



Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Blast Impact Analysis
Burlington Quarry Extension
Concession 2, Part Lot 1,2,17 &18
Township of Burlington

Submitted to:

Nelson Aggregate
2433 No. 2 Side Road
Burlington, ON
L7P 0G8



Prepared by

Explotech Engineering Ltd.
58 Antares Drive, Unit 5
Ottawa, Ontario
K2E 7W6

June 16, 2021



EXECUTIVE SUMMARY

ExploTech Engineering Ltd. was retained in November 2018 to provide a Blast Impact Analysis for the proposed Nelson Aggregate – Burlington Quarry Extension operation located on Concession 2, Part Lot 1,2,17 and 18 – geographical City of Burlington, Ontario.

Vibration levels assessed in this report are based on the Ministry of the Environment, Conservation and Parks Model Municipal Noise Control By-law (NPC 119) with regard to guidelines for blasting in Mines and Quarries. We have assessed the area surrounding the proposed license area with regard to potential damage from blasting operations and compliance with the aforementioned by-law document. In addition, we have reviewed blast and/or vibration reports collected at the existing licenced quarry for the 2014 - 2019 blasting campaigns.

Golder Associates undertook a vibration attenuation study at the existing Burlington Quarry in 2004. The resultant data was analyzed in order to develop site specific vibration attenuation characteristics and equations.

We have inspected the site and reviewed the available site plans. ExploTech Engineering Ltd. is of the opinion that the planned mineral 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 for blasting operations to be carried out in a safe and productive manner and to suitably manage and mitigate the possibility of damage to any buildings, wells, structures or residences surrounding the property.



TABLE OF CONTENTS

INTRODUCTION.....	4
EXISTING CONDITIONS.....	5
PROPOSED MINERAL EXTRACTION.....	9
BLAST VIBRATION AND OVERPRESSURE LIMITS	12
BLAST MECHANICS AND DERIVATIVES.....	13
VIBRATION AND OVERPRESSURE THEORY	14
VIBRATION LEVELS AT THE NEAREST SENSITIVE RECEPTOR	15
OVERPRESSURE LEVELS AT THE NEAREST SENSITIVE RECEPTOR.....	18
ADDITIONAL CONSIDERATIONS OUTSIDE OF THE BLAST IMPACT ANALYSIS SCOPE...	20
SUN CANADIAN HIGH PRESSURE OIL PIPELINE.....	20
FLYROCK.....	22
THEORETICAL HORIZONTAL FLYROCK CALCULATIONS	22
BLAST IMPACT ON ADJACENT FISH HABITATS.....	26
RESIDENTIAL WATER WELLS	29
REVIEW OF HISTORICAL BURLINGTON QUARRY DATA	30
2014-2019 DATA.....	30
RECOMMENDATIONS.....	32
CONCLUSION	33

APPENDIX A – OPERATIONAL PLANS

 SENSITIVE RECEPTOR OVERVIEWS

 HISTORIC VIBRATION MONITORING OVERVIEW

APPENDIX B – METEOROLOGICAL CONDITIONS

APPENDIX C – GOLDER ASSOCIATES BLAST IMPACT ASSESSMENT

 HISTORICAL BLAST REPORTS 2017-2019

 HISTORICAL VIBRATION DATA SUMMARIES 2014-2018

APPENDIX D – CURRICULUM VITAE OF REPORT WRITERS

APPENDIX E – BLASTING TERMS & DEFINITIONS

 REFERENCES

APPENDIX F – ATTACHMENTS



List of Tables

Table 1 – Pg 6 – Sensitive Receptor Distances Relative to Original Quarry and Extension

Table 2 – Pg 10 – Details for Extraction for Each Individual Phase of the Burlington Quarry Extension

Table 3 – Pg 16 – Maximum Load per Delay based on varied Stand-off Distance from Sensitive Receptors to Maintain 12.5mm/s Vibration Limit

Table 4 – Pg 25 – Maximum Flyrock Horizontal

Table 5 – Pg 27 – Maximum Loads per Delay to Maintain 100kPa at Various Separation Distances

Table 6 – Pg 28 – Maximum Loads per Delay to Maintain 13.0mm/s at Various Separation Distances

Table 7 – Pg 31 – Exceedances of NPC 119 Recorded During 2014-2019 Blasting Operations

List of Attachments

1. Golder Blast Impact Assessment_April 2006



INTRODUCTION

The proposed Nelson Aggregate – Burlington Quarry Extension operation is separated into two areas. The Burlington Quarry South Extension is located on the Southeast side of the existing licensed and operating Burlington Quarry (Licence 5499) while the Burlington Quarry West Extension is located along the Southwest face of the existing quarry. The legal description for the proposed licence is Concession 2, Part Lot 1,2,17 and 18 – geographical City of Burlington, Ontario.

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 a vibration monitoring program be continued on the existing licenced site as well as on the proposed Burlington Quarry 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 required scope of the Blast Impact Analysis under the Aggregate Resources Act, this report reviews the topics of flyrock and residential water wells. Exhaustive details related to residential water wells are addressed in the hydrogeological report 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 for blasting operations to be carried out in a safe and productive manner and to suitably manage and mitigate the possibility of damage to any buildings, wells, structures or residences surrounding the property.



EXISTING CONDITIONS

The current operating licensed area for the Nelson Aggregate Burlington Quarry (Licence 5499) is described as Concession 2, Lot 1 and 2 and Concession 3, Part Lot 1 and 2 – geographic City of Burlington. This property is bound by Colling Road to the Northeast, No. 2 Side Road to the Southeast, Burlington Springs Golf Club property to the Southwest and Guelph Line to the Northeast. The lands immediately surrounding the licence are sparsely populated with the areas of densest development lying to the Southwest.

The proposed Burlington Quarry extension is separated into two (2) areas designated as the South and West Extension Areas. The Burlington Quarry South Extension is legally described as Concession 2, Part Lot 17 and 18 and is located immediately Southeast of the existing licence separated by No. 2 Side Road. The Burlington Quarry South extension lands are bound by vacant lands to the Northeast and Southeast, No. 2 Side Road and the existing Burlington Quarry to the Northwest and residential properties located along No. 2 Side Road as well as the Camisle Golf Course to the Southwest. The South Extension lands are generally highest towards the Northeast boundary of the extension lands. The maximum elevations are in the order of 282MASL. The land drops in the South corner of the South extension lands to an elevation of approximately 274MASL.

The Burlington Quarry West Extension is legally described as Concession 2, Part Lot 1 & 2 and lies Southwest of the existing licence. The West Extension lands are bound by the existing quarry and Colling Road to the North, Cedar Springs Road and residential properties along Cedar Springs Road to the West, residential properties located along No. 2 Side Road and Cedar Springs Road to the South and East. The West Extension lands are generally highest towards the Northeast and South boundaries of the extension lands. The maximum elevations are in the order of 275MASL. The existing topography drops along the West boundary of the West Extension lands to an elevation of approximately 262MASL.

The licenced area for the proposed Burlington Quarry extension lands encompasses a total area of approximately 78.4HA. The associated extraction area is approximately 50.2HA when allowing for setbacks and sterilized areas.

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



Sensitive Receptor	Straight Line Distance from Existing Burlington Quarry Boundary to Receptor (m)	Straight Line Distance from proposed Burlington Quarry Extension Extraction Boundary to Receptor (m)	Extension Area Closest to Sensitive Receptor
2196 No. 2 Side Road	158	284	South
*2226 No. 2 Side Road	53	208	South
*2244 No. 2 Side Road	47	129	South
*2280 No. 2 Side Road	28	15	South
*2292 No. 2 Side Road	153	N/A	South
*2300 No. 2 Side Road	52	N/A	South
*2416 No. 2 Side Road	116	278	South
*2433 No 2 Side Road	69	280	South
2450 No. 2 Side Road	50	387	South
2462 No. 2 Side Road	60	423	South
2470 No. 2 Side Road	48	462	South
*2473 No. 2 Side Road	12	493	South
*2479 No. 2 Side Road	41	521	South
2485 No. 2 Side Road	75	549	South
2495 No. 2 Side Road	74	612	South
2496 No. 2 Side Road	449	636	South
2509 No. 2 Side Road	78	644	South
2519 No. 2 Side Road	118	664	South
4366 Guelph Line	613	740	South
4420 Guelph Line	380	517	South
4448 Guelph Line	349	663	South
4472 Guelph Line	312	674	South
4480 Guelph Line	288	669	South
4486 Guelph Line	183	535	South
4487 Guelph Line	329	672	South
4496 Guelph Line	282	668	South
5030 Guelph Line	35	697	South
1385 No. 2 Side Road	560	285	West
1405 No. 2 Side Road	500	239	West
1425 No. 2 Side Road	453	202	West
*2015 No. 2 Side Road	307	95	West



Sensitive Receptor	Straight Line Distance from Existing Burlington Quarry Boundary to Receptor (m)	Straight Line Distance from proposed Burlington Quarry Extension Extraction Boundary to Receptor (m)	Extension Area Closest to Sensitive Receptor
2080 No. 2 Side Road	144	143	West
2090 No. 2 Side Road	249	268	West
2102 No. 2 Side Road	90	118	West
2116 No. 2 Side Road	36	77	West
2126 No. 2 Side Road	39	100	West
2136 No. 2 Side Road	46	140	West
2170 No. 2 Side Road	167	298	West
5050 Cedar Springs Road	478	146	West
5070 Cedar Springs Road	523	154	West
5029 Cedar Springs Court	634	326	West
5059 Cedar Springs Court	620	279	West
5069 Cedar Springs Court	615	226	West
5079 Cedar Springs Court	610	188	West
5089 Cedar Springs Court	615	150	West
5106 Cedar Springs Court	735	237	West
5116 Cedar Springs Court	731	220	West
5132 Cedar Springs Court	738	245	West
5140 Cedar Springs Court	717	233	West
5158 Cedar Springs Road	707	237	West
5164 Cedar Springs Road	717	259	West
5165 Cedar Springs Road	625	189	West
5168 Cedar Springs Road	728	296	West
5172 Cedar Springs Road	729	266	West
5179 Cedar Springs Road	636	222	West
5191 Cedar Springs Road	542	139	West
5206 Cedar Springs Road	727	231	West
5214 Cedar Springs Road	747	234	West
5224 Cedar Springs Road	720	196	West
5234 Cedar Springs Road	712	184	West
*5235 Cedar Springs Road	327	N/A	West
5244 Cedar Springs Road	716	184	West
5245 Cedar Springs Road	642	110	West
5248 Cedar Springs Road	716	184	West

Sensitive Receptor	Straight Line Distance from Existing Burlington Quarry Boundary to Receptor (m)	Straight Line Distance from proposed Burlington Quarry Extension Extraction Boundary to Receptor (m)	Extension Area Closest to Sensitive Receptor
5254 Cedar Springs Road	713	173	West
5255 Cedar Springs Road	637	103	West
5258 Cedar Springs Road	704	152	West
5264 Cedar Springs Road	705	138	West
5268 Cedar Springs Road	705	131	West
5300 Cedar Springs Road	721	146	West
5318 Cedar Springs Road	717	140	West
5336 Cedar Springs Road	710	163	West
5352 Cedar Springs Road	721	225	West
5353 Cedar Springs Road	524	149	West
5360 Cedar Springs Road	725	235	West
5380 Cedar Springs Road	752	312	West
2129 Colling Road	94	114	West
2139 Colling Road	67	103	West

* Denotes properties owned by the proponent. If these properties are unoccupied at the time of blasting operations or their use has changed (eg converted to offices) they will no longer be considered sensitive receptors and are thereby exempt from the MECP Guideline vibration and overpressure limits.

The structures located at 2280 No 2 Side Road located directly adjacent the proposed south expansion license are classified as culturally significant and will be vacant at the time of extraction. In this instance, 2280 No 2 Side Road would not qualify as a sensitive receptor as defined by the MECP (refer to Appendix E for Definitions). In order to safeguard the structural integrity of these structures, we recommend that vibrations at the 2280 No 2 Side Road property be maintained below 50mm/s (>40Hz) in accordance with research performed by the United States Bureau of Mines (USBM RI8507). The closest structure on the property shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s.



PROPOSED MINERAL EXTRACTION

As per the April 2020 Extraction Plan (Refer to Appendix A), the proposed initial quarry operations will commence with a sinking cut at the North corner of the Burlington Quarry South extension area. The South Extension Area will be extracted in three (3) phases designated as Phase 1a, Phase 1b and Phase 2. Retreat of the face will progress in a general Southeast direction.

Initial blasting for the South Extension lands will be located approximately 410m from the closest sensitive receptor not owned by the proponent outside of the proposed limits of extraction, namely 2450 No. 2 Side Road. (Note: The property located at 2280 No. 2 Sideroad is located approximately 205m from the initial blasting. This property is owned by the proponent and will be vacant upon commencement of extraction operations in which case it would be exempt from NPC 119 guideline limits. In the event that the property is being used a residence upon commencement of blasting, the NPC 119 limits would be applicable at this property). As operations progress during the South Extension, quarry faces along the Southwest limits of extraction will come as close as 15m removed from the closest receptor (namely 2280 No.2 Side Road) owned by the proponent or approximately 300m (namely 2196 No. 2 Side Road) to the closest privately owned sensitive receptor.

The Burlington Quarry West Extension will be extracted in four (4) phases designated as Phases 3 through 6 (Refer to Appendix A). The West Extension area will leverage the existing Southwest face of the Burlington Quarry in Phases 3 and 5 with a general East to West face retreat in Phase 3, 4 and 5. The Phase 6 face will retreat in a general North to South direction leveraging the face created by the Phase 5 progress.

As operations progress during the Burlington Quarry West Extension, quarry faces along the East limits of extraction will come as close as 77m removed from the properties located on No. 2 Side Road. Table 2 denotes relevant extraction details as they pertain to each individual phase.

<p>TABLE 2</p> <p>Details for Extraction for Each Individual Phase of the Burlington Quarry Extension</p>	
Phase 1a	<ul style="list-style-type: none"> Phase 1a will commence with a sinking cut in the Northeast corner of the Burlington Quarry South Extension lands Extracted to a depth of 271MASL Retreat in a general Southeasterly direction Likely extracted in 1-2 benches
Phase 1b	<ul style="list-style-type: none"> Initial operations for Phase 1b will leverage the existing face of Phase 1a thereby initially eliminating the need for a sinking cut. Extracted to a depth of 270MASL Retreat in a general Southeasterly direction Extracted in 1 bench
Phase 2	<ul style="list-style-type: none"> Initial operations of Phase 2 will leverage the existing face of Phase 1b thereby initially eliminating the need for a sinking cut. Once operations reach the quarry floor elevation achieved in Phase 1b a sinking cut will be required to extract rock to the Phase 2 final floor elevation of 252.5MASL. Extracted to a depth of 252.5MASL Retreat in a general Southeasterly direction. Likely extracted in 1-2 benches
Phase 3	<ul style="list-style-type: none"> Phase 3 will commence along the Southeast corner of the Burlington Quarry West Extension lands Phase 3 will leverage the existing face of the Burlington Quarry thereby eliminating the need for a sinking cut. Extracted to a depth of 252.5MASL Retreat in a general Westerly direction Likely extracted in 2-3 benches
Phase 4	<ul style="list-style-type: none"> Phase 4 will leverage the face of the previously excavated Phase 3 therefore eliminating the need for a sinking cut. Extracted to a depth of 252.5MASL Retreat in a general Westerly and Southerly direction Likely extracted in 2-3 benches
Phase 5	<ul style="list-style-type: none"> Phase 5 will leverage the existing West face of the Burlington Quarry therefore eliminating the need for a sinking cut. Extracted to a depth of 252.5MASL Retreat in a general Westerly direction Likely extracted in 2-3 benches

Phase 6	<ul style="list-style-type: none">• Phase 6 will leverage the face of the previously excavated Phase 5 thereby eliminating the need for a sinking cut.• Extracted to a depth of 252.5MASL• Retreat in a general Southerly direction• Likely extracted in 2-3 benches
---------	---

Current practice at the Nelson Aggregate Burlington Quarry operation employs 102-152mm diameter blast holes with a typical load per delay of between 10kg and 400kg per period. Calculations contained within this report suggest modifications to current blast designs will be necessary as operations progress towards adjacent receptors.

It is a recommendation of this report that all blasts shall, as 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.

Recent 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/s Peak Particle Velocity (PPV)

Overpressure_____128dB Peak Sound Pressure Level (PSPL)

The above guidelines apply when blasts are being monitored. Cautionary levels are slightly lower and apply when blasts are not monitored on a routine basis. 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 receptor behind the blast, or closer, and one installed at the closest receptor in front of the blast, or closer.



BLAST MECHANICS AND DERIVATIVES

The detonation of explosives within a blast hole 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 through the air, measured in linear decibels (or dBL) 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 vibration 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 towards receptors, and blast vibrations are greatest when retreating towards the receptors.



VIBRATION LEVELS AT THE NEAREST SENSITIVE RECEPTOR

The most commonly used formula for predicting PPV is known as the 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 predicted 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, blast parameters, etc.). Based on the data collected from the previous attenuation study prepared by Golder Associates, the values for "e" and "K" have been established at -1.32 and 896 respectively (refer to Appendix C).

An **example** of this calculation is as follows:

For a distance of 410m (i.e. the closest standoff distance to the nearest existing structure outside of the extraction limits for the initial blasting of **Phase 1a** not owned by the proponent, namely 2450 No. 2 Sideroad) and a maximum explosive weight of 80kg (10m deep, 102mm blast hole, 2.4m collar, single hole per period), we can calculate the maximum PPV at the nearest receptor as follows:

$$ppv = 896 \left(\frac{410}{\sqrt{80}} \right)^{-1.32} = 5.75 \text{ mm / s}$$

As discussed in previous sections, the MECP guideline for blast-induced vibration is 12.5 mm/s (0.5 in/s). The calculated PPV based on the design parameters above would remain compliant at a calculated value of 5.75mm/s.

As noted previously, In the event that the proponent owned unit located at 2280 No. 2 Side Road qualifies as a sensitive receptor at the

commencement of blasting, the above theoretical design would need to be adjusted to ensure compliance with MECP guidelines (i.e at a separation distance of 205m and a load of 80kg per delay, the above calculation results in a calculated vibration level of 14.35mm/s).

For the Phase 3 area in the West Extension lands it is recommended that the initial blasting take place in the North corner of the common boundary between the extension lands and the existing quarry. At a separation distance of 350m (i.e. the closest standoff distance to the nearest existing structure outside of the extraction limits for the initial blasting of **Phase 3** not owned by the proponent, namely 2116 No. 2 Side Road, and a maximum explosive load per delay of 85kg (20m deep, 102mm blast hole, 2.5m surface collar, 2 explosive decks, single deck per period), we can calculate the maximum PPV at the nearest receptor to be 7.37mm/s.

Based on the data collected from the previous attenuation study, Table 3 below denotes the theoretical maximum charge per delay that can be used given the standoff distance to the nearest sensitive receptor:

TABLE 3 Maximum Load per Delay based on varied Stand-off Distance from Sensitive Receptors to Maintain 12.5mm/s Vibration Limit	
Distance from Sensitive Receptor (m)	Maximum Load per Delay (kg)
100	15.5
125	24.1
150	34.8
175	47.3
200	61.8
225	78.2
250	96.5
275	116.8
300	139.0



As the separation distance between the blast and closest receptor decreases, it will be necessary to adjust blast parameters to ensure continued compliance with the guideline limit. Fortunately, a variety of blast design alternatives are available to accomplish this including but not limited to reductions in blast hole diameter, change in explosives types, adjustment in bench heights and decking of holes. Given the planned phasing of the extension, vibration data will be continually collected and analyzed as the adjacent receptors are approached in order to confirm the requirement for any design modifications.



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 6dB for every doubling of distance.

As part of the attenuation study performed on site, air overpressure levels were measured and analyzed using cube root scaling based on the following equation:

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

Where, PSPL = the peak sound pressure level particle velocity (dB)

K, e = site factors

d = distance from receptor (m)

w = maximum explosive charge per delay (kg)

The collection of points gathered in the linear arrays emanating from each blast vibration were again analyzed and used to develop the following 95% regression equation (refer to Appendix C). Based on the data collected from the previous attenuation study prepared by Golder Associates, the values for "e" and "K" have been established at -0.0867 and 181 respectively (refer Appendix C).

$$PSPL = 181 \left(\frac{D}{\sqrt[3]{W}} \right)^{-0.0867}$$

As discussed in previous sections, the MECP guideline for blast-induced overpressure is 128dB. For a separation distance of

410m (i.e. the standoff distance to the closest existing structure located outside of the extraction limits in front of the blast for initial blasting for **Phase 1a** not owned by the proponent, namely 2450 No. 2 Sideroad) and a maximum explosive weight of 80kg per delay (10m deep, 102mm blast hole, 2.4m collar, single hole per period delay), we can calculate the PSPL at the nearest receptor as follows:

$$PSPL = 181 \left(\frac{410}{\sqrt[3]{80}} \right)^{-0.0867} = 121.94dB(L)$$

As discussed in previous sections, the MECP guideline for blast-induced overpressure is 128dB(L). The calculated overpressure based on the above blast parameters would remain compliant at a calculated value of 121.94dBL.

In the event that the proponent owned unit located at 2280 No. 2 Sideroad qualifies as a sensitive receptor at the commencement of blasting, the above theoretical design would need to be adjusted to ensure compliance with MECP guidelines (i.e. at a separation distance of 205m and a load of 80kg per delay, the above calculation results in a calculated overpressure level of 129.5dBL).

For the Phase 3 area in the West Extension lands, we again assume initial blasting will take place in the North corner of the common boundary between the extension lands and the existing quarry. At a separation distance of 350m (i.e. the closest standoff distance to the nearest existing structure outside of the extraction limits for the proposed initial blasting of **Phase 3** not owned by the proponent, namely 2116 No 2 Side Road and a maximum explosive load per delay of 85kg (20m deep, 102mm blast hole, 2.5m surface collar, 2 explosive decks, single deck per period), we can calculate the maximum overpressure at the nearest receptor to be 123.84dBL.

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. Given the intimate correlation between overpressure and environmental conditions, care must be taken to avoid blasting on days when weather patterns are less favourable.



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 by EarthFX and Azimuth Environmental Consulting as part of the licence application will address residential water wells 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.

SUN CANADIAN HIGH PRESSURE OIL PIPELINE

A Sun Canadian High Pressure Oil Pipeline runs parallel to Colling Road adjacent to Phase 5 of the of the proposed West expansion quarry limits (refer to Appendix A). The MECP guideline for blast-induced vibration (12.5mm/s) does not apply to pipelines as they are not classified as sensitive receptors. Sun Canadian Policy employs a 50mm/s vibration limit for welded steel pipelines. For the Phase 5 area in the West Extension lands it is recommended that the initial blasting take place in the South corner of the common boundary between the extension lands of Phase 5 and the existing quarry. Initial blasting operations will take place approximately 370m from the subject pipeline if they are initiated at the South corner, however, will reach as close as 12.8m throughout the course of the Phase 5 extraction.

Applying the equation from Predicated Vibration Limits at the Nearest Sensitive Receptor, for a distance of 370m (the conservative standoff distance to the pipeline for the initial blasting in **Phase 5**) and a maximum explosives load per delay of 177kg (20m deep, 102mm blast hole, 2.5m collar, single hole per period), we can calculate the maximum PPV at the pipeline as follows for the initial blast:

$$ppv = 896 \left(\frac{370}{\sqrt{177}} \right)^{-1.32} = 11.12 \text{ mm/s}$$

The calculated 95% predicted PPV (based on the proposed blasting data discussed above) would be 11.12mm/s, well below the



Sun Canadian limit of 50mm/s for a steel welded pipeline located adjacent to the proposed quarry. While this initial value resides below the required threshold, it is anticipated that design modifications will be necessary to maintain compliance as the separation distance to the pipeline decreases and column loads increase. Fortunately, a variety of blast design alternatives are available to accomplish this including but not limited to reductions in blast hole diameter, change in explosives types, adjustment in bench heights and decking of holes.

We do note that the Sun Canadian Blasting Specification requires the presence of a vibration monitoring program conducted by an independent third party engineer when blasting operations are to be conducted within 60m of a pipeline. The proposed Operational Plan dictates that blasting is to encroach within approximately 12.8m of the ROW and as such, it remains a recommendation of this report that an independent third party firm be retained to conduct vibration monitoring on this pipeline when separation encroaches within 60m of the pipeline or when calculations suggest ground vibrations in excess of 35mm/s as measured at the pipeline are anticipated. The results of this monitoring program will determine what alterations shall be necessary as the separation distance to the subject pipeline decreases.



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:

$$L_H = \frac{V_o^2 \sin 2\theta_0}{g} \quad [1]$$

where:

V_o = launch velocity (m/s)

θ_0 = launch angle (degrees)

g = gravitational constant (9.8 m/s²)

The theoretical maximum horizontal distance fly rock will travel occurs when $\theta_0 = 45$ degrees, thereby yielding the equation:

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

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:

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

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

where: θ = drill hole angle
 $L_{h\max}$ = 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 Burlington Quarry which utilize 102mm (4") diameter holes on a 3.5m x 3.5m (11.5'x 11.5') pattern, with total depths of up to 24m (80') and a collar length of 2m (8').

The range for the constant k is 13.5 for soft rocks and 27 for hard rocks. Given the proposed licence area is predominantly dolostone, we have applied a k value of 20. 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).

The following does not apply to the sinking cut which will require highly specialized designs and additional considerations for flyrock. 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)
1.5	30	274
2.0	30	129
2.5	30	72
3.0	30	45
3.5	30	30

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. Blast mats or sand can be placed on top of the shot to further reduce the distance for potential flyrock.

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.



BLAST IMPACT ON ADJACENT FISH HABITATS

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.

Current information suggests the presence of three waterbodies that have been classified as potential fish habitats located in close proximity to the proposed license areas. Specifically, these waterbodies are the Unnamed Tributary of Willoughby Creek located North of the proposed West extension along Colling Road, the Unnamed Tributary of Lake Medad located Southeast of the West extension along No. 2 Side Road and the East and West Arms of the West Branch of the Mount Nemo Tributary of Grindstone Creek located to Northeast and Southwest of the South extension area.

The operational plan shows an approximate minimum extraction setback distance of 55m to the Unnamed Tributary of Willoughby Creek, 130m to the Unnamed Tributary of Lake Medad and 85m to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Based on these separation distances, it is anticipated that alterations to blast designs will be necessary when blasting in close proximity to the identified waterbodies to maintain compliance with DFO water overpressure guidelines of 100kPa. A review of available topographic maps identifies elevations in the extraction areas closest to the above noted waterbodies ranging from 271-281masl, which will require blasting hole depths of up to 20m in some areas to reach the design quarry floor. The utilization of shallower blast holes, decks, smaller hole diameters and/or

changes in blasting patterns may be necessary to maintain compliance with DFO Guidelines.

In the event that blast designs for any given blast are scheduled to exceed maximum loads per delay as specified in the DFO “*Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (1998)*” publication Table 1, we recommend that a hydrophone sensor be installed in the closest point of the waterbody to verify water overpressure levels, provided water depth is a minimum of 1m. The DFO Table 1 load restrictions are reproduced in part in Table 5 below for continuity.

Separation distance between possible fish bearing waterbody and closest borehole (meters)	Maximum recommended explosive load per delay (Kilograms)
150	887
125	616
100	394
90	319
80	252
70	193
60	142
50	98.7
40	63.1
30	35.5

Table 5: Maximum Loads per Delay to Maintain 100kPa at Various Separation Distances

Active spring spawning beds (March 15 – July 15) are assumed to be present in all three (3) waterbodies listed above. During the spawning season, these waterbodies are subject to a vibration limit of 13mm/s recorded at the shoreline of the closest spawning location to the blast. Vibration monitoring will be required in order to confirm compliance with DFO limits for ground vibration.

Table 6 below is provided as initial guidance demonstrating maximum permissible loads per delay based on various separation distances from spawning beds. The following maximum loads per

delay are derived from the equation for ground vibrations listed earlier in this report and are based on a maximum vibration intensity of 13.0mm/s as experienced at the active spawning habitat:

Separation distance between possible spawning bed and closest borehole (meters)	Maximum recommended explosive load per delay (Kilograms)
500	410
450	332
400	262
350	200
300	147
250	102
200	65.5
150	36.8
100	16.4
75	9.2
50	4.1
30	1.5

Table 6: Maximum Loads per Delay to Maintain 13.0mm/s at Various Separation Distances

Should blasting operations take place outside of the active spawning window (March 15 – July 15), the above 13mm/s vibration limit would not apply.

It is a recommendation of this report that all blasts shall, as a minimum, be monitored for ground vibrations at the closest active spawning bed from March 15 – July 15 to ensure compliance with DFO guidelines when calculations suggest vibrations in excess of 75% of the DFO vibration limit may be reached at the location of a potential active spawning habitat.



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. 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.



REVIEW OF HISTORICAL BURLINGTON QUARRY DATA

A vibration and overpressure monitoring program has been in place for all blasts conducted at the Nelson Aggregate Burlington Quarry in recent years. As part of this analysis, Nelson Aggregates has provided copies of vibration data summaries collected for 2014 through 2019 inclusive. For continuity, summaries of the historical data collected and supplied by Nelson Aggregate are included in Appendix C to this report.

2014-2019 DATA

Vibration monitoring conducted during 2014 – 2019 has included the installation of seismographs at the following locations:

- 2479 No. 2 Side Road
- 2470 No. 2 Side Road
- 2450 No. 2 Side Road
- 2582 No. 2 Side Road
- Southwest Corner of the Quarry property along No. 2 Side Road (N 43.39339, W 79.88880)
- Colling Road and Blind Line Intersection (N 43.40605, W 79.89400)
- Northwest Corner of the Quarry Property along Colling Road
- Gas Line (N 43.40466, W 79.88098)

All vibration monitoring was performed by either the blasting contractor or the quarry owner. A review of the data supplied confirms that for 2014 through 2019 inclusive, two (2) blasts exceeded the MECP guideline limit of 12.5mm/s set for ground vibrations, while sixteen (16) blasts exceeded the MECP guideline limit of 128dB for overpressure. Table 7 below lists the blasts that exceeded these limits:

Table 7: Exceedances of NPC 119 Recorded During 2014-2019 Blasting Operations

Date	Time	Location	Limit Exceeded	Value of Exceedance
August 25, 2014	13:52	*SW Corner	>128dB(L)	132.2dB(L)
September 16, 2014	12:12	*Colling Road and Blind Line Intersection	>128dB(L)	134.6dB(L)
October 2, 2014	13:40	*2479 # 2 Side Road	>128dB(L)	131.8dB(L)
October 22, 2014	12:02	*SW Corner	>128dB(L)	128.4dB(L)
November 11, 2014	12:00	*2479 # 2 Side Road	>128dB(L)	130.6dB(L)
November 24, 2014	12:08	*2479 # 2 Side Road	>128dB(L)	128.7dB(L)
December 2, 2014	11:57	*Colling Road and Blind Line Intersection	>128dB(L)	132.8 dB(L)
June 12, 2015	12:18	*SW Corner	>128dB(L)	133.0 dB(L)
June 17, 2015	12:03	*Colling Road and Blind Line Intersection	>128dB(L)	130.7 dB(L)
July 13, 2015	12:02	*Colling Road and Blind Line Intersection	>128dB(L)	129.2 dB(L)
July 30, 2015	12:00	*2479 # 2 Side Road	>128dB(L)	130.7 dB(L)
September 1, 2015	12:01	*2479 # 2 Side Road	>128dB(L)	130.5 dB(L)
October 21, 2015	12:03	*2479 # 2 Side Road	>128dB(L)	134.3 dB(L)
May 4 , 2016	12:00	SW Corner	>12.5mm/s	12.8 mm/s
May 9 , 2016	12:00	Colling Road	>128dB(L)	129.5 dB(L)
July 5, 2016	12:00	Colling Road	>128dB(L)	128.3 dB(L)
August 30, 2016	12:00	Colling Road	>128dB(L)	128.8 dB(L)
April 11, 2017	11:56	SW Corner	>12.5mm/s	15.6 mm/s

* These locations are assumed but cannot be verified due to insufficient information being recorded during the 2014 and 2015 blasting campaigns.

Although the above table denotes exceedances of the MECP guidelines, given the heavy conservatism inherent to the guideline, the risk of damage associated with these vibrations and overpressures remain extremely low.



RECOMMENDATIONS

It is recommended that the following conditions be applied for all blasting operations at the proposed Nelson Aggregates – Burlington Quarry Extension areas:

1. All blasts shall be monitored for both ground vibration and overpressure at the closest privately owned sensitive receptors adjacent the site, or closer, with a minimum of two (2) instruments – one installed in front of the blast and one installed behind the blast.
2. Vibration and overpressure data collected during the first 12 months of extraction in the proposed quarry extension lands will be used to calibrate and update the 2004 Golder Associates attenuation equation. The proponent shall ensure information collected includes all relevant blast and monitoring details to permit and facilitate inclusion of the data in the attenuation data and resultant equation.
3. In order to safeguard the structural integrity of the structures located at 2280 No 2 Side Road, ground vibrations shall be maintained below 50mm/s (>40Hz) in accordance with research performed by the United States Bureau of Mines (USBM RI8507). The closest structure located at 2280 No 2 Side Road shall be monitored for ground vibration and overpressure when vibration calculations suggest vibrations in excess of 35mm/s.
4. All blasts within 60m of the adjacent Sun-Canadian High Pressure Oil Pipeline will be designed and monitored by a registered engineer, licensed in the province of Ontario or any distance specified in later revisions of the Sun-Canadian guidelines or when vibration calculations suggest vibrations in excess of 35mm/s at the pipeline.
5. To protect adjacent fish habitat, the Department of Fisheries and Oceans (DFO) has established limits for water overpressure and ground vibrations. Water overpressures are to be limited to 100kPa (year round), and in the presence of active spawning beds (March 15 – July 15), ground vibrations at the bed are to be limited to 13mm/s. Fish habitat and assumed spawning beds are present in the Unnamed Tributary of Willoughby Creek, the Unnamed Tributary of Lake Medad and the East and West Arms of the West Branch of the Mount Nemo Tributary of Grindstone Creek. The utilization of shallower blast holes, decks, smaller hole diameters and/or changes in blasting



patterns may be necessary when blasting adjacent to fish habitat at any time of year. These mitigation measures would also apply, when adjacent to spawning beds from March 15 – July 15.

6. From March 15 – July 15 of any year, blasts shall be designed to maintain vibrations below 13mm/s at the closest point of any spawning habitat to the blast. One (1) additional seismograph shall be installed on the shoreline adjacent the closest spawning habitat to any blast performed between March 15 and July 15 when calculations suggest vibrations in excess of 75% of the DFO vibration limit may be reached at the location of a potential active spawning habitat.
7. All blasting operations encroaching the Sun Canadian High Pressure Oil Pipeline will follow all requirements in the Sun Canadian Guidelines outlined in Section 8.3 to 8.5 under the heading “Vibration and Blasting Control” and any requirements specified in later revisions of the Sun Canadian guidelines.
8. 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.
9. In the event of an exceedance of NPC 119 limits or any such document, regulation or guideline which supersedes this standard, blast designs and protocol shall be reviewed prior to any subsequent blasts and revised accordingly in order to return the operations to compliant levels.
10. 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.
11. 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 current applicable guidelines and regulations.
12. Blasting procedures such as drilling and loading shall be reviewed on a yearly basis and modified as required to ensure compliance with industry standards.



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

The blast parameters described within this report are supported by the modeling in the attached appendices. As the quarry progresses and as site-specific data is collected from the on-going operation, the blast parameters can be refined, as necessary, to ensure continual compliance with MECP Guidelines.



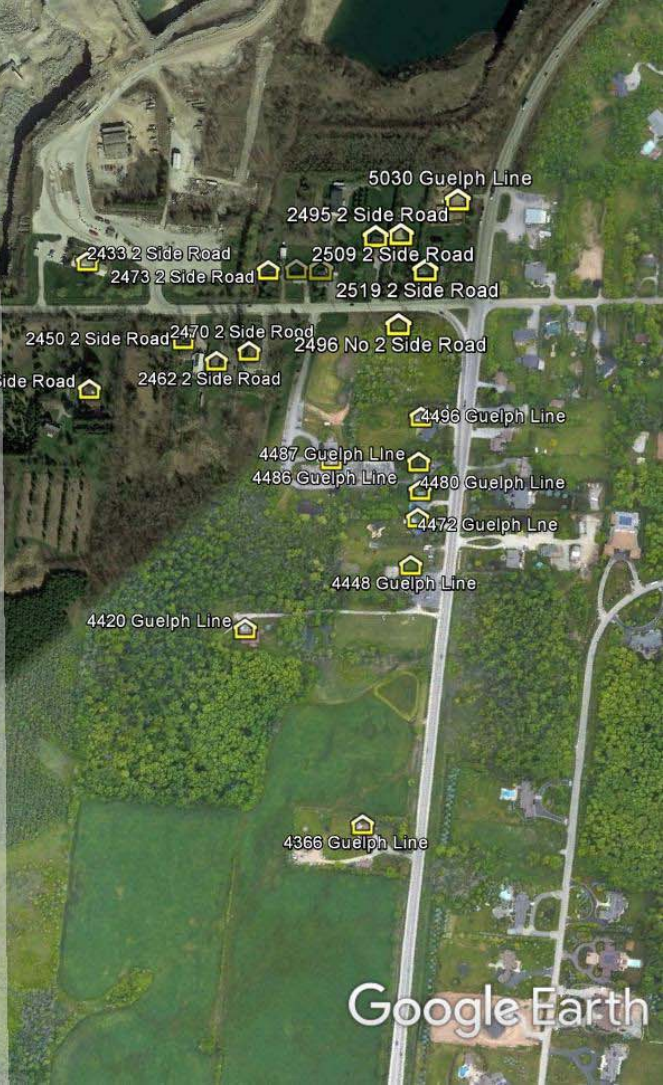
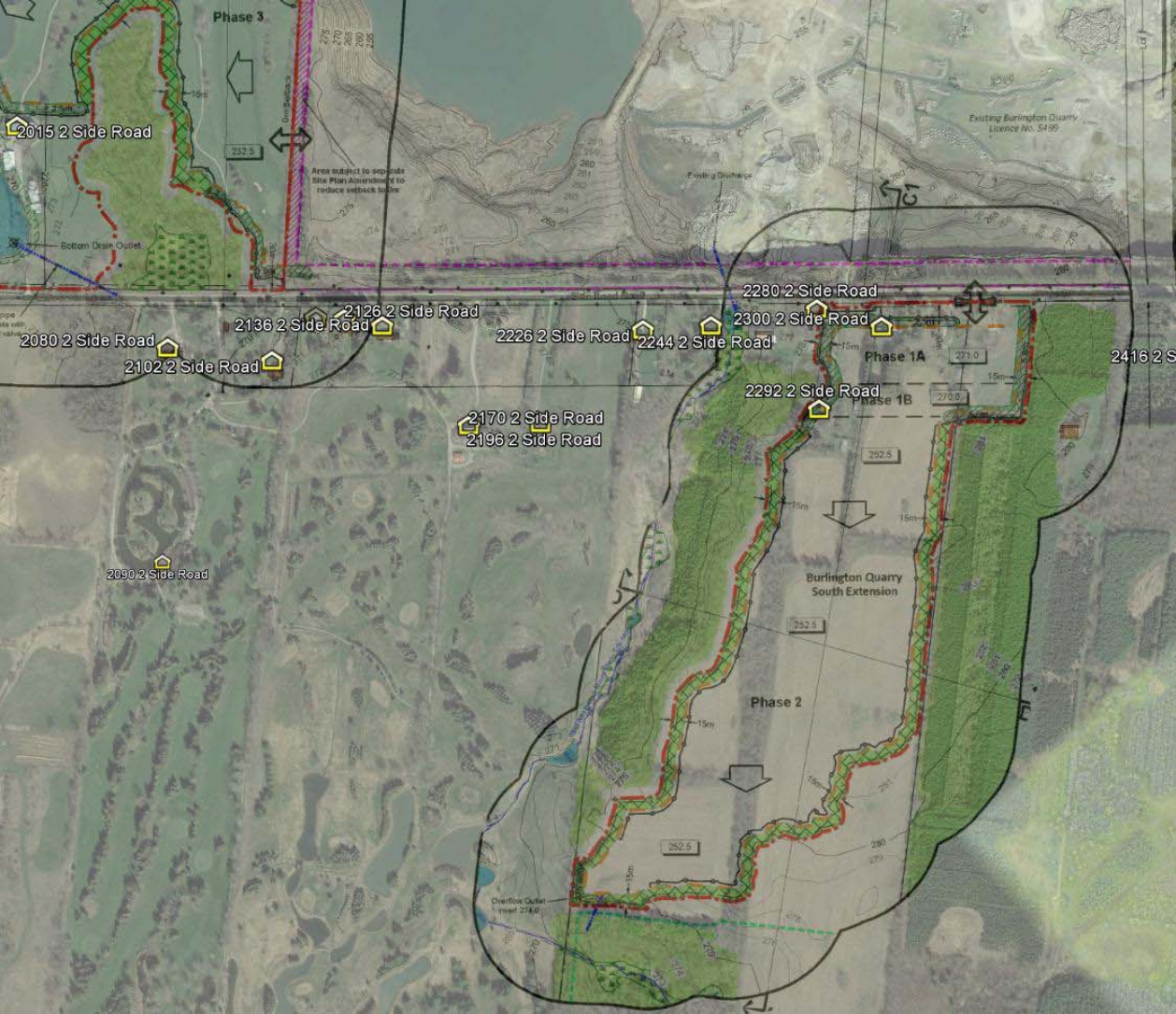
CONCLUSION

Blasting operations required for mineral extraction at the proposed Nelson Aggregates – Burlington Quarry 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.

Appendix A

5380 Cedar Spring Road
5353 Cedar Spring Road
5352 Cedar Spring Road
5318 Cedar Springs Road
5300 Cedar Springs Road
5264 Cedar Springs Road
5255 Cedar Spring Road
5248 Cedar Springs Road
5245 Cedar Spring Road
5244 Cedar Springs Road
5214 Cedar Springs Road
5235 Cedar Springs Road
5191 Cedar Springs Road
5186 Cedar Springs Road
5168 Cedar Springs Road
5158 Cedar Springs Road
5140 Cedar Springs Court
5132 Cedar Springs Court
5116 Cedar Springs Court
5106 Cedar Springs Court
5089 Cedar Springs Court
5069 Cedar Springs Court
5059 Cedar Springs Court
2015 2 Side Road
5050 Cedar Springs Road
1405 2 Side Road
1425 2 Side Road
2136 2 Side Road
2300 2 Side Road
2280 2 Side Road
2473 2 Side Road
2433 2 Side Road
2509 2 Side Road
2519 2 Side Road
2496 No 2 Side Road
2080 2 Side Road
2102 2 Side Road
2226 2 Side Road
2292 2 Side Road
2170 2 Side Road
2196 2 Side Road
2090 2 Side Road
4487 Guelph Line
4486 Guelph Line
4472 Guelph Line
4420 Guelph Line
4448 Guelph Line
4366 Guelph Line



5380 Cedar Spring Road

5353 Cedar Spring Road

5360 Cedar Spring Road

5352 Cedar Spring Road

2129 Colling Road

2139 Colling Road

5336 Cedar Spring Road

5328 Cedar Spring Road

5318 Cedar Springs Road

5300 Cedar Springs Road

5268 Cedar Springs Road

5264 Cedar Springs Road

5255 Cedar Spring Road

5254 Cedar Springs Road

5248 Cedar Springs Road

5245 Cedar Spring Road

5234 Cedar Springs Road

5244 Cedar Springs Road

5224 Cedar Springs Road

5214 Cedar Springs Road

5235 Cedar Springs Road

5206 Cedar Springs Road

5191 Cedar Springs Road

5172 Cedar Springs Road

5186 Cedar Springs Road

5179 Cedar Springs Road

5165 Cedar Springs Road

5140 Cedar Springs Court

5132 Cedar Springs Court

5116 Cedar Springs Court

5106 Cedar Springs Court

5089 Cedar Springs Court

5079 Cedar Springs Court

5069 Cedar Springs Court

5070 Cedar Springs Road

5059 Cedar Springs Court

2015 2 Side Road

5029 Cedar Springs Court

5050 Cedar Springs Road

1385 2 Side Road

1405 2 Side Road

1425 2 Side Road

2080 2 Side Road

2136 2 Side Road

2126 2 Side Road

2226 2 Side Road

2300 2 Side Road

2244 2 Side Road

2280 2 Side Road

2292 2 Side Road

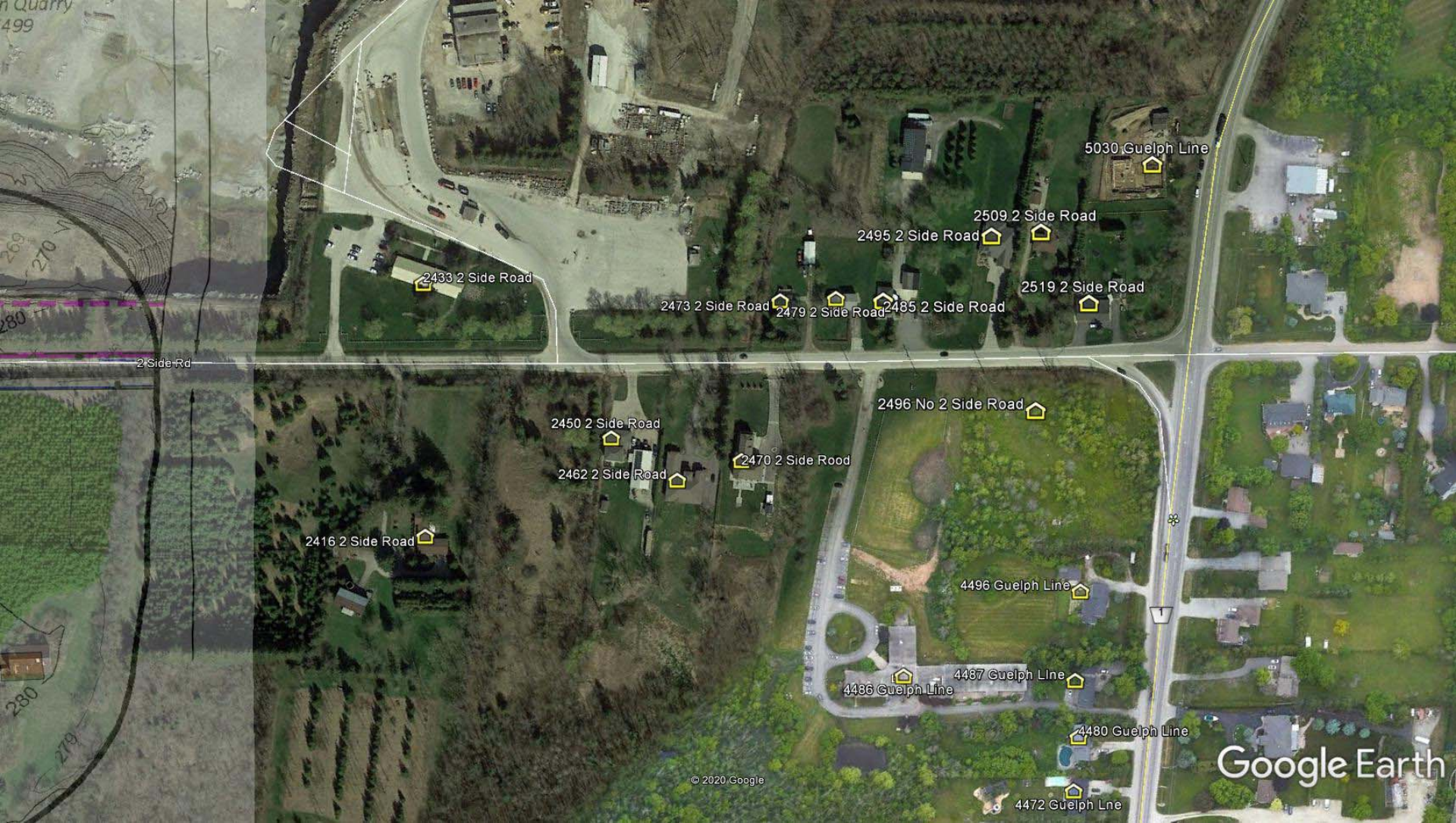
2170 2 Side Road

2196 2 Side Road

2433

Google Earth





quarry
499

280
270

2 Side Rd

2433 2 Side Road

2473 2 Side Road

2479 2 Side Road

2485 2 Side Road

2495 2 Side Road

2509 2 Side Road

2519 2 Side Road

5030 Guelph Line

2450 2 Side Road

2462 2 Side Road

2470 2 Side Road

2416 2 Side Road

2496 No 2 Side Road

4496 Guelph Line

4487 Guelph Line

4486 Guelph Line

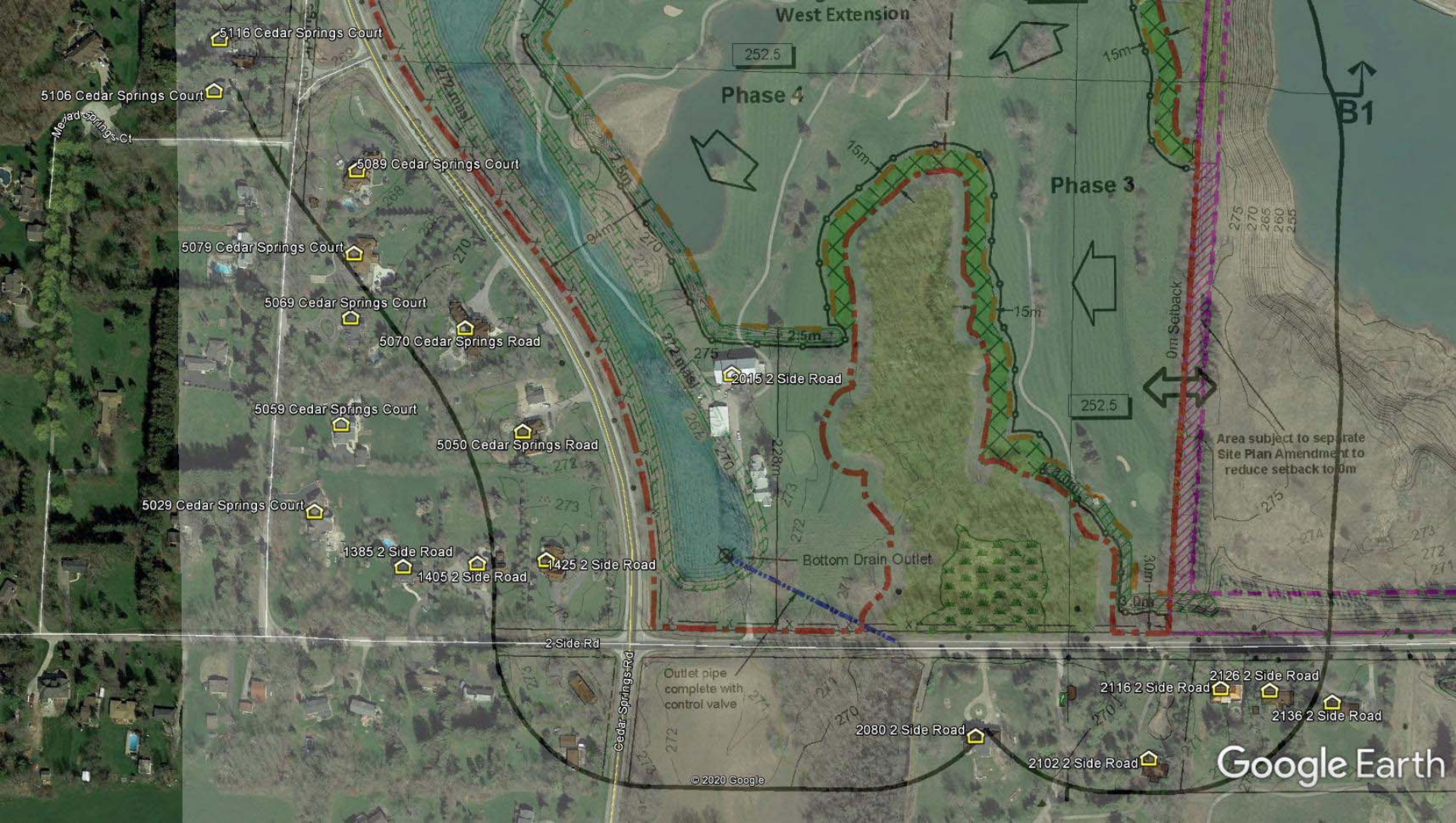
4480 Guelph Line

4472 Guelph Line

Google Earth

© 2020 Google







5380 Cedar Spring Road

5353 Cedar Spring Road

5360 Cedar Spring Road

5352 Cedar Spring Road

Center of diversion pipe shall remain a minimum 7.0m from Sun-Canadian Pipe Line easement

5336 Cedar Spring Road

2129 Colling Road

2139 Colling Road

Existing Control S

Colling Rd

Colling Road

5318 Cedar Springs Road

5300 Cedar Springs Road

Invert 269.1

5268 Cedar Springs Road

5264 Cedar Springs Road

5258 Cedar Springs Road

5254 Cedar Springs Road

5255 Cedar Spring Road

Burlington Quarry West Extension

Phase 5

Google Earth

© 2020 Google

Area sub
Site Plan

5353 Cedar Spring Road

☐ of diversion pipe shall remain a minimum 7.0m from Sun-Canadian Pipe Line easement

2129 Colling Road

2139 Colling Road

Existing Control Structure 269.5

Colling Road

Colling Rd

Invert 269.1

252.5

Burlington Quarry West Extension

Google Earth

Seismograph Location Overview



**Seismograph Location for
Blasting Operations
(2014-2019)**

Colling Road and Blind Line



Gas Line



Southwest Corner of Quarry Property



2450 No 2 Side Road



2470 No 2 Side Road



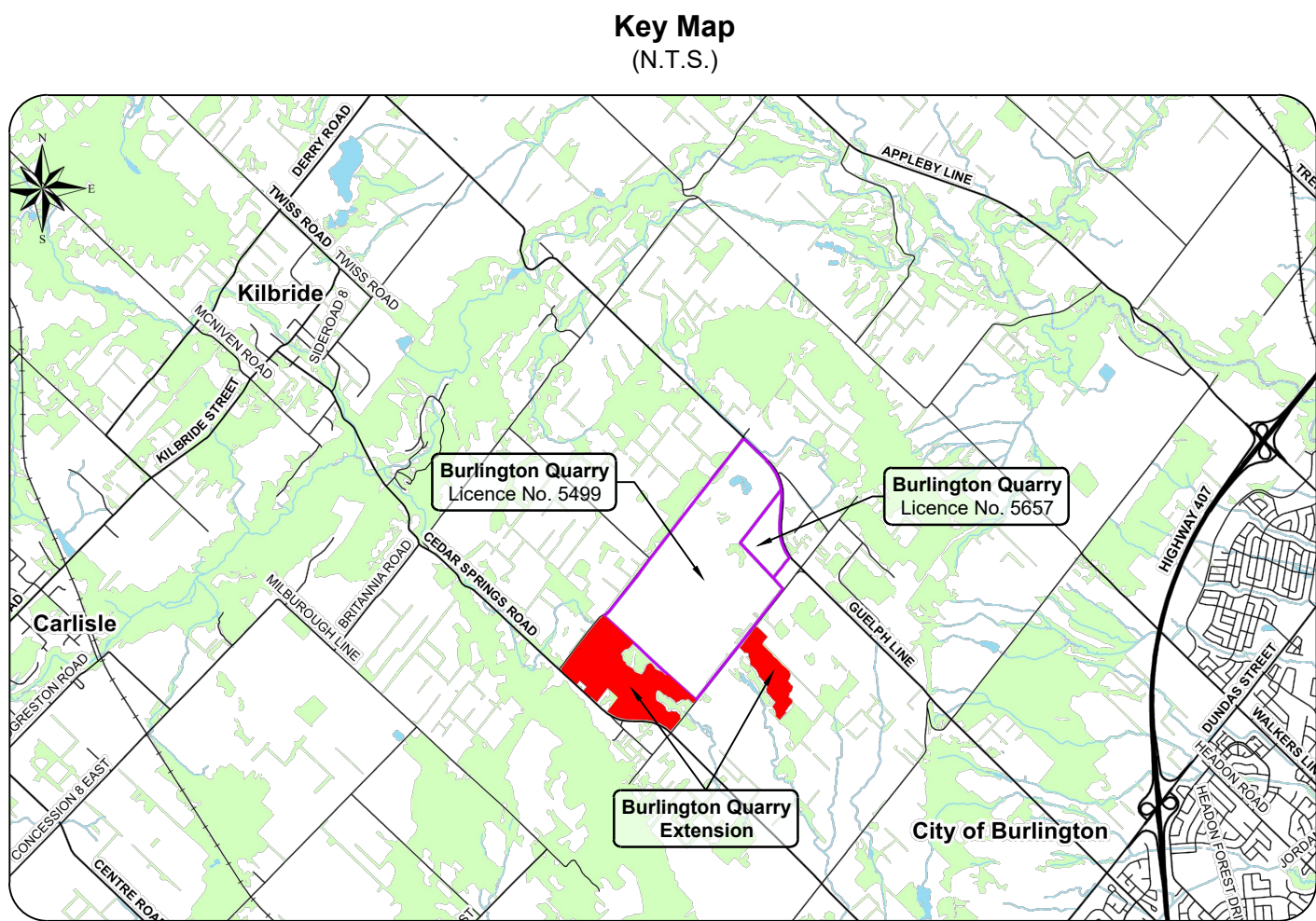
2479 No 2 Side Road



2582 No 2 Side Road



Google Earth



A. General

- This site plan is prepared under the Aggregate Resources Act (ARA) for a Class 'A' Licence, Category 2.
- Area Calculations:
 - Licence Area (total) 78.4 ha
 - South Extension 18.3 ha
 - West Extension 60.1 ha

B. References

- Contours were obtained from the City of Burlington's Open Data Catalogue based on 2017 data and are displayed in one metre intervals. Elevations shown are in metres above sea level (masl).
- Topographic information was obtained from numerous sources including Ontario GeoHub (Land Information Ontario), City of Burlington's Open Data Catalogue, Google Earth Pro aerial photography captured on May 7, 2018 and field investigations for technical reports.
- All topographic features and structures are shown to scale in Universal Transverse Mercator (UTM) with North American Datum 1983 (NAD83), Zone 17 (metre), Central Meridian 81 degrees west coordinate system.
- The licence boundaries were established using Municipal Property Assessment Corporation (MPAC) parcel fabric data. Distances are approximate and for reference purposes only.
- Land use designations on and within 120 metres of the licences are from the Niagara Escarpment Plan, Map 3 - Regional Municipality of Halton, approved June 1, 2017. The Burlington Quarry Extension lands are designated Escarpment Rural Area.
- Land use information and structures identified on or within 120 metres of the licence boundaries were determined using Google Earth Pro aerial photography captured on May 7, 2018.

C. Drainage

- Surface drainage on and within 120 metres of the licence boundaries are by overland flow in the directions shown by arrows on the plan view, or by infiltration.

D. Groundwater

- The established groundwater table varies between 264 masl to 273 masl in the South Extension and 263 masl to 265 masl in the West Extension (EarthFX 2020).

E. Site Access and Fencing

- There are four existing site accesses on Side Road No. 2 and a single existing site access on Cedar Springs Road.
- Post and wire fencing (unless noted otherwise) exists in the locations shown on the plan view.

F. Aggregate Related Site Features

- There are no existing aggregate operations or features on either Extension such as internal haul roads, processing stockpiles, scrap, fuel storage, berms or excavation faces.

G. Cross Sections

- See drawing 4 of 4.

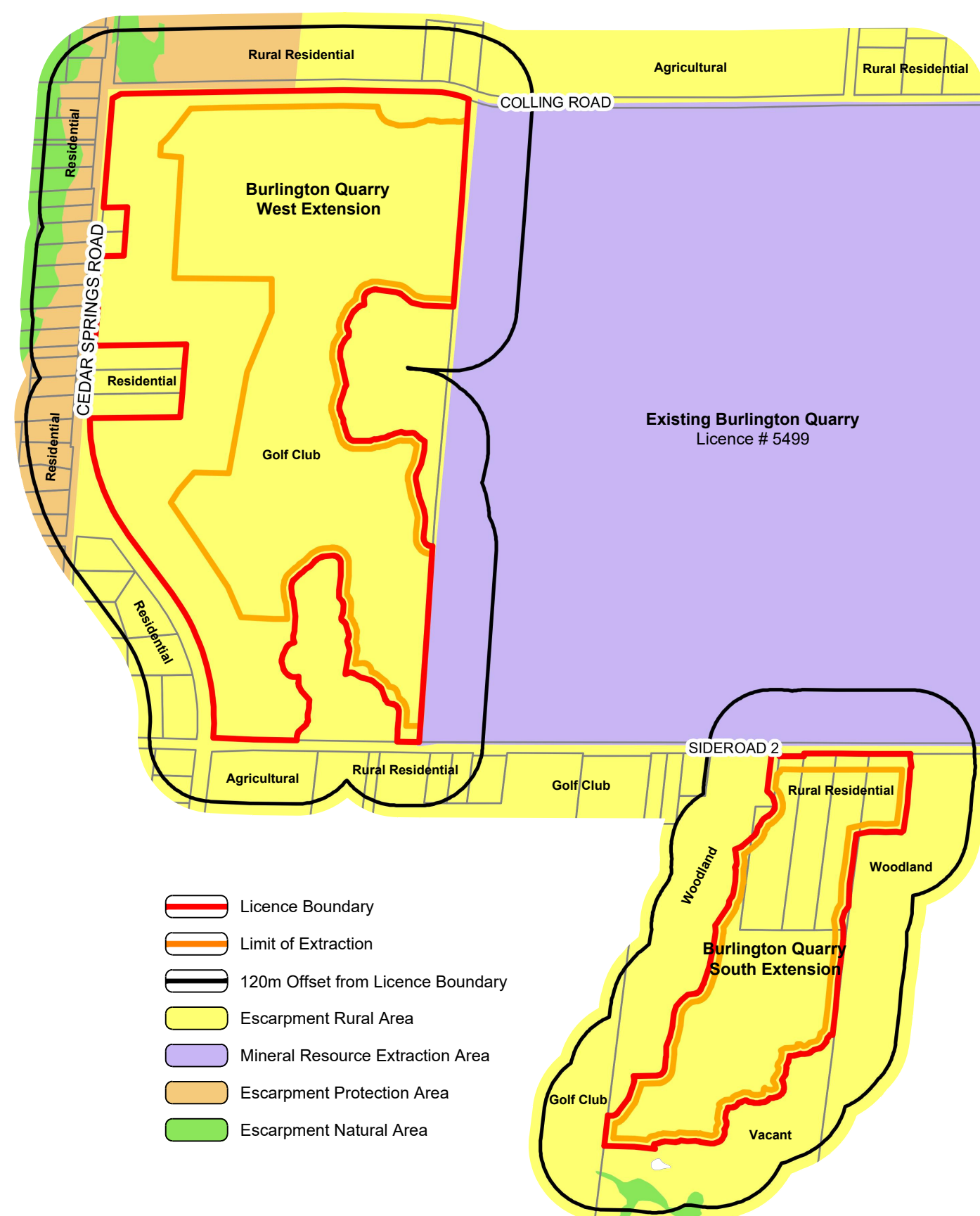
H. Technical Reports - References

- Adaptive Management Plan, Proposed Burlington Quarry Extension, EarthFX Inc., Savanta, and Tatham Engineering, April 2020.
- Agricultural Impact Assessment, Nelson Aggregate Co. Burlington Quarry Extension, BCX Environmental Consulting, March 2020.
- Air Quality Study for Nelson Aggregate Co., Burlington Quarry Extension, BCX Environmental Consulting, March 2020.
- Archaeological Assessment (Stages 1, 2 & 3), Nelson Aggregates Quarry Expansion, Archaeologic Inc., August 2003.
- Archaeological Assessment (Stage 4), Nelson Aggregates Quarry Expansion, Archaeologic Inc., August 2004.
- Stage 1-2 Archaeological Assessment, Proposed West Extension of the Burlington Quarry, Golder Associates, September 2020.
- Blast Impact Analysis, Burlington Quarry Extension, Epitech Engineering Ltd, April 23, 2020.
- Cultural Heritage Impact Assessment Report, Burlington Quarry Extension, MacNaughton Hermen Britton Clarkson Planning Limited (MHBC), April 2020.
- Financial Impact Study, Proposed Burlington Quarry Extension, Nelson Aggregates Co., April 2020.
- Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, Proposed Burlington Quarry Extension, EarthFX Incorporated, April 2020.
- Level 1 and 2 Natural Environment Technical Report, Proposed Burlington Quarry Extension, Savanta, April 2020.
- Noise Impact Assessment, Nelson Aggregate Quarry Extension, Howe Gastmeier Chapnik Limited, April 22, 2020.
- Nelson Aggregate Company, Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.
- Surface Water Assessment, Burlington Quarry Extension, Tatham Engineering, April 2020.
- Visual Impact Assessment Report, Proposed Extension of the Burlington Quarry, MacNaughton Hermen Britton Clarkson Planning Limited (MHBC), April 2020.

Other Lands Owned by Licensee



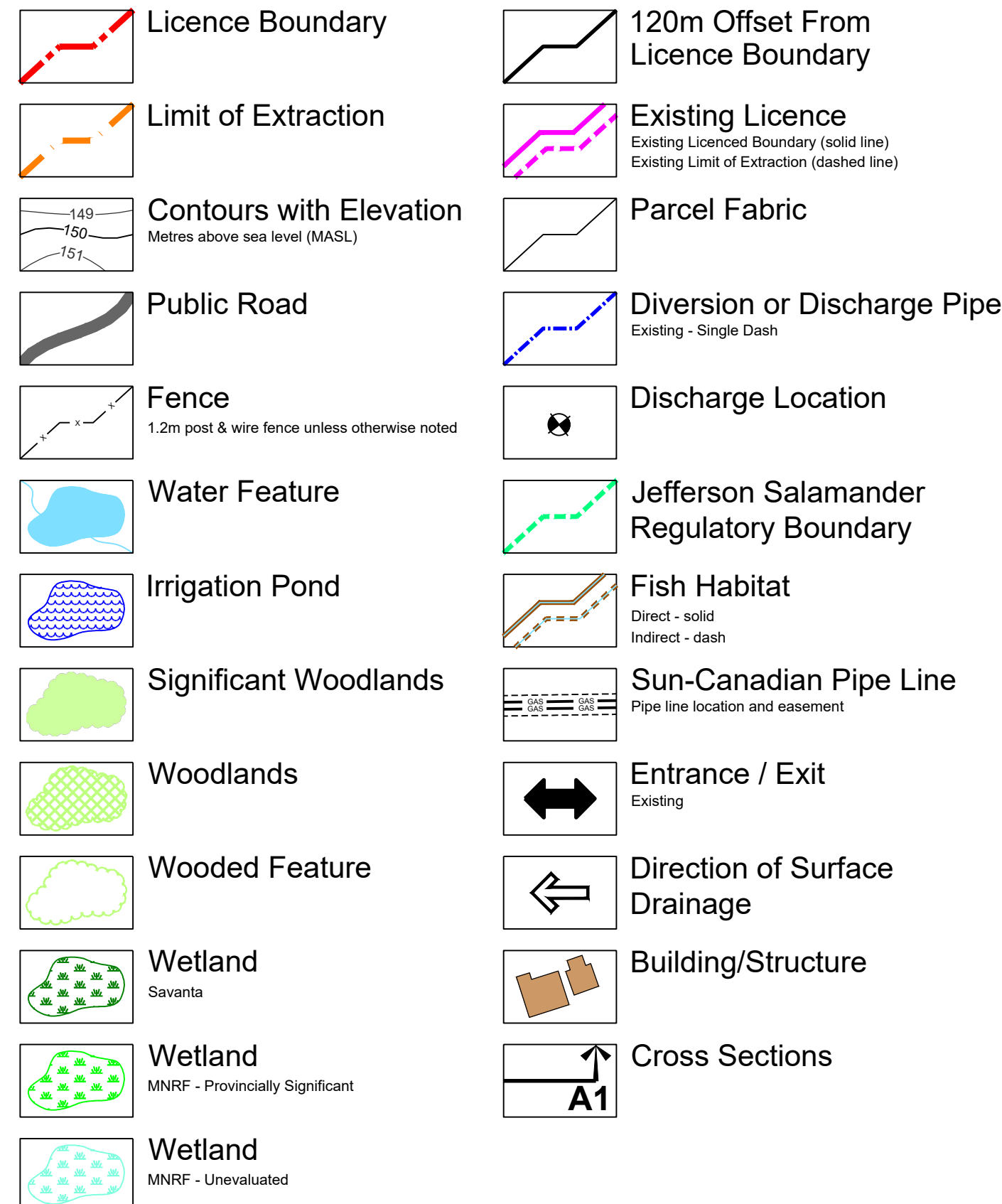
Niagara Escarpment Plan - Land Use Designations



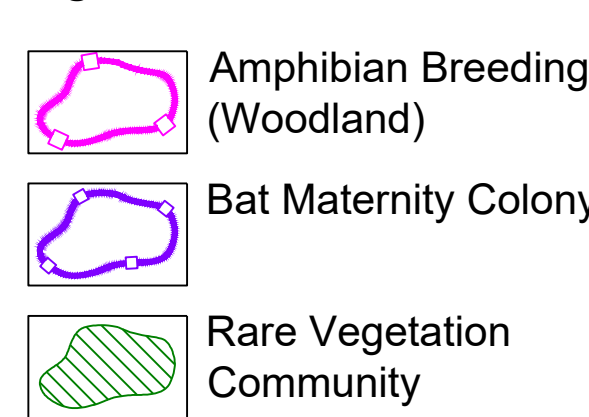
Legal Description

Part Lot 1 & 2, Concession 2 and Part Lot 17 & 18, Concession 2 NDS
(former geographic Township of Nelson)
City of Burlington
Region of Halton

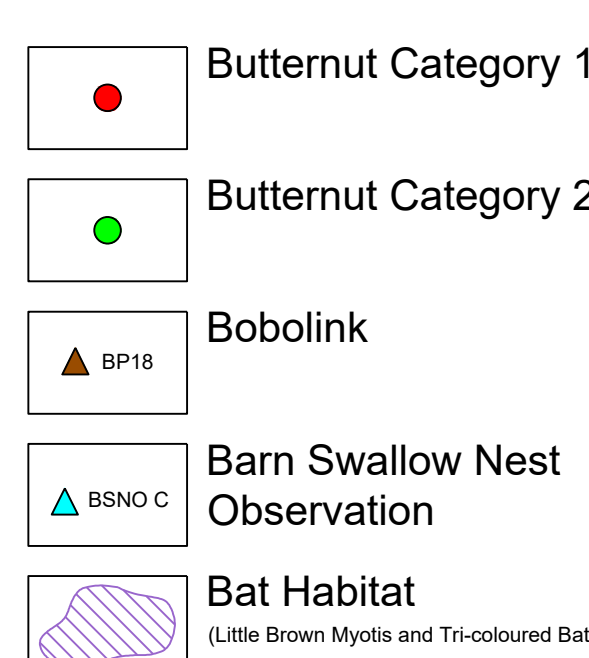
Legend



Significant Wildlife Habitat



Species at Risk



Site Plan Amendments

No.	Date	Description	By

Site Plan Revisions (Pre-Licensing)

No.	Date	Description	By
1.	September 2020	Update date of Archaeological Assessment Report in Section H.	CAP
2.	April 2021	Included MNRP standards for South Extension. Added Significant Wildlife Habitat, Species of Conservation Concern and Species at Risk. Update legend.	CAP



MNR Approval Stamp



Applicant



Project

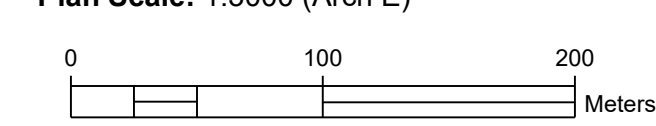
Burlington Quarry Extension

MNR Licence Reference No.

626477

Pre-approval review:

Plan Scale: 1:3000 (Arch E)



Date

April 2021

Drawn By

C.P.

Checked By

B.Z.

File No.

9135D

File Name

Existing Features

Drawing No.

1 of 4

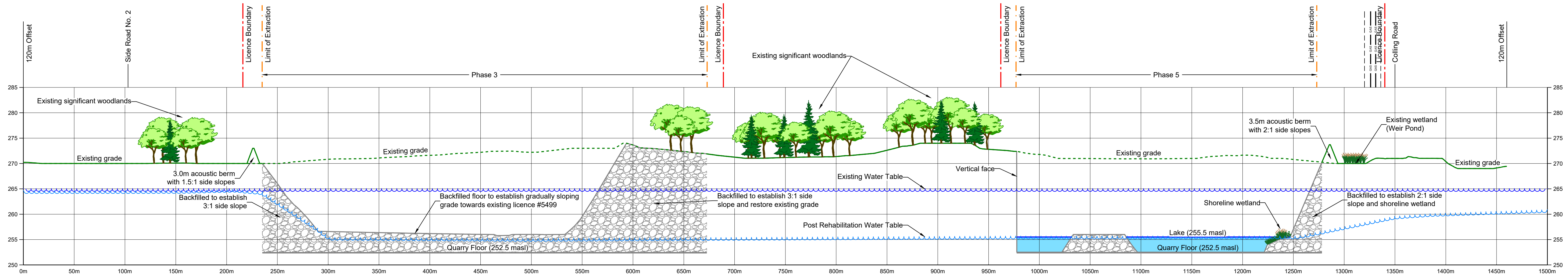
File Path: N:\Bram135D - Nelson - Project\Drawings\ARA Site Plans\Extension Site Plan\CAD135D - Site Plan - Blacklined - April 19, 2021.dwg

Drawing No. **3 of 4**

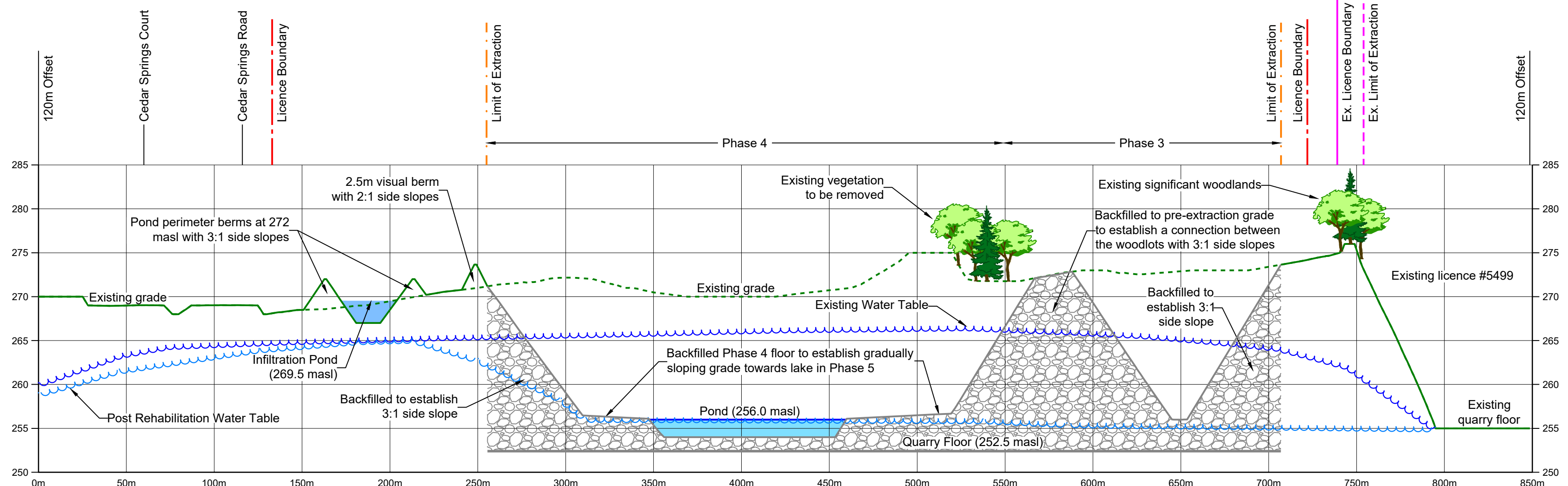
File Path N:\Briant\9135D- Nelson - Project Sideways\Drawings\ARA Site Plans\Extension Site Plan\CAD\9135D - Site Plan - Blacklined -

Legend

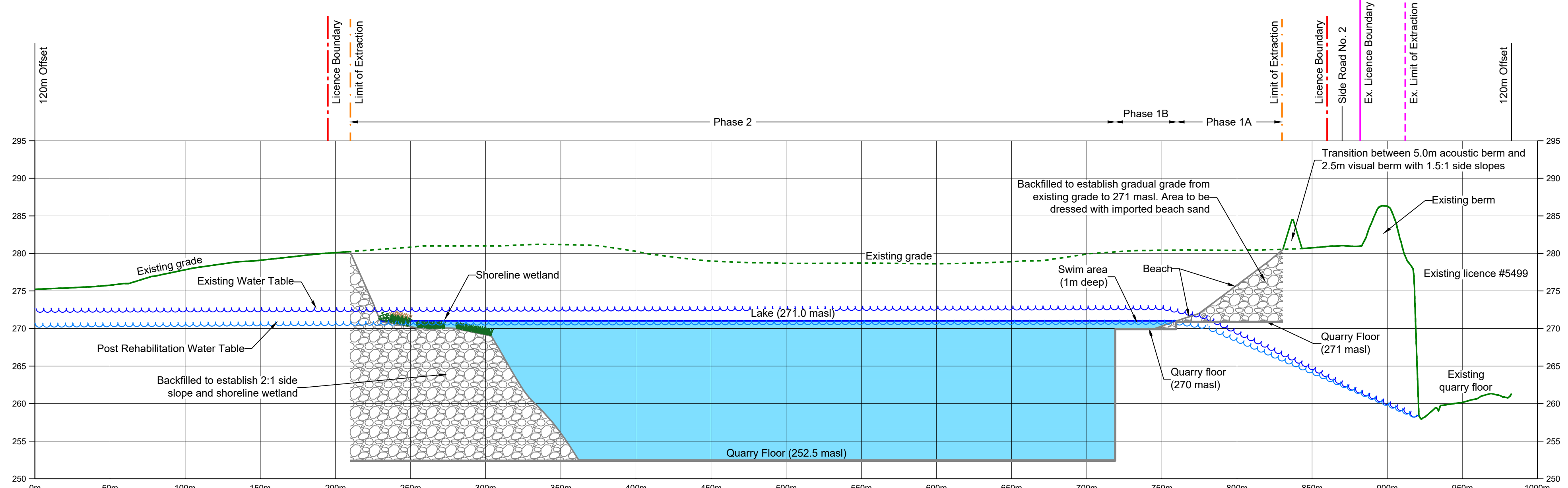
- Licence Boundary
- Limit of Extraction
- Existing Licence
- Existing Limit of Extraction
- 120m Offset From Licence Boundary
- Existing Grade - Removed / Altered
- Existing Grade - Undisturbed
- Quarry Floor / Face
- Berm
- Existing Water Table
- Post Rehabilitation Water Table
- Backfilled
- Lake or Pond



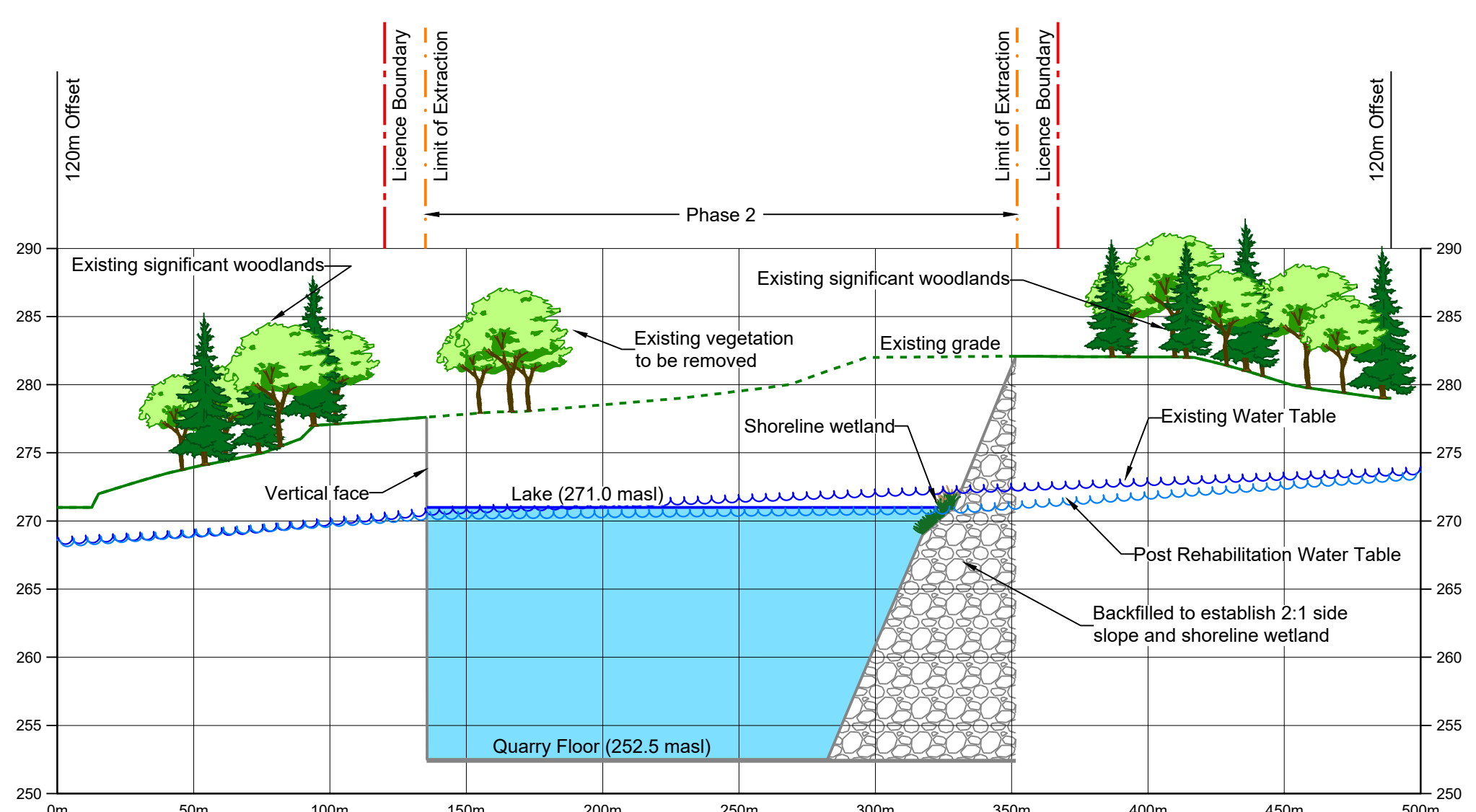
Cross Section A-A1



Cross Section B-B1

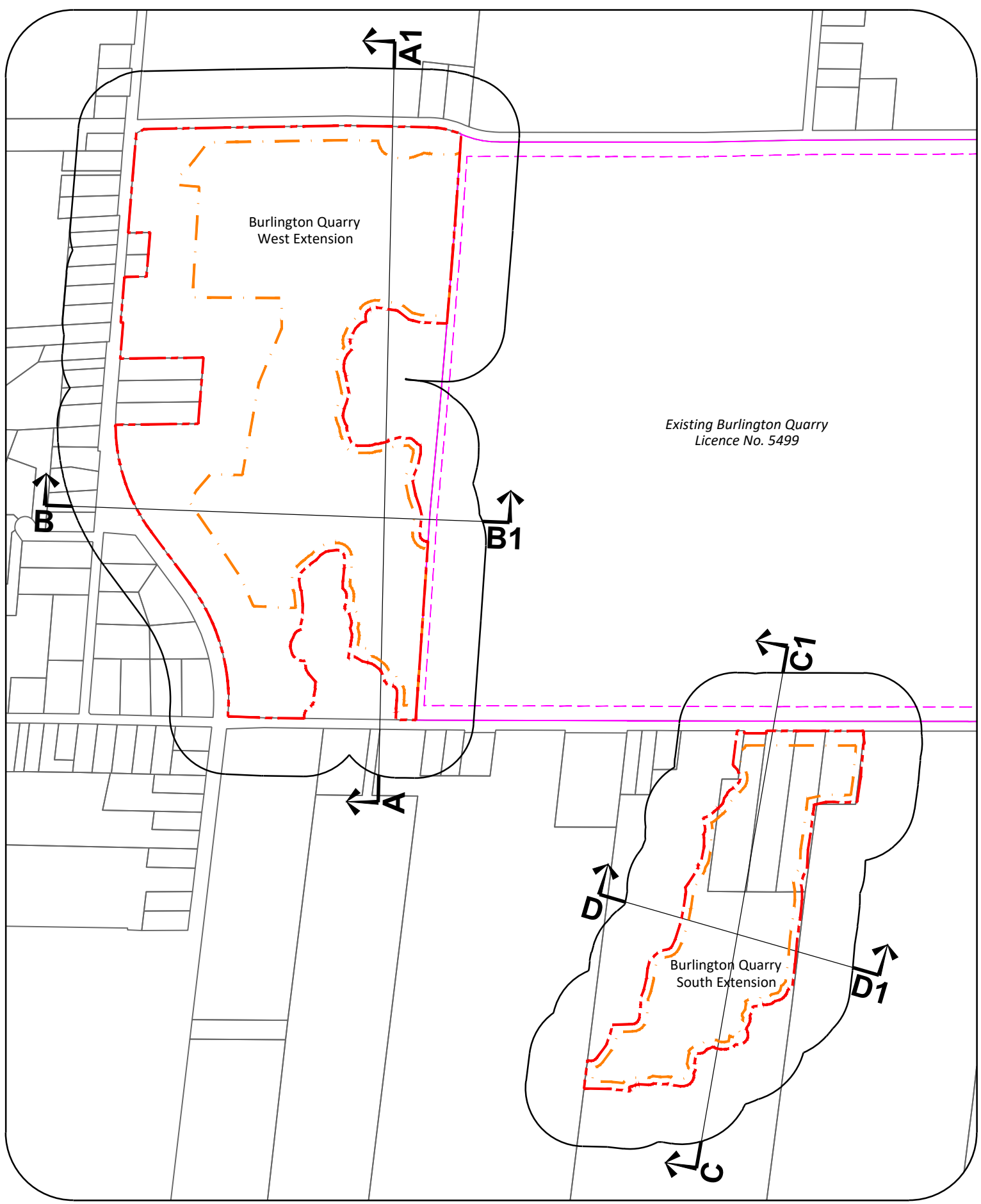


Cross Section C-C1



Cross Section D-D1

Key Map
Cross Sections



Site Plan Amendments			
No.	Date	Description	By

Site Plan Revisions (Pre-Licensing)			
1	April 2021	Added additional cross section labels for clarity	CAP
No.	Date	Description	By

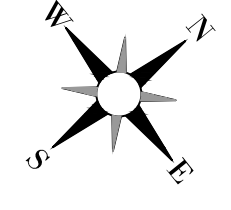


PLANNING
URBAN DESIGN
& LANDSCAPE
ARCHITECTURE
113 COLLEGE STREET, SUITE 201, L4M 1H2 | P: 705.728.0045 F: 705.728.2010 | WWW.MHBCPLAN.COM

MNRF Approval Stamp

MHBC Stamp

DRAFT



Applicant



**NELSON
AGGREGATE
CO.**
2433 No. 2 Sideroad
P.O. Box 1070 Burlington Ont. L7R 4L8
phone: (905) 335-5250

Project **Burlington Quarry Extension**

MNRF Licence Reference No. 626477	Pre-approval review:
--------------------------------------	----------------------

Plan Scale: Horizontal 1:2000 Vertical 1:400	Date April 2021	File No. 9135D
Drawn By C.P.	Checked By B.Z.	

File Name **Cross Sections**

Drawing No. **4 of 4**

Appendix B

Burlington Quarry Extension

PREVAILING METEOROLOGICAL CONDITIONS

Medians provided by Environment Canada
Canadian Climate Normals 1981-2010
Hamilton – Municipal Airport

Date	Wind Direction	Wind Velocity Km/h	Temperature (Deg Celsius)
January	SW	19.5	-5.5
February	W	18.6	-4.6
March	W	18.5	-0.1
April	NE	15.9	6.7
May	NE	14.0	12.8
June	SW	14.0	18.3
July	W	12.6	20.9
August	SW	11.8	20.0
September	SW	13.1	15.8
October	SW	15.6	9.3
November	W	17.4	3.7
December	SW	18.7	-2.3

Appendix C

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone 905-567-4444
Fax 905-567-6561



REPORT ON

**BLASTING IMPACT ASSESSMENT
PROPOSED NELSON AGGREGATE
NELSON QUARRY EXTENSION**

Submitted to:

Nelson Aggregate Co.
P.O. Box 1070
Burlington, Ont. L7R 4L8

DISTRIBUTION:

20 Copies - Nelson Aggregate Co.
2 Copies - Golder Associates Ltd.

April 2006

021-1238



EXECUTIVE SUMMARY

Blasting operations within the proposed extension of the Nelson quarry may be readily carried out in compliance with existing provincial environmental guideline limits with respect to ground and air vibrations. These effects are subject to recommended limits of 12.5 mm/s and 128 dBL respectively, as established by the Ontario Ministry of the Environment and outlined in Noise Pollution Control (NPC) publication 119 of the Model Municipal Noise Control By-Law, for operations where monitoring of these effects is carried out as a matter of routine.

Ground and air vibration attenuation characteristics were monitored and assessed from a number of routine production blasts within the existing Nelson quarry. The results indicate that the majority of the proposed extension may be excavated using the blast parameters currently being used in the existing quarry. These would include reducing the borehole diameter, reducing the bench height and reducing the explosive weight per delay period. The Nelson quarry would continue monitoring all blasts during extraction within the proposed extension area. The blasting operations within the proposed extension would have no impact on the integrity of adjacent water wells.

By ensuring that the ground and air vibration levels produced during blasting operations at the Nelson quarry continue to remain within the recommended provincial guideline limits, there would not be any noticeable cumulative effect on adjacent structures associated with the blasting operations within the proposed extension.

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
EXECUTIVE SUMMARY	I
TABLE OF CONTENTS	II
1.0 INTRODUCTION	1
2.0 EXISTING CONDITIONS	2
2.1 Site Description	2
2.2 Quarry Blasting Operations	2
3.0 PROPOSED EXTRACTION OF EXTENSION AREA	3
4.0 IMPACT IDENTIFICATION	4
5.0 QUARRY BLAST MONITORING	5
5.1 Attenuation Characteristics	5
5.1.1 Ground Vibrations	5
5.1.2 Air Vibrations	6
6.0 IMPACT ASSESSMENT	8
6.1 Compliance with NPC 119	8
6.2 Repeated Vibration Effects on Structures	8
6.3 Effects on Bedrock and Water Wells	9
7.0 CONCLUSIONS	11
REFERENCES	12
PUBLICATION NPC-119	1
Blasting	1
Scope 1	
Technical Definitions	1
Measurement Procedures	1
Concussion – Cautionary Limit	1
Concussion – Peak Pressure Level Limit	1
Vibration – Cautionary Limit	1
Vibration – Peak Particle Velocity Limit	1

LIST OF TABLES

Table 1	Existing Blast Details for Nelson Quarry Company Quarry
Table 2	Maximum Explosive Loads vs Distance for 12.5 mm/s and 128 dBL
Table 3	Strain Levels Induced by Household Activities, Environmental Changes and Blasting

LIST OF FIGURES

Figure 1	Key Location Plan Nelson Quarry
Figure 2	Proposed Nelson Quarry Extension Area
Figure 3	Description of Blasting Terms
Figure 4	Proposed Excavation Sequence of Nelson Quarry Extension Area
Figure 5	Nelson Quarry Ground Vibration Attenuation Curve
Figure 6	Nelson Quarry Air Vibration Attenuation Curve

LIST OF APPENDICES

Appendix A	Publication NPC 119
Appendix B	New Residence Receptor Location

1.0 INTRODUCTION

Golder Associates was retained by Nelson Aggregate Co. to carry out an impact assessment of the environmental effects from future blasting operations within the proposed extension of the existing licensed area of the Nelson Quarry Company quarry. The proposed extension would be located immediately south of No. 2 Sideroad on Part Lots 17 and 18, Concession 2 in the City of Burlington. The impact assessment specifically addresses whether the applicable Ontario Ministry of Environment guidelines with respect to ground and air vibration effects could be met at the residential properties closest to the proposed extension.

The investigation included monitoring a number of regularly scheduled production blasts at various receptor points around the blast site to assess site-specific ground and air vibration decay characteristics.

This report addresses the following topics:

- reviews existing provincial and federal guidelines for the assessment of environmental impacts from blasting,
- provides recommendations for the continued control of ground and air vibration effects,
- evaluates the potential impact of the blasting operations on bedrock strata and adjacent water wells,
- evaluates the long term impact of the blasting operations on surrounding structures.

2.0 EXISTING CONDITIONS

2.1 Site Description

The existing licensed Nelson Quarry Co. quarry (Nelson) is situated immediately north of No. 2 Sideroad and south of Colling Road between Guelph Line and Cedar Springs Road in the City of Burlington, Ontario in the Region of Halton (see Figure 1). The proposed extension area would encompass an area of approximately 82.3 Hectares immediately south of the existing quarry and No. 2 Sideroad, as seen in Figure 2.

As shown in Figures 2 and 4, the closest residential properties to the proposed extension consist of those residences to the east and west on the south side of No. 2 Sideroad. Compared to the existing quarry location, the proposed extension is relatively remote from the existing neighbouring properties. The closest residential receptors have been identified as the residences along No. 2 Sideroad (see Appendix B). The topography of the area generally consists of gently rolling hills.

2.2 Quarry Blasting Operations

The Nelson quarry currently operates a single bench which varies in height from approximately 19 to 26 m. Typical blast design details for the existing quarry are given in Table 1 while common quarry blasting terms and procedures are illustrated in Figure 3.

All blasting at the Nelson quarry is monitored for ground and air vibration effects. Monitoring is routinely being carried out at three locations along the south side of No. 2 Sideroad and occasionally within Mount Nemo Court, east of Guelph Line.

Blasting procedures within the proposed extension would be carried out in a manner similar to those currently being carried out for the existing Nelson quarry, as shown in Table 1.

3.0 PROPOSED EXTRACTION OF EXTENSION AREA

The proposed sequence of extraction for the extension is illustrated in Figure 4. Extraction within the proposed extension area would commence with the crossing of No. 2 Sideroad west of the existing office. Extraction of Phase 1 would see an approximately 100 m wide working face advanced in a westerly direction along the north side of the proposed extension, as shown in Figure 4. Phases 2 and 3 would see the entire west side of the extension extracted in a southerly direction before proceeding east along the south boundary.

Extraction of Phase 4 would be carried out in a northerly direction which would complete extraction of the west half of the proposed extension. Phases 5a and 5b would be carried out in an easterly direction in the southeast corner of the extension while the remainder of the property would be extracted as Phase 6 in a northerly direction, as seen in Figure 4.

4.0 IMPACT IDENTIFICATION

The environmental effects most often associated with blasting operations are ground vibrations and air concussion.

The intensity of ground vibrations, which is an elastic effect measured in units of peak particle velocity, is defined as the speed of excitation of particles within the ground resulting from vibratory motion. For the purposes of this report, peak particle velocity is measured in mm/s.

While ground vibration is an elastic effect, one must also consider the plastic or non-elastic effect produced locally by each detonation when assessing the effects on the bedrock strata and local water wells. The detonation of an explosive produces a very rapid and dramatic increase in volume due to the conversion of the explosive from a solid to a gaseous state. When this occurs within the confines of a borehole it has the following effect:

- The bedrock in the area immediately adjacent to the explosive product is crushed.
- As the energy from the detonation radiates outward from the borehole, the bedrock between the borehole and quarried face becomes fragmented and is displaced while the bedrock behind the borehole is fractured.
- Energy not used in the fracturing and displacement of the bedrock dissipates in the form of ground vibrations, sound and airblast. This energy attenuates rapidly from the blast site due to geometric spreading and natural damping.

Air concussion, or air vibrations, is a pressure wave traveling through the air produced by the direct action of the explosive on air or the indirect action of a confining material subjected to explosive loading. Air vibrations from surface blasting operations consist primarily of acoustic energy below 20 Hz, where human hearing is less acute (Siskind et al., 1980), while noise is that portion of the spectrum of the air vibration lying within the audible range from 20 to 2000 Hz. It is the lower frequency component (below 20 Hz) of air concussion, that which is less audible, that is of interest as it is often the source of secondary rattling and shaking within a structure. For the purposes of this report, air vibration is measured as decibels in the Linear or Unweighted mode (dBL). This differs from noise (above 20 Hz) which is measured in dBA.

Both ground and air vibration effects produced at private structures adjacent to surface or underground mining operations are subject to guidelines contained in Noise Pollution Control (NPC) publication 119 of the Model Municipal Noise Control By-Law, dated August, 1978, published by the Ontario Ministry of Environment. Under conditions where monitoring of the blasting operations is routinely carried out, as it is at the Nelson Quarry, the recommended ground and air vibration limitations at the nearest private structure would be 12.5 mm/s and 128 dBL respectively. A copy of Publication NPC 119 is reproduced in Appendix A.

