec	13:09	East Cell Bottom	0.074	129.2	ECBB 20-53
04-Dec	13:05	East Cell Top	0.260	114.8	ECTB 20-79
08-Dec	13:06	East Cell Top	0.135	104.9	ECTB 20-80
09-Dec	13:05	East Cell Bottom	0.230	108.4	ECBB 20-54

Should you have any questions or concerns related to the information contained herein or the monitoring program underway, please do not hesitate to contact the undersigned at your leisure.

Kindest regards,

Marcel Girard, B. A. Sc.
Explotech Engineering Ltd.

Appendix D

Robert J. Cyr, P. Eng.

Principal, Explotech Engineering Ltd.

EDUCATION

Bachelor of Applied Science,
Civil Engineering, Queen's University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
Association of Professional Engineers and Geoscientists of BC (APEG)
Association of Professional Engineers, Geologists and Geophysicists of Alberta
Association of Professional Engineers and Geoscientists of New Brunswick
Association of Professional Engineers of Nova Scotia
Association of Professional Engineers and Geoscientists Manitoba
Professional Engineers and Geoscientists Newfoundland and Labrador
International Society of Explosives Engineers (ISEE)
Aggregate Producers Association of Ontario (APAO)
Surface Blaster Ontario Licence 450109

SUMMARY OF EXPERIENCE

Over thirty years experience in many facets of the construction and mining industry has provided the expertise and experience required to efficiently and accurately address a comprehensive range of engineering and construction conditions. Sound technical training is reinforced by formidable practical experience providing the tools necessary for accurate, comprehensive analysis and application of feasible solutions. Recent focus on vibration analysis, blast monitoring, blast design, damage complaint investigation for explosives consumers and specialized consulting to various consulting engineering firms.

PROFESSIONAL RECORD

2001 – Present	-Principal, Explotech Engineering Ltd.
1996 – 2001	-Leo Alarie & Sons Limited - Project Engineer/Manager
1993 – 1996	-Rideau Oxford Developments Inc. – Project Manager
1982 – 1993:	-Alphe Cyr Ltd. – Project Coordinator/Manager

EXPLOTECH

Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Andrew Campbell, P.Eng.

Explotech Engineering Ltd.

EDUCATION

Bachelor of Engineering,
Mechanical Engineering, Carleton University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
International Society of Explosive Engineers (ISEE)

SUMMARY OF EXPERIENCE

An engineer working for Explotech Engineering Ltd., Andrew holds a Bachelor of Engineering degree in Mechanical Engineering and has strong analytical, technical, and interpersonal skills. A proven leader in collaborative environments, Andrew is comfortable managing projects, specifying details, and communicating internally and externally. Recent focus on blast designs, blast impact analyses, vibration analysis, damage complaint investigation, blast monitoring, and job estimations.

PROFESSIONAL RECORD

2018 – Present	- Engineer, Explotech Engineering Ltd.
2013 – 2018	- Technician, Explotech Engineering Ltd.
2012 – 2012	- Ride Technician, Canada's Wonderland

Appendix E

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Blasting Terminology

ANFO:	Ammonium Nitrate and Fuel Oil – explosive product
ANFO WR:	Water resistant ANFO
Blast Pattern:	Array of blast holes
Body hole:	Those blast holes behind the first row of holes (Face Holes)
Burden:	Distance between the blast hole and a free face
Column:	That portion of the blast hole above the required grade
Column Load:	The portion of the explosive loaded above grade
Collar:	That portion of the blast hole above the explosive column, filled with inert material, preferably clean crushed stone
Face Hole:	The blast holes nearest the free face
Overpressure:	A compressional wave in air caused by the direct action of the unconfined explosive or the direct action of confining material subjected to explosive loading.
Peak Particle Velocity:	The rate of change of amplitude, usually measured in mm/s or in/s. This is the velocity or excitation of the particles in the ground resulting from vibratory motion.
Scaled distance:	An equation relating separation distance between a blast and receptor to the energy (usually expressed as explosive weight) released at any given instant in time.
Spacing:	Distance between blast holes
Stemming:	Inert material, preferably clean crushed stone applied into the blast hole from the surface of the rock to the surface of the explosive in the blast hole.
Sub-grade:	That portion of the blast hole drilled band loaded below the required grade
Toe Load:	The portion of explosive loaded below grade

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