5.0 QUARRY BLAST MONITORING

As part of this study, peak ground and air vibration levels were monitored during several typical quarry production blasts in the existing quarry at progressively increasing distances from the blast site. The blasts occurred both on the south and east faces of the quarry. Instrumentation consisted of Instantel DS-077 Minimates, Minimate Pluses and DS-477 Blastmates. These instruments measure and record ground vibration velocities in each of three orthogonal directions, as well as simultaneously recording air vibration levels. Instrumentation was generally set up in a line at distances ranging from about 100 to 600 m from the blast site. Specific instrument and blast locations were established using a Garmin GPS electronic navigation aid (NAVAID) to determine accurate distances between the blast and receptors.

5.1 Attenuation Characteristics

The rate at which ground vibrations attenuate or decrease with increased distance from a blast source depends on a variety of conditions, including the type and condition of the bedrock being blasted, depth and composition of the earth covering deposits (soil), and the general topography. Air vibration effects are less affected by these factors, being more influenced by the prevailing weather conditions at the time of the blast.

The following relationships were established from the blast monitoring results.

5.1.1 Ground Vibrations

The ground vibration attenuation characteristics established for the Nelson Quarry is presented in Figure 5 as a plot of the peak particle velocity against the Scaled Distance. Scaled Distance is defined as:

$$\text{Scaled Distance (SD)} = D/\sqrt{W}$$

where D = distance (m) between the blast and receptor

W = maximum weight of explosive (kg) detonated per delay period

As seen in Figure 5 the collection of points defining the rate of decay for the ground vibrations exhibits a degree of scatter that is inherent in all Scaled Distance plots. Factors responsible for these variations include the geologic conditions of the bedrock (type and structure), different wave types, errors in blast initiation timing, differences between types of explosives, degree of confinement, and differences in blast efficiencies.

The equation for the 95% regression line developed in Figure 5 can be expressed as:

$$PPV = 896(SD)^{-1.32}$$

where PPV = Peak Particle Velocity (mm/s)

SD = Scaled Distance (m/(kg^{0.5}))

The calculated Scaled Distance for a peak ground vibration level of 12.5 mm/s would equal 25.5 m/(kg^{0.5}). The purpose of this equation is not so much to predict what a given vibration level would be at a particular location for a given blast, but to indicate the probability that the peak vibration would fall below the level indicated by the equation for a given distance and maximum explosive weight. The equation is therefore a useful blast design tool in establishing maximum explosive charge weights per delay for various distances from a blast site for a given maximum ground vibration level.

5.1.2 Air Vibrations

Cube root scaling was used in establishing the air vibration decay characteristics as given in the following relationship:

Scaled Distance (SD) = $D/\sqrt[3]{W}$, where D and W are defined as previously described.

Figure 6 shows the Scaled Distance air vibration plot, which exhibits considerably more scatter and has a typically poorer correlation than that seen with the ground vibration results. This is primarily due to variable weather conditions during each blast, which are entirely independent of the blasting operations. Other factors influencing air vibration distribution from a blast include the length of collar and type of stemming material used, differences in explosive types and variations in burden distance.

The 95% regression curve given in Figure 6 can be expressed as:

$$APL = 181(SD)^{-0.0867}$$

where SD = as defined above

APL = air pressure level (dBL)

The calculated Scaled Distance for a peak air vibration level of 128 dBL would equal 53.0 m/(kg^{0.33}). The variability in the plot suggests that it is less reliable as a tool for guiding blast design.

Site specific Scaled Distance plots are commonly used as a blast design tool since peak vibration levels can be reasonably predicted at specified distances from a blast site. Based on the 95%

regression equations given in Figures 5 and 6, Table 2 shows the maximum suggested explosive loads for various distances from the blast site based on the provincial guideline limits of 12.5 mm/s and 128 dBL discussed previously. It can be seen that the ground vibration limit of 12.5 mm/s becomes the more restrictive guideline when determining maximum explosive loads beyond a distance of about 225 m for the quarry's blasting operations.

6.0 IMPACT ASSESSMENT

6.1 Compliance with NPC 119

It is evident from the regression equations discussed in Section 5 that the distance between the blast and the receptor and the amount of explosive detonated per delay period are the principal parameters in controlling ground and air vibration effects. The maximum explosive loads given in Table 2 for limiting peak ground and air vibration levels to 12.5 mm/s and 128 dBL respectively, indicate that the provincial guidelines may be complied with for all blasting beyond a distance of about 200 m from adjacent private residential properties. This represents a majority of the proposed extension and is based on a maximum explosive weight per delay of about 60 kg. When blasting approaches to within about 200 m of adjacent private residences, it may become necessary to reduce the maximum explosive weight detonated per delay period within the blast. Any one or combination of the following operations would achieve this:

1. Reducing the borehole diameter with a corresponding reduction in the drill pattern.
2. Introduce additional decked charges within each borehole, as illustrated on Figure 3.
3. Reduce the borehole length (depth) by reducing the bench height.

For example, a reduction in the borehole diameter from 127 mm to 76 mm would effectively reduce the explosive column weight per hole by about 65%. Decking the explosive column could further reduce the explosive column weight by an additional 50%. Additional decking and reductions in bench heights, as identified above, could achieve further reductions in maximum explosive weights.

As it is the intention of the Nelson quarry to continue monitoring all blasting operations, the attenuation curves discussed previously would be used in conjunction with the monitoring data collected at adjacent properties to dictate when changes to the blast procedure become necessary within the proposed extension. Although a reduction in the maximum instantaneous explosive load is anticipated as blasting approaches the residences to the east and west, the ground and air vibration guideline limits contained within NPC 119 would continue to be maintained.

6.2 Repeated Vibration Effects on Structures

Blast vibrations characteristically produce temporary transient strains within the various materials that makeup a residential structure. These strains would typically have durations of no more than one or two seconds for each blast as the vibration passed the structure. In addition to these temporary strains, Table 3 shows the strain levels produced in a household by changes in temperature and humidity (environmental changes), as well as those produced by regular household activities (Dowding, 1985), which occur on a recurring and often frequent basis. These strain levels are compared to equivalent levels of ground vibration produced from blasting

operations. It is evident from Table 3 that routine household activities and environmental changes can at times produce strains within a structure that are well in excess of those produced by blasting.

Several studies have also been carried out to look at the long-term effects of repeated blasting on structures (Stagg et al, 1984, Siskind et al, 1980). These studies concluded that repeated blasting over several decades, producing peak vibration levels well in excess of the provincial guideline limit, were required to cause cosmetic threshold cracking to occur. By ensuring that blasting continues to remain within the provincial guideline limits, there would not be any noticeable cumulative effect associated with the blasting operations within the extension area.

6.3 Effects on Bedrock and Water Wells

As discussed previously, under typical blasting conditions stresses introduced into the bedrock by the explosive detonation and the accompanying gas pressures create and extend fractures within the bedrock around each borehole. Fracture development is usually limited to the equivalent distance of about 20 times the borehole diameter. In the case of the blast procedures expected for the proposed extension, this would equate to about two to three metres for a 114 mm diameter hole. The gas pressures within the hole may extend micro-cracks or existing natural discontinuities within the bedrock, such as joints or bedding planes, beyond this distance.

Studies on crack development within bedrock from blast detonations (Keil et al., 1977) indicate that peak ground vibration levels of 300 to 600 mm/s are required to create micro-cracks or open existing discontinuities. Our own experience within the limestone of Southern Ontario indicates that such values would not be anticipated beyond a distance of about 10 to 20 m from the blast site, depending on such parameters as drill hole diameter and the type of explosive product. It is evident therefore that the creation or extension of fractures within the bedrock would remain confined to an area immediately around the blast site.

Several studies have been carried out to investigate the effects of blasting on ground water wells (Froedge, 1983). These studies have concluded that:

1. When blast induced ground vibrations are less than about 25 mm/s maximum resultant particle velocity, the response of the well is limited to a slight temporary variation in water level on the order of 3 to 6 cm either up or down. The specific capacity of the water well is unchanged based on drawdown tests.
2. Vibration measurements made at the surface and at the bottom of the observation wells indicate the vibration levels are always lower at the bottom of the well.
3. All of the data collected indicates that a ground vibration limit of 50 mm/s peak particle velocity is adequate to protect the wells from any significant damage. There is a possibility that temporary turbidity may be caused at lower levels periodically, although not at any constant threshold level.

The research consistently indicates that blast vibrations below 25 mm/s should have no adverse effects on nearby wells. As the maximum provincial guideline vibration limitation at the nearest residence is only half of this value, at 12.5 mm/s, the ground vibrations produced from the quarry's blasting operations within the proposed extension area would have no effect on the integrity of neighbouring water wells.

7.0 CONCLUSIONS

Based on the foregoing considerations, it is our opinion that blasting operations may be readily performed within the limits of the proposed extension of Nelson Quarry Company quarry in compliance with the current quarry blasting guidelines published by the Ministry of Environment. All blasting and blast monitoring would occur in accordance with the Aggregate Resources Act prescribed conditions in order to ensure compliance with the provincial guidelines.

GOLDER ASSOCIATES LTD.



Marcus V. van Bers, P. Eng.
Associate

MVVB/AC/ms/co

N:\ACTIVE\2002\1200\021-1238 - nelson aggreg-extension-burlington\report impact assessment\021-1238 09may06 impact assessment (2).doc

REFERENCES

Dowding, C. H., *Blast Vibration Monitoring and Control*, 1985.

Froedge, D. T. , *Blasting Effects on Water Wells*, Proc. Ninth Conf. on Explosives and Blasting Technique, Int. Soc. of Explosives Engineers, 1983.

Keil, L. D., Burgess, A. S., Nielson, N. M., Koropatrik, A., *Blast Vibration Monitoring of Rock Excavation*, Canadian Geotechnical Journal, Volume 14, 1977.

Ministry of Environment, Model Municipal Noise Control By-Law, Final Report, August, 1978.

Siskind, D. E., Stagg, M. S., Kopp, J. W., Dowding, C. H., *Structure Response and Damage Produced by Ground Vibration From Surface Mine Blasting*, U.S.B.M. Report RI8507, 1980.

Stagg, M. S., Siskind, D. E., Stevens, M. G., Dowding, C. H., *Effects of Repeated Blasting on a Wood-Frame House*, U.S.B.M. Report RI8896, 1984.

TABLES

TABLE 1
Existing Blast Details for Nelson Quarry Company

PARAMETER	NELSON QUARRY
Bench (face) height (m)	19 - 26
Drill hole pattern (m)	2.4 x 2.4 – 4.3 x 4.3
Drill hole diameter (mm)	76 – 114
Sub-drill depth (m)	0.6
Collar length (m)	1.7 – 3.0
Holes per blast	7 – 40
Explosive product(s) used	Emulsion/ANFO blend
Initiation system	Electric, Electronic
Delay timing (ms)	25ms (electric), 13ms (electronic)
Maximum explosive weight per delay period (kg)	30 – 279

Note: See Figure 3 for a description of blasting terms.

TABLE 2
Maximum Explosive Loads vs Distance
for 12.5 mm/s and 128 dBL

Distance (m)	PPV = 12.5 mm/s SD = 25.5 kg/m ^{0.5}	INL = 128 dBL SD = 53.0 kg/m ^{0.33}
100	15	7
150	35	23
200	61	54
250	96	105
300	138	181
400	246	429
500	384	838
600	553	1449

Note: See Section 5 of accompanying report.

TABLE 3

Strain Levels Induced by Household Activities, Environmental Changes and Blasting

Loading Phenomena	Site^a	Microstrain Induced by Phenomena ($\mu\text{in.in.}$)	Corresponding Blast Vibration Level^b (mm/s)
Daily environmental changes	K ₁	149	30.0
	K ₂	385	76.0
Household activities:			
1. Walking	S ₂	9.1	0.8
2. Heel drops	S ₂	16.0	0.8
3. Jumping	S ₂	37.3	7.1
4. Door slams	S ₁	48.8	12.7
5. Pounding nails	S ₁₂	88.7	22.4

^a K₁ and K₂ were placed across a taped joint between two sheets of gypsum wallboard.

^b Blast equivalent based on envelope line of strain vs ground vibration.

Source: Dowding (1985)

FIGURES

KEY LOCATION PLAN NELSON QUARRY

FIGURE 1



Date: **SEPTEMBER 2004**

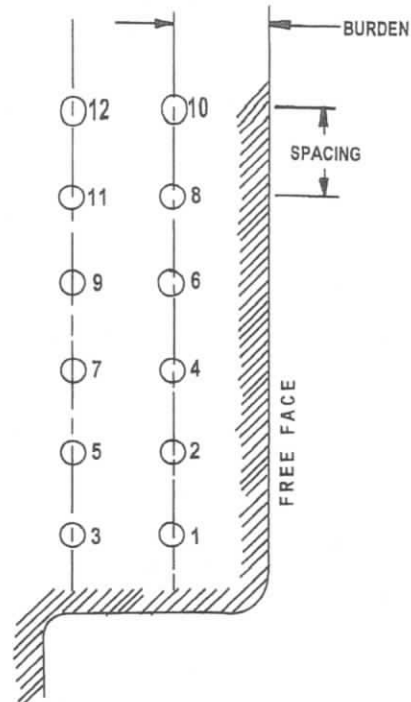
Project: **021-1238**

Golder Associates

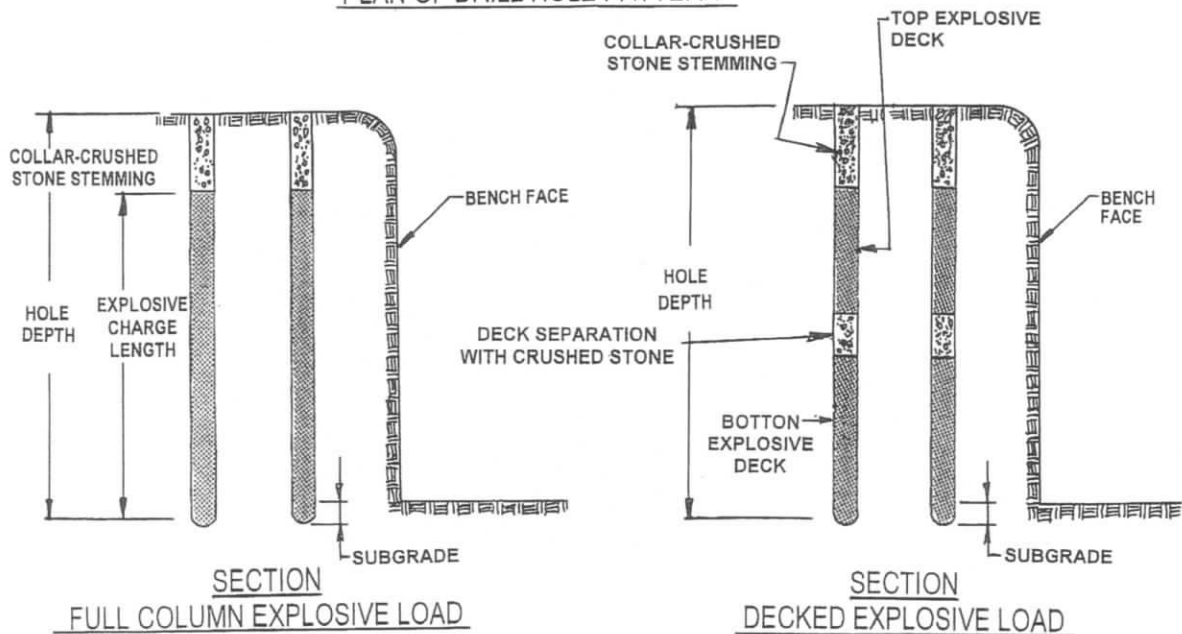
Drawn: **RJ**

Chkd: _____

NUMBERS SHOW SHORT PERIOD DELAY	EXAMPLE OF FIRING TIMES (MILLISECONDS)
PERIOD 1	25
PERIOD 2	50
PERIOD 3	75
PERIOD 4	100
PERIOD 5	125



PLAN OF DRILL HOLE PATTERN



Date: SEPTEMBER 2004

Project: 021-1238

Golder Associates

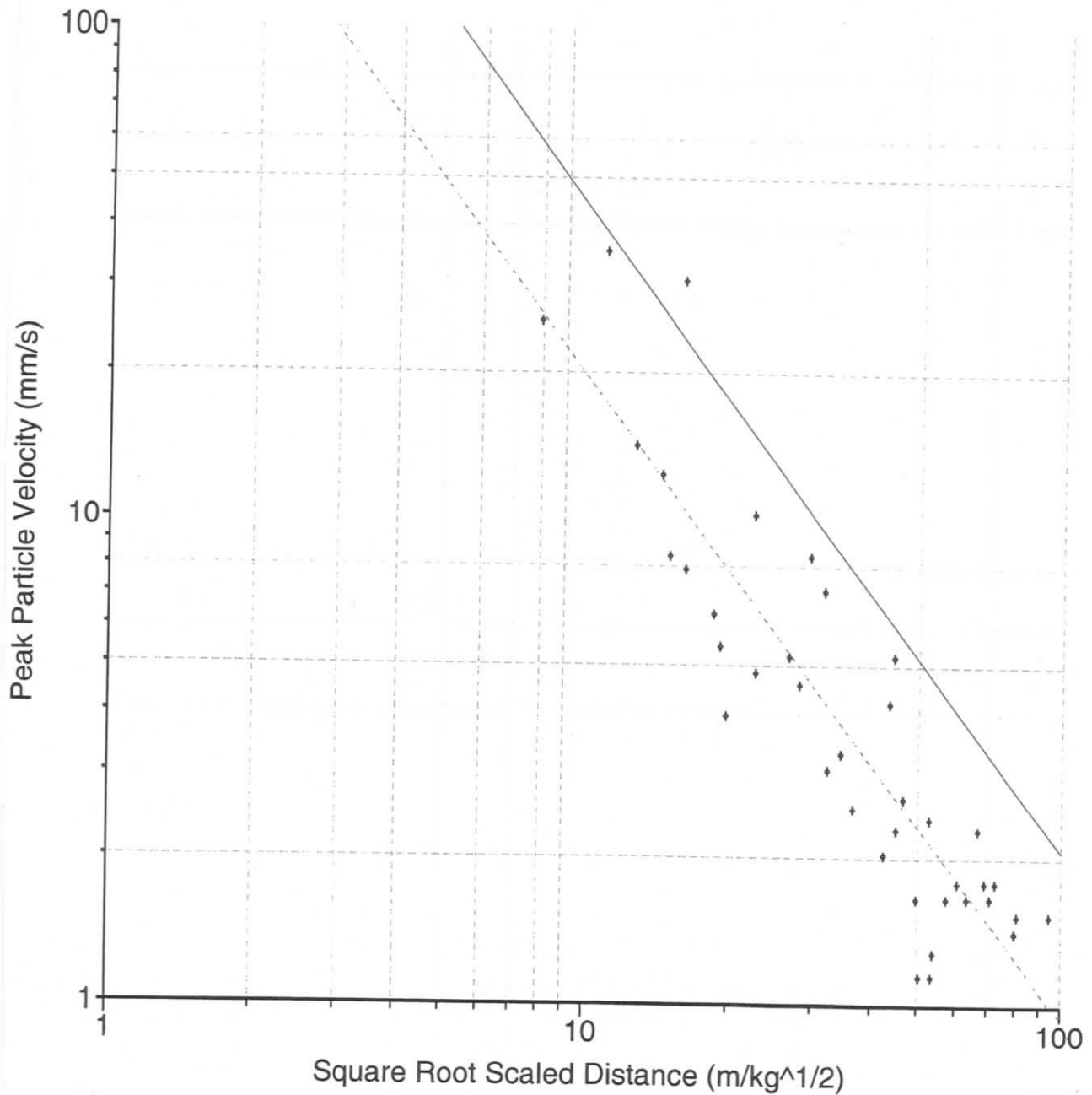
Drawn: RJ

Chkd:

NELSON QUARRY GROUND VIBRATION
ATTENUATION CURVE

FIGURE 5

Coefficient of Determination = 0.811 Standard Deviation = 0.172



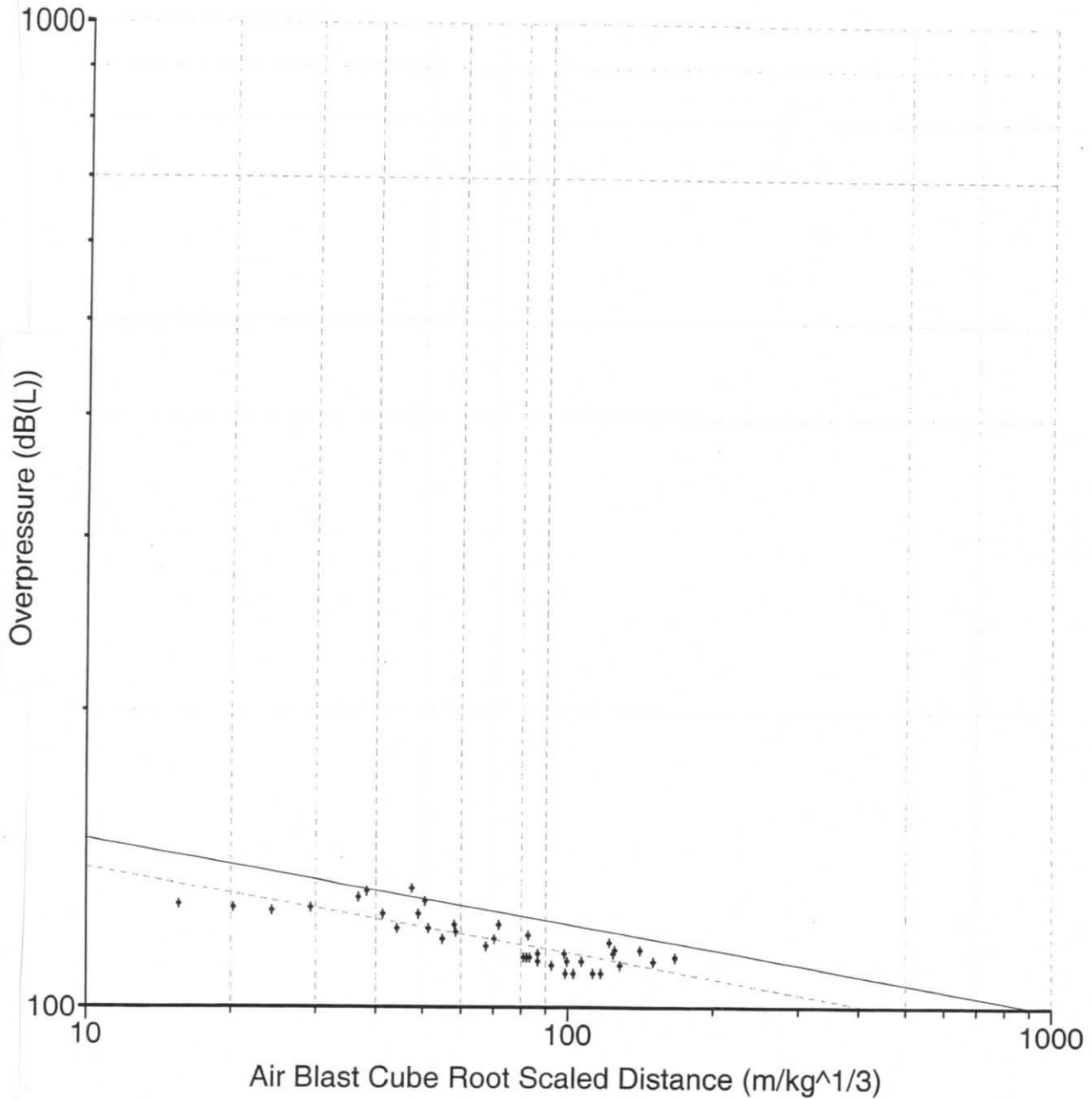
Date.....Aug 29/04.....
Project...021-1238.....

Drawn.....*mmB*.....
Chkd.....*mmB*.....

NELSON QUARRY AIR VIBRATION
ATTENUATION CURVE

FIGURE 6

Coefficient of Determination = 0.677 Standard Deviation = 0.0145



Date.....Aug 29/04.....
Project...021-1238.....

Drawn.....*MMB*.....
Chkd.....*MMB*.....

APPENDIX A
PUBLICATION NPC 119

PUBLICATION NPC-119

Blasting

Scope

This Publication refers to limits on sound (concussion) and vibration due to blasting operations.

Technical Definitions

The technical terms used in this Publication are defined in Publication NPC-101 – Technical Definitions.

Measurement Procedures

All measurements of peak pressure level and vibration velocity shall be made in accordance with the “Procedure for Measurement of Sound and Vibration due to Blasting Operations” set out in Publication NPC-103 – Procedures, section 5.

Concussion – Cautionary Limit

Subject to section 5 the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 120 dB.

Concussion – Peak Pressure Level Limit

If the person in charge of a blasting operation carries out routine monitoring of the peak pressure level, the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 128 dB.

Vibration – Cautionary Limit

Subject to section 7, the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.00 cm/s.

Vibration – Peak Particle Velocity Limit

If the person in charge of a blasting operation carries out routine monitoring of the vibration the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.25 cm/s.

APPENDIX B
NEW RESIDENCE RECEPTOR LOCATION

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone 905-567-4444
Fax 905-567-6561



December 13, 2004

021-1238

Nelson Aggregate Co.
P.O. Box 1070
Burlington, Ontario
L7R 4L8

Attention: Mr. Tom Palko
Property Manager

**RE: BLASTING IMPACT ASSESSMENT PROPOSED NELSON AGGREGATE
NELSON QUARRY EXTENSION NEW RESIDENCE RECEPTOR LOCATION**

Dear Mr. Palko:

Further to our report entitled "Blasting Impact Assessment Proposed Nelson Aggregate Nelson Quarry Extension" dated September, 2004, it is our understanding that the closest residential receptor to the proposed Nelson Aggregate Nelson quarry extension has now been identified as the residence at 2416 No. 2 Sideroad, located in the northeast corner of the proposed extraction area. The residence and ancillary buildings at 2416 No. 2 Sideroad are located a minimum of 290 m from the Phase 1 extraction area and 370 m from the Phase 5B extraction area.

As stated in Section 6.0 Impact Assessment of the report identified above, the recommended Ontario provincial ground and air vibration guideline limits of 12.5 mm/s and 128 dBL respectively, may be complied with for all blasting beyond a distance of about 200 m. This indicates that the extraction of Phases 1 through 5B and part of Phase 6 may be carried out without any changes to the quarry's existing blasting procedures.



It is our opinion that blasting operations may be carried out within the proposed extension area in compliance with the current quarry blasting guidelines while the residence at 2416 No. 2 Sideroad is occupied. If you have any additional questions please do not hesitate to contact me.

Yours truly,

GOLDER ASSOCIATES LTD.

Marcus V. van Bers, P.Eng.
Associate

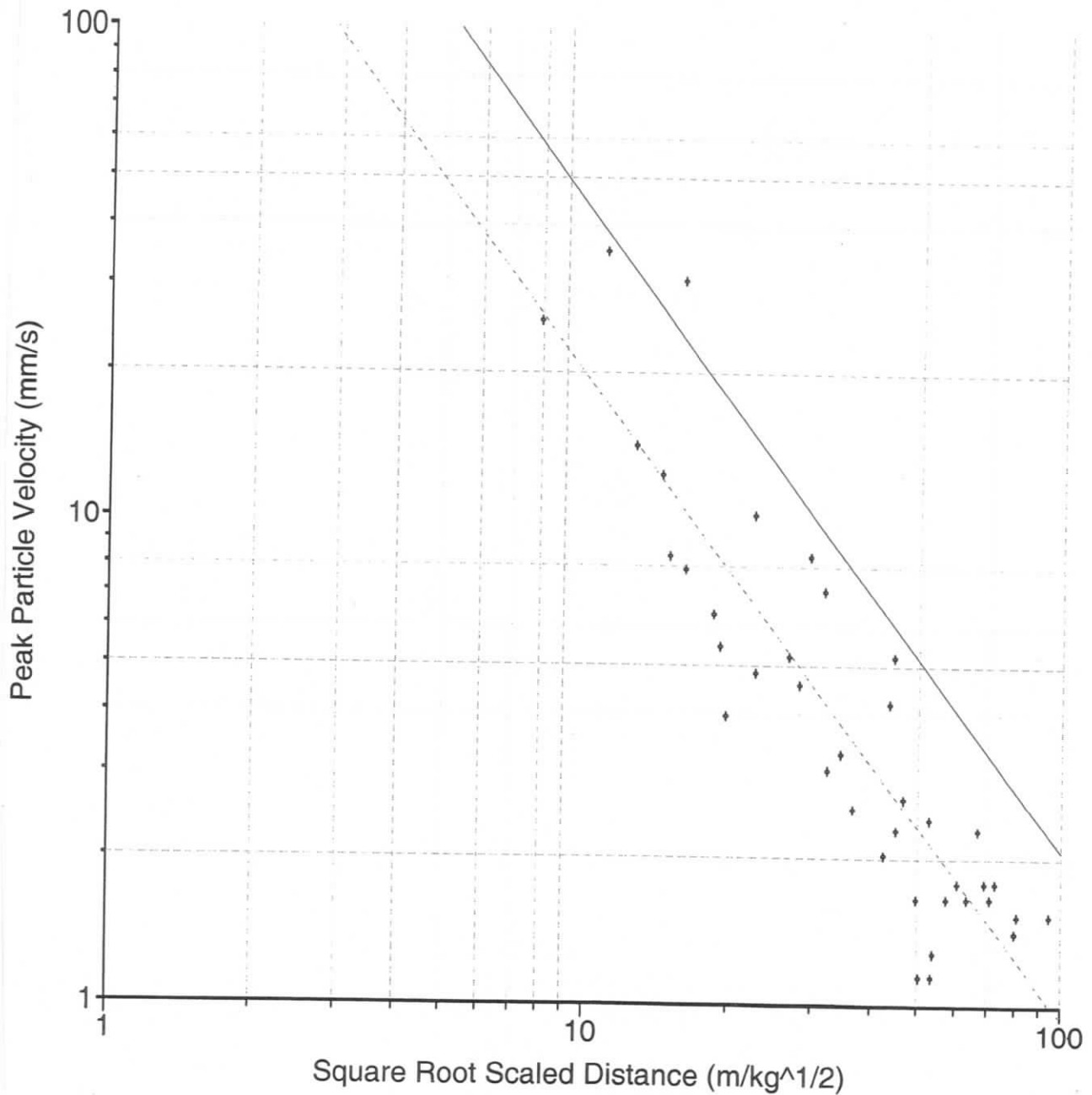
MVB/co
cc: Mr. Brian Zeman, MHBC Planning

n:\active\2002\1200\021-1238 - nelson aggreg-extension-burlington\reports\021-1238 ltr 04dec13 blasting impact assess-amendment.doc

NELSON QUARRY GROUND VIBRATION
ATTENUATION CURVE

FIGURE 5

Coefficient of Determination = 0.811 Standard Deviation = 0.172



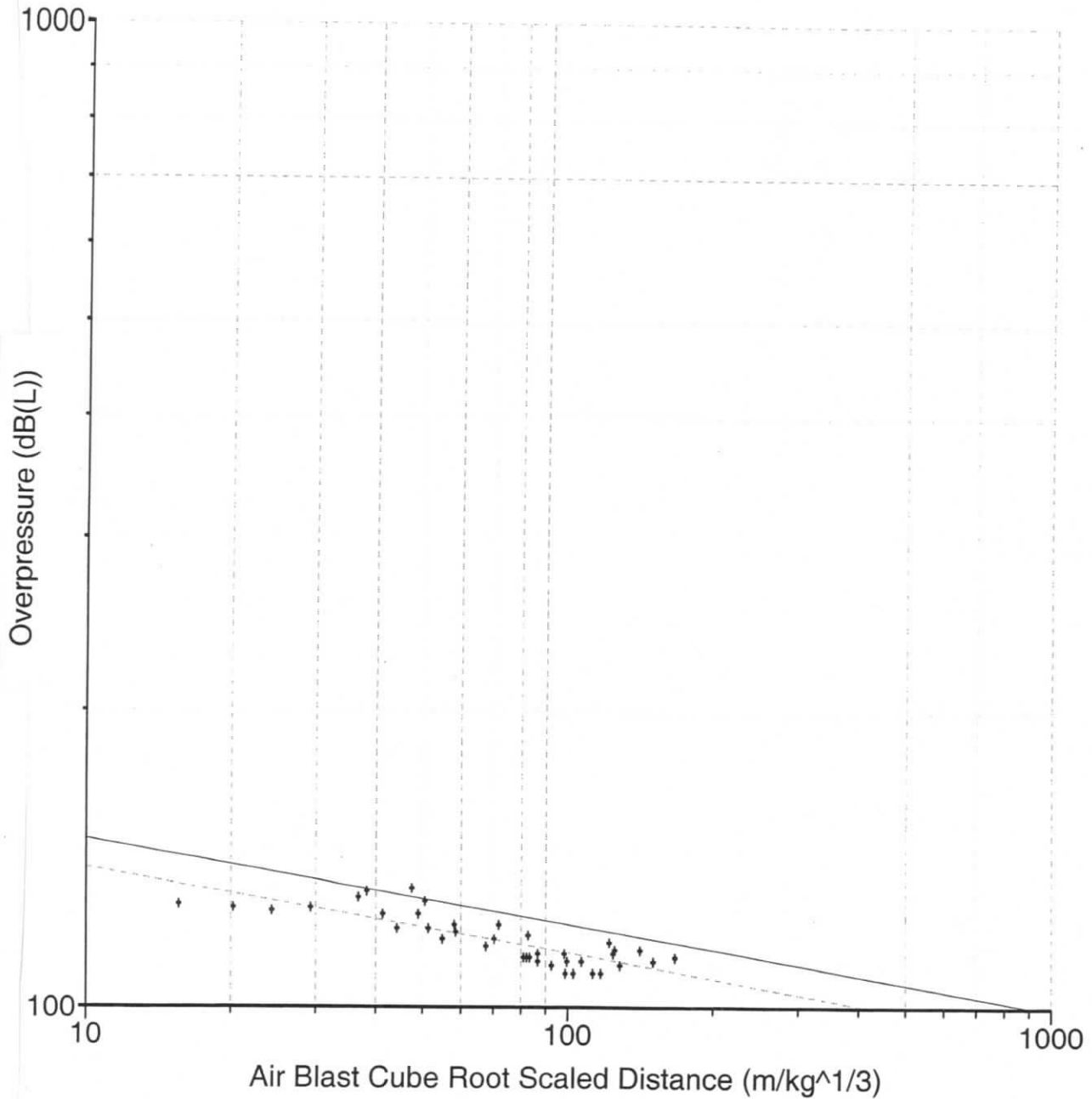
Date.....Aug 29/04.....
Project...021-1238.....

Drawn.....*mmB*.....
Chkd.....*mmB*.....

NELSON QUARRY AIR VIBRATION
ATTENUATION CURVE

FIGURE 6

Coefficient of Determination = 0.677 Standard Deviation = 0.0145



Date.....Aug 29/04.....
Project...021-1238.....

Drawn.....*MMB*.....
Chkd.....*MMB*.....



SEISMIC REPORT

Date: APRIL 11/17 Time: 11:56 AM Shot # 01-17
Weather: 20°C Terrain: UNEVEN Wind From: SW Wind Velocity: 20 KPH
Location of Blast: BULLIDGE, #2 SIDE RD.
Seismic Setup By: B. WHITE, NELSON Max. Kg/Delay: 92.15
Detonator System: ☐ Electric ☐ Non-Electric ☒ Electronic
Toe Load Product: CENTRA GOLD Column Load Product: CENTRA GOLD
Hole Dia. 4 in. Pattern: Spacing 11 ft. x Burden 11 ft.
of Decks 2 # of Rows 5 # of Holes 46
Time Between: Decks 13 ms., Holes 26 ms., Rows 136 ms.
Subdrill 2 ft. Ave. Water 60.37 ft. Ave. Hole Depth 68.25 ft. Total Tons 26417.9

Max. Vibration = 12.5 mm/sec, Max Airblast = 128.0 dbi

Monitor 1

Location: 2450 #2 SIDE RD.
Vibration: 2.53 mm/s Airblast: 111.5 dbi.

Monitor 2

Location: COLLING RD, BLIND LINE INTERSECTION, NELSON PROPERTY
Vibration: N/R mm/s Airblast: N/R. dbi.

Monitor 3

Location: SOUTH WEST CORNER, CAMISLE
Vibration: 15.6 mm/s Airblast: 113.1 dbi.

Monitor 4

Location: NOT USED
Vibration: _____ mm/s Airblast: _____ dbi.

Prepared by:

M. Nelson



SEISMIC REPORT

Date: APRIL 18/17 Time: 11:53 AM Shot # 02-17
Weather: CLEAR 10° Terrain: FLAT, Wind From: EAST Wind Velocity: 15 KPH
Location of Blast: HIGH WALL OLD SUB STATION
Seismic Setup By: B. WHITE, NELSON Max. Kg/Delay: 222.95
Detonator System: ☐ Electric ☐ Non-Electric ☒ Electronic
Toe Load Product: CENTRA GOLD Column Load Product: CENTRA GOLD
Hole Dia. 4 in. Pattern: Spacing 10 1/2 ft. x Burden 11 1/2 ft.
of Decks 1 # of Rows 3 # of Holes 27
Time Between: Decks 0 ms., Holes 13 ms., Rows 58 ms.
Subdrill 2 ft. Ave. Water 22.82 ft Ave. Hole Depth 80.5 ft Total Tons 21384.4

Max. Vibration = 12.5 mm/sec, Max Airblast = 128.0 dbi

Monitor 1

Location: NOT USED

Vibration: _____ mm/s

Airblast: _____ dbi

Monitor 2

Location: SOUTH WEST CORNER, CAMISLE

Vibration: 0.176 mm/s

Airblast: 124.1 dbi

Monitor 3

Location: 2450 #2 SIDE ROAD

Vibration: 3.66 mm/s

Airblast: 125.0 dbi

Monitor 4

Location: NOT USED

Vibration: _____ mm/s

Airblast: _____ dbi

Prepared by:

M. Wilson



SEISMIC REPORT

Date: APRIL 21/17 Time: 11:53 AM Shot # 03-17
Weather: RAIN, 10° Terrain: FLAT Wind From: WEST Wind Velocity: 22 KPH
Location of Blast: LOW BENCH
Seismic Setup By: B. WHITE, NELSON Max. Kg/Delay: 173.13
Detonator System: ☐ Electric ☐ Non-Electric ☒ Electronic
Toe Load Product: CENTRA GOLD Column Load Product: CENTRA GOLD
450 4"
Hole Dia. 12 1/2 in. Pattern: Spacing 10 1/2 ft. x Burden 11 1/2 ft.
of Decks 1 # of Rows 3 # of Holes 50
ROW 1: 2 19ms
Time Between: Decks 2 ms., Holes 13 ms., Rows 2 1/3 91ms
Subdrill 2 ft. Ave. Water 39.38 ft. Ave. Hole Depth 44.76 ft. Total Tons 21133.9

Max. Vibration = 12.5 mm/sec, Max Airblast = 128.0 dbi

Monitor 1

Location: COLLING RD BLIND LINE INTERSECTION, NELSON PROPERTY

Vibration: N/R mm/s

Airblast: N/R dbi.

Monitor 2

Location: 2450' 2 SIDE ROAD

Vibration: 3.56 mm/s

Airblast: 122.9 dbi

Monitor 3

Location: SOUTH WEST CORNER, CAMISLE

Vibration: 1.02 mm/s

Airblast: 116.7 dbi.

Monitor 4

Location: NOT USED

Vibration: _____ mm/s

Airblast: _____ dbi.

Prepared by:

M. Baker

	Customer: Nelson	Quarry: Burlington P.O. #: Blast Date: 2017-05-01	Blast Number: 17-004 Orica Order #: 2179557 Blast Time: 11:51 AM
	Blast Report		

page 1 Blaster-in-charge: **Kevin Toplis** (Print Name)

Blast Location: **South Wall** (Bench / Face)

GPS Coordinates: **43.39784** °N Latitude **79.86487** °W Longitude
Centre of Blast Centre of Blast

Wind from the: **E** at **15** kph Temperature: **6 to 10** °C

Clear: ☐ Rain: ☒ Overcast: ☐
 Partly Cloudy: ☐ Snow: ☐ Inversion: ☐ Ceiling: **185** m

- Drilling Information -

Primary Bit diam:	101.6 mm	Angle from Vertical: 0 °	# Holes: 32	= 2,230.4 ft (4 " diam)
Secondary Bit diam:	mm	°	# Holes:	= 0.0 ft (" diam)
Tertiary Bit diam:	mm	°	# Holes:	= 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,020	20,900	6,120

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	95	32.3

total explosives weight in Blast (kg): **6,152**
 Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators:	case #'s	ms	# used
UNITRONIC 600 15M			31
UNITRONIC 600 30M			63

Cord & Accessories:	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	25

Resource Deployment:

# of Blasts today (this Quarry)	1
# of Blasters (this Blast)	1
# of Helpers (this Blast)	1
# of MMU's (this Blast)	1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	Line Item (Fee per Blast)	1
3D LASER PROFILE	Enter "1" if 3D Profiled	
BORETRACK	Enter "1" if Boretraked	
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)	16.0

tonnes Blasted: **17,585** te **6,763** m³

Total tonnes per day: te

Total Holes Loaded: **32** holes

... including: Dead Holes

... and: Helper Holes

Helper Hole Collar: ft avg

Rows Blasted: **3** rows

- Pattern (Front Row) -

Burden: **10.5** ft avg

Spacing: **10.5** ft avg

Holes: **10** front row

Burden: **10.5** ft avg

Spacing: **10.5** ft avg

Holes: **22**

Bench Height: **67.7** ft avg

Sub-drill: **2.0** ft avg

Hole Depth: **69.7** ft avg

- Stone Decking -

Front Row: **4.0** ft avg

Main Body: **4.0** ft avg

Stone Decks: 31 per blast

- Collar Stemming -

Front Row: **7.0** ft avg

Main Body: **7.0** ft avg

Material used: **.75 clear**

- Charge Length -

Front Row: **58.7** ft avg

Main Body: **58.7** ft avg

- Charge Weight -

Front Row: **171.2** kg/hole

Main Body: **171.2** kg/hole

Max. per delay: **128.0** kg/delay

SD () Equation: **622.8** kg/delay

Total kg Loaded: **6,152** kg

Rock Density: **2.60** g/cc = te/m³

- Powder Factor -

Yield PF: **0.350** kg/te (actual)

Front row: **0.311** kg/te (theoretical)

Main Body: **0.311** kg/te (theoretical)

"KPI" PF: **0.000** kg/te (theoretical)

Theoretical PF: (Based on a single hole)

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

There is no video for this blast

All holes got 88kg on the bottom and then adjusted loads for the tops. A1 was only too to 50ft.

16 hours split between 1 blaster and 2 helper

Customer: **Nelson****Blast Design**Quarry: **Burlington**
P.O. #:
Blast Date: **2017-05-01**Blast Number: **17-004**
Orica Order #: **2179557**
Blast Time: **11:51 AM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39783	79.88548	0.757435	1.394265
Front Row Corner	43.39795	79.88469	0.757437	1.394251
Back Row Corner	43.39775	79.88443	0.757434	1.394246
Average (Centre of Blast)	43.39784	79.88487	0.757435	1.394254

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40246	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40246	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)	748.7	m		
Post Blast Data:	ppV:	2.6	mm/s	Trigger set at: 2.0
	frequency:	41.0	Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)
	air overpressure:	121.0	dB	Trigger set at: 115
2nd concession (orica monitor)				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043
Distance (2nd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV:	3.1	mm/s	Trigger set at: 2.0
	frequency:	43.0	Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)
	air overpressure:	108.0	dB	Trigger set at: 115
2450 2nd concession (Nelson monitor)				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV:		mm/s	Trigger set at: 2.0
	frequency:		Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)
	air overpressure:		dB	Trigger set at: 115
Enter description of seismograph location				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(748.7)^2}{30^2} \text{ kg}$$

$$= \frac{560,552}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **623** kg

Orica

Blaster-in-charge:

*Kevin Toplis*Signature required, indicating that
Blast Report is Complete & Accurate



Customer: **Nelsons**
Blast Report

Quarry: **Burlington**
P.O. #: **NA**
Blast Date: **2017-05-15**

Blast Number: **17-005**
Orica Order #: **2185675**
Blast Time: **12:35PM**

page 1

Blaster-in-charge: **Mitch Ossington**

(Print Name)

Blast Location: **South face**

(Bench / Face)

GPS Coordinates: **43.39788** °N Latitude **79.88447** °W Longitude
Centre of Blast Centre of Blast

Wind from the: **NW** at **10** kph Temperature: **16 to 20** °C

Clear: **X** Rain: Overcast:
Partly Cloudy: Snow: Inversion: Ceiling: **30000ft** m

tonnes Blasted: **21,062** te **8,101** m³
Total tonnes per day: **21,062** te **TBA** Rate Code
Total Holes Loaded: **34** holes
... including: **0** Dead Holes
... and: **0** Helper Holes
Helper Hole Collar: **0.0** ft avg
Rows Blasted: **3** rows
- Pattern (Front Row) -
Burden: **10.5** ft avg
Spacing: **11.6** ft avg
Holes: **11** front row

- Drilling Information -

Angle from Vertical
Primary Bit diam: **101.6** mm **0**° # Holes: **34** = 2,516.0 ft (**4** " diam)
Secondary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Nominal Bit Diameter:

Burden: **10.0** ft avg
Spacing: **11.6** ft avg
Holes: **23**
Bench Height: **72.0** ft avg
Sub-drill: **2.0** ft avg
Hole Depth: **74.0** ft avg
- Stone Decking -
Front Row: **4.0** ft avg
Main Body: **4.0** ft avg
Stone Decks: **33** per blast

Bulk Explosives: in (kg) out (kg) kg
CENTRA GOLD 70 **27,020** **19,900** 7,120

Packaged Explosives: cs shipped cs returned kg

Boosters: kg / unit # used kg
PENTEX 12 (OR EQUIVALENT) 0.34 **103** 35.0

total explosives weight in Blast (kg): 7,155
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators: case #'s ms # used
UNITRONIC 600 15M 34
UNITRONIC 600 20M 32
UNITRONIC 600 30M 37

Cord & Accessories: U of M # used
HARNES WIRE DUPLEX (6 PACK) 400M units 1
STEMMING PLUG MINI units 12
units

Resource Deployment:

of Blasts today (this Quarry)
of Blasters (this Blast)
of Helpers (this Blast)
of MMU's (this Blast)

Services:

GPS LAYOUT Line Item (Hourly Rate) 1
BULK TRUCK CHARGE >=5,000kg <10,000kg 1
SHOT SERVICE FEE * Line Item (Fee per Blast) 1
SEISMOGRAPH RENTAL * 1 unit in Shot Service Fee
3D LASER PROFILE Enter "1" if 3D Profiled
BORETRACK Enter "1" if Boretraked
LABOUR CHARGE (enter HOURS) Must be pre-authorized

lb/yd³

Cost Reduction Notes (this Blast) - change in Blt , B. S. Expl or IS from previous Blast:

3D laser profile = 0.5hrs

Blaster hours = 6.5hrs

Helper hours = 6

All Nelsons seismographs used.

Salesman will have to provide a rate code.

- Powder Factor -

Yield PF: **0.340** kg/te (actual)
Front row: **0.287** kg/te (theoretical)
Main Body: **0.301** kg/te (theoretical)
"KPI" PF: **#DIV/0!** kg/te (theoretical)



Customer: **Nelsons**
Blast Design

Quarry: **Burlington**
P.O. #: **NA**
Blast Date: **2017-05-15**

Blast Number: **17-005**
Orica Order #: **2185675**
Blast Time: **12:35PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.39805	79.88465
Front Row Corner	43.39790	79.88466
Back Row Corner	43.39770	79.88439
Average (Centre of Blast)	43.39788	79.88447

(N) Radians	(W) Radians
0.757439	1.394248
0.757436	1.394247
0.757433	1.394246
0.757436	1.394247

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading		
	2nd Reading		
	Average	0.00000	0.00000
	Distance (1st Seis. From Centre of Blast)	0.0 m	
	Post Blast Data: ppV:	0.1 mm/s	Trigger set at: 2.0 mm/s
	frequency:	Hz	V / T / L T (Vertical, Transverse or Longitudinal)
	air overpressure:	88.0 dB	Trigger set at: 115 dB

(N) Radians	(W) Radians
0.000000	0.000000

Colling Rd

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading		
	2nd Reading		
	Average	0.00000	0.00000
	Distance (2nd Seis. From Centre of Blast)	0.0 m	
	Post Blast Data: ppV:	3.8 mm/s	Trigger set at: 2.0 mm/s
	frequency:	Hz	V / T / L ? (Vertical, Transverse or Longitudinal)
	air overpressure:	111.5 dB	Trigger set at: 115 dB

(N) Radians	(W) Radians
0.000000	0.000000

2450 #2 sideroad

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading		
	2nd Reading		
	Average	0.00000	0.00000
	Distance (3rd Seis. From Centre of Blast)	0.0 m	
	Post Blast Data: ppV:	3.3 mm/s	Trigger set at: 2.0 mm/s
	frequency:	Hz	V / T / L ? (Vertical, Transverse or Longitudinal)
	air overpressure:	95.9 dB	Trigger set at: 115 dB

(N) Radians	(W) Radians
0.000000	0.000000

Camisle

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor:

$$W = \frac{D^2}{2}$$

$$= \frac{(0)^2}{2} \text{ kg}$$

$$= \frac{0}{0} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = kg

Orica
Blaster-in-charge:

Mitch Ossington

Signature required, indicating that
Blast Report is Complete & Accurate

Customer: **Nelson****Blast Report**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-05-17**Blast Number: **17-006**Orica Order #: **2187001**Blast Time: **11:53 AM**

page 1

Blaster-in-charge: **Kevin Toplis** (Print Name)Blast Location: **Lower middle bench** (Bench / Face)GPS Coordinates: **43.40414** °N Latitude **79.88442** °W Longitude
Centre of Blast Centre of BlastWind from the: **SW** at **40** kph Temperature: **26 to 30** °CClear: ☐ Rain: ☒ Overcast: ☒
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: **9,144** m**- Drilling Information -**

Angle from Vertical Nominal Bit Diameter:

Primary Bit diam: **101.6** mm **0**° # Holes: **41** = 1,689.2 ft (4 " diam)

Secondary Bit diam: **114.3** mm " # Holes: **1** = 41.2 ft (4 1/2 " diam)

Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,060	22,200	4,860

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	84	28.6

total explosives weight in Blast (kg): **4,889**Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators:	case #'s	ms	# used
UNITRONIC 600 6M			41
UNITRONIC 600 15M			43

Cord & Accessories:	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	3
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>=2,000kg <5,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)	16.0

tonnes Blasted: **15,010** te **5,773** m³

Total tonnes per day: **15,010** te

Total Holes Loaded: **42** holes

... including: Dead Holes

... and: Helper Holes

Helper Hole Collar: ft avg

Rows Blasted: **2** rows

- Pattern (Front Row) -

Burden: **10.5** ft avg

Spacing: **11.5** ft avg

Holes: **22** front row

Burden: **10.5** ft avg

Spacing: **11.5** ft avg

Holes: **20**

Bench Height: **40.2** ft avg

Sub-drill: **1.0** ft avg

Hole Depth: **41.2** ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Stone Decks: **0** per blast**- Collar Stemming -**

Front Row: **7.0** ft avg

Main Body: **7.0** ft avg

Material used: **.75** clear**- Charge Length -**

Front Row: **34.2** ft avg

Main Body: **34.2** ft avg

- Charge Weight -

Front Row: **99.7** kg/hole

Main Body: **99.7** kg/hole

Max. per delay: **140.0** kg/delay

SD () Equation: **325.6** kg/delayTotal kg Loaded: **4,889** kgRock Density: **2.60** g/cc = te/m³**- Powder Factor -**

1.427 lb/yd³ Yield PF: **0.326** kg/te (actual)

1.223 lb/yd³ Front row: **0.279** kg/te (theoretical)

1.223 lb/yd³ Main Body: **0.279** kg/te (theoretical)

0.000 lb/yd³ "KPI" PF: **0.000** kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit B.S. Expl or IS from previous Blast:

Hole B2 is a 4 1/2"

Hole B1 slumped to 18ft, a 15m uni was used instead of a 6m uni. The hole was plugged 10ft.

Hole collars adjusted: A22 10ft, A21-19 10ft, A18-14 8ft.

There was no Orica seismograph used.

Labour hours is split between 1 blaster and 2 helpers

Customer: **Nelson****Blast Design**Quarry: **Burlington**
P.O. #:
Blast Date: **2017-05-17**Blast Number: **17-006**
Orica Order #: **2187001**
Blast Time: **11:53 AM**

page 2

Blast Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast		43.40414	79.88444	0.757545	1.394246
Front Row Corner		43.40388	79.88413	0.757541	1.394241
Back Row Corner		43.40440	79.88469	0.757550	1.394251
Average (Centre of Blast)		43.40414	79.88442	0.757545	1.394246

1st Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40246	79.87814	0.757516	1.394137
2nd Reading					
Average		43.40246	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)		541.3	m		
Post Blast Data:	ppV:	DID	mm/s	Trigger set at: 2.0	mm/s
	frequency:	NOT	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
	air overpressure:	TRIGGER	dB	Trigger set at: 115	dB
2nd concession (Nelson monitor)					

2nd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.71939	80.38847	0.763047	1.403043
2nd Reading					
Average		43.71939	80.38847	0.763047	1.403043
Distance (2nd Seis. From Centre of Blast)		0.0	m		
Post Blast Data:	ppV:	1.1	mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure:	111.8	dB	Trigger set at: 115	dB
2450 2nd concession (Nelson monitor)					

3rd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)		0.0	m		
Post Blast Data:	ppV:		mm/s	Trigger set at: 2.0	mm/s
	frequency:		Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure:		dB	Trigger set at: 115	dB
Enter description of seismograph location					

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(541.3)^2}{30^2} \text{ kg} \\
 &= \frac{293,006}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = **326** kg

Orica

Blaster-in-charge:

*Kevin Toplis*Signature required, indicating that
Blast Report is Complete & Accurate



Customer: **Nelsons**
Blast Report

Quarry: **Burlington**
P.O. #: **NA**
Blast Date: **2017-05-29**

Blast Number: **17-007**
Orica Order #: **2191786**
Blast Time: **12:00PM**

page 1

Blaster-in-charge: **Mitch Ossington**

(Print Name)

Blast Location: **South face**

(Bench / Face)

GPS Coordinates: **43.39805** °N Latitude **79.88433** °W Longitude
Centre of Blast Centre of Blast

Wind from the: **SE** at **5** kph Temperature: **21 to 25** °C

Clear: ☒ Rain: ☐ Overcast: ☐
Partly Cloudy: ☐ Snow: ☐ Inversion: ☐ Ceiling: **30000ft** m

tonnes Blasted: **20,898** te **7,886** m³
Total tonnes per day: **20,898** te TBA Rate Code

Total Holes Loaded: **30** holes

... including: **0** Dead Holes

... and: **0** Helper Holes

Helper Hole Collar: **0.0** ft avg

Rows Blasted: **3** rows

- Pattern (Front Row) -

Burden: **10.5** ft avg

Spacing: **11.5** ft avg

Holes: **10** front row

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 ° # Holes: 30	= 2,442.0 ft (4 " diam)
Secondary Bit diam: mm	0 ° # Holes:	= 0.0 ft (" diam)
Tertiary Bit diam: mm	" # Holes:	= 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,530	26,710	6,820

Packaged Explosives:	cs shipped	cs returned	kg
----------------------	------------	-------------	----

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	118	40.1

total explosives weight in Blast (kg): **6,860**

Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators:	case #'s	ms	# used
UNITRONIC 800 6M			29
UNITRONIC 800 20M			29
UNITRONIC 800 30M			60

Cord & Accessories:	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)	1
# of Blasters (this Blast)	1
# of Helpers (this Blast)	2
# of MMU's (this Blast)	1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit In Shot Service Fee	0
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	

Burden: **10.0** ft avg

Spacing: **11.5** ft avg

Holes: **20**

Bench Height: **79.4** ft avg

Sub-drill: **2.0** ft avg

Hole Depth: **81.4** ft avg

- Stone Decking -

Front Row: **4.0** ft avg

Main Body: **4.0** ft avg

Stone Decks: **29** per blast

- Collar Stemming -

Front Row: **10.0** ft avg

Main Body: **7.0** ft avg

Material used: **1/2" crush**

- Charge Length -

Front Row: **67.4** ft avg

Main Body: **70.4** ft avg

- Charge Weight -

Front Row: **196.5** kg/hole

Main Body: **205.3** kg/hole

Max. per delay: **130.0** kg/delay

SD () Equation: **0.0** kg/delay

Total kg Loaded: **6,860** kg

Rock Density: **2.86** g/cc = te/m³

- Powder Factor -

1.466 lb/yd³

1 220 lb/yd³

1 338 lb/yd³

lb/yd³

Yield PF: **0.328** kg/te (actual)

Front row: **0.273** kg/te (theoretical)

Main Body: **0.300** kg/te (theoretical)

"KPI" PF: **#DIV/0!** kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

saleman will provide a rate code.

Blastr Hours= 6hrs

Helper Hours= 10hrs



Customer: **Nelsons**
Blast Design

Quarry: **Burlington**
P.O. #: **NA**
Blast Date: **2017-05-29**

Blast Number: **17-007**
Orica Order #: **2191786**
Blast Time: **12:00PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39814	79.88442	0.757440	1.394246
Front Row Corner	43.39803	79.88434	0.757439	1.394245
Back Row Corner	43.39798	79.88423	0.757438	1.394243
Average (Centre of Blast)	43.39805	79.88433	0.757439	1.394245

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Sels. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: DNT	mm/s	Trigger set at: 2.0 mm/s	
	frequency: DNT	Hz	V / T / L: T (Vertical, Transverse or Longitudinal)	
	air overpressure: DNT	dB	Trigger set at: 115 dB	
Colling Rd				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (2nd Sels. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 3.3 mm/s	mm/s	Trigger set at: 2.0 mm/s	
	frequency: 34.0 Hz	Hz	V / T / L: ? (Vertical, Transverse or Longitudinal)	
	air overpressure: 94.0 dB	dB	Trigger set at: 115 dB	
2450 #2 sideroad				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Sels. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 2.4 mm/s	mm/s	Trigger set at: 2.0 mm/s	
	frequency: 98.0 Hz	Hz	V / T / L: ? (Vertical, Transverse or Longitudinal)	
	air overpressure: 98.0 dB	dB	Trigger set at: 115 dB	
Camisle				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(0)^2}{30^2} \text{ kg} \\
 &= \frac{0}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = **0** kg

Orica
Blaster-in-charge:

Mitch Ossington

Signature required, indicating that
Blast Report is Complete & Accurate



Customer: **Nelson**
Blast Report

Quarry: Burlington
P.O. #: n/a
Blast Date: 2017-06-01

Blast Number: 17-008
Orica Order #: 2194148
Blast Time: 2:38 PM

page 1

Master-in-charge: Ken George

Blast Location: East Middle
GPS Coordinates: 0 00000 °N Latitude 0 00000 °W Longitude

Wind from the: SW at 25 kph Temperature: -16 to -20 °C

Clear: X Rain: Overcast:
Partly Cloudy: Snow: Inversion: Ceiling: m

tonnes Blasted: 29,085 te 10,976 m³
Total tonnes per day: te
Total Holes Loaded: 86 holes
Including: 0 Dead Holes
.. and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 4 rows
Burden: 10.5 ft avg
Spacing: 11.5 ft avg
Holes: 27

Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0 # Holes: 86 = 3,382.0 ft (4 " diam)
Secondary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm " # Holes: = 0.0 ft (" diam)

Burden: 10.5 ft avg
Spacing: 11.5 ft avg
Bench Height: 37.3 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 39.3 ft avg
Front Row: 0.0 ft avg
Main Body: 0.0 ft avg
Stone Decks: 0 per blast

Bulk Explosives: in (kg) out (kg) kg
CENTRA GOLD 70 26,860 17,350 9,510

Packaged Explosives: cs shipped cs returned kg

Boosters: kg / unit # used kg
PENTEX 12 (OR EQUIVALENT) 0 34 174 59.2

total explosives weight in Blast (kg): 9,569
Pkgd Prod (0 kg) % of Total kg: 0 0%

Detonators: case #'s ms # used
UNITRONIC 600 6M 84
UNITRONIC 600 15M 90

Cord & Accessories: U of M # used
HARNESS WIRE DUPLEX (6 PACK) 400M units
units
units

1.470 lb/yd³

Yield PF: 0.329 kg/te (actual)

lb/yd³

"KPI" PF: #DIV/0! kg/te (theoretical)

1

1

3 Angled holes drill underneath concrete tunnel

2

MMU ran out of ammonium nitrate, 100% emulsion blend used to load last 9 holes

1

Services:

GPS LAYOUT Line Item (Hourly Rate) 1
BULK TRUCK CHARGE >=5,000kg <10,000kg 1
SHOT SERVICE FEE * Line Item (Fee per Blast) 1
SEISMOGRAPH RENTAL * 1 unit in Shot Service Fee
3D LASER PROFILE Line Item (Hourly Rate) 1
BORETRACK Line Item (Hourly Rate) 1



Customer: **Nelson**
Blast Design

Quarry: Burlington
P.O #: n/a
Blast Date: 2017-06-01

Blast Number: 17-008
Orica Order #: 2194148
Blast Time: 2:38 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast				
Front Row Corner				
Back Row Corner				
Average (Centre of Blast)	0.00000	0.00000	0.000000	0.000000

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (1st Seis. From Centre of Blast)		m		
	Post Blast Data: ppV:	5.8	mm/s	2.0	
	frequency:		Hz	T	
	air overpressure:	101.0	dB	115	
	2450 #2 Side Rd				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (2nd Seis. From Centre of Blast)		m		
	Post Blast Data: ppV:	3.8	mm/s	2.0	
	frequency:		Hz	?	
	air overpressure:	91.5	dB	115	
	Northwest				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)		m		
	Post Blast Data: ppV:	1.5	mm/s	2.0	
	frequency:		Hz	?	
	air overpressure:	88.0	dB	115	
	Southwest				

Scaling Factor denotes the degree of Blast confinement

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor:

$$W = \frac{D^2}{2}$$

$$= \frac{(0)^2}{2} \text{ kg}$$

$$= \frac{0}{0} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = kg

Orica
Blaster-in-charge:

Ken George

 <small>ORICA</small> <small>The Blasting Professionals</small>	Customer: Nelsons	Quarry: Burlington	Blast Number: 17-009
	<h2 style="margin: 0;">Blast Report</h2>	P.O. #: NA	Orica Order #: 2191786
		Blast Date: 2017-06-08	Blast Time: 12:00PM

page 1
 Master-in-charge: **Mitch Ossington** (Print Name)

Blast Location: **South face** (Bench / Face)

GPS Coordinates: **43.39805** °N Latitude **79.88433** °W Longitude
Centre of Blast Centre of Blast

Wind from the: **SE** at **5** kph Temperature: **21 to 25** °C

Clear: ☒ Rain: ☐ Overcast: ☐ Partly Cloudy: ☐ Snow: ☐ Inversion: ☐ Ceiling: **30000** m

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm # Holes: 30		= 2,442.0 ft (4 " diam)
Secondary Bit diam: mm # Holes:		= 0.0 ft (" diam)
Tertiary Bit diam: mm # Holes:		= 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,530	26,710	6,820

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	118	40.1

total explosives weight in Blast (kg): **6,860**
 Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators:	case #'s	ms	# used
UNITRONIC 600 6M			29
UNITRONIC 600 20M			29
UNITRONIC 600 30M			60

Cord & Accessories:	U of M	# used
HARNESSE WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

Line Item	Hourly Rate	
GPS LAYOUT		1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	

tonnes Blasted:	20,898 te	7,886 m ³
Total tonnes per day:	20,898 te	TBA Rate Cube
Total Holes Loaded:	30 holes	
... including:	0 Dead Holes	
... and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	
- Pattern (Front Row) -		
Burden:	10.5 ft avg	
Spacing:	11.5 ft avg	
# Holes:	10 front row	
Burden:	10.0 ft avg	
Spacing:	11.5 ft avg	
# Holes:	20	
Bench Height:	79.4 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	81.4 ft avg	
- Stone Decking -		
Front Row:	4.0 ft avg	
Main Body:	4.0 ft avg	
# Stone Decks:	29 per blast	
- Collar Stemming -		
Front Row:	10.0 ft avg	
Main Body:	7.0 ft avg	
Material used:	1/2" crush	
- Charge Length -		
Front Row:	67.4 ft avg	
Main Body:	70.4 ft avg	
- Charge Weight -		
Front Row:	196.5 kg/hole	
Main Body:	205.3 kg/hole	
Max. per delay:	130.0 kg/delay	
SD () Equation:	0.0 kg/delay	
Total kg Loaded:	6,860 kg	
Rock Density:	2.65 g/cc = te/m ³	
- Powder Factor -		
Yield PF:	0.328 kg/te (actual)	
Front row:	0.273 kg/te (theoretical)	
Main Body:	0.300 kg/te (theoretical)	
"KPI" PF:	#DIV/0! kg/te (theoretical)	


Theoretical PF: (Based on a single hole)

1.466 lb/yd³ 1.220 lb/yd³ 1.338 lb/yd³ ##### lb/yd³

Cost Reduction Notes (this Blast) - change in Bl, S, Exp or IS from previous Blast:

saeman will provide a rate code.

Blaster Hours= 6hrs
Helper Hours= 10hrs

	Customer: Nelsons	Quarry: Burlington	Blast Number: 17-009
	Blast Design	P.O. #: NA	Orica Order #: 2191786
		Blast Date: 2017-06-08	Blast Time: 12:00PM

page 2

Blast Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast		43.39814	79.88442	0.757440	1.394246
Front Row Corner		43.39803	79.88434	0.757439	1.394245
Back Row Corner		43.39798	79.88423	0.757438	1.394243
Average (Centre of Blast)		43.39805	79.88433	0.757439	1.394245

1st Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)		0.0	m		
Post Blast Data:					
ppV: DNT		mm/s	Trigger set at: 2.0	mm/s	
frequency: DNT		Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
air overpressure: DNT		dB	Trigger set at: 115 dB		
Colling Rd					

2nd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (2nd Seis. From Centre of Blast)		0.0	m		
Post Blast Data:					
ppV: 3.3		mm/s	Trigger set at: 2.0	mm/s	
frequency: ?		Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
air overpressure: 94.0		dB	Trigger set at: 115 dB		
2450 #2 sideroad					

3rd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)		0.0	m		
Post Blast Data:					
ppV: 2.4		mm/s	Trigger set at: 2.0	mm/s	
frequency: ?		Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
air overpressure: 88.0		dB	Trigger set at: 115 dB		
Camisle					

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.
A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(0)^2}{30^2} \text{ kg} \\
 &= \frac{0}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = **0** kg

Orica
Blaster-in-charge:

Mitch Ossington

Signature required, indicating that
Blast Report is Complete & Accurate



Customer: **Nelsons**
Blast Report

Quarry: **Burlington**
P.O. #: **NA**
Blast Date: **2017-06-21**

Blast Number: **17-010**
Orica Order #: **2202619**
Blast Time: **12:35PM**

page 1

Blaster-in-charge: **Mitch Ossington**

Blast Location: **Lower Middle**
GPS Coordinates: **43.40406** °N Latitude **79.88412** °W Longitude

Wind from the: **W** at **10** kph Temperature: **21 to 25** °C

Clear: Rain: Overcast:
Partly Cloudy: **X** Snow: Inversion: Ceiling: **30000** m

tonnes Blasted: **25,680** te **9,690** m³
Total tonnes per day: **25,680** te TBA
Total Holes Loaded: **84** holes
... including: **0** Dead Holes
... and: **0** Helper Holes
Helper Hole Collar: **0.0** ft avg
Rows Blasted: **3** rows

Burden: **12.0** ft avg
Spacing: **10.5** ft avg
Holes: **28**

Nominal Bit Diameter:
Primary Bit diam: **101.6** mm **0** " # Holes: **78** = **3,182.4** ft (**4** " diam)
Secondary Bit diam: **114.3** mm **0** " # Holes: **6** = **244.8** ft (**4 1/2** " diam)
Tertiary Bit diam: mm " # Holes: = **0.0** ft (" diam)

Burden: **9.0** ft avg
Spacing: **10.5** ft avg

Bench Height: **38.8** ft avg
Sub-drill: **2.0** ft avg
Hole Depth: **40.8** ft avg

Bulk Explosives: in (kg) out (kg) kg
CENTRA GOLD 70 **27,170** **18,720** **8,450**

Packaged Explosives: cs shipped cs returned kg

Front Row: **10.0** ft avg
Main Body: **0.0** ft avg

Stone Decks: **1** per blast

Boosters: kg / unit # used kg
PENTEX 12 (OR EQUIVALENT) **0.34** **95** **32.3**

Front Row: **8.0** ft avg
Main Body: **7.0** ft avg
Material used: **1/2"** crush

total explosives weight in Blast (kg): **8,482**
Pkgd Prod (0 kg) % of Total kg: **0.0%**

Front Row: **22.8** ft avg
Main Body: **33.8** ft avg

Detonators: case #'s ms # used
UNITRONIC 600 15M **91**
UNITRONIC 600 6M **4**

Front Row: **66.5** kg/hole
Main Body: **98.6** kg/hole
Max. per delay: **117.0** kg/delay
SD () Equation: **0.0** kg/delay
Total kg Loaded: **8,482** kg
Rock Density: **2.65** g/cc = **te/m³**

Cord & Accessories: U of M # used
HARNES WIRE DUPLEX (6 PACK) 400M units **1**
STEMMING PLUG MINI units **5**

1.475 lb/yd³

Yield PF: **0.330** kg/te (actual)

Resource Deployment:

of Blasts today (this Quarry):

of Blasts (this Blast):

of helpers this Blast:

of H&M's this Blast:

lb/yd³

"KPI" PF: **#DIV/0!** kg/te (theoretical)

Services:

GPS LAYOUT Line Item (Hourly Rate) **1** Blaster Hours= **6.5**
BULK TRUCK CHARGE >=5,000kg <10,000kg **1** Helper Hours= **12**
SHOT SERVICE FEE * Line Item (Fee per Blast) **1**
SEISMOGRAPH RENTAL * 1 unit in Shot Service Fee **0**
3D LASER PROFILE Line Item (Hourly Rate) **1**
BORETRACK Enter "1" if Boretraked **0**
LABOUR CHARGE (enter HOURS) Must be pre-authorized

Customer wants to try higher collars in back row to try to break the top better on the middle bench.



Customer: **Nelsons**
Blast Design

Quarry: **Burlington**
P.O. #: **NA**
Blast Date: **2017-06-21**

Blast Number: **17-010**
Orica Order #: **2202619**
Blast Time: **12:35PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40401	79.88408
Front Row Corner	43.40370	79.88380
Back Row Corner	43.40447	79.88447
Average (Centre of Blast)	43.40406	79.88412

(N) Radians	(W) Radians
0.757543	1.394240
0.757537	1.394235
0.757551	1.394247
0.757544	1.394241

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading		
2nd Reading		
Average	0.00000	0.00000

(N) Radians	(W) Radians
0.000000	0.000000

Distance (1st Seis. From Centre of Blast)	0.0	m
Post Blast Data:	ppV: DNT	mm/s
	frequency: DNT	Hz
	air overpressure: DNT	dB

Colling Rd

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading		
2nd Reading		
Average	0.00000	0.00000

(N) Radians	(W) Radians
0.000000	0.000000

Distance (2nd Seis. From Centre of Blast)	0.0	m
Post Blast Data:	ppV: DNT	mm/s
	frequency: DNT	Hz
	air overpressure: DNT	dB

2450 #2 sideroad

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading		
2nd Reading		
Average	0.00000	0.00000

(N) Radians	(W) Radians
0.000000	0.000000

Distance (3rd Seis. From Centre of Blast)	0.0	m
Post Blast Data:	ppV: DNT	mm/s
	frequency: DNT	Hz
	air overpressure: DNT	dB

Camisle

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned} W &= \frac{D^2}{30^2} \\ &= \frac{(0)^2}{30^2} \text{ kg} \\ &= \frac{0}{900} \text{ kg} \end{aligned}$$

Maximum Indicated Charge Weight per Delay = **0** kg

Orica
Blaster-in-charge:

Mitch Ossington

Customer: **Nelsons****Blast Report**Quarry: **Burlington**P.O. #: **NA**Blast Date: **2017-06-20**Blast Number: **17-011**Orica Order #: **2201920**Blast Time: **12:02PM**

page 1

Blaster-in-charge: **Mitch Ossington** (Print Name)Blast Location: **South Wall** (Bench / Face)GPS Coordinates: **43.39816** °N Latitude **79.88425** °W Longitude

Centre of Blast:

Centre of Blast:

Wind from the: **SW** at **10** kphTemperature: **21 to 25** °CClear: ☐Rain: ☐Overcast: ☐Partly Cloudy: ☒Snow: ☐Inversion: ☐Ceiling: **2540ft** mtonnes Blasted: **23,583** te **8,899** m³Total tonnes per day: **23,583** te **TBA** Rate CodeTotal Holes Loaded: **36** holes... including: **0** Dead Holes... and: **0** Helper HolesHelper Hole Collar: **0.0** ft avg# Rows Blasted: **3** rows

- Pattern (Front Row) -

Burden: **18.0** ft avgSpacing: **6.0** ft avg# Holes: **16** front row

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: **101.6** mm **0**° # Holes: **36** = 3,027.6 ft (4 " diam)Secondary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)

Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Burden: **10.0** ft avgSpacing: **10.5** ft avg# Holes: **20**Bench Height: **82.1** ft avgSub-drill: **2.0** ft avgHole Depth: **84.1** ft avg

- Stone Decking -

Front Row: **4.0** ft avgMain Body: **4.0** ft avg# Stone Decks: **35** per blast

- Collar Stemming -

Front Row: **8.0** ft avgMain Body: **7.0** ft avgMaterial used: **1/2"** crush

- Charge Length -

Front Row: **72.1** ft avgMain Body: **73.1** ft avg

- Charge Weight -

Front Row: **210.2** kg/holeMain Body: **213.2** kg/holeMax. per delay: **150.0** kg/delaySD (j) Equation: **0.0** kg/delayTotal kg Loaded: **8,379** kgRock Density: **2.65** g/cc = te/m³

- Powder Factor -

1.587 lb/yd³**1.411** lb/yd³**1.472** lb/yd³##### lb/yd³Yield PF: **0.355** kg/te (actual)Front row **0.316** kg/te (theoretical)Main Body: **0.330** kg/te (theoretical)"KPI" PF: **#DIV/0!** kg/te (theoretical)**Bulk Explosives:**

in (kg) out (kg) kg

CENTRA GOLD 70 **30,240** **21,910** **8,330****Packaged Explosives:**

cs shipped cs returned kg

Boosters:

kg / unit # usec kg

PENTEX 12 (OR EQUIVALENT) **0.34** **143** **48.6**total explosives weight in Blast (kg): **8,379**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators:**

case #'s ms # used

UNITRONIC 600 9M **35****UNITRONIC 600 15M** **36****UNITRONIC 600 30M** **72****Cord & Accessories:**

U of M # used

HARNES WIRE DUPLEX (6 PACK) 400M units **1**

Resource Deployment:

of Blasts today (this Quarry) **1**# of Blasters (this Blast) **1**# of Helpers (this Blast) **Note Exception** **2**# of MMU's (this Blast) **1****Services:**GPS LAYOUT Line Item (Hourly Rate) **1**BULK TRUCK CHARGE >=5,000kg <10,000kg **1**SHOT SERVICE FEE * Line Item (Fee per Blast) **1**SEISMOGRAPH RENTAL * 1 unit in Shot Service Fee **0**3D LASER PROFILE Line Item (Hourly Rate) **1**BORETRACK Enter "1" if Boretraked **0**

LABOUR CHARGE (enter HOURS) Must be pre-authorized


Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

Hole A8 bottom dets would not pull so a 15m unitronic was used as a safety

Hole A4 collapsed at collar, no top deck.

Blaster Hours= 6.5

Helper Hours= 11



Customer: Nelsons

Blast Design

Quarry: Burlington

P.O. #: NA

Blast Date: 2017-06-20

Blast Number: 17-011

Orica Order #: 2201920

Blast Time: 12:02PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39823	79.88432	0.757442	1.394244
Front Row Corner	43.39816	79.88428	0.757441	1.394244
Back Row Corner	43.39810	79.88415	0.757440	1.394241
Average (Centre of Blast)	43.39816	79.88425	0.757441	1.394243

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: DNT	mm/s	Trigger set at: 2.0	mm/s
	frequency: DNT	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
	air overpressure: DNT	dB	Trigger set at: 115	dB
Colling Rd				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (2nd Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 2.0	mm/s	Trigger set at: 2.0	mm/s
	frequency: ?	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 108.4	dB	Trigger set at: 115	dB
2450 #2 sideroad				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 2.4	mm/s	Trigger set at: 2.0	mm/s
	frequency: ?	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 101.9	dB	Trigger set at: 115	dB
Camisle				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = kg

Orica

Blaster-in-charge:

Mitch Ossington

Signature required indicating that
blast design is complete & accurate

Customer: **Nelsons****Blast Design**Quarry: **Burlington**
P.O. #: **NA**
Design Date: **2017-06-20**Blast Number: **17-011**
Orica Order #:

page 1

Blastmaster-in-charge: **Mitch Ossington** (Print Name)Blast Location: **South Face** (Bench / Face)
GPS Coordinates: **43.39805** °N Latitude **79.88433** °W Longitude
Centre of Blast Centre of BlastDesign to Blasted: **23,583** te
Total Holes Loaded: **36** holes
... including: **0** Dead Holes
... and: **0** Helper Holes
Helper Hole Collar: **0.0** ft avg
Rows Blasted: **3** rows**- Drilling Information -**

	Angle from Vertical		Nominal Bit Diameter:
Primary Bit diam:	101.6 mm	0 °	# Holes: 36 = 3,027.6 ft (4 " diam)
Secondary Bit diam:	mm	0 °	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam:	mm	0 °	# Holes: = 0.0 ft (" diam)

- Design Pattern (Front Row) -Burden: **18.0** ft avg
Spacing: **6.0** ft avg
Holes: **16** front row**- Design Pattern (Main Body) -**Burden: **10.0** ft avg
Spacing: **10.5** ft avg
Holes: **20** main body
Bench Height: **82.1** ft avg
Sub-drill: **2.0** ft avg
Hole Depth: **84.1** ft avg**- Design Stone Decking -**Front Row: **4.0** ft avg
Main Body: **4.0** ft avg**- Design Collar Stemming -**Front Row: **7.0** ft avg
Main Body: **7.0** ft avgMaterial used: **1/2" crush****- Design Charge Length -**Front Row: **73.1** ft avg
Main Body: **73.1** ft avg**- Design Charge Weight -**Front Row: **213.2** kg/hole
Main Body: **213.2** kg/hole
Max Chge Wt / delay: **130.0** kg/delay
150Required kg Loaded: **8,565** kg
Rock Density: **2.65** g/cc = te/m³**- Design Powder Factor -**Expected Yield PF: **0.363** kg/te (actual)
Front row: **0.320** kg/te (theoretical)
Main Body: **0.330** kg/te (theoretical)
"KPI" PF: **0.326** kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Hole A8 bottom dets would not pull, put in a 15m qs safety.

Hole A4 collapsed at collar, no top deck.

Bulk Explosives Req'd:	kg
CENTRA GOLD 70	ChargeWt.exe 8,500

Pkgd Explosives Req'd:	kg
-------------------------------	----

Boosters Req'd:	kg/u	# used	kg
PENTEX 16 (OR EQUIVALENT)	0.45	144	65.4

total explosives weight in Blast (kg): **8,565**
Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators Req'd:	ms	# req'd
UNITRONIC 600 30M		72
UNITRONIC 600 45M 20m		36
UNITRONIC 600 9M		36

Cord & Access. Req'd:	U of M	# req'd
----------------------------------	--------	---------

IRE DUPLEX (6 PACK) 400M	units	1
STEMMING PLUG MINI	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note: Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>=5,000kg	<10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Fee per Blast)		1
BORETRACK	Enter "1" if Boretraked		
LABOUR CHARGE (enter HOURS Must be pre-authorized)			



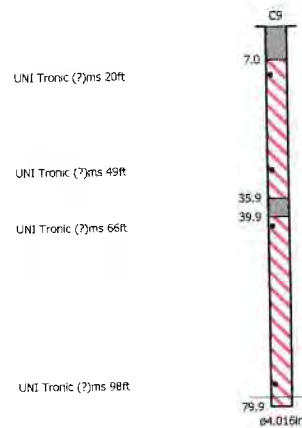
Customer: **Nelsons**
Blast Design

Quarry: **Burlington**
P.O. #:
Blast Date: ~~2017-08-01~~
2017/06/20

Blast Number: **17-011**
~~17-007~~
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mitch Ossington

#

Quarry Manager:

Signature required, indicating
sign off on Blast Design



Orica Canada Inc.
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

Bill of Lading / Connaissance

*BLASTER MITCH
HELP KEITH
BRAD*

GROSS / BRUT	
TARE	
NET	
TIME IN HEURE D'ENTRÉE 700	TIME OUT HEURE SORTIE 1230
ORDER NUMBER N° DE COMMANDE 2201920	B/L NUMBER N° DE CONNAISSEMENT 85682632

REPRINT

PAGE **2**

DATE REQUIRED DATE REQUISE 20 Jun 2017	TIME REQUIRED HEURE REQUISE 00:00:00	INVOICE TO / BUYER FACTURÉ À / ACHETEUR NELSON AGGREGATE COMPANY	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT n/a
DATE SHIPPED EXPÉDIÉ LE 20 Jun 2017	FREIGHT TERMS CONDITIONS DE LIVRAISON FOB Dest'n, Own Truck	SHIP. MAG. LIC. PERMIS EXPÉDITEUR F-73289	VEHICLE NO. N° DE VÉHICULE 1SD01
SHIP VIA TRANSPORTEUR Orica Truck		ROUTING ITINÉRAIRE STANDARD	MAG. LIC. NO. N° DE PERMIS

QTY. QTYE	UM	QTY. RET'D QTYE RET.	QTY. SOLD QTYE FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
196	PC	53	143	PENTEX BC 340 (49/CS)	4	71.540
2	PC	1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
60	PC	25	35	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
66	PC	30	36	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
108	PC	36	72	*uni tronic 600-30M C/Z SPL(100')36P	3	31.752
100	PC	100	0	MINI STEM PLUGS - PART #6015		0.700
1	PC			LICENSED BLASTER		
1.0	HR			LABOUR CHARGE		
1	PC			ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT						126.998 KG
**** TOTAL PACKAGES ****						10
GHS/WHMIS SDS documents available Website: www.oricaminingsservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)						

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE ERAP 2-1510	EMERGENCY RESPONSE NO./24 HOUR NUMBER TELEPHONE D'URGENCE/24 HEURE NUMERO 1-877-561-3636	PLACARDS OFFERED / PLACARDS OFFERT YES / OUI NO / NON	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENT À Orica Canada Inc. 301 rue hotel de ville Brownburg-Chatham, QC J6G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE \$	NETTE No. CONV PRESSAGE WT AGREEMENT NO.

SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR GRAND VALLEY	CARRIER / TRANSPORTEUR Orica Truck	CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY
SHIPPER'S SIGNATURE (PLEASE PRINT) / NOM D'EXPÉDITEUR <i>Brad Hutchins</i>	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR <i>B. Hutchins</i>	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE <i>Brad Hutchins</i>	DATE 20 JUN 17	SIGNATURE <i>B. Hutchins</i>
DATE 20 JUN 17	DATE 20 JUN 17	DATE 20 JUN 17

ORIGINAL - NOT NEGOTIABLE
ORIGINAL - NON NEGOCIABLE

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT/CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ÊTRE SIGNÉ PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO
**** PAGE 2 OF 2 ****
D.F.G S772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

1st row burden: 18.0ft

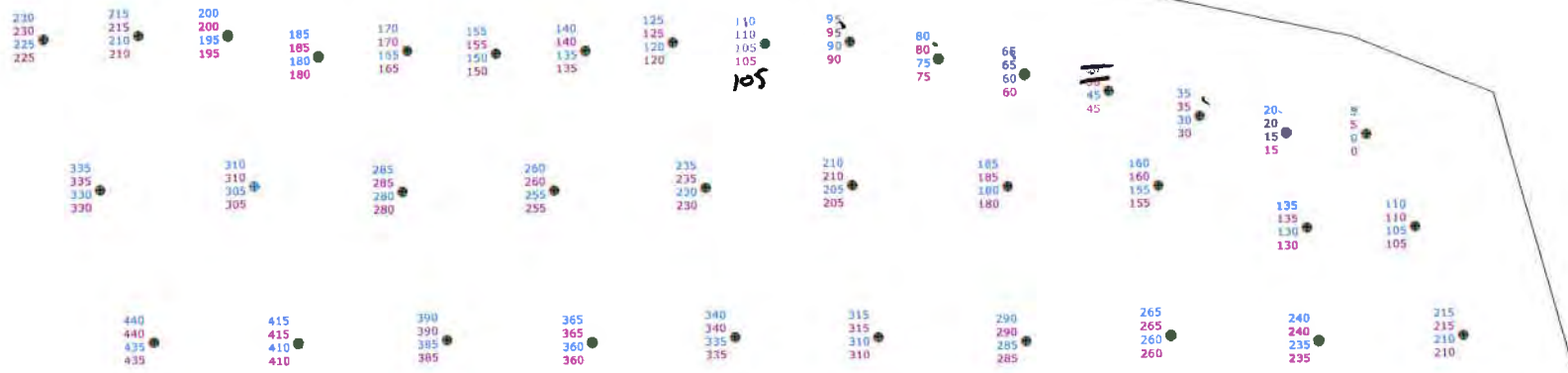
Hole Diameter: 4.0in

Number of holes: 36

Hole angle: 0.0°

Total drilled: 3030.6ft

Free Face



SHOTPlus 5.6.2.7	20/06/2017
Mine	
Location	
Title/author	17-011 South Face Final G. Palcso
Filename	17-011 South Face Final (2).spf



Scale 1:150

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

1st row burden: 18.0ft

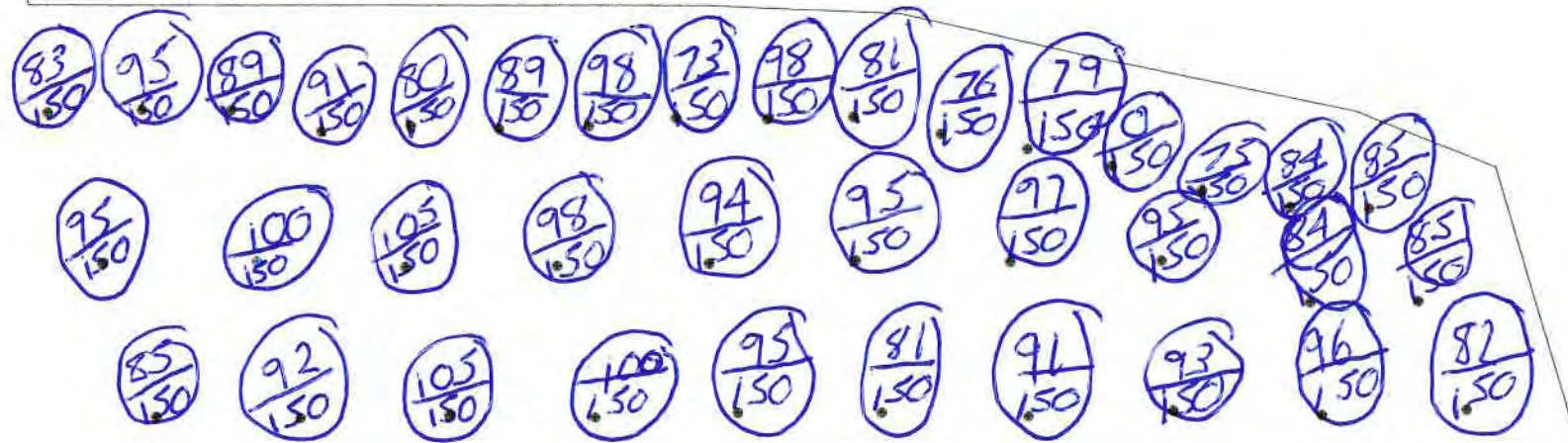
Hole Diameter: 4.0in

Number of holes: 36

Hole angle: 0.0°

Total drilled: 3030.6ft

Free Face



* 150 kg in all bottom decks:



Scale 1:150

SHOTPlus 5.6.2.7

20/06/2017

Mine

Location

Title/author 17-011 South Face Final G. Palcso

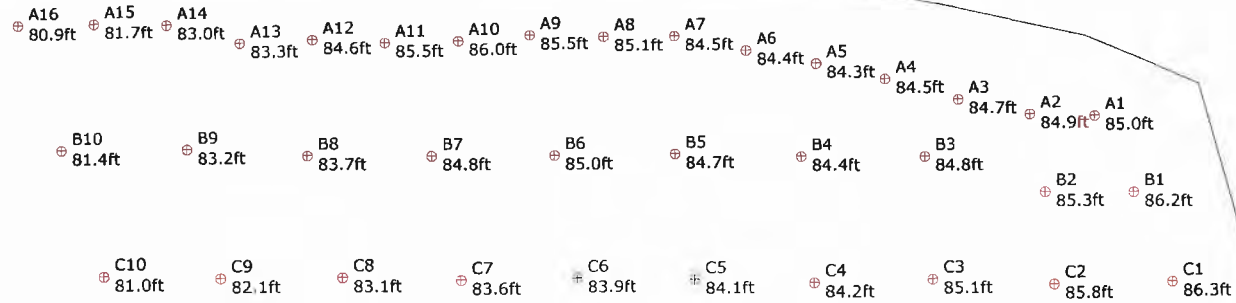
Filename 17-011 South Face Final.spf

SHOTPlus 5 Plan

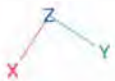
Blast Summary Data

Burden: 10.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 18.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Total drilled: 3030.8ft			

Free Face



17-011 South Face Final
 Front Row - 18' X 6' - Body - 10' X 10.5' - 4" Bit
 248.5 + .6 Sub



Not to scale

ShotPlus5 5.2.29.0	12/06/2017
Mine	
Location	
Title/author	17-011 South Face Final G. Palcso
Filename	17-011 South Face Final.spf



Customer: **Nelson**
Blast Report

Quarry: **Burlington**
P.O. #: **n/a**
Blast Date: **2017-06-26**

Blast Number: **17-012**
Orica Order #: **2204495**
Blast Time: **1:14 PM**

page 1

Master-in-charge: **Ken George**

Blast Location: **Floor**
GPS Coordinates: **43.40250 °N Latitude 79.88614 °W Longitude**

Wind from the: **SW** at **15 kph** Temperature: **21 to 25 °C**

Clear: Rain: Overcast:
Partly Cloudy: **X** Snow: Inversion: Ceiling: **30 000 m**

tonnes Blasted: **40,014 te** 15,099 m³
Total tonnes per day: **40,014 te** Rate Code
Total Holes Loaded: **252 holes**
... including: **0 Dead Holes**
... and: **0 Helper Holes**
Helper Hole Collar: **0.0 ft avg**
Rows Blasted: **12 rows**
Burden: **11.5 ft avg**
Spacing: **11.5 ft avg**
Holes: **17**

Nominal Bit Diameter:
Primary Bit diam: **101.6 mm** 0 # Holes: **252** = **4,032.0 ft (4 " diam)**
Secondary Bit diam: **mm** 0 # Holes: **= 0.0 ft (" diam)**
Tertiary Bit diam: **mm** 0 # Holes: **= 0.0 ft (" diam)**

Burden: **11.5 ft avg**
Spacing: **11.5 ft avg**
Bench Height: **16.0 ft avg**
Sub-drill: **0.0 ft avg**
Hole Depth: **16.0 ft avg**
Front Row: **0.0 ft avg**
Main Body: **0.0 ft avg**
Stone Decks: **0 per blast**

Bulk Explosives: in (kg) out (kg) kg
CENTRA GOLD 70 34,290 27,570 6,720

Packaged Explosives: cs shipped cs returned kg

Boosters: kg / unit # usec kg
PENTEX 12 (OR EQUIVALENT) 0.34 252 85.7

total explosives weight in Blast (kg): **6,806**
Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators: case #'s ms # used
EXEL HANDIDET 12m 25/500 252
CONNECTADET 12M 42 ms 18
UNITRONIC 600 6M 1

Cord & Accessories: U of M # used
HARNESS WIRE DUPLEX (6 PACK) 400M units 1
units
units

0.760 lb/yd³

Yield PF: **0.170 kg/te (actual)**

lb/yd³

"KPI" PF: **#DIV/0! kg/te (theoretical)**

Services:

GPS LAYOUT Line Item (Hourly Rate) 1
BULK TRUCK CHARGE >=5,000kg <10,000kg 1
SHOT SERVICE FEE * Line Item (Fee per Blast) 1
SEISMOGRAPH RENTAL * 1 unit in Shot Service Fee
3D LASER PROFILE Enter "1" if 3D Profiled
BORETRACK Enter "1" if Boretraked

1
1
2
1



Customer: **Nelson**
Blast Design

Quarry: Burlington
P.O. #: n/a
Blast Date: 2017-06-26

Blast Number: 17-012
Orica Order #: 2204495
Blast Time: 1:14 PM

page 2

Blast Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast		43.40254	79.88612	0.757517	1.394276
Front Row Corner		43.40207	79.88607	0.757509	1.394275
Back Row Corner		43.40288	79.88623	0.757523	1.394278
Average (Centre of Blast)		43.40250	79.88614	0.757516	1.394276

1st Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)		0.0	m		
Post Blast Data:		ppV:	6.2 mm/s	2.0	
		frequency:	Hz	T	
		air overpressure:	91.5 dB	115	
2450 #2 Side Rd					

2nd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (2nd Seis. From Centre of Blast)		0.0	m		
Post Blast Data:		ppV:	DNT mm/s	2.0	
		frequency:	Hz	?	
		air overpressure:	DNT dB	115	
Northwest					

3rd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)		0.0	m		
Post Blast Data:		ppV:	1.8 mm/s	2.0	
		frequency:	Hz	?	
		air overpressure:	88.0 dB	115	
Southwest					

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor:

$$W = \frac{D^2}{Z}$$

$$= \frac{(0)^2}{2} \text{ kg}$$

$$= \frac{0}{0} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = kg

Orica
Blaster-in-charge:

Ken George

 <small>ORICA</small> <small>The Blasting Professionals™</small>	Customer: Nelson	Quarry: Burlington	Blast Number: 17-013
	Blast Report	P.O. #: Blast Date: 2017-07-10	Orica Order #: 2210809 Blast Time: 1:40 PM

page 1
Blaster-in-charge: **Kevin Toplis** (Print Name)

Blast Location: **Floor** (Bench / Face)
GPS Coordinates: **43.40152** °N Latitude **79.88959** °W Longitude
Centre of Blast Centre of Blast

Wind from the: **SW** at **10** kph Temperature: **21 to 25** °C

Clear: ☐

Rain: ☐

Overcast: ☐

Partly Cloudy: ☒

Snow: ☐

Inversion: ☐

Ceiling: **2,804** m

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 °	# Holes: 299 = 5,980.0 ft (4 " diam)
Secondary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)
Tertiary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,150	25,680	8,470

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	300	102.0

total explosives weight in Blast (kg): **8,572**
Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators:	case #'s	ms	# used
EXEL HANDIDET 12m		25/500	300
CONNECTADET 12M		42 ms	21
UNITRONIC 600 6M			1

Cord & Accessories:	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)	1
# of Blasters (this Blast)	1
# of Helpers (this Blast)	2
# of MMU's (this Blast)	1

Services:

GPS LAYOUT	Enter "1" if Layout by GPS	0
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)	16.0

tonnes Blasted:	58,552 te	22,095 m ³
Total tonnes per day:	58,552 te	<small>Rate Code</small>
Total Holes Loaded:	295 holes	
... including:	0 Dead Holes	
... and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	11 rows	
<i>- Pattern (Front Row)-</i>		
Burden:	11.5 ft avg	
Spacing:	11.5 ft avg	
# Holes:	28 front row	
Burden:	11.5 ft avg	
Spacing:	11.5 ft avg	
# Holes:	58,524	
Bench Height:	20.0 ft avg	
Sub-drill:	0.0 ft avg	
Hole Depth:	20.0 ft avg	
<i>- Stone Decking -</i>		
Front Row:	0.0 ft avg	
Main Body:	0.0 ft avg	
# Stone Decks:	0 per blast	
<i>- Collar Stemming -</i>		
Front Row:	7.0 ft avg	
Main Body:	7.0 ft avg	
Material used:	3/4 Clear	
<i>- Charge Length -</i>		
Front Row:	13.0 ft avg	
Main Body:	13.0 ft avg	
<i>- Charge Weight -</i>		
Front Row:	37.9 kg/hole	
Main Body:	37.9 kg/hole	
Max. per delay:	46.0 kg/delay	
SD () Equation:	0.0 kg/delay	
Total kg Loaded:	8,572 kg	
Rock Density:	2.65 g/cc = te/m ³	
<i>- Powder Factor -</i>		
Yield PF:	0.146 kg/te (actual)	
Front row:	0.191 kg/te (theoretical)	
Main Body:	0.191 kg/te (theoretical)	
"KPI" PF:	#DIV/0! kg/te (theoretical)	

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Holes A1,2,3- B1,2- C1 where not drilled.

Holes A24, C24 where not loaded, but primed. They both where at 8ft.

Holes, K17, I15 det did not pull, a safety was used.

Holes, G28, H28 did not get loaded, do to both only being 3ft.

Blaster hours: **8.5**

Helper hours: **7.5**

2017-07-10 Burlington 17-013 floor

REPORT

Customer: **Nelson****Blast Design**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-07-10**Blast Number: **17-013**Orica Order #: **2210809**Blast Time: **1:40 PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40144	79.88941	0.757498	1.394333
Front Row Corner	43.40125	79.89002	0.757495	1.394344
Back Row Corner	43.40186	79.88933	0.757505	1.394332
Average (Centre of Blast)	43.40152	79.88959	0.757499	1.394336

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.71939	80.38847	0.763047	1.403043
	2nd Reading				
	Average	43.71939	80.38847	0.763047	1.403043
	Distance (1st Seis. From Centre of Blast)	0.0 m			
	Post Blast Data: ppV:	2.2 mm/s	Trigger set at: 2.0 mm/s		
	frequency:	Hz	V / T / L : T (Vertical, Transverse or Longitudinal)		
	air overpressure:	91.5 dB	Trigger set at: 115 dB		
	2450 #2 Side Rd (Nelson monitor)				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (2nd Seis. From Centre of Blast)	0.0 m			
	Post Blast Data: ppV:	1.0 mm/s	Trigger set at: 2.0 mm/s		
	frequency:	Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
	air overpressure:	104.2 dB	Trigger set at: 115 dB		
	Northwest (Nelson monitor)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	0.0 m			
	Post Blast Data: ppV:	4.2 mm/s	Trigger set at: 2.0 mm/s		
	frequency:	Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
	air overpressure:	88.0 dB	Trigger set at: 115 dB		
	Southwest (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned} W &= \frac{D^2}{30^2} \\ &= \frac{(0)^2}{30^2} \text{ kg} \\ &= \frac{0}{900} \text{ kg} \end{aligned}$$

Maximum Indicated Charge Weight per Delay = **0** kg

Orica

Blaster-in-charge:

jim bray

Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft

Spacing: 11.5ft

Subdrill: 0.0ft

Stemming: 7.0ft

1st row burden: 11.5ft

Hole Diameter: 4.0in

Number of holes: 305

Hole angle: 0.0°

Total drilled: 6100.0ft

Free Face

16 22 16 16 x 20 15 15 22 22 16 22 22 22 24 29 27 21 32 29 22 35 26 34 26 x x
 8 19 22 16 14 16 13 18 26 21 22 22 24 27 26 32 32 29 34 32 32 37 35 34 34 42 x y
 13 22 22 16 x 19 16 22 22 22 22 26 27 27 32 32 35 34 35 38 37 37 37 38 42 38 x
 16 16 18 22 14 19 22 24 26 22 22 21 22 30 30 32 30 30 32 37 38 39 37 34 35 42 42 34
 16 16 19 16 19 21 22 27 22 22 22 21 22 29 29 32 24 32 32 34 38 38 38 38 37 42 42 42
 29 16 19 13 16 21 22 24 22 22 22 16 22 30 30 32 32 29 34 37 38 38 37 38 38 42 42 42
 16 29 29 13 16 16 22 22 19 19 24 26 26 26 29 26 32 26 29 34 38 42 35 35 38 42 42 42
 19 14 22 12 16 16 20 22 19 19 26 26 29 29 29 32 30 29 32 37 35 35 27 38 38 42 42 42
 x 16 13 19 20 19 22 19 24 26 26 29 27 22 29 32 32 35 38 38 27 38 38 42 42 38 45
 16 16 20 20 22 20 22 22 19 26 26 29 29 22 29 32 37 35 42 42 40 43 42 45 45 38 45
 19 19 22 19 19 19 22 18 22 29 29 29 26 29 32 32 34 34 29 38 42 42 45 38 45 45 45

17-013 Floor Blast - 11.5' X 11.5' - 4" Bit - Drill to shale

8497



Not to scale

SHOTPlus 5.6.3.6	07/07/2017
Mine	Burlington
Location	
Title/author	17-013 Floor Blast G. Palcso
Filename	17-013_Floor_Blast_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft Spacing: 11.5ft Subdrill: 0.0ft Stemming: 7.0ft
 1st row burden: 11.5ft Hole Diameter: 4.0in Number of holes: 305 Hole angle: 0.0°
 Total drilled: 6100.0ft

Timing

Free Face



17-013 Floor Blast - 11.5' X 11.5' - 4" Bit - Drill to shale



Not to scale

SHOTPlus 5.6.4.3	10/07/2017
Mine	Burlington
Location	
Title/author	17-013 Floor Blast G. Palcso
Filename	17-013_Floor_Blast_Final Timing Op

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 7.0ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 305	Hole angle: 0.0°
Total drilled: 4575.0ft			

Free Face

A28	A27	A26	A25	A24	A23	A22	A21	A20	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
B28	B27	B26	B25	B24	B23	B22	B21	B20	B19	B18	B17	B16	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
C28	C27	C26	C25	C24	C23	C22	C21	C20	C19	C18	C17	C16	C15	C14	C13	C12	C11	C10	C9	C8	C7	C6	C5	C4	C3	C2	C1
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
E28	E27	E26	E25	E24	E23	E22	E21	E20	E19	E18	E17	E16	E15	E14	E13	E12	E11	E10	E9	E8	E7	E6	E5	E4	E3	E2	E1
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
F28	F27	F26	F25	F24	F23	F22	F21	F20	F19	F18	F17	F16	F15	F14	F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
G28	G27	G26	G25	G24	G23	G22	G21	G20	G19	G18	G17	G16	G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4	G3	G2	G1
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
H28	H27	H26	H25	H24	H23	H22	H21	H20	H19	H18	H17	H16	H15	H14	H13	H12	H11	H10	H9	H8	H7	H6	H5	H4	H3	H2	H1
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
I27	I26	I25	I24	I23	I22	I21	I20	I19	I18	I17	I16	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1	
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
J27	J26	J25	J24	J23	J22	J21	J20	J19	J18	J17	J16	J15	J14	J13	J12	J11	J10	J9	J8	J7	J6	J5	J4	J3	J2	J1	
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	
K27	K26	K25	K24	K23	K22	K21	K20	K19	K18	K17	K16	K15	K14	K13	K12	K11	K10	K9	K8	K7	K6	K5	K4	K3	K2	K1	
15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	15.0ft	

17-013 Floor Blast - 11.5' X 11.5' - 4" Bit - Drill to shale



Not to scale

ShotPlus5 5.2.29.0	16/06/2017
Mine	Burlington
Location	
Title/author	17-013 Floor Blast G. Palcso
Filename	17-013 Floor Blast Final.spf

Customer: **Nelson****Blast Design**Quarry: **Burlington**
P.O. #:
Design Date: **2017-07-07**Blast Number: **17-013**
Orica Order #:

page 1

Master-in-charge: **Kevin Topliss**

(Print Name)

Blast Location: **Floor**
GPS Coordinates: **0.00000** °N Latitude **0.00000** °W Longitude
Centre of BlastDesign to Blasted: **60,536** te
Total Holes Loaded: **305** holes
... including: **0** Dead Holes
... and: **0** Helper Holes
Helper Hole Collar: **0.0** ft avg
Rows Blasted: **11** rows**- Drilling Information -**

Angle from Vertical:

Nominal Bit Diameter:

Primary Bit diam: **101.6** mm **0**° # Holes: **305** = 6,100.0 ft (**4** " diam)
Secondary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)**- Design Pattern (Front Row) -**Burden: **11.5** ft avg
Spacing: **11.5** ft avg
Holes: **28** front row**- Design Pattern (Main Body) -**Burden: **11.5** ft avg
Spacing: **11.5** ft avg
Holes: **277** main body
Bench Height: **20.0** ft avg
Sub-drill: **0.0** ft avg
Hole Depth: **20.0** ft avg**- Design Stone Decking -**Front Row: **0.0** ft avg
Main Body: **0.0** ft avg**- Design Collar Stemming -**Front Row: **7.0** ft avg
Main Body: **7.0** ft avgMaterial used: **3/4 Clear****- Design Charge Length -**Front Row: **13.0** ft avg
Main Body: **13.0** ft avg**- Design Charge Weight -**Front Row: **37.9** kg/hole
Main Body: **37.9** kg/hole
Max Chge Wt / delay: **30.0** kg/delayRequired kg Loaded: **7,912** kg
Rock Density: **2.65** g/cc = te/m³**- Design Powder Factor -**Expected Yield PF: **0.131** kg/te (actual)
Front row: **0.191** kg/te (theoretical)
Main Body: **0.191** kg/te (theoretical)
"KPI" PF: **0.191** kg/te (theoretical)0.853 lb/yd³
0.853 lb/yd³
0.853 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Bulk Explosives Req'd:

kg

CENTRA GOLD 70 ChargeWt.exe **7,808****Pkgd Explosives Req'd:**

kg

Boosters Req'd:

kg/u # used

kg

PENTEX 12 (OR EQUIVALENT) 0.34 **305** 103.7total explosives weight in Blast (kg): **7,912**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators Req'd:**

ms

req'd

EXEL HANDIDET 12m **25/500** **305****CONNECTADET 12M** **42 ms** **11****UNITRONIC 600 6M** **1****Cord & Access. Req'd:**

U of M

req'd

IRE DUPLEX (6 PACK) 400M units **1****Resource Deployment**

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS Must be pre-authorized)		



Customer: **Nelson**

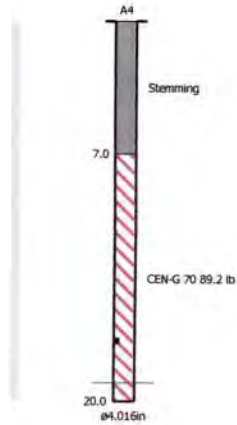
Blast Design

Quarry: **Burlington**
P.O. #:
Blast Date: **2017-07-10**

Blast Number: **17-013**
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Kevin Toplis

#

Quarry Manager:

Signature required, indicating
approval on Blast Design.

1085980

Bill of Lading / Connaissancement



CONSIGNOR
EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT	
TARE	
NET	
TIME IN HEURE D'ENTRÉE 16:45	TIME OUT HEURE SORTIE 14:00
ORDER NUMBER N° DE COMMANDE 2210809	B/L NUMBER N° DE CONNAISSANCEMENT 85701951

PAGE 2

DATE REQUIRED DATE REQUISE 10 Jul 2017	TIME REQUIRED HEURE REQUISE 00:00:00	INVOICE TO / BUYER FACTURÉ À / ACHETEUR NELSON AGGREGATE COMPANY	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT n/a
DATE SHIPPED EXPÉDIÉ LE 10 Jul 2017	FREIGHT TERMS CONDITIONS DE LIVRAISON FOB Dest'n, Own Truck	SHIP, MAG, LIC. PERMIS EXPÉDITEUR F-73289	VEHICLE NO. N° DE VÉHICULE PT115013
SHIP VIA TRANSPORTEUR Orica Truck		ROUTING ITINÉRAIRE STANDARD	MAG. LIC. NO. N° DE PERMIS

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT.	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
NET EXPLOSIVES QUANTITY:					133.810 KG		
392	PC	X	92	300	PENTEX BC 340 (49/CS)	8	143.080
400	PC	X	100	300	EXEL HANDIDET 12M 25/500(40') 50/CS	8	49.200
65	PC	X	65	0	EXEL Connectadet 9M 25MS (30 FT) 65/CS	2	7.760
50	PC	X	29	21	EXEL Connectadet 12M 42MS (40 FT) 50/CS	1	6
5	PC	X	4	1	*uni tronic 600-06.0M CU/ZC(20')80PC	1	0.365
2	PC	X	1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT						212.245 KG	
**** TOTAL PACKAGES ****						21	

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES		PALLETS RETURNED / PALETTES RETOURNÉES		BAGS USED / SACS UTILISÉS	
EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE ERAP 2-1510		EMERGENCY RESPONSE NO./24 HOUR NUMBER TELEPHONE D'URGENCE/24 HEURE NUMERO 1-877-561-3636		PLACARDS OFFERED / PLACARDS OFFERT YES / OUI NO / NON	
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE \$		NETTE No. CONV PRESSAGE WT AGREEMENT NO.	
				301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5	

CONSIGNOR / EXPÉDITEUR GRAND VALLEY		CARRIER / TRANSPORTEUR Orica Truck		CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY	
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR KEITH PLATT		DRIVER'S NAME (PLEASE PRINT) / NOM DU CHAMIONNEUR KEITH PLATT		RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR	
SIGNATURE [Signature]	DATE 10/7/17 D/J M/M Y/A	SIGNATURE [Signature]	DATE 10/7/17 D/J M/M Y/A	SIGNATURE	DATE

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSANCEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO
**** PAGE 2 OF 3 ****
D.F.G. S7772

Customer: **Nelson****Blast Report**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-07-04**Blast Number: **17-014 A**Orica Order #: **2207581**Blast Time: **12:46 PM**

page 1

blaster-in-charge: **Kevin Topplis** (Print Name)Blast Location: **Lower middle bench** (Bench / Face)GPS Coordinates: **43.40390** °N Latitude **79.88386** °W Longitude
Centre of Blast Centre of BlastWind from the: **SE** at **10** kph Temperature: **21 to 25** °CClear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: **9,144** m**- Drilling Information -**

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 °	# Holes: 36 = 1,497.6 ft (4 " diam)
Secondary Bit diam: 114.3 mm	0 °	# Holes: 7 = 291.2 ft (4 1/2 " diam)
Tertiary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,050	29,193	4,857

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	86	29.2

total explosives weight in Blast (kg): 4,886

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			43
UNITRONIC 600 15M			43

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	20
	units	

Resource Deployment:

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>=2,000kg <5,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)	14.0

tonnes Blasted:	11,970 te	4,517 m ³
Total tonnes per day:	33,601 te	TBA Rate Code
Total Holes Loaded:	43 holes	
... including:	0 Dead Holes	
... and:	4 Helper Holes	
Helper Hole Collar:	10.0 ft avg	
# Rows Blasted:	3 rows	
- Pattern (Front Row)-		
Burden:	12.0 ft avg	
Spacing:	10.5 ft avg	
# Holes:	12 front row	
- Pattern (Main Body) -		
Burden:	9.0 ft avg	
Spacing:	10.5 ft avg	
# Holes:	31 main body	
Bench Height:	39.6 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	41.6 ft avg	
- Stone Decking -		
Front Row:	0.0 ft avg	
Main Body:	0.0 ft avg	
# Stone Decks:	0 per blast	
- Collar Stemming -		
Front Row:	7.0 ft avg	
Main Body:	7.0 ft avg	
Material used:	.75 clear	
- Charge Length -		
Front Row:	34.6 ft avg	
Main Body:	34.6 ft avg	
- Charge Weight -		
Front Row:	100.9 kg/hole	
Main Body:	100.9 kg/hole	
Max. per delay:	125.0 kg/delay	
SD () Equation:	0.0 kg/delay	
Total kg Loaded:	4,886 kg	
Rock Density:	2.65 g/cc = te/m ³	
- Powder Factor -		
Yield PF:	0.408 kg/te (actual)	
Front row:	0.269 kg/te (theoretical)	
Main Body:	0.359 kg/te (theoretical)	
"KPI" PF:	0.350 kg/te (theoretical)	

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

blaster hours: **7.5**helper hours: **6.5**

This blast was shot with 17-014 B, with a 5 second delay

Holes A1, X1, X2 got 10ft collars. Holes B1, X3, X4, C1 got 12ft collars.

Customer: **Nelson****Blast Design**Quarry: **Burlington**P.O. #: Blast Date: **2017-07-04**Blast Number: **17-014 A**Orica Order #: **2207581**Blast Time: **12:46 PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40388	79.88387	0.757541	1.394236
Front Row Corner	43.40375	79.88372	0.757538	1.394234
Back Row Corner	43.40406	79.88399	0.757544	1.394239
Average (Centre of Blast)	43.40390	79.88386	0.757541	1.394236

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 1.3	mm/s	Trigger set at: 2.0	mm/s
	frequency: 	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
	air overpressure: 88.0	dB	Trigger set at: 115	dB
northwest- colling rd. (Nelson monitor)				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043
Distance (2nd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 12.2	mm/s	Trigger set at: 2.0	mm/s
	frequency: 	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 95.9	dB	Trigger set at: 115	dB
2450 2nd concession (Nelson monitor)				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 4.2	mm/s	Trigger set at: 2.0	mm/s
	frequency: 	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 88.0	dB	Trigger set at: 115	dB
southwest- Camisle (Nelson Monitor)				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg**Orica**

Blaster-in-charge:

jim bray

*Kevin Toplis*Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

1st row burden: 12.0ft

Hole Diameter: 4.0in

Number of holes: 43

Hole angle: 0.0°

Total drilled: 1793.4ft

Holes A1,B1,C1, X1,X2,X3,X4 are 4.5" Diameter Marked with Green Paint

open face

timing



Lower Middle 17-014 Part A
12x10.5 Front Row, 9x10.5 Body
4" Hole Diameter
250m Floor Elevation + 0.6m Subdrill



Not to scale

SHOTPlus 5.6.3.6	03/07/2017
Mine	Burlington
Location	Lower Middle
Title/author	Blast 17-014 Design Ken George
Filename	Blast 17-014 Lower Middle Design.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

1st row burden: 12.0ft

Hole Diameter: 4.0in

Number of holes: 43

Hole angle: 0.0°

Total drilled: 1793.4ft

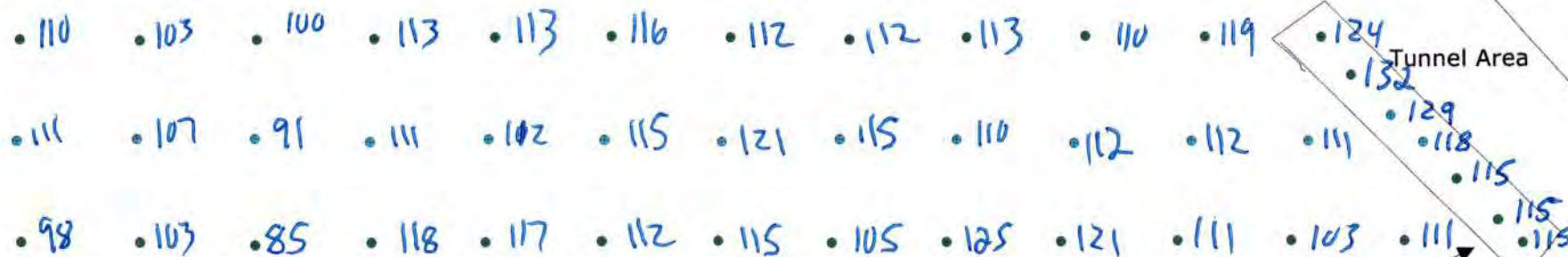
Holes A1,B1,C1, X1,X2,X3,X4 are 4.5" Diameter Marked with Green Paint

load sheet

open face

pc counter

max load: 140kg



Lower Middle 17-014 Part A
 12x10.5 Front Row, 9x10.5 Body
 4" Hole Diameter
 250m Floor Elevation + 0.6m Subdrill

4.5" holes

4811



Not to scale

SHOTPlus 5.6.3.6	03/07/2017
Mine	Burlington
Location	Lower Middle
Title/author	Blast 17-014 Design Ken George
Filename	Blast 17-014 Lower Middle Design.spf

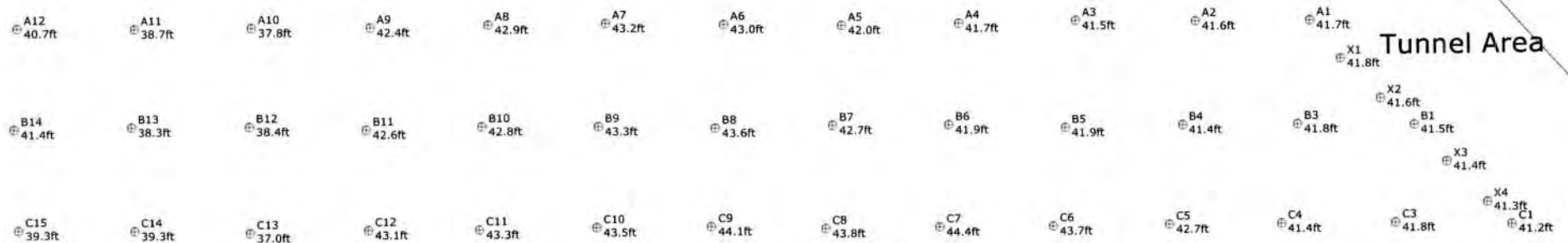
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 43	Hole angle: 0.0°
Total drilled: 1793.4ft			

Holes A1,B1,C1, X1,X2,X3,X4 are 4.5" Diameter Marked with Green Paint

open face



Lower Middle 17-014 Part A
12x10.5 Front Row, 9x10.5 Body
4" Hole Diameter
250m Floor Elevation + 0.6m Subdrill



Not to scale

SHOTPlus 5.6.4.3	22/06/2017
Mine	Burlington
Location	Lower Middle
Title/author	Blast 17-014 Design Ken George
Filename	Blast 17-014 Lower Middle Design.sp

Customer: **Nelson**Quarry: **Burlington**Blast Number: **17-014 A**

P.O. #:

Orica Order #:

Blast DesignDesign Date: **2017-07-04**

page 1

Blastmaster-in-charge: **Kevin Toplis**

(Print Name)

Blast Location: **Lower middle bench**

(Bench / Face)

GPS Coordinates: **43.40390** °N Latitude **79.88386** °W Longitude

Centre of Blast

Centre of Blast

Design te Blasted: **12,949** teTotal Holes Loaded: **43** holes... including: **0** Dead Holes... and: **4** Helper HolesHelper Hole Collar: **7.0** ft avg# Rows Blasted: **3** rows**- Drilling Information -**

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: **101.6** mm **0**° # Holes: **36** = **1,497.6** ft (**4** " diam)Secondary Bit diam: **114.3** mm **0**° # Holes: **7** = **291.2** ft (**4 1/2** " diam)Tertiary Bit diam: mm **0**° # Holes: = **0.0** ft (" diam)**- Design Pattern (Front Row) -**Burden: **12.0** ft avgSpacing: **10.5** ft avg# Holes: **12** front row**- Design Pattern (Main Body) -**Burden: **9.0** ft avgSpacing: **10.5** ft avg# Holes: **31** main bodyBench Height: **39.6** ft avgSub-drill: **2.0** ft avgHole Depth: **41.6** ft avg**- Design Stone Decking -**Front Row: **0.0** ft avgMain Body: **0.0** ft avg**- Design Collar Stemming -**Front Row: **7.0** ft avgMain Body: **7.0** ft avgMaterial used: **.75** clear**- Design Charge Length -**Front Row: **34.6** ft avgMain Body: **34.6** ft avg**- Design Charge Weight -**Front Row: **100.9** kg/holeMain Body: **100.9** kg/holeMax Chge Wt / delay: **140.0** kg/delayRequired kg Loaded: **4,920** kgRock Density: **2.60** g/cc = **te/m³****- Design Powder Factor -**Expected Yield PF: **0.380** kg/te (actual)Front row: **0.275** kg/te (theoretical)Main Body: **0.366** kg/te (theoretical)"KPI" PF: **0.336** kg/te (theoretical)1.204 lb/yd³1.605 lb/yd³1.471 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit - B - S - Expl or IS from previous Blast

Bulk Explosives Req'd:

kg

CENTRA GOLD 70 ChargeWt.exe **4,891****Pkgd Explosives Req'd:**

kg

Boosters Req'd:

kg/u # used

kg

PENTEX 12 (OR EQUIVALENT) 0.34 **86** 29.2total explosives weight in Blast (kg): **4,920**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators Req'd:**

ms

req'd

UNITRONIC 600 15M **43****UNITRONIC 600 9M** **43****Cord & Access. Req'd:**

U of M

req'd

IRE DUPLEX (6 PACK) 400M units **1****Resource Deployment**

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>=2,000kg <5,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	



Customer: **Nelson**

Blast Design

Quarry: **Burlington**

P.O. #:

Blast Date: **2017-07-04**

Blast Number: **17-014 A**

Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:

UNI Tronic (7)ms 20ft
PENTEX BC 12 * 340 x1

UNI Tronic (7)ms 49ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Kevin Toplis

#

Quarry Manager:

Signature required, indicating
sign-off on Blast Design.

1085878



Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

Bill of Lading / Connaissance

GROSS / BRUT	
TARE	
NET	
TIME IN HEURE D'ENTRÉE 7:00	TIME OUT HEURE SORTIE 13:30
ORDER NUMBER N° DE COMMANDE 2207581	B/L NUMBER N° DE CONNAISSANCE 85695134

PAGE **2**

DATE REQUIRED DATE REQUISE 04 Jul 2017	TIME REQUIRED HEURE REQUISE 00:00:00	INVOICE TO / BUYER FACTURÉ À / ACHETEUR NELSON AGGREGATE COMPANY	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT n/a
DATE SHIPPED EXPÉDIÉ LE 04 Jul 2017	FREIGHT TERMS CONDITIONS DE LIVRAISON FOB Dest'n, Own Truck	SHIP. MAG. LIC. PERMIS EXPÉDITEUR F-73289	VEHICLE NO. N° DE VÉHICULE PT 12013

SHIP VIA TRANSPORTEUR Orica Truck	ROUTING ITINÉRAIRE STANDARD	MAG. LIC. NO. N° DE PERMIS
--	--	-------------------------------

QTY. QTE.	UM	DG MD	QTY. RET'D QTE. RET.	QTY. SOLD QTE. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
245	PC	X	85	160	PENTEX BC 340 (49/CS)	5	89.425
160	PC	X	81	79	*uni tronic 600-06.0M CU/ZC(20')80PC	2	11.680
66	PC	X	23	43	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
72	PC	X	34	38	*uni tronic 600-30M C/Z SPL(100')36P	2	21.168
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
200	PC		160	40	Stem + gnt		
TOTAL GROSS WEIGHT							139.399 KG
***** TOTAL PACKAGES *****							11
GHS/WHMIS SDS documents available Website: www.oricaminingsservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES ERAP 2-1510	PALLETS RETURNED / PALETTES RETOURNÉES 1-877-561-3636	BAGS USED / SACS UTILISÉS	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À N° DE CONNAISSANCE D'ORICA: 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO.24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT YES / OUI NO / NON	

CONSIGNOR / EXPÉDITEUR GRAND VALLEY	CARRIER / TRANSPORTEUR Orica Truck	CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR Tristan Nelly	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR Tristan Nelly	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE [Signature]	DATE 4 7 17 D/J M/M Y/A	SIGNATURE [Signature]
	DATE 4 7 17 D/J M/M Y/A	DATE 4 7 17 D/J M/M Y/A

**3 MEMORANDUM
MÉMOIRE**

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE
SHIPPER AND CARRIER)
(CE CONNAISSANCE-CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ÊTRE SIGNÉ
PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO
***** PAGE 2 OF 2 *****
D.F.G. S7772

Customer: **Nelson****Blast Report**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-07-04**Blast Number: **17-014 B**Orica Order #: **2207581**Blast Time: **12:46 PM**

page 1

blaster-in-charge: **Kevin Topplis** (Print Name)Blast Location: **Lower middle bench** (Bench / Face)GPS Coordinates: **43.40347** °N Latitude **79.88363** °W Longitude
Centre of Blast Centre of BlastWind from the: **SE** at **10** kph Temperature: **21 to 25** °CClear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: **9,144** m**- Drilling Information -**

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 °	# Holes: 36 = 2,840.4 ft (4 " diam)
Secondary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)
Tertiary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	29,193	20,540	8,653

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	74	25.2

total explosives weight in Blast (kg): **8,678**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators:**

	case #'s	ms	# used
UNITRONIC 600 6M			36
UNITRONIC 600 30M			38

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	20
	units	

Resource Deployment:

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)	14.0

tonnes Blasted:	21,631 te	8,163 m ³
Total tonnes per day:	33,601 te	TBA Rate Code
Total Holes Loaded:	36 holes	
... including:	0 Dead Holes	
... and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	

- Pattern (Front Row)-Burden: **12.0** ft avgSpacing: **10.5** ft avg# Holes: **11** front rowBurden: **9.0** ft avgSpacing: **10.5** ft avg# Holes: **25**Bench Height: **76.9** ft avgSub-drill: **2.0** ft avgHole Depth: **78.9** ft avg**- Stone Decking -**Front Row: **15.0** ft avgMain Body: **0.0** ft avg# Stone Decks: **1** per blast**- Collar Stemming -**Front Row: **8.0** ft avgMain Body: **7.0** ft avgMaterial used: **.75 clear****- Charge Length -**Front Row: **55.9** ft avgMain Body: **71.9** ft avg**- Charge Weight -**Front Row: **163.0** kg/holeMain Body: **209.7** kg/holeMax. per delay: **250.0** kg/delaySD () Equation: **0.0** kg/delayTotal kg Loaded: **8,678** kgRock Density: **2.65** g/cc = te/m³**- Powder Factor -**Yield PF: **0.401** kg/te (actual)Front row: **0.224** kg/te (theoretical)Main Body: **0.384** kg/te (theoretical)"KPI" PF: **#DIV/0!** kg/te (theoretical)1.792 lb/yd³1.001 lb/yd³1.717 lb/yd³##### lb/yd³

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

blaster hours: **7.5**helper hours: **6.5**

This shot was fired with 17-014 A, with a 5 second delay.

Hole A11 was loaded to 65ft, stone deck to 41ft.

Hole A10 got a 14ft collar, Hole A1 got a 10ft collar, Holes, A4+5 got 14ft collar.

Customer: **Nelson****Blast Design**Quarry: **Burlington**P.O. #: Blast Date: **2017-07-04**Blast Number: **17-014 B**Orica Order #: **2207581**Blast Time: **12:46 PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40345	79.88364	0.757533	1.394232
Front Row Corner	43.40335	79.88349	0.757531	1.394230
Back Row Corner	43.40362	79.88376	0.757536	1.394235
Average (Centre of Blast)	43.40347	79.88363	0.757533	1.394232

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 1.3	mm/s	Trigger set at: 2.0	mm/s
	frequency: 	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
	air overpressure: 88.0	dB	Trigger set at: 115	dB
Northwest- colling rd (Nelson monitor)				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043
Distance (2nd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 12.2	mm/s	Trigger set at: 2.0	mm/s
	frequency: 	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 95.9	dB	Trigger set at: 115	dB
2450 2nd concession (Nelson monitor)				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 4.2	mm/s	Trigger set at: 2.0	mm/s
	frequency: 	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 88.0	dB	Trigger set at: 115	dB
Southwest- Camisle (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned} W &= \frac{D^2}{30^2} \\ &= \frac{(0)^2}{30^2} \text{ kg} \\ &= \frac{0}{900} \text{ kg} \end{aligned}$$

Maximum Indicated Charge Weight per Delay = **0** kg**Orica**

Blaster-in-charge:

jim bray

*Kevin Toplis*Signature required, indicating that
Blast Report is Complete & Accurate.

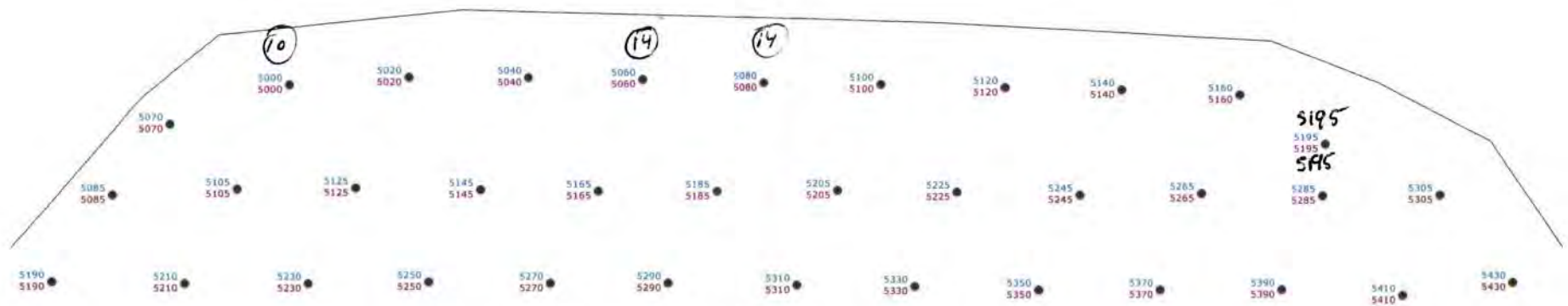
Blast Summary Data

Stemming: 7.0ft

Hole angle: 0.0°

Blasted tonnage: 20,509S/T

open face



Lower Middle 17-014 Part B
12x10.5 Front Row, 9x10.5 Body
4" Hole Diamter
250m Elevation + 0.6m subdrill



SHOTPlus 5.6.3.6

03/07/2017

Mine	Burlington
------	------------

Location	Lower Middle Bench
----------	--------------------

Title/author	Lower Middle 17-014 Part B	Ken George
--------------	----------------------------	------------

Filename	Blast_17-014_Lower_Middle_Design_Part_B.s
----------	---

SHOTPlus 5 Plan

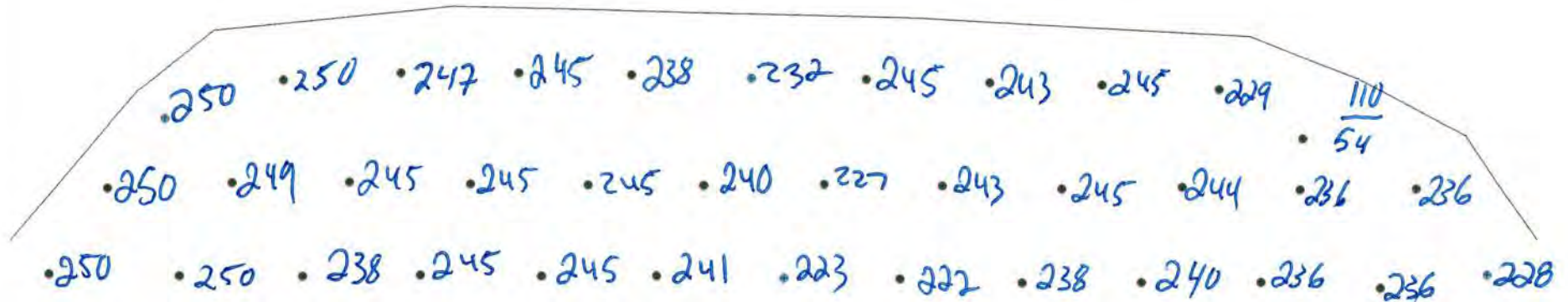
Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2841.9ft	Blasted tonnage: 20,509S/T	

load sheet
pc counter:
max load 233kg



open face



Lower Middle 17-014 Part B
12x10.5 Front Row, 9x10.5 Body
4" Hole Diameter
250m Elevation + 0.6m subdrill

8570



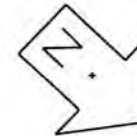
Not to scale

SHOTPlus 5.6.3.6	03/07/2017
Mine	Burlington
Location	Lower Middle Bench
Title/author	Lower Middle 17-014 Part B Ken George
Filename	Blast_17-014_Lower_Middle_Design_Part_B.s

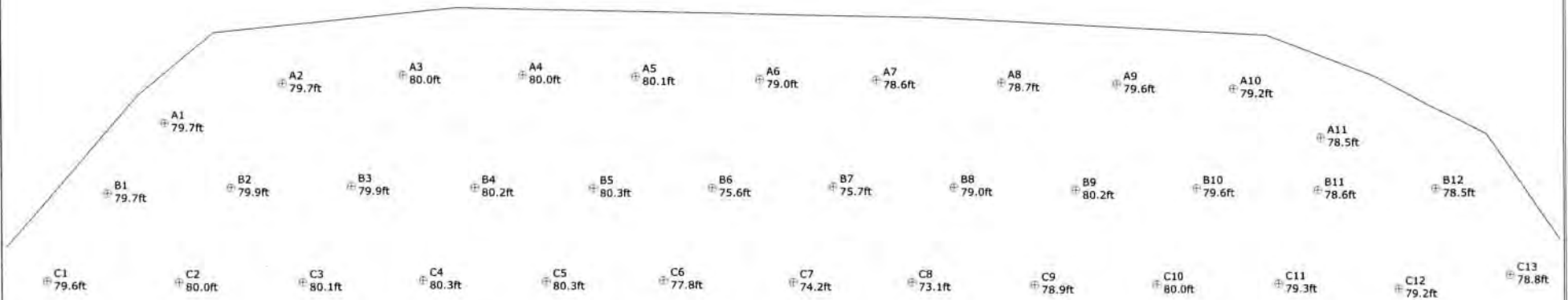
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 36	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2841.9ft	Blasted tonnage: 20,509S/T	



open face



Lower Middle 17-014 Part B
 12x10.5 Front Row, 9x10.5 Body
 4" Hole Diameter
 250m Elevation + 0.6m subdrill



Not to scale

SHOTPlus 5.6.4.3		22/06/2017
Mine	Burlington	
Location	Lower Middle Bench	
Title/author	Lower Middle 17-014 Part B Ken Ge	
Filename	Blast 17-014 Lower Middle Design Pa	

Customer: **Nelson****Blast Design**Quarry: **Burlington**

P.O. #:

Design Date: **2017-07-04**Blast Number: **17-014 B**

Orica Order #:

page 1

Blastmaster-in-charge: **Kevin Toplis** (Print Name)Blast Location: **Lower middle bench** (Bench / Face)GPS Coordinates: **43.40347** °N Latitude **79.88363** °W Longitude
Centre of Blast Centre of Blast

Design te Blasted: **21,631** te
 Total Holes Loaded: **36** holes
 ... including: **0** Dead Holes
 ... and: **0** Helper Holes
 Helper Hole Collar: **0.0** ft avg
 # Rows Blasted: **3** rows

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: **101.6** mm **0**° # Holes: **36** = 2,840.4 ft (4 " diam)
 Secondary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)
 Tertiary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: **12.0** ft avg
 Spacing: **10.5** ft avg
 # Holes: **11** front row

- Design Pattern (Main Body) -

Burden: **9.0** ft avg
 Spacing: **10.5** ft avg
 # holes: **25** main body

Bench Height: **76.9** ft avgSub-drill: **2.0** ft avgHole Depth: **78.9** ft avg**- Design Stone Decking -**

Front Row: **0.0** ft avg
 Main Body: **0.0** ft avg

- Design Collar Stemming -

Front Row: **7.0** ft avg
 Main Body: **7.0** ft avg

Material used: **.75** clear**- Design Charge Length -**

Front Row: **71.9** ft avg
 Main Body: **71.9** ft avg

- Design Charge Weight -

Front Row: **209.7** kg/hole
 Main Body: **209.7** kg/hole
 Max Chge Wt / delay: **230.0** kg/delay

Required kg Loaded: **8,318** kgRock Density: **2.65** g/cc = te/m³**- Design Powder Factor -**

Expected Yield PF: **0.385** kg/te (actual)
 Front row: **0.288** kg/te (theoretical)
 Main Body: **0.384** kg/te (theoretical)
 "KPI" PF: **0.352** kg/te (theoretical)

1.288 lb/yd³1.717 lb/yd³1.574 lb/yd³

Cost Reduction Notes (this Blast) - change in Blt B, S, Expl or IS from previous Blast

Bulk Explosives Req'd:

kg

CENTRA GOLD 70 ChargeWt.exe **8,294****Pkgd Explosives Req'd:**

kg

Boosters Req'd:

kg/u # used

kg

PENTEX 12 (OR EQUIVALENT) 0.34 **72** 24.5total explosives weight in Blast (kg): **8,318**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators Req'd:**

ms

req'd

UNITRONIC 600 30M **36**UNITRONIC 600 9M **36****Cord & Access. Req'd:**

U of M

req'd

IRE DUPLEX (6 PACK) 400M units **1**

units

units

Resource Deployment

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretracked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	



Customer: **Nelson**

Blast Design

Quarry: **Burlington**

P.O. #:

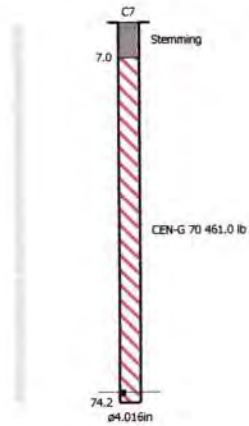
Blast Date: **2017-07-04**

Blast Number: **17-014B**

Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Kevin Toplis

#

Quarry Manager:

Signature required, indicating
sign off on Blast Design.

Customer: **Nelson****Blast Report**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-07-25**Blast Number: **17-015**Orica Order #: **2216725**Blast Time: **11:57 AM**

page 1

blaster-in-charge: **Kevin Topplis** (Print Name)Blast Location: **Lower middle bench** (Bench / Face)GPS Coordinates: **43.40395** °N Latitude **79.88376** °W Longitude
Centre of Blast Centre of BlastWind from the: **NE** at **5** kph Temperature: **16 to 20** °CClear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: **9,144** m**- Drilling Information -**

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 °	# Holes: 52 = 2,184.0 ft (4 " diam)
Secondary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)
Tertiary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,100	21,270	5,830

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	52	17.7

total explosives weight in Blast (kg): **5,848**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators:**

	case #'s	ms	# used
UNITRONIC 600 15M			52

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

	Line Item (Hourly Rate)	
GPS LAYOUT		1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)	12.0

tonnes Blasted:	15,057 te	5,682 m ³
Total tonnes per day:	15,057 te	TBA Rate Code
Total Holes Loaded:	52 holes	
... including:	3 Dead Holes	
... and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	4 rows	

- Pattern (Front Row)-Burden: **12.0** ft avgSpacing: **10.5** ft avg# Holes: **13** front rowBurden: **9.0** ft avgSpacing: **10.5** ft avg# Holes: **39**Bench Height: **40.0** ft avgSub-drill: **2.0** ft avgHole Depth: **42.0** ft avg**- Stone Decking -**Front Row: **0.0** ft avgMain Body: **0.0** ft avg# Stone Decks: **0** per blast**- Collar Stemming -**Front Row: **9.0** ft avgMain Body: **7.0** ft avgMaterial used: **.75 clear****- Charge Length -**Front Row: **33.0** ft avgMain Body: **35.0** ft avg**- Charge Weight -**Front Row: **96.2** kg/holeMain Body: **102.1** kg/holeMax. per delay: **125.0** kg/delaySD () Equation: **0.0** kg/delayTotal kg Loaded: **5,848** kgRock Density: **2.65** g/cc = te/m³**- Powder Factor -**Yield PF: **0.388** kg/te (actual)Front row: **0.254** kg/te (theoretical)Main Body: **0.360** kg/te (theoretical)"KPI" PF: **#DIV/0!** kg/te (theoretical)1.735 lb/yd³1.136 lb/yd³1.607 lb/yd³##### lb/yd³

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

blaster hours: **6.5**helper hours: **5.5**Tech hours: **GPS 1hr**adjusted collars to holes: **A1,3,4-10ft +O21:AA54A7,8-11ft A9,10,11-10ft A12-12ft A13-B1, C1, D1-10ft X1-20ft X2-12ft X3-10ft**

Customer: **Nelson****Blast Design**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-07-25**Blast Number: **17-015**Orica Order #: **2216725**Blast Time: **11:57 AM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40393	79.88378	0.757542	1.394235
Front Row Corner	43.40406	79.88393	0.757544	1.394238
Back Row Corner	43.40385	79.88356	0.757540	1.394231
Average (Centre of Blast)	43.40395	79.88376	0.757542	1.394235

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 1.1 mm/s	Trigger set at: 2.0 mm/s		
	frequency: Hz	V / T / L : T (Vertical, Transverse or Longitudinal)		
	air overpressure: 112.8 dB	Trigger set at: 115 dB		
Northwest- colling rd (Nelson monitor)				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043
Distance (2nd Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 3.6 mm/s	Trigger set at: 2.0 mm/s		
	frequency: Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
	air overpressure: 91.5 dB	Trigger set at: 115 dB		
2450 2nd concession (Nelson monitor)				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 2.2 mm/s	Trigger set at: 2.0 mm/s		
	frequency: Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
	air overpressure: 88.0 dB	Trigger set at: 115 dB		
Southwest- Camisle (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned} W &= \frac{D^2}{30^2} \\ &= \frac{(0)^2}{30^2} \text{ kg} \\ &= \frac{0}{900} \text{ kg} \end{aligned}$$

Maximum Indicated Charge Weight per Delay = **0** kg**Orica**

Blaster-in-charge:

jim bray

*Kevin Toplis*Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

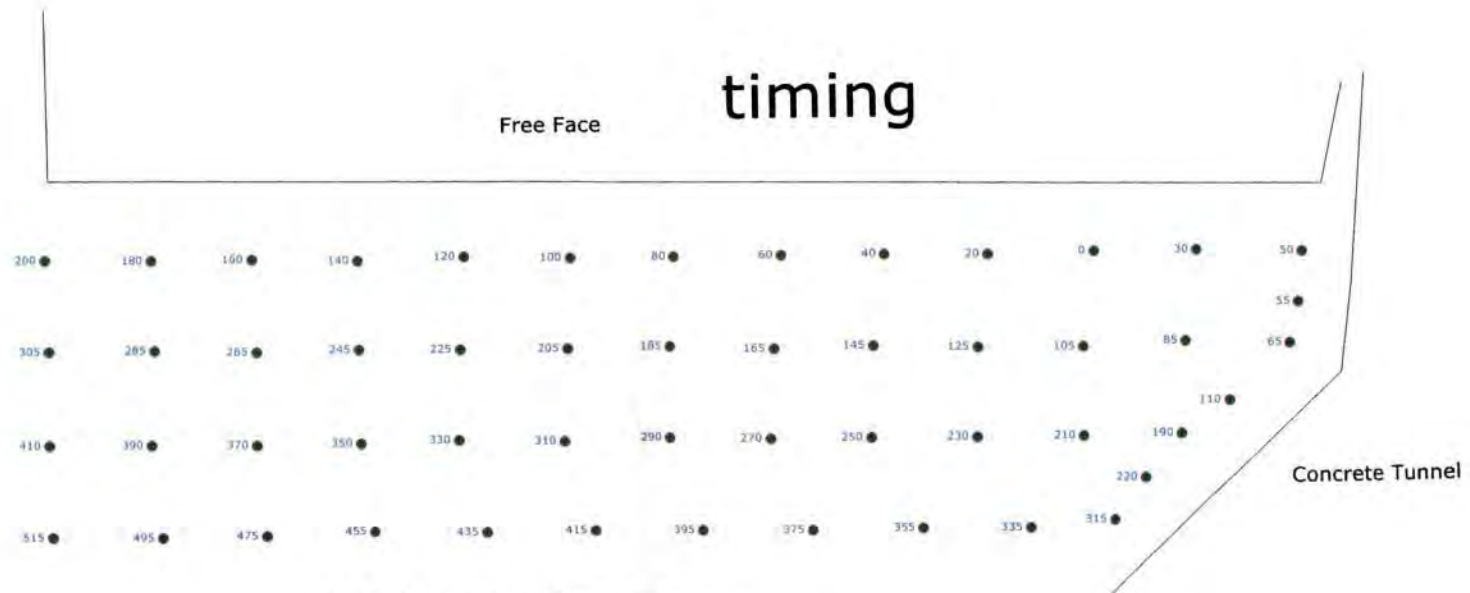
1st row burden: 12.0ft

Hole Diameter: 4.0in

Number of holes: 52

Hole angle: 0.0°

Total drilled: 2188.5ft



17-015 Lower Middle Bench
12' X 10.5' Front Row - 9' X 10.5' Body
4" Drill Bit
250 Floor Elevation + .6 Sub



Not to scale

SHOTPlus 5.6.3.6	24/07/2017
Mine	Burlington
Location	
Title/author	17-015 Lower Middle Bench G. Palcso
Filename	17-015_Lower_Middle_Bench_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

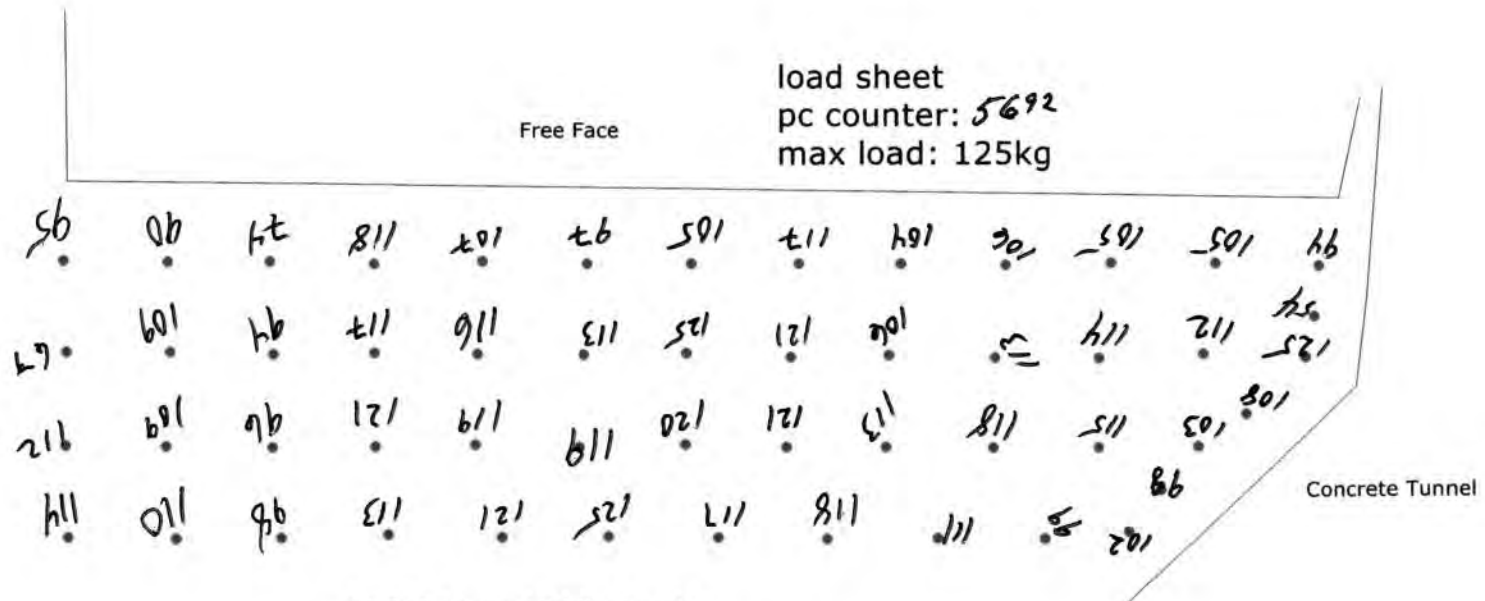
1st row burden: 12.0ft

Hole Diameter: 4.0in

Number of holes: 52

Hole angle: 0.0°

Total drilled: 2188.5ft



17-015 Lower Middle Bench
12' X 10.5' Front Row - 9' X 10.5' Body
4" Drill Bit
250 Floor Elevation + .6 Sub

SHOTPlus 5.6.3.6	24/07/2017
Mine	Burlington
Location	
Title/author	17-015 Lower Middle Bench G. Palcso
Filename	17-015_Lower_Middle_Bench_Final.spf

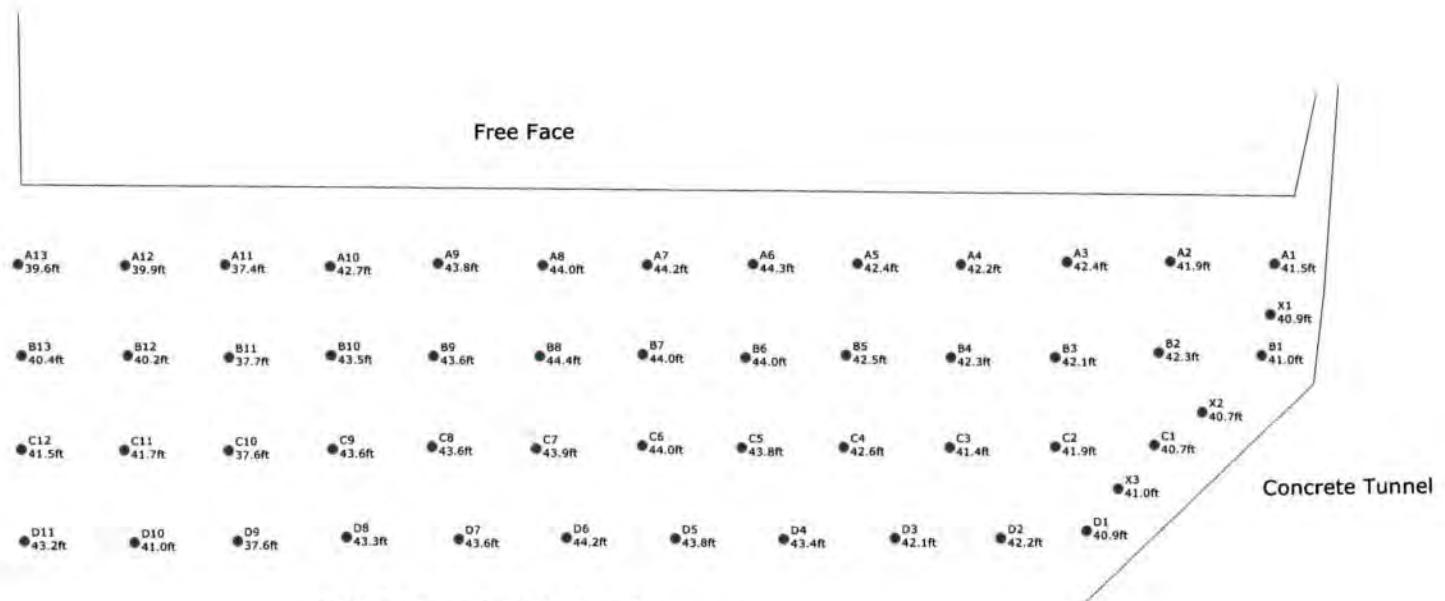


Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.5ft Subdrill: 2.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 52 Hole angle: 0.0°
 Total drilled: 2188.5ft



17-015 Lower Middle Bench
 12' X 10.5' Front Row - 9' X 10.5' Body
 4" Drill Bit
 250 Floor Elevation + .6 Sub



Not to scale

SHOTPlus 5.6.3.6		24/07/2017
Mine	Burlington	
Location		
Title/author	17-015 Lower Middle Bench G. Palcso	
Filename	17-015_Lower_Middle_Bench_Final.spf	

Customer: **Nelson**Quarry: **Burlington**Blast Number: **17-015****Blast Design**

P.O. #:

Orica Order #:

Design Date: **2017-07-25**

page 1

Blaster-in-charge: **Kevin Toplis** (Print Name)Blast Location: **Lower middle bench** (Bench / Face)GPS Coordinates: **43.40395** °N Latitude **79.88376** °W Longitude

Centre of Blast

Centre of Blast

Design te Blasted: **15,057** te
 Total Holes Loaded: **52** holes
 ... including: **3** Dead Holes
 ... and: **0** Helper Holes
 Helper Hole Collar: **0.0** ft avg
 # Rows Blasted: **4** rows

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: **101.6** mm **0**° # Holes: **52** = 2,184.0 ft (4 " diam)
 Secondary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)
 Tertiary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)

- Design Pattern (Front Row) -Burden: **12.0** ft avgSpacing: **10.5** ft avg# Holes: **13** (front row)**- Design Pattern (Main Body) -**Burden: **9.0** ft avgSpacing: **10.5** ft avg# Holes: **39** main bodyBench Height: **40.0** ft avgSub-drill: **2.0** ft avgHole Depth: **42.0** ft avg**- Design Stone Decking -**Front Row: **0.0** ft avgMain Body: **0.0** ft avg**- Design Collar Stemming -**Front Row: **8.0** ft avgMain Body: **7.0** ft avgMaterial used: **.75** clear**- Design Charge Length -**Front Row: **34.0** ft avgMain Body: **35.0** ft avg**- Design Charge Weight -**Front Row: **99.1** kg/holeMain Body: **102.1** kg/holeMax Chge Wt / delay: **115.0** kg/delayRequired kg Loaded: **5,842** kgRock Density: **2.65** g/cc = te/m³**- Design Powder Factor -**Expected Yield PF: **0.388** kg/te (actual)Front row: **0.262** kg/te (theoretical)Main Body: **0.360** kg/te (theoretical)"KPI" PF: **0.335** kg/te (theoretical)1.171 lb/yd³1.607 lb/yd³1.498 lb/yd³

Cost Reduction Notes (this Blast) - change in Blt, B, S, Expl or IS from previous Blast

Bulk Explosives Req'd:

kg

CENTRA GOLD 70 ChargeWt.exe **5,824****Pkgd Explosives Req'd:**

kg

Boosters Req'd:

kg/u # used

kg

PENTEX 12 (OR EQUIVALENT) 0.34 **52** 17.7total explosives weight in Blast (kg): **5,842**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators Req'd:**

ms

req'd

UNITRONIC 600 15M **52****Cord & Access. Req'd:**

U of M

req'd

IRE DUPLEX (6 PACK) 400M units **1****Resource Deployment**

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretracked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	

1086292



Bill of Lading / Connaissance

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSEMENT

2216725

85716915

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
25 Jul 2017	00:00:00	NELSON AGGREGATE COMPANY	N/A
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON	SHIP, MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
25 Jul 2017	FOB Dest'n, Own Truck	F-73289	16055
SHIP VIA TRANSPORTEUR	ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS	
Orica Truck	STANDARD		

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT.	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
98	PC	X	46	52	PENTEX BC 340 (49/CS)	2	35.770
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	80	0	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
132	PC	X	80	52	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
100	PC		100	0	MINI STEM PLUGS - PART #6015		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							70.722 KG
**** TOTAL PACKAGES ****							6
GHS/WHMIS SDS documents available Website: www.oricaminingsservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE		EMERGENCY RESPONSE NO.24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMERO		PLACARDS OFFERED / PLACARDS OFFERT		FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA :	
ERAP 2-1510		1-877-561-2626		YES / OUI NO / NON		Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5	
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.				DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE		NETTE No. CONV PRESSAGE WT AGREEMENT NO.	
CONSIGNOR / EXPÉDITEUR		CARRIER / TRANSPORTEUR		CONSIGNEE / DESTINATAIRE			
GRAND VALLEY		Orica Truck		NELSON AGGREGATE COMPANY			
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR		DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR		RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR			
Neil Kwart		Neil Kwart					
SIGNATURE		SIGNATURE		SIGNATURE		DATE	
25 07 17		25 07 17		25 07 17		D/J M/M Y/A	

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNED LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 2 ****

D.F.G. S7772

Customer: **Nelsons****Blast Report**Quarry: **Burlington**P.O. #: **NA**Blast Date: **2017-08-30**Blast Number: **17-016**Orica Order #: **2232326**Blast Time: **12:01 PM**

page 1

Blaster-in-charge: **Mitch Ossington** (Print Name)Blast Location: **South face** (Bench / Face)GPS Coordinates: **43.39837** °N Latitude **79.88412** °W Longitude
Centre of Blast Centre of BlastWind from the: **SW** at **5** kph Temperature: **21 to 25** °CClear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: **3000ft** m**- Drilling Information -**

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 °	# Holes: 28 = 2,360.4 ft (4 " diam)
Secondary Bit diam: <input type="text"/> mm	0 °	# Holes: <input type="text"/> = 0.0 ft (" diam)
Tertiary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,280	20,510	6,770

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	112	38.1

total explosives weight in Blast (kg): **6,808**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators:**

	case #'s	ms	# used
UNITRONIC 600 6M			28
UNITRONIC 600 20M			28
UNITRONIC 600 30M			56

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	

tonnes Blasted:	16,211 te	6,118 m ³
Total tonnes per day:	16,211 te	TBA Rate Code
Total Holes Loaded:	28 holes	
... including:	0 Dead Holes	
... and:	3 Helper Holes	
Helper Hole Collar:	7.0 ft avg	
# Rows Blasted:	3 rows	
- Pattern (Front Row)-		
Burden:	10.0 ft avg	
Spacing:	10.5 ft avg	
# Holes:	14 front row	
- Pattern (Main Body) -		
Burden:	10.0 ft avg	
Spacing:	10.5 ft avg	
# Holes:	14 main body	
Bench Height:	82.3 ft avg	
Sub-drill:	2.0 ft avg	
Hole Depth:	84.3 ft avg	
- Stone Decking -		
Front Row:	4.0 ft avg	
Main Body:	4.0 ft avg	
# Stone Decks:	28 per blast	
- Collar Stemming -		
Front Row:	10.0 ft avg	
Main Body:	7.0 ft avg	
Material used:	1/2" crush	
- Charge Length -		
Front Row:	70.3 ft avg	
Main Body:	73.3 ft avg	
- Charge Weight -		
Front Row:	205.0 kg/hole	
Main Body:	213.7 kg/hole	
Max. per delay:	150.0 kg/delay	
SD () Equation:	0.0 kg/delay	
Total kg Loaded:	6,808 kg	
Rock Density:	2.65 g/cc = te/m ³	
- Powder Factor -		
Yield PF:	0.420 kg/te (actual)	
Front row:	0.316 kg/te (theoretical)	
Main Body:	0.330 kg/te (theoretical)	
"KPI" PF:	0.328 kg/te (theoretical)	

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Blaster Hours= 6hr
Helper Hours= 10hrs

Customer: **Nelsons****Blast Design**Quarry: **Burlington**P.O. #: **NA**Blast Date: **2017-08-30**Blast Number: **17-016**Orica Order #: **2232326**Blast Time: **12:01 PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39827	79.88426	0.757443	1.394243
Front Row Corner	43.39837	79.88413	0.757444	1.394241
Back Row Corner	43.39847	79.88398	0.757446	1.394238
Average (Centre of Blast)	43.39837	79.88412	0.757444	1.394241

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (1st Seis. From Centre of Blast)	0.0 m			
	Post Blast Data:	ppV: 1.1 mm/s	Trigger set at: 2.0 mm/s		
		frequency: Hz	V / T / L : T (Vertical, Transverse or Longitudinal)		
		air overpressure: 107.5 dB	Trigger set at: 115 dB		
	Colling Rd				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (2nd Seis. From Centre of Blast)	0.0 m			
	Post Blast Data:	ppV: 1.5 mm/s	Trigger set at: 2.0 mm/s		
		frequency: Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
		air overpressure: 91.5 dB	Trigger set at: 115 dB		
	2450 #2 sideroad				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	0.0 m			
	Post Blast Data:	ppV: 1.5 mm/s	Trigger set at: 2.0 mm/s		
		frequency: Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
		air overpressure: 88.0 dB	Trigger set at: 115 dB		
	Camisle				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned} W &= \frac{D^2}{30^2} \\ &= \frac{(0)^2}{30^2} \text{ kg} \\ &= \frac{0}{900} \text{ kg} \end{aligned}$$

Maximum Indicated Charge Weight per Delay = **0** kg**Orica**

Blaster-in-charge:

jim bray

*Mitch Ossington*Signature required, indicating that
Blast Report is Complete & Accurate.

Customer: **Nelsons****Blast Design**Quarry: **Burlington**P.O. #: **NA**Design Date: **2017-08-30**Blast Number: **17-016**

Orica Order #:

page 1

Master-in-charge: **Mitch Ossington** (Print Name)Blast Location: **South Face** (Bench / Face)GPS Coordinates: **43.39805** °N Latitude **79.88433** °W Longitude
Centre of Blast Centre of Blast

Design te Blasted: **18,157** te
 Total Holes Loaded: **28** holes
 ... including: **0** Dead Holes
 ... and: **3** Helper Holes
 Helper Hole Collar: **7.0** ft avg
 # Rows Blasted: **3** rows

- Drilling Information -

Angle from Vertical
 Primary Bit diam: **101.6** mm **0'** # Holes: **28** = 2,360.4 ft (4 " diam)
 Secondary Bit diam: mm **0'** # Holes: = 0.0 ft (" diam)
 Tertiary Bit diam: mm **0'** # Holes: = 0.0 ft (" diam)

Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: **10.0** ft avg
 Spacing: **10.5** ft avg
 # Holes: **14** front row

- Design Pattern (Main Body) -

Burden: **10.0** ft avg
 Spacing: **10.5** ft avg
 # Holes: **14** main body
 Bench Height: **82.3** ft avg
 Sub-drill: **2.0** ft avg
 Hole Depth: **84.3** ft avg

- Design Stone Decking -

Front Row: **4.0** ft avg
 Main Body: **4.0** ft avg

- Design Collar Stemming -

Front Row: **7.0** ft avg
 Main Body: **7.0** ft avg
 Material used: **1/2" crush**

- Design Charge Length -

Front Row: **73.3** ft avg
 Main Body: **73.3** ft avg

- Design Charge Weight -

Front Row: **213.7** kg/hole
 Main Body: **213.7** kg/hole
 Max Chge Wt / delay: **130.0** kg/delay

Required kg Loaded: **6,551** kg
 Rock Density: **2.65** g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: **0.361** kg/te (actual)
 1 472 lb/yd³
 Front row: **0.330** kg/te (theoretical)
 1 472 lb/yd³
 Main Body: **0.330** kg/te (theoretical)
 1,472 lb/yd³
 "KPI" PF: **0.330** kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

130 kg in bottom deck. Bob the top deck to collar.**Bulk Explosives Req'd:**

	ChargeWt.exe	kg
CENTRA GOLD 70		6,500

Pkgd Explosives Req'd:

	kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 16 (OR EQUIVALENT)	0.45	112	50.8

total explosives weight in Blast (kg): **6,551**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators Req'd:**

	ms	# req'd
UNITRONIC 600 30M		56
UNITRONIC 600 20M		28
UNITRONIC 600 9M		28

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
STEMMING PLUG MINI	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

	>=5,000kg	<10,000kg	
BULK TRUCK CHARGE			1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		
3D LASER PROFILE	Line Item (Fee per Blast)		1
BORETRACK	Enter "1" if Boretraked		
LABOUR CHARGE (enter HOURS)	Must be pre-authorized		



Customer: **Nelsons**

Blast Design

Quarry: **Burlington**

P.O. #:

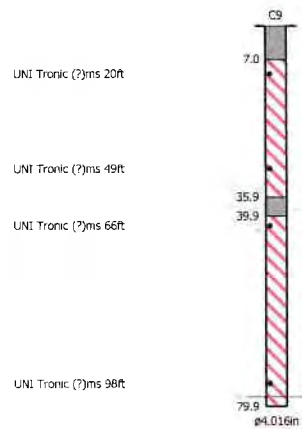
Blast Date: **2017-08-30**

Blast Number: **17-019**

Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mitch Ossington

#

Quarry Manager:

Signature required, indicating
sign off on Blast Design

1086863

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES
SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissance



Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT	
TARE	
NET	
TIME IN HEURE D'ENTRÉE 845	TIME OUT HEURE SORTIE 1230
ORDER NUMBER N° DE COMMANDE 2232326	B/L NUMBER N° DE CONNAISSEMENT 85752392

PAGE 2

DATE REQUIRED DATE REQUISE 30 Aug 2017	TIME REQUIRED HEURE REQUISE 00:00:00	INVOICE TO / BUYER FACTURÉ À / ACHETEUR NELSON AGGREGATE COMPANY	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT n/a
DATE SHIPPED EXPÉDIÉ LE 30 Aug 2017	FREIGHT TERMS CONDITIONS DE LIVRAISON FOB Dest'n, Own Truck	SHIP. MAG. LIC. PERMIS EXPÉDITEUR F-73289	VEHICLE NO. N° DE VÉHICULE
SHIP VIA TRANSPORTEUR Orica Truck		ROUTING ITINÉRAIRE STANDARD	MAG. LIC. NO. N° DE PERMIS

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
196	PC	X	84	112	PENTEX BC 340 (49/CS)	4	71.540
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	52	28	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
66	PC	X	38	28	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
72	PC	X	16	56	*uni tronic 600-30M C/Z SPL(100')36P	2	21.168
100	PC		100	0	MINI STEM PLUGS - PART #6015		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							118.552 KG
**** TOTAL PACKAGES ****						9	
GHS/WHMIS SDS documents available Website: www.oricamining.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE FRAP 2-1510		EMERGENCY RESPONSE NO./24 HOUR NUMBER TELEPHONE D'URGENCE/24 HEURE NUMERO 1-877-561-3636		PLACARDS OFFERED / PLACARDS OFFERT YES / OUI NO / NON		FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA: Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5	
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE \$		NETTE No. CONV PRESSAGE WT AGREEMENT NO.			
CONSIGNOR / EXPÉDITEUR GRAND VALLEY		CARRIER / TRANSPORTEUR Orica Truck		CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY			
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR B. Williams		DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR B. Williams		RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR B. Williams			
SIGNATURE B. Williams		DATE 30 Aug 17 D/J M/M Y/A		SIGNATURE B. Williams		DATE 30 Aug 17 D/J M/M Y/A	

3

MEMORANDUM
MEMORANDUM

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE
SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ÊTRE SIGNÉ
PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 2 ****

D.F.G. S7772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft
1st row burden: 10.0ft
Total drilled: 2362.0ft

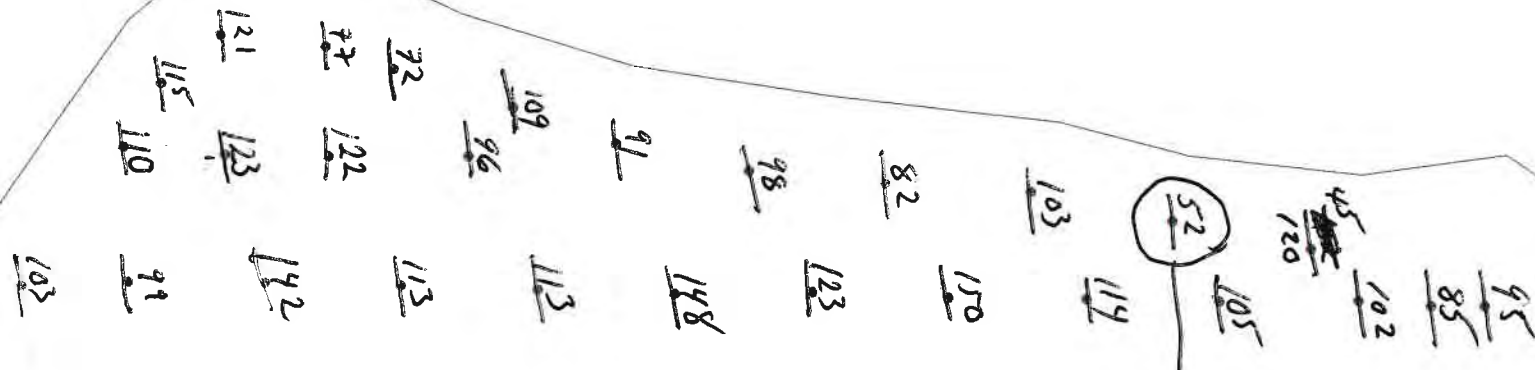
Spacing: 10.5ft
Hole Diameter: 4.0in

Subdrill: 2.0ft
Number of holes: 28

Stemming: 7.0ft
Hole angle: 0.0°

Free Face

Free Face



17-016 South Wall Final
10' X 10.5' - 4" Bit
248.5 Floor Elevation + .6 Sub

ALL BOTTOM DECKS
TOOK 130 Kg UNLESS
MARKED.



Scale 1:175

SHOTPlus 5.6.2.7	29/08/2017
Mine	Burlington
Location	
Title/author	17-016 South Wall Final G. Palcso
Filename	17-016 South Wall Final Timing.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft Spacing: 10.5ft Subdrill: 2.0ft Stemming: 7.0ft
 1st row burden: 10.0ft Hole Diameter: 4.0in Number of holes: 28 Hole angle: 0.0°
 Total drilled: 2362.0ft

Free Face

Free Face

17-016 South Wall Final
 10' X 10.5' - 4" Bit
 248.5 Floor Elevation + .6 Sub



Scale 1:175

SHOTPlus 5.6.2.7	29/08/2017
Mine	Burlington
Location	
Title/author	17-016 South Wall Final G. Palcso
Filename	17-016 South Wall Final Timing.spf

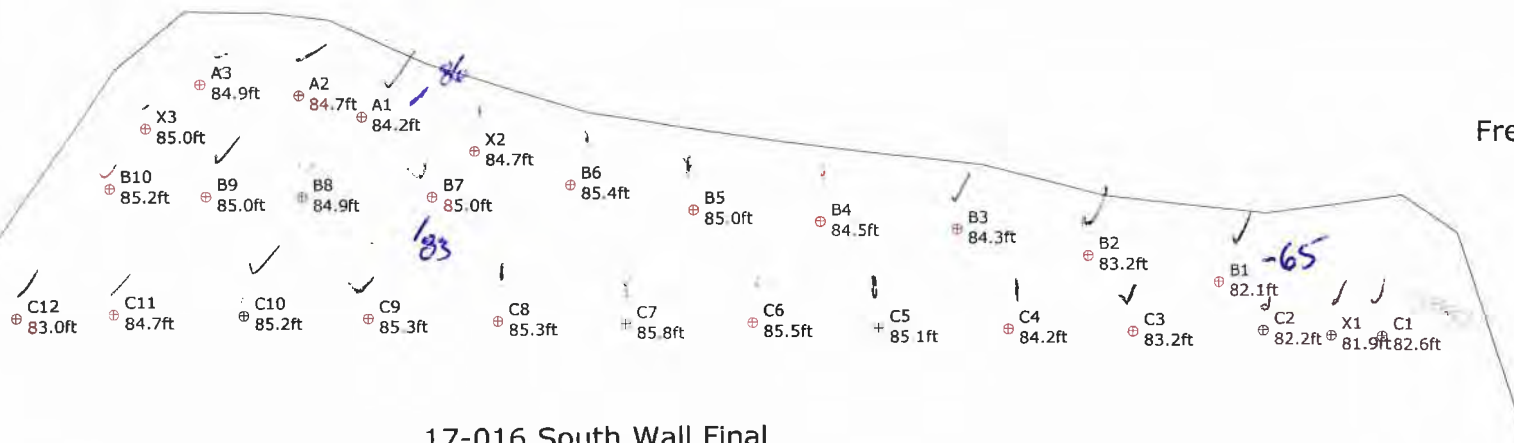
SHOTPlus 5 Plan

Blast Summary Data

Burden: 10.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 10.0ft	Hole Diameter: 4.0in	Number of holes: 28	Hole angle: 0.0°
Total drilled: 2362.1ft			

Free Face

Free Face



17-016 South Wall Final
10' X10.5' - 4" Bit
248.5 Floor Elevation + .6 Sub



over drilled 2' needs to be back filled.



Not to scale

ShotPlus5 5.2.29.0	13/07/2017
Mine	Burlington
Location	
Title/author	17-016 South Wall Final G. Palcso
Filename	17-016 South Wall Final.spf

Customer: **Nelson****Blast Report**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-08-03**Blast Number: **17-017**Orica Order #: **2220757**Blast Time: **12:41 PM**

page 1

Blaster-in-charge: **Kevin Topplis** (Print Name)Blast Location: **Upper middle bench** (Bench / Face)GPS Coordinates: **43.40358** °N Latitude **79.88363** °W Longitude
Centre of Blast Centre of BlastWind from the: **N** at **0** kph Temperature: **26 to 30** °CClear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: **9,144** m**- Drilling Information -**

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 °	# Holes: 7 = 539.7 ft (4 " diam)
Secondary Bit diam: 114.3 mm	°	# Holes: 6 = 462.6 ft (4 1/2 " diam)
Tertiary Bit diam: 127.0 mm	°	# Holes: 8 = 616.8 ft (5 " diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	31,090	25,230	5,860

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	46	15.6

total explosives weight in Blast (kg): **5,876**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators:**

	case #'s	ms	# used
UNITRONIC 600 30M			26
UNITRONIC 600 9M			20

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	2
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)		1
# of MMU's (this Blast)		1

Services:

	Line Item (Hourly Rate)	
GPS LAYOUT		1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)	13.0

tonnes Blasted:	11,832 te	4,465 m ³
Total tonnes per day:	11,832 te	TBA Rate Code
Total Holes Loaded:	23 holes	
... including:	2 Dead Holes	
... and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	4 rows	

- Pattern (Front Row)-Burden: **12.0** ft avgSpacing: **10.5** ft avg# Holes: **4** front rowBurden: **9.0** ft avgSpacing: **10.5** ft avg# Holes: **19**Bench Height: **75.1** ft avgSub-drill: **2.0** ft avgHole Depth: **77.1** ft avg**- Stone Decking -**Front Row: **0.0** ft avgMain Body: **0.0** ft avg# Stone Decks: **0** per blast**- Collar Stemming -**Front Row: **9.0** ft avgMain Body: **8.0** ft avgMaterial used: **.75 clear****- Charge Length -**Front Row: **68.1** ft avgMain Body: **69.1** ft avg**- Charge Weight -**Front Row: **198.6** kg/holeMain Body: **201.5** kg/holeMax. per delay: **393.0** kg/delaySD () Equation: **0.0** kg/delayTotal kg Loaded: **5,876** kgRock Density: **2.65** g/cc = te/m³**- Powder Factor -**Yield PF: **0.497** kg/te (actual)Front row: **0.280** kg/te (theoretical)Main Body: **0.378** kg/te (theoretical)"KPI" PF: **#DIV/0!** kg/te (theoretical)2.218 lb/yd³1.249 lb/yd³1.690 lb/yd³##### lb/yd³

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Blaster hours: **7**helper hours: **6**

B1 and X1 are 6"

Adjusted collars to holes: A1-23ft, A2-16ft, A3-14ft, A4-16ft, A5-20ft, B1-20ft, C1-15ft

C6-load to 63ft 10ft collar, D1-20ft, D7-12ft, D8-12ft, X1 load to 35ft 10ft collar, X2-28ft

Holes C6, X1 and X2 got 2 30m uni,

Customer: **Nelson****Blast Design**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-08-03**Blast Number: **17-017**Orica Order #: **2220757**Blast Time: **12:41 PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40358	79.88365	0.757535	1.394233
Front Row Corner	43.40365	79.88370	0.757537	1.394234
Back Row Corner	43.40350	79.88355	0.757534	1.394231
Average (Centre of Blast)	43.40358	79.88363	0.757535	1.394232

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: did	mm/s	Trigger set at: 2.0	mm/s
	frequency: not	Hz	V / T / L : T	(Vertical, Transverse or Longitudinal)
	air overpressure: trigger	dB	Trigger set at: 115	dB
Northwest- colling rd (Nelson monitor)				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043
Distance (2nd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 2.9	mm/s	Trigger set at: 2.0	mm/s
	frequency:	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 88.0	dB	Trigger set at: 115	dB
2450 2nd concession (Nelson monitor)				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 1.3	mm/s	Trigger set at: 2.0	mm/s
	frequency:	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 88.0	dB	Trigger set at: 115	dB
Southwest- Camisle (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$
$$= \frac{(0)^2}{30^2} \text{ kg}$$
$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg

Orica

Blaster-in-charge:

jim bray

*Kevin Toplis*Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 23	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1775.1ft	Blasted tonnage: 18,453S/T	

Timing

A2, A3, B4, B5, D7, and D8 are 4.5" Diameter
A1, B1, C1, D1, X1, X2, B6, and C6 are 5" Diameter
all other holes drill 4" Diameter

open face



Upper Middle 17-017 Final
12x10.5 9x10.5 Pattern
4" - 4.5" - 5" Hole Diameter
250m Elevation + 0.6m Subdrill



Not to scale

SHOTPlus 5.6.3.6	03/08/2017
Mine	
Location	
Title/author	Middle/ Upper 17-015 Design G. Palcso
Filename	17-017_Upper_Middle_Final.spf

$0-6''$
 $\square-5''$
 $\Delta-4.5''$

load sheet
pc counter:

[illegible]

5731 kg



Not to scale

SHOTPlus 5.6.3.6

03/08/2017

Title/author	Middle/ Upper 17-015 Design	G. Palcso
--------------	-----------------------------	-----------

Filename	17-017_Upper_Middle_Final.spf
----------	-------------------------------

Customer: **Nelson****Blast Design**Quarry: **Burlington**

P.O. #:

Design Date: **2017-08-03**Blast Number: **17-017**Orica Order #: **2220757**

page 1

Blaster-in-charge: **Kevin Toplis** (Print Name)Blast Location: **Upper middle bench** (Bench / Face)GPS Coordinates: **43.40358** °N Latitude **79.88363** °W Longitude

Centre of Blast

Centre of Blast

Design te Blasted: **11,670** te
 Total Holes Loaded: **23** holes
 ... including: **2** Dead Holes
 ... and: **0** Helper Holes
 Helper Hole Collar: **0.0** ft avg
 # Rows Blasted: **4** rows

Drilling Information

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: **101.6** mm **0**° # Holes: **9** = 693.9 ft (**4** " diam)
 Secondary Bit diam: **114.3** mm **0**° # Holes: **6** = 462.6 ft (**4 1/2** " diam)
 Tertiary Bit diam: **127.0** mm **0**° # Holes: **8** = 616.8 ft (**5** " diam)

Design Pattern (Front Row)Burden: **12.0** ft avgSpacing: **10.5** ft avg# Holes: **3** (row) row**Design Pattern (Main Body)**Burden: **9.0** ft avgSpacing: **10.5** ft avg# Holes: **20** main bodyBench Height: **75.1** ft avgSub-drill: **2.0** ft avgHole Depth: **77.1** ft avg**Design Stone Charging**Front Row: **0.0** ft avgMain Body: **0.0** ft avg**Design Collar Stemming**Front Row: **8.0** ft avgMain Body: **7.0** ft avgMaterial used: **.75** clear**Design Charge Length**Front Row: **69.1** ft avgMain Body: **70.1** ft avg**Design Charge Weight**Front Row: **201.5** kg/holeMain Body: **204.4** kg/holeMax Chge Wt / delay: **kg/delay**Required kg Loaded: **18** kgRock Density: **2.65** g/cc = te/m³**Design Powder Factor**Expected Yield PF: **0.002** kg/te (actual)Front row: **0.284** kg/te (theoretical)Main Body: **0.384** kg/te (theoretical)"KPI" PF: **0.359** kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

Bulk Explosives Req'd:

kg

CENTRA GOLD 70	ChargeWt.exe	
-----------------------	--------------	--

Pkgd Explosives Req'd:

kg

Boosters Req'd:

kg/u # used

kg

PENTEX 12 (OR EQUIVALENT)	0.34	52	17.7
----------------------------------	------	-----------	------

total explosives weight in Blast (kg): **18**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators Req'd:**

ms

req'd

UNITRONIC 600 30M		23
--------------------------	--	-----------

Cord & Access. Req'd:

U of M

req'd

IRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	<2,000kg	
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS Must be pre-authorized)		



Customer: **Nelson**

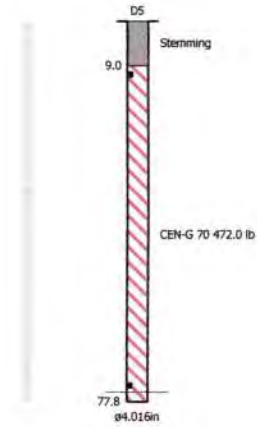
Blast Design

Quarry: **Burlington**
P.O. #:
Blast Date: **2017-08-03**

Blast Number: **17-017**
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle



Orica

Blaster-in-charge:

Kevin Toplis

#

Quarry Manager:

Signature required, indicating
sign off on Blast Design

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 23	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1775.1ft	Blasted tonnage: 14,442S/T	

A2, A3, B4, B5, D7, and D8 are 4.5" Diameter
A1, B1, C1, D1, X1, X2, B6, and C6 are 5" Diameter
all other holes drill 4" Diameter

open face



Upper Middle 17-017 Final
12x10.5 9x10.5 Pattern
4" - 4.5" - 5" Hole Diameter
250m Elevation + 0.6m Subdrill



Not to scale

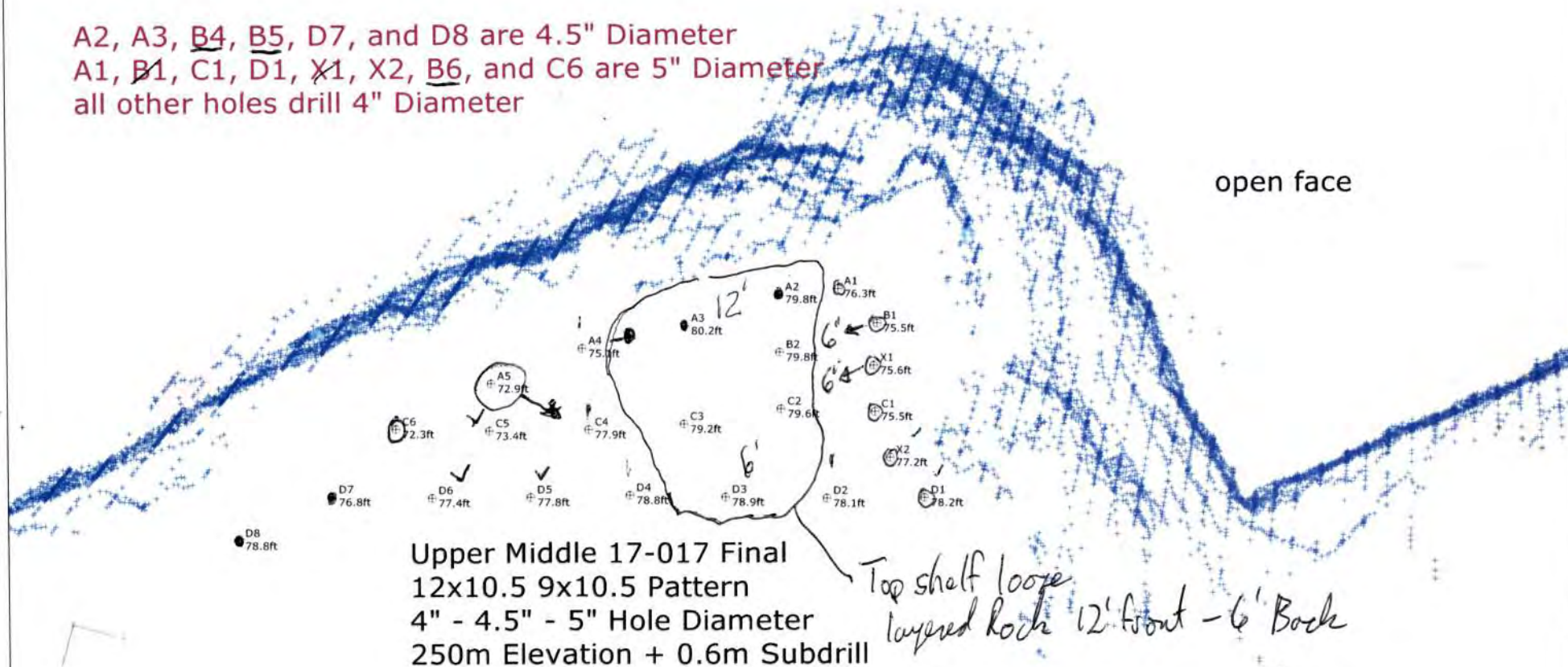
SHOTPlus 5.6.3.6	03/08/2017
Mine	
Location	
Title/author	Middle/ Upper 17-015 Design G. Palcso
Filename	17-017_Upper_Middle_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 23	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 1775.1ft	Blasted tonnage: 14,442S/T	

A2, A3, B4, B5, D7, and D8 are 4.5" Diameter
A1, B1, C1, D1, X1, X2, B6, and C6 are 5" Diameter
all other holes drill 4" Diameter



Upper Middle 17-017 Final
12x10.5 9x10.5 Pattern
4" - 4.5" - 5" Hole Diameter
250m Elevation + 0.6m Subdrill

Top shelf loose
layered rock 12' front - 6' Back

holes overdrilled used to be back filled



Not to scale

INDEMNITY & RELEASE AGREEMENT

Orica	Orica Canada Inc. , a Canadian corporation with its principal place of business at 301 Hotel de Ville, Brownsburg, Quebec J8G 3B5 ("Orica")
Customer	Cox Constuction Limited , with a place of business at 965 York Road, Guelph, Ontario Canada.
Date	June 1, 2017
Site	Nelson Aggregates, Burlington Quarry
Blasting Plan	Crushing production requires that a the crushing plant and other equipment and property be left in the designated blast area during the blast. Crusher is 64 meters from blast.

Subject to the terms and conditions of this Indemnity & Release Agreement (this "Agreement"), Orica has agreed to perform certain blasting services (the "Services") for Customer in accordance with the Blasting Plan. Customer recognizes and acknowledges that the performance of the Services in accordance with the Blasting Plan, despite the use of best practices, subjects Orica and Customer to increased risks (a) that the intended blasting results will not be obtained, and (b) of injury and/or death to persons and damage and/or destruction to real and personal property, including without limitation, any property listed above in the Blasting Plan.

Customer, for itself and its parent companies, subsidiaries, shareholders, affiliates and each of their respective agents, representatives, managers, members, directors, officers, employees, heirs, executors, successors and assigns (the "Customer Parties"), shall forever release, discharge, defend and indemnify Orica, its direct and indirect shareholders, subsidiaries, affiliates and parent companies, and each of their respective agents, representatives, managers, members, directors, officers, employees, successors and assigns (collectively, the "Orica Parties"), of, from and against each and every claim made, asserted or threatened and any and all disputes, suits, losses, demands, actions, causes of action, damages, compensation, costs, fees, expenses, interest, awards, judgment, diminution in value, fines, contracts, covenants, obligations, liens, debts and liabilities of every kind and nature whatsoever, presently known or unknown, that the Customer Parties or any third party may now or in the future claim, assert or have, whether in tort, contract, law, equity or otherwise, against the Orica Parties, resulting from, arising out of or relating in any way to the performance of the Services in accordance with the Blasting Plan.

This Agreement constitutes the entire agreement between Customer and Orica with respect to all matters referred to herein and there is no other understanding, agreement, warranty or representation whether express or implied (whether by statute or otherwise) in any way extending, defining or otherwise relating to this Agreement. This Agreement may only be varied or amended by an agreement in writing between Orica and Customer. This Agreement shall be governed and construed in accordance with the laws of the Province of Ontario, without reference to its rules regarding conflicts of laws. This Agreement may be executed by electronic signature and in one or more counterparts.

Cox Constuction Limited

By: Bill White
Name: Bill White
Title: Super

1086458



Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

Bill of Lading / Connaissance

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

7:00

TIME OUT
HEURE SORTIE

1:00

ORDER NUMBER
N° DE COMMANDE

2220757

B/L NUMBER
N° DE CONNAISSEMENT

85726282

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
03 Aug 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	SHIP VIA TRANSPORTEUR	SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
03 Aug 2017	FOB Dest'n, Own Truck	F-73289	DT-15001
Orica Truck		STANDARD	
QTY. QTE.	UM	QTY. RET'D QTE. RET.	QTY. SOLD QTE. FACT
147	PC	X 101	46
2	PC	X 1	1
60	PC	X 40	20
66	PC	X 66	0
72	PC	X 46	26
100	PC	X 98	2
1	PC		
1.0	HR		
1	PC		
DESCRIPTION		# OF / DE PKGS.	AMOUNT MONTANT
PENTEX BC 340 (49/CS)		3	53.655
Harness Wire Duplex (6 pack) 400m		1	5.840
*uni tronic 600-09.0M CU/ZC(30')60PC		1	5.880
*uni tronic 600-15M C/Z SPL(50')66PC		1	11.286
*uni tronic 600-30M C/Z SPL(100')36P		2	21.168
MINI STEM PLUGS - PART #6015			0.700
LICENSED BLASTER			
LABOUR CHARGE			
ROG (ROCK ON GROUND)			
TOTAL GROSS WEIGHT			98.529 KG
**** TOTAL PACKAGES ****		8	
GHS/WHMIS SDS documents available Website: www.oricaminingservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)			

24 HOUR TECHNICAL INFORMATION EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE		BAGS USED / SACS UTILISÉS	
BRAP 2-1510		1-877-561-2636	
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENCE À NO DE CONNAISSEMENT D'ORICA:	
CONSIGNOR / EXPÉDITEUR		CONSIGNEE / DESTINATAIRE	
GRAND VALLEY		NELSON AGGREGATE COMPANY	
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR		RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR	
Tristan Neely		Tristan Neely	
SIGNATURE		SIGNATURE	
DATE		DATE	
3 8 17		3 8 17	
B/J M/M Y/A		B/J M/M Y/A	

1 ORIGINAL - NOT NEGOTIABLE
ORIGINAL - NON NEGOCIABLE
(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSEMENT-CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ÊTRE SIGNÉ PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉES AU VERSO

Customer: **Nelson**Quarry: **Burlington**Blast Number: **17-018****Blast Report**

P.O. #:

Orica Order #: **2230835**Blast Date: **2017-08-28**Blast Time: **12:32 PM**

page 1

Blast-in-charge: **Kevin Toplis** (Print Name)Blast Location: **Floor** (Bench / Face)GPS Coordinates: **43.37370** °N Latitude **79.92779** °W Longitude
Centre of Blast Centre of BlastWind from the: **W** at **5** kph Temperature: **21 to 25** °CClear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: **9,144** m**- Drilling Information -**

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: **101.6** mm **0**° # Holes: **188** = 3,327.6 ft (4 " diam)
Secondary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm * # Holes: = 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,130	21,910	5,220

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	167	56.8

total explosives weight in Blast (kg): 5,277

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:	case #'s	ms	# used
EXEL HANDIDET 12m		25/500	167
CONNECTADET 12M		42 ms	31
UNITRONIC 600 6M			1
CONNECTADET 9M		25 ms	3

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter "1" if Layout by GPS	0
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretracked	0
LABOUR CHARGE (enter HOURS)	Line Item (Fee per Hour)	12.0

tonnes Blasted: **26,351** te **9,944** m³
Total tonnes per day: **26,351** te tba Rate Code
Total Holes Loaded: **167** holes
... including: **8** Dead Holes
... and: **0** Helper Holes
Helper Hole Collar: **0.0** ft avg
Rows Blasted: **8** rows
- Pattern (Front Row)-
Burden: **11.5** ft avg
Spacing: **11.5** ft avg
Holes: **26** front row

Burden: **11.5** ft avg
Spacing: **11.5** ft avg
Holes: **26,325**
Bench Height: **16.7** ft avg
Sub-drill: **1.0** ft avg
Hole Depth: **17.7** ft avg
- Stone Decking -
Front Row: **0.0** ft avg
Main Body: **0.0** ft avg
Stone Decks: **0** per blast

- Collar Stemming -
Front Row: **7.0** ft avg
Main Body: **7.0** ft avg
Material used: **3/4 Clear**

- Charge Length -
Front Row: **10.7** ft avg
Main Body: **10.7** ft avg
- Charge Weight
Front Row: **31.2** kg/hole
Main Body: **31.2** kg/hole
Max. per delay: **45.0** kg/delay
SD () Equation: **0.0** kg/delay
Total kg Loaded: **5,277** kg
Rock Density: **2.65** g/cc = te/m³

- Powder Factor -

0.894 lb/yd³ Yield PF: **0.200** kg/te (actual)
0.841 lb/yd³ Front row: **0.188** kg/te (theoretical)
0.841 lb/yd³ Main Body: **0.188** kg/te (theoretical)
#DIV/0! lb/yd³ "KPI" PF: #DIV/0! kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Holes F1, 16, 21, 22, 23, G18,19,20,21 H9, 11, 17,18,19 D24, 25 E20,21,22,23,24,25
where left out of the shot, due to not being drilled, or to short on depth.

Blaster hours: 7

Helper hours: 5

Customer: **Nelson****Blast Design**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-08-28**Blast Number: **17-018**Orica Order #: **2230835**Blast Time: **12:32 PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.31765	80.00309	0.756036	1.396317
Front Row Corner	43.40165	79.88986	0.757502	1.394341
Back Row Corner	43.40179	79.89043	0.757504	1.394351
Average (Centre of Blast)	43.37370	79.92779	0.757014	1.395003

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043
Distance (1st Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 4.7	mm/s	Trigger set at: 2.0	mm/s
	frequency:	Hz	V / T / L: T	(Vertical, Transverse or Longitudinal)
	air overpressure: 104.9	dB	Trigger set at: 115	dB
2450 #2 Side Rd (Nelson monitor)				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (2nd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 1.1	mm/s	Trigger set at: 2.0	mm/s
	frequency:	Hz	V / T / L: ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 107.5	dB	Trigger set at: 115	dB
Northwest (Nelson monitor)				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0	m		
Post Blast Data:	ppV: 3.3	mm/s	Trigger set at: 2.0	mm/s
	frequency:	Hz	V / T / L: ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 88.0	dB	Trigger set at: 115	dB
Southwest (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting.

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kgOrica
Blaster-in-charge:*Kevin Toplis*Signature required, indicating that
Blast Report is Complete & Accurate

Customer: **Nelson****Blast Report**Quarry: **Burlington**

P.O. #:

Blast Date: **2017-09-12**Blast Number: **17-019**Orica Order #: **2237955**Blast Time: **11:49 AM**

page 1

Blaster-in-charge: **Kevin Topplis** (Print Name)Blast Location: **Lower middle bench-north** (Bench / Face)GPS Coordinates: **43.40436** °N Latitude **79.88425** °W Longitude
Centre of Blast Centre of BlastWind from the: **SE** at **10** kph Temperature: **21 to 25** °CClear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: **9,144** m**- Drilling Information -**

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 °	# Holes: 37 = 1,513.3 ft (4 " diam)
Secondary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)
Tertiary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	30,317	24,940	5,377

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	41	13.9

total explosives weight in Blast (kg): **5,391**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators:**

	case #'s	ms	# used
UNITRONIC 600 15M			39
UNITRONIC 600 9M			2

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
SPIDER STEMMING PLUG 8"	units	6
	units	

Resource Deployment:

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Line Item (Hourly Rate)	1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Enter "1" if 3D Profiled	0
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	

tonnes Blasted: **10,087** te **3,806** m³Total tonnes per day: **21,101** te **TBA** Rate CodeTotal Holes Loaded: **37** holes... including: **3** Dead Holes... and: **1** Helper HolesHelper Hole Collar: **0.0** ft avg# Rows Blasted: **3** rows

- Pattern (Front Row)-

Burden: **12.0** ft avgSpacing: **10.5** ft avg# Holes: **12** front rowBurden: **9.0** ft avgSpacing: **10.5** ft avg# Holes: **25**Bench Height: **38.9** ft avgSub-drill: **2.0** ft avgHole Depth: **40.9** ft avg

- Stone Decking -

Front Row: **4.0** ft avgMain Body: **4.0** ft avg# Stone Decks: **2** per blast

- Collar Stemming -

Front Row: **8.0** ft avgMain Body: **7.0** ft avgMaterial used: **.75 clear**

- Charge Length -

Front Row: **28.9** ft avgMain Body: **29.9** ft avg

- Charge Weight -

Front Row: **84.3** kg/holeMain Body: **87.2** kg/holeMax. per delay: **140.0** kg/delaySD () Equation: **0.0** kg/delayTotal kg Loaded: **5,391** kgRock Density: **2.65** g/cc = te/m³

- Powder Factor -

Yield PF: **0.534** kg/te (actual)Front row: **0.229** kg/te (theoretical)Main Body: **0.316** kg/te (theoretical)"KPI" PF: **#DIV/0!** kg/te (theoretical)2.387 lb/yd³1.023 lb/yd³1.412 lb/yd³##### lb/yd³

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

total labour charge, see blast report 17-021

4ft stone decks where used in holes A1 and B8

This blast was shot with 17-021, 6 second delay, this shot going first

adjusted collars to following holes: A1 12ft, A4 13ft, A9 14ft A12 15ft

Customer: **Nelson****Blast Design**Quarry: **Burlington**P.O. #: Blast Date: **2017-09-12**Blast Number: **17-019**Orica Order #: **2237955**Blast Time: **11:49 AM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40436	79.88428	0.757549	1.394244
Front Row Corner	43.40423	79.88413	0.757547	1.394241
Back Row Corner	43.40450	79.88436	0.757551	1.394245
Average (Centre of Blast)	43.40436	79.88425	0.757549	1.394243

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 1.0 mm/s	Trigger set at: 2.0 mm/s		
	frequency: Hz	V / T / L : T (Vertical, Transverse or Longitudinal)		
	air overpressure: 114.6 dB	Trigger set at: 115 dB		
Northwest- colling rd (Nelson monitor)				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.71939	80.38847	0.763047	1.403043
2nd Reading				
Average	43.71939	80.38847	0.763047	1.403043
Distance (2nd Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 2.9 mm/s	Trigger set at: 2.0 mm/s		
	frequency: Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
	air overpressure: 88.0 dB	Trigger set at: 115 dB		
2450 2nd concession (Nelson monitor)				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 1.9 mm/s	Trigger set at: 2.0 mm/s		
	frequency: Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
	air overpressure: 94.0 dB	Trigger set at: 115 dB		
Southwest- Camisle (Nelson monitor)				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(0)^2}{30^2} \text{ kg}$$

$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg**Orica**

Blaster-in-charge:

jim bray

*Kevin Toplis*Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

1st row burden: 12.0ft

Hole Diameter: 4.0in

Number of holes: 37

Hole angle: 0.0°

Total drilled: 1515.0ft

Free Face

timing



17-019 Lower Middle North Final - 12' X 10.5' - 9' X 10.5' - 4" Bit
250 + .6m Sub



Not to scale

SHOTPlus 5.6.3.6	11/09/2017
Mine	Burlington
Location	
Title/author	17-019 Lower Middle North Final G. Palcso
Filename	17-019_Lower_Middle_North_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.5ft Subdrill: 2.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 37 Hole angle: 0.0°
 Total drilled: 1515.0ft

Free Face

load sheet
 pc counter:
 max load: 115kg

83	109	112	89	105	105	109	106	94	106	104	$\frac{30}{88}$
108	122	111	110	$\frac{37}{103}$	105	102	110	106	104	69	105
61											
111	111	106	113	107	118	114	114	107	107	98	111

17-019 Lower Middle North Final - 12' X 10.5' - 9' X 10.5' - 4" Bit
 250 + .6m Sub

8148



Not to scale

SHOTPlus 5.6.3.6	11/09/2017
Mine	Burlington
Location	
Title/author	17-019 Lower Middle North Final G. Palcso
Filename	17-019_Lower_Middle_North_Final.spf

Customer: **Nelson****Blast Design**Quarry: **Burlington**

P.O. #:

Design Date: **2017-09-12**Blast Number: **17-019**

Orica Order #:

page 1

Blastmaster-in-charge: **Kevin Toplis** (Print Name)Blast Location: **Lower middle bench-north** (Bench) (Face)GPS Coordinates: **43.40436** °N Latitude **79.88425** °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: **10,393** te
 Total Holes Loaded: **37** holes
 ... including: **3** Dead Holes
 ... and: **1** Helper Holes
 Helper Hole Collar: **0.0** ft avg
 # Rows Blasted: **3** rows

- Drilling Information -

Angle from Vertical

Primary Bit diam:	101.6 mm	0 °	# Holes:	37	=	1,513.3 ft (4 " diam)
Secondary Bit diam:	mm	0 °	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:	mm	0 °	# Holes:		=	0.0 ft (" diam)

Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: **12.0** ft avg
 Spacing: **10.5** ft avg
 # Holes: **12** front row

- Design Pattern (Main Body) -

Burden: **9.0** ft avg
 Spacing: **10.5** ft avg
 # Holes: **25** main body
 Bench Height: **38.9** ft avg
 Sub-drill: **2.0** ft avg
 Hole Depth: **40.9** ft avg

- Design Stone Decking -

Front Row: **0.0** ft avg
 Main Body: **0.0** ft avg

- Design Collar Stemming -

Front Row: **8.0** ft avg
 Main Body: **7.0** ft avg
 Material used: **.75** clear

- Design Charge Length -

Front Row: **32.9** ft avg
 Main Body: **33.9** ft avg

- Design Charge Weight -

Front Row: **95.9** kg/hole
 Main Body: **98.8** kg/hole
 Max Chge Wt / delay: **115.0** kg/delay

Required kg Loaded: **4,038** kg
 Rock Density: **2.65** g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: **0.388** kg/te (actual)
 Front row: **0.261** kg/te (theoretical)
 Main Body: **0.358** kg/te (theoretical)
 "KPI" PF: **0.326** kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

Bulk Explosives Req'd:

CENTRA GOLD 70	ChargeWt.exe	4,025 kg
-----------------------	--------------	-----------------

Pkgd Explosives Req'd:

		kg

Boosters Req'd:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	37	12.6

total explosives weight in Blast (kg): **4,038**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators Req'd:**

	ms	# req'd
UNITRONIC 600 15M		37

Cord & Access. Req'd:

	U of M	# req'd
IRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)	Note Exception	2
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>=2,000kg	<5,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)		1/2
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee		0
3D LASER PROFILE	Enter "1" if 3D Profiled		0
BORETRACK	Enter "1" if Boretraked		0
LABOUR CHARGE (enter HOURS Must be pre-authorized)			



Customer: **Nelson**

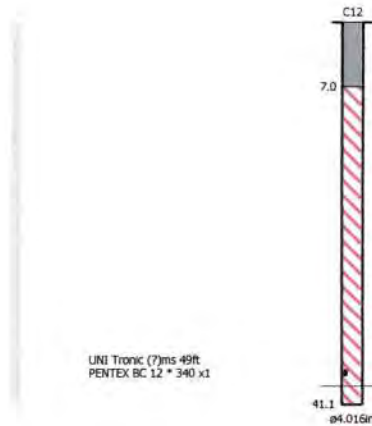
Blast Design

Quarry: **Burlington**
P.O. #:
Blast Date: **2017-09-12**

Blast Number: **17-019**
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Kevin Toplis

#

Quarry Manager:

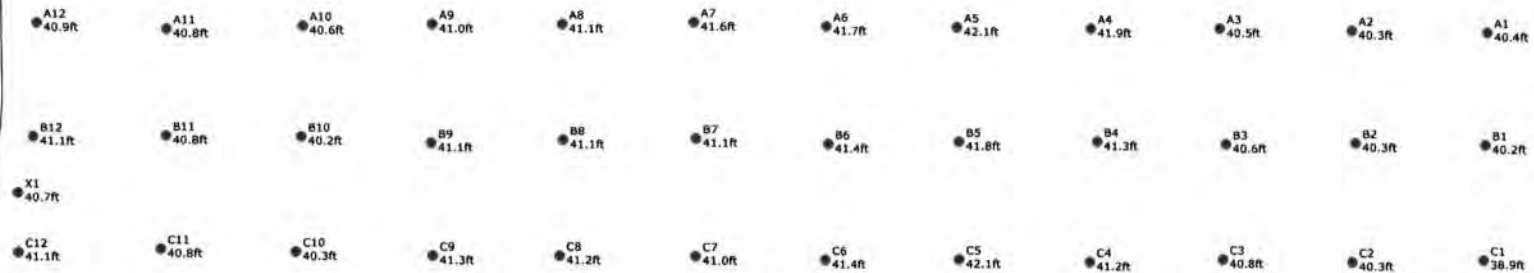
Signature required, indicating
sign-off on Blast Design

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.5ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 37	Hole angle: 0.0°
Total drilled: 1515.0ft			

Free Face



17-019 Lower Middle North Final - 12' X 10.5' - 9' X 10.5' - 4" Bit
250 + .6m Sub



Not to scale

SHOTPlus 5.6.3.6	11/09/2017
Mine	Burlington
Location	
Title/author	17-019 Lower Middle North Final G. Palcso
Filename	17-019_Lower_Middle_North_Final.spf

1086994

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABREGÉE DE CONNAISSANCE NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES
SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissance



CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSEMENT

2237955

85765597

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR		CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT			
12 Sep 2017	00:00:00	NELSON AGGREGATE COMPANY		n/a			
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON		SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE			
12 Sep 2017	FOB Dest'n, Own Truck		F-73289	16055			
SHIP VIA TRANSPORTEUR			ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS			
Orica Truck			STANDARD				
QTY. QTE.	UM	DG MD	QTY. RET'D QTE. RET.	QTY. SOLD QTE. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
98	PC	X	19	79	PENTEX BC 340 (49/CS)	2	35.770
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
60	PC	X	36	4	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
132	PC	X	57	75	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
100	PC		88	12	MINI STEM PLUGS - PART #6015		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							70.762 KG
**** TOTAL PACKAGES ****							6
GHS/WHMIS SDS documents available Website: www.oricaminingservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24 HOUR TECHNICAL INFORMATION

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENT À NO DE CONNAISSEMENT D'ORICA:
ERAP 2-1510	1-877-561-2636	YES / OUI NO / NON	Orica Canada Inc.
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE	NETTE No. CONV PRESSAGE WT AGREEMENT NO.
NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		\$	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE	
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY	
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR	
BRAND HUTCHINS	BRAND HUTCHINS		
SIGNATURE	DATE	SIGNATURE	DATE
Blb	12/9/17		12/9/17
D/J M/M Y/A	D/J M/M Y/A	D/J M/M Y/A	D/J M/M Y/A

3

MEMORANDUM
MEMORANDUM

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE
SHIPPER AND CARRIER)
(CE CONNAISSANCE-CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ÊTRE SIGNÉ
PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 2 ****

D.F.G. S7772

Customer: **Nelsons****Blast Report**Quarry: **Burlington**P.O. #: **NA**Blast Date: **2017-09-27**Blast Number: **17-020**Orica Order #: **2244865**Blast Time: **12:01 PM**

page 1

Blaster-in-charge: **Mitch Ossington** (Print Name)Blast Location: **South face** (Bench / Face)GPS Coordinates: **43.39828** °N Latitude **79.88401** °W Longitude

Centre of Blast

Centre of Blast

Wind from the: **W** at **10** kph Temperature: **26 to 30** °CClear: ☐Rain: ☐Overcast: ☐Partly Cloudy: ☒Snow: ☐Inversion: ☐Ceiling: **3000ft** m**- Drilling Information -**

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam:	101.6 mm	0 °	# Holes:	34	=	2,852.6 ft (4 " diam)
Secondary Bit diam:	114.3 mm	0 °	# Holes:	6	=	503.4 ft (4 1/2 " diam)
Tertiary Bit diam:			# Holes:		=	0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,070	24,600	9,470

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	157	53.4

total explosives weight in Blast (kg): **9,523**Pkgd Prod (0 kg) % of Total kg: **0.0%****Detonators:**

	case #'s	ms	# used
UNITRONIC 600 6M			36
UNITRONIC 600 20M			41
UNITRONIC 600 30M			80

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
STEMMING PLUG MINI	units	2
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

	Line Item (Hourly Rate)	
GPS LAYOUT		1
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	0
3D LASER PROFILE	Line Item (Hourly Rate)	1
BORETRACK	Enter "1" if Boretraked	0
LABOUR CHARGE (enter HOURS)	Must be pre-authorized	

tonnes Blasted: **27,877** te **10,520** m³Total tonnes per day: **27,877** te **TBA** Rate CodeTotal Holes Loaded: **40** holes... including: **0** Dead Holes... and: **0** Helper HolesHelper Hole Collar: **0.0** ft avg# Rows Blasted: **3** rows

- Pattern (Front Row)-

Burden: **12.0** ft avgSpacing: **10.5** ft avg# Holes: **16** front rowBurden: **10.0** ft avgSpacing: **10.5** ft avg# Holes: **24**Bench Height: **81.9** ft avgSub-drill: **2.0** ft avgHole Depth: **83.9** ft avg

- Stone Decking -

Front Row: **6.0** ft avgMain Body: **6.0** ft avg# Stone Decks: **40** per blast

- Collar Stemming -

Front Row: **10.0** ft avgMain Body: **7.0** ft avgMaterial used: **1/2" crush**

- Charge Length -

Front Row: **67.9** ft avgMain Body: **70.9** ft avg

- Charge Weight -

Front Row: **198.0** kg/holeMain Body: **206.7** kg/holeMax. per delay: **150.0** kg/delaySD () Equation: **0.0** kg/delayTotal kg Loaded: **9,523** kgRock Density: **2.65** g/cc = te/m³

- Powder Factor -

Yield PF: **0.342** kg/te (actual)Front row: **0.256** kg/te (theoretical)Main Body: **0.320** kg/te (theoretical)"KPI" PF: **#DIV/0!** kg/te (theoretical)1.526 lb/yd³1.142 lb/yd³1.431 lb/yd³##### lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Deck height varied if deck was in a void.

Blaster Hours= 6hr

Helper Hours= 11hrs

Customer: **Nelsons****Blast Design**Quarry: **Burlington**
P.O. #: **NA**
Blast Date: **2017-09-27**Blast Number: **17-020**
Orica Order #: **2244865**
Blast Time: **12:01 PM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.39844	79.88387	0.757446	1.394237
Front Row Corner	43.39826	79.88401	0.757443	1.394239
Back Row Corner	43.39813	79.88414	0.757440	1.394241
Average (Centre of Blast)	43.39828	79.88401	0.757443	1.394239

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (1st Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: DNT	mm/s	Trigger set at: 2.0 mm/s	
	frequency: DNT	Hz	V / T / L : T (Vertical, Transverse or Longitudinal)	
	air overpressure: DNT	dB	Trigger set at: 115 dB	
Colling Rd				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (2nd Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 2.5 mm/s	mm/s	Trigger set at: 2.0 mm/s	
	frequency: ? Hz	Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
	air overpressure: 103.5 dB	dB	Trigger set at: 115 dB	
2450 #2 sideroad				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading				
2nd Reading				
Average	0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)	0.0 m			
Post Blast Data:	ppV: 3.2 mm/s	mm/s	Trigger set at: 2.0 mm/s	
	frequency: ? Hz	Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
	air overpressure: 88.0 dB	dB	Trigger set at: 115 dB	
Camisle				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$
$$= \frac{(0)^2}{30^2} \text{ kg}$$
$$= \frac{0}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **0** kg

Orica

Blaster-in-charge:

jim bray

*Mitch Ossington*Signature required, indicating that
Blast Report is Complete & Accurate.

Customer: **Nelsons**Quarry: **Burlington**Blast Number: **17-020****Blast Design**P.O. #: **NA**

Orica Order #:

Design Date: **2017-09-27**

page 1

Master-in-charge: **Mitch Ossington** (Print Name)Blast Location: **South Face** (Bench / Face)GPS Coordinates: 0.00000 °N Latitude 0.00000 °W Longitude
Centre of Blast Centre of Blast

Design te Blasted: **27,877** te

Total Holes Loaded: **40** holes

... including: **0** Dead Holes

... and: **3** Helper Holes

Helper Hole Collar: **0.0** ft avg

Rows Blasted: **3** rows

- Drilling Information -

Angle from Vertical

Primary Bit diam: **101.6** mm **0**° # Holes: **40** = 3,356.0 ft (4 " diam)

Secondary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)

Tertiary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)

Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: **12.0** ft avg

Spacing: **10.5** ft avg

Holes: **16** front row

- Design Pattern (Main Body) -

Burden: **10.0** ft avg

Spacing: **10.5** ft avg

Holes: **24** main body

Bench Height: **81.9** ft avg

Sub-drill: **2.0** ft avg

Hole Depth: **83.9** ft avg

- Design Stone Decking -

Front Row: **4.0** ft avg

Main Body: **4.0** ft avg

- Design Collar Stemming -

Front Row: **7.0** ft avg

Main Body: **7.0** ft avg

Material used: **1/2" crush****- Design Charge Length -**

Front Row: **72.9** ft avg

Main Body: **72.9** ft avg

- Design Charge Weight -

Front Row: **212.6** kg/hole

Main Body: **212.6** kg/hole

Max Chge Wt / delay: **150.0** kg/delay

Required kg Loaded: **9,554** kg

Rock Density: **2.65** g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: **0.343** kg/te (actual)

1 226 lb/yd³ Front row: **0.275** kg/te (theoretical)

1 471 lb/yd³ Main Body: **0.329** kg/te (theoretical)

1.390 lb/yd³ "KPI" PF: **0.311** kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

Bulk Explosives Req'd: kg

CENTRA GOLD 70 ChargeWt.exe **9,500**

Pkgd Explosives Req'd: kg

Boosters Req'd: kg/u # used kg

PENTEX 12 (OR EQUIVALENT) 0.34 **160** 54.4

total explosives weight in Blast (kg): **9,554**

Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators Req'd: ms # req'd

UNITRONIC 600 30M **80**

UNITRONIC 600 20M **40**

UNITRONIC 600 9M **40**

Cord & Access. Req'd: U of M # req'd

IRE DUPLEX (6 PACK) 400M units **1**

STEMMING PLUG MINI units

Resource Deployment

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
SHOT SERVICE FEE *	Line Item (Fee per Blast)	1
SEISMOGRAPH RENTAL	* 1 unit in Shot Service Fee	
3D LASER PROFILE	Line Item (Fee per Blast)	1
BORETRACK	Enter "1" if Boretracked	
LABOUR CHARGE (enter HOURS Must be pre-authorized)		

12:01 pm

28c fawclouds

11km/h W

30,000 ft



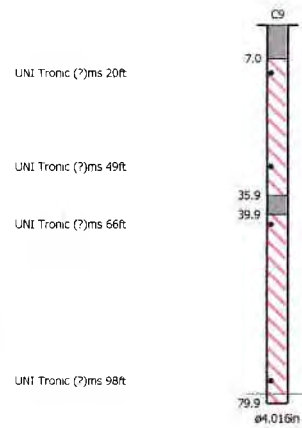
Customer: **Nelsons**
Blast Design

Quarry: **Burlington**
P.O. #:
Blast Date: **2017-09-27**

Blast Number: **17-020**
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mitch Ossington

#

Quarry Manager:

Signature required, indicating
sign off on Blast Design

1087276



Bill of Lading / Connaissancement

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT

TARE

NET

TIME IN HEURE D'ENTRÉE	TIME OUT HEURE SORTIE
6:30	
ORDER NUMBER N° DE COMMANDE	B/L NUMBER N° DE CONNAISSANCEMENT
2244865	85781592

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURE À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
27 Sep 2017	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
27 Sep 2017	FOB Dest'n, Own Truck	E-73289	DT-15001
SHIP VIA TRANSPORTEUR	ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS	
Orica Truck	STANDARD		

QTY. QTE.	UM	DG MD	QTY. RET'D QTE. RET.	QTY. SOLD QTE. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
196	PC	X	34	157	PENTEX BC 340 (49/CS)	4	71.540
2	PC	X	2	0	Harness Wire Duplex (6 pack) 400m	1	5.840
60	PC	X	24	26	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
66	PC	X	25	41	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
140	PC	X	64	80	*uni tronic 600-30M C/Z SPL(100')36P	4	35.280 42.73
75	PC	X	73	2	MINI STEM PLUGS - PART #6015		0.525
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							132.529 KG
**** TOTAL PACKAGES ****						11	
GHS/WHMIS SDS documents available Website: www.oricaminingservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

PALLETES USED / PALETTES UTILISÉES		PALLETES RETURNED / PALETTES RETOURNÉES		BAGS USED / SACS UTILISÉS	
EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE		EMERGENCY RESPONSE NO./24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO		PLACARDS OFFERED / PLACARDS OFFERT	
ERAP 2-1510		1-877-561-2626		YES / OUI NO / NON	
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.				DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE	
				\$	
				NETTE No. CONV PRESSAGE WT AGREEMENT NO.	
				FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA : Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5	
CONSIGNOR / EXPÉDITEUR		CARRIER / TRANSPORTEUR		CONSIGNEE / DESTINATAIRE	
GRAND VALLEY		Orica Truck		NELSON AGGREGATE COMPANY	
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR		DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR		RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR	
Taylor Neely		Taylor Neely			
SIGNATURE		SIGNATURE		SIGNATURE	
DATE		DATE		DATE	
27 9 17		27 9 17			
D/J M/M Y/A		D/J M/M Y/A		D/J M/M Y/A	

3 MEMORANDUM
MEMORANDUM
(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSANCEMENT-CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ÊTRE SIGNÉ PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

SHOTPlus 5 Plan

Blast Summary Data

Burden: 12.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

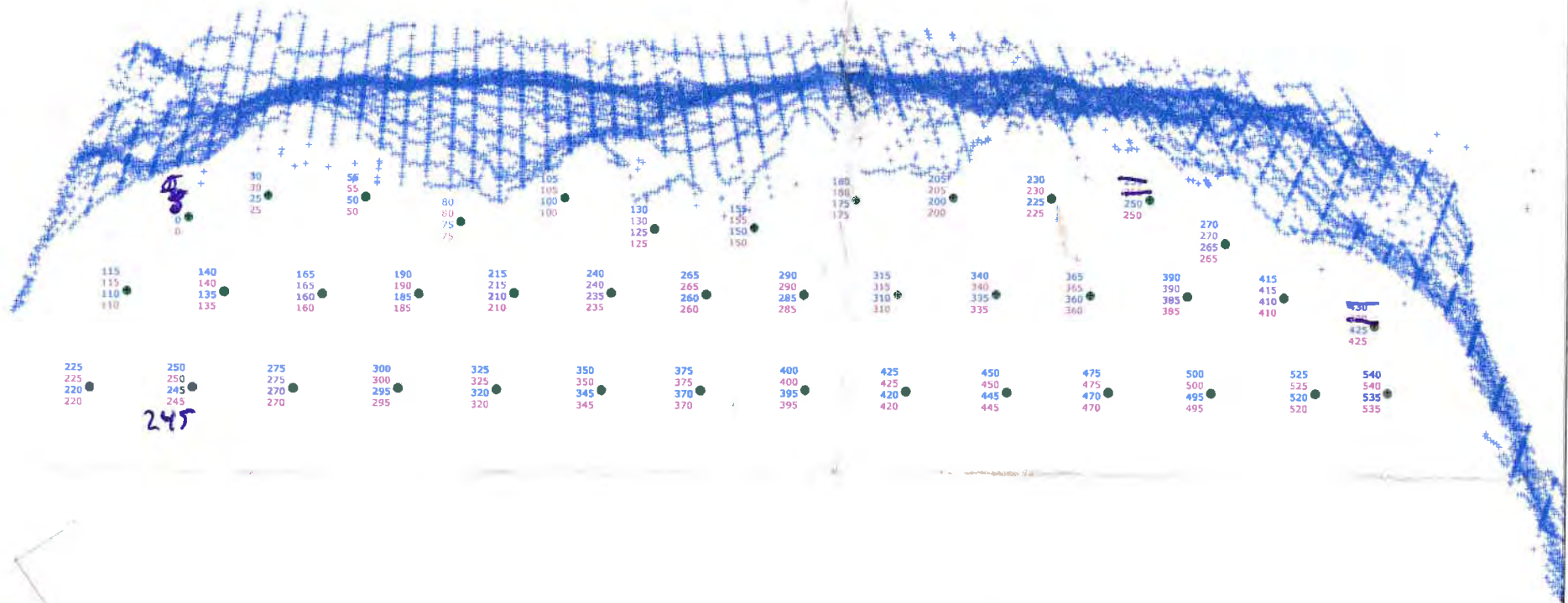
1st row burden: 10.0ft

Hole Diameter: 4.0in

Number of holes: 40

Hole angle: 0.0°

Total drilled: 3358.0ft



Scale 1:200

SHOTPlus 5.6.2.7	27/09/2017
Mine	Burlington
Location	
Title/author	17-016 South Wall Final G. Palcso
Filename	17-020_South_Wall_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 12.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

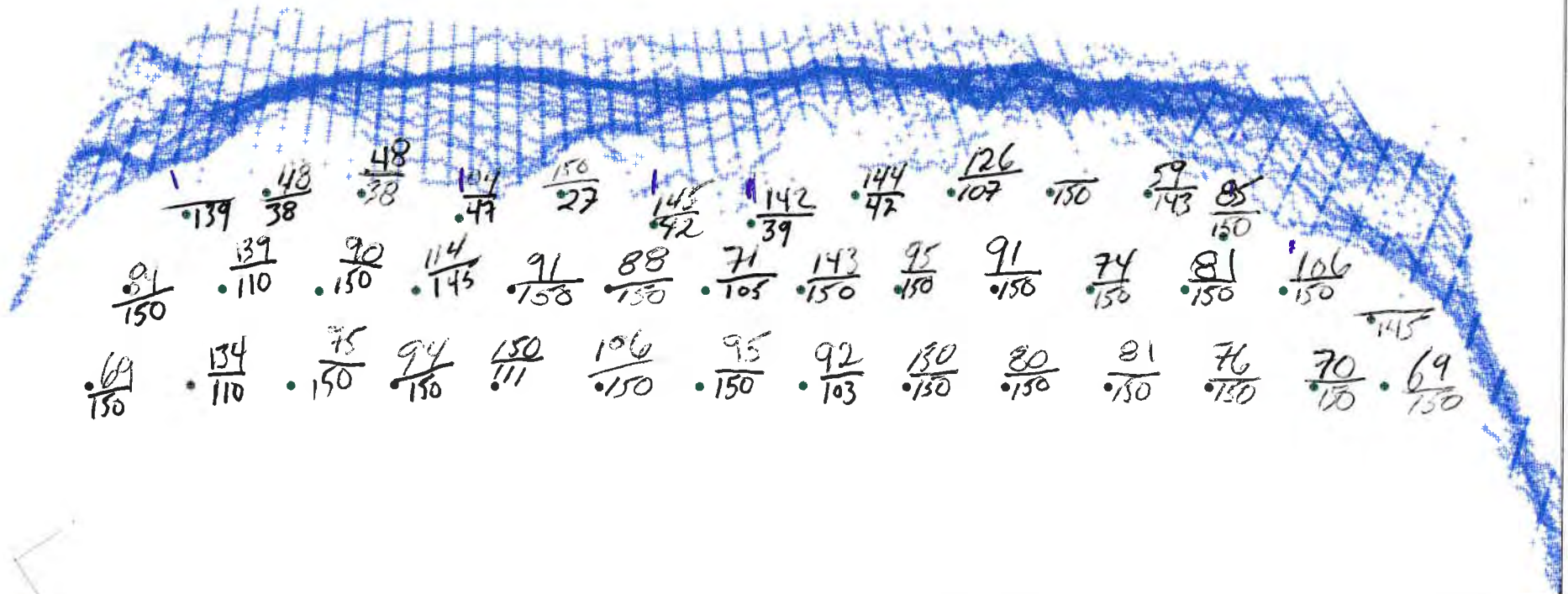
1st row burden: 10.0ft

Hole Diameter: 4.0in

Number of holes: 40

Hole angle: 0.0°

Total drilled: 3358.0ft



Scale 1:200

SHOTPlus 5.6.2.7	27/09/2017
Mine	Burlington
Location	
Title/author	17-016 South Wall Final G. Palcso
Filename	17-020_South_Wall_Final.spf

Blast Summary Data

Burden: 12.0ft

Spacing: 10.5ft

Subdrill: 2.0ft

Stemming: 7.0ft

1st row burden: 10.0ft

Hole Diameter: 4.0in

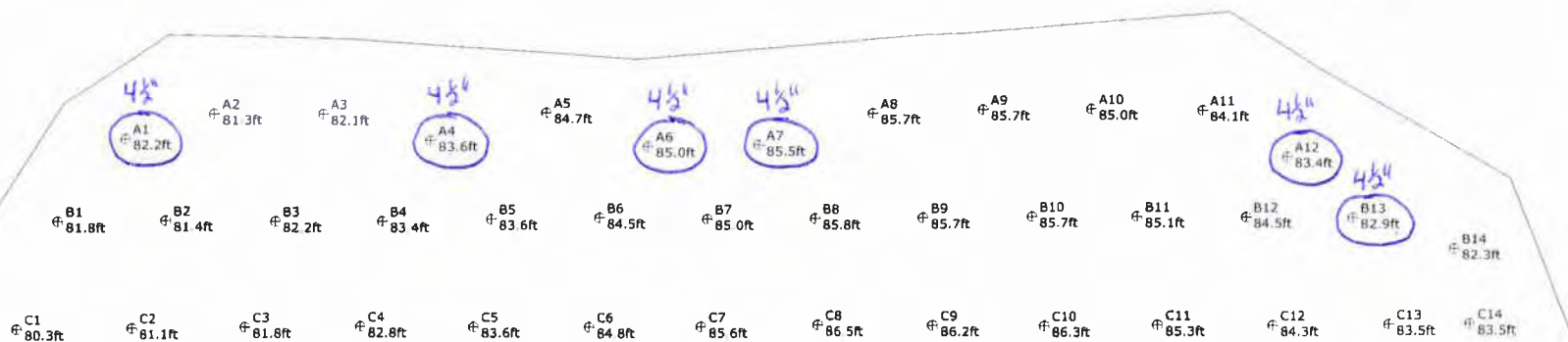
Number of holes: 40

Hole angle: 0.0°

Total drilled: 3358.0ft

Hole A1, A4, A6, A7, A12 and B13 are 4.5 Hole Diameter
Marked in Green

open face



South Face 17-020

12x10.5 Front Row - 10x10.5 Body

4" Hole Diameter

248.5m Floor Elevation + 0.6m Sub



Not to scale

Customer: **Nelson Aggregat****Blast Report**Quarry: **Burlington**P.O. #: Blast Date: **2018-04-09**Blast Number: **18-001**Orica Order #: **2322201**Blast Time: **11:56 AM**

page 1

Blaster-in-charge: **Mike Derkinderen** (Print Name)

Blast Location: **Upper Middle** (Bench / Face)
 GPS Coordinates: **43.40358** °N Latitude **79.88337** °W Longitude
 Centre of Blast Centre of Blast

Wind from the: **SE** at **5** kph Temperature: **1 to 5** °C

Clear: ☐ Rain: ☐ Overcast: ☐
 Partly Cloudy: ☒ Snow: ☐ Inversion: ☐

30000**- Drilling Information -**

Angle from Vertical Nominal Bit Diameter:
 Primary Bit diam: **101.6** mm **0** # Holes: **49** = 3,797.5 ft (4 " diam)
 Secondary Bit diam: mm **0** # Holes: = 0.0 ft (" diam)
 Tertiary Bit diam: mm **0** # Holes: = 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,030	21,700	12,330

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	102	34.7

total explosives weight in Blast (kg): **12,365**Pkgd Prod (0 kg) % of Total kg: **0.0%**

Detonators:	case #'s	ms	# used
UNITRONIC 600 9M			48
UNITRONIC 600 30M			52

Cord & Accessories:	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:	# req'd
# of Blasts today (this Quarry)	1
# of Blasters (this Blast)	1 6 hr
# of Helpers (this Blast)	Note Exception 2 12 hr
# of MMU's (this Blast)	1

Services:

ADVANCED BLAST DESIGN	Enter "1" if Advance Blast Des	
BULK TRUCK CHARGE	As per agreement	1
SHOT SERVICE FEE *	As per agreement	1
BORETRACK	Enter "1" if Boretraked	0
SEISMOGRAPH RENTAL	Enter # of Seismographs Used	0

tonnes Blasted: **27,194** te **10,262** m³

Holes Loaded: **49** holes
 ... including: **0** Dead Holes
 ... and: **3** Helper Holes
 Helper Hole Collar: **8.0** ft avg
 # Rows Blasted: **3** rows

- Pattern (Front Row)-Burden: **12.0** ft avgSpacing: **10.0** ft avg# Holes: **13** front row**- Pattern (Main Body) -**Burden: **9.0** ft avgSpacing: **10.0** ft avg# Holes: **36** main bodyBench Height: **75.5** ft avgSub-drill: **2.0** ft avgHole Depth: **77.5** ft avg**- Stone Decking -**Front Row: **0.0** ft avgMain Body: **0.0** ft avg# Stone Decks: **0** per blast**- Collar Stemming -**Front Row: **7.0** ft avgMain Body: **7.0** ft avgMaterial used: **.75 clear****- Charge Length -**Front Row: **70.5** ft avgMain Body: **70.5** ft avg**- Charge Weight -**Front Row: **205.6** kg/holeMain Body: **205.6** kg/holeMax. per delay: **256.0** kg/delaySD () Equation: **#NUM!** kg/delayTotal kg Loaded: **12,365** kgRock Density: **2.65** g/cc = te/m³**- Powder Factor -**Yield PF: **0.455** kg/te (actual)Front row: **0.302** kg/te (theoretical)Main Body: **0.403** kg/te (theoretical)"KPI" PF: **0.370** kg/te (theoretical)**NOTES:**

Hole A-10 Received A stone deck from 50'-32' due to lean burden

Hole X-3 Received A stone deck from 60'-50' due to lean burden

Hole X-1 Received a toe load to 55'

Hole X-2 was plugged at 24'

Rate Code TBA by sale representative

6 Blaster hours

6 Helper hours times 2 Helpers



Customer: **Nelson Aggregat**
Blast Design

Quarry: **Burlington**
P.O. #:
Blast Date: **2018-04-09**

Blast Number: **18-001**
Orica Order #: **2322201**
Blast Time: **11:56 AM**

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40358	79.88339	0.757535	1.394228
Front Row Corner	43.40343	79.88334	0.757533	1.394227
Back Row Corner	43.40374	79.88338	0.757538	1.394228
Average (Centre of Blast)	43.40358	79.88337	0.757535	1.394228

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	441.3	m		
	Post Blast Data:				
	ppV:	3.6	mm/s	2.0	mm/s
	frequency:	7.3	Hz	?	(Vertical, Transverse or Longitudinal)
	air overpressure:	115.3	dB	115	dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	902.8	m		
	Post Blast Data:				
	ppV:	0.4	mm/s	2.0	mm/s
	frequency:	7.4	Hz	?	(Vertical, Transverse or Longitudinal)
	air overpressure:	121.9	dB	115	dB
	Colling Road & Blind line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (3rd Seis. From Centre of Blast)	#NUM!	m		
	Post Blast Data:				
	ppV:	1.2	mm/s	2.0	mm/s
	frequency:	7.3	Hz	?	(Vertical, Transverse or Longitudinal)
	air overpressure:	119.7	dB	115	dB
	South West Corner Of Property				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{\#NUM!}{30^2} \text{ kg}$$

$$= \frac{\#NUM!}{900} \text{ kg}$$


Maximum Indicated Charge Weight per Delay = **#NUM!** kg

Orica

Blaster-in-charge:

Mike Derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate

	Customer: Jelson Aggregat	Quarry: Burlington	Blast Number: 18-002
	Blast Report	P.O. #: Blast Date: 2018-04-11	Orica Order #: 2323512 Blast Time: 11:16 AM

page 1 Blaster-in-charge: **Mike Derkinderen** (Print Name)

Blast Location: **Floor** (Bench / Face)

GPS Coordinates: **43.40235** °N Latitude **79.88634** °W Longitude
Centre of Blast Centre of Blast

Wind from the: **SW** at **10** kph Temperature: **1 to 5** °C

Clear: ☐ Rain: ☐ Overcast: ☒
 Partly Cloudy: ☐ Snow: ☐ Inversion: ☐ **30000**

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0 °	# Holes: 180 = 1,980.0 ft (4 " diam)
Secondary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)
Tertiary Bit diam: <input type="text"/> mm	<input type="text"/> °	# Holes: <input type="text"/> = 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	30,150	27,630	2,520

Packaged Explosives:	cs shipped	cs returned	kg

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	182	61.9

total explosives weight in Blast (kg): 2,582

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 6M			1
EXEL HANDIDET 12m		25/500	182
CONNECTADET 9M		25 ms	3
CONNECTADET 9M		42 ms	30

Cord & Accessories:	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment: # req'd

# of Blasts today (this Quarry)	Enter #		
# of Blasters (this Blast)		1	7 hr
# of Helpers (this Blast)	Note Exception	2	10 hr
# of MMU's (this Blast)		1	

Services:

	Enter "1" if Advance Blast Des	
ADVANCED BLAST DESIGN		
BULK TRUCK CHARGE	As per agreement	1
SHOT SERVICE FEE *	As per agreement	#DIV/0!
BORETRACK	Enter "1" if Boretraked	0
SEISMOGRAPH RENTAL	Enter # of Seismographs Used	0

tonnes Blasted: **19,279** te **7,415** m³

Holes Loaded: **180** holes

... including: **0** Dead Holes

... and: **0** Helper Holes

Helper Hole Collar: **0.0** ft avg

Rows Blasted: **9** rows

- Pattern (Front Row) -

Burden: **11.5** ft avg

Spacing: **11.5** ft avg

Holes: **28** front row

- Pattern (Main Body) -

Burden: **11.5** ft avg

Spacing: **11.5** ft avg

Holes: **152** main body

Bench Height: **11.0** ft avg

Sub-drill: **0.0** ft avg

Hole Depth: **11.0** ft avg

- Stone Decking -

Front Row: **0.0** ft avg

Main Body: **0.0** ft avg

Stone Decks: **0** per blast

- Collar Stemming -

Front Row: **7.0** ft avg

Main Body: **7.0** ft avg

Material used: **.75** clear

- Charge Length -

Front Row: **4.0** ft avg

Main Body: **4.0** ft avg

- Charge Weight -

Front Row: **11.7** kg/hole

Main Body: **11.7** kg/hole

Max. per delay: **14.0** kg/delay

SD () Equation: #NUM! kg/delay

Total kg Loaded: **2,582** kg

Rock Density: **2.60** g/cc = te/m³

- Powder Factor -

Yield PF: **0.134** kg/te (actual)

Front row: **0.109** kg/te (theoretical)

Main Body: **0.109** kg/te (theoretical)

"KPI" PF: **0.109** kg/te (theoretical)

Theoretical PF (Based on a single hole)

Yield Powder Factor (kg Loaded / te Blaster)

NOTES:

5 Holes in the pattern had caved in when we measured the shot the morning of, we were unable to load those 5 holes

Customer: **Jelson Aggregat****Blast Design**Quarry: Burlington
P.O. #:
Blast Date: 2018-04-11Blast Number: 18-002
Orica Order #: 2323512
Blast Time: 11:16 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40230	79.88635	0.757513	1.394280
Front Row Corner	43.40209	79.88602	0.757509	1.394274
Back Row Corner	43.40267	79.88664	0.757519	1.394285
Average (Centre of Blast)	43.40235	79.88634	0.757514	1.394280

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	663.1	m		
	Post Blast Data:	ppV:	mm/s	Trigger set at: 2.0	mm/s
		frequency:	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure:	dB	Trigger set at: 115	dB
	2450 2nd Line Did not set up for this blast (as per bill)				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	744.0	m		
	Post Blast Data:	ppV: Did	mm/s	Trigger set at: 2.0	mm/s
		frequency: Not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB	Trigger set at: 115	dB
	Colling Rd & Blind Line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (3rd Seis. From Centre of Blast)	#NUM!	m		
	Post Blast Data:	ppV: 2.0	mm/s	Trigger set at: 2.0	mm/s
		frequency: 3.3	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 88.4	dB	Trigger set at: 115	dB
	SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.
The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$
$$= \frac{\#NUM!}{30^2} \text{ kg}$$
$$= \frac{\#NUM!}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = #NUM! kg

Orica

Blaster-in-charge:

jim bray

Mike Derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Report

Quarry:
P.O. #:
Blast Date: 2018-04-18

Blast Number: 18-003
Orica Order #: 2326529
Blast Time: 10:54 AM

page 1

Blaster-in-charge: Mike der Kinderen

Blast Location: Lower Middle
GPS Coordinates: 43.40418 °N Latitude 79.88352 °W Longitude

Wind from the: W at 10 kph Temperature: 1 to 5 °C

Clear: Rain: Overcast: X
Partly Cloudy: Snow: Inversion: Ceiling 39 000 ft

Tonnes Blasted: 11,087 te 4,184 m³
Total tonnes per day: 11,087 te TBA
Total Holes Loaded: 39 holes
... including: 0 Dead Holes
... and: 1 Helper Holes
Helper Hole Collar: 7.0 ft avg
Rows Blasted: 4 rows

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 9

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 30 main blast
Bench Height: 40.1 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 42.1 ft avg

Front Row: 8.0 ft avg
Main Body: 0.0 ft avg
Decks: 1 per blast

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg

Material used: 3/4 Stone

Front Row: 27.1 ft avg
Main Body: 35.1 ft avg

Front Row: 79.1 kg/hole
Main Body: 102.4 kg/hole
Max. per delay: 129.0 kg/delay
SD () Equation: 251.0 kg/delay
Total kg Loaded: 4,817 kg
Rock Density: 2.65 g/cc = t/m³

Yield PF: 0.434 kg/te (actual)
Front row: 0.219 kg/te (theoretical)
Main Body: 0.378 kg/te (theoretical)
"KPI" PF: 0.338 kg/te (theoretical)

Drilling Information

Angle from Vertical: Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0° # Holes: 39 = 1,642.4 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Bulk Explosives:	in (kg)	out (kg)	kg
CENTRA GOLD 70	29,810	25,070	4,740

Packaged Explosives:	cs shipped	cs returned	kg
FORTELE PRO 75X400	6	4	50

Boosters:	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	78	26.5

total explosives weight in Blast (kg): 4,817
Pkgd Prod (50 kg) % of Total kg: 1.0%

Detonators:	case #'s	ms	# used
UNITRONIC 600 6M			39
UNITRONIC 600 15M			39

Cord & Accessories:	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment

# of Blasts today (this Quarry)	1
# of Blasts (this Blast)	1
# of Helpers (this Blast)	2
# of OMA's (this Blast)	1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=2,000kg <5,000kg	1
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	4.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Cost Reduction Notes (this Blast) - change in Bit - B-5 (expl or 15 from previous Blast)

Holes D-1 D-2 D-3 Had either caved in or were to short to load

Hole B-1 Was loaded to 18' then package was used on the top

A-7 Received a stone deck from 16'-24' due to a void identified on the drill log

Please contact our sales rep for Rate code



Blast Report

Quarry:
P.O. #:
Blast Date: 2018-04-18

Blast Number: 18-003
Orica Order #: 2326529
Blast Time: 10:54 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40418	79.88317
Front Row Corner	43.40423	79.88351
Back Row Corner	43.40412	79.88387
Average (Centre of Blast)	43.40418	79.88352

(N) Radians	(W) Radians
0.757546	1.394224
0.757547	1.394230
0.757545	1.394236
0.757546	1.394230

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40245	79.87814
2nd Reading		
Average	43.40245	79.87814
Distance (1st Seis. From Centre of Blast)	476.3	m
Post Blast Data:	ppV: 2.7	mm/s
	frequency: 43.0	Hz
	air overpressure: 119.7	dB

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2450 2nd Line

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40605	79.89400
2nd Reading		
Average	43.40605	79.89400
Distance (2nd Seis. From Centre of Blast)	673.3	m
Post Blast Data:	ppV: DID	mm/s
	frequency: NOT	Hz
	air overpressure: TRIGGER	dB

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

Colling Road & Blind Line Bruce Trail

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.39339	79.88880
2nd Reading		
Average	43.39339	79.88880
Distance (3rd Seis. From Centre of Blast)	1274.5	m
Post Blast Data:	ppV: DID	mm/s
	frequency: NOT	Hz
	air overpressure: TRIGGER	dB

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

South West Corner of Property

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(476.3)^2}{30^2} \text{ kg}$$

$$= \frac{226,910}{900} \text{ kg}$$

$$\text{Maximum Indicated Charge Weight per Delay} = 251 \text{ kg}$$

Orica
Blaster-in-charge:

Mike der kinderen



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-05-22

Blast Number: 18-004
Orica Order #: 2339509
Blast Time: 12 02 PM

page 1

Blaster-in-charge: Mike der Kinderen

Blast Location: Upper Middle
GPS Coordinates: 43.40364 °N Latitude 79.88324 °W Longitude

Wind from the: SE at 5 kph Temperature: 11 to 15 °C

Clear: Rain: Overcast: x
Partly Cloudy: Snow: Inversion: Ceiling 1062 ft

Tonnes Blasted: 26,332 te 9,937 m³
Total tonnes per day: 26,332 te NB80-01 Rate Code
Total Holes Loaded: 49 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 3 rows

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 8

Primary Bit diam: 101.6 mm 0" # Holes: 40 = 3,098.6 ft (4 " diam)
Secondary Bit diam: 114.3 mm 0" # Holes: 9 = 697.2 ft (4 1/2 " diam)
Tertiary Bit diam: mm 0" # Holes: = 0.0 ft (" diam)

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Bench Height: 75.5 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 77.5 ft avg

Bulk Explosives: In (kg) out (kg) kg
CENTRA GOLD 70 33,680 21,760 11,920

Packaged Explosives: cs shipped cs returned kg

Front Row: ft avg
Main Body: ft avg
Decks: per blast

Boosters: kg / unit # used kg
PENTEX 12 (OR EQUIVALENT) 0.34 98 33.3

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: 75" Stone

total explosives weight in Blast (kg): 11.953
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators: case #'s ms # used
UNITRONIC 600 9M 49
UNITRONIC 600 25M 14
UNITRONIC 600 30M 35

Front Row: 70.5 ft avg
Main Body: 70.5 ft avg
Front Row: 205.5 kg/hole
Main Body: 205.5 kg/hole
Max. per delay: 298.0 kg/delay
SD () Equation: 208.9 kg/delay
Total kg Loaded: 11,953 kg
Rock Density: 2.65 g/cc = te/m³

Cord & Accessories: U of M # used
HARNESS WIRE DUPLEX (6 PACK) 400M units 1
units
units

2.028 lb/yd³

Yield PF: 0.454 kg/te (actual)

1.651 lb/yd³

Front Body: 2,302 kg/te (theoretical)

1.651 lb/yd³

Main Body: 0,403 kg/te (theoretical)

1.651 lb/yd³

"KPI" PF: 0.370 kg/te (theoretical)

Resource Deployment

of Blasts today (this Quarry): 1
of Blasts (this Blast): 1
of Helpers (this Blast): 1
of M/M's (this Blast): 1

Services:

GPS LAYOUT Enter hours 0.0
BULK TRUCK CHARGE >=10,000 kg 1
BLASTER HOURS Enter Blaster hours 7.0
HELPER HOURS Enter total Helper man-hours 5.5
SEISMOGRAPH RENTAL Enter # Orica Seismographs 2
3D LASER PROFILE Enter hours 0.0
BORETRACK Enter hours 0.0
TECHNICAL BLAST DESIGN (per day) Enter # of days 0.0

Cast Residual Notes (this Blast): average in B-1 B-2 B-3 is from previous Blast
It was extremely foggy during the blast



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-05-22

Blast Number: 18-004
Orica Order #: 2339509
Blast Time: 12:02 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40362	79.88325
Front Row Corner	43.40349	79.88326
Back Row Corner	43.40382	79.88322
Average (Centre of Blast)	43.40364	79.88324

(N) Radians	(W) Radians
0.757536	1.394226
0.757534	1.394226
0.757540	1.394225
0.757536	1.394226

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40245	79.87814
	2nd Reading		
	Average	43.40245	79.87814
	Distance (1st Seis. From Centre of Blast)	433.6	m
	Post Blast Data:	ppV:	3.3 mm/s
		frequency:	8.1 Hz
		air overpressure:	124.3 dB
	2450 2nd Line		

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40605	79.89400
	2nd Reading		
	Average	43.40605	79.89400
	Distance (2nd Seis. From Centre of Blast)	910.4	m
	Post Blast Data:	ppV:	0.3 mm/s
		frequency:	8.9 Hz
		air overpressure:	123.1 dB
	Colling Rd & Blind Line Bruce Trail		

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.39339	79.88880
	2nd Reading		
	Average	43.39339	79.88880
	Distance (3rd Seis. From Centre of Blast)	1228.7	m
	Post Blast Data:	ppV:	0.3 mm/s
		frequency:	100.0 Hz
		air overpressure:	39.1 dB
	SouthWest Corner of Property		

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(433.6)^2}{30^2} \text{ kg}$$

$$= \frac{188,009}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 209 kg

Orica
Blaster-in-charge:

Mike der Kinderen



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-06-04

Blast Number: 18-005

Orica Order #: 2345753

Blast Time: 11:50 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Middle South (Bench / Face)

GPS Coordinates: 43.40398 °N Latitude 79.88319 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 15 kph Temperature: 16 to 20 °C

Clear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: 2.563 ft

- Drilling Information -

Primary Bit diam: 101.6 mm 0° # Holes: 67 = 2,963.5 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,890	25,710	8,180

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	138	46.9

total explosives weight in Blast (kg): 8,227

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			69
UNITRONIC 600 15M			69

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted: 20,811 te 7,853 m3
Total tonnes per day: 20,811 te NB40-07 Rate Code

Total Holes Loaded: 67 holes
... including: Dead Holes
... and: Helper Holes

Helper Hole Collar: ft avg

Rows Blasted: 8 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 8 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 59 main body

Bench Height: 44.2 ft avg

Sub-drill: 0.0 ft avg

Hole Depth: 44.2 ft avg

- Stone Decking -

Front Row: 0.0 ft avg

Main Body: 5.0 ft avg

Decks: 2 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" stone

- Charge Length -

Front Row: 37.2 ft avg

Main Body: 32.2 ft avg

- Charge Weight -

Front Row: 108.6 kg/hole

Main Body: 94.0 kg/hole

Max. per delay: 132.0 kg/delay

SD () Equation: 217.6 kg/delay

Total kg Loaded: 8,227 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.395 kg/te (actual)

Front row: 0.273 kg/te (theoretical)

Main Body: 0.315 kg/te (theoretical)

"KPI" PF: 0.309 kg/te (theoretical)

1.766 lb/yd³

1.218 lb/yd³

1.405 lb/yd³

1.382 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast

Stone decks were required at E-7 & F-7 due to voids identified on drill log

Hole H-5 was at 38'

1st seismograph was set to trigger at 100db and when I went to pick it up the memory was full truck traffic going by.



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-06-04

Blast Number: 18-005
Orica Order #: 2345753
Blast Time: 11:50 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40399	79.88318	0.757542	1.394225
Front Row Corner	43.40400	79.88336	0.757543	1.394228
Back Row Corner	43.40396	79.88302	0.757542	1.394222
Average (Centre of Blast)	43.40398	79.88319	0.757542	1.394225

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137

Distance (1st Seis. From Centre of Blast) **442.5** m

Post Blast Data: ppV: **Memory** mm/s Trigger set at: **2.0** mm/s
frequency: **Was** Hz V / T / L ? (Vertical, Transverse or Longitudinal)
air overpressure: **Full** dB Trigger set at: **100** dB

2450 2nd Line

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413

Distance (2nd Seis. From Centre of Blast) **904.3** m

Post Blast Data: ppV: **Did** mm/s Trigger set at: **2.0** mm/s
frequency: **Not** Hz V / T / L ? (Vertical, Transverse or Longitudinal)
air overpressure: **Trigger** dB Trigger set at: **115** dB

Colling Rd & Blind Line Bruce Trail

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323

Distance (3rd Seis. From Centre of Blast) **1263.7** m

Post Blast Data: ppV: **Did** mm/s Trigger set at: **2.0** mm/s
frequency: **Not** Hz V / T / L ? (Vertical, Transverse or Longitudinal)
air overpressure: **Trigger** dB Trigger set at: **115** dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: **30** Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(442.5)^2}{30^2} \text{ kg}$$

$$= \frac{195,806}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = **218** kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

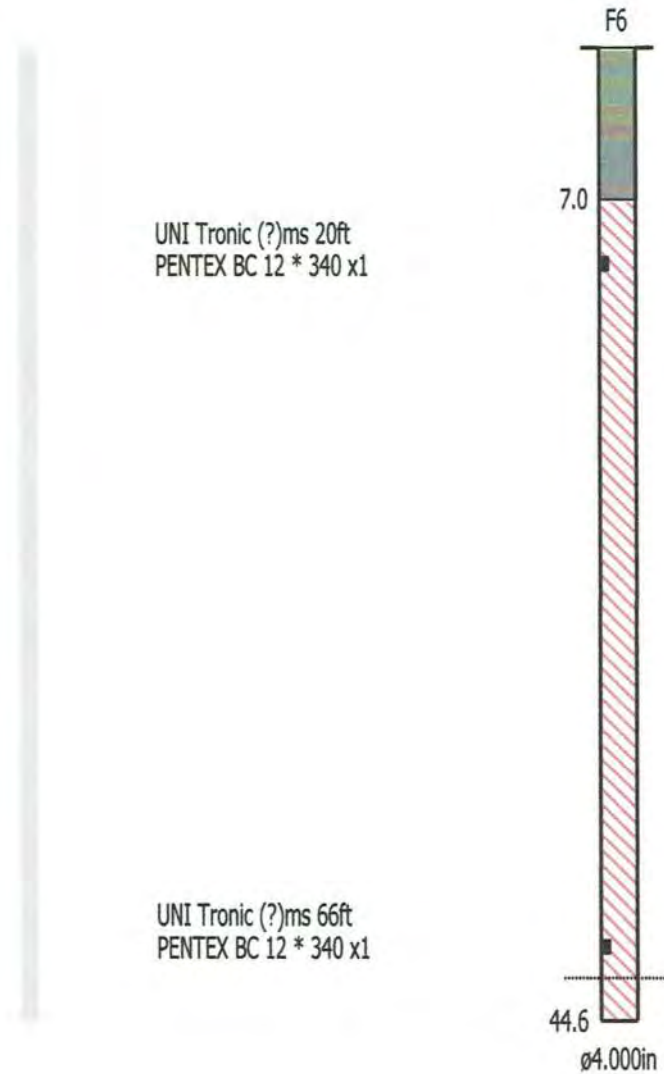
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 6/4/2018

Blast Number: 18-005
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

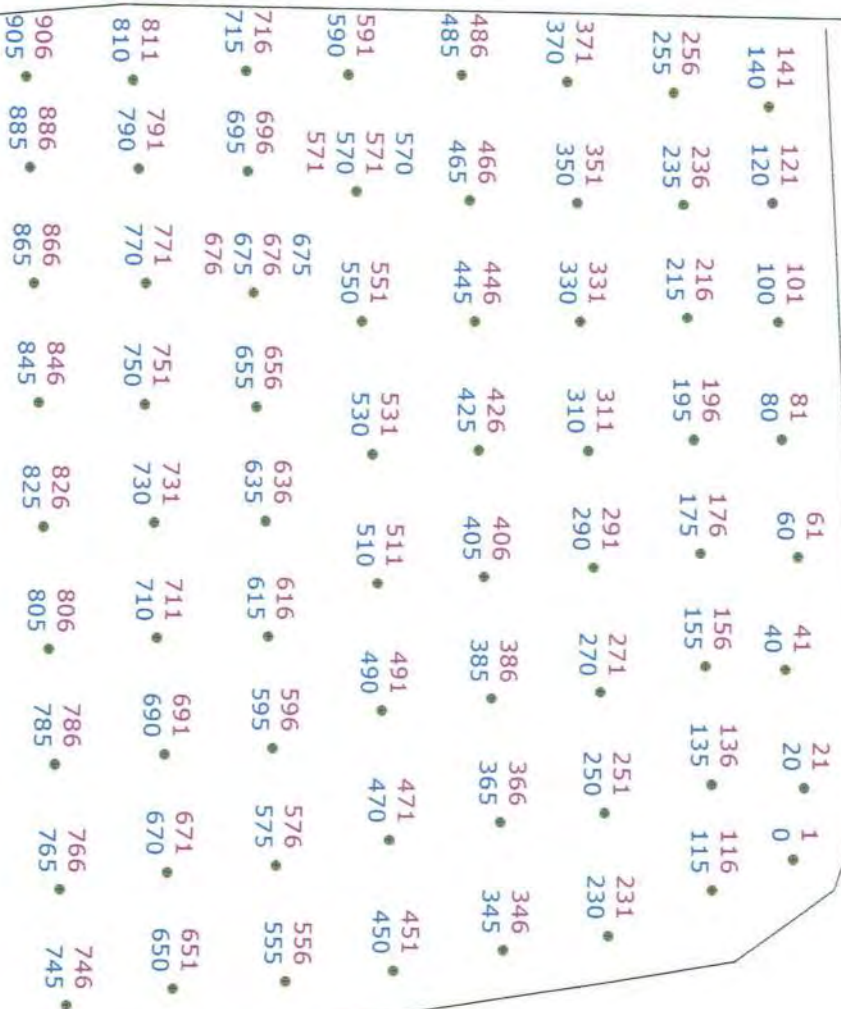
Mike der Kinderen

Quarry Manager:

Bill White

Signature required, indicating
sign off on Blast Design.

Timing



Not to scale



SHOTPlus 5.7.1.1		6/4/2018
Mine	Burlington	
Location		
Title/author	18-005 Bottom Middle South I. Deemert	
Filename	2018-06-04 18-005 Lower Middle.spf	

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Subdrill: 0.0ft Stemming: 6.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 67 Hole angle: 0.0°
 Rock density: 2.65g/cc Total drilled: 2963.6ft Blasted tonnage: 21,8805/T

Load Sheet 132kg MAX

Highwall

•74 •108 •92 •117 •114 •116 •114 •~~112~~
 •114 •116 •108 •121 •113 •113 •131 •~~107~~ 97
 •118 •114 •118 •116 •117 •126 •119 •112
 •124 •124 •122 •132 •123 •116 •106 •109
 •119 • $\frac{15}{124}$ •121 •123 •125 •124 •109 •116
 •123 •126 •132 • $\frac{7}{2}$ •119 •122 •107 •119 •111 •97
 •131 •104 •128 •121 •119 •94 •115 •129 •121
 •129 •129 •132 •123 •99 •121 •121 •120 •107



Not to scale

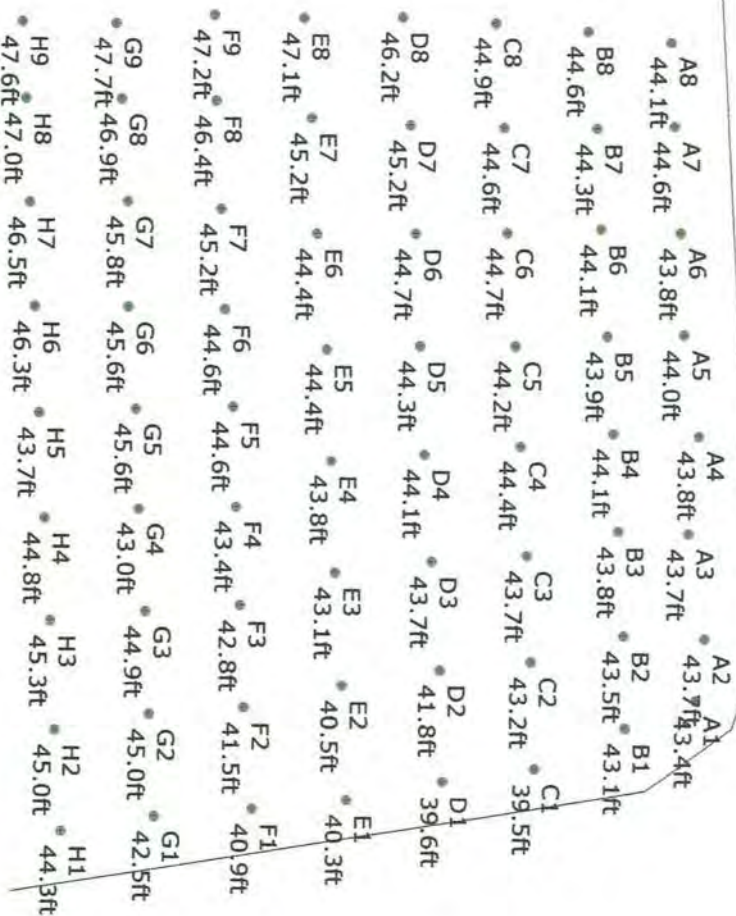
SHOTPlus 5.7.1.1	5/30/2018
Mine	Burlington
Location	
Title/author	18-005 Bottom Middle South I. Deemert
Filename	2018-06-04 18-005 Lower Middle.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 0.0ft	Sterming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 67	Hole angle: 0.0°
Rock density: 2.65g/cc	Total drilled: 2963.6ft	Blasted tonnage: 21,8805/T	

Highwall



Not to scale

SHOTPlus 5.7.1.1		5/30/2018
Mine	Burlington	
Location		
Title/author	18-005 Bottom Middle South I. Deemert	
Filename	2018-06-04 18-005 Lower Middle.spf	

1089712



CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

Bill of Lading / Connaissancement

BLASTER: MIKE D
HOLD: MIKE A
KEITH
BULIC
JEFF

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSANCEMENT

2345753

86028794

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR		CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT			
04 Jun 2018	00:00:00	NELSON AGGREGATE COMPANY		n/a			
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON		SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE			
04 Jun 2018	FOB Dest'n, Own Truck		F-73289	15013			
SHIP VIA TRANSPORTEUR		ROUTING ITINÉRAIRE		MAG. LIC. NO. N° DE PERMIS			
Orica Truck		STANDARD					
QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
196	PC	X	58	138	PENTEX BC 340 (49/CS)	4	71.540
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	11	69	*uni tronic 600-06.0M CU/ZC(20')30PC	1	5.840
132	PC	X	63	69	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
66	PC	X	66	0	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
100	PC		95	5	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							119.956 KG
**** TOTAL PACKAGES ****							9
GHS/WHMIS SDS documents available Website: www.oricaminingservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24 HOUR TECHNICAL INFORMATION 1-612-996-6666

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE		EMERGENCY RESPONSE NO./24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMERO		PLACARDS OFFERED / PLACARDS OFFERT		FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSANCEMENT D'ORICA: Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5	
ERAP 2-1510		1-877-561-3636		YES / OUI NO / NON			
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORT AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.				DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE		NETTE No. CONV PRESSAGE WT AGREEMENT NO.	
CONSIGNOR / EXPÉDITEUR GRAND VALLEY		CARRIER / TRANSPORTEUR Orica Truck		CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY			
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR K. PLATT		DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR K. PLATT		RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR			
SIGNATURE K. Platt		SIGNATURE K. Platt		SIGNATURE		DATE	
DATE 4 6 18		DATE 4 6 18		DATE		DATE	
D/J M/M Y/A		D/J M/M Y/A		D/J M/M Y/A		D/J M/M Y/A	

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSANCEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉES AU VERSO

**** PAGE 2 OF 2 ****

D.F.G. 57772

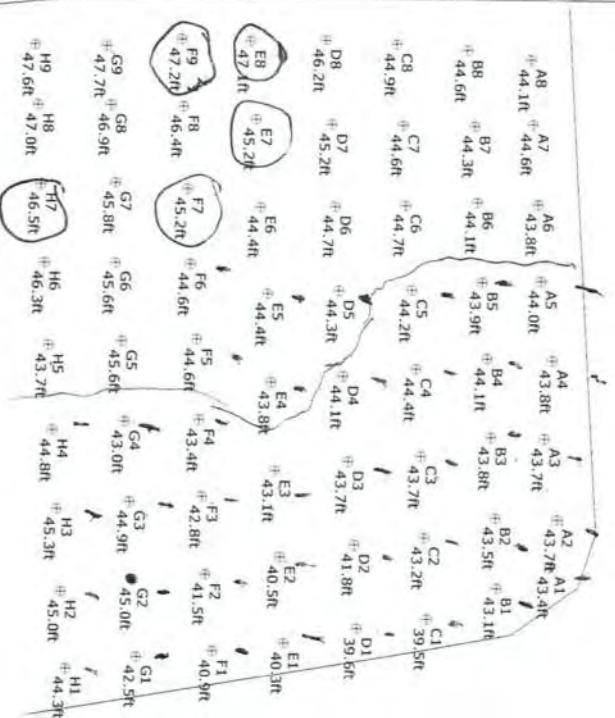
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Rock density: 2.65g/cc
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Total drilled: 2963.6ft
 Subdrill: 0.0ft
 Number of holes: 67
 Blasted tonnage: 21,8805/T
 Stemming: 6.0ft
 Hole angle: 0.0°

Open Face

Highwall



Bottom Middle South 18-005
 12x10 Front Row 9x10 Body
 4" Hole Diameter
 250m Floor Elevation + 0.6m Su



Not to scale

SHOTPlus 5.7.2.1	02/05/2018
Mine	Burlington
Location	
Title/author	18-005 Bottom Middle South I. Dee
Filename	18-005 Design Final.spf



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-06-06

Blast Number: 18-006
Orica Order #: 2346925
Blast Time: 12:10 PM

page 1 Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Bench (Bench / Face)
GPS Coordinates: 43.40428 °N Latitude 79.88387 °W Longitude
(Centre of Blast) (Centre of Blast)

Wind from the: W at 5 kph Temperature: 11 to 15 °C

Clear: ☐ Rain: ☐ Overcast: X
Partly Cloudy: ☐ Snow: ☐ Inversion: ☐ Ceiling: 3,116 ft

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 61 = 2,668.2 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Bulk Explosives: in (kg) out (kg) kg
CENTRA GOLD 70 26,650 19,410 7,240

Packaged Explosives: cs shipped cs returned kg

Boosters: kg / unit # used kg
PENTEX 8 (OR EQUIVALENT) 0.23 130 29.5

total explosives weight in Blast (kg): 7,270
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators: case #s ms # used
UNITRONIC 600 6M 59
UNITRONIC 600 15M 71

Cord & Accessories: U of M # used
HARNES WIRE DUPLEX (6 PACK) 400M units 1
MINI STEM PLUGS - 6015 (4") units 8

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services:

GPS LAYOUT Enter hours 0.0
BULK TRUCK CHARGE >=5,000kg <10,000kg 1
BLASTER HOURS Enter Blaster hours 7.0
HELPER HOURS Enter total Helper man-hours 11.0
SEISMOGRAPH RENTAL Enter # Orica Seismographs 0
3D LASER PROFILE Enter hours 0.0
BORETRACK Enter hours 0.0
TECHNICAL BLAST DESIGN (per day) Enter # of days 0.0

Tonnes Blasted: 17,948 te 6,773 m³
Total tonnes per day: 17,948 te NB40-08 Rate Code

Total Holes Loaded: 61 holes
... including: Dead Holes
... and: Helper Holes

Helper Hole Collar: ft avg

Rows Blasted: 11 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 8 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 53 main body

Bench Height: 41.7 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 43.7 ft avg

- Stone Decking -

Front Row: 7.0 ft avg

Main Body: 5.0 ft avg

Decks: 6 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" stone

- Charge Length -

Front Row: 29.7 ft avg

Main Body: 31.7 ft avg

- Charge Weight -

Front Row: 86.7 kg/hole

Main Body: 92.6 kg/hole

Max. per delay: 145.0 kg/delay

SD () Equation: 284.6 kg/delay

Total kg Loaded: 7,270 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

1.809 lb/yd³

1.031 lb/yd³

1.467 lb/yd³

1.427 lb/yd³

Yield PF: 0.405 kg/te (actual)

Front row: 0.231 kg/te (theoretical)

Main Body: 0.328 kg/te (theoretical)

"KPI" PF: 0.319 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Due to voids identified on drill log and found while loading we had to put in 6 stone decks rang from 5'-7'

Every front row hole had lean burden, therefore we used toe loads and stem plugs

See load adjustment sheet in report



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-06-06

Blast Number: 18-006
Orica Order #: 2346925
Blast Time: 12:10 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40427	79.88388
Front Row Corner	43.40428	79.88368
Back Row Corner	43.40428	79.88405
Average (Centre of Blast)	43.40428	79.88387

(N) Radians	(W) Radians
0.757547	1.394237
0.757548	1.394233
0.757548	1.394240
0.757548	1.394237

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40245	79.87814
2nd Reading		
Average	43.40245	79.87814

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

Distance (1st Seis. From Centre of Blast) 506.1 m
 Post Blast Data: ppV: Did mm/s Trigger set at: 2.0 mm/s
 frequency: Not Hz V / T / L: ? (Vertical, Transverse or Longitudinal)
 air overpressure: Trigger dB Trigger set at: 120 dB

2450 2nd Line

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40605	79.89400
2nd Reading		
Average	43.40605	79.89400

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

Distance (2nd Seis. From Centre of Blast) 842.9 m
 Post Blast Data: ppV: Did mm/s Trigger set at: 2.0 mm/s
 frequency: Not Hz V / T / L: ? (Vertical, Transverse or Longitudinal)
 air overpressure: Trigger dB Trigger set at: 115 dB

Colling Rd & Blind Line Bruce Trail

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.39339	79.88880
2nd Reading		
Average	43.39339	79.88880

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Distance (3rd Seis. From Centre of Blast) 1276.3 m
 Post Blast Data: ppV: Did mm/s Trigger set at: 2.0 mm/s
 frequency: Not Hz V / T / L: ? (Vertical, Transverse or Longitudinal)
 air overpressure: Trigger dB Trigger set at: 115 dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(506.1)^2}{30^2} \text{ kg} \\
 &= \frac{256,137}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 285 kg

Orica
Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

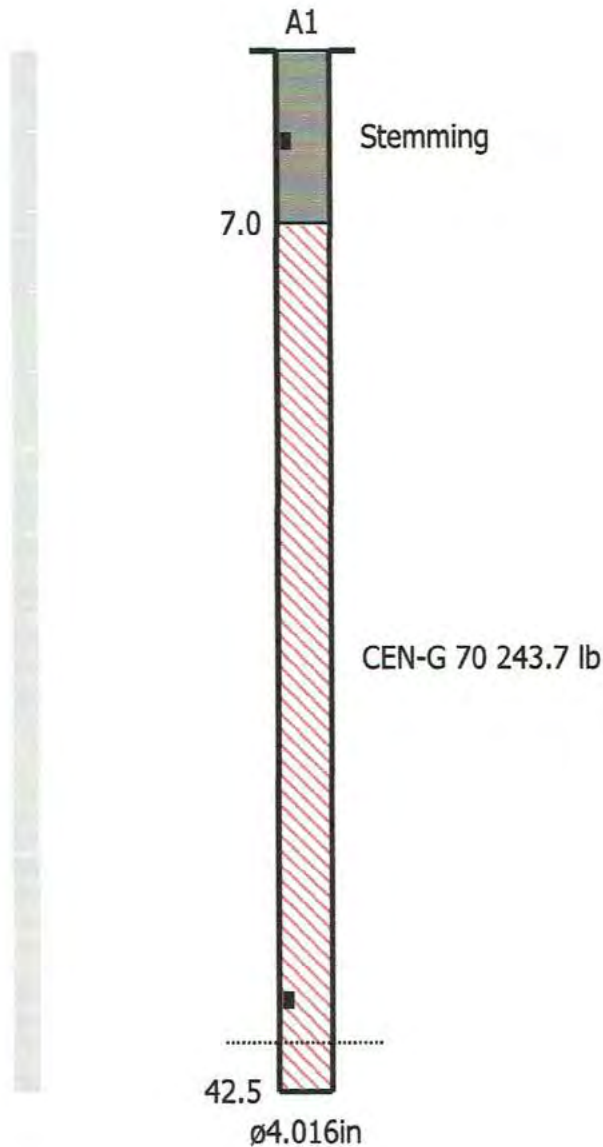
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 6/6/2018

Blast Number: 18-006
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

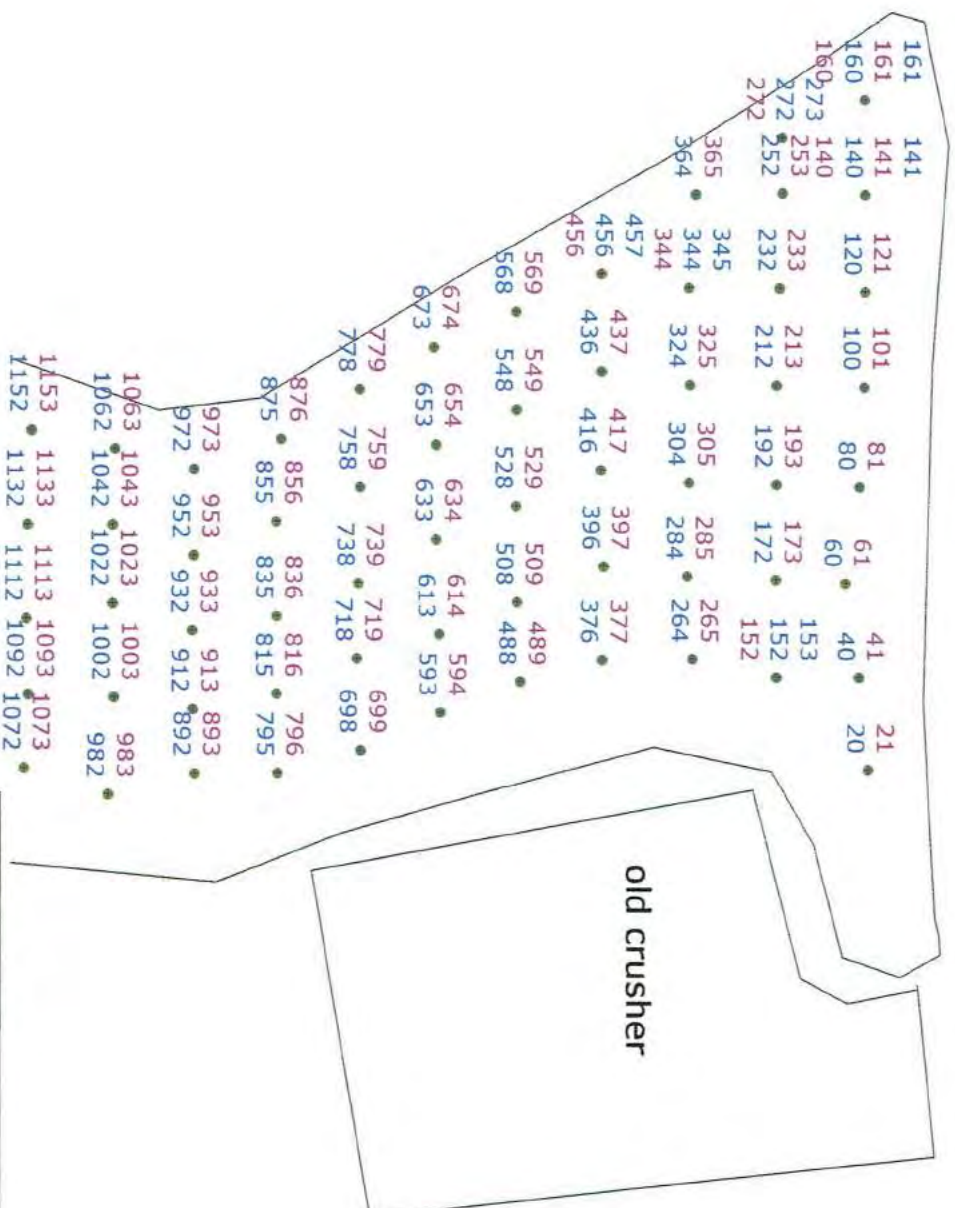
Mike der Kinderen

Quarry Manager:

Bill White

Signature required, indicating
sign off on Blast Design.

Timing



Not to scale

SHOTPlus 5.7.1.1		6/7/2018
Mine	Burlington	
Location		
Title/author	18-006 K. George	
Filename	2018-06-06 18-006.spf	

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 62	Hole angle: 0.0°
Total drilled: 2588.0ft			

Load Sheet 130Kg MAX



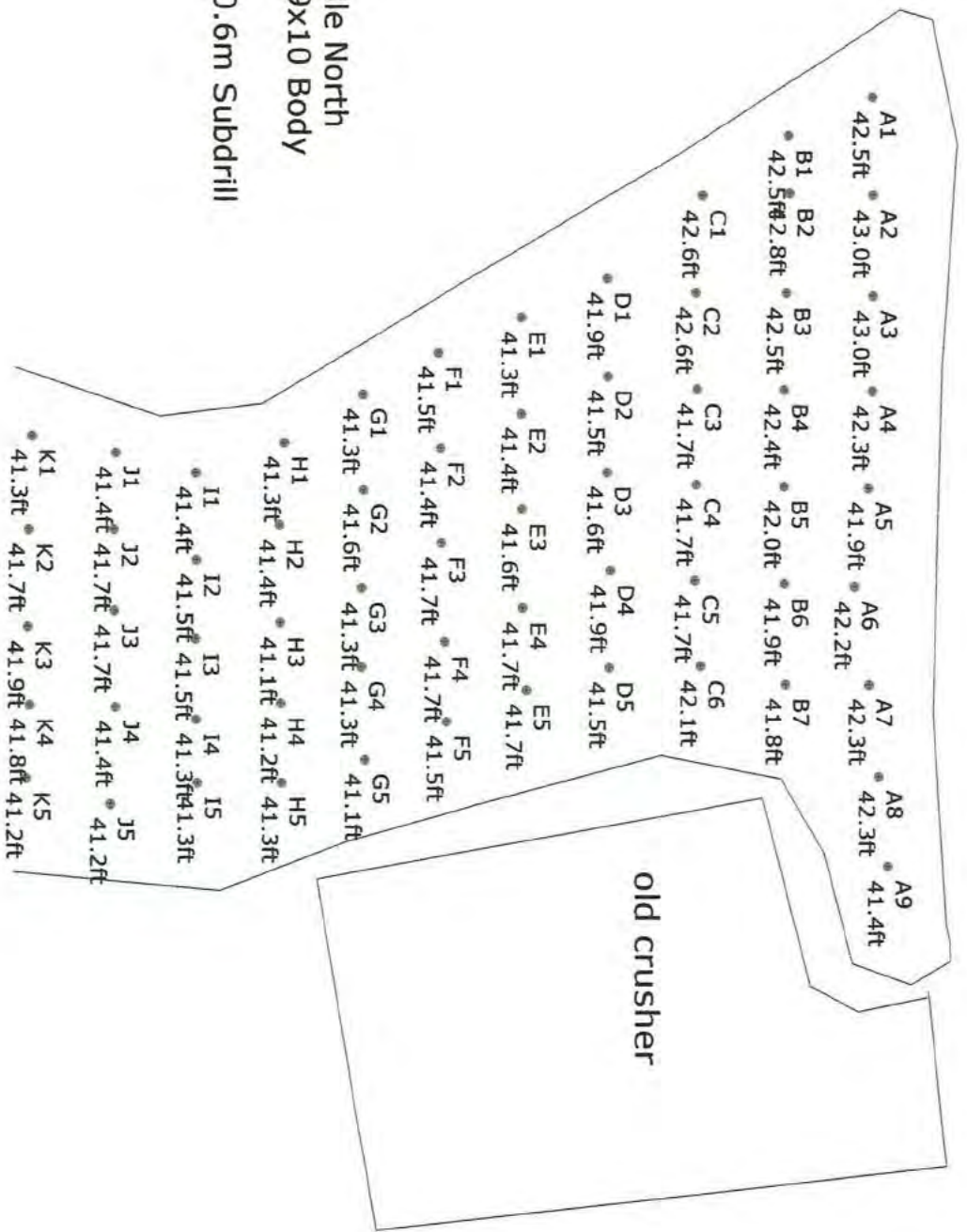
Not to scale

SHOTPlus 5.7.1.1	6/4/2018
Mine	Burlington
Location	
Title/author	18-006 K. George
Filename	2018-06-06 18-006.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 62	Hole angle: 0.0°
Total drilled: 2588.0ft			



18-006 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diameter
250m Elevation + 0.6m Subdrill

open face

old crusher



Not to scale

SHOTPlus 5.7.1.1	6/4/2018
Mine	Burlington
Location	
Title/author	18-006 K. George
Filename	2018-06-06 18-006.spf

1089736

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSANCE NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES
SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissance



CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

Blaster - Mike
Helpers - Dylan
Ken

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSANCE

2346925

86032192

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
06 Jun 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
06 Jun 2018	FOB Dest'n, Own Truck	F-73289	PT 1500
SHIP VIA TRANSPORTEUR		ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS
Orica Truck		STANDARD	

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
196	PC	X	66	130	PENTEX BC 340 (49/CS)	4	71.540
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	21	59	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
132	PC	X	61	71	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
100	PC		92	8	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							106.492 KG
**** TOTAL PACKAGES ****						8	
GHS/WHMIS SDS documents available Website: www.oricaminingsservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENT À NO DE CONNAISSANCE D'ORICA: Orica Canada Inc.
ERAP 2-1510	1-877-561-3636	YES / OUI NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE \$	NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
Dylan Tratt	Dylan Tratt	
SIGNATURE	DATE	SIGNATURE
<i>[Signature]</i>	06 06 18 D/J M/M Y/A	<i>[Signature]</i>
DATE	SIGNATURE	DATE
06 06 18 D/J M/M Y/A	<i>[Signature]</i>	D/J M/M Y/A

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE AVOIR SIGNED LA COPIE ORIGINALE (1) DU CONNAISSANCE CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 2 ****

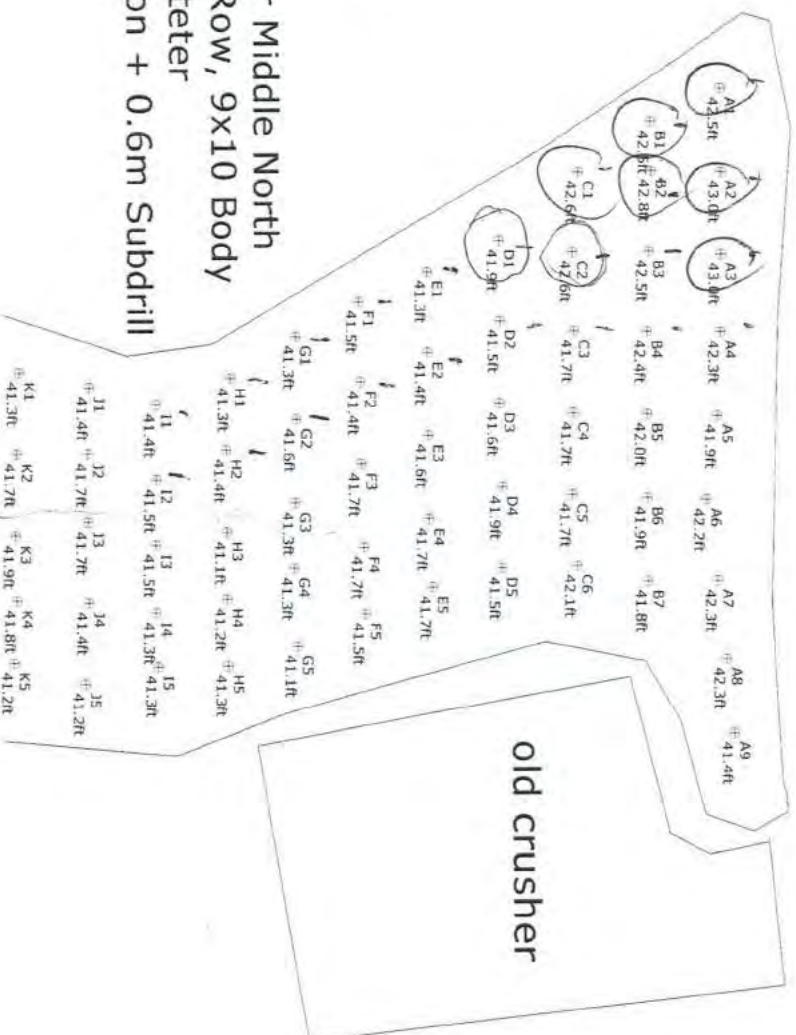
D.F.G. 57772

2 SHIPPING ORDER
BON D'EXPÉDITION

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Subdrill: 2.0ft Stemming: 6.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 62 Hole angle: 0.0°
 Total drilled: 2588.0ft



open face

18-006 Lower Middle North
 12x10 Front Row, 9x10 Body
 4" Hole Diameter
 250m Elevation + 0.6m Subdrill



Not to scale

SHOTPlus 5.7.2.1	02/05/2018
Mine	Burlington
Location	
Title/author	18-006 K. George
Filename	18-006 Lower Middle.spf



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-06-11

Blast Number: 18-007

Orica Order #: 2348563

Blast Time: 11:56 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40368 °N Latitude 79.88315 °W Longitude
Centre of Blast Centre of Blast

Wind from the: E at 15 kph Temperature: 21 to 25 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 54 = 4,055.1 ft (4 " diam)
Secondary Bit diam: 101.6 mm	0°	# Holes: 1 = 75.1 ft (4 " diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
	33,850	21,090	12,760

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	110	37.4

total explosives weight in Blast (kg): 12,797

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			54
UNITRONIC 600 15M			1
UNITRONIC 600 25M			55

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	10

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	28,467 te	10,742 m3
Total tonnes per day:	28,467 te	NB80-01 Rate Code
Total Holes Loaded:	55 holes	
... including:	Dead Holes	
... and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	4 rows	

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 8 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 47 main body

Bench Height: 73.1 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 75.1 ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Decks: per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 68.1 ft avg

Main Body: 68.1 ft avg

- Charge Weight -

Front Row: 198.6 kg/hole

Main Body: 198.6 kg/hole

Max. per delay: 261.0 kg/delay

SD () Equation: 202.9 kg/delay

Total kg Loaded: 12,797 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.450 kg/te (actual)

Front row: 0.302 kg/te (theoretical)

Main Body: 0.402 kg/te (theoretical)

"KPI" PF: 0.377 kg/te (theoretical)

2.008 lb/yd³

1.347 lb/yd³

1.797 lb/yd³

1.684 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

Some holes received an 8' or 9' collar due to broken rock on top or lean burden at the crest



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-06-11

Blast Number: 18-007
Orica Order #: 2348563
Blast Time: 11:56 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40364	79.88314
Front Row Corner	43.40353	79.88317
Back Row Corner	43.40386	79.88312
Average (Centre of Blast)	43.40368	79.88315

(N) Radians	(W) Radians
0.757536	1.394224
0.757535	1.394224
0.757540	1.394223
0.757537	1.394224

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40245	79.87814
	2nd Reading		
	Average	43.40245	79.87814
	Distance (1st Seis. From Centre of Blast)	427.3	m
	Post Blast Data: ppV:	2.7	mm/s
	frequency:	12.0	Hz
	air overpressure:	116.9	dB
	2450 2nd Line		

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40605	79.89400
	2nd Reading		
	Average	43.40605	79.89400
	Distance (2nd Seis. From Centre of Blast)	916.8	m
	Post Blast Data: ppV:	0.2	mm/s
	frequency:	10.0	Hz
	air overpressure:	120.2	dB
	Colling Rd & Blind Line Bruce Trail		

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.39339	79.88880
	2nd Reading		
	Average	43.39339	79.88880
	Distance (3rd Seis. From Centre of Blast)	1233.5	m
	Post Blast Data: ppV:	0.1	mm/s
	frequency:	0.0	Hz
	air overpressure:	119.6	dB
	SouthWest Corner of Property		

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(427.3)^2}{30^2} \text{ kg}$$

$$= \frac{182,585}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 203 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

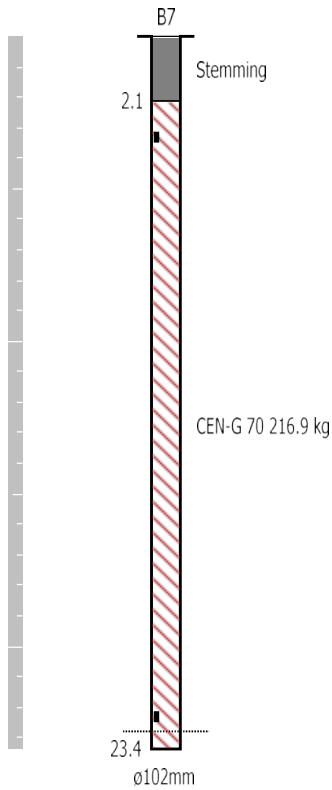
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 6/11/2018

Blast Number: 18-007
Orica Order #: 2348563

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Bill White

Signature required, indicating
sign off on Blast Design.

SHOTPlus 5 Plan

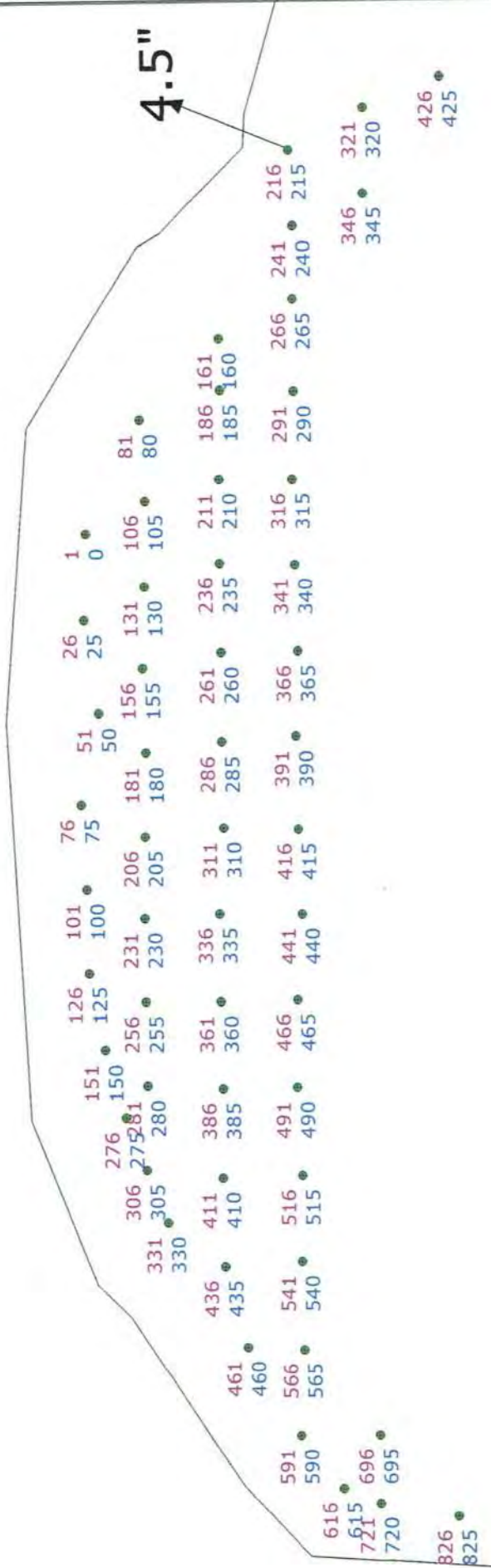
Blast Summary Data

Burden: 2.7m Spacing: 3.0m Stemming: 2.1m
 1st row burden: 3.7m Hole Diameter: 102.0mm Number of holes: 55 Hole angle: 0.0°
 Rock density: 2.65g/cc Total drilled: 1292.0m Blasted tonnage: 29,020tne

open face



4.5"



SHOTPlus 5.7.1.1

6/11/2018



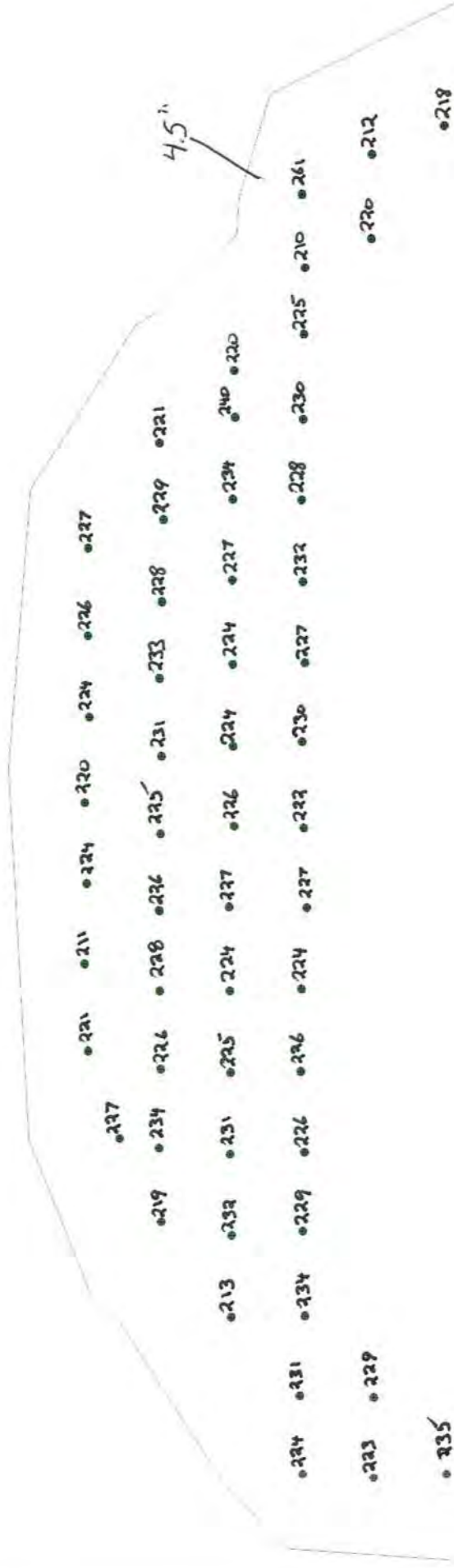
Mine	Burlington
Location	Upper Middle Bench
Title/author	18-007 Upper Middle Design Ken George
Filename	18-007_Upper_Middle_Final.spf

Not to scale

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 55 Hole angle: 0.0°
 Rock density: 2.65g/cc Total drilled: 4130.2ft Blasted tonnage: 25,592S/T

Load Sheet Max Load 240kg



Not to scale

SHOTPlus 5.7.1.1 6/7/2018

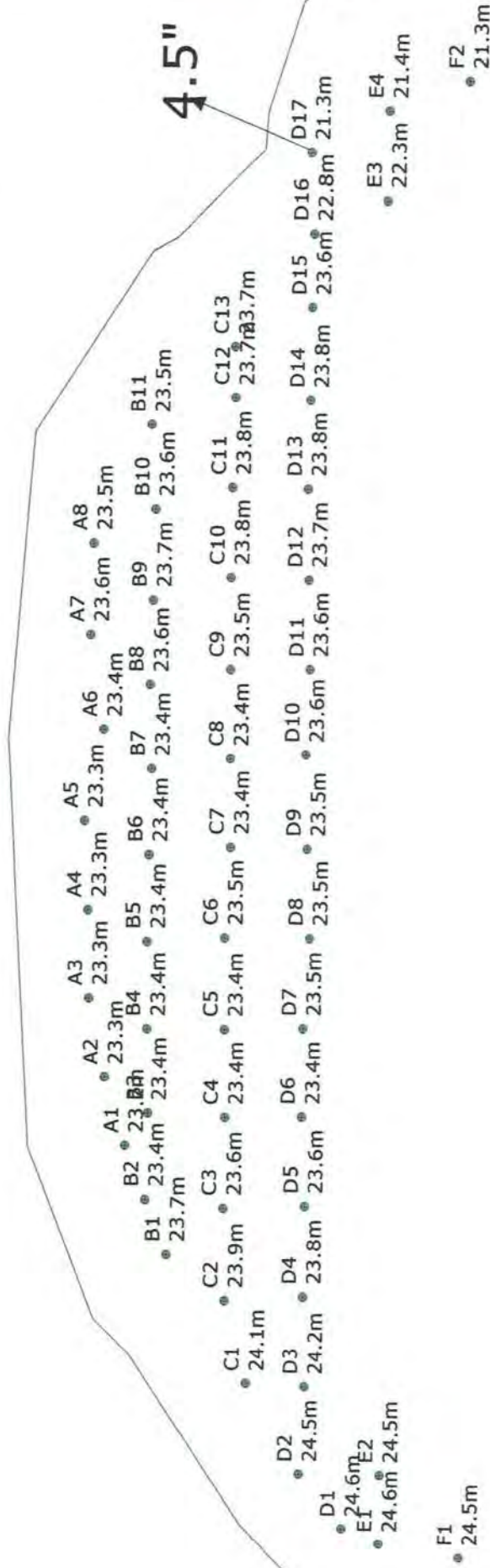
Mine	Burlington
Location	Upper Middle Bench
Title/author	18-007 Upper Middle Design Ken George
Filename	18-007_Upper_Middle_Final.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 2.7m
 1st row burden: 3.7m
 Rock density: 2.65g/cc
 Spacing: 3.0m
 Hole Diameter: 102.0mm
 Total drilled: 1292.0m
 Stemming: 2.1m
 Subdrill: 0.2m
 Number of holes: 55
 Hole angle: 0.0°
 Blasted tonnage: 29,020tne

open face



Not to scale

SHOTPlus 5.7.1.1	6/11/2018
Mine	Burlington
Location	Upper Middle Bench
Title/author	18-007 Upper Middle Design Ken George
Filename	18-007_Upper_Middle_Final.spf

1089791

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSANCE NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES
SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissance



Orica Canada Inc.

GRAND VALLEY

033411 SIDE ROAD 21-22

GRAND VALLEY ON

CA L9W 7G1

CONSIGNOR
EXPÉDITEURCONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY

BURLINGTON ON

CA L7R 4L8

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉETIME OUT
HEURE SORTIEORDER NUMBER
N° DE COMMANDEB/L NUMBER
N° DE CONNAISSANCE

2348563

86036212

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
11 Jun 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
11 Jun 2018	FOB Dest'n, Own Truck	F-73289	PT 15013
SHIP VIA TRANSPORTEUR	ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS	
Orica Truck	STANDARD		

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
147	PC	X	37	110	PENTEX BC 340 (49/CS)	3	53.655
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	26	54	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
66	PC	X	65	1	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
108	PC	X	53	55	*uni tronic 600-25M CU/ZC SPL(80')54P	2	26.352
100	PC		90	10	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							103.673 KG
**** TOTAL PACKAGES ****						8	
GHS/WHMIS SDS documents available Website: www.oricaminingsservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES		PALLETS RETURNED / PALETTES RETOURNÉES		BAGS USED / SACS UTILISÉS	
EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE		EMERGENCY RESPONSE NO./24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO		PLACARDS OFFERED / PLACARDS OFFERT	
ERAP 2-1510		1-877-561-3636		YES / OUI NO / NON	
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE		NETTE No. CONV PRESSAGE WT AGREEMENT NO.	
CONSIGNOR / EXPÉDITEUR GRAND VALLEY		CARRIER / TRANSPORTEUR Orica Truck		CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY	
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR Ryan Behnam		DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR Ryan Behnam		RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR	
SIGNATURE [Signature]		SIGNATURE [Signature]		SIGNATURE [Signature]	
DATE 11 06 18		DATE 11 06 18		DATE	
D/J M/M Y/A		D/J M/M Y/A		D/J M/M Y/A	

3 MEMORANDUM
MÉMOIRE

(THIS BILL OF LADING-EXPRESS SHIPPING CONTRACT IS TO BE SIGNED BY THE SHIPPER AND CARRIER)
(CE CONNAISSANCE-CONTRAT D'EXPÉDITION PAR MESSAGERIES DOIT ÊTRE SIGNÉ PAR L'EXPÉDITEUR ET LE TRANSPORTEUR)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉES AU VERSO
**** PAGE 2 OF 2 ****

D.F.G. S7772



Blast Design

Nelson Aggregate

Quarry: **Burlington**
P.O. #:
Design Date: **2018-06-11**

Blast Number: **18-007**
Orica Order #:

page 1

Blaster-in-charge: **Mike der Kinderen** (Print Name)

Blast Location: **Upper Middle** (Bench / Face)
GPS Coordinates: **43.40368** °N Latitude **79.88315** °W Longitude
Centre of Blast: Centre of Blast

Design to Blasted: **27,150** te
Total Holes Loaded: **55** holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: **4** rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: **101.6** mm **0** # Holes: **55** = 4,130.2 ft (4 " diam)
Secondary Bit diam: mm **0** # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm **0** # Holes: = 0.0 ft (" diam)
Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: **12.0** ft avg
Spacing: **10.0** ft avg
Holes: front row

- Design Pattern (Main Body) -

Burden: **9.0** ft avg
Spacing: **10.0** ft avg
Holes: 55 main body
Bench Height: **73.1** ft avg
Sub-drill: **2.0** ft avg
Hole Depth: 75.1 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: **7.0** ft avg
Main Body: **7.0** ft avg

Material used: **.75" Stone**

- Design Charge Length -

Front Row: 68.1 ft avg
Main Body: 68.1 ft avg

- Design Charge Weight -

Front Row: 198.6 kg/hole
Main Body: 198.6 kg/hole
Max Chge Wt / delay: **240.0** kg/delay

Required kg Loaded: 13,237 kg
Rock Density: **2.65** g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: **0.488** kg/te (actual)
Front row: 0.302 kg/te (theoretical)
Main Body: 0.402 kg/te (theoretical)
"KPI" PF: **0.377** kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit B. S. Expl or IS from previous Blast

A-3 ⑦
C-1 ⑧
D-17 C-20 P⑧

Bulk Expl. Required:

	kg
CENTRA GOLD 70	13,200

Pkgd Expl. Required:

	kg

Boosters Required:

	kg/u	# usec	kg
PENTEX 12 (OR EQUIVALENT)	0.34	110	37.4

total explosives weight in Blast (kg): 13,237

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		55
UNITRONIC 600 25M		55

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

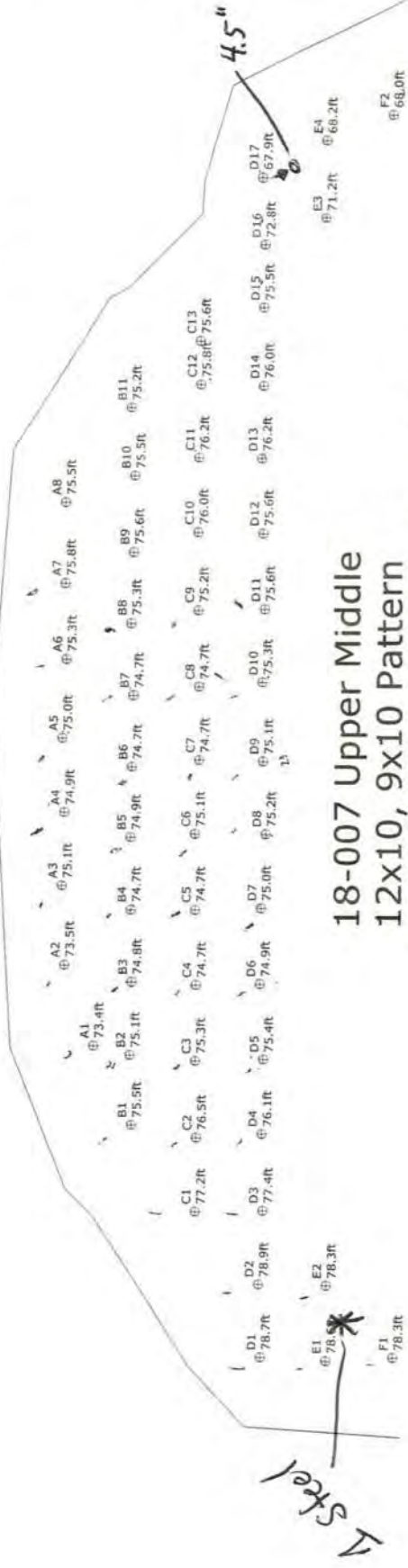
A1-A8
B1
C1
D1
E1

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Subdrill: 0.6ft Stemming: 7.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 55 Hole angle: 0.0°
 Rock density: 2.65g/cc Total drilled: 4130.2ft Blasted tonnage: 25,8625/T



open face



18-007 Upper Middle
 12x10, 9x10 Pattern
 4" Hole Unless otherwise noted
 250m + 0.6m Subdrill



Not to scale

SHOTPlus5Beta 5.7.3.9	04/06/2018
Mine Burlington	
Location Upper Middle Bench	
Title/author 18-004 Upper Middle Design Ken G	
Filename 18-007 Upper Middle Final.spf	

Date/Time Long at 11:56:25 June 11, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.5 Volts
Unit Calibration May 3, 2017 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada
General: N.43.40245 W.79.87814

Extended Notes

Sand Bagged

Microphone Linear Weighting

PSPL 116.9 dB(L) at 1.206 sec

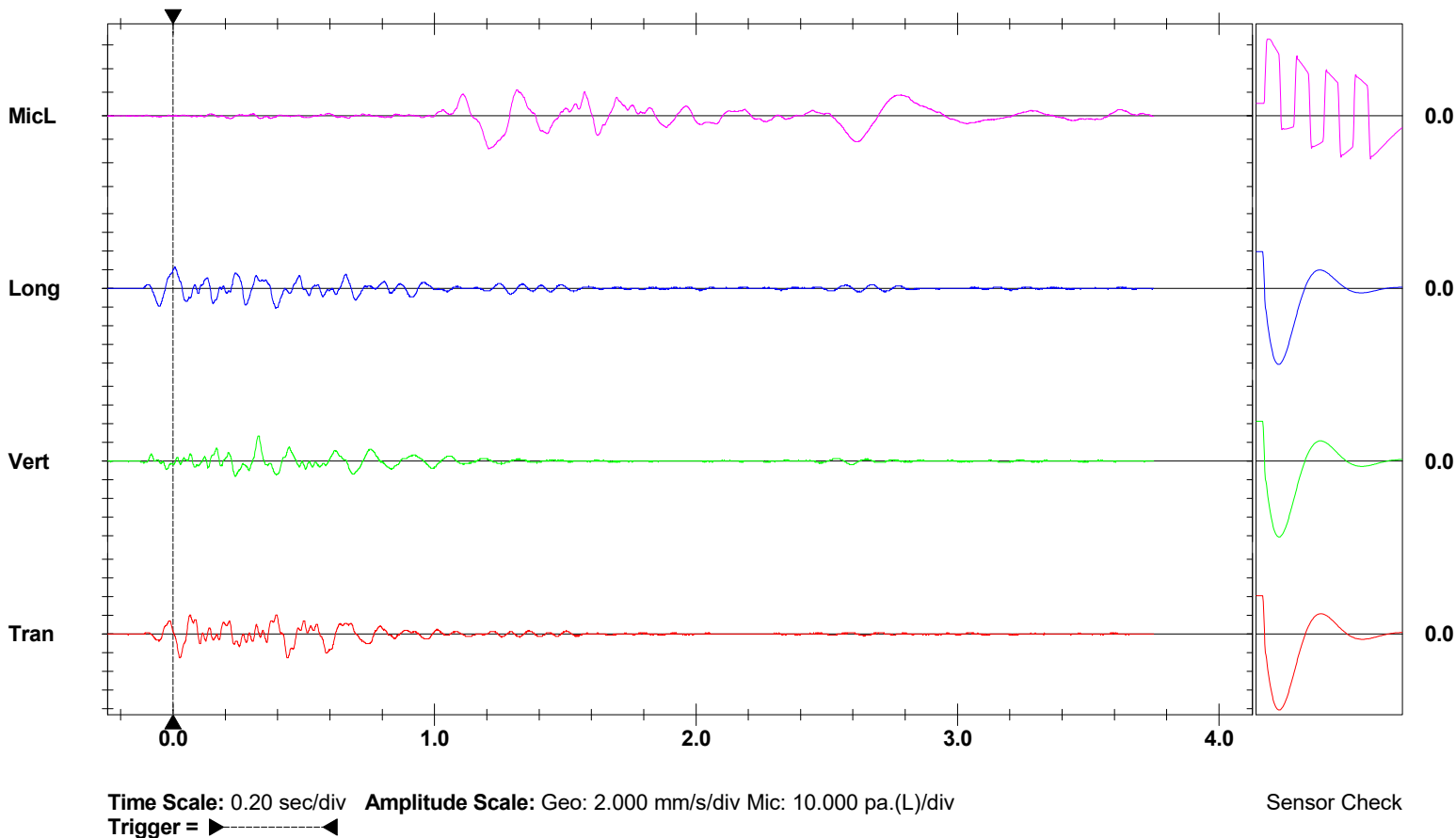
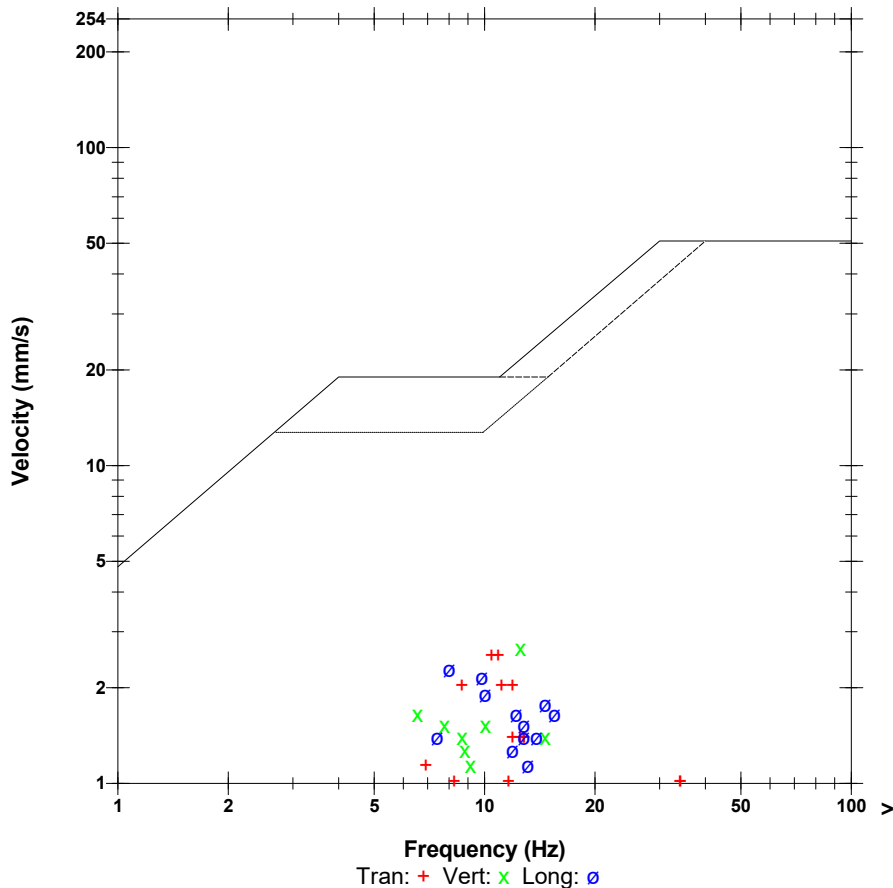
ZC Freq 3.5 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 693 mv)

	Tran	Vert	Long	
PPV	2.540	2.667	2.286	mm/s
ZC Freq	11	12	8.0	Hz
Time (Rel. to Trig)	0.024	0.324	0.006	sec
Peak Acceleration	0.040	0.027	0.040	g
Peak Displacement	0.038	0.031	0.042	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.4	7.4	Hz
Overswing Ratio	3.8	3.8	4.2	

Peak Vector Sum 3.277 mm/s at 0.393 sec

USBM RI8507 And OSMRE



Date/Time MicL at 11:56:27 June 11, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.107 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/BURLINGTON.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.5 Volts
Unit Calibration February 14, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

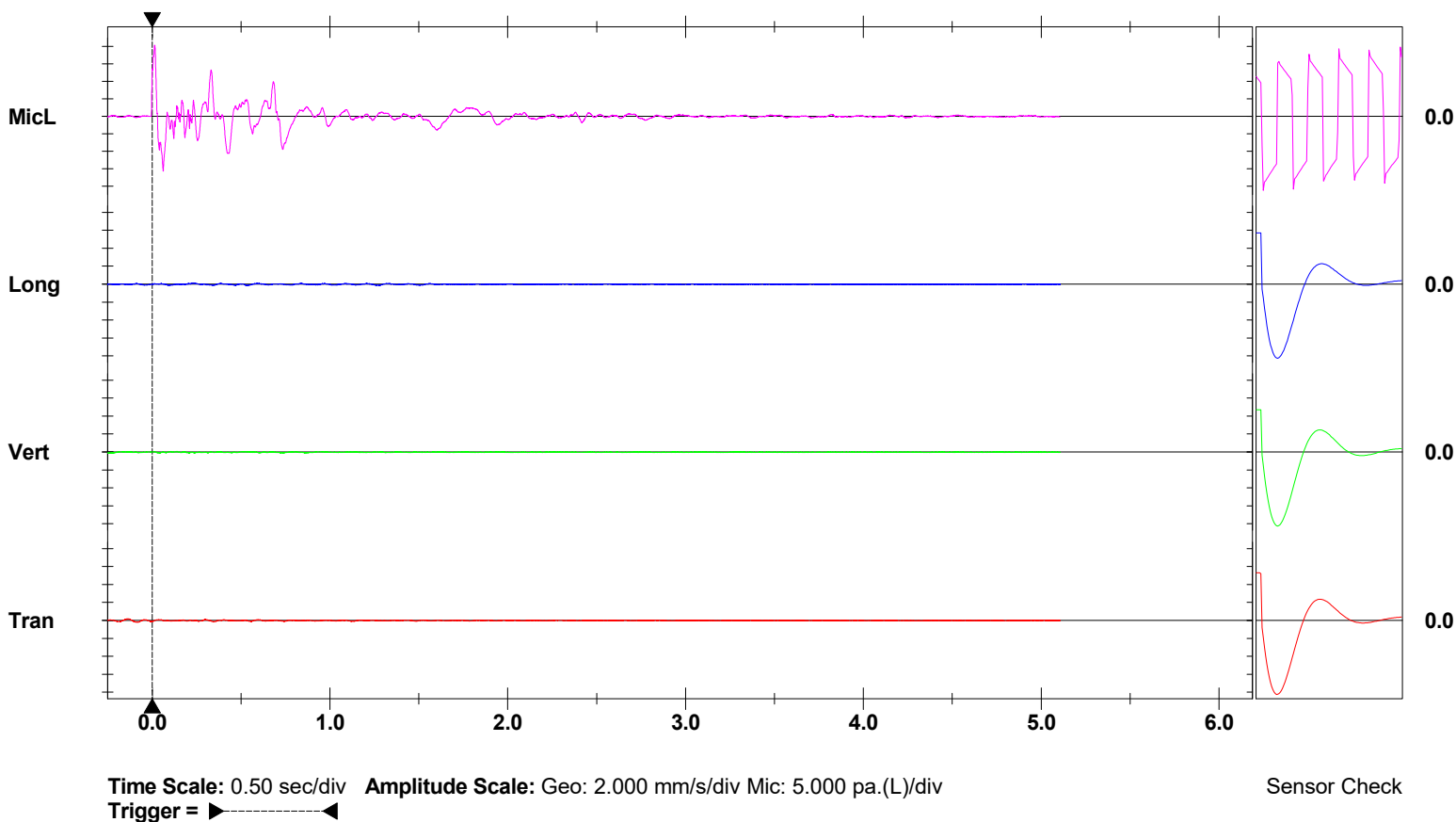
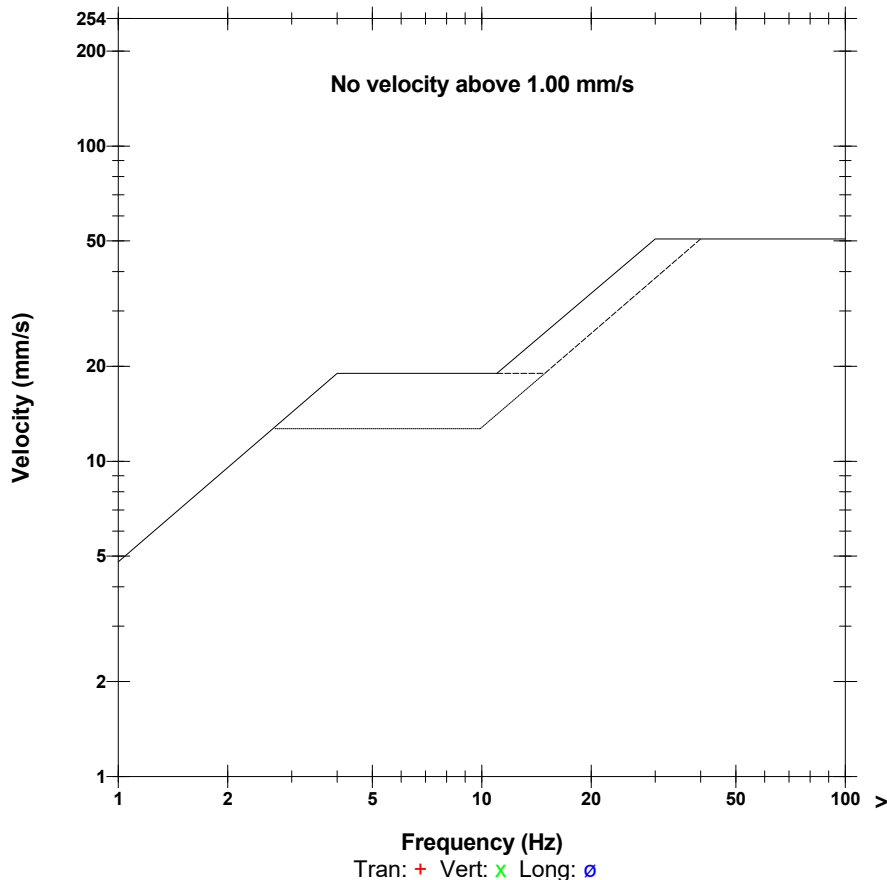
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 120.2 dB(L) at 0.015 sec
ZC Freq 13.0 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1331 mv)

	Tran	Vert	Long	
PPV	0.213	0.126	0.158	mm/s
ZC Freq	9.7	9.3	10.0	Hz
Time (Rel. to Trig)	-0.085	-0.241	0.533	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.004	0.004	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.5	3.3	3.6	

Peak Vector Sum 0.227 mm/s at -0.084 sec

USBM RI8507 And OSMRE



Date/Time MicL at 11:56:29 June 11, 2018
Trigger Source Geo: 1.500 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 1024 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration November 3, 2017 by InstanTel
File Name __TEMP.EVT
Scaled Distance 3879.2 (1226.7 m, 0.1 kg)

Notes

Location: South West Corner of Property
Client: Nelson Aggregates Burlington Quarry
User Name: ORICA CANADA INC.
General:

Extended Notes

43.39339 ,79.88880

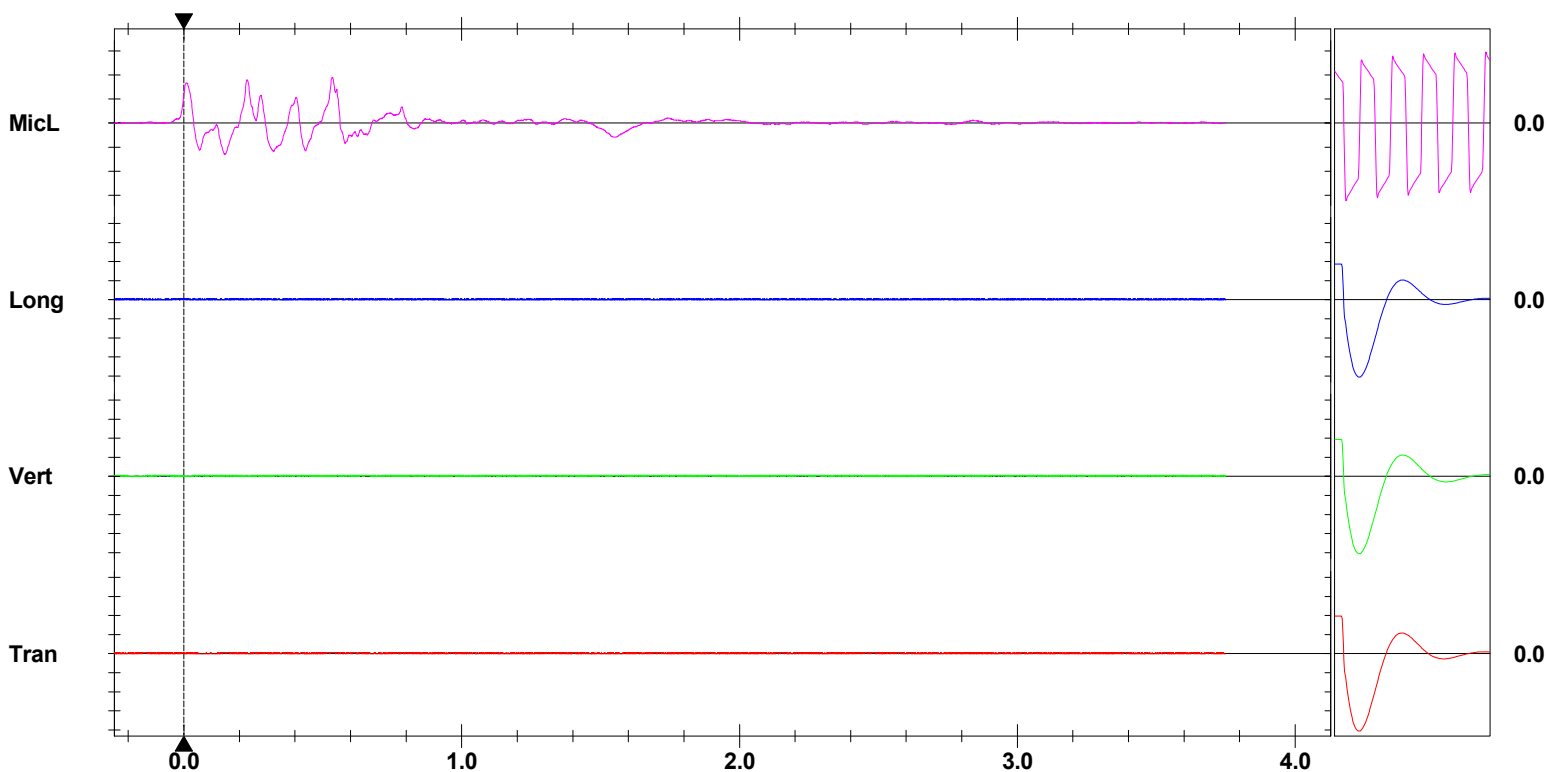
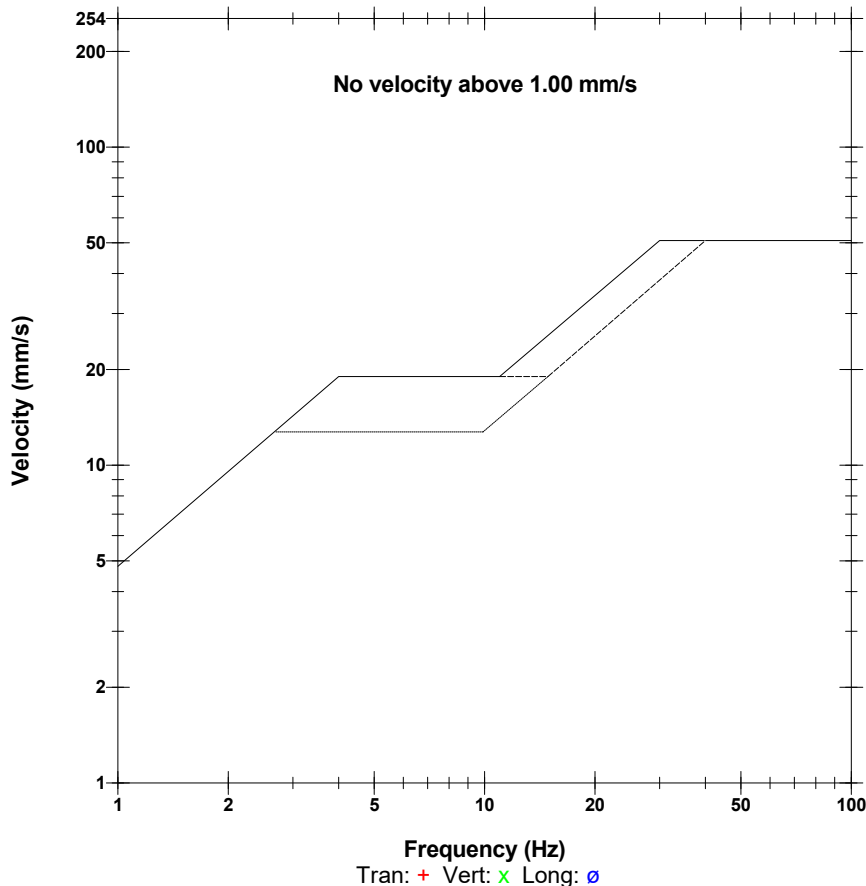
Microphone Linear Weighting
PSPL 119.6 dB(L) at 0.533 sec
ZC Freq 6.8 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 618 mv)

	Tran	Vert	Long	
PPV	0.127	0.127	0.127	mm/s
ZC Freq	N/A	N/A	>100	Hz
Time (Rel. to Trig)	-0.250	-0.250	-0.246	sec
Peak Acceleration	0.013	0.013	0.013	g
Peak Displacement	0.000	0.000	0.000	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.8	3.7	4.0	

Peak Vector Sum 0.220 mm/s at -0.244 sec

N/A: Not Applicable

USB RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-06-13

Blast Number: 18-008

Orica Order #: 2349625

Blast Time: 11:52 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)

GPS Coordinates: 43.40407 °N Latitude 79.88289 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 10 kph Temperature: 21 to 25 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 2,554 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 89 = 4,450.9 ft (4 " diam)
Secondary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,790	20,940	12,850

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	3	2	25

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	187	63.6

total explosives weight in Blast (kg): 12,939

Pkgd Prod (25 kg) % of Total kg: 0.2%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			87
UNITRONIC 600 15M			8
UNITRONIC 600 20M			92

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	10.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	28,929 te	10,917 m3
Total tonnes per day:	28,929 te	NB40-06 Rate Code
Total Holes Loaded:	89 holes	
... including:	Dead Holes	
... and:	3 Helper Holes	
Helper Hole Collar:	9.0 ft avg	
# Rows Blasted:	7 rows	

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 10 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 79 main body

Bench Height: 48.0 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 50.0 ft avg

- Stone Decking -

Front Row: 5.0 ft avg

Main Body: 5.0 ft avg

Decks: 8 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 38.0 ft avg

Main Body: 38.0 ft avg

- Charge Weight -

Front Row: 110.8 kg/hole

Main Body: 110.8 kg/hole

Max. per delay: 157.0 kg/delay

SD () Equation: 200.0 kg/delay

Total kg Loaded: 12,939 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.447 kg/te (actual)

Front row: 0.256 kg/te (theoretical)

Main Body: 0.342 kg/te (theoretical)

"KPI" PF: 0.330 kg/te (theoretical)

1.998 lb/yd³

1.145 lb/yd³

1.527 lb/yd³

1.472 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

Hole X-3 & G9 Could not be found once loading had been started

A-8,C-4,B-8,C-12,C-7,C-8,F-4,F-10 All Received a 5' stone deck due to incompetent rock

See Attached Load Adjustment sheet for any more Changes



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-06-13

Blast Number: 18-008
Orica Order #: 2349625
Blast Time: 11:52 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40407	79.88286	0.757544	1.394219
Front Row Corner	43.40417	79.88310	0.757546	1.394223
Back Row Corner	43.40397	79.88271	0.757542	1.394216
Average (Centre of Blast)	43.40407	79.88289	0.757544	1.394219

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	424.3	m		
	Post Blast Data:	ppV: 1.0	mm/s	Trigger set at: 2.0	mm/s
		frequency: 15.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 120.6	dB	Trigger set at: 115	dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	925.3	m		
	Post Blast Data:	ppV: Did	mm/s	Trigger set at: 2.0	mm/s
		frequency: Not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB	Trigger set at: 115	dB
	Colling Rd & Blind Line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (3rd Seis. From Centre of Blast)	1281.4	m		
	Post Blast Data:	ppV: Did	mm/s	Trigger set at: 2.0	mm/s
		frequency: Not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB	Trigger set at: 115	dB
	SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(424.3)^2}{30^2} \text{ kg}$$

$$= \frac{180,030}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 200 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

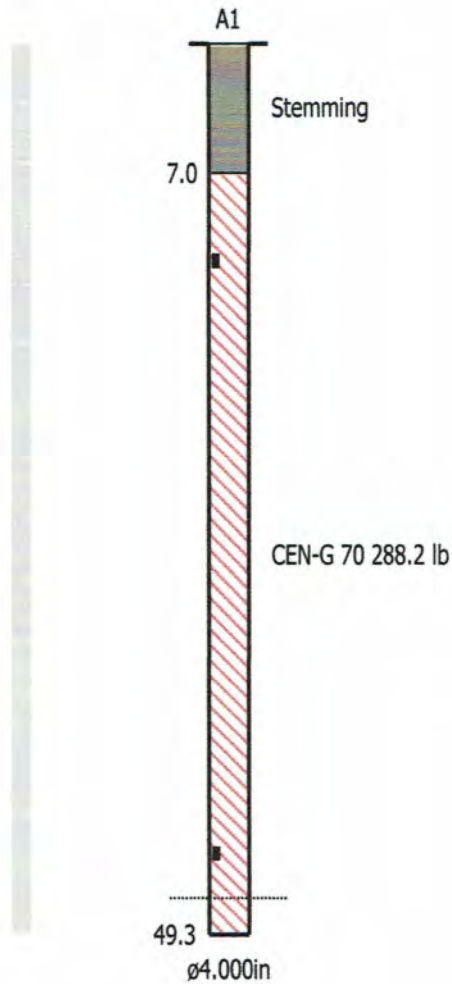
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 6/13/2018

Blast Number: 18-008
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

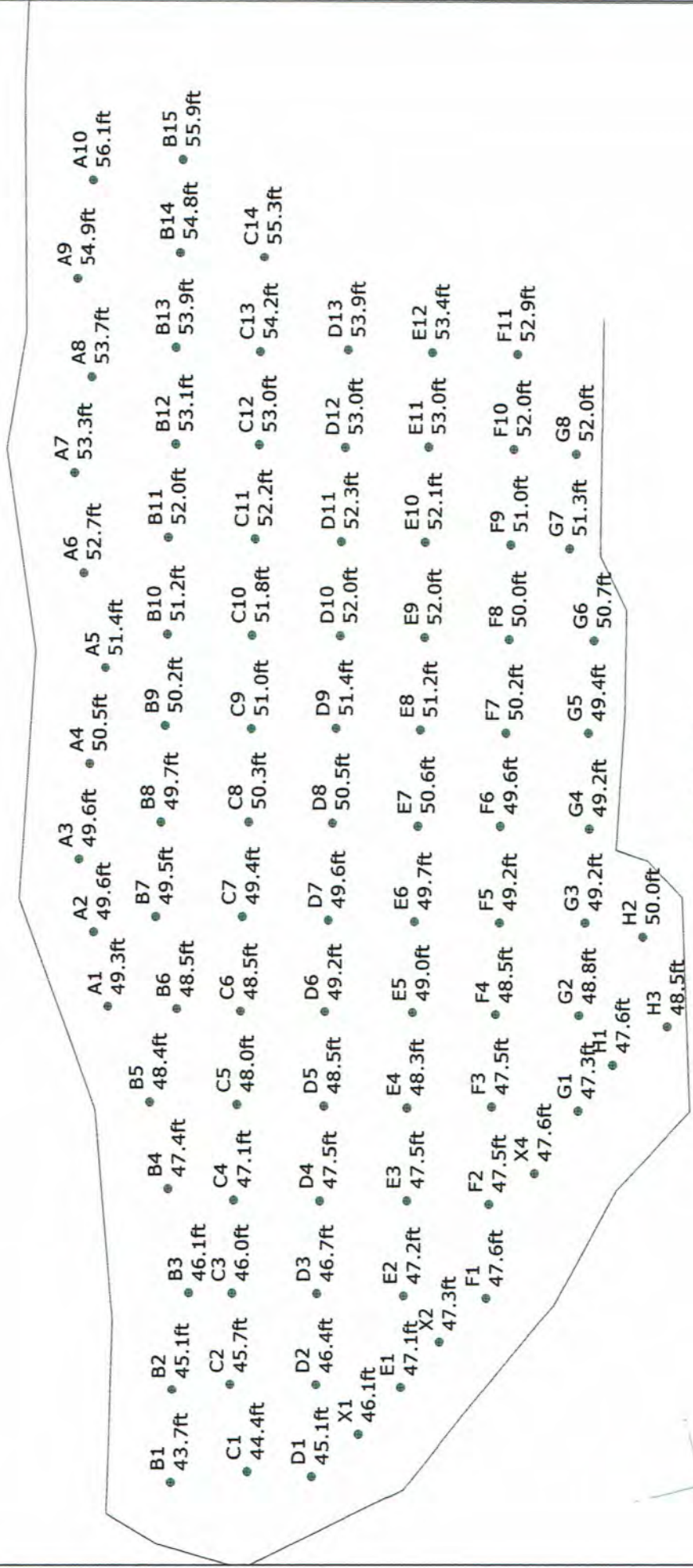
Bill White

Signature required, indicating
sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 Spacing: 10.0ft
 Stemming: 6.0ft
 1st row burden: 12.0ft
 Hole Diameter: 4.0in
 Number of holes: 89
 Hole angle: 0.0°
 Rock density: 2.65g/cc
 Total drilled: 4446.2ft
 Blasted tonnage: 33,192S/T



Not to scale

SHOTPlus 5.7.1.1

6/13/2018

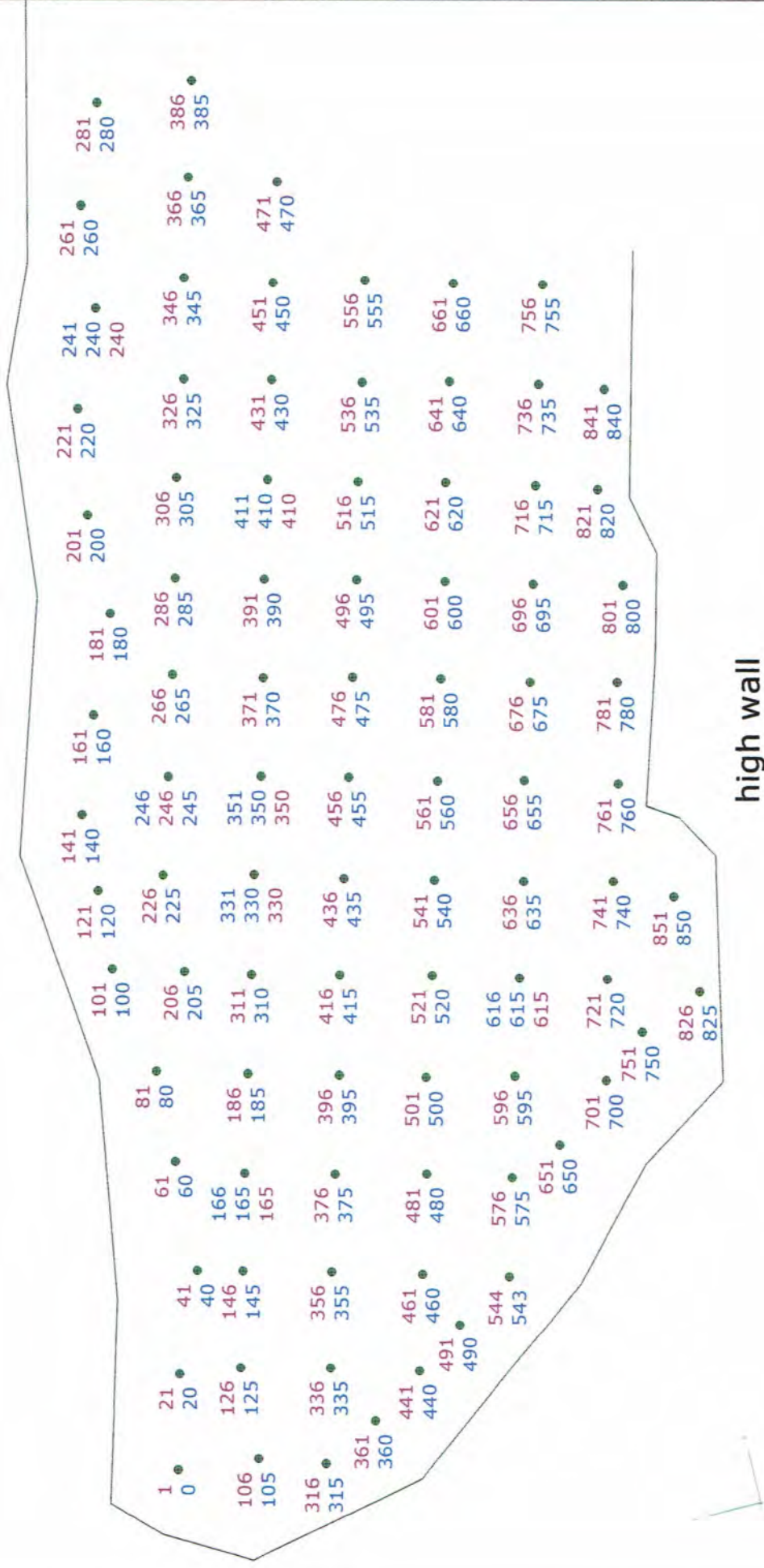
Mine Burlington

Location

Title/author 18-008 Bottom Middle South K George

Filename 2018-06-13 18-008 Lower Middle.spf

Timing



high wall



Not to scale

SHOTPlus 5.7.1.1

6/13/2018

Mine Burlington

Location

Title/author 18-008 Bottom Middle South K George

Filename 2018-06-13 18-008 Lower Middle.spf

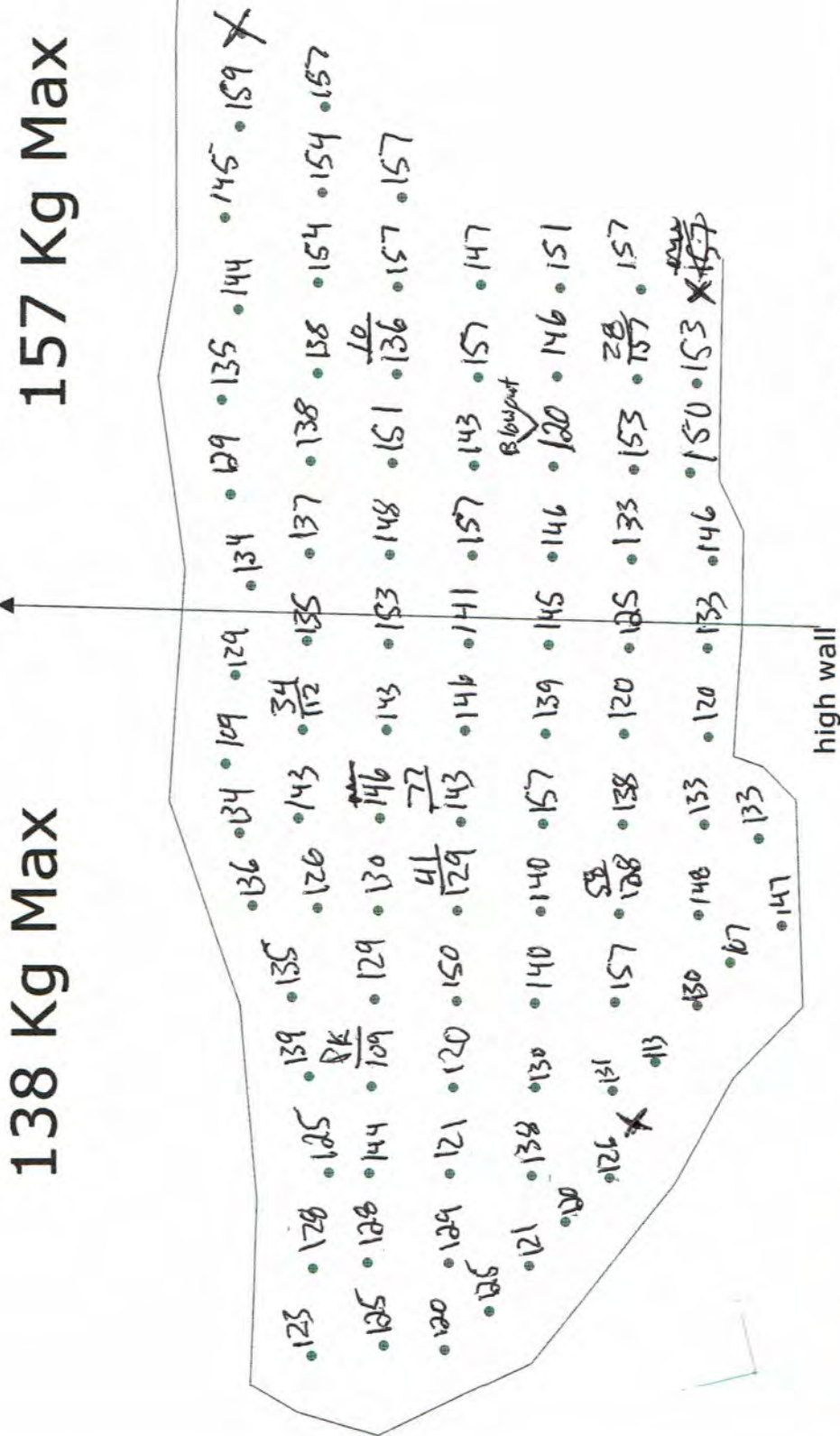
53

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 6.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 92 Hole angle: 0.0°
 Rock density: 2.65g/cc Total drilled: 4601.0ft Blasted tonnage: 34,239S/T

Load Sheet



Not to scale

SHOTPlus 5.7.1.1

6/11/2018

Mine Burlington

Location

Title/author 18-008 Bottom Middle South K George

Filename 2018-06-13 18-008 Lower Middle.spf

1089815



Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

Bill of Lading / Connaissance

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSEMENT

2349625

86039399

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURE À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
13 Jun 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
13 Jun 2018	FOB Dest'n, Own Truck	F-73289	PT 151013
SHIP VIA TRANSPORTEUR	ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS	
Orica Truck	STANDARD		

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
3	CS	X	2	1	FORTELO PRO 75X400 (3X16)	3	78.900
294	PC	X	107	187	PENTEX BC 340 (49/CS)	6	107.310
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
160	PC	X	73	87	*uni tronic 600-06.0M CU/ZC(20')80PC	2	11.680
66	PC	X	58	8	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
132	PC	X	40	92	*uni tronic 600-20M CU/ZC SPL(65')66P	2	26.928
100	PC		94	6	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							242.644 KG
**** TOTAL PACKAGES ****						15	

24 HOUR TECHNICAL INFORMATION: 1-613-996-6666

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO.24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENT À NO DE CONNAISSEMENT D'ORICA: Orica Canada Inc.
ERAP 2-1510	1-877-561-3636	YES / OUI NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.			
DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE		NETTE No. CONV PRESSAGE WT AGREEMENT NO.	

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
Ryan Benham	Ryan Benham	
SIGNATURE	SIGNATURE	SIGNATURE
DATE	DATE	DATE
13 06 18	13 06 18	
D/J M/M Y/A	D/J M/M Y/A	D/J M/M Y/A

2

SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE AVOIR SIGNED LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 3 ****

D.F.G. S7772

Date/Time MicL at 11:52:09 June 13, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.25 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.4 Volts
Unit Calibration May 3, 2017 by InstanTel
File Name _TEMP.EVT

Notes

Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada
General: N.43.40245 W.79.87814

Extended Notes

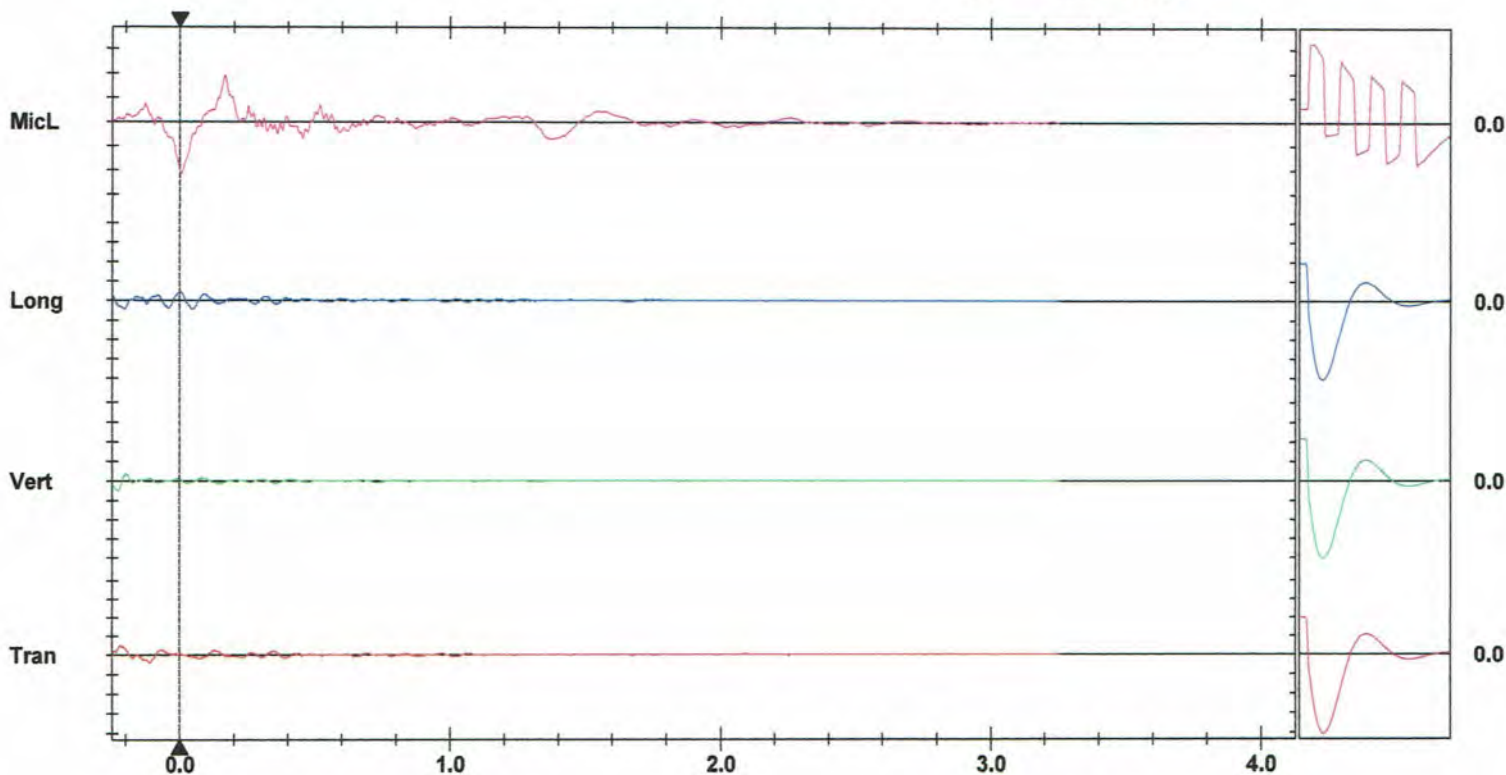
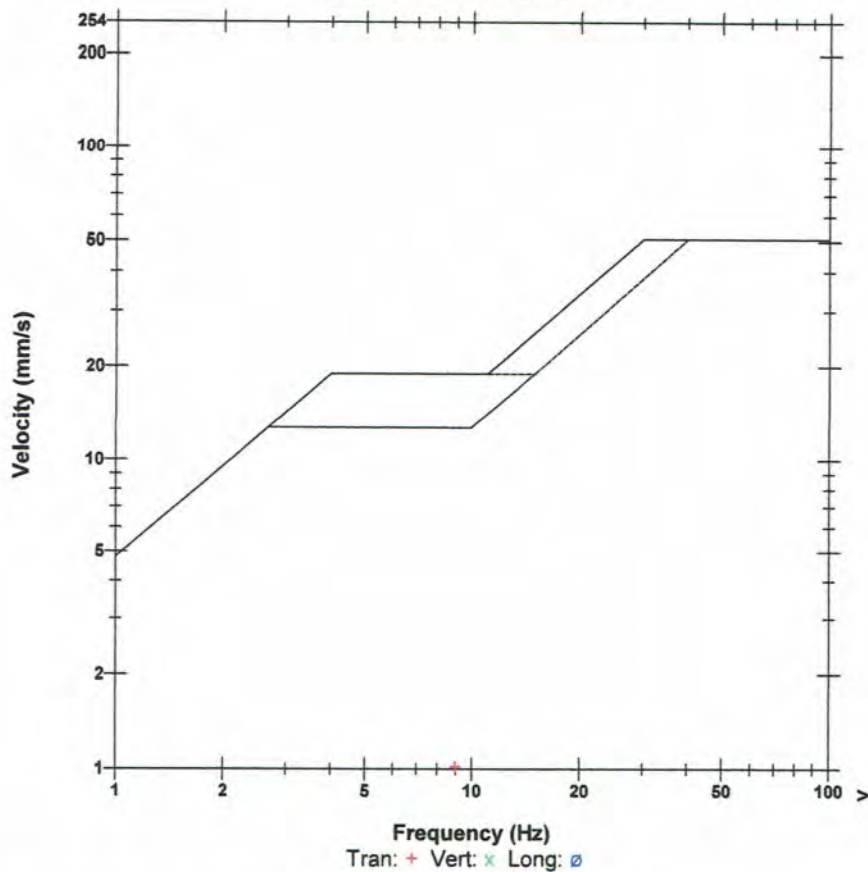
Sand Bagged

Microphone Linear Weighting
PSPL 120.6 dB(L) at 0.004 sec
ZC Freq 3.4 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 615 mv)

	Tran	Vert	Long	
PPV	1.016	1.016	0.889	mm/s
ZC Freq	9.0	15	10	Hz
Time (Rel. to Trig)	-0.223	-0.228	-0.208	sec
Peak Acceleration	0.013	0.013	0.027	g
Peak Displacement	0.017	0.012	0.014	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.4	7.4	Hz
Overswing Ratio	3.8	3.8	4.2	

Peak Vector Sum 1.420 mm/s at -0.228 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

613 305 0454

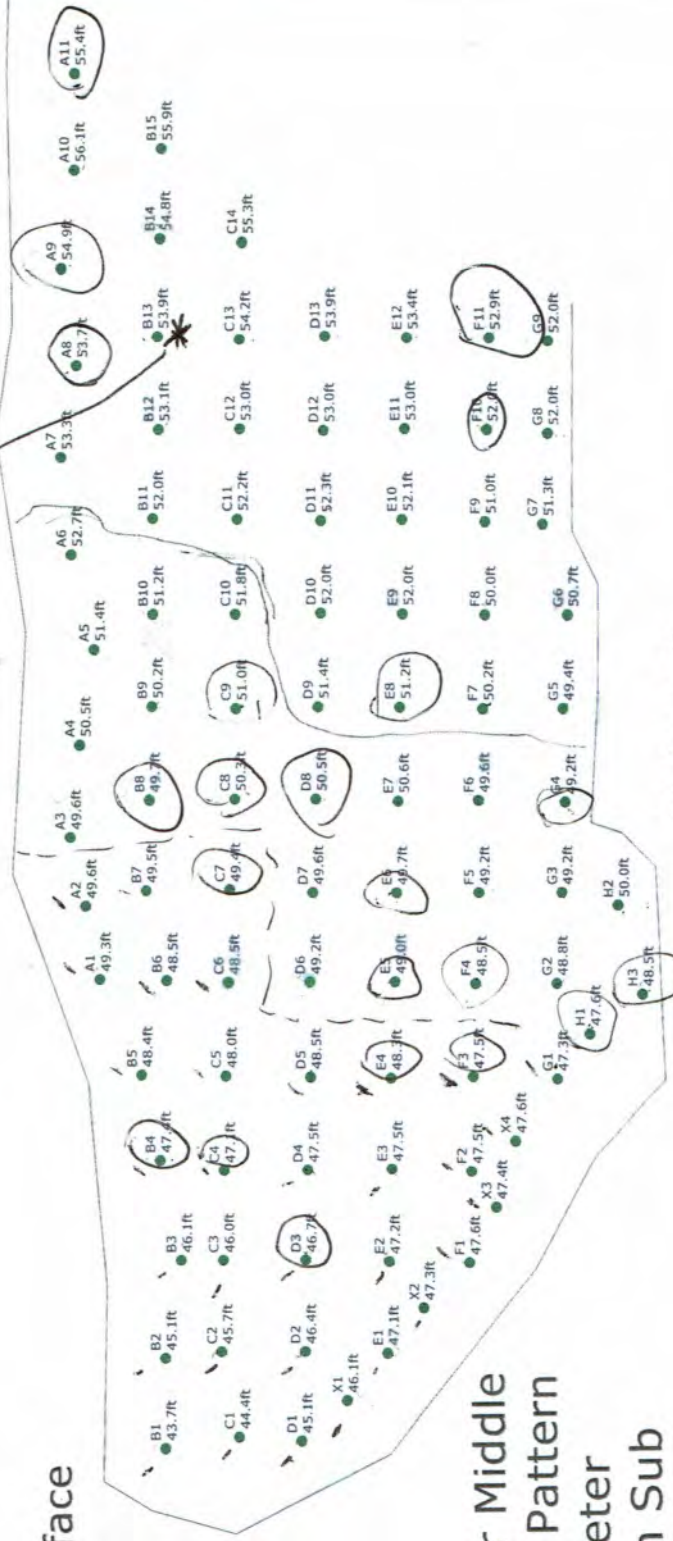
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 6.0ft
1st row burden: 12.0ft Subdrill: 2.0ft Hole angle: 0.0°
Hole Diameter: 4.0in Number of holes: 92
Rock density: 2.65g/cc Total drilled: 4601.0ft Blasted tonnage: 34,239S/T



open face



18-008 Lower Middle
12X10, 9X10 Pattern
4" Hole Diameter
250m + 0.6m Sub

high wall



Not to scale

SHOTPlus5Beta 5.7.3.9

06/06/2018

Mine Burlington

Location

Title/author 18-005 Bottom Middle South I. Dee

Filename 18-008 Lower Middle South Design F



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-06-13

Blast Number: 18-008
Orica Order #:

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)
GPS Coordinates: 43.40407 °N Latitude 79.88289 °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: 29,670 te
Total Holes Loaded: 97 holes
... including: Dead Holes
... and: 4 Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 8 rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 92 = 4,600.9 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 11 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 81 main body
Bench Height: 48.0 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 50.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg

Material used: .75" Stone

- Design Charge Length -

Front Row: 43.0 ft avg
Main Body: 43.0 ft avg

- Design Charge Weight -

Front Row: 125.4 kg/hole
Main Body: 125.4 kg/hole
Max Chge Wt / delay: 170.0 kg/delay

Required kg Loaded: 12,875 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.434 kg/te (actual)
Front row: 0.290 kg/te (theoretical)
Main Body: 0.387 kg/te (theoretical)
"KPI" PF: 0.375 kg/te (theoretical)

1.296 lb/yd³

1.728 lb/yd³

1.674 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Bulk Expl. Required: kg
 12,700

Pkgd Expl. Required: kg
FORTELE PRO 75X400 3 75

Boosters Required: kg/u # used kg
PENTEX 12 (OR EQUIVALENT) 0.34 294 100.0

total explosives weight in Blast (kg): 12,875

Pkgd Prod (75 kg) % of Total kg: 0.6%

Detonators Required: ms # req'd

UNITRONIC 600 6M 160

UNITRONIC 600 15M 66

UNITRONIC 600 20M 132

Cord & Access. Req'd: U of M # req'd

WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

of Blasts today (this Quarry) 1

of Blasters (this Blast) 1

of Helpers (this Blast) Note Exception 2

of MMU's (this Blast) 1

Services Req'd:

GPS LAYOUT Enter hours 0.0

BULK TRUCK CHARGE <2,000kg

BLASTER HOURS Enter Blaster hours 0.0

HELPER HOURS Enter total Helper man-hours 0.0

SEISMOGRAPH RENTAL Enter # Orica Seismographs 0

3D LASER PROFILE Enter hours 0

BORETRACK Enter hours 0

TECHNICAL BLAST DESIGN (per day) Enter # of days 0.0



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-06-25

Blast Number: 18-009

Orica Order #: 2354121

Blast Time: 12:01 PM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)

GPS Coordinates: 43.40451 °N Latitude 79.88425 °W Longitude
Centre of Blast Centre of Blast

Wind from the: SE at 10 kph Temperature: 16 to 20 °C

Clear: X

Rain: X

Overcast: X

Partly Cloudy: X

Snow: X

Inversion: X

Ceiling 30,000 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 99 = 3,692.3 ft (4 " diam)
Secondary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,280	17,620	9,660

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	3	0	75

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	200	68.0

total explosives weight in Blast (kg): 9,803

Pkgd Prod (75 kg) % of Total kg: 0.8%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			98
UNITRONIC 600 15M			102

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted: 25,983 te 9,805 m3
 Total tonnes per day: 25,893 te NB40-07 Rate Code
 Total Holes Loaded: 99 holes
 ... including: Dead Holes
 ... and: Helper Holes
 Helper Hole Collar: ft avg
 # Rows Blasted: 13 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 30 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 69 main body

Bench Height: 35.3 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 37.3 ft avg

- Stone Decking -

Front Row: 5.0 ft avg

Main Body: 5.0 ft avg

Decks: 2 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 25.3 ft avg

Main Body: 25.3 ft avg

- Charge Weight -

Front Row: 73.8 kg/hole

Main Body: 73.8 kg/hole

Max. per delay: 118.0 kg/delay

SD () Equation: 329.8 kg/delay

Total kg Loaded: 9,803 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.377 kg/te (actual)

Front row: 0.232 kg/te (theoretical)

Main Body: 0.309 kg/te (theoretical)

"KPI" PF: 0.303 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Hole B-1 and B-2 Reviewed stone decks due to voids found while loading

Hole N-5 to N-11 were not loaded because we ran out of product in our MMU



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-06-25

Blast Number: 18-009
Orica Order #: 2354121
Blast Time: 12:01 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40452	79.88424
Front Row Corner	43.40442	79.88402
Back Row Corner	43.40458	79.88449
Average (Centre of Blast)	43.40451	79.88425

(N) Radians	(W) Radians
0.757552	1.394243
0.757550	1.394239
0.757553	1.394247
0.757552	1.394243

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40245	79.87814
	2nd Reading		
	Average	43.40245	79.87814
	Distance (1st Seis. From Centre of Blast)	544.8	m
	Post Blast Data:	ppV: Did	mm/s
		frequency: Not	Hz
		air overpressure: Trigger	dB
			Trigger set at: 2.0 mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
			Trigger set at: 115 dB
			2450 2nd Line

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40605	79.89400
	2nd Reading		
	Average	43.40605	79.89400
	Distance (2nd Seis. From Centre of Blast)	807.0	m
	Post Blast Data:	ppV: Did	mm/s
		frequency: Not	Hz
		air overpressure: Trigger	dB
			Trigger set at: 2.0 mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
			Trigger set at: 115 dB
			Colling Rd & Blind Line Bruce Trail

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.39339	79.88880
	2nd Reading		
	Average	43.39339	79.88880
	Distance (3rd Seis. From Centre of Blast)	1291.1	m
	Post Blast Data:	ppV: Did	mm/s
		frequency: Not	Hz
		air overpressure: Trigger	dB
			Trigger set at: 2.0 mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
			Trigger set at: 115 dB
			SouthWest Corner of Property

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(544.8)^2}{30^2} \text{ kg}$$

$$= \frac{296,807}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 330 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-07-05

Blast Number: 18-010

Orica Order #: 2359087

Blast Time: 11:51 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40369 °N Latitude 79.88327 °W Longitude
Centre of Blast Centre of Blast

Wind from the: SW at 5 kph Temperature: 26 to 30 °C

Clear: X

Rain: X

Overcast: X

Partly Cloudy: X

Snow: X

Inversion: X

Ceiling 30,000 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 53 = 4,133.5 ft (4 " diam)
Secondary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,780	21,100	12,680

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	118	40.1

total explosives weight in Blast (kg): 12,720

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			53
UNITRONIC 600 25M			16
UNITRONIC 600 30M			49

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	10.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	30,963 te	11,684 m3
Total tonnes per day:	30,963 te	NB80-01 Rate Code
Total Holes Loaded:	53 holes	
... including:	Dead Holes	
... and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	3 rows	

- Pattern (Front Row)-

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 22 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 31 main body

Bench Height: 76.0 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 78.0 ft avg

- Stone Decking -

Front Row: 0.0 ft avg

Main Body: 15.0 ft avg

Decks: 6 per blast

- Collar Stemming -

Front Row: 8.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 70.0 ft avg

Main Body: 56.0 ft avg

- Charge Weight -

Front Row: 204.1 kg/hole

Main Body: 163.3 kg/hole

Max. per delay: 250.0 kg/delay

SD () Equation: 212.6 kg/delay

Total kg Loaded: 12,720 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.411 kg/te (actual)

Front row: 0.298 kg/te (theoretical)

Main Body: 0.318 kg/te (theoretical)

"KPI" PF: 0.311 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

While measuring the blast we discovered Hole B-4 was only at a depth of 59' (19'short of the v
I told Bill White from Nelson Aggregates and he told us to proceed with loading.

Attached is a load adjustment sheet showing all the deck that were added due to voids and se



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-07-05

Blast Number: 18-010
Orica Order #: 2359087
Blast Time: 11:51 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40367	79.88381
Front Row Corner	43.40348	79.88299
Back Row Corner	43.40391	79.88301
Average (Centre of Blast)	43.40369	79.88327

(N) Radians	(W) Radians
0.757537	1.394235
0.757534	1.394221
0.757541	1.394222
0.757537	1.394226

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40245	79.87814
	2nd Reading		
	Average	43.40245	79.87814
	Distance (1st Seis. From Centre of Blast)	437.4	m
	Post Blast Data:	ppV: 2.3	mm/s
		frequency: 9.5	Hz
		air overpressure: 115.9	dB
		Trigger set at: 2.0	mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
		Trigger set at: 115	dB
	2450 2nd Line		

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40605	79.89400
	2nd Reading		
	Average	43.40605	79.89400
	Distance (2nd Seis. From Centre of Blast)	906.7	m
	Post Blast Data:	ppV: Did	mm/s
		frequency: Not	Hz
		air overpressure: Trigger	dB
		Trigger set at: 2.0	mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
		Trigger set at: 115	dB
	Colling Rd & Blind Line Bruce Trail		

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.39339	79.88880
	2nd Reading		
	Average	43.39339	79.88880
	Distance (3rd Seis. From Centre of Blast)	1230.8	m
	Post Blast Data:	ppV: Did	mm/s
		frequency: Not	Hz
		air overpressure: Trigger	dB
		Trigger set at: 2.0	mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
		Trigger set at: 115	dB
	SouthWest Corner of Property		

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(437.4)^2}{30^2} \text{ kg}$$

$$= \frac{191,319}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 213 kg

Orica

Blaster-in-charge:

jim bray

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

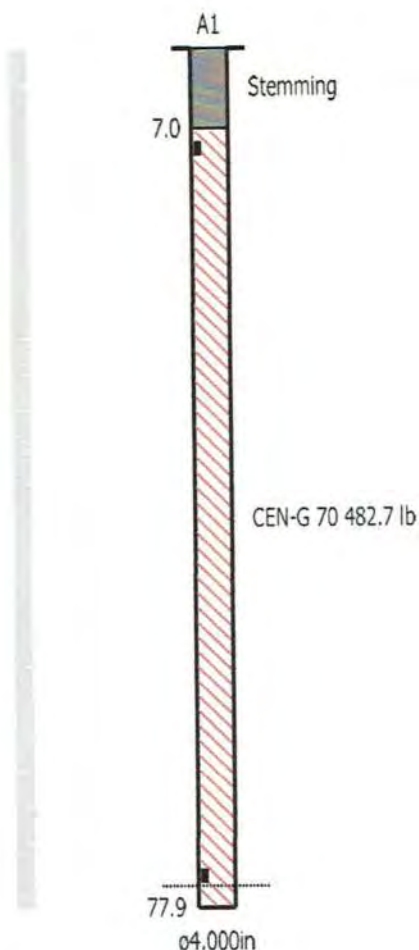
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 7/5/2018

Blast Number: 18-010
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

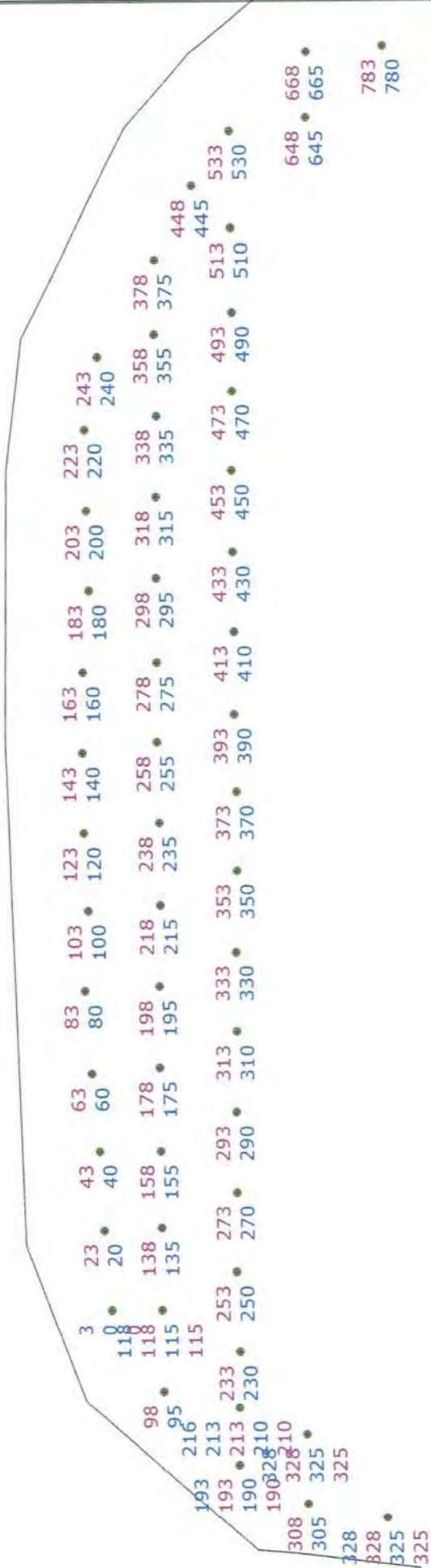
Bill White

Signature required, indicating
sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4133.5ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 53
 Stemming: 7.0ft
 Hole angle: 0.0°



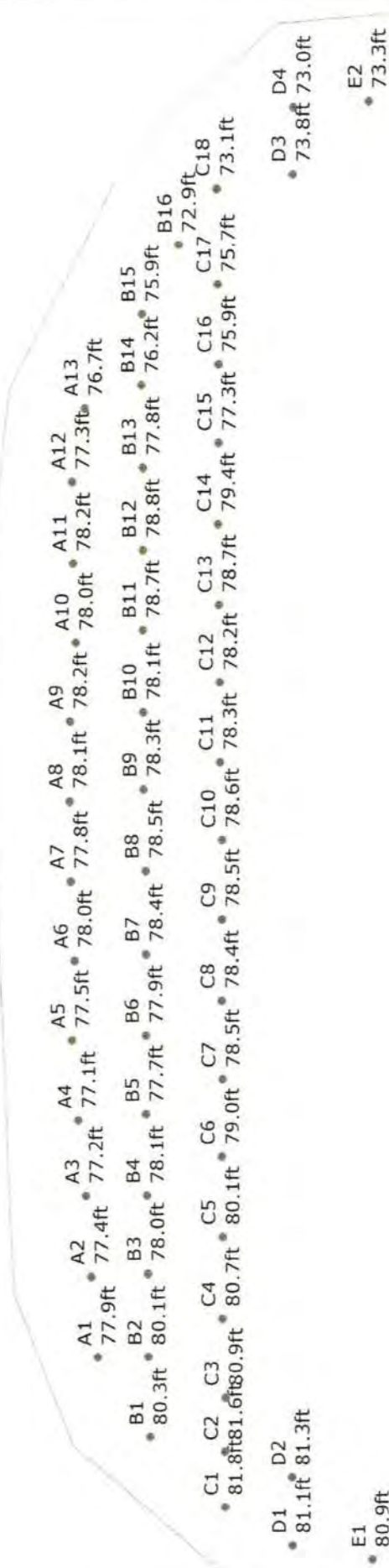
Not to scale

SHOTPlus 5.7.1.1		7/6/2018
Mine	Burlington	
Location	18-010 Upper Middle Final	
Title/author	2018-07-05 18-010 Upper Middle.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4133.5ft
 Spacing: 10.0ft
 Subdrill: 2.0ft
 Number of holes: 53
 Stemming: 7.0ft
 Hole angle: 0.0°



Not to scale

SHOTPlus 5.7.1.1		7/4/2018
Mine	Burlington	
Location		
Title/author	18-010 Upper Middle Final	
Filename	2018-07-05 18-010 Upper Middle.spf	

1089976

Bill of Lading / Connaissance



CONSIGNOR
EXPÉDITEUR
GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE
NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT	
TARE	
NET	
TIME IN HEURE D'ENTRÉE 6.45	TIME OUT HEURE SORTIE
ORDER NUMBER N° DE COMMANDE 2359087	B/L NUMBER N° DE CONNAISSEMENT 86063385

PAGE 2

DATE REQUIRED DATE REQUISE 05 Jul 2018	TIME REQUIRED HEURE REQUISE 00:00:00	INVOICE TO / BUYER FACTURÉ À / ACHETEUR NELSON AGGREGATE COMPANY	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT n/a
DATE SHIPPED EXPÉDIÉ LE 05 Jul 2018	FREIGHT TERMS CONDITIONS DE LIVRAISON FOR Dest'n, Own Truck	SHIP. MAG. LIC. PERMIS EXPÉDITEUR F-73289	VEHICLE NO. N° DE VÉHICULE P712103
SHIP VIA TRANSPORTEUR Orica Truck		ROUTING ITINÉRAIRE STANDARD	MAG. LIC. NO. N° DE PERMIS

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
147	PC	X	29	118	PENTEX BC 340 (49/CS)	3	53.655
80	PC	X	27	53	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
54	PC	X	38	16	*uni tronic 600-25M CU/ZC SPL(80')54P	1	13.176
72	PC	X	23	49	*uni tronic 600-30M C/Z SPL(100')36P	2	21.168
100	PC		100	8	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
2	PC				Harness Wire Duplex (6 pack) 400m	1	5.840
TOTAL GROSS WEIGHT							100.379 KG
**** TOTAL PACKAGES ****						8	
GHS/WHMIS SDS documents available Website: www.oricaminingservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24 HOUR NUMBER 1-613-996-6666

PALETS RETURNED / PALETTES RETOURNÉES

BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE ERAP 2-1510	EMERGENCY RESPONSE NO/24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMERO 1-877-561-3636	PLACARDS OFFERED / PLACARDS OFFERT YES / OUI NO / NON	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSEMENT D'ORICA: Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE \$	NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR GRAND VALLEY	CARRIER / TRANSPORTEUR Orica Truck	CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR Mike Agar	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR Mike Agar	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE Mike Agar	DATE 05 07 18 D/J M/M Y/A	SIGNATURE Mike Agar
	DATE 05 07 18 D/J M/M Y/A	DATE D/J M/M Y/A

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 2 ****

D.F.G. S7772

Date/Time Long at 11:51:55 July 5, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.25 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.5 Volts
Unit Calibration May 3, 2017 by InstanTel
File Name _TEMP.EVT

Notes

Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada
General: N.43.40245 W.79.87814

Extended Notes

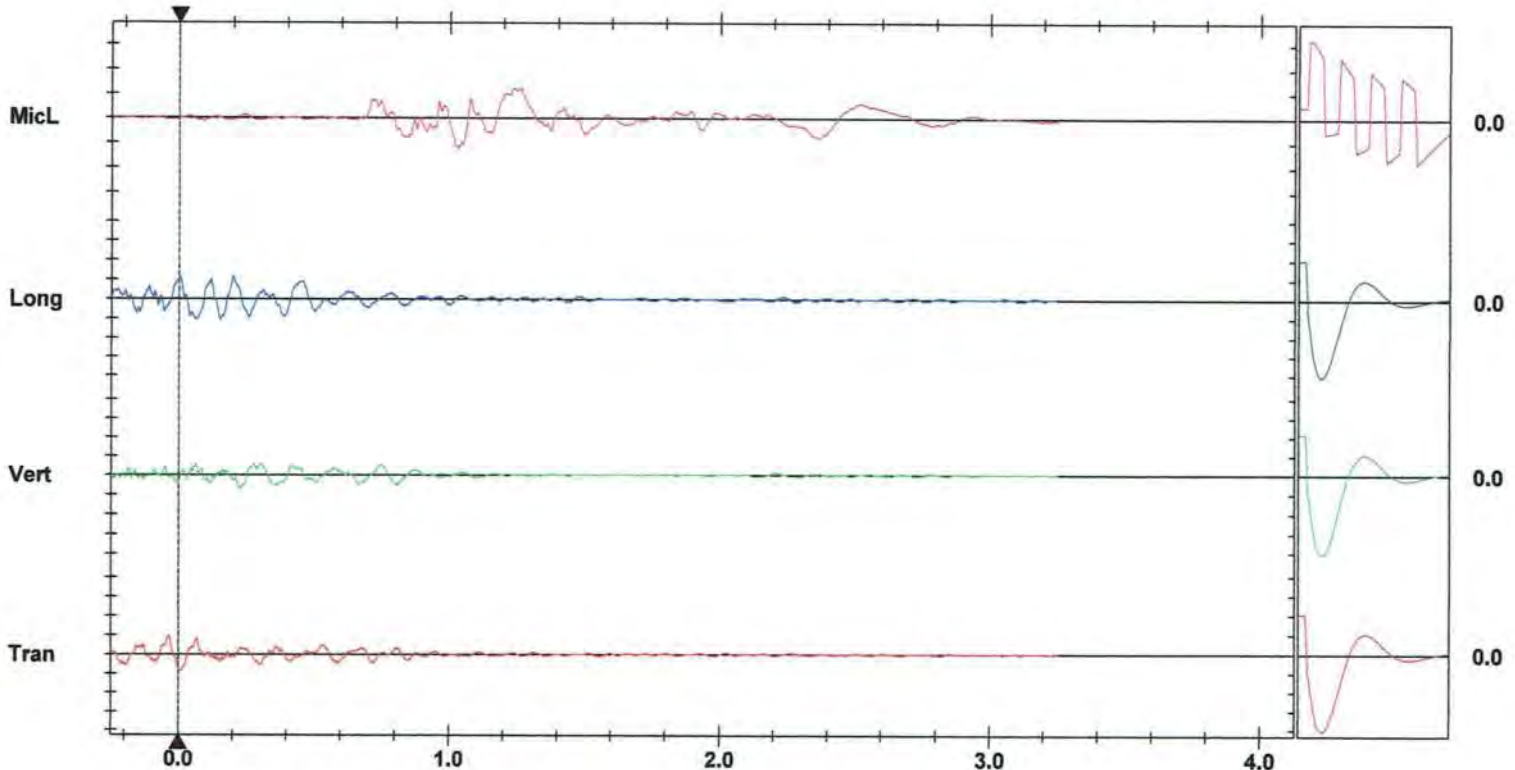
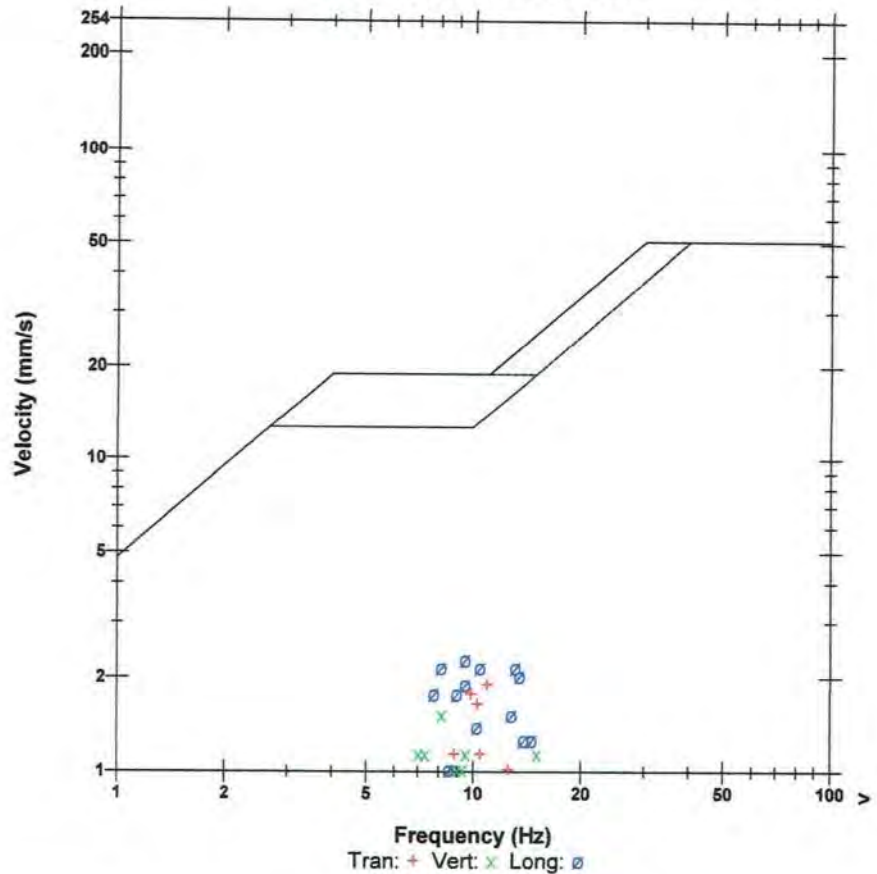
Sand Bagged

Microphone Linear Weighting
PSPL 115.9 dB(L) at 1.240 sec
ZC Freq 3.6 Hz
Channel Test Passed (Freq = 20.1 Hz Amp = 673 mv)

	Tran	Vert	Long	
PPV	1.905	1.524	2.286	mm/s
ZC Freq	11	8.1	9.5	Hz
Time (Rel. to Trig)	-0.037	0.226	0.198	sec
Peak Acceleration	0.027	0.027	0.040	g
Peak Displacement	0.028	0.029	0.046	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.2	7.4	7.5	Hz
Overswing Ratio	3.8	3.7	4.1	

Peak Vector Sum 2.823 mm/s at 0.003 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

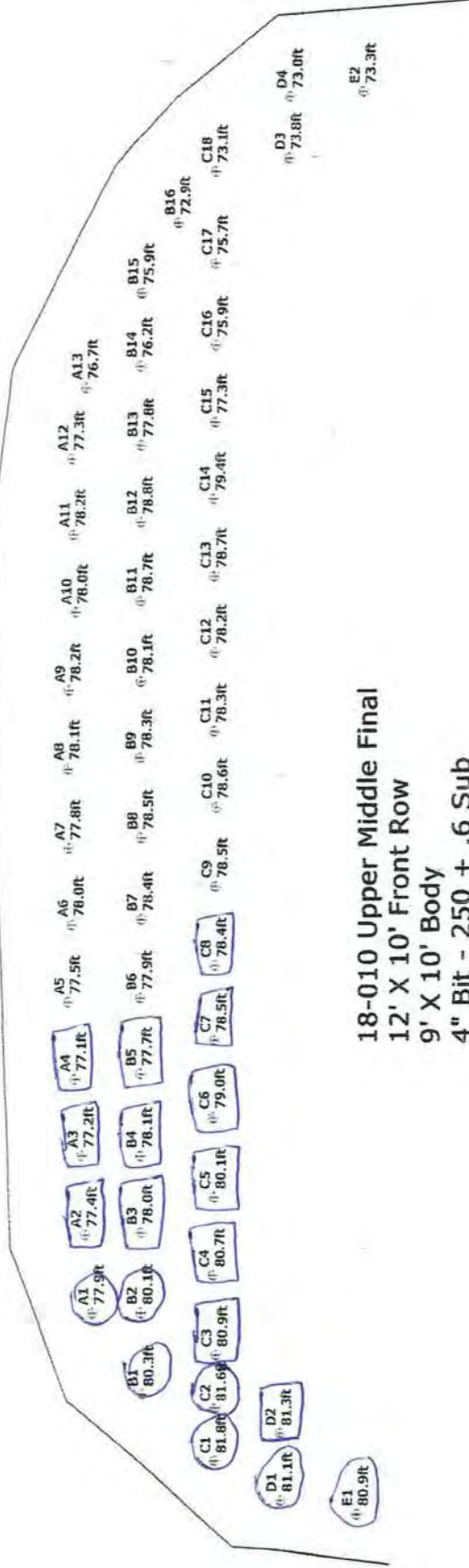
Sensor Check

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4133.5ft
 Spacing: 10.0ft
 Subdrill: 2.0ft
 Number of holes: 53
 Stemming: 7.0ft
 Hole angle: 0.0°

Free Face



18-010 Upper Middle Final
 12' X 10' Front Row
 9' X 10' Body
 4" Bit - 250 + .6 Sub



Not to scale

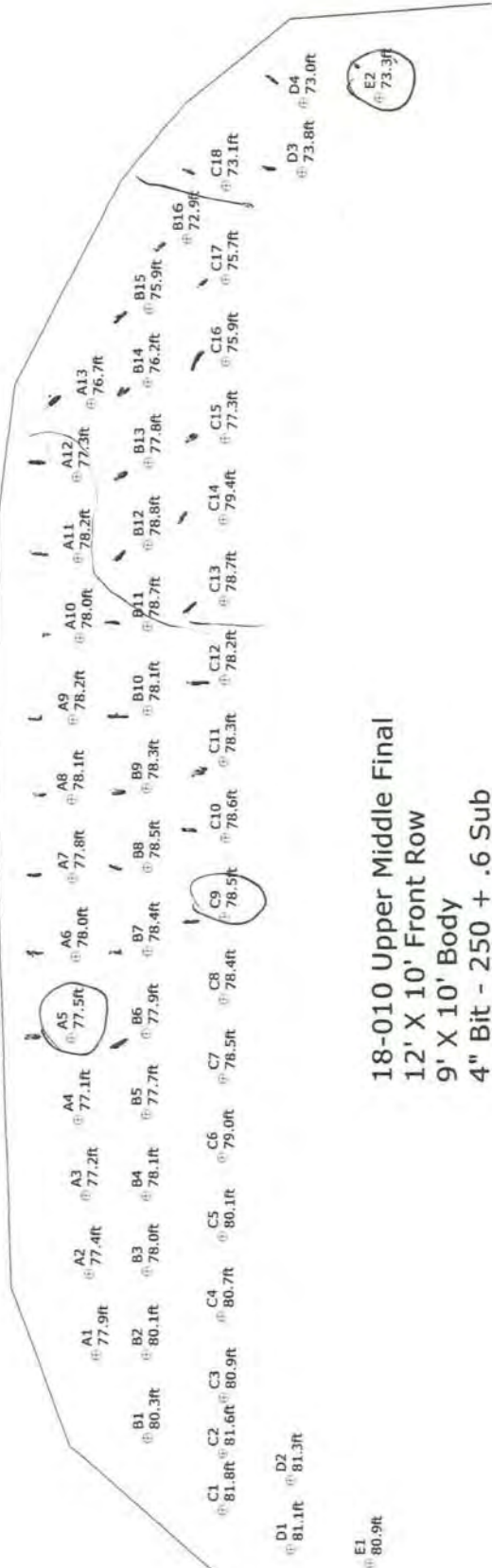
SHOTPlus 5.7.2.1	12/06/2018
Mine Burlington	
Location	
Title/author 18-010 Upper Middle Final	
Filename 18-010 Upper Middle Final.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4133.5ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Stemming: 7.0ft
 Subdrill: 2.0ft
 Number of holes: 53
 Hole angle: 0.0°

Free Face



Not to scale

SHOTPlus 5.7.2.1 12/06/2018

Mine Burlington

Location

Title/author 18-010 Upper Middle Final

Filename 18-010 Upper Middle Final.spf



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-07-05

Blast Number: 18-010
Orica Order #:

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)
GPS Coordinates: 43.40369 °N Latitude 79.88327 °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: 30,963 te
Total Holes Loaded: 53 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 3 rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 53 = 4,133.5 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 22 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 31 main body
Bench Height: 76.0 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 78.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg

Material used: .75" Stone

- Design Charge Length -

Front Row: 71.0 ft avg
Main Body: 71.0 ft avg

- Design Charge Weight -

Front Row: 207.0 kg/hole
Main Body: 207.0 kg/hole
Max Chge Wt / delay: 250.0 kg/delay

Required kg Loaded: 13,236 kg
Rock Density: 2.65 g/cc = te/m^3

- Design Powder Factor -

Expected Yield PF: 0.427 kg/te (actual)
Front row: 0.303 kg/te (theoretical)
Main Body: 0.403 kg/te (theoretical)
"KPI" PF: 0.370 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in B4, B, S, Expl or IS from previous Blast:

Bulk Expl. Required:

kg

13,200

Pkgd Expl. Required:

kg

Boosters Required:

kg/u # used

kg

PENTEX 12 (OR EQUIVALENT) 0.34 106 36.0

total explosives weight in Blast (kg): 13,236

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

ms

req'd

UNITRONIC 600 6M 80
UNITRONIC 600 25M 54
UNITRONIC 600 30M 36

Cord & Access. Req'd:

U of M

req'd

WIRE DUPLEX (6 PACK) 400M units 1
units
units

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services Req'd:

GPS LAYOUT Enter hours 0.0
BULK TRUCK CHARGE <2,000kg
BLASTER HOURS Enter Blaster hours 0.0
HELPER HOURS Enter total Helper man-hours 0.0
SEISMOGRAPH RENTAL Enter # Orica Seismographs 0
3D LASER PROFILE Enter hours 0
BORETRACK Enter hours 0
TECHNICAL BLAST DESIGN (per day) Enter # of days 0.0



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-06-20

Blast Number: 18-011

Orica Order #: 2367871

Blast Time: 11:59 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)

GPS Coordinates: 43.40486 °N Latitude 79.88449 °W Longitude
Centre of Blast Centre of Blast

Wind from the: E at 5 kph Temperature: 21 to 25 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 125 = 3,500.0 ft (4 " diam)
Secondary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,090	25,800	8,290

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	270	91.8

total explosives weight in Blast (kg): 8,382

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			123
UNITRONIC 600 9M			51
UNITRONIC 600 15M			96

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	3

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=5,000kg <10,000kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	12.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	24,173 te	9,122 m3
Total tonnes per day:	te	NB40-07 Rate Code
Total Holes Loaded:	125 holes	
... including:	Dead Holes	
... and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	15 rows	

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 38 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 87 main body

Bench Height: 26.0 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 28.0 ft avg

- Stone Decking -

Front Row: 5.0 ft avg

Main Body: 6.0 ft avg

Decks: 10 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 16.0 ft avg

Main Body: 15.0 ft avg

- Charge Weight -

Front Row: 46.7 kg/hole

Main Body: 43.7 kg/hole

Max. per delay: 90.0 kg/delay

SD () Equation: 372.7 kg/delay

Total kg Loaded: 8,382 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.347 kg/te (actual)

Front row: 0.199 kg/te (theoretical)

Main Body: 0.249 kg/te (theoretical)

"KPI" PF: 0.246 kg/te (theoretical)

1.549 lb/yd³

0.890 lb/yd³

1.113 lb/yd³

1.098 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

10 Stone decks were added to this blast due to the drill logs showing voids

The timing sheet identifies where they are as well as the drill log and load sheet.

Attached is a load adjustment sheet



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-06-20

Blast Number: 18-011
Orica Order #: 2367871
Blast Time: 11:59 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40487	79.88448
Front Row Corner	43.40462	79.88452
Back Row Corner	43.40508	79.88446
Average (Centre of Blast)	43.40486	79.88449

(N) Radians	(W) Radians
0.757558	1.394247
0.757554	1.394248
0.757562	1.394247
0.757558	1.394247

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40245	79.87814
	2nd Reading		
	Average	43.40245	79.87814
	Distance (1st Seis. From Centre of Blast)	579.2	m
	Post Blast Data:	ppV: Did	mm/s
		frequency: Not	Hz
		air overpressure: Trigger	dB
			Trigger set at: 2.0 mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
			Trigger set at: 115 dB
			2450 2nd Line

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40605	79.89400
	2nd Reading		
	Average	43.40605	79.89400
	Distance (2nd Seis. From Centre of Blast)	780.7	m
	Post Blast Data:	ppV: Did	mm/s
		frequency: Not	Hz
		air overpressure: Trigger	dB
			Trigger set at: 2.0 mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
			Trigger set at: 115 dB
			Colling Rd & Blind Line Bruce Trail

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.39339	79.88880
	2nd Reading		
	Average	43.39339	79.88880
	Distance (3rd Seis. From Centre of Blast)	1323.3	m
	Post Blast Data:	ppV: Did	mm/s
		frequency: Not	Hz
		air overpressure: Trigger	dB
			Trigger set at: 2.0 mm/s
			V / T / L : ? (Vertical, Transverse or Longitudinal)
			Trigger set at: 115 dB
			SouthWest Corner of Property

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(579.2)^2}{30^2} \text{ kg}$$

$$= \frac{335,473}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 373 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

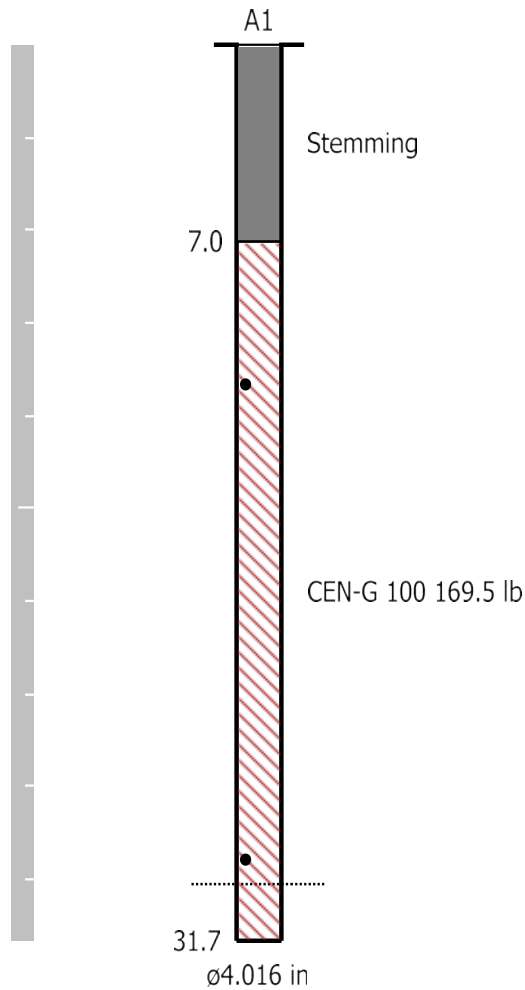
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 7/30/2018

Blast Number: 18-011
Orica Order #: 2367871

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

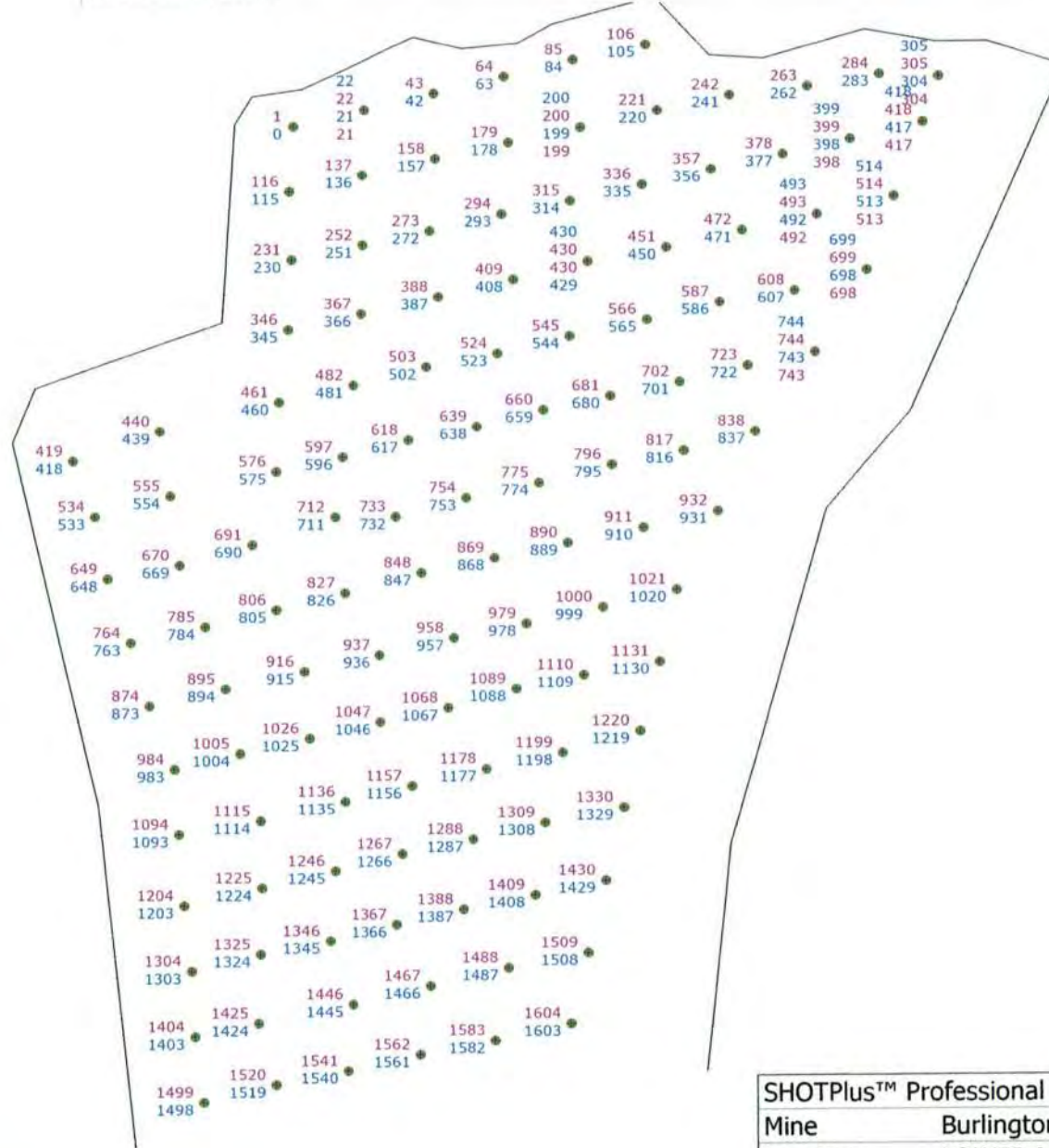
Bill White

Signature required, indicating
sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Subdrill: 2.0ft Stemming: 5.9ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 125 Hole angle: 0.0°
 Total drilled: 3500.1ft



Not to scale

SHOTPlus™ Professional 5.7.3.0		7/30/2018
Mine	Burlington	
Location	LOWER MIDDLE	
Title/author	DESIGN 18-011 LOWER MIDDLE	
Filename	Timing from A-1.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
1st row burden: 12.0ft
Total drilled: 3500.1ft

Spacing: 10.0ft
Hole Diameter: 4.0in

Subdrill: 2.0ft
Number of holes: 125

Stemming: 5.9ft
Hole angle: 0.0°

80 KG Max

65KG Max

18-011 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diameter
250m Elevation + 0.6m Subdrill

SHOTPlus™ Professional 5.7.3.0

7/27/2018

Mine Burlington

Location LOWER MIDDLE

Title/author DESIGN 18-011 LOWER MIDDLE

Filename Blast_18-011_Lower_Middle.spf

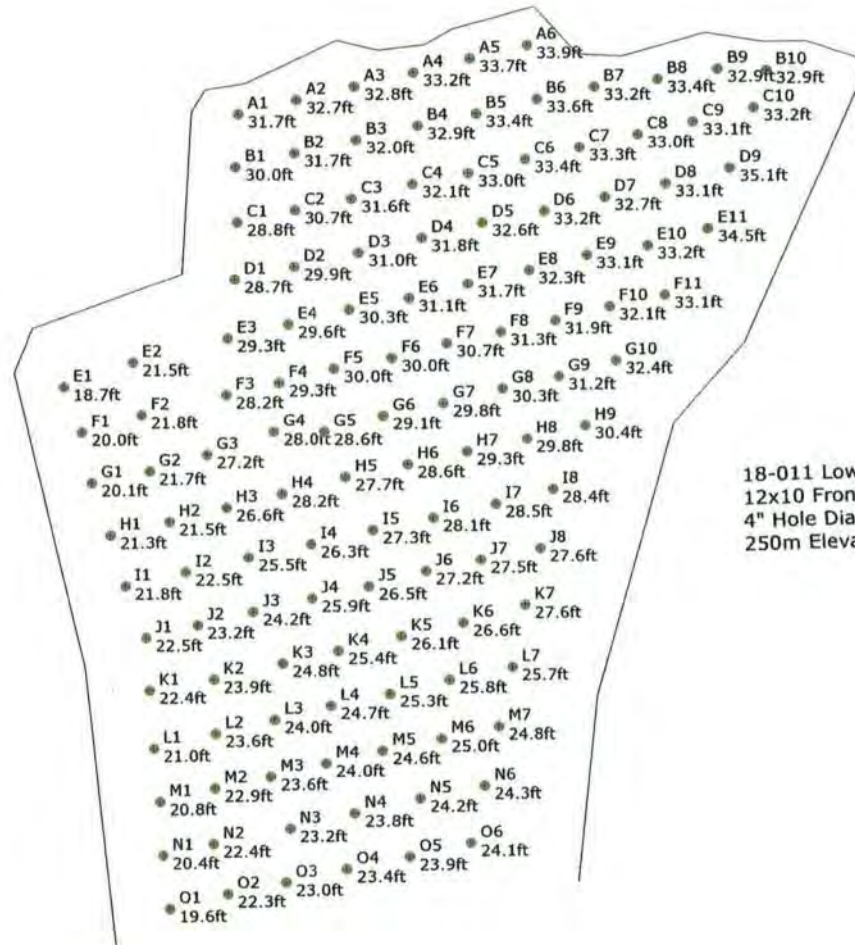


Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Subdrill: 2.0ft Stemming: 5.9ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 125 Hole angle: 0.0°
 Total drilled: 3500.1ft



Not to scale

SHOTPlus™ Professional 5.7.3.0	7/30/2018
Mine	Burlington
Location	LOWER MIDDLE
Title/author	DESIGN 18-011 LOWER MIDDLE
Filename	2018-07-30 18-011 Lower Middle.spf

1090217

Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

Bill of Lading / Connaissance

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSANCE

2367871

86087520

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURE À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
30 Jul 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
30 Jul 2018	FOB Dest'n, Own Truck	F-73289	18230
SHIP VIA TRANSPORTEUR		ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS
Orica Truck		STANDARD	

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
294	PC	X	24	270	PENTEX BC 340 (49/CS)	6	107.310
2	PC	X	1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
184	PC	X	61	123	*uni tronic 600-06.0M CU/ZC(20')80PC	3	13.432
60	PC	X	9	51	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
102	PC	X	6	96	*uni tronic 600-15M C/Z SPL(50')66PC	2	17.442
131	PC	X	131	0	*uni tronic 600-20M CU/ZC SPL(65')66P	2	26.724
100	PC	X	97	3	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							177.328 KG
**** TOTAL PACKAGES ****						15	
GHS/WHMIS SDS documents available Website: www.oricaminingsservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES

PALLETS RETURNED / PALETTES RETOURNÉES

BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENT À B/L DE CONNAISSANCE ORICA:
ERAP 2-1510	1-877-561-3636	YES / OUI NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE	NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
K. Kaban	K. Kaban	
SIGNATURE	SIGNATURE	SIGNATURE
[Signature]	[Signature]	
DATE	DATE	DATE
30 7 18	30 7 18	
D/J M/M Y/A	D/J M/M Y/A	D/J M/M Y/A

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DÉTACHER ET GARDER CETTE COPIE APRÈS AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSANCE CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO
**** PAGE 2 OF 2 ****

D.F.G. S7772



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-07-30

Blast Number: 18-011
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Lower Middle (Bench / Face)
GPS Coordinates: 43.40486 °N Latitude 79.88449 °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: 24,173 te
Total Holes Loaded: 125 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 15 rows

- Drilling Information -

Angle from Vertical

Primary Bit diam:	<u>101.6</u> mm	<u>0</u> °	# Holes:	<u>125</u>	=	3,500.0 ft (<u>4</u> " diam)
Secondary Bit diam:	mm	0°	# Holes:		=	0.0 ft (" diam)
Tertiary Bit diam:	mm	0°	# Holes:		=	0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 38 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 87 main body
Bench Height: 26.0 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 28.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg

Material used: .75" Stone

- Design Charge Length -

Front Row: 21.0 ft avg
Main Body: 21.0 ft avg

- Design Charge Weight -

Front Row: 61.2 kg/hole
Main Body: 61.2 kg/hole
Max Chge Wt / delay: 80.0 kg/delay

Required kg Loaded: 10,085 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.417 kg/te (actual)
Front row: 0.262 kg/te (theoretical)
Main Body: 0.349 kg/te (theoretical)
"KPI" PF: 0.343 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bl., S., Expl or IS from previous Blast

Bulk Expl. Required:

CENTRA GOLD 70 kg 10,000

Pkgd Expl. Required:

E113 75X400 kg

Boosters Required:

	kg/u	# used	kg
<u>PENTEX 12 (OR EQUIVALENT)</u>	<u>0.34</u>	<u>250</u>	<u>85.0</u>

total explosives weight in Blast (kg): 10,085

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

	ms	# req'd
<u>UNITRONIC 600 6M</u>		<u>125</u>
<u>UNITRONIC 600 15M</u>		<u>125</u>

Cord & Access. Req'd:

	U of M	# req'd
<u>WIRE DUPLEX (6 PACK) 400M</u>	units	<u>1</u>
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		<u>1</u>
# of Blasters (this Blast)		<u>1</u>
# of Helpers (this Blast)	Note Exception	<u>2</u>
# of MMU's (this Blast)		<u>1</u>

Services Req'd:

GPS LAYOUT	Enter hours	<u>0.0</u>
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	<u>0.0</u>
HELPER HOURS	Enter total Helper man-hours	<u>0.0</u>
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	<u>0</u>
3D LASER PROFILE	Enter hours	<u>0</u>
BORETRACK	Enter hours	<u>0</u>
TECHNICAL BLAST DESIGN	(per day) Enter # of days	<u>0.0</u>

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft

Spacing: 10.0ft

Subdrill: 2.0ft

Stemming: 5.9ft

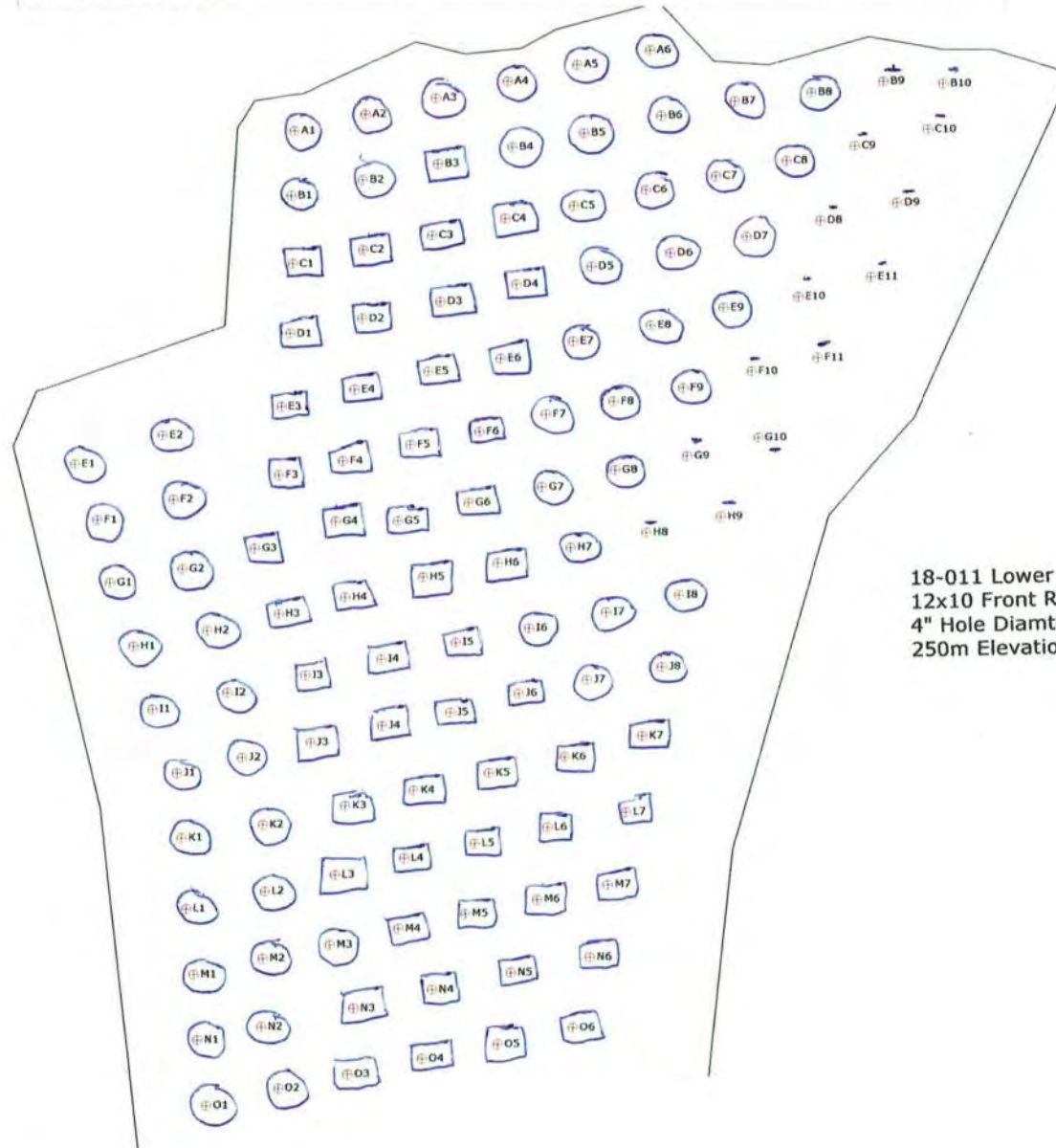
1st row burden: 12.0ft

Hole Diameter: 4.0in

Number of holes: 125

Hole angle: 0.0°

Total drilled: 3500.1ft



18-011 Lower Middle North
12x10 Front Row, 9x10 Body
4" Hole Diameter
250m Elevation + 0.6m Subdrill



Not to scale



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-08-03

Blast Number: 18-012

Orica Order #: 2370307

Blast Time: 11:52 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40371 °N Latitude 79.88291 °W Longitude
Centre of Blast Centre of Blast

Wind from the: at 0 kph Temperature: 16 to 20 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 24,791 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 46 = 3,606.6 ft (4 " diam)
Secondary Bit diam: 127.0 mm	0°	# Holes: 1 = 78.4 ft (5 " diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,800	22,760	11,040

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	106	36.0

total explosives weight in Blast (kg): 11,076

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 9M			45
UNITRONIC 600 25M			25
UNITRONIC 600 30M			36

Cord & Accessories:

	U of M	# used
MINI STEM PLUGS - 6015 (4")	units	12
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	27,176 te	10,255 m3
Total tonnes per day:	27,176 te	NB80-01 Rate Code
Total Holes Loaded:	47 holes	
... including:	Dead Holes	
... and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	3 rows	

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 17 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 30 main body

Bench Height: 76.4 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 78.4 ft avg

- Stone Decking -

Front Row: 10.0 ft avg

Main Body: 10.0 ft avg

Decks: 6 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 61.4 ft avg

Main Body: 61.4 ft avg

- Charge Weight -

Front Row: 179.0 kg/hole

Main Body: 179.0 kg/hole

Max. per delay: 265.0 kg/delay

SD () Equation: 187.2 kg/delay

Total kg Loaded: 11,076 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.408 kg/te (actual)

Front row: 0.260 kg/te (theoretical)

Main Body: 0.347 kg/te (theoretical)

"KPI" PF: 0.318 kg/te (theoretical)

1.820 lb/yd³

1.162 lb/yd³

1.550 lb/yd³

1.421 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

3 Siesmographs set up

Holes D-1,D2 and E1 were not loaded due to lean burden on profiles



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-08-03

Blast Number: 18-012
Orica Order #: 2370307
Blast Time: 11:52 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40369	79.88291
Front Row Corner	43.40351	79.88288
Back Row Corner	43.40392	79.88295
Average (Centre of Blast)	43.40371	79.88291

(N) Radians	(W) Radians
0.757537	1.394220
0.757534	1.394219
0.757541	1.394220
0.757538	1.394220

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40245	79.87814
	2nd Reading		
	Average	43.40245	79.87814
	Distance (1st Seis. From Centre of Blast)	410.5	m
	Post Blast Data:		
	ppV:	2.4	mm/s
	frequency:	7.2	Hz
	air overpressure:	115.0	dB
	2450 2nd Line		

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40605	79.89400
	2nd Reading		
	Average	43.40605	79.89400
	Distance (2nd Seis. From Centre of Blast)	934.1	m
	Post Blast Data:		
	ppV:	0.1	mm/s
	frequency:	7.1	Hz
	air overpressure:	116.4	dB
	Colling Rd & Blind Line Bruce Trail		

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.39339	79.88880
	2nd Reading		
	Average	43.39339	79.88880
	Distance (3rd Seis. From Centre of Blast)	1243.6	m
	Post Blast Data:		
	ppV:	0.1	mm/s
	frequency:	7.4	Hz
	air overpressure:	117.1	dB
	SouthWest Corner of Property		

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(410.5)^2}{30^2} \text{ kg}$$

$$= \frac{168,510}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 187 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-08-14

Blast Number: 18-013

Orica Order #: 2374191

Blast Time: 10:54 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40146 °N Latitude 79.88807 °W Longitude
Centre of Blast Centre of Blast

Wind from the: S at 5 kph Temperature: 21 to 25 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,420 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 182 = 1,820.0 ft (4 " diam)
Secondary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,500	26,290	1,210

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	182	61.9

total explosives weight in Blast (kg): 1,272

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			2
EXEL HANDIDET 9m		25/500	182
CONNECTADET 9M		25 ms	4
CONNECTADET 12M		42 ms	44

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	1
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	17,069 te	6,441 m3
Total tonnes per day:	17,069 te	NF-15 Rate Code
Total Holes Loaded:	182 holes	
... including:	10 Dead Holes	
... and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	11 rows	

- Pattern (Front Row) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 18 front row

- Pattern (Main Body) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 164 main body

Bench Height: 10.0 ft avg

Sub-drill: 0.0 ft avg

Hole Depth: 10.0 ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Decks: per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 3.0 ft avg

Main Body: 3.0 ft avg

- Charge Weight -

Front Row: 8.7 kg/hole

Main Body: 8.7 kg/hole

Max. per delay: 16.0 kg/delay

SD () Equation: 545.1 kg/delay

Total kg Loaded: 1,272 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.075 kg/te (actual)

Front row: 0.088 kg/te (theoretical)

Main Body: 0.088 kg/te (theoretical)

"KPI" PF: 0.088 kg/te (theoretical)

0.333 lb/yd³

0.394 lb/yd³

0.394 lb/yd³

0.394 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-08-14

Blast Number: 18-013
Orica Order #: 2374191
Blast Time: 10:54 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40115	79.88796
Front Row Corner	43.40147	79.88808
Back Row Corner	43.40176	79.88818
Average (Centre of Blast)	43.40146	79.88807

(N) Radians	(W) Radians
0.757493	1.394308
0.757499	1.394310
0.757504	1.394312
0.757498	1.394310

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40245	79.87814
	2nd Reading		
	Average	43.40245	79.87814
	Distance (1st Seis. From Centre of Blast)	811.0	m
	Post Blast Data:	ppV: Did	mm/s Trigger set at: 2.0
		frequency: Not	Hz V / T / L : ? (Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB Trigger set at: 115
	2450 2nd Line		

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40605	79.89400
	2nd Reading		
	Average	43.40605	79.89400
	Distance (2nd Seis. From Centre of Blast)	700.4	m
	Post Blast Data:	ppV: Did	mm/s Trigger set at: 2.0
		frequency: Not	Hz V / T / L : ? (Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB Trigger set at: 115
	Colling Rd & Blind Line Bruce Trail		

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.39339	79.88880
	2nd Reading		
	Average	43.39339	79.88880
	Distance (3rd Seis. From Centre of Blast)	900.7	m
	Post Blast Data:	ppV: Did	mm/s Trigger set at: 2.0
		frequency: Not	Hz V / T / L : ? (Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB Trigger set at: 115
	SouthWest Corner of Property		

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(700.4)^2}{30^2} \text{ kg}$$

$$= \frac{490,560}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 545 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 8/9/2018

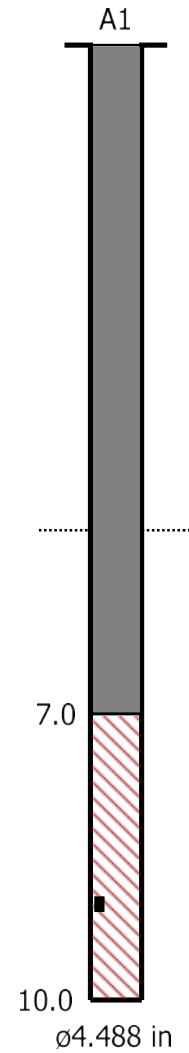
Blast Number: 18-013
Orica Order #: 2374191

page 2

Paste ShotPlus Diagram inside Rectangle:



HANDIDET 500ms 16ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Bill White

Signature required, indicating
sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft
1st row burden: 11.5ft
Total drilled: 1819.9ft

Spacing: 11.5ft
Hole Diameter: 4.0in

Subdrill: 0.0ft
Number of holes: 182

Stemming: 8.2ft
Hole angle: 0.0°

Blasted and Backfilled



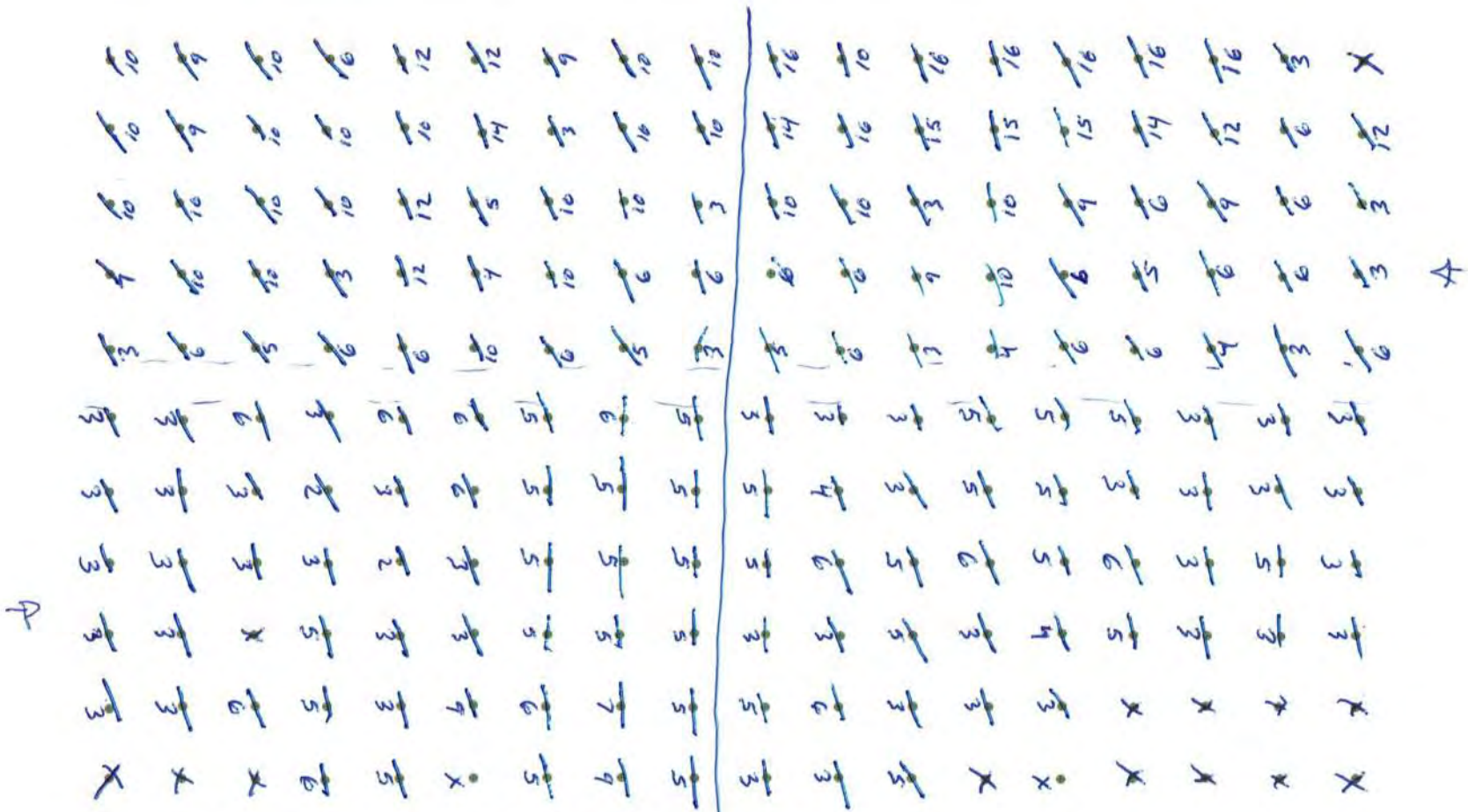
Blast 18-013 Floor
4" Hole
11.5 X 11.5



Not to scale

SHOTPlus™ Professional 5.7.3.0		8/14/2018
Mine	Burlington	
Location		
Title/author	18-013 Floor	
Filename	2018-08-14 18-013 Floor.spf	

24
24
47
47



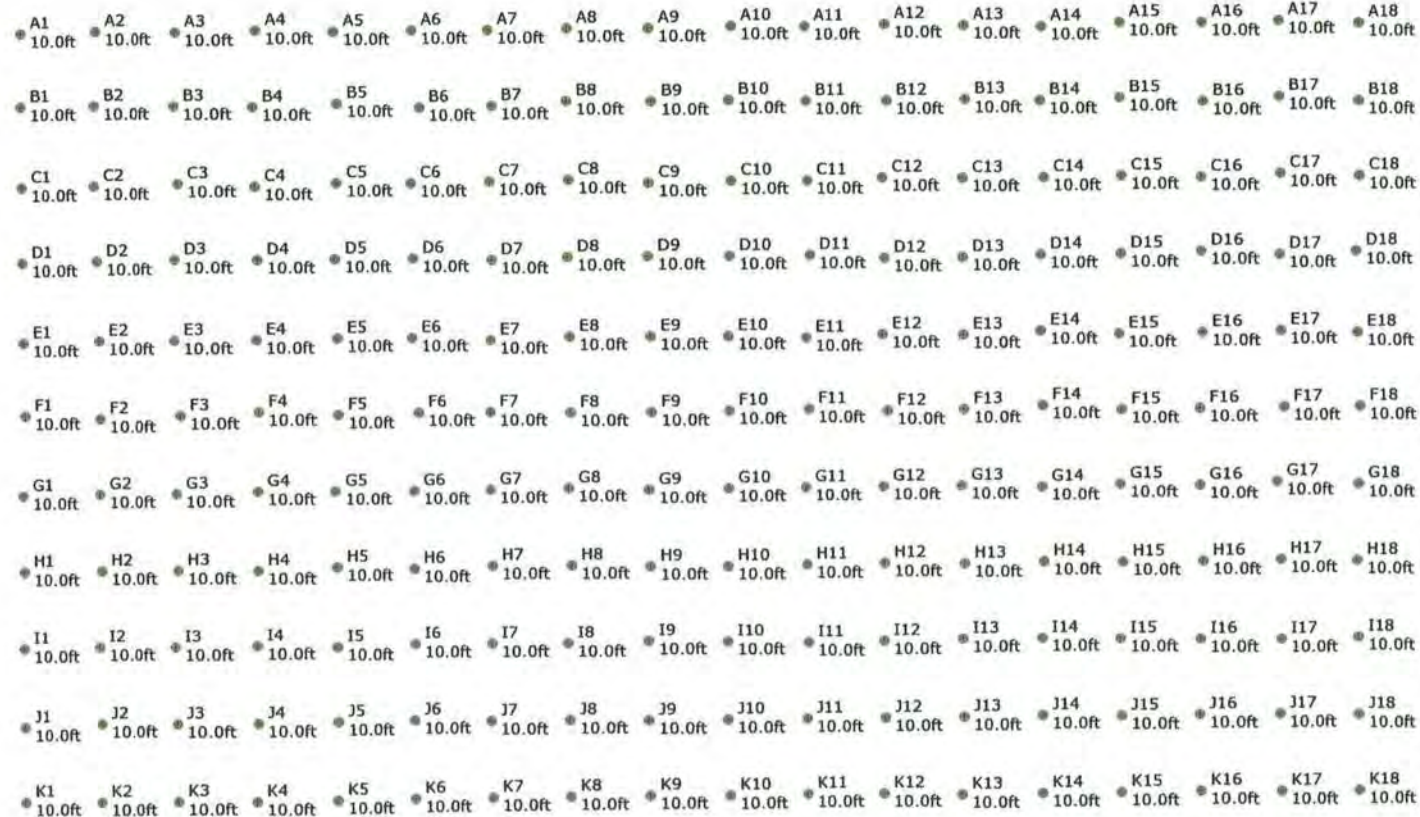
Blast 18-013 Floor
4" Hole
11.5 X 11.5



Not to scale

SHOTPlus™ Professional 5.7.3.0		8/7/2018
Mine	Burlington	
Location		
Title/author	18-013 Floor	
Filename	Timing.spf	

Blasted and Backfilled



Blast 18-013 Floor
4" Hole
11.5 X 11.5



Not to scale

SHOTPlus™ Professional 5.7.3.0		8/7/2018
Mine	Burlington	
Location		
Title/author	18-013 Floor	
Filename	Timing.spf	

1090420



Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY

033411 SIDE ROAD 21-22

GRAND VALLEY ON

CA L9W 7G1

Bill of Lading / Connaissance

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY

BURLINGTON ON

CA L7R 4L8

GROSS / BRUT

TARE

NET

7 TIME-IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSEMENT

2374191

86102967

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR		CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT			
14 Aug 2018	00:00:00	NELSON AGGREGATE COMPANY		n/a			
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON		SHIP, MAG, LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE			
14 Aug 2018	FOB Dest'n, Own Truck		F-73289	1-81			
SHIP VIA TRANSPORTEUR		ROUTING ITINÉRAIRE		MAG. LIC. NO. N° DE PERMIS			
Orica Truck		STANDARD					
QTY. QTE.	UM	DG MD	QTY. RET'D QTE. RET.	QTY. SOLD QTE. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
NET EXPLOSIVES QUANTITY:					83.718 KG		
<hr/>							
245	PC	X	63	182	PENTEX BC 340 (49/CS)	5	89.425
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
18	PC	X	16	2	*uni tronic 600-06.0M CU/ZC(20')80PC	1	1.314
100	PC		100	0	MINI STEM PLUGS - PART #74853		0.700
260	PC	X	78	182	EXEL HANDIDET 9M 25/500(30') 65/CS	4	26.260
50	PC	X	50	0	EXEL HANDIDET 12M 25/500(40') 50/CS	1	6.150
27	PC	X	23	4	EXEL Connectadet 9M 25MS (30 FT) 65/CS	1	2.619
50	PC	X	6	44	EXEL Connectadet 12M 42MS (40 FT) 50/CS	1	6
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							138.308 KG
**** TOTAL PACKAGES ****						14	

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES

PALLETS RETURNED / PALETTES RETOURNÉES

BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO/24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT A N° DE CONNAISSEMENT D'ORICA:
ERAP 2-1510	1-877-561-3636	YES / OUI NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE	NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
Neil Kwast	Neil Kwast	
SIGNATURE	DATE	SIGNATURE
	14 08 18	
SIGNATURE	DATE	SIGNATURE
	14 08 18	

**2 SHIPPING ORDER
BON D'EXPÉDITION**

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 3 ****

D.F.G. S7772



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-08-09

Blast Number: 18-013
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.40146 °N Latitude 79.88807 °W Longitude
(Centre of Blast) (Centre of Blast)

Design to Blasted: 19,650 te
Total Holes Loaded: 198 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 11 rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 198 = 1,980.0 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Nominal Bit Diameter:

- Design Pattern (Front Row)-

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 38 front row

- Design Pattern (Main Body) -

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 160 main body
Bench Height: 10.0 ft avg
Sub-drill: 0.0 ft avg
Hole Depth: 10.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 6.0 ft avg
Main Body: 6.0 ft avg
Material used: .75" Stone

- Design Charge Length -

Front Row: 4.0 ft avg
Main Body: 4.0 ft avg

- Design Charge Weight -

Front Row: 11.7 kg/hole
Main Body: 11.7 kg/hole
Max Chge Wt / delay: 20.0 kg/delay

Required kg Loaded: 3,567 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.182 kg/te (actual)
Front row: 0.118 kg/te (theoretical)
Main Body: 0.118 kg/te (theoretical)
"KPI" PF: 0.118 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

Bulk Expl. Required:

CENTRA GOLD 70 kg 3,500

Pkgd Expl. Required:

kg

Boosters Required:

kg/u # used kg
PENTEX 12 (OR EQUIVALENT) 0.34 198 67.3

total explosives weight in Blast (kg): 3,567

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

ms # req'd

UNITRONIC 600 6M 6
EXEL HANDIDET 9m 25/500 198
EXEL HANDIDET 12m 25/500 50
CONNECTADET 9M 25 ms 50
CONNECTADET 12M 42 ms

Cord & Access. Req'd:

U of M # req'd

WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services Req'd:

GPS LAYOUT Enter hours 0.0
BULK TRUCK CHARGE <2,000kg
BLASTER HOURS Enter Blaster hours 0.0
HELPER HOURS Enter total Helper man-hours 0.0
SEISMOGRAPH RENTAL Enter # Orica Seismographs 0
3D LASER PROFILE Enter hours 0
BORETRACK Enter hours 0
TECHNICAL BLAST DESIGN (per day) Enter # of days 0.0



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-08-30

Blast Number: 18-014

Orica Order #: 2380811

Blast Time: 11:55 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40372 °N Latitude 79.88278 °W Longitude
Centre of Blast Centre of Blast

Wind from the: NE at 5 kph Temperature: 16 to 20 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 50 = 3,859.1 ft (4 " diam)
Secondary Bit diam: 127.0 mm	0°	# Holes: 8 = 617.4 ft (5 " diam)
Tertiary Bit diam:	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,770	20,690	13,080

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	154	52.4

total explosives weight in Blast (kg): 13,132

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			50
UNITRONIC 600 9M			4
UNITRONIC 600 20M			22
UNITRONIC 600 25M			6
UNITRONIC 600 30M			72

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	15.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	
3D LASER PROFILE	Enter hours	
BORETRACK	Enter hours	
TECHNICAL BLAST DESIGN	(per day) Enter # of days	

Tonnes Blasted:	31,778 te	11,992 m3
Total tonnes per day:	31,778 te	NB80-01 Rate Code
Total Holes Loaded:	58 holes	
... including:	Dead Holes	
... and:	3 Helper Holes	
Helper Hole Collar:	60.0 ft avg	
# Rows Blasted:	3 rows	

- Pattern (Front Row)-

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 24 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 34 main body

Bench Height: 75.2 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 77.2 ft avg

- Stone Decking -

Front Row: 8.4 ft avg

Main Body: 9.8 ft avg

Decks: 19 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 61.8 ft avg

Main Body: 60.4 ft avg

- Charge Weight -

Front Row: 180.1 kg/hole

Main Body: 176.1 kg/hole

Max. per delay: 307.0 kg/delay

SD () Equation: 178.7 kg/delay

Total kg Loaded: 13,132 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.413 kg/te (actual)

Front row: 0.266 kg/te (theoretical)

Main Body: 0.347 kg/te (theoretical)

"KPI" PF: 0.320 kg/te (theoretical)

1.846 lb/yd³

1.189 lb/yd³

1.549 lb/yd³

1.429 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

3 Helpers requested due to the amount of voids located on drill log and stone decking require Holes A3,A7,B5,B8,C8,C12 All measured short in depth by an average of 12'.

Bill White from Nelson Burlington said we have to blast it, the drill wont be back until Sept.4, 2

3 Siesmographs supplied and set-up



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-08-30

Blast Number: 18-014
Orica Order #: 2380811
Blast Time: 11:55 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40374	79.88277	0.757538	1.394217
Front Row Corner	43.40351	79.88279	0.757534	1.394218
Back Row Corner	43.40392	79.88277	0.757541	1.394217
Average (Centre of Blast)	43.40372	79.88278	0.757538	1.394217

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	401.0	m		
	Post Blast Data:	ppV:	3.7 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	12.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	113.3 dB	Trigger set at: 115 dB	
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	943.9	m		
	Post Blast Data:	ppV: Did	mm/s	Trigger set at: 2.0 mm/s	
		frequency: Not	Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure: Trigger	dB	Trigger set at: 115 dB	
	Colling Rd & Blind Line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (3rd Seis. From Centre of Blast)	1249.2	m		
	Post Blast Data:	ppV: 2.0	mm/s	Trigger set at: 2.0 mm/s	
		frequency: 2.5	Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure: 93.2	dB	Trigger set at: 115 dB	
	SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(401)^2}{30^2} \text{ kg} \\
 &= \frac{160,801}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 179 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

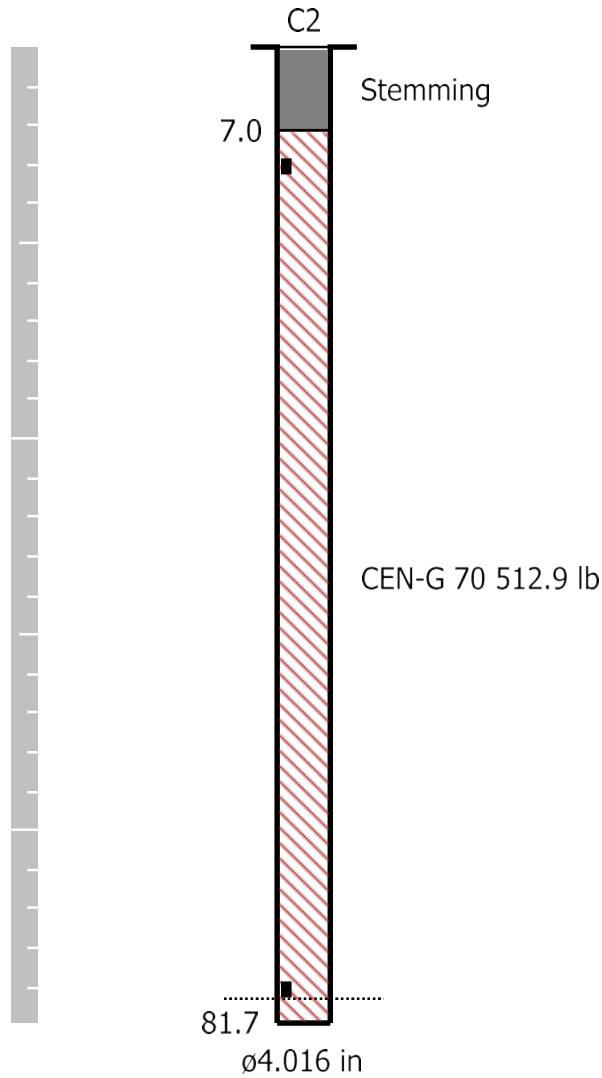
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 8/30/2018

Blast Number: 18-014
Orica Order #: 2380811

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

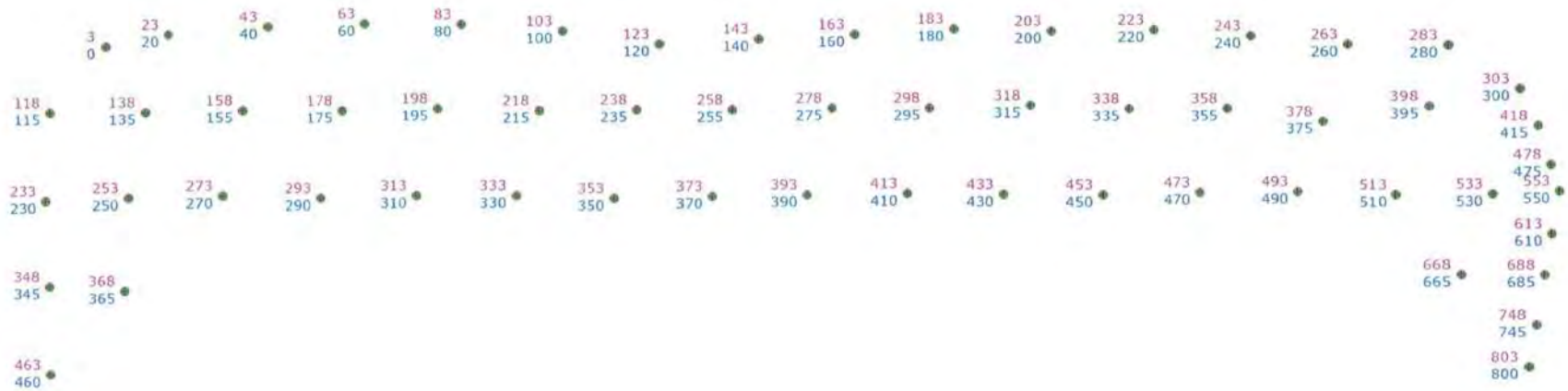
Bill White

Signature required, indicating
sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.2ft Spacing: 10.2ft Subdrill: 2.0ft Stemming: 6.9ft
 1st row burden: 12.1ft Hole Diameter: 4.0in Number of holes: 58 Hole angle: 0.0°
 Total drilled: 4476.5ft



Not to scale

SHOTPlus™ Professional 5.7.3.0	8/16/2018
Mine	Burlington
Location	UPPER MIDDLE
Title/author	Design 18-013 UPPER MIDDLE Partial Final
Filename	Design_18-014_UPPER_MIDDLE_Final.spf

Blast Summary Data

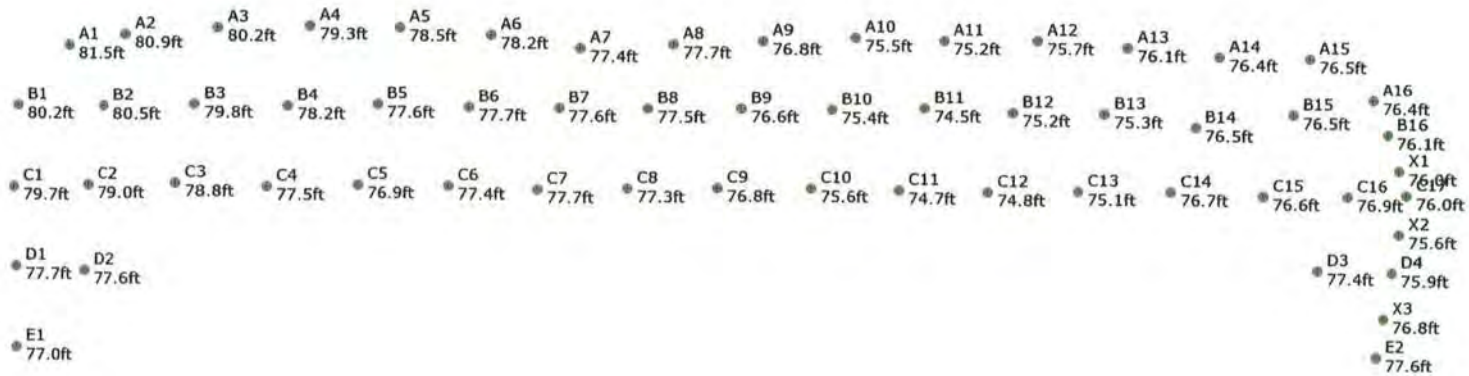
Total drilled: 4476.5ft

SHOTPlus™ Professional 5.7.3.0		8/29/2018
Mine	Burlington	
Location	UPPER MIDDLE	
Title/author	Design 18-013 UPPER MIDDLE Partial Final	
Filename	2018-08-00 18-014 Upper Middle.spf	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.2ft Spacing: 10.2ft Subdrill: 2.0ft Stemming: 6.9ft
 1st row burden: 12.1ft Hole Diameter: 4.0in Number of holes: 58 Hole angle: 0.0°
 Total drilled: 4476.5ft



Not to scale

SHOTPlus™ Professional 5.7.3.0	8/29/2018
Mine	Burlington
Location	UPPER MIDDLE
Title/author	Design 18-013 UPPER MIDDLE Partial Final
Filename	2018-08-00 18-014 Upper Middle.spf

1090563



Date/Time Tran at 12:17:50 August 30, 2018
Trigger Source Geo: 1.500 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.758 sec (Auto=4Sec) at 2048 sps
Operator/Setup: Operator/Nelson Agg.mmb

Serial Number UM6859 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration December 22, 2017 by Instantel
File Name UM6859_20180830121750.IDFW

Notes

Location: SouthWest Corner Of Property
Client: Nelson Aggregates
User Name: Orica Canada
General: Burlington

Extended Notes

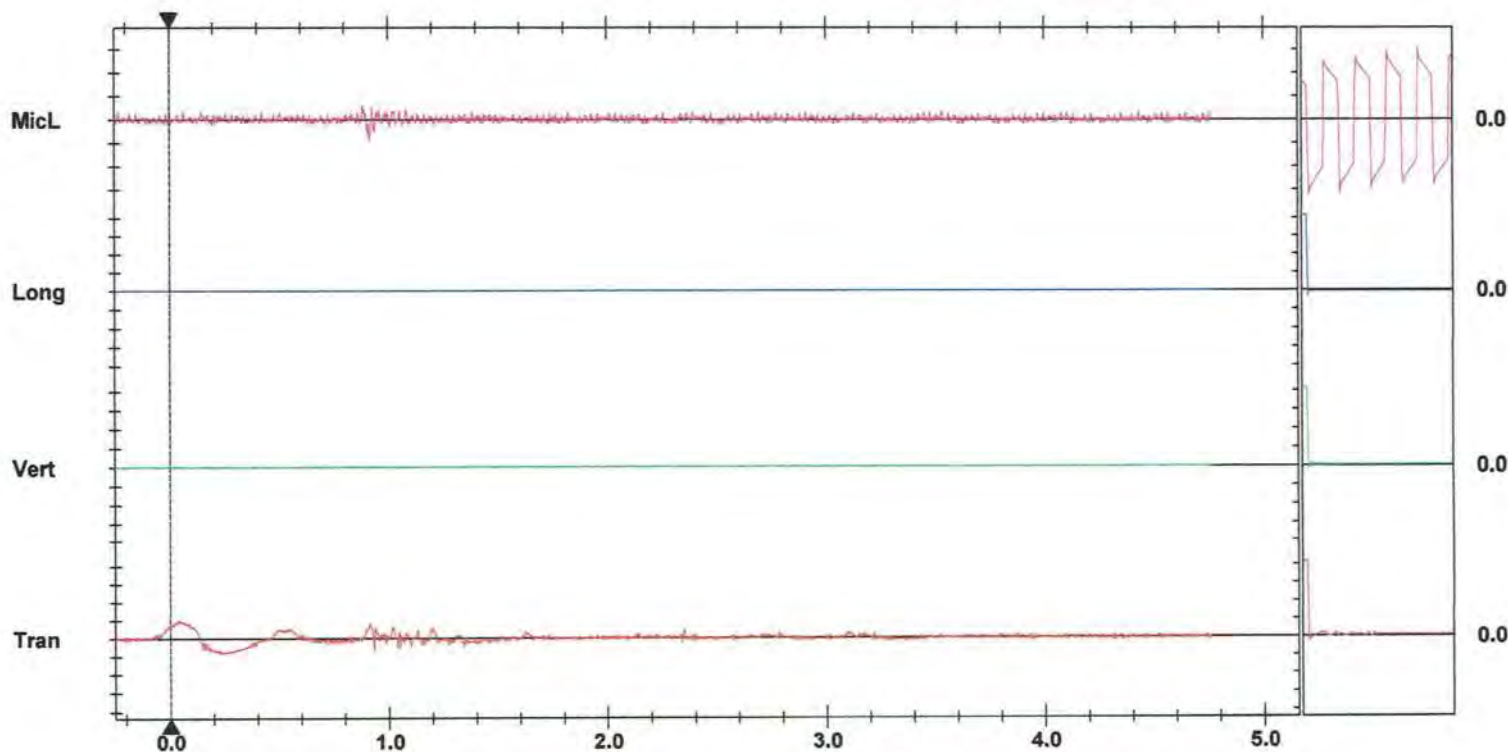
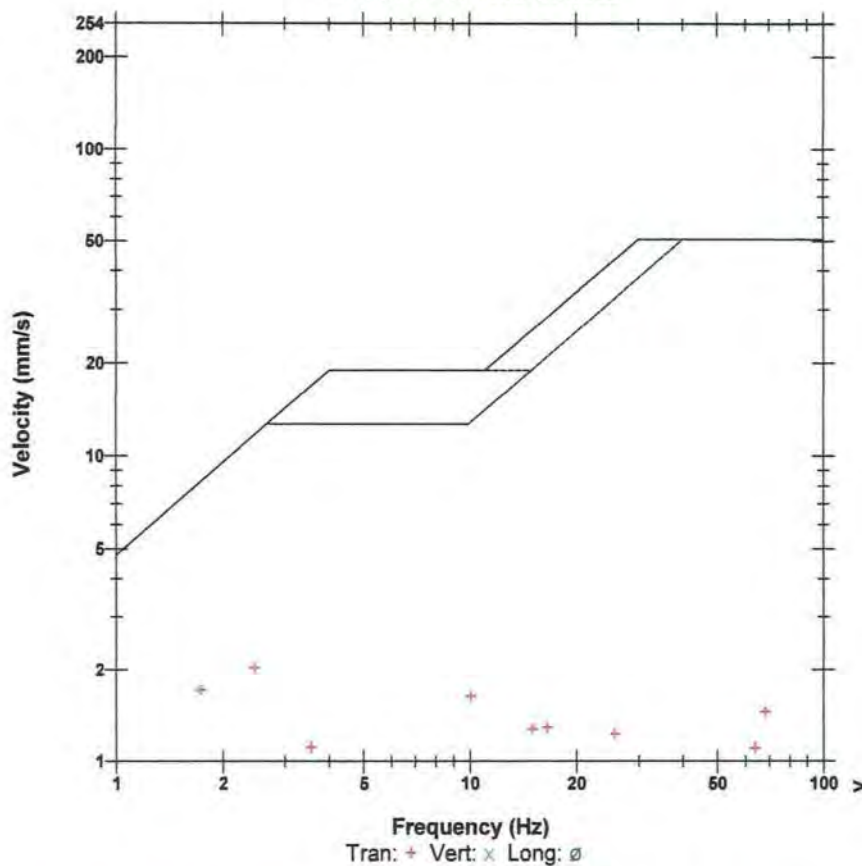
Sand Bagged
 43.39339-79.88880

Microphone Linear Weighting
PSPL 93.2 dB(L) at 0.916 sec
ZC Freq 22 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1334 mv)

	Tran	Vert	Long	
PPV	2.041	0.110	0.055	mm/s
ZC Freq	2.5	68	>200	Hz
Time (Rel. to Trig)	0.044	0.822	4.283	sec
Peak Acceleration	0.142	0.012	0.008	g
Peak Displacement	0.152	0.000	0.000	mm
Sensor Check	Check	Check	Check	
Frequency	20.9	1024.0	1024.0	Hz
Overswing Ratio	1.2	0.0	0.0	

Peak Vector Sum 2.041 mm/s at 0.044 sec

USBM RI8507 And OSMRE



Date/Time Tran at 11:55:00 August 30, 2018
Trigger Source Geo: 1.500 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.25 sec (Auto=3Sec) at 1024 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.1 Volts
Unit Calibration November 3, 2017 by InstanTel
File Name _TEMP.EVT
Scaled Distance 5850.2 (1850.0 m, 0.1 kg)

Notes

Location: 2450 2nd Line
Client: Nelson Aggregate
User Name: Orica Canada
General: Burlington

Extended Notes

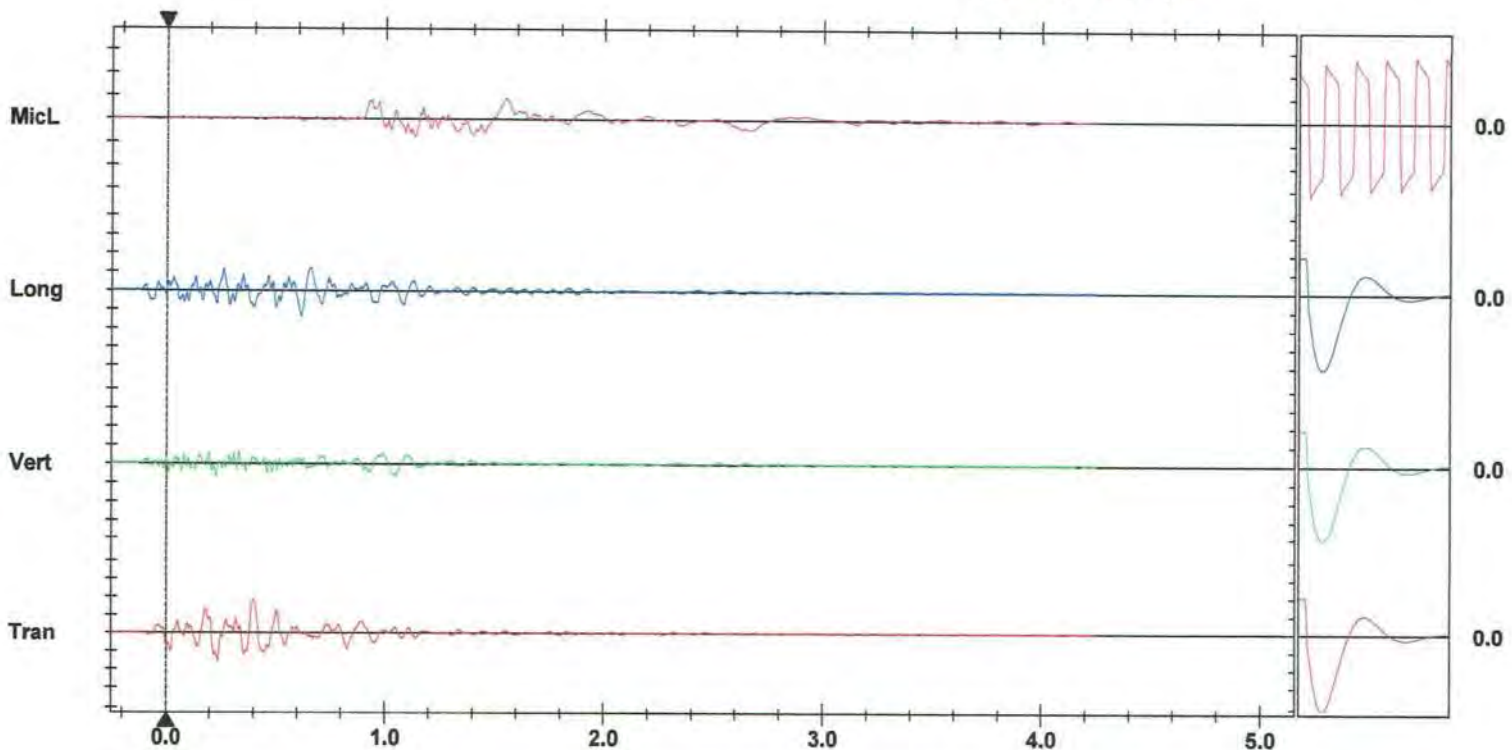
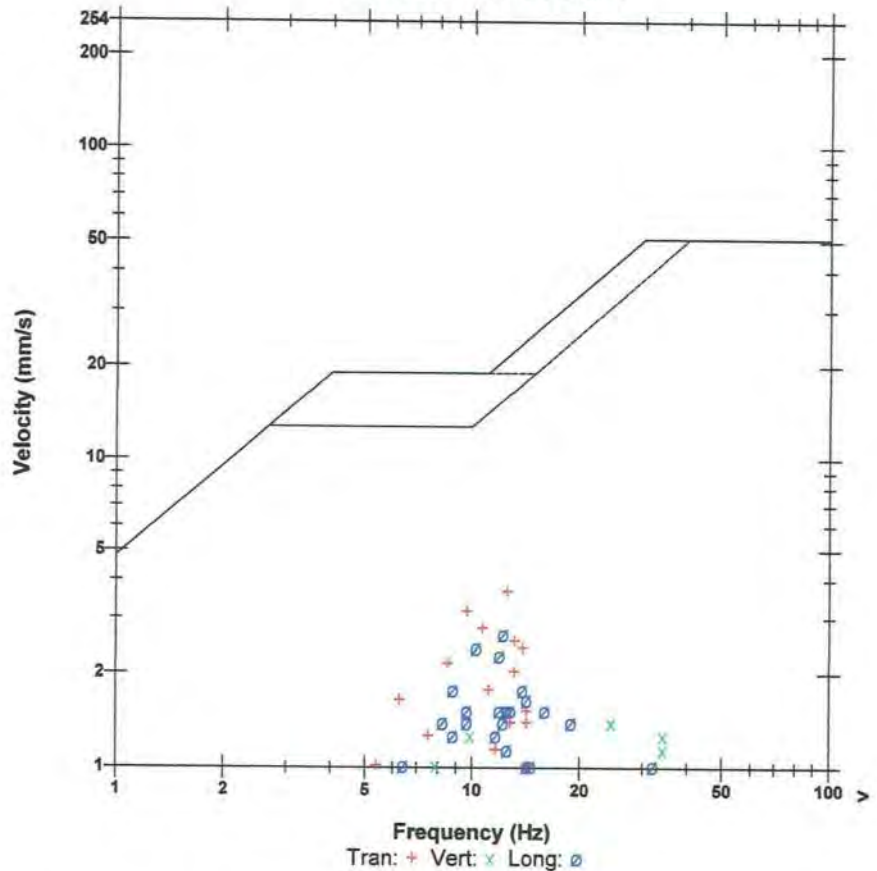
Sand Bagged
 43.40245-79.87814

Microphone Linear Weighting
PSPL 113.3 dB(L) at 1.545 sec
ZC Freq 3.0 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 558 mv)

	Tran	Vert	Long	
PPV	3.683	1.397	2.667	mm/s
ZC Freq	12	24	12	Hz
Time (Rel. to Trig)	0.395	0.229	0.614	sec
Peak Acceleration	0.053	0.040	0.040	g
Peak Displacement	0.050	0.022	0.037	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.8	3.6	4.0	

Peak Vector Sum 4.139 mm/s at 0.396 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.2ft

Spacing: 10.2ft

Subdrill: 2.0ft

Stemming: 6.9ft

1st row burden: 12.1ft

Hole Diameter: 4.0in

Number of holes: 58

Hole angle: 0.0°

Total drilled: 4476.5ft



5" HOLES IN GREEN

A16

B16

C17

D4

E2

X1 X2 X3

Design 18-013 UPPER MIDDLE Final- 4" Blast Hole 12x10 9x10 274 and 250 + .6 SUB ELEV



Scale 1:275

SHOTPlus 5.7.0.8

8/7/2018

Mine Burlington

Location UPPER MIDDLE

Title/author Design 18-013 UPPER MIDDLE Partial Final

Filename Design 18-013 UPPER MIDDLE Partial.spf



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-08-30

Blast Number: 18-014
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Filler)
GPS Coordinates: 43.40372 °N Latitude 79.88278 °W Longitude
Centre of Blast Centre of Blast

Design te Blasted: 31,778 te
Total Holes Loaded: 58 holes
... including: Dead Holes
... and: 3 Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 3 rows

- Drilling Information -

Angle from Vertical: 0°
Primary Bit diam: 101.6 mm # Holes: 50 = 3,859.1 ft (4 " diam)
Secondary Bit diam: 127.0 mm # Holes: 8 = 617.4 ft (5 " diam)
Tertiary Bit diam: mm # Holes: = 0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 24 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 34 main body
Bench Height: 75.2 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 77.2 ft avg

- Design Stone Decking -

Front Row: 5.0 ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg

Material used: .75" Stone

- Design Charge Length -

Front Row: 65.2 ft avg
Main Body: 70.2 ft avg

- Design Charge Weight -

Front Row: 190.1 kg/hole
Main Body: 204.6 kg/hole
Max Chge Wt / delay: 240.0 kg/delay

Required kg Loaded: 13,539 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.426 kg/te (actual)
Front row: 0.281 kg/te (theoretical)
Main Body: 0.403 kg/te (theoretical)
"KPI" PF: 0.362 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast.

3 Helpers

Bulk Expl. Required: kg
CENTRA GOLD 70 13,500

Pkgd Expl. Required: kg

Boosters Required: kg/u # used kg
PENTEX 12 (OR EQUIVALENT) 0.34 116 39.4

total explosives weight in Blast (kg): 13,539
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required: ms # req'd
UNITRONIC 600 6M 58
UNITRONIC 600 15M
UNITRONIC 600 30M 58

Cord & Access. Req'd: U of M # req'd
WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

# of Blasts today (this Quarry)	1
# of Blasters (this Blast)	1
# of Helpers (this Blast)	Note Exception 3
# of MMU's (this Blast)	1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-09-10

Blast Number: 18-015

Orica Order #: 2384839

Blast Time: 11:49 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40084 °N Latitude 79.88808 °W Longitude
Centre of Blast Centre of Blast

Wind from the: E at 15 kph Temperature: 11 to 15 °C

Clear:

Rain: X

Overcast: X

Partly Cloudy:

Snow:

Inversion:

Ceiling 1,324 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 204 = 2,244.0 ft (4 " diam)
Secondary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	31,670	29,370	2,300

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	235	79.9

total explosives weight in Blast (kg): 2,380

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			2
EXEL HANDIDET 9m		25/500	235
CONNECTADET 9M		25 ms	11 X
CONNECTADET 9M		42 ms	34

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=2,000kg <5,000kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	16.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	22,269 te	8,404 m3
Total tonnes per day:	22,269 te	NF-15
Total Holes Loaded:	204	holes
... including:		Dead Holes
... and:		Helper Holes
Helper Hole Collar:		ft avg
# Rows Blasted:	9	rows

- Pattern (Front Row) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 20 front row

- Pattern (Main Body) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 184 main body

Bench Height: 11.0 ft avg

Sub-drill: 0.0 ft avg

Hole Depth: 11.0 ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Decks: per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 4.0 ft avg

Main Body: 4.0 ft avg

- Charge Weight -

Front Row: 11.7 kg/hole

Main Body: 11.7 kg/hole

Max. per delay: 30.0 kg/delay

SD () Equation: 629.5 kg/delay

Total kg Loaded: 2,380 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.107 kg/te (actual)

Front row: 0.107 kg/te (theoretical)

Main Body: 0.107 kg/te (theoretical)

"KPI" PF: 0.107 kg/te (theoretical)

0.477 lb/yd³

0.477 lb/yd³

0.477 lb/yd³

0.477 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

3 Helpers needed due to the number of holes and conditions

31 additional primers were needed because the primary was stuck and would not pull into product.



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-09-10

Blast Number: 18-015
Orica Order #: 2384839
Blast Time: 11:49 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40083	79.88805	0.757487	1.394310
Front Row Corner	43.40067	79.88858	0.757485	1.394319
Back Row Corner	43.40102	79.88760	0.757491	1.394302
Average (Centre of Blast)	43.40084	79.88808	0.757487	1.394310

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40245	79.87814	0.757516	1.394137
2nd Reading				
Average	43.40245	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)	823.6	m		
Post Blast Data:	ppV: Did	mm/s	Trigger set at: 1.5	mm/s
	frequency: Not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: Trigger	dB	Trigger set at: 124	dB
2450 2nd Line (set to 124dB trigger due to continuous truck traffic)				

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.40605	79.89400	0.757578	1.394413
2nd Reading				
Average	43.40605	79.89400	0.757578	1.394413
Distance (2nd Seis. From Centre of Blast)	752.7	m		
Post Blast Data:	ppV: 0.1	mm/s	Trigger set at: 2.0	mm/s
	frequency: 7.5	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: 118.0	dB	Trigger set at: 115	dB
Colling Rd & Blind Line Bruce Trail				

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading	43.39339	79.88880	0.757358	1.394323
2nd Reading				
Average	43.39339	79.88880	0.757358	1.394323
Distance (3rd Seis. From Centre of Blast)	831.0	m		
Post Blast Data:	ppV: Not	mm/s	Trigger set at: 2.0	mm/s
	frequency: Set	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
	air overpressure: Up	dB	Trigger set at: 115	dB
SouthWest Corner of Property (Only require 2 Siesmographs for floor blasts)				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(752.7)^2}{30^2} \text{ kg}$$

$$= \frac{566,557}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 630 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 9/10/2018

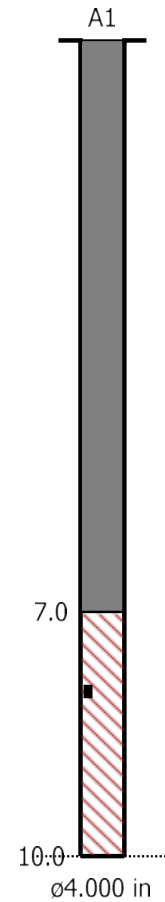
Blast Number: 18-015
Orica Order #: 2384839

page 2

Paste ShotPlus Diagram inside Rectangle:



HANDIDET 500ms 16ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Bill White

Signature required, indicating
sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 3.5m

Spacing: 3.5m

Subdrill: 0.0m

Stemming: 2.5m

1st row burden: 3.5m

Hole Diameter: 101.6mm

Number of holes: 204

Hole angle: 0.0°

Total drilled: 673.2m

-013
Floor
Previous Blast

Timing



Concrete
Pad



Not to scale

SHOTPlus™ Professional 5.7.3.0	9/10/2018
Mine	Burlington
Location	
Title/author	18-013 Floor
Filename	18-015 Floor Final Not timed.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft
1st row burden: 11.5ft
Total drilled: 2360.2ft

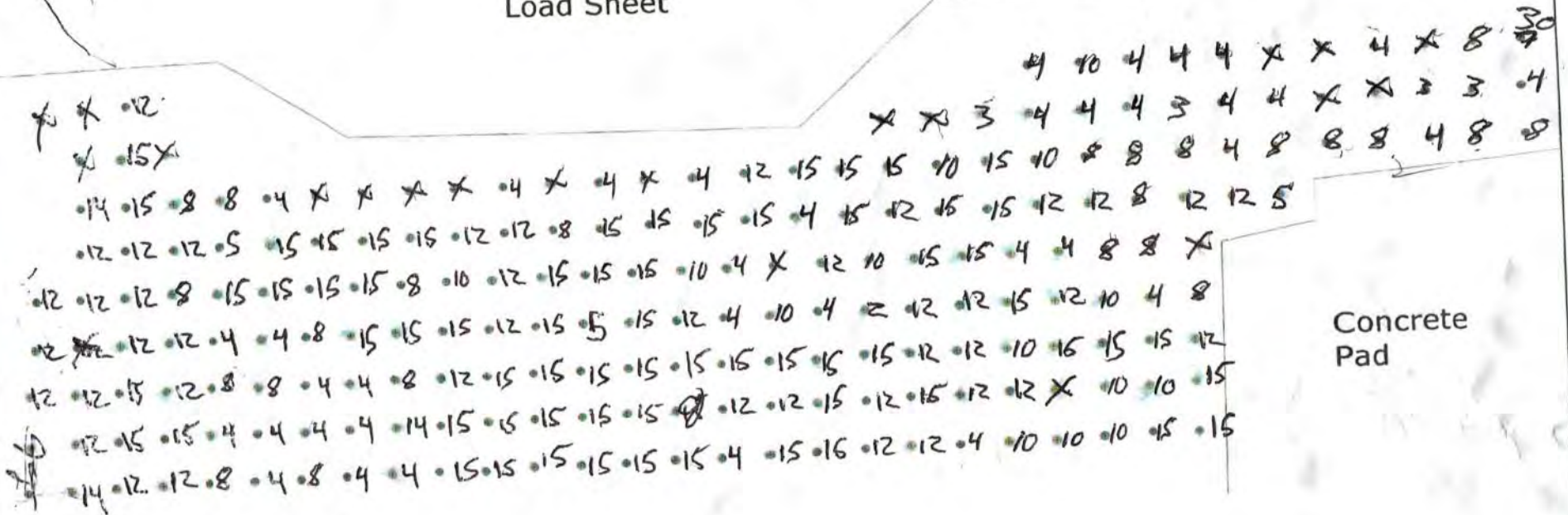
Spacing: 11.5ft
Hole Diameter: 4.0in

Subdrill: 0.0ft
Number of holes: 218

Stemming: 8.2ft
Hole angle: 0.0°

8-013
Floor
Previous Blast

Load Sheet



Concrete Pad

DRILL TO SHALE



Not to scale

SHOTPlus™ Professional 5.7.3.0

9/9/2018

Mine

Burlington

Location

Title/author

18-013 Floor

Filename

18-015 Floor Final.spf

Date/Time MicL at 11:49:28 September 10, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.03 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/BURLINGTON.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.6 Volts
Unit Calibration February 14, 2018 by InstanTEL
File Name UM6857_20180910114928.IDFW

Notes
 Location: COLLING RD & BLINDLINE
 Client: NELSON AGGREGATES
 User Name: ORICA CANADA
 General:

Extended Notes

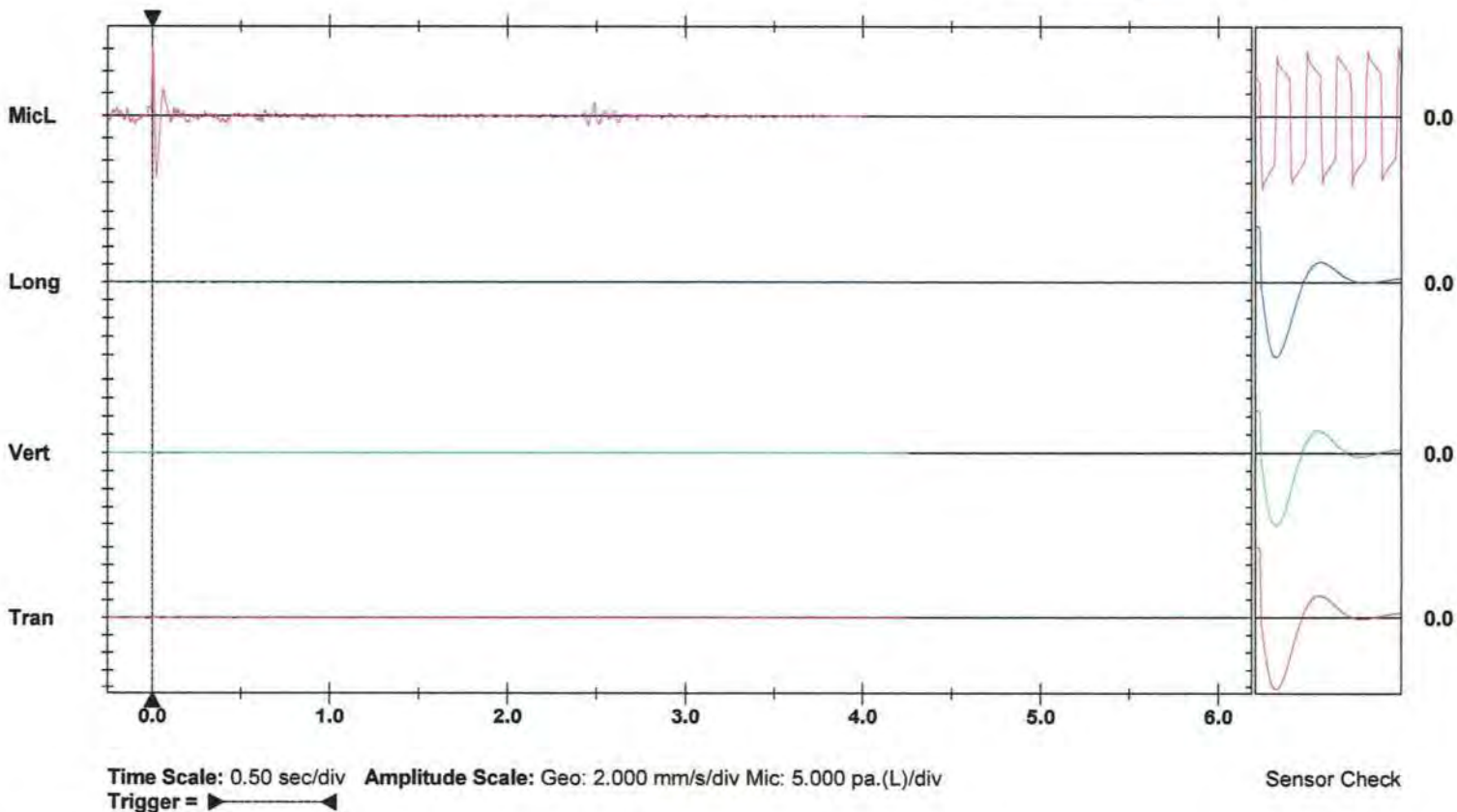
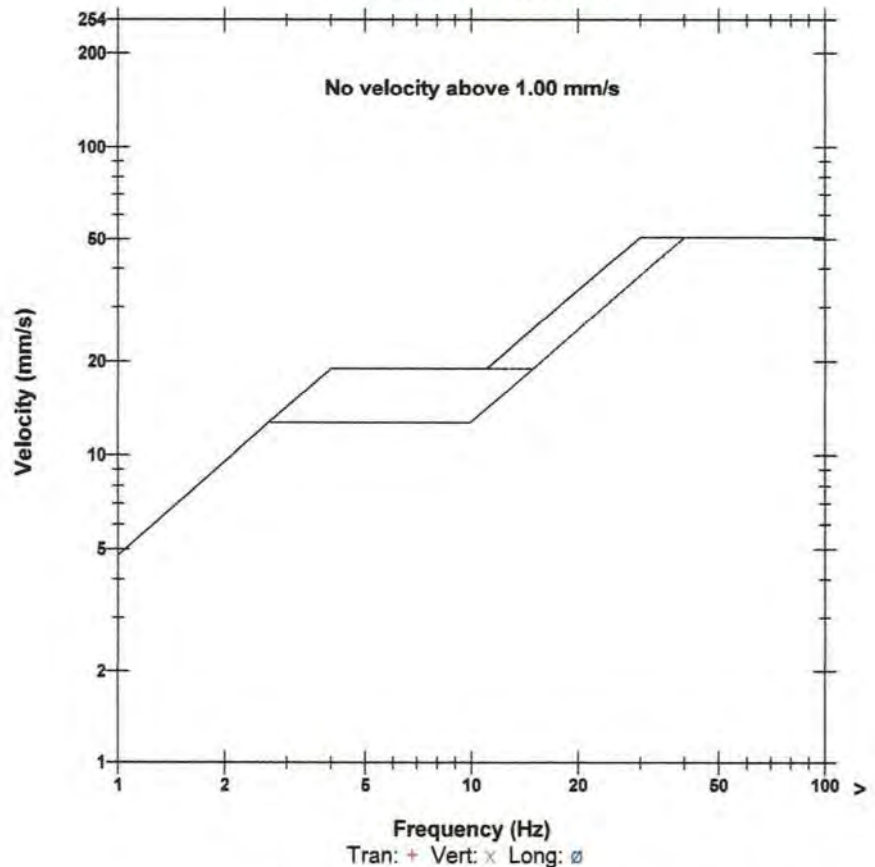
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 118.0 dB(L) at 0.001 sec
ZC Freq 11.1 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 1457 mv)

	Tran	Vert	Long	
PPV	0.110	0.110	0.110	mm/s
ZC Freq	11.6	27	16.0	Hz
Time (Rel. to Trig)	-0.020	0.049	0.026	sec
Peak Acceleration	0.010	0.010	0.012	g
Peak Displacement	0.001	0.001	0.010	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.5	7.3	Hz
Overswing Ratio	3.3	3.4	3.6	

Peak Vector Sum 0.136 mm/s at 0.049 sec

USBM RI8507 And OSMRE



1090658



Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

Bill of Lading / Connaissance

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE
6 45 AM

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

2384839

B/L NUMBER
N° DE CONNAISSEMENT

86129828

PAGE 2

PAGE

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR		CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT			
10 Sep 2018	00:00:00	NELSON AGGREGATE COMPANY		n/a			
DATE SHIPPED EXPÉDIE LE	FREIGHT TERMS CONDITIONS DE LIVRAISON		SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE			
10 Sep 2018	FOB Dest'n, Own Truck		F-73289	AT15013			
SHIP VIA TRANSPORTEUR		ROUTING ITINÉRAIRE		MAG. LIC. NO. N° DE PERMIS			
Orica Truck		STANDARD					
QTY. QTE.	UM	DG MD	QTY. RET'D QTE. RET.	QTY. SOLD QTE. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
NET EXPLOSIVES QUANTITY:					100.426 KG		
294	PC	X	59	235	PENTEX BC 340 (49/CS)	6	107.310
12	PC	X	0	1	Harness Wire Duplex (6 pack) 400m	1	5.840
30	PC	X	28	2	*uni tronic 600-06.0M CU/ZC(20') 80PC	1	2.190
100	PC	X	100	6	MINI STEM PLUGS - PART #74853		0.700
325	PC	X	90	235	EXEL HANDIDET 9M 25/500(30') 65/CS	5	32.825
65	PC	X	59	6	EXEL Connectadet 9M 25MS (30 FT) 65/CS	1	6.305
65	PC	X	31	34	EXEL Connectadet 9M 42MS (30 FT) 65/CS	1	6.370
108	PC	X	10	8	EXEL Connectadet 12M 42MS (40 FT) 50/CS	1	1.080
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT					162.620 KG		
**** TOTAL PACKAGES ****					16		

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES

PALLETS RETURNED / PALETTES RETOURNÉES

BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO. 24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENT À N° DE CONNAISSEMENT ORICA:
ERAP 2-1510	1-877-561-3636	YES / OUI NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SONT MENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE	NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
K. PLATT	K. PLATT	
SIGNATURE	SIGNATURE	SIGNATURE
K. Platt	K. Platt	
DATE	DATE	DATE
10 9 18	10 9 18	
D/J M/M Y/A	D/J M/M Y/A	D/J M/M Y/A

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNED LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 3 ****

D.F.G. S7772

2 SHIPPING ORDER
BON D'EXPÉDITION



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-09-10

Blast Number: 18-015
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.40084 °N Latitude 79.88808 °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: 22,329 te
Total Holes Loaded: 225 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 225 = 2,250.0 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 20 front row
Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 205
Bench Height: 10.0 ft avg
Sub-drill: 0.0 ft avg
Hole Depth: 10.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" Stone

- Design Charge Length -

Front Row: 3.0 ft avg
Main Body: 3.0 ft avg

- Design Charge Weight -

Front Row: 8.7 kg/hole
Main Body: 8.7 kg/hole
Max Chge Wt / delay: 12.0 kg/delay

Required kg Loaded: 2,957 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.132 kg/te (actual)
Front row: 0.088 kg/te (theoretical)
Main Body: 0.088 kg/te (theoretical)
"KPI" PF: 0.000 kg/te (theoretical)

0.394 lb/yd³

0.394 lb/yd³

0.000 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast

Bulk Expl. Required:

	kg
CENTRA GOLD 70	2,880

Pkgd Expl. Required:

	kg

Boosters Required:

	kg/u	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	225	76.5

total explosives weight in Blast (kg): 2,957

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

	ms	# req'd
UNITRONIC 600 6M		6
EXEL HANDIDET 9m	25/500	225
CONNECTADET 12M	42 ms	36

Cord & Access. Req'd:

	U of M	# req'd
WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

SHOTPlus 5 Plan

Blast Summary Data

Burden: 3.5m

Spacing: 3.5m

Subdrill: 0.0m

Stemming: 2.5m

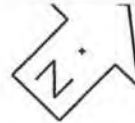
1st row burden: 3.5m

Hole Diameter: 101.6mm

Number of holes: 259

Hole angle: 0.0°

Total drilled: 789.4m

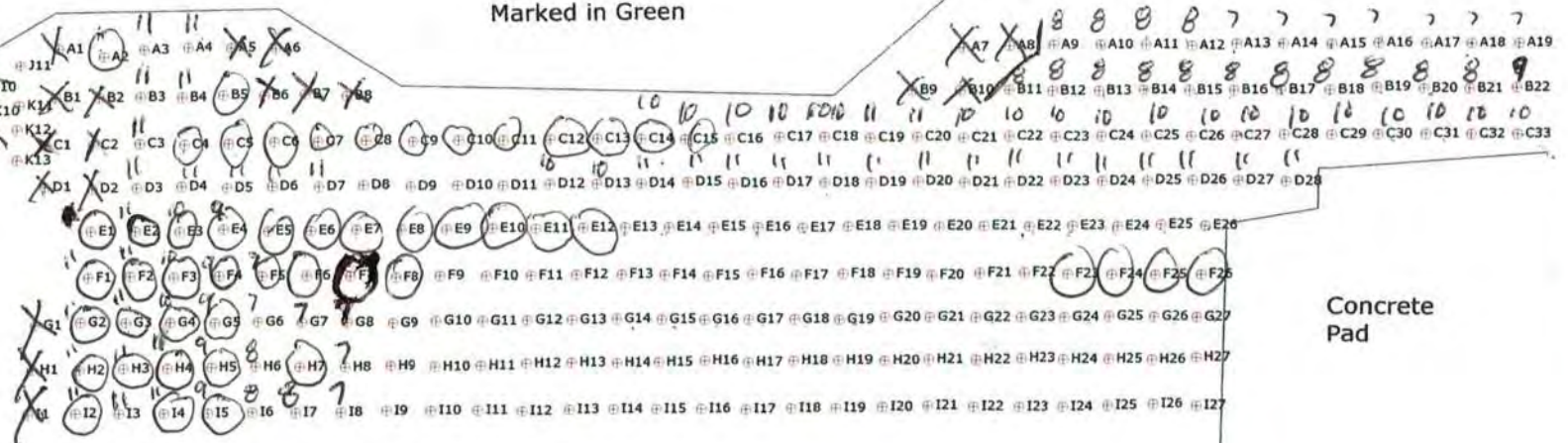


18-013
Floor
Previous Blast

Blast 18-015 Floor
4" Hole
11.5 X 11.5

3.5" Hole
9 X 9.5
Marked in Green

Ramp



Concrete
Pad

DRILL TO SHALE



Not to scale



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-09-21

Blast Number: 18-018
Orica Order #: 2390035
Blast Time: 12:34 PM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)
GPS Coordinates: 43.40052 °N Latitude 79.88765 °W Longitude
Centre of Blast Centre of Blast

Wind from the: SW at 15 kph Temperature: 26 to 30 °C

Clear: ☐ Rain: ☐ Overcast: ☐
Partly Cloudy: ☒ Snow: ☐ Inversion: ☐ Ceiling: 30,000 ft

- Drilling Information -

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0° # Holes: 345 = 3,877.8 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	30,490	26,640	3,850

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	349	118.7

total explosives weight in Blast (kg): 3,969

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			349

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	2

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=2,000kg <5,000kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	18.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted: 38,483 te 14,522 m3
Total tonnes per day: 38,483 te NF-14 Rate Code
Total Holes Loaded: 345 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 21 rows

- Pattern (Front Row) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 26 front row

- Pattern (Main Body) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 319 main body

Bench Height: 11.2 ft avg

Sub-drill: 0.0 ft avg

Hole Depth: 11.2 ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Decks: per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 4.2 ft avg

Main Body: 4.2 ft avg

- Charge Weight -

Front Row: 12.4 kg/hole

Main Body: 12.4 kg/hole

Max. per delay: 30.0 kg/delay

SD () Equation: 709.0 kg/delay

Total kg Loaded: 3,969 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.103 kg/te (actual)

Front row: 0.111 kg/te (theoretical)

Main Body: 0.111 kg/te (theoretical)

"KPI" PF: 0.111 kg/te (theoretical)

0.461 lb/yd³

0.495 lb/yd³

0.495 lb/yd³

0.495 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

Unitronic detonators were used due to a shortage of non-electronic detonators.

The rate code will show use of non-electronic detonators, therefore no additional cost will be incurred by the customer

4 holes received a secondary primers because the bottom primer was stuck additional helper due to number of hole and difficulty of blast



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-09-21

Blast Number: 18-018
Orica Order #: 2390035
Blast Time: 12:34 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40053	79.88773
Front Row Corner	43.40099	79.88756
Back Row Corner	43.40004	79.88767
Average (Centre of Blast)	43.40052	79.88765

(N) Radians	(W) Radians
0.757482	1.394304
0.757490	1.394301
0.757474	1.394303
0.757482	1.394303

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40245	79.87814
2nd Reading		
Average	43.40245	79.87814

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

Distance (1st Seis. From Centre of Blast) 798.8 m
Post Blast Data: ppV: Did mm/s Trigger set at: 1.5 mm/s
frequency: Not Hz V / T / L : ? (Vertical, Transverse or Longitudinal)
air overpressure: Trigger dB Trigger set at: 124 dB

2450 2nd Line

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40605	79.89400
2nd Reading		
Average	43.40605	79.89400

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

Distance (2nd Seis. From Centre of Blast) 801.6 m
Post Blast Data: ppV: Did mm/s Trigger set at: 2.0 mm/s
frequency: Not Hz V / T / L : ? (Vertical, Transverse or Longitudinal)
air overpressure: Trigger dB Trigger set at: 115 dB

Colling Rd & Blind Line Bruce Trail

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.39339	79.88880
2nd Reading		
Average	43.39339	79.88880

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Distance (3rd Seis. From Centre of Blast) 799.3 m
Post Blast Data: ppV: Did mm/s Trigger set at: 2.0 mm/s
frequency: Not Hz V / T / L : ? (Vertical, Transverse or Longitudinal)
air overpressure: Set-up dB Trigger set at: 115 dB

SouthWest Corner of Property

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(798.8)^2}{30^2} \text{ kg}$$

$$= \frac{638,081}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 709 kg

Orica

Blaster-in-charge:

jim bray

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 9/21/2018

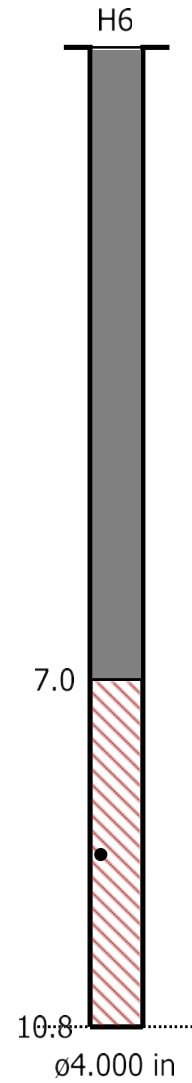
Blast Number: 18-018
Orica Order #: 2390035

page 2

Paste ShotPlus Diagram inside Rectangle:



UNI Tronic (?)ms 20ft



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Bill White

Signature required, indicating
sign off on Blast Design.

240 • 220 • 200 • 180 • 160 • 140 • 120 • 100 • 80 • 60 • 40 • 20 • 0 • 29 • 49 • 69 • 89 • 109 • 129 • 149 • 169 • 189 • 209 • 229 • 249 • 269 •

355 • 335 • 315 • 295 • 275 • 255 • 235 • 215 • 195 • 175 • 155 • 135 • 115 • 144 • 164 • 184 • 204 • 224 • 244 • 264 • 284 • 304 • 324 • 344 • 364 • 384 •

470 • 450 • 430 • 410 • 390 • 370 • 350 • 330 • 310 • 290 • 270 • 250 • 230 • 259 • 279 • 299 • 319 • 339 • 359 • 379 • 399 • 419 • 439 • 459 • 479 • 499 •

585 • 565 • 545 • 525 • 505 • 485 • 465 • 445 • 425 • 405 • 385 • 365 • 345 • 374 • 394 • 414 • 434 • 454 • 474 • 494 • 514 • 534 • 554 • 574 • 594 • 614 •

700 • 680 • 660 • 640 • 620 • 600 • 580 • 560 • 540 • 520 • 500 • 480 • 460 • 489 • 509 • 529 • 549 • 569 • 589 • 609 • 629 • 649 • 669 • 689 • 709 • 729 •

795 • 775 • 755 • 735 • 715 • 695 • 675 • 655 • 635 • 615 • 595 • 575 • 604 • 624 • 644 • 664 • 684 • 704 • 724 • 744 • 764 • 784 • 804 • 824 • 844 •

910 • 890 • 870 • 850 • 830 • 810 • 790 • 770 • 750 • 730 • 710 • 690 • 719 • 739 • 759 • 779 • 799 • 819 • 839 • 859 • 879 • 899 • 919 • 939 • 959 •

1025 • 1005 • 985 • 965 • 945 • 925 • 905 • 885 • 865 • 845 • 825 • 805 • 834 • 854 • 874 • 894 • 914 • 934 • 954 • 974 • 994 • 1014 • 1034 • 1054 • 1074 •

1140 • 1120 • 1100 • 1080 • 1060 • 1040 • 1020 • 1000 • 980 • 960 • 940 • 920 • 949 • 969 • 989 • 1009 • 1029 • 1049 • 1069 • 1089 • 1109 •

1255 • 1235 • 1215 • 1195 • 1175 • 1155 • 1135 • 1115 • 1095 • 1075 • 1055 • 1035 • 1064 • 1084 • 1104 • 1124 • 1144 • 1164 • 1184 • 1204 •

1350 • 1330 • 1310 • 1290 • 1270 • 1250 • 1230 • 1210 • 1190 • 1170 • 1150 • 1179 • 1199 • 1219 • 1239 • 1259 • 1279 • 1299 •

1465 • 1445 • 1425 • 1405 • 1385 • 1365 • 1345 • 1325 • 1305 • 1285 • 1265 • 1294 • 1314 • 1334 • 1354 • 1374 • 1394 •

1580 • 1560 • 1540 • 1520 • 1500 • 1480 • 1460 • 1440 • 1420 • 1400 • 1380 • 1409 • 1429 • 1449 • 1469 •

1695 • 1675 • 1655 • 1635 • 1615 • 1595 • 1575 • 1555 • 1535 • 1515 • 1495 • 1524 • 1544 •

1810 • 1790 • 1770 • 1750 • 1730 • 1710 • 1690 • 1670 • 1650 • 1630 • 1610 •

1935 • 1915 • 1895 • 1875 • 1855 • 1835 • 1815 • 1795 • 1775 •

2050 • 2030 • 2010 • 1990 • 1970 • 1950 • 1930 •

2165 • 2145 • 2125 • 2105 • 2085 • 2065 •

2280 • 2260 • 2240 • 2220 •

2395 • 2375 • 2355 •

2510 • 2490 •

X = HOLE UNLOADABLE
O = DOUBLE PRIMED



Not to scale

SHOTPlus™ Professional 5.7.3.0	9/20/2018
Mine	Burlington
Location	
Title/author	18-018 Floor I. Deemert
Filename	18-018_Floor_Design_Final.spf

1090791

Orica Canada Inc. Bill of Lading / Connaissance

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSEMENT

2390035

86143198

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
21 Sep 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON		SHIP. MAG. LIC. PERMIS EXPÉDITEUR
21 Sep 2018	FOB Dest'n, Own Truck		F-73289
SHIP VIA TRANSPORTEUR		ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS

Orica Truck

STANDARD

QTY. QTE.	UM	DG MD	QTY. RET'D QTE. RET.	QTY. SOLD QTE. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
392	PC	X	43	349	PENTEX BC 340 (49/CS)	8	143.080
3	PC		1	2	Harness Wire Duplex (6 pack) 400m	1	8.760
400	PC	X	51	349	*uni tronic 600-06.0M CU/ZC(20')80PC	5	29.200
60	PC	X	60	0	*uni tronic 600-09.0M CU/ZC(30')60PC	1	5.880
100	PC		100	0	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							187.620 KG
**** TOTAL PACKAGES ****						15	
GHS/WHMIS SDS documents available Website: www.oricaminingservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES		PALLETS RETURNED / PALETTES RETOURNÉES		BAGS USED / SACS UTILISÉS	
EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE		EMERGENCY RESPONSE NO./24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO		PLACARDS OFFERED / PLACARDS OFFERT	
ERAP 2-1510		1-877-561-3636		YES / OUI NO / NON	
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE		NETTE No. CONV PRESSAGE WT AGREEMENT NO.	
CONSIGNOR / EXPÉDITEUR GRAND VALLEY		CARRIER / TRANSPORTEUR Orica Truck		CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY	
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR K. Platt		DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR K. Platt		RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR	
SIGNATURE K. Platt		DATE 21 9 18 D/J M/M Y/A		SIGNATURE K. Platt	
				DATE 21 9 18 D/J M/M Y/A	

FORWARD INVOICE FOR PREPAID FREIGHT
QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE
POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENT À
NO DE CONNAISSEMENT D'ORICA:
Orica Canada Inc.
301 rue hotel de ville
Brownsburg-Chatham, QC
J8G 3B5

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNED LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

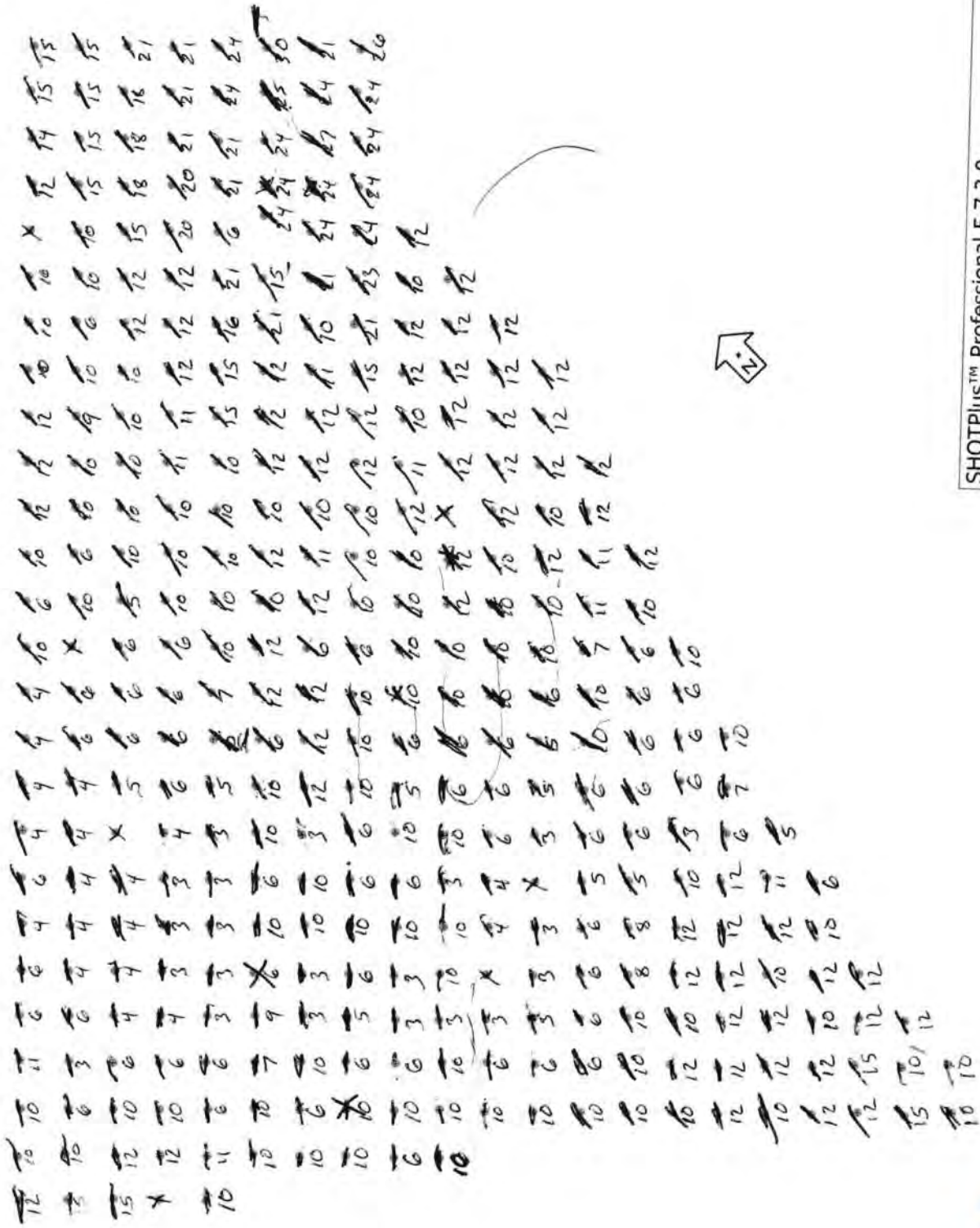
**** PAGE 2 OF 2 ****

D.F.G. 57772

Open Face

Load Sheet 16 Kg Max

Previous Blast

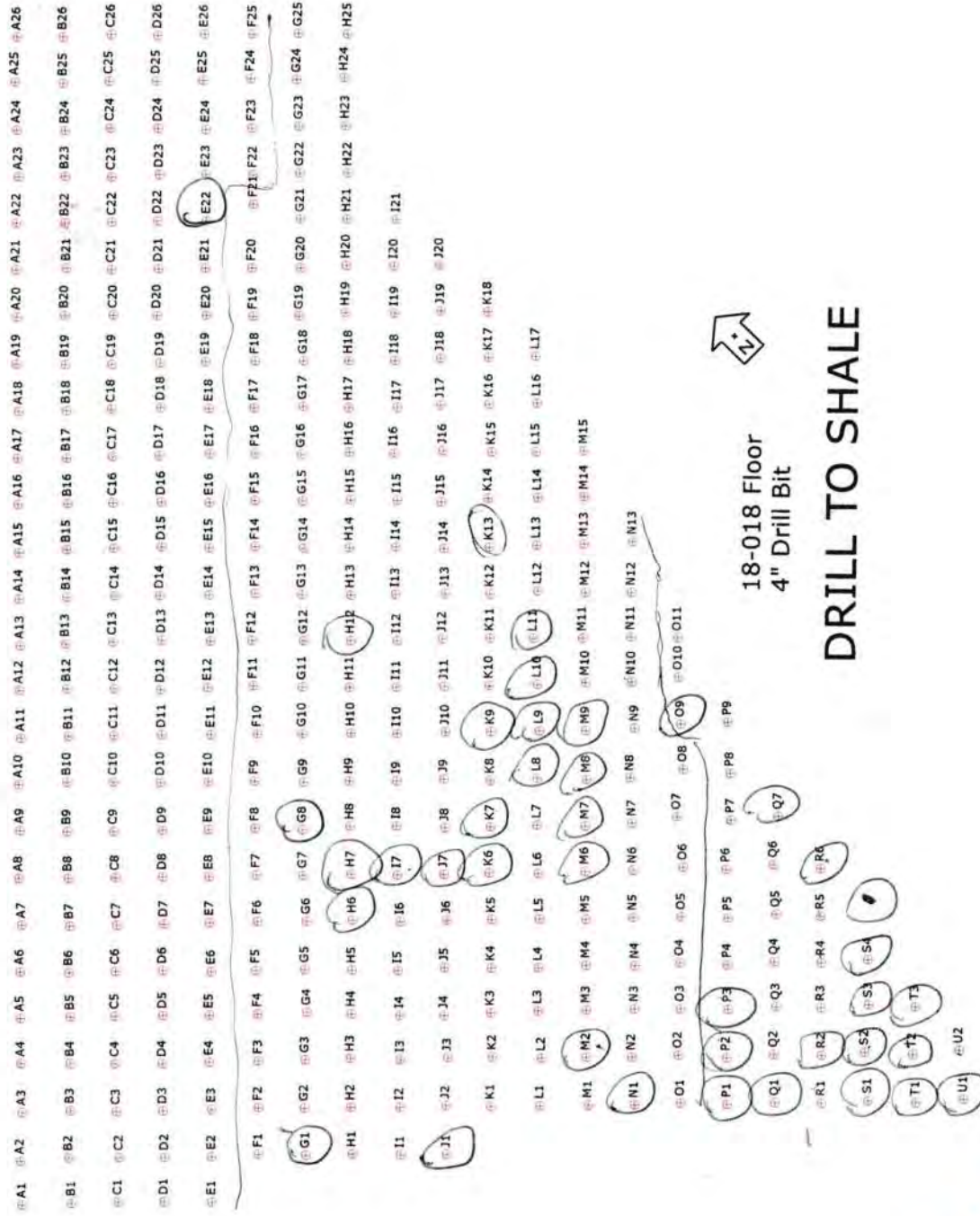


Not to scale

SHOTPlus™ Professional 5.7.3.0	9/20/2018
Mine	Burlington
Location	
Title/author	18-018 Floor I. Deemert
Filename	18-018_Floor_Design_Final.spf

Blast 18-015 Floor
Previous Blast

Open Face



Not to scale



~~TS 70B~~ ~~7670B~~
~~012 70B~~

GODRI LING

SHOT DIARY

Client:

Job:

Date:

1 foot into the Shale

134 holes, footage-1531'

in shot so far

Driller:

Blast Num:

Employee:

GPS Coordinates

GPS LF:

GPS RF:

GPS LR:

GPS RR:

100

79-608

905765

905-485 906-55

[illegible]

Shot	Notes	Shot	Notes
63	111	46	70B
64	111	47	70B
65	111	48	70B
66	111	49	70B
67	111	50	70B
68	111	51	70B
69	111	52	70B
70	111	53	70B
71	111	54	70B
72	111	55	70B
73	111	56	70B
74	111	57	70B
75	111	58	70B
76	111	59	70B
77	111	60	70B
78	111	61	70B
79	111	62	70B
80	111	63	70B
81	111	64	70B
82	111	65	70B
83	111	66	70B
84	111	67	70B
85	111	68	70B
86	111	69	70B
87	111	70	70B
88	111	71	70B
89	111	72	70B
90	111	73	70B
91	111	74	70B
92	111	75	70B
93	111	76	70B
94	111	77	70B
95	111	78	70B
96	111	79	70B
97	111	80	70B
98	111	81	70B
99	111	82	70B
100	111	83	70B
101	111	84	70B
102	111	85	70B
103	111	86	70B
104	111	87	70B
105	111	88	70B
106	111	89	70B
107	111	90	70B
108	111	91	70B
109	111	92	70B
110	111	93	70B
111	111	94	70B
112	111	95	70B
113	111	96	70B
114	111	97	70B
115	111	98	70B
116	111	99	70B
117	111	100	70B
118	111	101	70B
119	111	102	70B
120	111	103	70B
121	111	104	70B
122	111	105	70B
123	111	106	70B
124	111	107	70B
125	111	108	70B
126	111	109	70B
127	111	110	70B
128	111	111	70B
129	111	112	70B
130	111	113	70B
131	111	114	70B
132	111	115	70B



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #: 2018-09-21
Design Date: 2018-09-21

Blast Number: 18-018
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Parks Names)

Blast Location: Floor (Bench / P-way)
GPS Coordinates: enter data on p2 °N Latitude enter data on p2 °W Longitude
Centre of Blast Centre of Blast

Design te Blasted: 39,153 te
Total Holes Loaded: 351 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 21 rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 351 = 3,945.2 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 26 front row

- Design Pattern (Main Body) -

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 325 main body
Bench Height: 11.2 ft avg
Sub-drill: 0.0 ft avg
Hole Depth: 11.2 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" Stone

- Design Charge Length -

Front Row: 4.2 ft avg
Main Body: 4.2 ft avg

- Design Charge Weight -

Front Row: 12.4 kg/hole
Main Body: 12.4 kg/hole
Max Chge Wt / delay: 16.0 kg/delay

Required kg Loaded: 10,119 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.258 kg/te (actual)
Front row: 0.111 kg/te (theoretical)
Main Body: 0.111 kg/te (theoretical)
"KPI" PF: 0.111 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Blt, B, S, Expl or IS from previous Blast:

Bulk Expl. Required: kg
CENTRA GOLD 70 10,000

Pkgd Expl. Required: kg

Boosters Required: kg/u # used kg
PENTEX 12 (OR EQUIVALENT) 0.34 351 119.3

total explosives weight in Blast (kg): 10,119
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required: ms # req'd
UNITRONIC 600 SM 351

Cord & Access. Req'd: U of M # req'd
WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

# of Blasts today (this Quarry)		<u>1</u>
# of Blasters (this Blast)		<u>1</u>
# of Helpers (this Blast)	Note Exception	<u>3</u>
# of MMU's (this Blast)		<u>1</u>

Services Req'd:

GPS LAYOUT	Enter hours	<u>0.0</u>
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	<u>0.0</u>
HELPER HOURS	Enter total Helper man-hours	<u>0.0</u>
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	<u>0</u>
3D LASER PROFILE	Enter hours	<u>0</u>
BORETRACK	Enter hours	<u>0</u>
TECHNICAL BLAST DESIGN	(per day) Enter # of days	<u>0.0</u>



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-10-02

Blast Number: 18-017

Orica Order #: 2394470

Blast Time: 12:02 PM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40374 °N Latitude 79.88268 °W Longitude
Centre of Blast Centre of Blast

Wind from the: SW at 5 kph Temperature: 11 to 15 °C

Clear:

Rain: X

Overcast: X

Partly Cloudy:

Snow:

Inversion:

Ceiling 751 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 48 = 3,763.4 ft (4 " diam)
Secondary Bit diam: mm	°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,740	22,350	11,390

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	108	36.7

total explosives weight in Blast (kg): 11,427

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			45
UNITRONIC 600 25M			26
UNITRONIC 600 30M			36
UNITRONIC 600 15M			1

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	>=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	11.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	26,868 te	10,139 m3
Total tonnes per day:	26,868 te	NB80-01 Rate Code
Total Holes Loaded:	48 holes	
... including:	Dead Holes	
... and:	2 Helper Holes	
Helper Hole Collar:	50.0 ft avg	
# Rows Blasted:	3 rows	

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 19 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 29 main body

Bench Height: 76.4 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 78.4 ft avg

- Stone Decking -

Front Row: 10.0 ft avg

Main Body: 10.0 ft avg

Decks: 6 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 61.4 ft avg

Main Body: 61.4 ft avg

- Charge Weight -

Front Row: 179.0 kg/hole

Main Body: 179.0 kg/hole

Max. per delay: 265.0 kg/delay

SD () Equation: 172.7 kg/delay

Total kg Loaded: 11,427 kg

Rock Density: 2.65 g/cc = te/m³

- Powder Factor -

Yield PF: 0.425 kg/te (actual)

Front row: 0.260 kg/te (theoretical)

Main Body: 0.347 kg/te (theoretical)

"KPI" PF: 0.318 kg/te (theoretical)

1.900 lb/yd³

1.162 lb/yd³

1.550 lb/yd³

1.421 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit, B, S, Expl or IS from previous Blast:

3 Siesmographs set up



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-10-02

Blast Number: 18-017
Orica Order #: 2394470
Blast Time: 12:02 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40371	79.88267
Front Row Corner	43.40358	79.88266
Back Row Corner	43.40393	79.88271
Average (Centre of Blast)	43.40374	79.88268

(N) Radians	(W) Radians
0.757538	1.394216
0.757535	1.394215
0.757541	1.394216
0.757538	1.394216

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40245	79.87814
2nd Reading		
Average	43.40245	79.87814
Distance (1st Seis. From Centre of Blast)	394.2	m
Post Blast Data:	ppV:	5.3 mm/s
	frequency:	7.6 Hz
	air overpressure:	114.2 dB
2450 2nd Line		

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40605	79.89400
2nd Reading		
Average	43.40605	79.89400
Distance (2nd Seis. From Centre of Blast)	951.1	m
Post Blast Data:	ppV:	0.2 mm/s
	frequency:	7.1 Hz
	air overpressure:	121.6 dB
Colling Rd & Blind Line Bruce Trail		

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.39339	79.88880
2nd Reading		
Average	43.39339	79.88880
Distance (3rd Seis. From Centre of Blast)	1253.8	m
Post Blast Data:	ppV:	0.5 mm/s
	frequency:	7.3 Hz
	air overpressure:	123.5 dB
SouthWest Corner of Property		

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(394.2)^2}{30^2} \text{ kg}$$

$$= \frac{155,394}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 173 kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

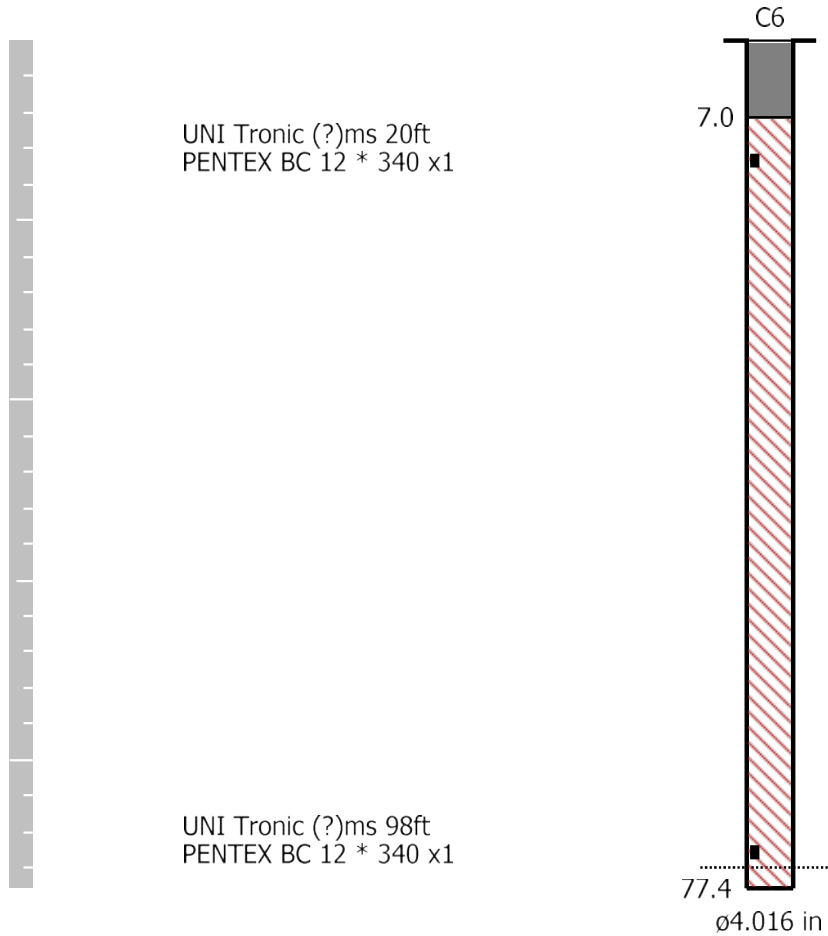
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 10/2/2018

Blast Number: 18-017
Orica Order #: 2394470

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Bill White

Signature required, indicating
sign off on Blast Design.

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft

Spacing: 10.0ft

Subdrill: 2.0ft

Stemming: 6.0ft

1st row burden: 12.1ft

Hole Diameter: 4.0in

Number of holes: 49

Hole angle: 0.0°

Total drilled: 3733.8ft

open face



TRY C17A 4" FIRST POSITION IF UNSUC
TRY C17B 5" SECOND POSITION
NO ROUNDING DUE TO RAMP

SHOTPlus™ Professional 5.7.3.0		10/1/2018
Mine	Burlington	
Location	UPPER MIDDLE NO ROUNDING ON NORTH	
Title/author	Design 18-017 UPPER MIDDLE	
Filename	2018-10-02 18-017 Upper Middle.spf	



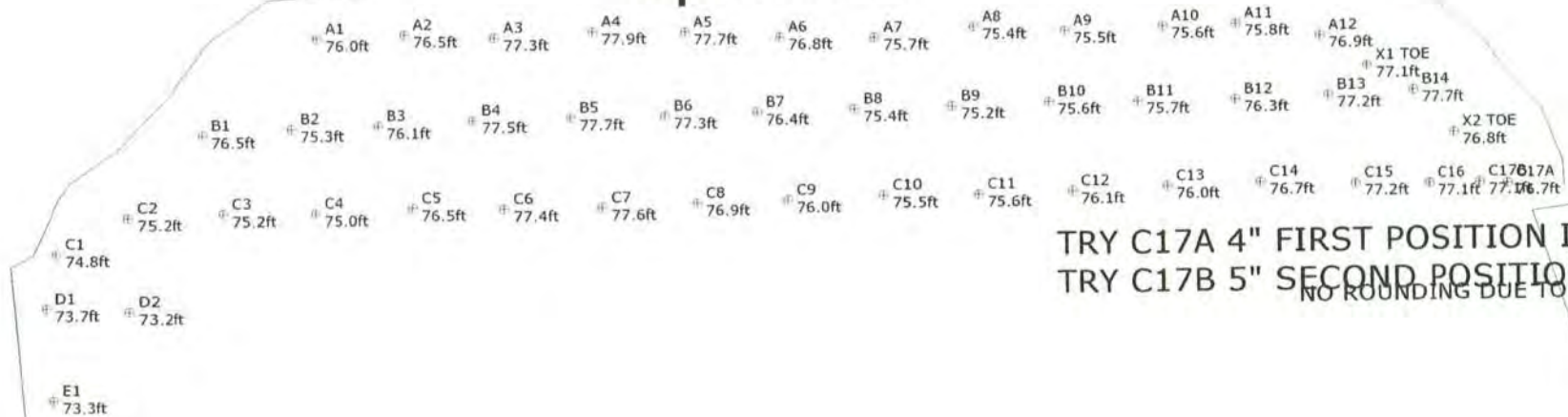
Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 6.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 49	Hole angle: 0.0°
Total drilled: 3733.8ft			

open face



TRY C17A 4" FIRST POSITION IF UNSUC
TRY C17B 5" SECOND POSITION
NO ROUNDING DUE TO RAMP



Not to scale

SHOTPlus™ Professional 5.7.3.0	9/17/2018
Mine	Burlington
Location	UPPER MIDDLE NO ROUNDING ON NORTH
Title/author	Design 18-017 UPPER MIDDLE
Filename	Design_18-017_UPPER_MIDDLE_Fnl.spf

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft

Spacing: 10.0ft

Subdrill: 2.0ft

Stemming: 6.0ft

1st row burden: 12.1ft

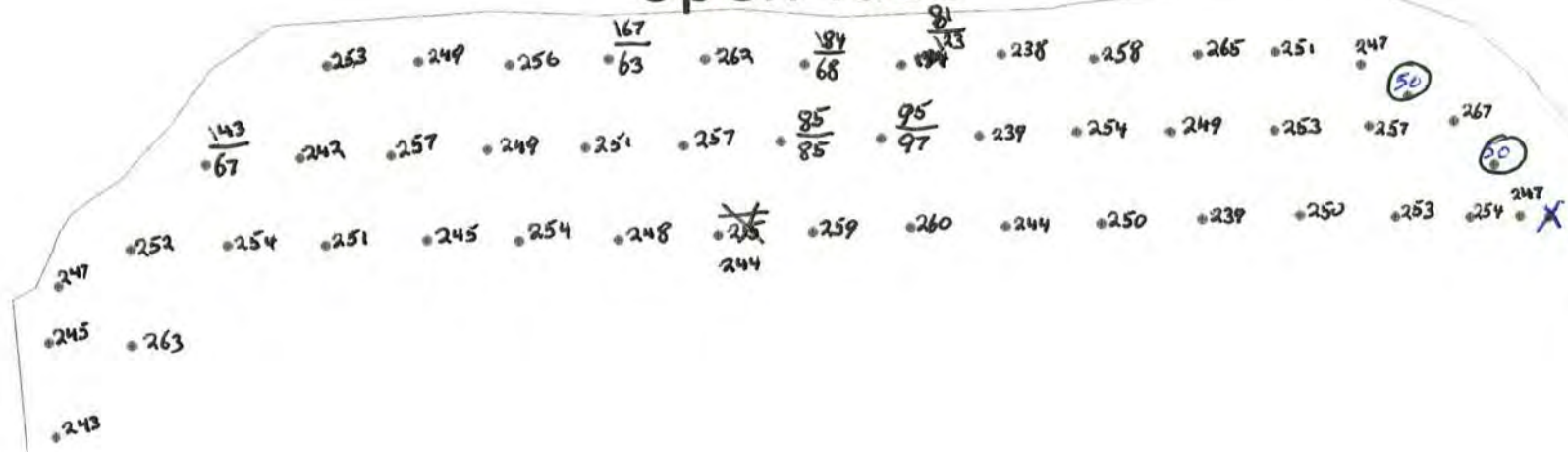
Hole Diameter: 4.0in

Number of holes: 49

Hole angle: 0.0°

Total drilled: 3733.8ft

Load Sheet 240 Kg Max open face



Not to scale

SHOTPlus™ Professional 5.7.3.0	9/28/2018
Mine	Burlington
Location	UPPER MIDDLE NO ROUNDING ON NORTH
Title/author	Design 18-017 UPPER MIDDLE
Filename	Design_18-017_UPPER_MIDDLE_Fnl.spf

1090892

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSANCE NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES
SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissance



Orica Canada Inc.

GRAND VALLEY

033411 SIDE ROAD 21-22

GRAND VALLEY ON

CA L9W 7G1

NELSON AGGREGATE COMPANY

BURLINGTON ON

CA L7R 4L8

CONSIGNEE
CONSIGNATAIRE

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉETIME OUT
HEURE SORTIEORDER NUMBER
N° DE COMMANDEB/L NUMBER
N° DE CONNAISSANCE

2394470

86154431

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
02 Oct 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
02 Oct 2018	FOB Dest'n, Own Truck	F-73289	PT 18230
SHIP VIA TRANSPORTEUR	ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS	
Orica Truck	STANDARD		

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
147	PC	X	39	108	PENTEX BC 340 (49/CS)	3	53.655
2	PC	X	1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
80	PC	X	35	45	*uni tronic 600-06.0M CU/ZC(20')80PC	1	5.840
66	PC	X	65	1	*uni tronic 600-15M C/Z SPL(50')66PC	1	11.286
54	PC	X	28	26	*uni tronic 600-25M CU/ZC SPL(80')54P	1	13.176
36	PC	X	0	36	*uni tronic 600-30M C/Z SPL(100')36P	1	8.820
100	PC				MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							99.317 KG
**** TOTAL PACKAGES ****							8
GHS/WHMIS SDS documents available Website: www.oricaminingservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES

PALLETS RETURNED / PALETTES RETOURNÉES

BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO./24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRENT À NO DE CONNAISSANCE D'ORICA:
ERAP 2-1510	1-877-561-3636	YES / OUI NO / NON	Orica Canada Inc.
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE	NETTE No. CONV PRESSAGE WT AGREEMENT NO.
CONSIGNOR / EXPÉDITEUR GRAND VALLEY		CARRIER / TRANSPORTEUR Orica Truck	CONSIGNEE / DESTINATAIRE NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR JEFF NORWICH		DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR JEFF NORWICH	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
SIGNATURE	DATE 2-10-18	SIGNATURE	DATE 2-10-18
	D/J M/M Y/A		D/J M/M Y/A

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSANCE CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO

**** PAGE 2 OF 2 ****

D.F.G. S7772

Date/Time MicL at 12:02:29 October 2, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.308 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/BURLINGTON.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.6 Volts
Unit Calibration February 14, 2018 by Instantel
File Name UM6857_20181002120229.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

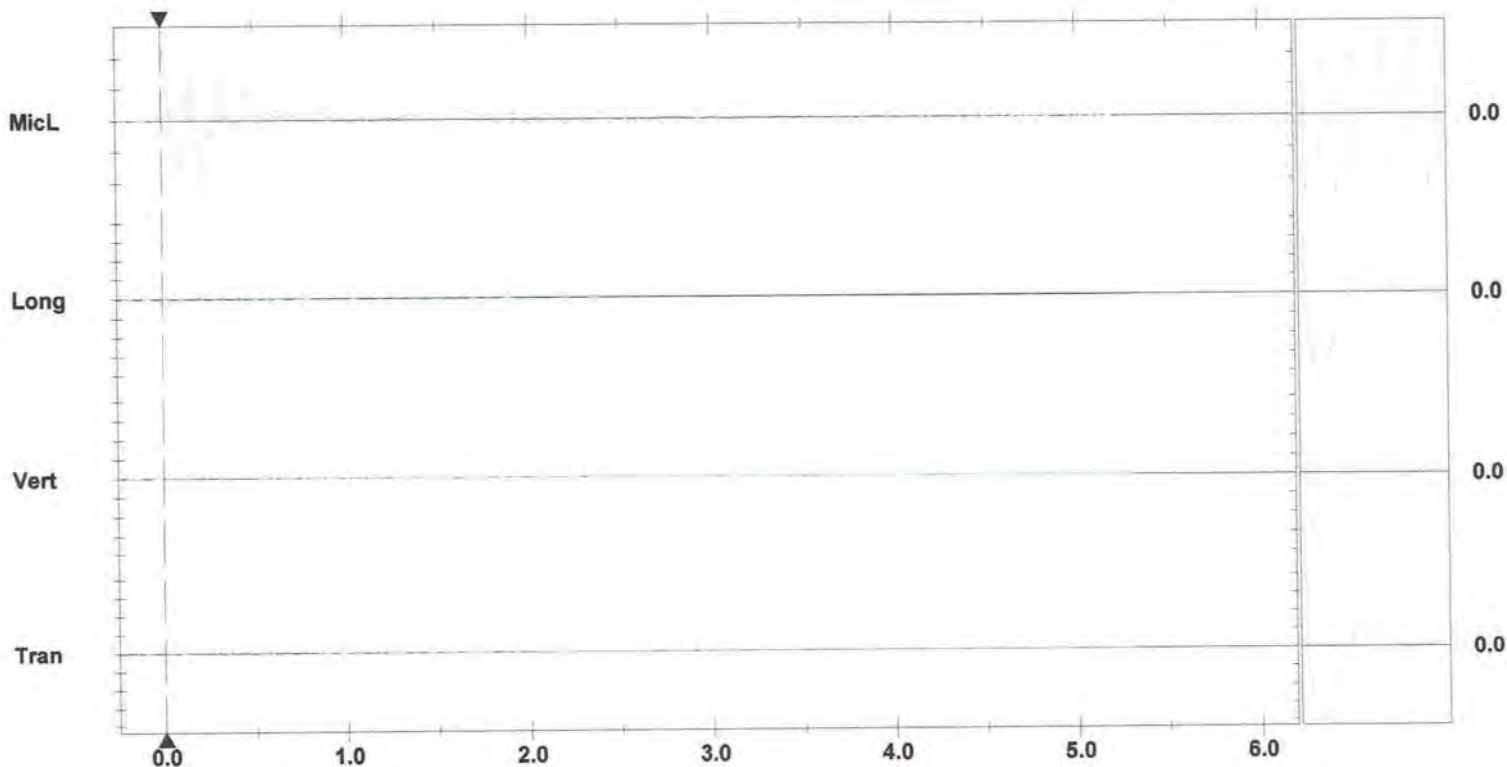
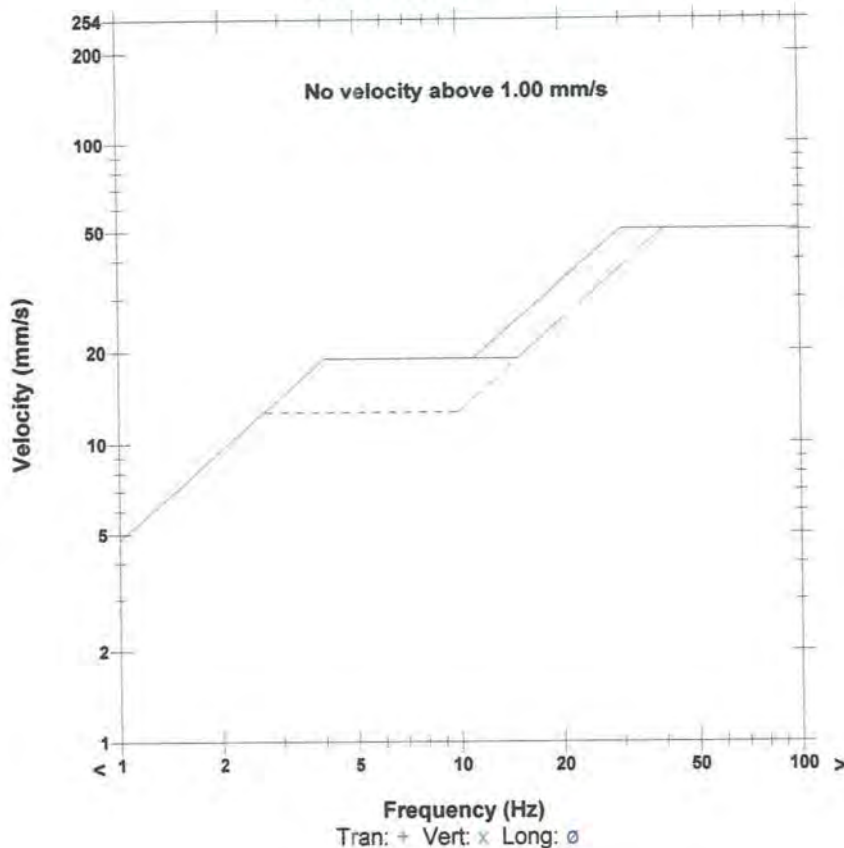
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 121.6 dB(L) at 0.202 sec
ZC Freq 4.3 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1470 mv)

	Tran	Vert	Long	
PPV	0.150	0.189	0.205	mm/s
ZC Freq	16.5	17.1	7.9	Hz
Time (Rel. to Trig)	0.407	0.215	0.388	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.002	0.002	0.013	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.3	3.4	3.6	

Peak Vector Sum 0.214 mm/s at 0.394 sec

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Long at 12:02:24 October 2, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.3 Volts
Unit Calibration August 31, 2018 by InstanTel
File Name _TEMP.EVT

Notes

Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada
General: N.43.40245 W.79.87814

Extended Notes

Sand Bagged

Microphone Linear Weighting

PSPL 114.2 dB(L) at 1.513 sec

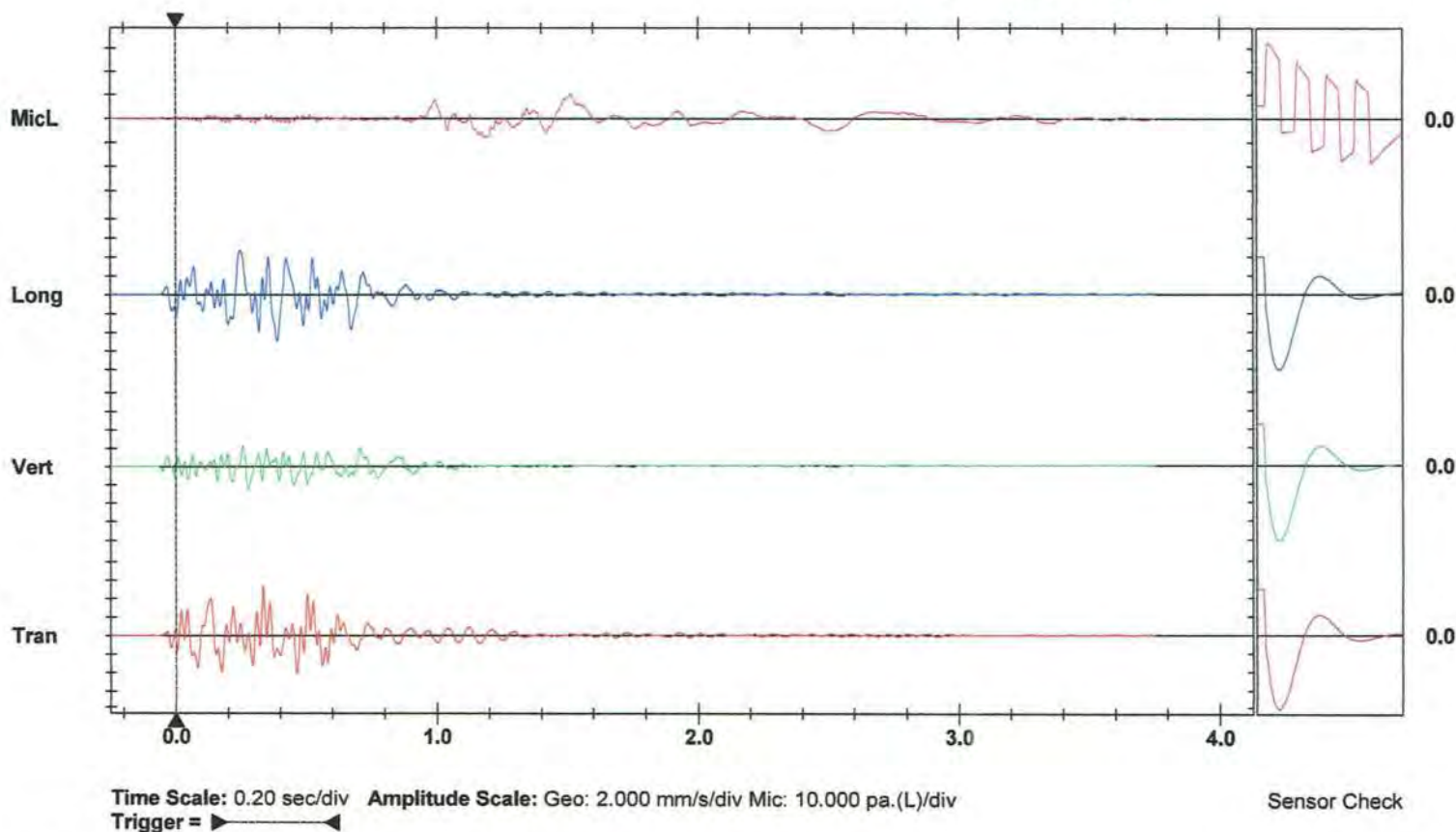
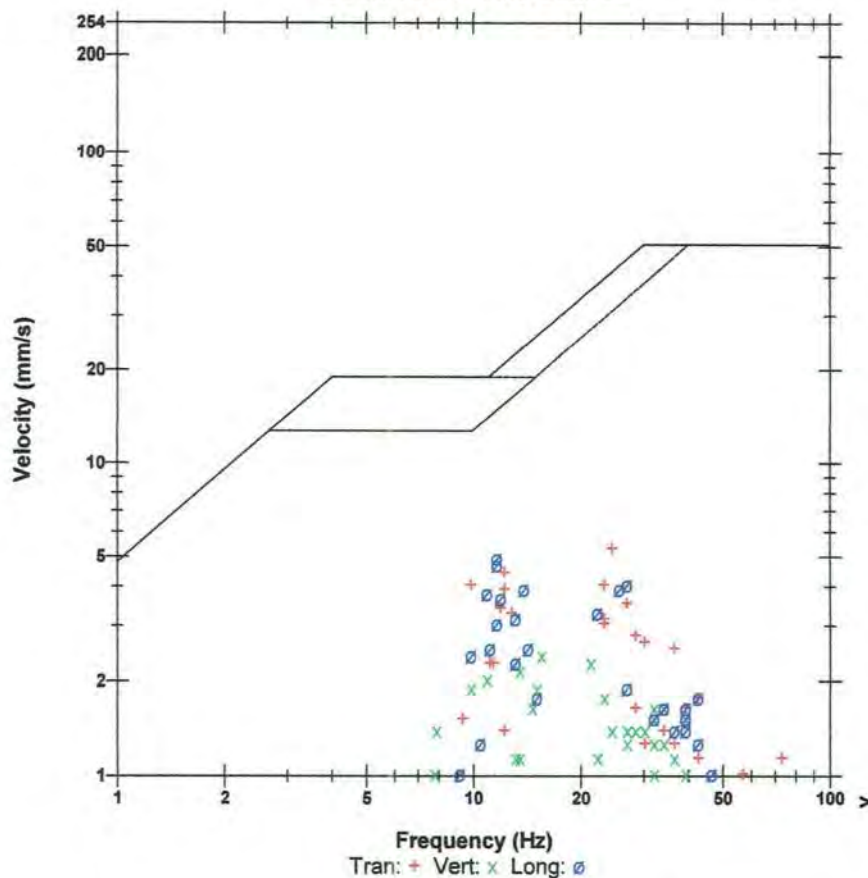
ZC Freq 3.5 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 692 mv)

	Tran	Vert	Long	
PPV	5.334	2.413	4.953	mm/s
ZC Freq	24	16	12	Hz
Time (Rel. to Trig)	0.334	0.275	0.388	sec
Peak Acceleration	0.093	0.053	0.066	g
Peak Displacement	0.056	0.027	0.066	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.6	7.4	7.4	Hz
Overswing Ratio	3.7	3.9	4.2	

Peak Vector Sum 5.677 mm/s at 0.333 sec

USBM RI8507 And OSMRE



Date/Time MicL at 12:02:29 October 2, 2018
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.25 sec (Auto=3Sec) at 1024 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.2 Volts
Unit Calibration November 3, 2017 by InstanTel
File Name _TEMP.EVT
Scaled Distance 5850.2 (1850.0 m, 0.1 kg)

Notes

Location: SouthWest Corner of property
Client: Nelson Aggregates
User Name: Orica Canada
General: N. 44.39585; W-80.25085

Extended Notes

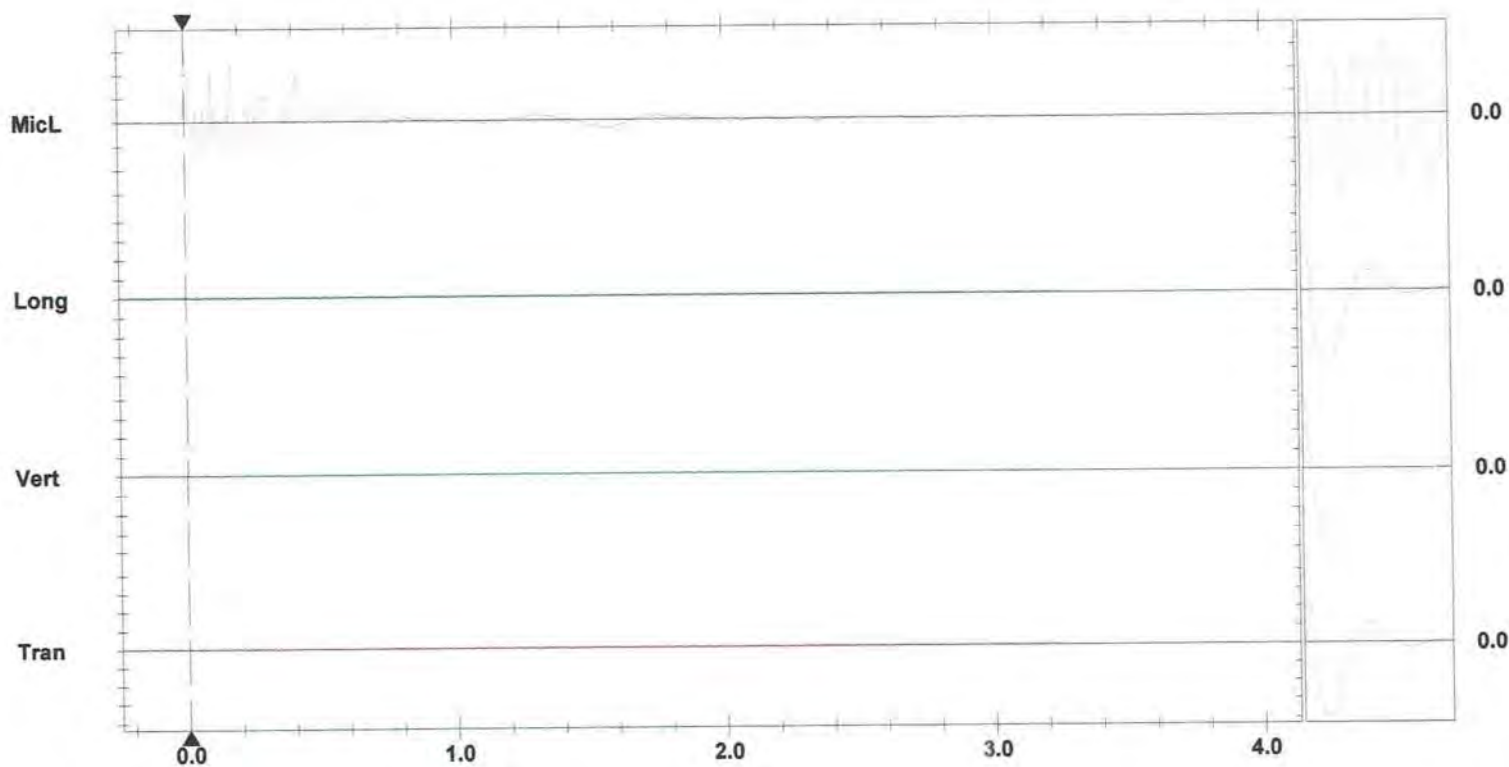
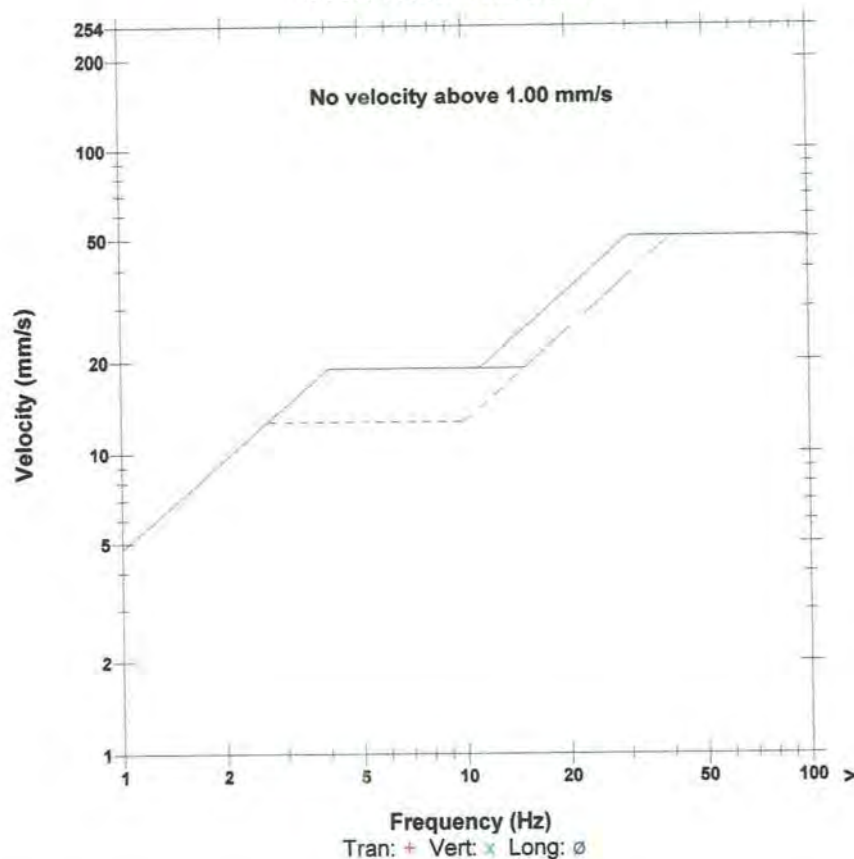
Sand Bagged

Microphone Linear Weighting
PSPL 123.5 dB(L) at 0.004 sec
ZC Freq 20 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 584 mv)

	Tran	Vert	Long	
PPV	0.254	0.508	0.254	mm/s
ZC Freq	>100	47	73	Hz
Time (Rel. to Trig)	0.032	0.197	0.037	sec
Peak Acceleration	0.013	0.013	0.027	g
Peak Displacement	0.001	0.002	0.001	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.9	3.7	4.1	

Peak Vector Sum 0.568 mm/s at 0.197 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-10-02

Blast Number: 18-017
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)
GPS Coordinates: 43.40374 °N Latitude 79.88268 °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: 26,093 te
Total Holes Loaded: 48 holes
... including: Dead Holes
... and: 2 Helper Holes
Helper Hole Collar: 60.0 ft avg
Rows Blasted: 4 rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 48 = 3,657.6 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 19 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 29 main body
Bench Height: 74.2 ft avg
Sub-drill: 2.0 ft avg
Hole Depth: 76.2 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg
Material used: .75" Stone

- Design Charge Length -

Front Row: 69.2 ft avg
Main Body: 69.2 ft avg

- Design Charge Weight -

Front Row: 201.8 kg/hole
Main Body: 201.8 kg/hole
Max Chge Wt / delay: 250.0 kg/delay

Required kg Loaded: 12,533 kg
Rock Density: 2.65 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.480 kg/te (actual)
Front row: 0.302 kg/te (theoretical)
Main Body: 0.403 kg/te (theoretical)
"KPI" PF: 0.377 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

Bulk Expl. Required:

CENTRA GOLD 70 kg 12,500

Pkgd Expl. Required:

Boosters Required:

PENTEX 12 (OR EQUIVALENT) kg/u # used kg 0.34 98 33.3

total explosives weight in Blast (kg): 12,533

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

UNITRONIC 600 6M ms # req'd 80

UNITRONIC 600 15M 66

UNITRONIC 600 25M 54

UNITRONIC 600 30M 36

Cord & Access. Req'd:

WIRE DUPLEX (6 PACK) 400M U of M # req'd 1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

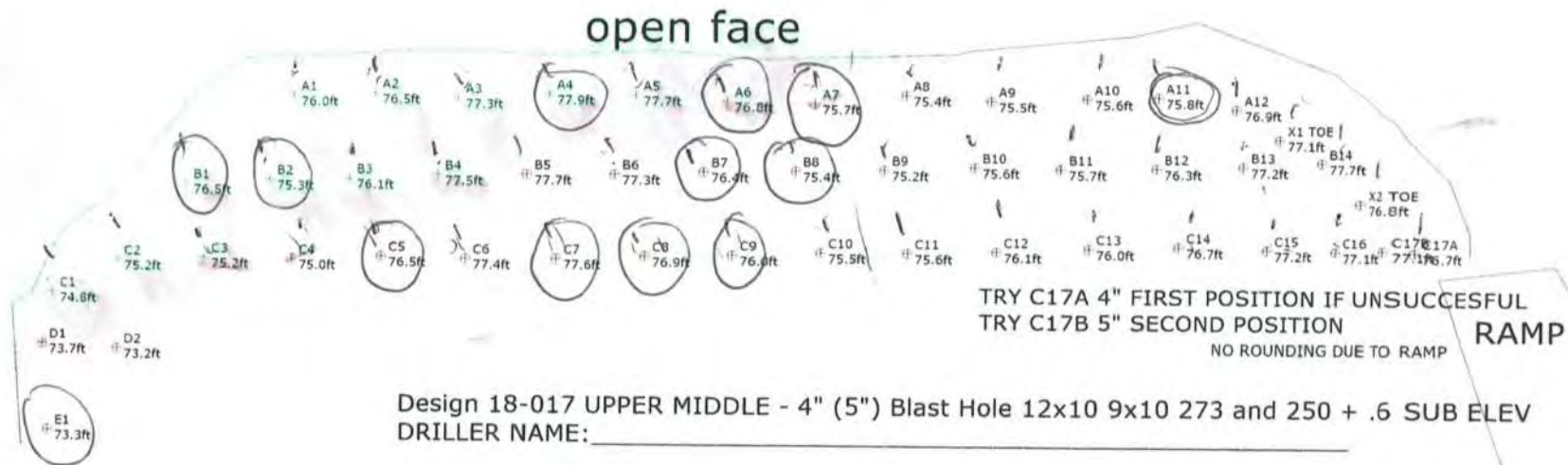
Services Req'd:

GPS LAYOUT	Enter hours	0.0
BULK TRUCK CHARGE	<2,000kg	
BLASTER HOURS	Enter Blaster hours	
HELPER HOURS	Enter total Helper man-hours	
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0
BORETRACK	Enter hours	0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Subdrill: 2.0ft Stemming: 6.0ft
 1st row burden: 12.1ft Hole Diameter: 4.0in Number of holes: 49 Hole angle: 0.0°
 Total drilled: 3733.8ft



Scale 1:250

SHOTPlus 5.7.0.8	9/5/2018
Mine	Burlington
Location	UPPER MIDDLE NO ROUNDING ON NORTH
Title/author	Design 18-017 UPPER MIDDLE
Filename	



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-11-01

Blast Number: 18-019

Orica Order #: 2407202

Blast Time: 11:57 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40371 °N Latitude 79.88251 °W Longitude
Centre of Blast Centre of Blast

Wind from the: at 0 kph Temperature: 6 to 10 °C

Clear:

Rain: X

Overcast: X

Partly Cloudy:

Snow:

Inversion:

Ceiling 7.842 ft

- Drilling Information -

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0° # Holes: 44 = 3,319.4 ft (4 " diam)
Secondary Bit diam: 114.3 mm 0° # Holes: 6 = 452.6 ft (4 1/2 " diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,970	22,720	11,250

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	132	44.9

total explosives weight in Blast (kg): 11,295

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			49
UNITRONIC 600 15M			10
UNITRONIC 600 20M			7
UNITRONIC 600 25M			66

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	5

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	1.0
BULK TRUCK CHARGE	>=10,000 kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	15.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	1.0

Tonnes Blasted: 27,342 te 10,516 m3
Total tonnes per day: 27,342 te NB80-01 Rate Code
Total Holes Loaded: 50 holes
... including: Dead Holes
... and: 1 Helper Holes
Helper Hole Collar: 60.0 ft avg
Rows Blasted: 5 rows

- Pattern (Front Row)-

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 22 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 28 main body

Bench Height: 73.4 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 75.4 ft avg

- Stone Decking -

Front Row: 8.0 ft avg

Main Body: 8.0 ft avg

Decks: 16 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75' Stone

- Charge Length -

Front Row: 60.4 ft avg

Main Body: 60.4 ft avg

- Charge Weight -

Front Row: 176.2 kg/hole

Main Body: 176.2 kg/hole

Max. per delay: 288.0 kg/delay

SD () Equation: 160.6 kg/delay

Total kg Loaded: 11,295 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.413 kg/te (actual)

Front row: 0.272 kg/te (theoretical)

Main Body: 0.362 kg/te (theoretical)

"KPI" PF: 0.344 kg/te (theoretical)

1.810 lb/yd³

1.190 lb/yd³

1.587 lb/yd³

1.508 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

3 Helper due to the amount of voids found on the drill log.

16 Stone decks in total



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-11-01

Blast Number: 18-019
Orica Order #: 2407202
Blast Time: 11:57 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40371	79.88251
Front Row Corner	43.40391	79.88264
Back Row Corner	43.40352	79.88237
Average (Centre of Blast)	43.40371	79.88251

(N) Radians	(W) Radians
0.757538	1.394213
0.757541	1.394215
0.757534	1.394210
0.757538	1.394213

1st Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40245	79.87814
2nd Reading		
Average	43.40245	79.87814
Distance (1st Seis. From Centre of Blast)	380.2	m
Post Blast Data:	ppV: 5.7	mm/s
	frequency: 11.3	Hz
	air overpressure: 116.3	dB
2450 2nd Line		

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.40605	79.89400
2nd Reading		
Average	43.40605	79.89400
Distance (2nd Seis. From Centre of Blast)	965.3	m
Post Blast Data:	ppV: 0.3	mm/s
	frequency: 12.2	Hz
	air overpressure: 118.8	dB
Coling rd & Blind Line (Bruce Trail)		

(N) Radians	(W) Radians
0.757578	1.394413
0.757578	1.394413

3rd Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
1st Reading	43.39339	79.88880
2nd Reading		
Average	43.39339	79.88880
Distance (3rd Seis. From Centre of Blast)	1257.1	m
Post Blast Data:	ppV: 1.8	mm/s
	frequency: 41.0	Hz
	air overpressure: 114.2	dB
South West Corner of Property		

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(380.2)^2}{30^2} \text{ kg}$$

$$= \frac{144,552}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 161 kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 10/23/2018

Blast Number: 18-019
Orica Order #: 2407202

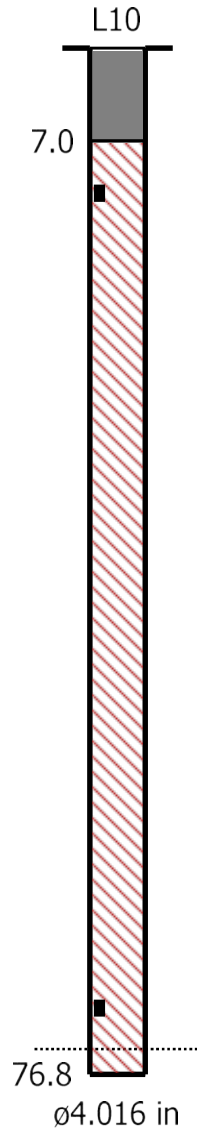
page 2

Paste ShotPlus Diagram inside Rectangle:



UNI Tronic (?)ms 20ft
PENTEX BC 12 * 340 x1

UNI Tronic (?)ms 98ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Bill White

Signature required, indicating
sign off on Blast Design.

Date/Time MicL at 11:57:30 November 1, 2018
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.357 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/COLLING RD_BURLINGTO.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.6 Volts
Unit Calibration February 14, 2018 by Instantel
File Name UM6857_20181101115730.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

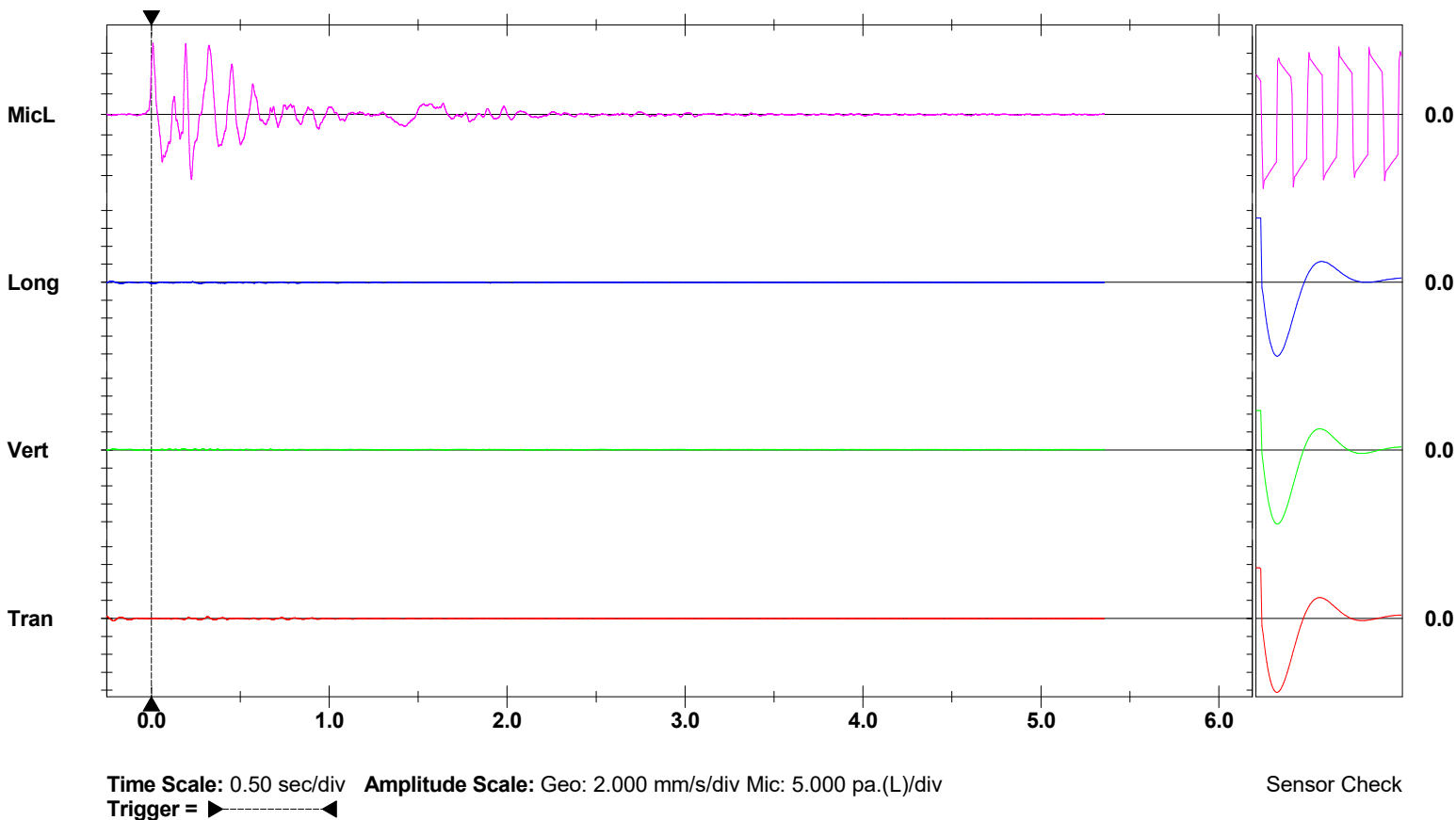
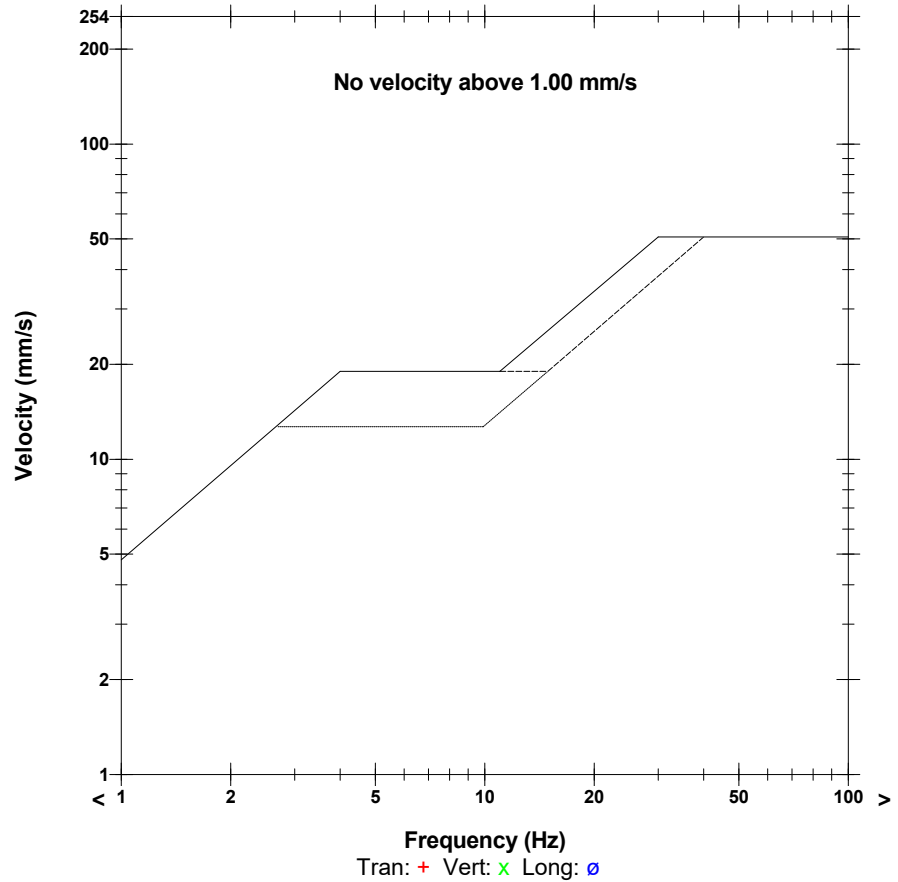
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 118.8 dB(L) at 0.010 sec
ZC Freq 5.7 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1551 mv)

	Tran	Vert	Long	
PPV	0.284	0.166	0.181	mm/s
ZC Freq	12.2	17.7	7.5	Hz
Time (Rel. to Trig)	-0.209	0.292	0.275	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.004	0.023	0.018	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.5	3.5	3.5	

Peak Vector Sum 0.299 mm/s at -0.209 sec

USBM RI8507 And OSMRE



Date/Time Long at 11:57:29 November 1, 2018
Trigger Source Geo: 1.500 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 2048 sps
Operator/Setup: ORICA CANADA/Nelson 2450 2nd.MMB

Serial Number UM9119 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration December 7, 2017 by InstanTEL
File Name UM9119_20181101115729.IDFW

Notes

Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

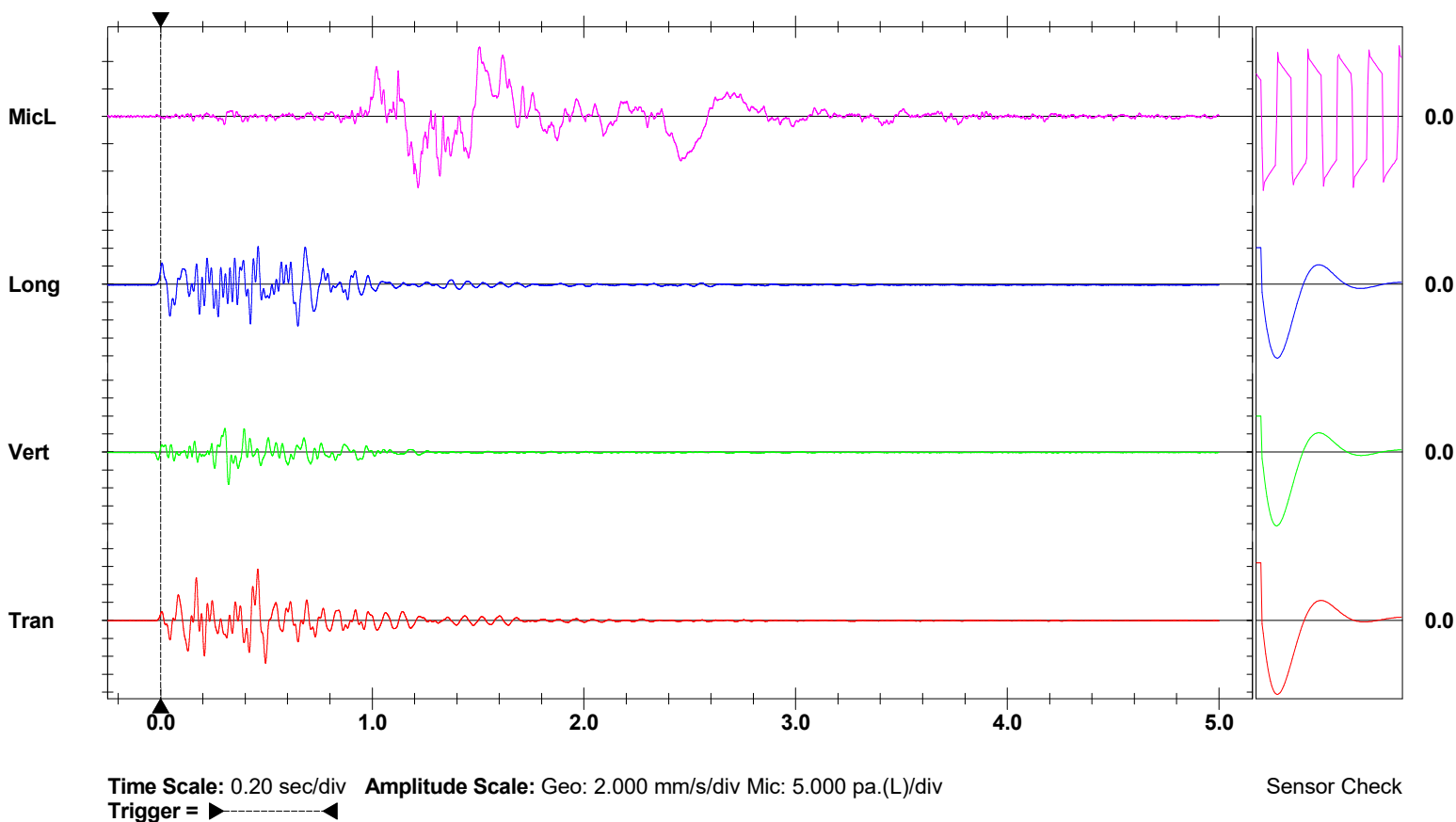
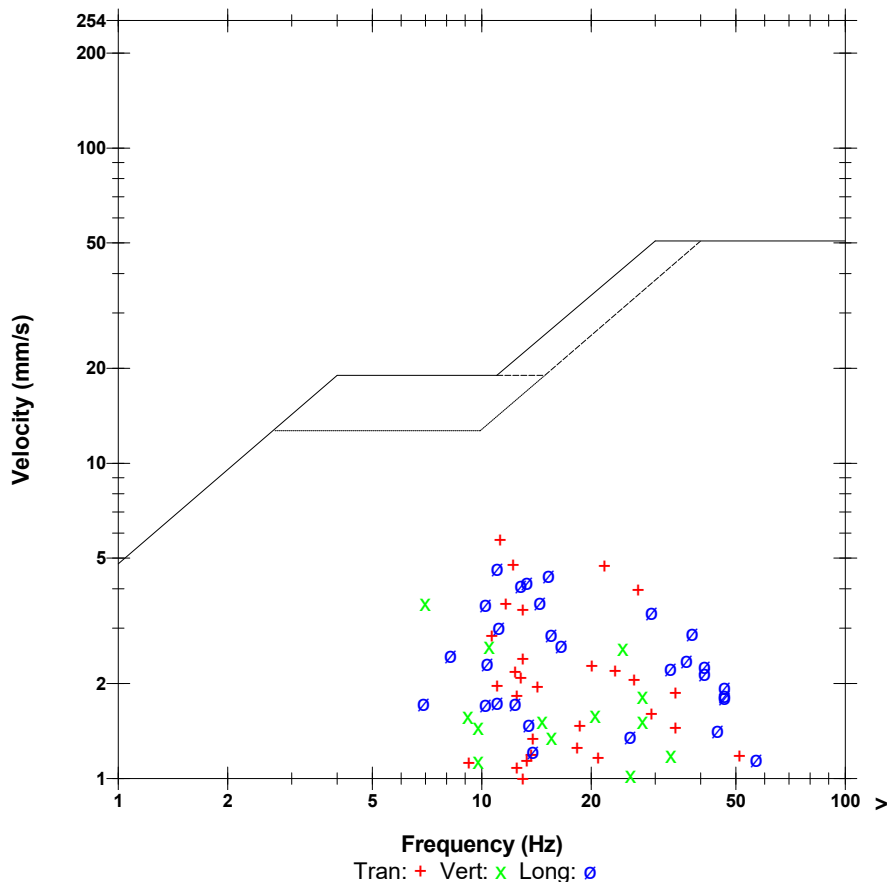
43.40245,-79.87814
 Sand Bagged

Microphone Linear Weighting
PSPL 116.3 dB(L) at 1.216 sec
ZC Freq 4.1 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 1547 mv)

	Tran	Vert	Long	
PPV	5.714	3.618	4.658	mm/s
ZC Freq	11.3	7.0	11.0	Hz
Time (Rel. to Trig)	0.459	0.321	0.648	sec
Peak Acceleration	0.092	0.066	0.123	g
Peak Displacement	0.068	0.049	0.055	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.5	7.3	Hz
Overswing Ratio	3.7	3.8	3.8	

Peak Vector Sum 7.029 mm/s at 0.460 sec

USBM RI8507 And OSMRE



Date/Time Long at 11:57:29 November 1, 2018
Trigger Source Geo: 1.500 mm/s, Mic: 121.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.024 sec (Auto=4Sec) at 2048 sps
Operator/Setup: Operator/Nelsons SW.mmb

Serial Number UM6859 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration December 22, 2017 by InstanTel
File Name UM6859_20181101115729.IDFW

Notes

Location: SouthWest Corner of Quarry
Client: Nelsons Burlington
User Name: Orica Canada Inc.
General: Monitoring Vibration and Airblast

Extended Notes

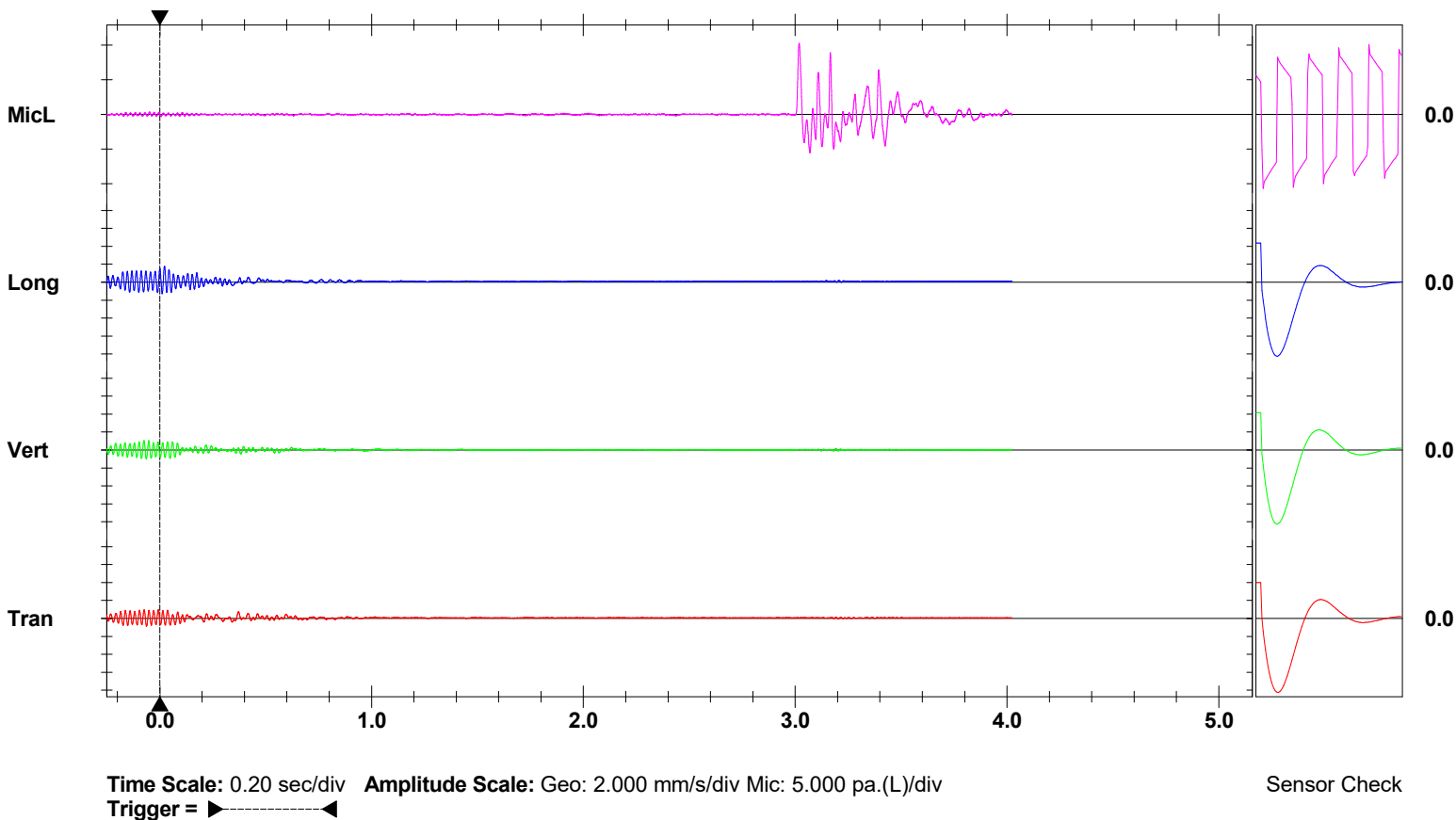
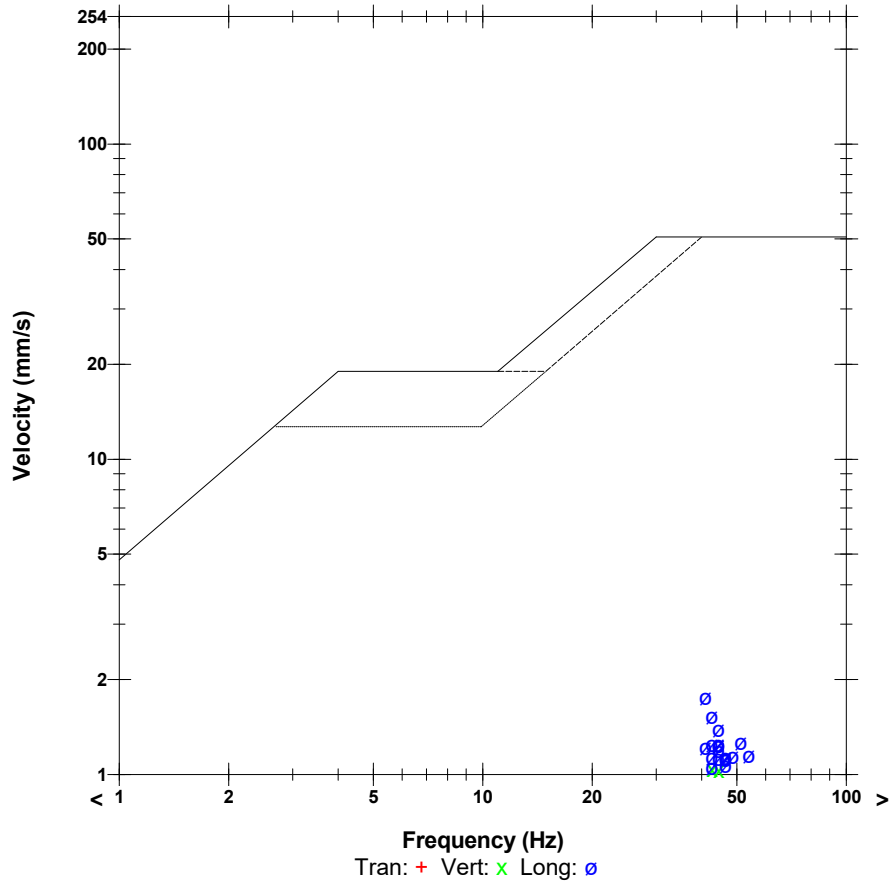
N 43.39339
 W 79.88880

Microphone Linear Weighting
PSPL 114.2 dB(L) at 3.019 sec
ZC Freq 17.1 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1525 mv)

	Tran	Vert	Long	
PPV	0.977	1.040	1.766	mm/s
ZC Freq	43	43	41	Hz
Time (Rel. to Trig)	-0.007	-0.052	0.022	sec
Peak Acceleration	0.031	0.038	0.048	g
Peak Displacement	0.060	0.004	0.105	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.1	Hz
Overswing Ratio	3.9	3.6	4.4	

Peak Vector Sum 1.938 mm/s at 0.023 sec

USBM RI8507 And OSMRE



SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.3ft

Spacing: 10.0ft

Subdrill: 2.0ft

Stemming: 7.0ft

1st row burden: 12.1ft

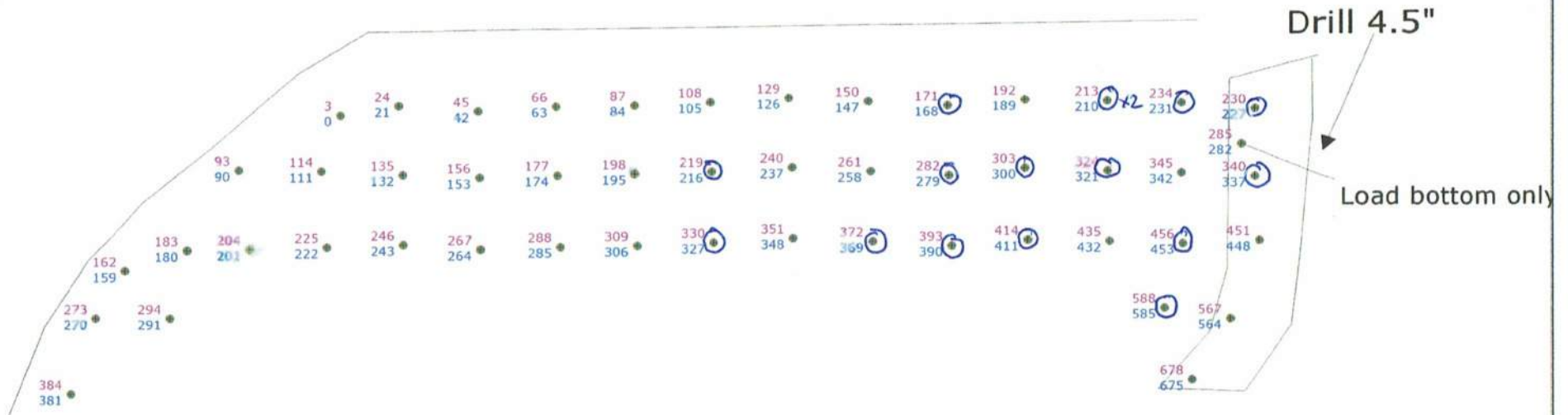
Hole Diameter: 4.0in

Number of holes: 50

Hole angle: 0.0°

Total drilled: 3772.9ft

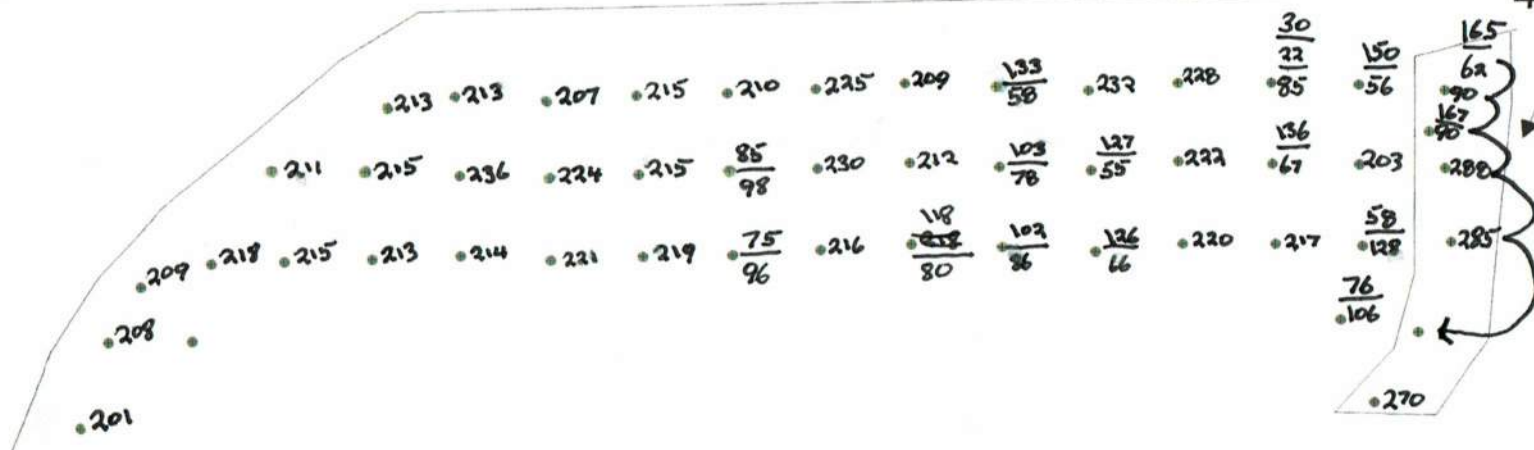
O = DECK



Not to scale

SHOTPlus™ Professional 5.7.3.0	10/31/2018
Mine	Burlington
Location	UPPER MIDDLE SOUTH FACE SCAN Design
Title/author	Design 18-019 UPPER MIDDLE Partial Fnl
Filename	2018-11-02 18-019 Revised Timing Upper Mid

320 Kg
4.5" Hole



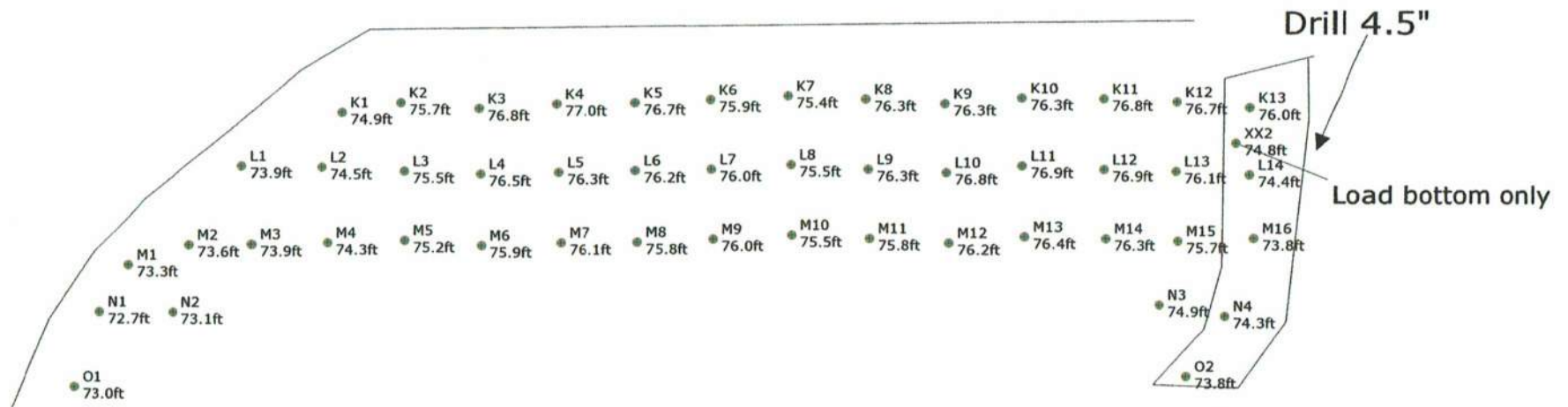
Not to scale

SHOTPlus™ Professional 5.7.3.0		10/29/2018
Mine	Burlington	
Location	UPPER MIDDLE SOUTH FACE SCAN Design	
Title/author	Design 18-019 UPPER MIDDLE Partial Fnl	
Filename	Dessign_18-019_Upper_Middle_Partial_Fnl.tif	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.3ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.1ft	Hole Diameter: 4.0in	Number of holes: 50	Hole angle: 0.0°
Total drilled: 3772.9ft			



Not to scale

SHOTPlus™ Professional 5.7.3.0		11/1/2018
Mine	Burlington	
Location	UPPER MIDDLE SOUTH FACE SCAN Design	
Title/author	Design 18-019 UPPER MIDDLE Partial Fnl	
Filename	2018-11-02 18-019 Revised Timing Upper Mid	

SHOTPlus 5 Plan

Blast Summary Data

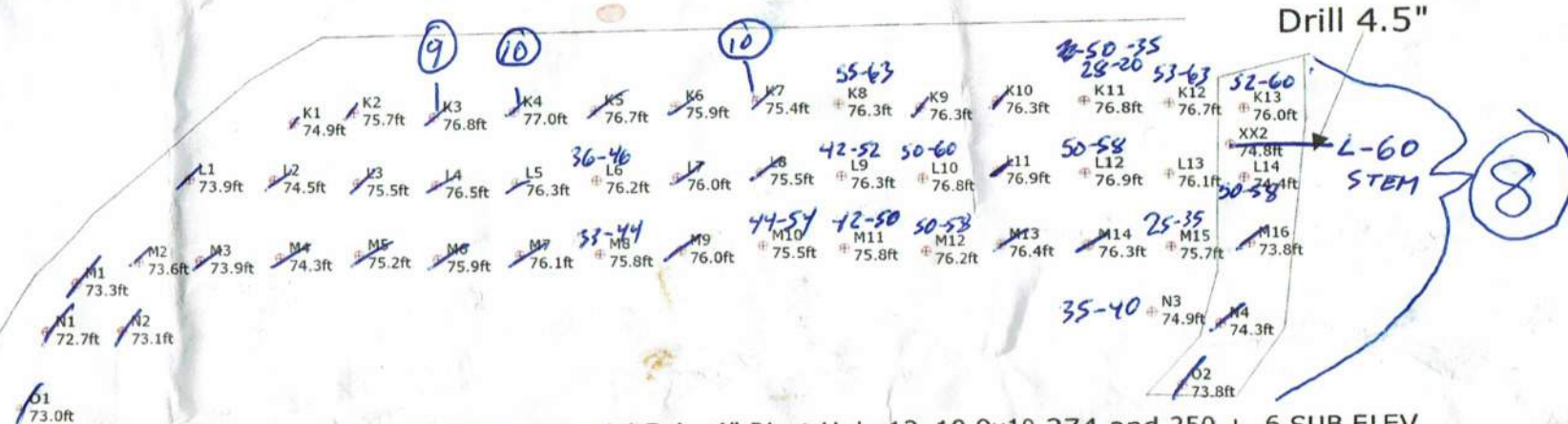
Burden: 9.3ft
1st row burden: 12.1ft
Total drilled: 3772.9ft

Spacing: 10.0ft
Hole Diameter: 4.0in

Subdrill: 2.0ft
Number of holes: 50

Stemming: 7.0ft
Hole angle: 0.0°

16 DECKS



Design 18-019 UPPER MIDDLE Partial Fnl - 4" Blast Hole 12x10 9x10 274 and 250 + .6 SUB ELEV
DRILLER NAME: _____



Not to scale

SHOTPlus™ Professional 5.7.3.0		10/23/2018
Mine	Burlington	
Location	UPPER MIDDLE SOUTH FACE SCAN Design	
Title/author	Design 18-019 UPPER MIDDLE Partial Fnl	
Filename	Dessign_18-019_Upper_Middle_Partial_Fnl.spf	

1091137

COMBINATION SHORT FORM STRAIGHT BILL OF LADING-EXPRESS SHIPPING CONTRACT ADOPTED BY RAIL FREIGHT AND EXPRESS CARRIERS SUBJECT TO THE JURISDICTION OF THE NATIONAL TRANSPORT AGENCY.
FORMULE COMBINÉE ET ABRÉGÉE DE CONNAISSANCEMENT NOMINATIF ET CONTRAT DE TRANSPORT DE MESSAGERIES
SOUS RÉSERVE DE LA JURISDICTION DE L'OFFICE DES TRANSPORTS.

Bill of Lading / Connaissancement



Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY
033411 SIDE ROAD 21-22
GRAND VALLEY ON
CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY
BURLINGTON ON
CA L7R 4L8

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉETIME OUT
HEURE SORTIEORDER NUMBER
N° DE COMMANDEB/L NUMBER
N° DE CONNAISSANCEMENT

2407202

86185300

REPRINT

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR	CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT
01 Nov 2018	00:00:00	NELSON AGGREGATE COMPANY	n/a
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON	SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE
01 Nov 2018	FOB Dest'n, Own Truck	F-73289	PT 15013
SHIP VIA TRANSPORTEUR	ROUTING ITINÉRAIRE	MAG. LIC. NO. N° DE PERMIS	

Orica Truck

QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
245	PC	X	113	132	PENTEX BC 340 (49/CS)	5	89.425
2	PC		1	1	Harness Wire Duplex (6 pack) 400m	1	5.840
160	PC	X	111	49	*uni tronic 600-06.0M CU/ZC(20')80PC	2	11.680
132	PC	X	122	10	*uni tronic 600-15M C/Z SPL(50')66PC	2	22.572
108	PC	X	118	42.66	*uni tronic 600-25M CU/ZC SPL(80')54P	2	26.352
100	PC		95	5	MINI STEM PLUGS - PART #74853		0.700
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
66	PC	X	59	7	*uni tronic 600-20M CU/ZC SPL(65')66P	1	13.464
TOTAL GROSS WEIGHT							170.033 KG
**** TOTAL PACKAGES ****						13	
GHS/WHMIS SDS documents available Website: www.oricaminingservices.com Email: sds.na@orica.com Phone: 1-855-26-ORICA (1-855-266-7422)							

24 HOUR NUMBER 1-613-996-6666

PALETS RETURNED / PALETTES RETOURNÉES

BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO/24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMERO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À NO DE CONNAISSANCEMENT D'ORICA:
ERAP 2-1510	1-877-561-3636	YES / OUI NO / NON	Orica Canada Inc. 301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORTATION AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÉGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE	NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
Ryan Benham	Ryan Benham	
SIGNATURE	SIGNATURE	SIGNATURE
DATE	DATE	DATE
01/11/18	01/11/18	
D/J M/M Y/A	D/J M/M Y/A	D/J M/M Y/A

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNÉ LA COPIE ORIGINALE (1) DU CONNAISSANCEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉES AU VERSO

**** PAGE 2 OF 2 ****

D.F.G. S7772



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2018-10-23

Blast Number: 18-019
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)
GPS Coordinates: 43.40371 °N Latitude 79.88251 °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: 27,342 te
Total Holes Loaded: 50 holes
... including: Dead Holes
... and: 1 Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 5 rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 44 = 3,319.4 ft (4 " diam)
Secondary Bit diam: 114.3 mm 0° # Holes: 6 = 452.6 ft (4 1/2 " diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

- Design Pattern (Front Row)-

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 22 front row

- Design Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 28 main body

Bench Height: 73.4 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 75.4 ft avg

- Design Stone Decking -

Front Row: ft avg

Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Material

- Design Charge Length -

Front Row: 68.4 ft avg

Main Body: 68.4 ft avg

- Design Charge Weight -

Front Row: 199.6 kg/hole

Main Body: 199.6 kg/hole

Max Chge Wt / delay: 220.0 kg/delay

Required kg Loaded: 12,234 kg

Rock Density: 2.60 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.447 kg/te (actual)

Front row: 0.308 kg/te (theoretical)

Main Body: 0.410 kg/te (theoretical)

"KPI" PF: 0.390 kg/te (theoretical)

1.348 lb/yd³

1.797 lb/yd³

1.707 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

Bulk Expl. Required:

kg

12,200

Pkgd Expl. Required:

kg

Boosters Required:

kg/u # used kg

PENTEX 12 (OR EQUIVALENT) 0.34 100 34.0

total explosives weight in Blast (kg): 12,234

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

ms # req'd

UNITRONIC 600 6M 60

UNITRONIC 600 15M 66

UNITRONIC 600 25M 54

Cord & Access. Req'd:

U of M # req'd

units

units

units

Resource Deployment:

of Blasts today (this Quarry) 1

of Blasters (this Blast) 1

of Helpers (this Blast) Note Exception 2

of MMU's (this Blast) 1

Services Req'd:

GPS LAYOUT Enter hours 0.0

BULK TRUCK CHARGE <2,000kg

BLASTER HOURS Enter Blaster hours 0.0

HELPER HOURS Enter total Helper man-hours 0.0

SEISMOGRAPH RENTAL Enter # Orica Seismographs 0

3D LASER PROFILE Enter hours 0

BORETRACK Enter hours 0

TECHNICAL BLAST DESIGN (per day) Enter # of days 0.0

Blast Summary Data

Burden: 9.3ft

Spacing: 10.0ft

Subdrill: 2.0ft

Stemming: 7.0ft

1st row burden: 12.1ft

Hole Diameter: 4.0in

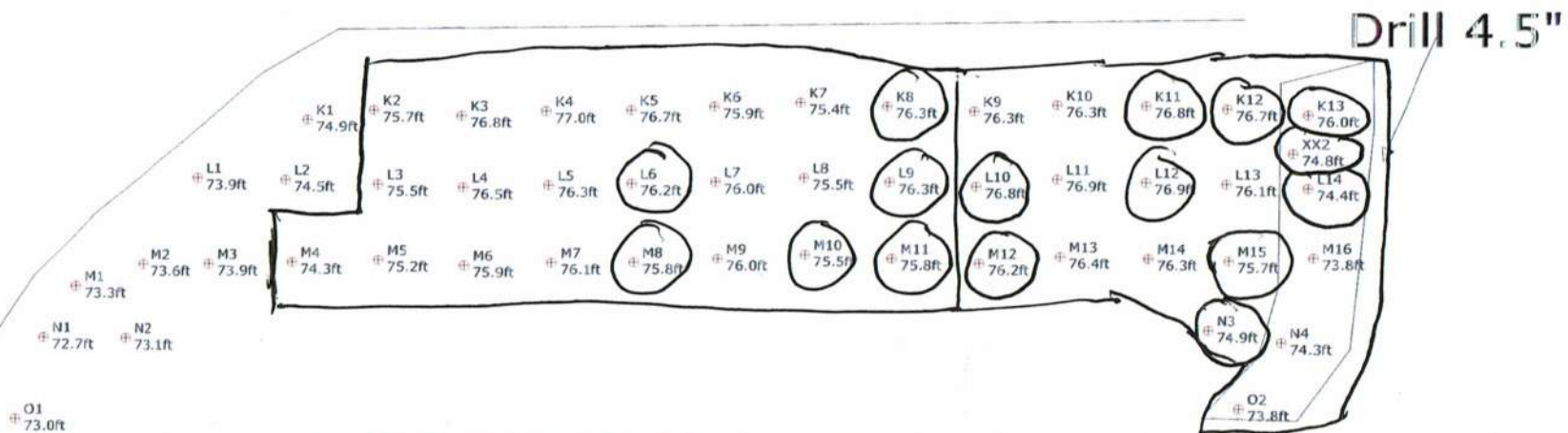
Number of holes: 50

Hole angle: 0.0°

Total drilled: 3772.9ft

4" dia = 3326"

4½" dia = 4471"



Design 18-019 UPPER MIDDLE Partial Fnl - 4" Blast Hole 12x10 9x10 274 and 250 +
 DRILLER NAME: _____



Not to scale

SHOTPlus™ Professional 5.7.4.19	11/10/2018
Mine	Burlington
Location	UPPER MIDDLE SOUTH FACE SCAN I
Title/author	Design 18-019 UPPER MIDDLE Partia
Filename	Dessign_18-019_Upper_Middle_Partia



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2018-11-08

Blast Number: 18-020

Orica Order #: 2410149

Blast Time: 11:57 AM

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40437 °N Latitude 79.88535 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 5 kph Temperature: 1 to 5 °C

Clear:

Rain:

Overcast: X

Partly Cloudy:

Snow:

Inversion:

Ceiling 3,758 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 251 = 2,756.0 ft (4 " diam)
Secondary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	25,140	22,650	2,490

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	251	85.3

total explosives weight in Blast (kg): 2,575

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
EXEL HANDIDET 9m		25/500	251
CONNECTADET 9M		25 ms	18
CONNECTADET 9M		42 ms	23
UNITRONIC 600 6M			2

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	0
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	3
# of MMU's (this Blast)		1

Services:

GPS LAYOUT	Enter hours	2.5
BULK TRUCK CHARGE	>=2,000kg <5,000kg	1
BLASTER HOURS	Enter Blaster hours	7.0
HELPER HOURS	Enter total Helper man-hours	18.0
SEISMOGRAPH RENTAL	Enter # Orica Seismographs	0
3D LASER PROFILE	Enter hours	0.0
BORETRACK	Enter hours	0.0
TECHNICAL BLAST DESIGN	(per day) Enter # of days	0.0

Tonnes Blasted:	24,552 te	9,443 m3
Total tonnes per day:	24,552 te	NF-14 Rate Code
Total Holes Loaded:	251 holes	
... including:	Dead Holes	
... and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	12 rows	

- Pattern (Front Row) -

Burden: 11.0 ft avg

Spacing: 11.0 ft avg

Holes: 21 front row

- Pattern (Main Body) -

Burden: 11.0 ft avg

Spacing: 11.0 ft avg

Holes: 230 main body

Bench Height: 11.0 ft avg

Sub-drill: 0.0 ft avg

Hole Depth: 11.0 ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Decks: per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: .75" Stone

- Charge Length -

Front Row: 4.0 ft avg

Main Body: 4.0 ft avg

- Charge Weight -

Front Row: 11.6 kg/hole

Main Body: 11.6 kg/hole

Max. per delay: 21.0 kg/delay

SD () Equation: 429.0 kg/delay

Total kg Loaded: 2,575 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.105 kg/te (actual)

Front row: 0.119 kg/te (theoretical)

Main Body: 0.119 kg/te (theoretical)

"KPI" PF: 0.119 kg/te (theoretical)

0.460 lb/yd³

0.520 lb/yd³

0.520 lb/yd³

0.520 lb/yd³

Cost Reduction Notes (this Blast) - change in Bit , B , S , Expl or IS from previous Blast:

1 Extra helper due to the number of holes

1 Advanced Blast design



Blast Report

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 2018-11-08

Blast Number: 18-020
Orica Order #: 2410149
Blast Time: 11:57 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.
Mid Blast	43.40442	79.88533
Front Row Corner	43.40454	79.88495
Back Row Corner	43.40417	79.88577
Average (Centre of Blast)	43.40437	79.88535

(N) Radians	(W) Radians
0.757550	1.394262
0.757552	1.394255
0.757546	1.394270
0.757549	1.394262

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.40245	79.87814
	2nd Reading		
	Average	43.40245	79.87814
	Distance (1st Seis. From Centre of Blast)	621.4	m
	Post Blast Data:		
	ppV:	2.0	mm/s
	frequency:	43.0	Hz
	air overpressure:	110.4	dB
	2450 2nd Line (Beside cut tree stump in front yard)		

(N) Radians	(W) Radians
0.757516	1.394137
0.757516	1.394137

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading	43.39339	79.88880
	2nd Reading		
	Average	43.39339	79.88880
	Distance (2nd Seis. From Centre of Blast)	1254.2	m
	Post Blast Data:		
	ppV:	Did	mm/s
	frequency:	Not	Hz
	air overpressure:	Trigger	dB
	South West Corner of Property		

(N) Radians	(W) Radians
0.757358	1.394323
0.757358	1.394323

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.
	1st Reading		
	2nd Reading		
	Average	0.00000	0.00000
	Distance (3rd Seis. From Centre of Blast)	0.0	m
	Post Blast Data:		
	ppV:	0.0	mm/s
	frequency:	0.0	Hz
	air overpressure:	0.0	dB

(N) Radians	(W) Radians
0.000000	0.000000

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$W = \frac{D^2}{30^2}$$

$$= \frac{(621.4)^2}{30^2} \text{ kg}$$

$$= \frac{386,138}{900} \text{ kg}$$

Maximum Indicated Charge Weight per Delay = 429 kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

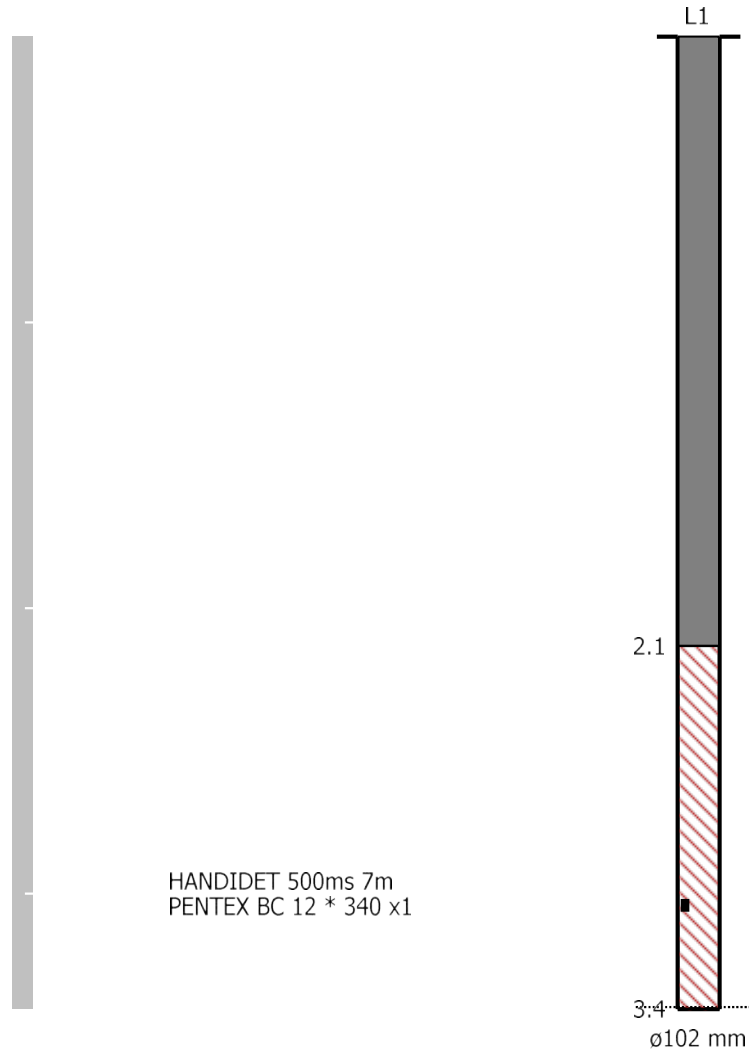
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 11/8/2018

Blast Number: 18-020
Orica Order #: 2410149

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Signature required, indicating
sign off on Blast Design.

Date/Time Vert at 12:57:15 November 8, 2018
Trigger Source Geo: 1.500 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.0 sec at 2048 sps
Operator/Setup: ORICA CANADA/Nelson 2450 2nd.mmb

Serial Number UM9119 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration December 7, 2017 by InstanTEL
File Name UM9119_20181108125715.IDFW

Notes

Location: 2450 2nd Line
Client: Nelson Aggregates
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

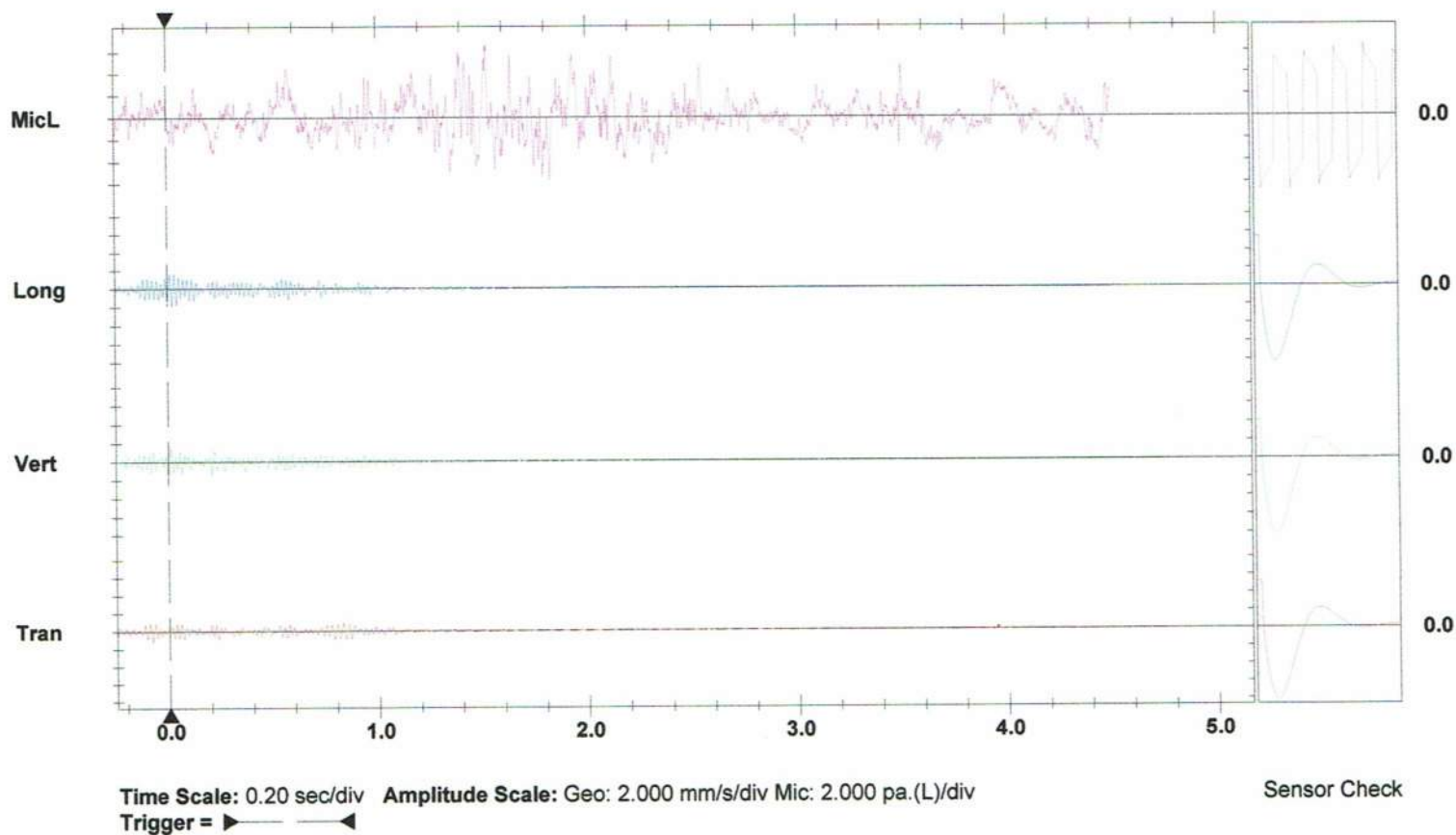
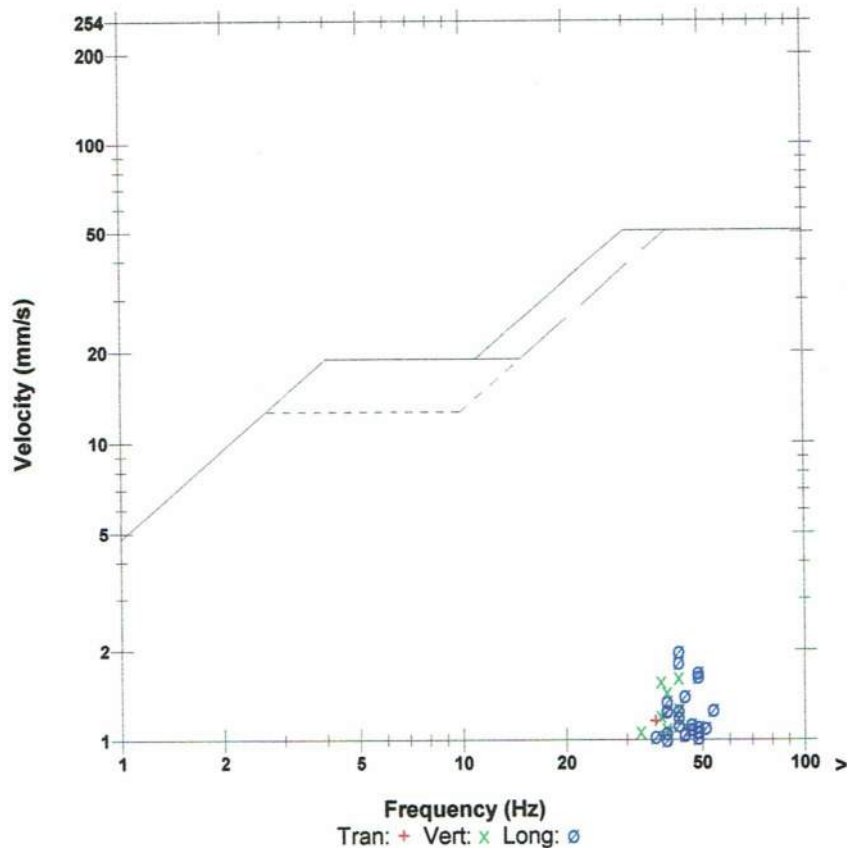
43.40245,-79.87814
 Sand Bagged

Microphone Linear Weighting
PSPL 110.4 dB(L) at 1.525 sec
ZC Freq 14.2 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1585 mv)

	Tran	Vert	Long	
PPV	1.151	1.616	1.978	mm/s
ZC Freq	37	43	43	Hz
Time (Rel. to Trig)	-0.081	0.013	0.022	sec
Peak Acceleration	0.031	0.046	0.089	g
Peak Displacement	0.005	0.008	0.018	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.3	Hz
Overswing Ratio	3.9	3.9	3.9	

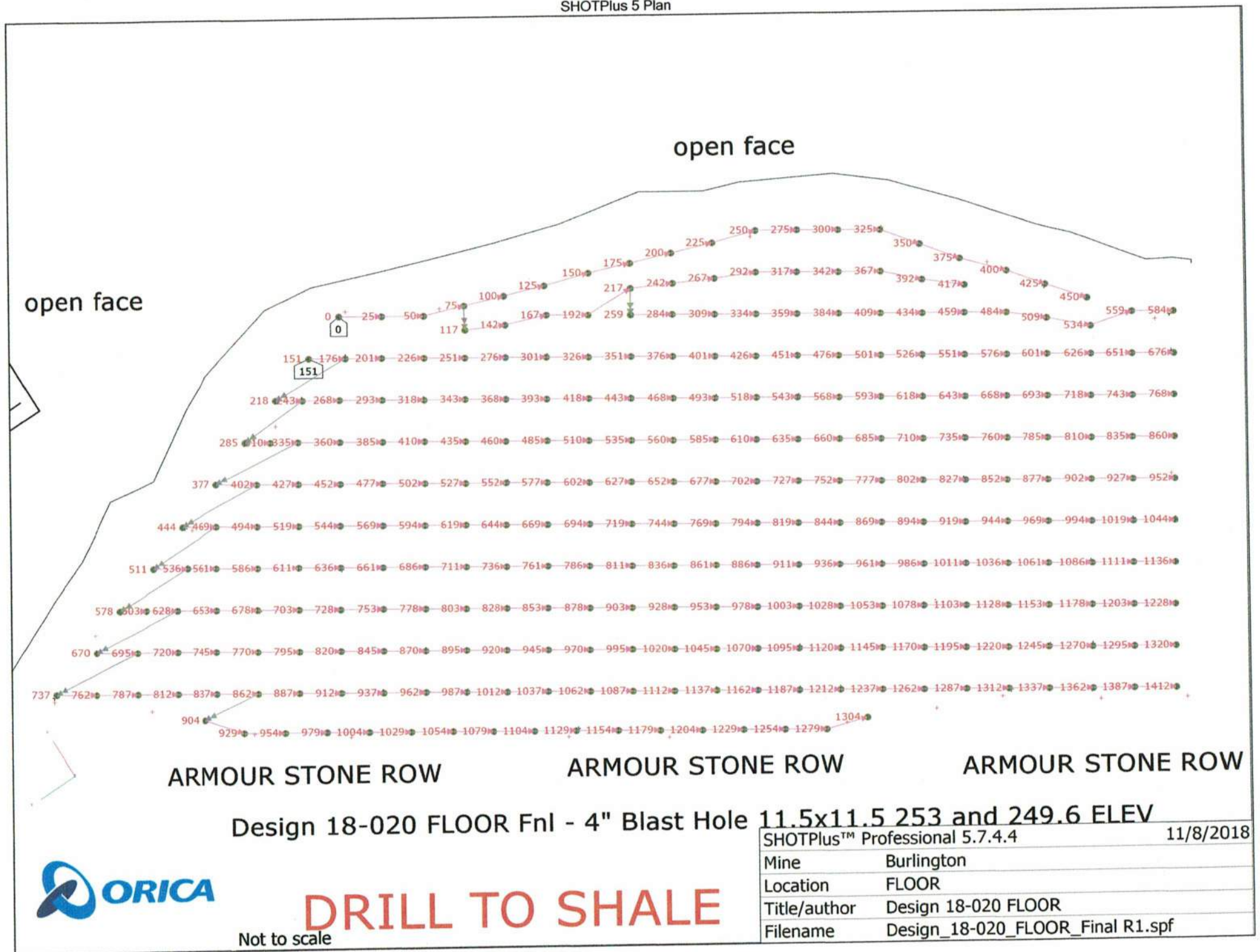
Peak Vector Sum 2.305 mm/s at 0.023 sec

USBM RI8507 And OSMRE



DRILL TO SHALE

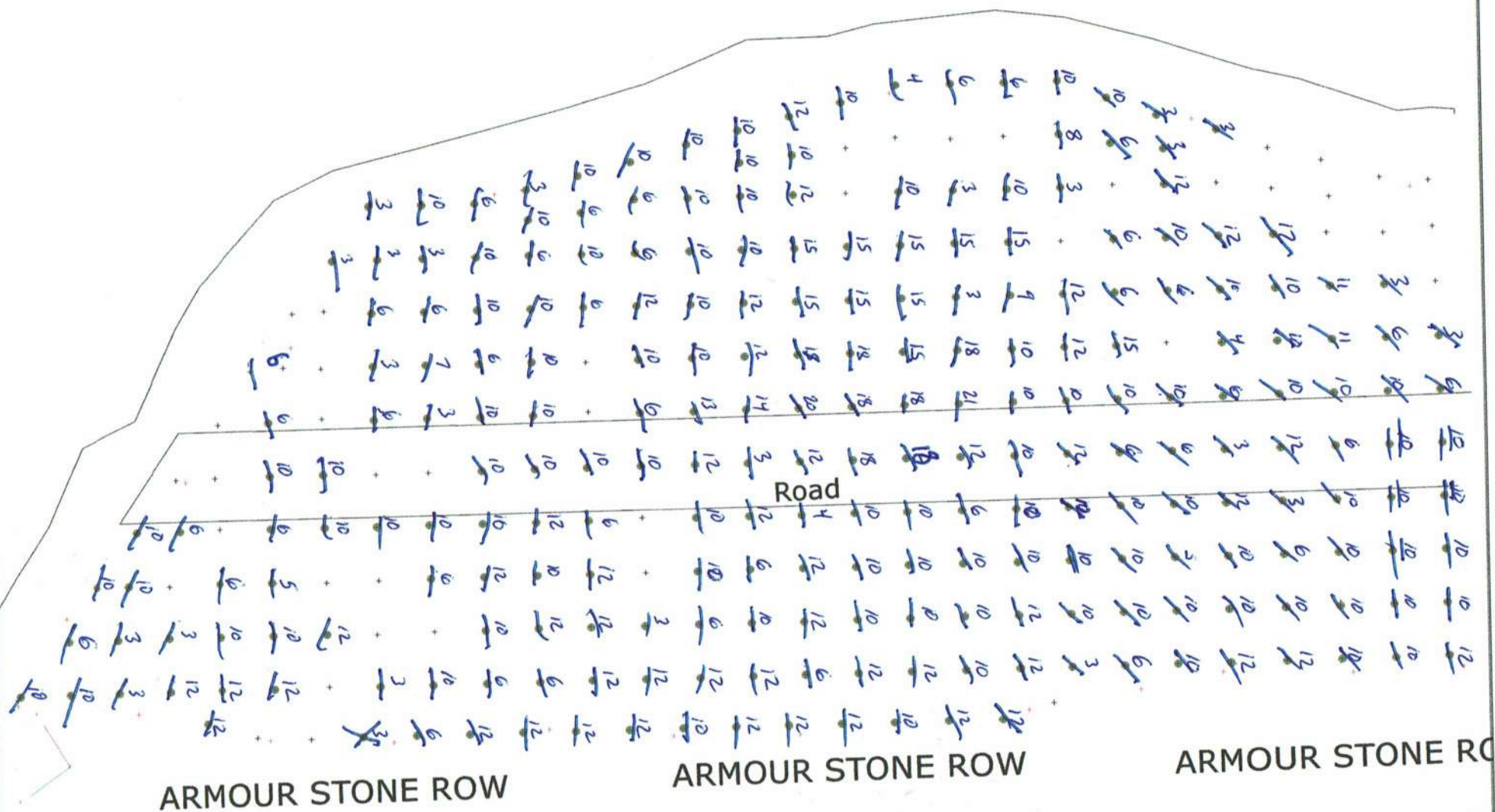
Not to scale



SHOTPlus™ Professional 5.7.4.4		11/8/2018
Mine	Burlington	
Location	FLOOR	
Title/author	Design 18-020 FLOOR	
Filename	Design_18-020_FLOOR_Final R1.spf	

Load sheet

Max Load 21Kg



Not to scale

SHOTPlus™ Professional 5.7.4.4

11/7/2018

Mine Burlington

Location FLOOR

Title/author Design 18-020 FLOOR

Filename Design_18-020_FLOOR_Final.spf

SHOTPlus 5 Plan

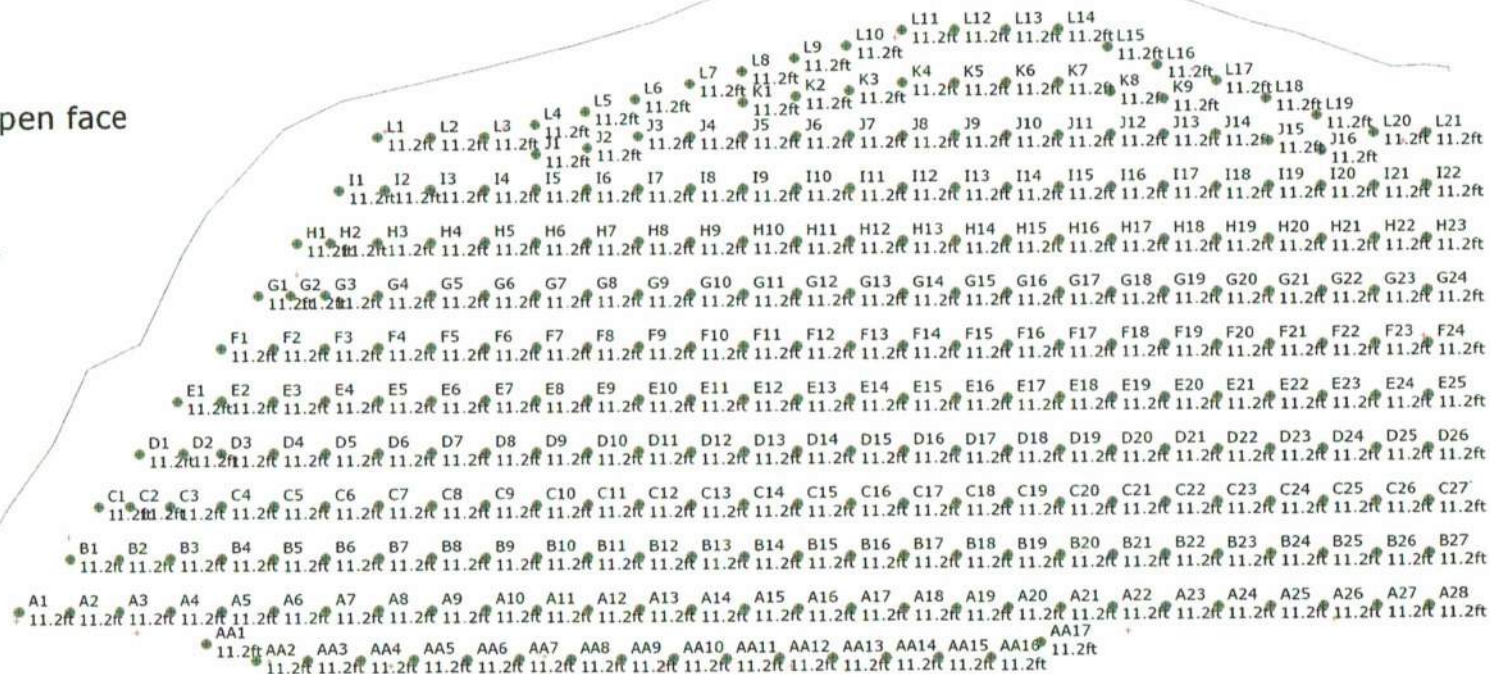
Blast Summary Data

Burden: 11.8ft	Spacing: 11.8ft	Subdrill: 0.0ft	Stemming: 5.6ft
1st row burden: 11.8ft	Hole Diameter: 4.0in	Number of holes: 289	Hole angle: 0.0°
Total drilled: 3228.3ft			

open face

open face

= BILL'S
MARKI
STONES



ARMOUR STONE ROW

ARMOUR STONE ROW

ARMOUR STONE ROW

Design 18-020 FLOOR Fnl - 4" Blast Hole 11.5x11.5 253 and 249.6 ELEV



DRILL TO SHALE

Not to scale

SHOTPlus™ Professional 5.7.3.0	11/1/2018
Mine	Burlington
Location	FLOOR
Title/author	Design 18-020 FLOOR
Filename	Design_18-020_FLOOR_Final.spf

1091195



Orica Canada Inc.

CONSIGNOR
EXPÉDITEUR

GRAND VALLEY

033411 SIDE ROAD 21-22

GRAND VALLEY ON

CA L9W 7G1

CONSIGNEE
CONSIGNATAIRE

NELSON AGGREGATE COMPANY

BURLINGTON ON

CA L7R 4L8

Bill of Lading / Connaissance

GROSS / BRUT

TARE

NET

TIME IN
HEURE D'ENTRÉE

TIME OUT
HEURE SORTIE

ORDER NUMBER
N° DE COMMANDE

B/L NUMBER
N° DE CONNAISSEMENT

2410149

86192440

PAGE 2

DATE REQUIRED DATE REQUISE	TIME REQUIRED HEURE REQUISE	INVOICE TO / BUYER FACTURÉ À / ACHETEUR		CUSTOMER REFERENCE NO. N° DE COMMANDE DU CLIENT			
08 Nov 2018	00:00:00	NELSON AGGREGATE COMPANY		n/a			
DATE SHIPPED EXPÉDIÉ LE	FREIGHT TERMS CONDITIONS DE LIVRAISON		SHIP. MAG. LIC. PERMIS EXPÉDITEUR	VEHICLE NO. N° DE VÉHICULE			
08 Nov 2018	FOB Dest'n, Own Truck		F-73289	PT18230			
SHIP VIA TRANSPORTEUR		ROUTING ITINÉRAIRE		MAG. LIC. NO. N° DE PERMIS			
Orica Truck		STANDARD					
QTY. QTÉ.	UM	DG MD	QTY. RET'D QTÉ. RET.	QTY. SOLD QTÉ. FACT	DESCRIPTION	# OF / DE PKGS.	AMOUNT MONTANT
NET EXPLOSIVES QUANTITY:					117.137 KG		
343	PC	X	92	251	PENTEX BC 340 (49/CS)	7	125.195
1	PC		1	0	Harness Wire Duplex (6 pack) 400m	1	2.920
5	PC	X	3	2	*uni tronic 600-06.0M CU/ZC(20')80PC	1	0.365
100	PC		100	0	MINI STEM PLUGS - PART #74853		0.700
390	PC	X	139	251	EXEL HANDIDET 9M 25/500(30') 65/CS	6	39.390
65	PC	X	47	18	EXEL Connectadet 9M 25MS (30 FT) 65/CS	1	6.305
65	PC	X	42	23	EXEL Connectadet 9M 42MS (30 FT) 65/CS	1	6.370
1	PC				LICENSED BLASTER		
1.0	HR				LABOUR CHARGE		
1	PC				ROG (ROCK ON GROUND)		
TOTAL GROSS WEIGHT							181.245 KG
**** TOTAL PACKAGES ****						17	

24-HOUR NUMBER: 1-613-996-6666

PALLETS USED / PALETTES UTILISÉES

PALLETS RETURNED / PALETTES RETOURNÉES

BAGS USED / SACS UTILISÉS

EMERGENCY RESPONSE PLAN / RÉSUMÉ DE PLAN D'URGENCE	EMERGENCY RESPONSE NO.24 HOUR NUMBER TÉLÉPHONE D'URGENCE/24 HEURE NUMÉRO	PLACARDS OFFERED / PLACARDS OFFERT	FORWARD INVOICE FOR PREPAID FREIGHT QUOTING ORICA B/L TO / FAIRE SUIVRE FACTURE POUR EXPÉDITION PORT PAYÉ EN RÉFÉRANT À N° DE CONNAISSEMENT ORICA:
ERAP 2-1510	1-877-561-3636	YES / OUI NO / NON	301 rue hotel de ville Brownsburg-Chatham, QC J8G 3B5
THIS IS TO CERTIFY THAT THE ABOVE NAMED ARTICLES ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELLED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE NATIONAL TRANSPORT AGENCY AND THE DEPARTMENT OF TRANSPORT. NOUS CERTIFIONS QUE LA CLASSE, LA DESCRIPTION, L'EMBALLAGE, LE MARQUAGE ET L'ÉTIQUETAGE DES MARCHANDISES SUSMENTIONNÉES DE MÊME QUE LES CONDITIONS DE TRANSPORT SONT CONFORMES À LA RÉALITÉ ET AUX RÈGLEMENTS DE L'OFFICE NATIONAL DES TRANSPORTS ET DU MINISTÈRE DES TRANSPORTS.		DECLARED VALUE OF SHIPMENT VALEUR DÉCLARÉE	NETTE No. CONV PRESSAGE WT AGREEMENT NO.

CONSIGNOR / EXPÉDITEUR	CARRIER / TRANSPORTEUR	CONSIGNEE / DESTINATAIRE
GRAND VALLEY	Orica Truck	NELSON AGGREGATE COMPANY
SHIPPER'S NAME (PLEASE PRINT) / NOM D'EXPÉDITEUR	DRIVER'S NAME (PLEASE PRINT) / NOM DU CAMIONNEUR	RECEIVER'S NAME (PLEASE PRINT) / NOM DU RECEVEUR
K. Platt	K. Platt	
SIGNATURE	SIGNATURE	SIGNATURE
K. Platt	K. Platt	
DATE	DATE	DATE
8 11 18	8 11 18	
D/J M/M Y/A	D/J M/M Y/A	D/J M/M Y/A

2 SHIPPING ORDER
BON D'EXPÉDITION

(AGENT MUST DETACH AND RETAIN THIS SHIPPING ORDER AND MUST SIGN THE ORIGINAL BILL OF LADING-EXPRESS SHIPPING CONTRACT)
(L'AGENT DOIT DETACHER ET GARDER CETTE COPIE APRES AVOIR SIGNE LA COPIE ORIGINALE (1) DU CONNAISSEMENT CONTRAT D'EXPÉDITION PAR MESSAGERIES)

SUBJECT TO ALL THE TERMS AND CONDITIONS ON THE BACK
SOUS RÉSERVE DES CONDITIONS ET RESTRICTIONS ÉNUMÉRÉS AU VERSO
**** PAGE 2 OF 3 ****

D.F.G. S7772

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.8ft	Spacing: 11.8ft	Subdrill: 0.0ft	Stemming: 5.6ft
1st row burden: 11.8ft	Hole Diameter: 4.0in	Number of holes: 289	Hole angle: 0.0°
Total drilled: 3228.3ft			

4'-5' Broken material over all holes

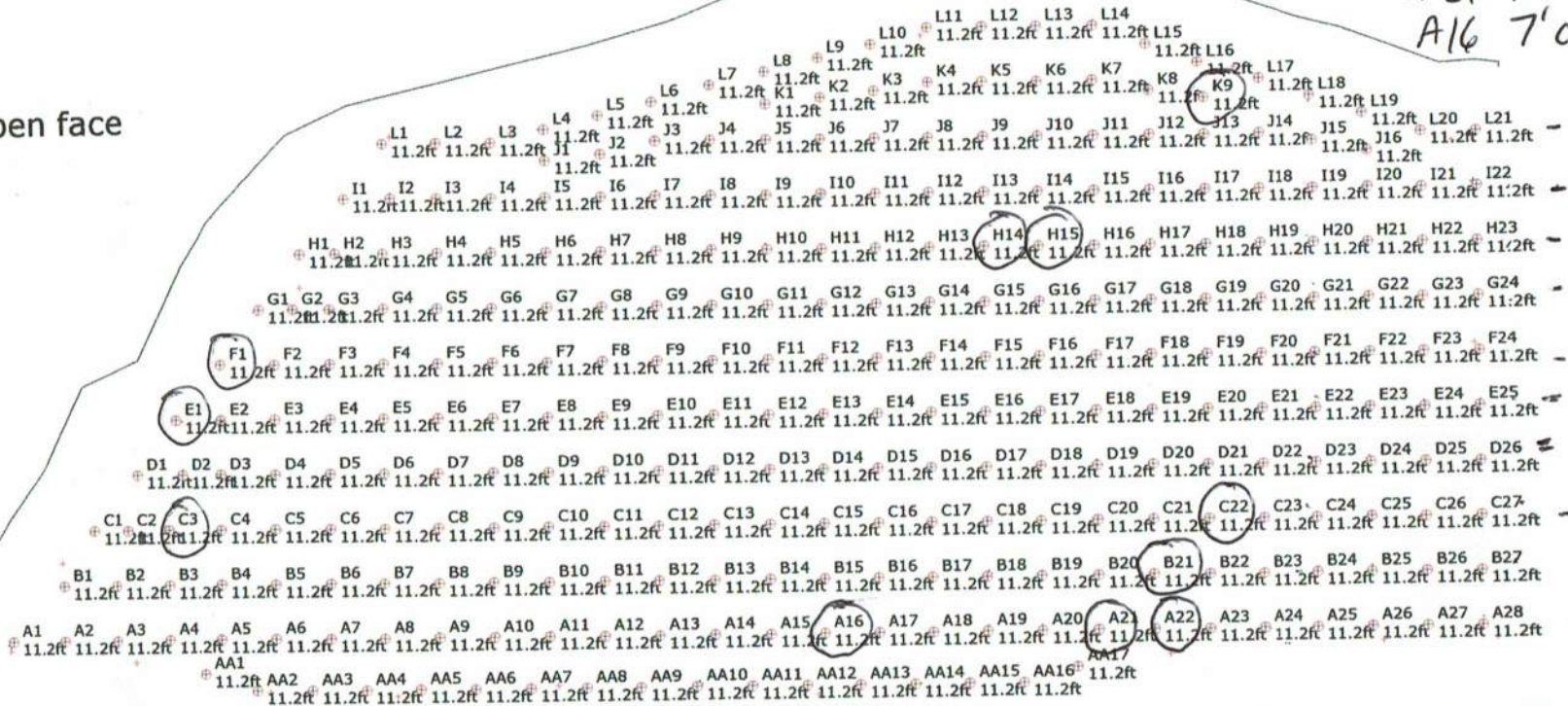
H15 6'0B
H14 6'0B
K9 VOID 7-7.5'
C22 VOID 7.5-8'
C3 NO ROCK
B21 VOID 7-7.5
A22 VOID 7-7.5
A21 NO ROCK
A16 7'0B

open face

open face

= BILL'S
MARKI
STONE

F1 NO ROCK
E1 NO ROCK



ARMOUR STONE ROW

ARMOUR STONE ROW

ARMOUR STONE ROW

Design 18-020 FLOOR Fnl - 4" Blast Hole 11.5x11.5 253 and 249.6 ELEV

DRILL TO SHALE



Not to scale

SHOTPlus™ Professional 5.7.3.0	11/1/2018
Mine	Burlington
Location	FLOOR
Title/author	Design 18-020 FLOOR
Filename	Design_18-020_FLOOR_Final.spf

HOT DIAGRAM

Driller: ONEILL

Blast Num:

Employee:

Depth to shale.

PS Coordinates

GPS LF:

GPS RF:

GPS LR:

GPS RR:

Spacing: Hole Diameter: Total Cubic Meters: Total Tonnes: Total Footage:

Average Hole Depth: Total Holes:

125



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date:

Blast Number: 18-020
Orica Order #:

page 1

Blaster-in-charge: Mike derkinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: enter data on p2 °N Latitude enter data on p2 °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: 28,320 te
Total Holes Loaded: 289 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 12 rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 289 = 3,179.0 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: 11.0 ft avg
Spacing: 11.0 ft avg
Holes: 21 front row

- Design Pattern (Main Body) -

Burden: 11.0 ft avg
Spacing: 11.0 ft avg
Holes: 268 main body
Bench Height: 11.0 ft avg
Sub-drill: 0.0 ft avg
Hole Depth: 11.0 ft avg

- Design Stone Decking -

Front Row: 0.0 ft avg
Main Body: 0.0 ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg

Material used: .75" Stone

- Design Charge Length -

Front Row: 4.0 ft avg
Main Body: 4.0 ft avg

- Design Charge Weight -

Front Row: 11.7 kg/hole
Main Body: 11.7 kg/hole
Max Chge Wt / delay: 16.0 kg/delay

Required kg Loaded: 6,098 kg
Rock Density: 2.60 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.215 kg/te (actual)
0.522 lb/yd³ Front row: 0.119 kg/te (theoretical)
0.522 lb/yd³ Main Body: 0.119 kg/te (theoretical)
0.522 lb/yd³ "KPI" PF: 0.119 kg/te (theoretical)

Cost Reduction Notes (this Blast) - change in Bit , B, S, Expl or IS from previous Blast:

Bulk Expl. Required:

kg

6,000

Pkgd Expl. Required:

kg

Boosters Required:

kg/u # used kg

PENTEX 12 (OR EQUIVALENT) 0.34 289 98.3

total explosives weight in Blast (kg): 6,098

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

ms # req'd

EXEL HANDIDET 9m 25/500 289

Cord & Access. Req'd:

U of M # req'd

WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 3
of MMU's (this Blast) 1

Services Req'd:

GPS LAYOUT Enter hours 0.0
BULK TRUCK CHARGE <2,000kg
BLASTER HOURS Enter Blaster hours 0.0
HELPER HOURS Enter total Helper man-hours 0.0
SEISMOGRAPH RENTAL Enter # Orica Seismographs 0
3D LASER PROFILE Enter hours 0
BORETRACK Enter hours 0
TECHNICAL BLAST DESIGN (per day) Enter # of days 0.0

SIESMIC REPORT SUMMARY

Shot #	Date	Time	Max Kg/Delay	Hole	Pattern	Burden (ft.)	# Of Decks	# Of Rows	# Of Holes	Time Between (ms.)			Sub Drill	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1		Monitor 2		Monitor 3		Monitor 4	
				Dia. (in.)	Spacing (ft.)					Decks	Holes	Rows					(mm/s)	(dbl.)	(mm/s)	(dbl.)	(mm/s)	(dbl.)	(mm/s)	(dbl.)
01-14	Mar. 5/14	11:21AM	130.80	4	11.5	11.5	1	8	117	0	25	67	0	N/A	17.00	21800.0	1.02	103.5	2.05	104.2	1.78	115.2		
02-14	Mar. 31/14	11:58AM	75.80	4	11.5	11.5	1	6	102	0	25	67	0	N/A	18.75	20609.0	N/R	N/R	2.52	103.5	1.78	115.2		
03-14	Apr. 9/14	12:42PM	54.0	4	12	12	1	6	186	0	25	134	0	N/A	13.00	28371.2	2.03	104.9	1.02	108.0	1.02	100.0		
04-14	Apr. 21/14	12:00PM	240.79	4	11	11	1	2	37	0	13	110	2	73.38	81.00	29548.2	2.79	126.7	N/R	N/R	N/R	N/R		
05-14	Apr. 30/14	11:57AM	107.02	4	11.5	11.5	1	9	138	0	25	67	0	N/A	18.00	26726.4	1.78	106.0	N/R	N/R	1.27	101.0		
06-14	May 7/14	11:59AM	44.59	4	11.5	11.5	1	7	162	0	25	67	0	N/A	11.00	19202.7	2.16	105.5	N/R	N/R	1.02	104.9		
07-14	May 16/14	12:01PM	80.06	4	11.5	11.5	1	9	125	0	25	67	0	N/A	15.50	23884.8	2.67	101.9	1.48	97.5	3.17	110.6		
08-14	May 27/14	01:08PM	234.84	4	11	11	1	2	40	0	13	58	2	71.56	82.25	32437.0	3.56	120.4	N/R	N/R	1.90	125.5		
09-14	Jun. 2/14	11:10AM	89.19	4	11.5	11.5	1	10	116	0	25	67	0	N/A	16.00	21379.4	N/R	N/R	N/R	N/R	N/R	N/R		
10-14	Jun. 11/14	12:00PM	89.18	4	11.5	11.5	1	8	155	0	25	67	0	N/A	13.50	26185.5	N/R	N/R	1.78	88.0	3.43	111.5		
11-14	Jun. 17/14	12:07PM	237.42	4	11	11	1	2	43	0	13	110	2	76.29	82.50	34975.7	3.05	114.9	2.16	118.6	N/R	N/R		
12-14	Jun. 24/14	11:11AM	65.25	4	11.5	11.5	1	14	164	0	25	67	0	N/A	13.50	24294.3	N/R	N/R	N/R	N/R	3.05	111.2		
13-14	Jul. 7/14	12:18PM	240.79	4	11	11	1	1	34	0	13	0	2	70.83	80.50	26984.8	2.92	116.9	N/R	N/R	1.78	124.1		
14-14	Jul. 15/14	11:57AM	55.74	4	11.5	11.5	1	8	210	0	25	67	0	N/A	11.25	25458.1	N/R	N/R	N/R	N/R	N/R	N/R		
15-14	Jul. 21/14	12:07PM	240.79	4	11	11	1	1	35	0	13	0	2	77.04	83.50	28813.7	4.57	123.4	1.02	124.2	N/R	N/R		
16-14	Aug. 1/14	12:02PM	240.79	4	11	11	1	1	29	0	13	0	2	78.28	82.75	23659.8	3.68	126.6	N/R	N/R	1.90	127.0		
17-14	Aug. 14/14	11:34AM	77.29	4	11.5	11.5	1	7	155	0	25	84	0	N/A	12.50	20878.4	1.78	106.0	1.27	104.2	1.02	100.0		
18-14	Aug. 20/14	11:55AM	49.05	4	11.5	11.5	1	9	166	0	25	67	0	N/A	11.50	23669.3	N/R	N/R	1.02	88.0	N/R	N/R		
19-14	Aug. 25/14	1:52PM	204.67	4	11	11	1	1	35	0	13	0	2	76.73	85.00	29331.3	3.30	129.4	2.16	132.2	N/R	N/R		
20-14	Aug. 28/14	12:15PM	77.29	4	11.5	11.5	1	9	190	0	25	84	0	N/A	12.50	25592.8	N/R	N/R	1.40	103.5	1.02	101.0		
21-14	Sept. 4/14	12:11PM	62.43	4	11.5	11.5	1	17	187	0	25	67	0	N/A	13.00	26336.4	N/R	N/R	N/R	N/R	5.08	111.8		
22-14	Sept. 10/14	12:47PM	176.58	4	11.5	11.5	1	14	186	0	25	67	0	N/A	12.75	25555.1	N/R	N/R	1.02	94.0	8.64	127.9		
23-14	Sept. 16/14	12:12PM	204.14	4	11.5	11.5	1	2	37	0	13	97	2	71.70	83.50	33292.2	5.21	128.4	1.40	133.4	1.40	134.6		
24-14	Sept. 24/14	11:59AM	40.13	4	11.5	11.5	1	9	141	0	25	84	0	N/A	12.75	19509.8	N/R	N/R	N/R	N/R	2.92	107.0		
25-14	Sept. 24/14	12:10PM	62.43	4	11.5	11.5	1	7	73	0	25	67	0	N/A	13.00	10226.3	N/R	N/R	N/R	N/R	10.70	113.3		
26-14	Oct. 2/14	1:40PM	240.79	4	11.5	11.5	1	2	60	0	13	97	2	74.93	85.25	55107.0	4.32	131.8	1.65	124.2	1.27	128.6		
27-14	Oct. 7/14	12:23PM	60.20	4	11.5	11.5	1	10	172	0	25	67	0	N/A	12.75	23631.6					6.86	116.4		
28-14	Oct. 22/14	11:54AM	255.65	4	11.5	11.5	1	2	31	0	13	97	2	73.73	87.75	29313.2	6.22	128.0	2.03	128.4	1.40	119.2		
29-14	Oct. 31/14	12:02PM	62.43	4	11.5	11.5	1	9	231	0	25	67	0	N/A	13.00	33340.7	N/R	N/R	3.17	104.9	3.68	112.3		
30-14	Nov. 5/14	12:02PM	246.74	4	11.5	11.5	1	2	35	0	13	97	2	74.69	87.00	32812.7	4.57	118.6	1.02	127.1	1.65	126.7		
31-14	Nov. 11/14	12:00PM	237.82	4	11.5	11.5	1	2	28	0	13	110	2	72.85	81.75	24666.1	3.56	130.6	N/R	N/R	N/R	N/R		
32-14	Nov. 24/14	12:08PM	246.74	4	11.5	11.5	1	2	26	0	13	97	2	74.88	88.75	24865.5	3.81	128.7	1.02	98.8	1.90	101.0		
33-14	Nov 27/14	11:55AM	71.34	4	11.5	11.5	1	7	232	0	24	84	0	N/A	14.00	35000.2	N/R	N/R	3.56	94.0	4.83	115.9		



SIESMIC REPORT SUMMARY

Shot #	Date	Time	Hole		Pattern		# Of Decks	# Of Rows	# Of Holes	Time Between (ms.)			Sub Drill	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1		Monitor 2		Monitor 3		Monitor 4	
			Max Kg/Delay	Dia. (in.)	Spacing (ft.)	Burden (ft.)				Decks	Holes	Rows					(mm/s)	(dbl.)	(mm/s)	(dbl.)	(mm/s)	(dbl.)	(mm/s)	(dbl.)
34-14	Dec. 2/14	11:57AM	246.74	4	11.5	11.5	1	2	59	0	13	97	2	71.46	83.75	52344.1	4.83	129.6	2.03	127.5	1.40	132.8		
35-14	Dec. 9/14	11:50AM	89.60	4	11.5	11.5	1	9	179	0	25	67,84	0	N/A	13.00	25215.7	1.14	104.9	2.16	88.0	4.83	116.7		

SIESMIC REPORT SUMMARY

Shot #	Date	Time	Max Kg/Delay	Hole	Pattern		# Of Decks	# Of Rows	# Of Holes	Time Between (ms.)			Sub Drill	Ave. Water	Ave Hole Depth	Total Tons	Monitor 1		Monitor 2		Monitor 3		Monitor 4	
				Dia. (in.)	Spacing (ft.)	Burden (ft.)				Decks	Holes	Rows					(mm/s)	(dbl.)	(mm/s)	(dbl.)	(mm/s)	(dbl.)	(mm/s)	(dbl.)
01-15	Apr. 2/15	12:00PM	225.93	4	11.5	11.5	1	2	24	0	13	84	2	73.37	82.00	21207.0	2.41	115.6	1.52	94.0	2.29	125.6		
02-15	Apr. 9/15	11:57AM	35.67	4	11.5	11.5	1	19	121	0	25	84	0	N/A	12.00	17198.4	1.27	117.1	2.16	88.0	2.16	126.7		
03-15	Apr. 21/15	12:05PM	11.9	4	11.5	11.5	1	20	114	0	25	84	0	N/A	10.00	14763.0	11.78	104.2	1.02	98.8	N/R	N/R		
04-15	Apr. 23/15	12:03PM	225.93	4	11.5	11.5	1	2	23	0	13	123	2	75.04	81.00	20075.5	4.06	123.2	1.78	122.4	2.79	124.8		
07-15	May. 15/15	11:54AM	49.05	4	11.5	11.5	1	19	159	0	25	67	0	N/A	14.25	25644.0	1.78	103.5	1.4	103.5	N/R	N/R		
08-15	May. 22/15	11:51AM	120.39	4	11.5	11.5	1	12	153	0	25	67	0	N/A	19.50	32150.0	1.02	104.9	1.27	105.5	1.52	101.9		
09-15	May 28 2015	12:02PM	222.95	4	11.5	11.5	1	2	28	0	13	110	2	70.42	28.00	23534.6	3.81	116.6	N/R	N/R	1.02	122.3		
10-15	June 2 2015	12:01PM	246.74	4	11.5	11.5	1	1	15	0	13	0	2	80.27	92.75	14992.0	3.3	122.9	1.02	95.9	1.78	125		
11-15	June 10/15	11:50AM	225.92	4	11.5	11.5	1	2	30	0	13	110	2	70.86	77.25	24793.2	4.32	119.8	1.02	114.2	2.79	123.4		
12-15	June 12/15	12:18PM	98.1	4	11.5	11.5	1	13	254	0	25	67	0	N/A	17.00	47629.6	1.78	125.5	3.81	133.0	1.40	128.2		
13-15	June 17/15	12:03PM	255.65	4	11.5	11.5	1	2	35	0	13	130	2	83.00	92.00	34698.5	4.83	125.3	1.27	122	11.52	130.7		
14-15	July 8/15	12:02PM	214.04	4	11.5	11.5	1	2	29	0	13	123	2	71.64	77.00	24062.6	3.17	117.2	N/R	N/R	2.67	124.1		
15-15	July 13/15	12:02PM	275.20	4	11.5	11.5	1	2	38	0	13	38	2	77.87	88.50	36239.4	4.32	124.3	N/R	N/R	1.40	129.2		
16-15	July 30/15	12:00PM	214.04	4	11.5	11.5	1	6	29	0	13	29	2	75.38	77.75	24297.0	2.29	130.7	N/R	N/R	2.92	112.6		
17-15	Aug 19/15	12:02PM	246.74	4	11.5	11.5	1	2	44	0	13	182	2	75.75	86.25	39827.8	3.68	126.3	1.4	126.9	N/R	N/R		
18-15	Aug 26/15	12:01PM	120.49	4	11.5	11.5	1	9	242	0	25	84	0	N/A	19.50	51061.7	1.27	107	2.03	108.4	N/R	N/R		
19-15	Sept 1/15	12:01PM	217.01	4	11.5	11.5	1	3	34	0	13	68	2	70.87	78.50	28761.0	4.19	130.5	1.02	91.5	N/R	N/R		
20-15	Sept10/15	11:19AM	115.94	4	11.5	11.5	1	9	153	0	25	67	0	N/A	19.00	31325.6	N/R	N/R	1.40	106.0	N/R	N/R		
21-15	Oct 6/15	12:03PM	237.82	4	11.5	11.5	1	3	25	0	13	45	2	72.72	82.50	22225.4	5.08	121.1	1.78	88	1.02	123.0		
22-15	Oct 21/15	12:03PM	225.93	4	11.5	11.5	1	5	32	0	13	45	2	73.28	80.50	27758.7	6.6	134.3	1.78	91.5	3.94	130.9		

BLAST REPORT SUMMARY

Blast #	Date	Time	Blast		Weather	Wind From	Wind Velocity	Terrain	Hole Dia	# Of	# Of	Ave.	Ave Hole	Total	Monitor 1			Monitor 2			Monitor 3		
			Location						(in.)	Rows	Holes	Water	Depth	Tons	Location	(mm/s)	(dbl.)	Location	(mm/s)	(dbl.)	Location	(mm/s)	(dbl.)
01-16	Apr. 8/16	1:01PM	Bulge #2 Side Rd						4	2	40	55.25	70.00	27605.9	2479 #2 Side R	N/R	N/R	SW Corner	N/R	N/R	2450 #2 Side R	2.29	113.5
02-16	Apr. 19/16	12:28PM	NE Face						4	2	27	69.37	81.00	23567.0	2470 #2 Side R	N/R	N/R	SW Corner	1.65	97.5	Colling Rd	1.14	123.1
03-16	May 4/16	12:00PM	Bulge #2 Side Rd						4	2	42	51.86	67.75	28054.0	2470 #2 Side R	1.40	112.0	SW Corner	12.80	118.1	Colling Rd	2.41	116.6
04-16	May 9/16	12:00PM	NE Face	Partly Cloudy 14c		East	5 KPH	Rough	4,4.5	2	26,1	75.35	84.25	23604.7	2450 #2 Side R	3.43	118.8	SW Corner	1.65	91.5	Colling Rd	3.17	129.5
05-16	May 18/16	12:06PM	Pit Floor	Clear 15c		East	10 KPH	Flat	4	16	272	N/A	15.00	43965.8	2450 #2 Side R	N/R	N/R	SW Corner	2.92	105.5	Colling Rd	1.65	111.5
06-16	May 24/16	12:01PM	Pit Floor	Clear 27c		West	15 KPH	Flat	4	14	152	N/A	16.50	27026.0	2450 #2 Side R	1.02	109.5	SW Corner	2.41	95.9	Colling Rd	3.81	106.0
07-16	May 30/16	2:41PM	NE Face	Partly Cloudy 25c		West	10 KPH	Uneven	4,4.5	3	46,3	70.40	79.50	41977.6	2450 #2 Side R	3.94	124.9	SW Corner	1.14	125.0	Colling Rd	2.67	124.6
08-16	Jun 3/16	12:00PM	Bulge #2 Side Rd	Partly Cloudy 23c		East	10 KPH	Slope	4	2	43	50.39	63.75	27026.7	2450 #2 Side R	1.52	113.3	SW Corner	5.71	114.8	Colling Rd	1.90	115.9
16-09	Jul 5/16	12:00PM	N Face	Partly Cloudy 31		West	15KPH	Flat	4	3	20	74.74	83.00	17888.0	2450 #2 Side R	2.79	123.6	SW corner	N/R	N/R	Colling Rd	N/R	N/R
16-10	Jul 5/16	12:01PM	NE Face	Partly Cloudy 31		West	15kKPH	Flat	4	1	10	62.20	74.25	8001.1	2450 #2 Side R	4.06	122.1	SW Corner	N/R	N/R	Colling Rd	1.90	128.3
16-11	Jul 12/16	12:38PM	Pit Floor	Clear 32		Southwest	15KPH	Flat	4	14	248	N/A	19.00	50776.2	NOT USED			SW Corner	1.02	106	Colling Rd	4.06	105.5
16-12	Jul 15/16	12:00PM	Bulge#2 Side Rd	Partly Cloudy 27		West	25KPH	Flat	4	3	31	45.40	57.75	17650.5	2450 #2 Side R	1.14	88	SW Corner	4.44	117.4	Colling Rd	1.52	110.9
16-13	Jul 20/16	11:55PM	Pit Floor	Clear 29		West	10KPH	Flat	4.5	14	202	N/A	17.50	39035.8	2450 #2 Side R	N/R	N/R	SW Corner	2.54	103.5	Colling Rd	2.41	106
16-14	Jul 22/16	12:00PM	N Face	Partly Cloudy 33		Northwest	25KPH	Flat	4	3	21	61.50	73.50	16632.6	2450 #2 Side R	2.92	118.1	SW Corner	N/R	N/R	Colling Rd	1.40	124.5
16-15	Aug 4/16	12:00PM	Bulge#2 Side Rd	Clear 31		Southwest	10KPH	Flat	4	3	35	43.85	58.00	20014.3	2450 #2 Side R	1.40	108.8	SW Corner	3.05	117.9	Colling Rd	1.02	113.8
16-16	Aug 9/16	12:00PM	N Face	Partly Cloudy 31		South	15KPH	Uneven	4,4.5	3	45	66.05	77.50	37581.0	2450 #2 Side R	2.29	115.7	SW Corner	1.4	118.8	Colling Rd	2.16	127.5
16-17	Aug 30/16	12:00PM	N Face	Clear		West	15KPH	Uneven	4	3	41	64.95	80.00	35345.0	2450 #2 Side R	3.05	120.0	SW Corner	N/R	N/R	Colling Rd	1.78	128.8
16-18	Sep 20/16	12:01PM	NE Face	Clear		Northwest	10KPH	Flat	4,4.5	3	47	41.90	47.50	24057.3	2450 #2 Side R	2.52	127.2	SW Corner	N/R	N/R	Colling Rd	1.78	117.4
16-19	Oct 6/16	11:55AM	N Face	Clear		South	10KPH	Flat	4,4.5	2	41	38.78	45.75	20212.9	2450 #2 Side R	2.67	124.3	SW Corner	2.29	91.5	Colling Rd	1.65	114.4
16-20	Oct 12/16	11:47AM	NE Face	Clear		South	20KPH	Downslope	4,4.5	6	27	60.00	71.75	20872.3	2450 #2 Side R	4.57	122.1	SW Corner	1.52	88	Colling Rd	2.03	122.9
16-21	Oct 24/16	11:59AM	Bulge#2 Side Rd	Partly Cloudy 11		Northwest	25KPH	Uneven	4	4	29	45.68	59.25	16940.7	2450 #2 Side R	3.05	111.2	SW Corner	4.06	123.4	Colling Rd	2.41	109.9
17-01	Apr 11/17	11:56AM	Bulge#2 Side Rd	Partly Cloudy 20		Southwest	20KPH	Uneven	4	5	26	50.33	58.25	26417.9	2450 #2 Side R	2.55	111.5	SW Corner	N/R	N/R	Colling Rd	N/R	N/R
17-02	Apr 18/17	11:53AM	N Face	Clear		East	15KPH	Flat	4	3	13	72.82	80.50	21384.4	2450 #2 Side R	3.56	125.0	SW Corner	0.18	124.1	Colling Rd	N/R	N/R
17-03	April 21/17	11:53AM	Low Bench	Rain		West	22KPH	Flat	4,4.5	3	50	39.38	44.75	21133.9	2450 #2 Side R	3.56	122.9	SW Corner	1.02	116.7	Colling Rd	N/R	N/R
17-04	May 1/17	11:52AM	Bulge#2 Side Rd	Rain		East	15KPH	Downslope	4	3	32	N/A	69.70	17585.0	2450 #2 Side R	3.05	108.0	SW Corner	2.03	88	Colling Rd	N/R	N/R
17-05	May 15/17	12:35PM	Bulge#2 Side Rd	Clear		Northwest	10KPH	Downslope	4	3	34	N/A	74.00	21062.0	2450 #2 Side R	3.82	111.5	SW Corner	3.30	95.9	Colling Rd	0.13	88.0
17-06	May 17/17	11:53AM	Low Bench	Cloudy26		Southwest	40KPH	Flat	4,4.5	2	42	N/A	41.20	15010.0	2450 #2 Side R	N/R	N/R	SW Corner	N/R	N/R	Colling Rd	1.14	111.8
17-07	May 29/17	12:00PM	Bulge#2 Side Rd	Cloudy23		West	10KPH	Flat	4	3	32	N/A	72.00	21440.0	2450 #2 Side R	1.42	98.8	SW Corner	1.52	88	Colling Rd	6.10	91.5
17-08	Jun 1/17	2:30PM	Low Bench	Clear		Southwest	25KPH	Flat	4	4	86	N/A	37.30	29085	2450 #2 Side R	5.84	101.0	SW Corner	N/R	N/R	Colling Rd	3.81	91.5
17-09	June 8/17	11:55PM	Bulge#2 Side Rd	Clear		Southeast	5KPH	Flat	4	3	30	N/A	79.40	20898	2450 #2 Side R	3.30	94.0	SW Corner	2.41	88	Colling Rd	N/R	N/R



Blast								Hole Dia	# Of	# Of	Ave.	Ave Hole	Total	Monitor 1			Monitor 2			Monitor 3			
Blast #	Date	Time	Location	Weather	Wind From	Wind Velocity	Terrain	(in.)	Rows	Holes	Water	Depth	Tons	Location	(mm/s)	(dbl.)	Location	(mm/s)	(dbl.)	Location	(mm/s)	(dbl.)	
17-01	April 11/17	11:56AM	Bulge#2 Side Rd	Part Cloudy	20	Southwest	20KPH	Uneven	4	5	26	50.33	58.25	26417.9	2450#2 Side R	2.55	111.5	SW Corner	N/R	N/R	Colling Rd	N/R	N/R
17-02	April 18/17	11:53AM	North Face	Clear	East	15KPH	Flat	4	3	13	72.82	80.50	21384.4	2450#2 Side R	3.56	125	SW Corner	0.18	124.1	Colling Rd	N/R	N/R	
17-03	April 21/17	11:53AM	Low bench	Rain	West	22KPH	Flat	4,4,5	3	50	39.38	44.75	21133.9	2450#2 Side R	3.56	122.9	SW Corner	1.02	116.7	Colling Rd	N/R	N/R	
17-04	May 1/17	11:52AM	Bulge#2 Side Rd	Rain	East	15KPH	Downslope	4	3	32	N/A	69.70	17585.0	2450 #2 Side R	3.05	108	SW Corner	2.03	88	Colling Rd	N/R	N/R	
17-05	May 15/17	12:35PM	Bulge#2 Side Rd	Clear	Northwest	10KPH	Downslope	4	3	34	N/A	74.00	21062.0	2450#2 Side R	3.82	111.5	SW Corner	3.3	95.9	Colling Rd	0.13	88.0	
17-06	May 17/17	11:53AM	Low bench	Cloudy	26	Southwest	40KPH	Flat	4,4,5	2	42	N/A	41.20	15010.0	2450#2 Side R	N/R	N/R	SW Corner	N/R	N/R	Colling Rd	1.14	111.8
17-07	May 29/17	12:00PM	Bulge#2 Side Rd	Cloudy	23	West	10KPH	Flat	4	3	32	N/A	72.00	21440.0	2450#2 Side R	1.42	98.8	SW Corner	1.52	88.0	Colling Rd	6.10	91.5
17-08	June 1/17	2:30PM	Low bench	Clear	Southwest	25KPH	Flat	4	4	86	N/A	37.30	29085.0	2450#2 Side R	5.84	101	SW Corner	N/R	N/R	Colling Rd	3.81	91.5	
17-09	June 8/17	11:55AM	Bulge#2 Side Rd	Clear	Southeast	5KPH	Flat	4	3	30	N/A	79.40	20898.0	2450#2 Side R	3.3	94	SW Corner	2.41	88	Colling Rd	N/R	N/R	
17-11	June 20/17	12:02PM	Bulge#2 Side Rd	Part Cloudy	22	Southwest	10KPH	Flat	4	3	36	N/A	84.10	23583.0	2450#2 Side R	2.03	108.4	SW Corner	2.41	101.9	Colling Rd	N/R	N/R
17-10	June 21/17	12:35PM	Low bench	Part Cloudy	21	West	10KPH	Flat	4,4,5	3	84	N/A	40.80	25680.0	2450#2 Side R	N/R	N/R	SW Corner	N/R	N/R	Colling Rd	did not	use
17-12	June 26/17	1:00PM	Floor	Part Cloudy	Southwest	15KPH	Flat	4	12	252	N/A	16.00	40014.0	2450#2 Side R	6.22	91.5	SW Corner	1.78	88	Colling Rd	N/R	N/R	
17-14	July 4/17	12:46PM	North Face	Part Cloudy	Southeast	10KPH	Flat	4,4,5	3	36	N/A	57.95	33601.0	2450#2 Side R	12.20	95.9	SW Corner	4.19	88.0	Colling Rd	1.27	88	
17-13	July 10/17	1:40PM	Floor	Part Cloudy	Southwest	10KPH	Flat	4	11	295	N/A	16.70	48920.0	2450#2 Side R	2.16	91.5	SW Corner	4.22	88.0	Colling Rd	1.02	104.2	
17-15	July 25/17	11:57AM	Low Bench	Part Cloudy	NorthEast	5KPH	Flat	4	4	52	N/A	42.00	15057.0	2450#2 Side R	3.56	91.5	SW Corner	2.16	88	Colling Rd	1.14	112.8	
17-17	August 3/17	12:41PM	North Face	Part Cloudy	North	0.00	Flat	4,5	4	23	N/A	77.10	11832.0	2450#2 Side R	2.92	88	SW Corner	1.27	88	Colling Rd	N/R	N/R	
17-18	August 28/17	12:32PM	Floor	Partly Cloudy	West	5KPH	Flat	4	8	188	N/A	17.70	26351.0	2450 #2 Side R	4.70	104.9	SW Corner	3.3	88	Colling Rd	1.14	107.5	
17-16	August 30/17	12:01PM	Bulge#2 Side Rd	Partly Cloudy	Southwest	5KPH	Flat	4	3	28	N/A	84.30	16211.0	2450 #2 Side R	1.52	91.5	SW Corner	1.52	92.0	Colling Rd	N/R	N/R	
17-19	September 12/17	11:49AM	Low bench	Partly Cloudy	Southeast	10KPH	Flat	4	3	37	N/A	38.90	21101.0	2450 #2 Side R	2.92	88.0	SW Corner	1.90	94	Colling Rd	1.02	114.6	
17-22	September 26/17	11:56AM</																					



Blast						Hole Dia			# Of	# Of	Ave.	Ave Hole	Total	Monitor 1			Monitor 2			Monitor 3		
Blast#	Date	Time	Location	Weather	Wind From	Wind Velocity	Terrain	(in.)	Rows	Holes	Water	Depth	Tons	Location	(mm/s)	(dbl.)	Location	(mm/s)	(dbl.)	Location	(mm/s)	(dbl.)
18-001	Apr 9/18	11:56 AM	Upper Middle	Part Cloudy	Southeast	5KPH	Flat	4	3	49	N/A	75.50	27194.0	2450#2 Side R	3.60	115.3	SW Corner	1.2	119.7	Colling Rd	0.4	121.9
18-002	Apr 11/18	11:16AM	Floor	Overcast	Southwest	10KPH	Flat	4	9	180	N/A	10.00	19279.0	2450#2 Side R	DNT	DNT	SW Corner	2	88.4	Colling Rd	N/A	N/A
18-003	Apr 18/18	10:54	Lower middle	Overcast	West	10KPH	Flat	4	4	39	N/A	40.10	11087.0	2450#2 Side R	2.70	119.7	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-004	May 22/18	12:02PM	Upper Middle	Overcast	SouthEast	5KPH	Flat	4,4,5	3	49	N/A	75.50	26332.0	2450#2 Side R	3.3	124.3	SW Corner	0.3	39.1	Colling Rd	0.30	123.1
18-005	June 4/18	11:50AM	Lower middle	Overcast	West	15KPH	Flat	4	8	67	N/A	44.20	20811.0	2450#2 Side R	N/R	N/R	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-006	June 6/18	12:10PM	Lower middle	Overcast	West	5KPH	Flat	4	11	61	N/A	41.70	17948.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-007	June 11/18	11:56AM	Upper Middle	Part Cloudy	East	15KPH	Flat	4,4,5	4	55	N/A	73.10	28467.0	2450#2 Side R	2.70	116.9	SW Corner	0.10	119.6	Colling Rd	0.20	120.2
18-008	June 13/18	11:52AM	Lower middle	Part Cloudy	West	10KPH	Sloped	4	7	89	N/A	50.00	28929.0	2450#2 Side R	1	120.6	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-009	June 25/18	12:01PM	Lower middle	Clear	Southeast	10KPH	Flat	4	13	99	N/A	35.30	25983.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-010	July 5/18	11:51AM	Upper Middle	Clear	Southwest	5KPH	Flat	4	3	53	N/A	76.00	30963.0	2450#2 Side R	2.30	115.9	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-011	20-Jul	11:59AM	Lower middle	Part Cloudy	East	5KPH	Flat	4	15	125	N/A	26.00	24173.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-012	Aug 3/18	11:52AM	Upper Middle	Part Cloudy	none	0	Flat	4,5	3	46	N/A	76.40	27176.0	2450#2 Side R	2.4	115	SW Corner	0.01	117.1	Colling Rd	0.01	116.4
18-013	Aug 14/18	10:54AM	Floor	Part Cloudy	South	5.00	Flat	4	11	182	N/A	10.00	17069.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-014	Aug 30/18	11:55AM	Upper Middle	Part Cloudy	NorthEast	5KPH	Flat	4,5	3	58	N/A	75.20	31778.0	2450#2 Side R	3.7	113.3	SW Corner	2.00	93.2	Colling Rd	DNT	DNT
18-015	Sept 10/18	11:49AM	Floor	Rain	East	15KPH	Flat	4	9	204	N/A	11.50	22269.0	2450#2 Side R	DNT	DNT	SW Corner	NSU	NSU	Colling Rd	0.1	118
18-018	Sept 21/18	12:34PM	Floor	Part Cloudy	Southwest	15KPH	Flat	4	21	345	N/A	11.20	38483.0	2450#2 Side R	DNT	DNT	SW Corner	NSU	NSU	Colling Rd	DNT	DNT
18-017	Oct 2/18	12:02PM	Upper Middle	Rain	Sourhwest	5KPH	Flat	4	3	48	N/A	76.40	26868.0	2450#2 Side R	5.30	114.2	SW Corner	0.5	123.5	Colling Rd	0.20	121.6
18-016	Oct 10/18	12:24PM	Lower middle	Part Cloudy	East	5KPH	Flat	4	5	100	N/A	61.80	44223.0	2450#2 Side R	DNT	DNT	SW Corner	DNT	DNT	Colling Rd	DNT	DNT
18-019	Nov 1/18	11:57AM	Upper Middle	Rain	None	0.00	Flat	4,4,5	5	50	N/A	73.40	27342.0	2450#2 Side R	5.70	116.3	SW Corner	1.80	114.2	Colling Rd	0.30	118.8
18-020	Nov11/18	11:57AM	Floor	Cloudy	West	5KPH	Flat	4	12	251	N/A	11.00	24552.0	2450#2 Side R	2.00	110.4	SW Corner	DNT	DNT	Colling Rd	0	



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-05-28

Blast Number: 19-006

Orica Order #: 2487394

Blast Time: 11:09 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Upper Middle North East (Bench / Face)

GPS Coordinates: 43.40506 °N Latitude 79.88187 °W Longitude
Centre of Blast Centre of Blast

Wind from the: NE at 10 kph Temperature: 6 to 10 °C

Clear: ☐

Rain: ☐

Overcast: ☒

Partly Cloudy: ☐

Snow: ☐

Inversion: ☐

Ceiling 591 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 43 = 2,739.9 ft (4 " diam)
Secondary Bit diam: 92.1 mm	0°	# Holes: 4 = 254.9 ft (3 5/8 " diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,740	25,080	8,660

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	1	25

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	47	10.7
PENTEX 12 (OR EQUIVALENT)	0.34	47	16.0

total explosives weight in Blast (kg): 8,712

Pkgd Prod (25 kg) % of Total kg: 0.3%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			47
UNITRONIC 600 25M			47

Cord & Accessories:

	U of M	# used
HARNES WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	2

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	5.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	1.0
BORETRACK	Enter hours	0.0

Tonnes Blasted:	18,760 te	7,215 m3
Total tonnes per day:	18,760 te	NB60-08 Rate Code
Total Holes Loaded:	47 holes	
... including:	5 Dead Holes	
... and:	Helper Holes	
Helper Hole Collar:	ft avg	
# Rows Blasted:	4 rows	

- Pattern (Front Row)-

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 13 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 34 main body

Bench Height: 61.7 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 63.7 ft avg

- Stone Decking -

Front Row: 0.0 ft avg

Main Body: 0.0 ft avg

Decks: 0 per blast

- Collar Stemming -

Front Row: 8.0 ft avg

Main Body: 8.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 55.7 ft avg

Main Body: 55.7 ft avg

- Charge Weight -

Front Row: 162.5 kg/hole

Main Body: 162.5 kg/hole

Max. per delay: 197.0 kg/delay

SD () Equation: 195.0 kg/delay

Total kg Loaded: 8,712 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.464 kg/te (actual)

Front row: 0.298 kg/te (theoretical)

Main Body: 0.397 kg/te (theoretical)

"KPI" PF: 0.372 kg/te (theoretical)

2.035 lb/yd³

1.306 lb/yd³

1.741 lb/yd³


1.632 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

Hole D7 Recived packaged product to load though small seam from 15'-9'

We were unable to locate the drill log.

After speaking with the driller we felt confident to continue and load the blast

 The Blasting Professionals™	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry:	Burlington	Blast Number:	19-006
		P.O. #:		Orica Order #:	2487394
		Blast Date:	2019-05-28	Blast Time:	11:09 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40510	79.88190	0.757562	1.394202
Front Row Corner	43.40488	79.88179	0.757558	1.394200
Back Row Corner	43.40519	79.88193	0.757563	1.394203
Average (Centre of Blast)	43.40506	79.88187	0.757561	1.394202

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	418.9	m		
	Post Blast Data:	ppV:	4.2 mm/s	Trigger set at:	2.0 mm/s
		frequency:	10.7 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	119.6 dB	Trigger set at:	115 dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	987.1	m		
	Post Blast Data:	ppV:	0.2 mm/s	Trigger set at:	2.0 mm/s
		frequency:	8.8 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	118.9 dB	Trigger set at:	115 dB
	Colling Rd & Blind Line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (3rd Seis. From Centre of Blast)	1414.7	m		
	Post Blast Data:	ppV:	Did mm/s	Trigger set at:	2.0 mm/s
		frequency:	Not Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	Trigger dB	Trigger set at:	115 dB
	SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(418.9)^2}{30^2} \text{ kg} \\
 &= \frac{175,477}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = kg

Orica

Blaster-in-charge:

Mike der Kinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

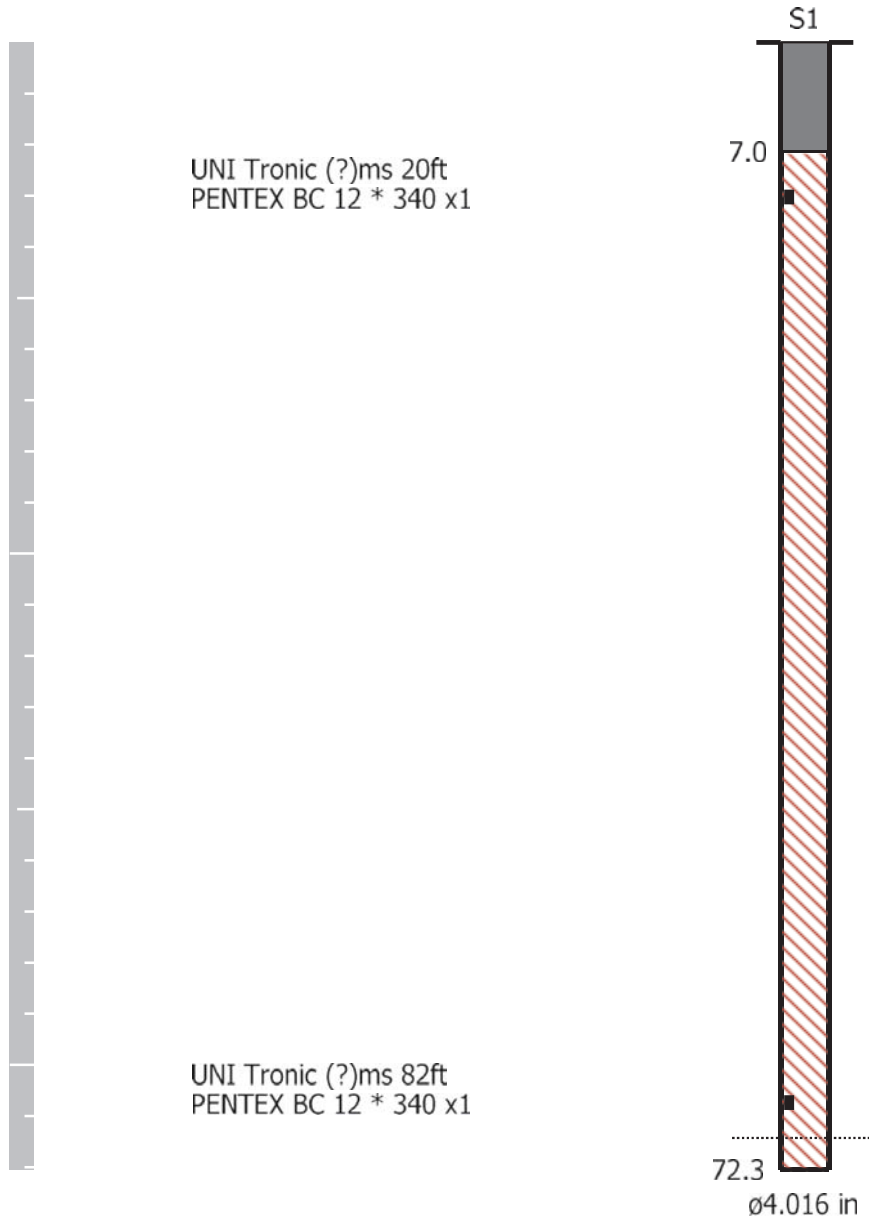
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 5/28/2019

Blast Number: 19-006
Orica Order #: 2487394

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nick Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 11:09:14 May 28, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.2 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name _TEMP.EVT

Notes

Location: 2450 Line 2
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

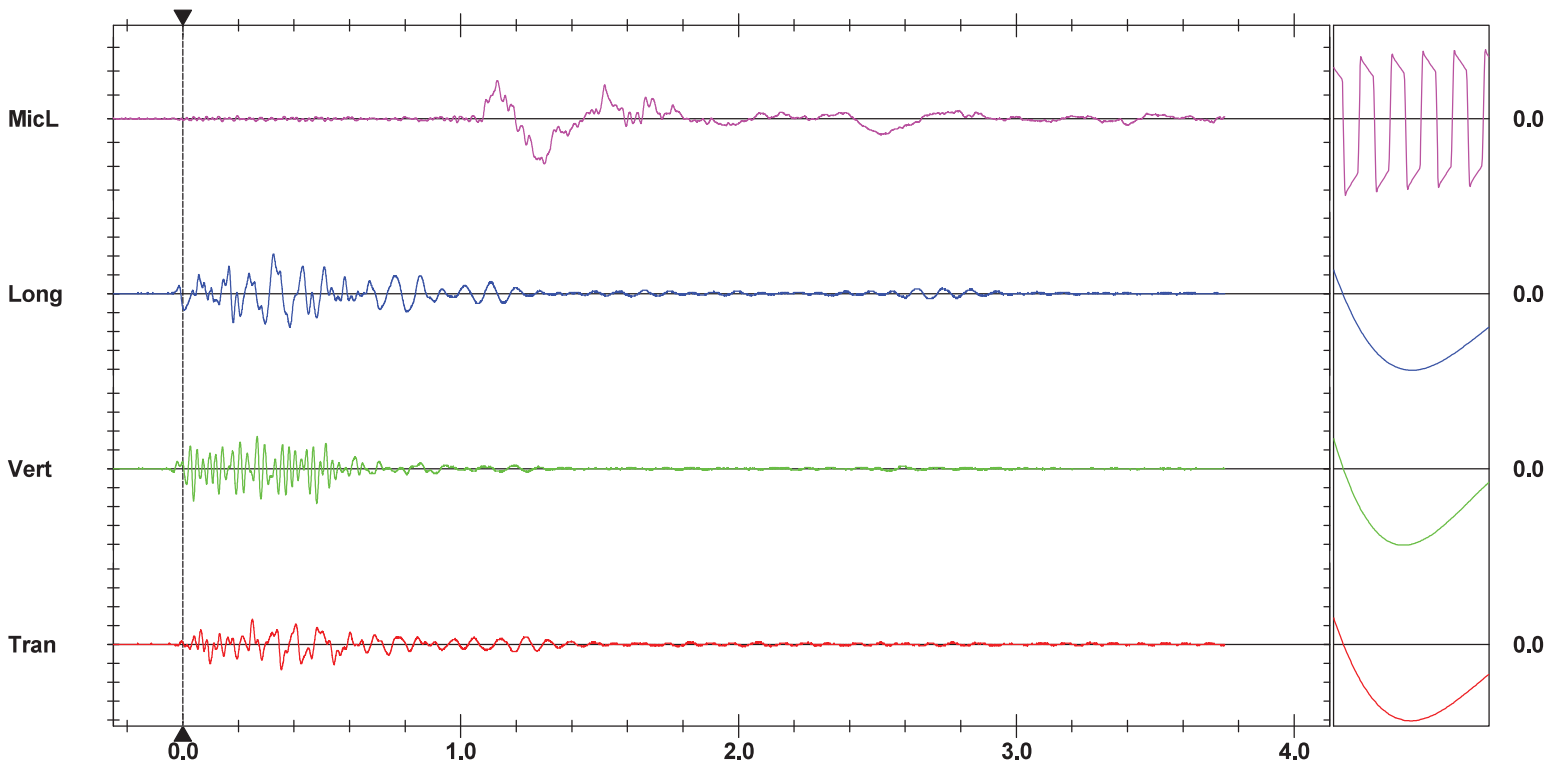
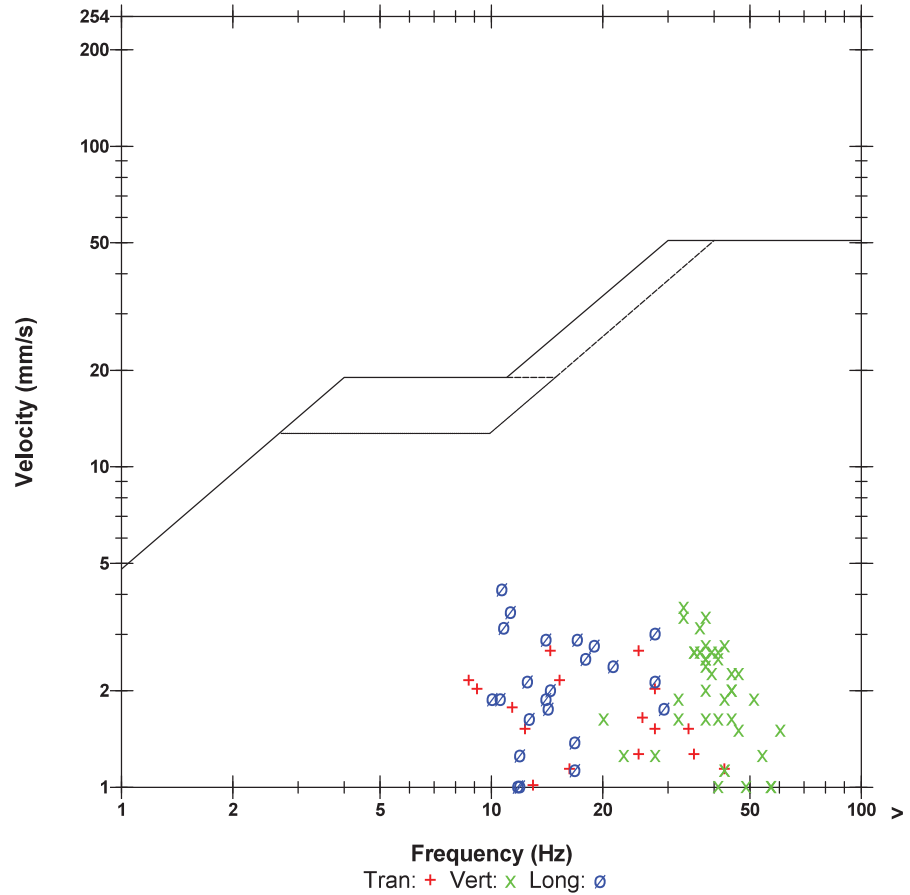
In front Yard by tree stump
 N-43.40245, W-79.87814

Microphone Linear Weighting
PSPL 119.6 dB(L) at 1.301 sec
ZC Freq 2.0 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 562 mv)

	Tran	Vert	Long	
PPV	2.667	3.683	4.191	mm/s
ZC Freq	25	33	10.7	Hz
Time (Rel. to Trig)	0.250	0.482	0.325	sec
Peak Acceleration	0.053	0.106	0.106	g
Peak Displacement	0.030	0.018	0.057	mm
Sensor Check	Check	Check	Check	
Frequency	2.2	2.2	2.2	Hz
Overswing Ratio	226.0	174.0	247.0	

Peak Vector Sum 4.814 mm/s at 0.482 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time MicL at 11:09:17 May 28, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.117 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL,MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.8 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20190528110917.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

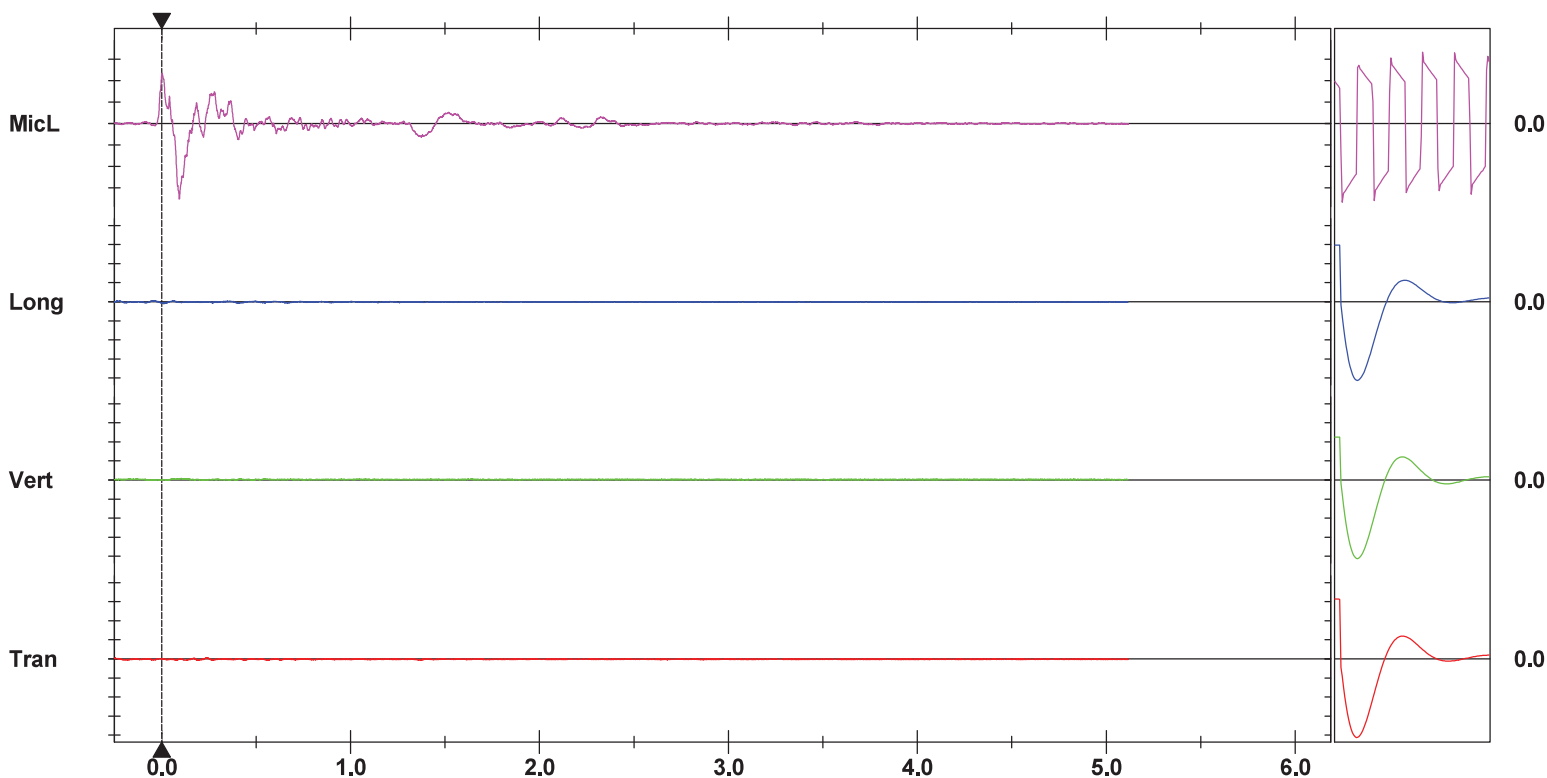
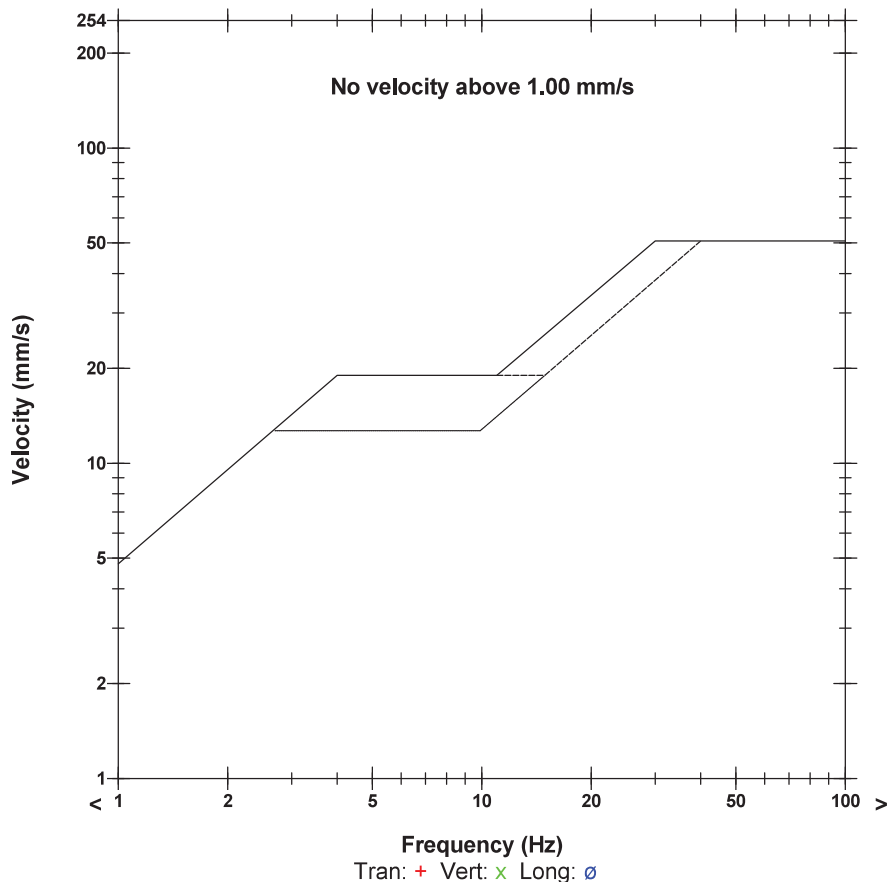
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 118.9 dB(L) at 0.093 sec
ZC Freq 4.7 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1541 mv)

	Tran	Vert	Long	
PPV	0.142	0.166	0.197	mm/s
ZC Freq	9.6	3.0	8.8	Hz
Time (Rel. to Trig)	0.124	0.103	0.008	sec
Peak Acceleration	0.012	0.010	0.015	g
Peak Displacement	0.026	0.034	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.4	3.4	3.6	

Peak Vector Sum 0.202 mm/s at 0.008 sec

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

**Nelson Aggregate
Across road from 2102 Road 2
Burlington 2019-05-28 Blast 19-005**

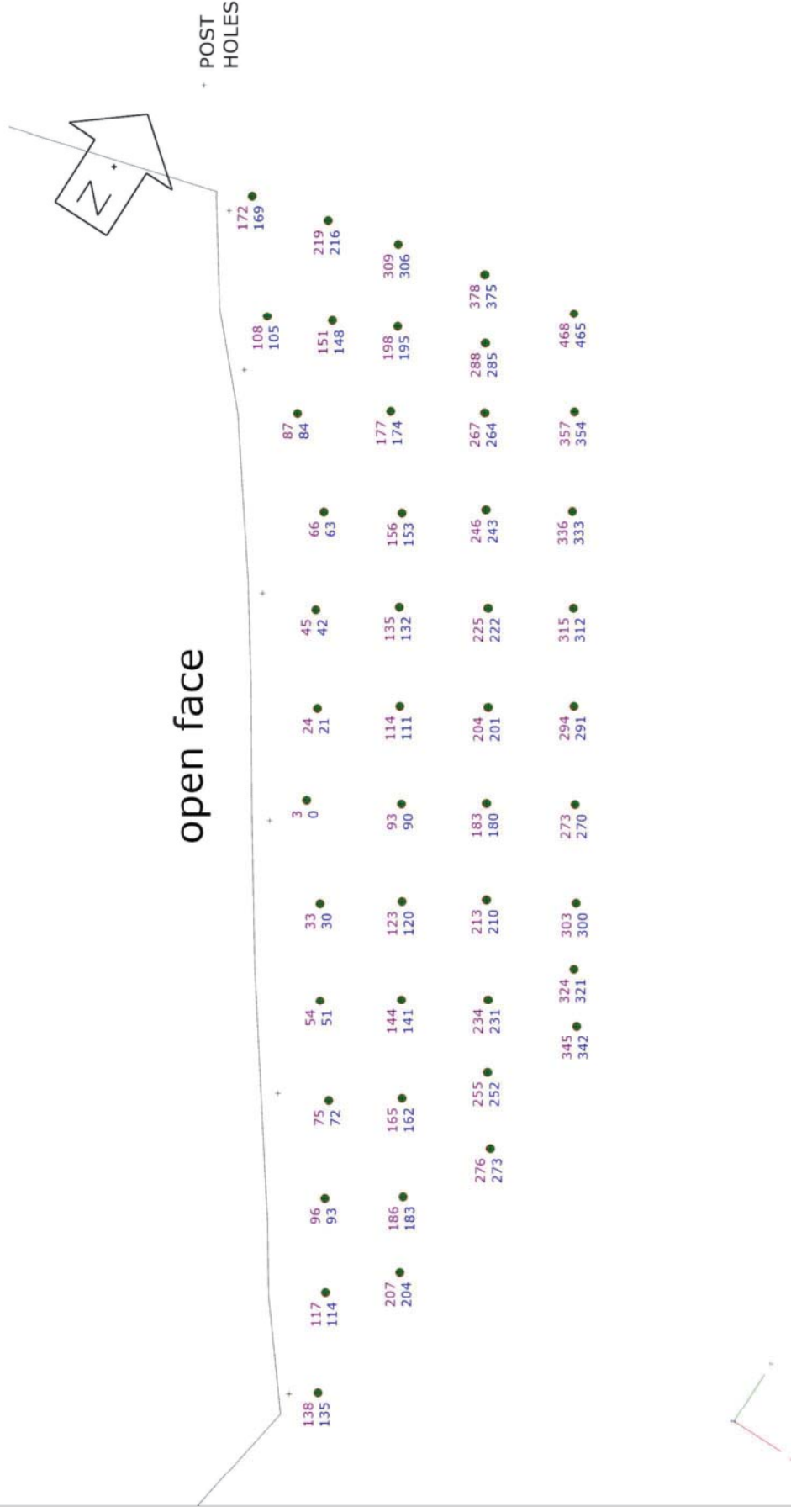
Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6859
May 28 /19 05:53:15		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
May 28 /19 05:53:15	May 28 /19 11:40:31	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic:

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Hole angle: 0.0°
 Total drilled: 2994.8ft Number of holes: 47



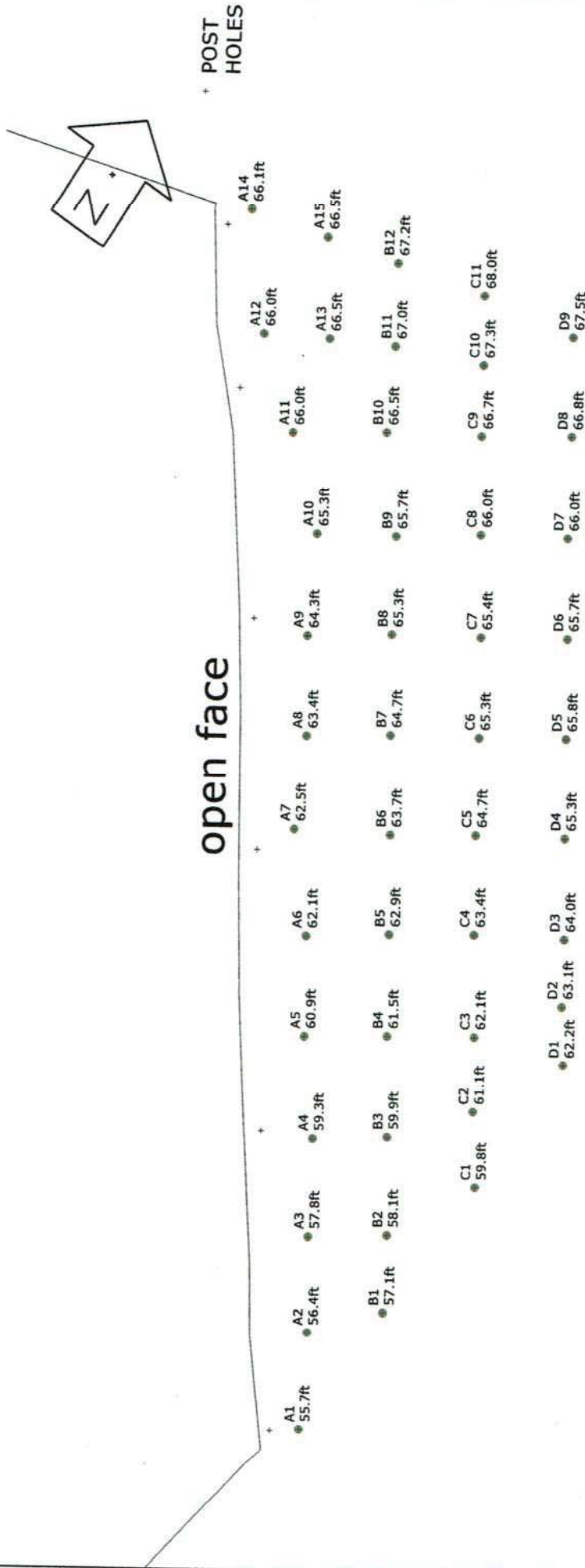
Not to scale

SHOTPlus™ Professional 5.7.4.4		5/28/2019
Mine	Burlington	
Location	N E CRNR NEXT TO UPPER MIDDLE	
Title/author	9NECRNR005 Design Partial	
Filename	Burlington 2019-05-28 Blast 19-005 Upper Mic	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 Spacing: 10.0ft
 Stemming: 7.0ft
 1st row burden: 12.0ft
 Subdrill: 2.0ft
 Hole angle: 0.0°
 Hole Diameter: 4.0in
 Number of holes: 47
 Total drilled: 2994.8ft



9NECRNR005 Design Fnl -3.625 and 4" Blast Holes 12x10 9x10 270.25 a
 DRILLER NAME:

GREEN MARKER STONES 3.625" Blast Holes



Not to scale

SHOTPlus™ Professional 5.7.4.4	5/27/2019
Mine	Burlington
Location	N E CRNR NEXT TO UPPER MIDDLE
Title/author	9NECRNR005 Design Partial
Filename	Burlington 2019-05-28 Blast 19-005 Upper Mid

SHOTPlus 5 Plan

Blast Summary Data

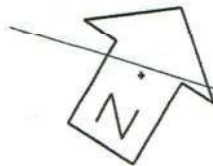
Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 2994.8ft
 Spacing: 10.0ft
 Subdrill: 2.0ft
 Number of holes: 47
 Stemming: 7.0ft
 Hole angle: 0.0°

Load Sheet 215Kg Max

open face

$\phi = 3 \frac{5}{8}"$

• POST
HOLES



• 159 • 173 • 181 • 156 • 161 • 180 • 184 • 185 • 190 • 197 • 195 • 190 • 182
 • 176 • 160 • 163 • 179 • 184 • 191 • 196 • 194 • 192 • 191 • 192 • 189 • 152 • 144
 • 168 • 187 • 186 • 190 • 197 • 187 • 190 • 192 • 146 • 193
 181 • 143 • 184 • 194 • 179 • 193 • 193 • 185



Not to scale

SHOTPlus™ Professional 5.7.4.4	5/27/2019
Mine	Burlington
Location	N E CRNR NEXT TO UPPER MIDDLE
Title/author	9NECRNR005 Design Partial
Filename	Burlington 2019-05-28 Blast 19-005 Upper Mic



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-05-10

Blast Number: 19-007

Orica Order #: 2480529

Blast Time: 12:55 PM

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40368 °N Latitude 79.88238 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 30 kph Temperature: 11 to 15 °C

Clear: Rain: Overcast: X
Partly Cloudy: Snow: Inversion: Ceiling 2,434 ft

- Drilling Information -

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0 # Holes: 283 = 4,188.4 ft (4 " diam)
Secondary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	34,110	27,740	6,370

Packaged Explosives:

	cs shipped	cs returned	kg
FORTELE PRO 75X400	5	5	0

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	280	95.2

total explosives weight in Blast (kg): 6,465

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
EXEL HANDIDET 9m		25/500	280
CONNECTADET 9M		25 ms	1
CONNECTADET 9M		42 ms	26

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	7.5
HELPER HOURS	Enter total Helper man-hours	13.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	1.0
BORETRACK	Enter hours	0.0

Tonnes Blasted: 40,349 te 15,519 m3
Total tonnes per day: 40,349 te NF-02 Rate Code
Total Holes Loaded: 280 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 13 rows

- Pattern (Front Row) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 4 front row

- Pattern (Main Body) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 276 main body

Bench Height: 14.8 ft avg

Sub-drill: 0.0 ft avg

Hole Depth: 14.8 ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Decks: 0 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: 3/4" Stone

- Charge Length -

Front Row: 7.8 ft avg

Main Body: 7.8 ft avg

- Charge Weight -

Front Row: 22.7 kg/hole

Main Body: 22.7 kg/hole

Max. per delay: 42.0 kg/delay

SD () Equation: 151.3 kg/delay

Total kg Loaded: 6,465 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.160 kg/te (actual)

Front row: 0.158 kg/te (theoretical)

Main Body: 0.158 kg/te (theoretical)

"KPI" PF: 0.158 kg/te (theoretical)

0.702 lb/yd³

0.692 lb/yd³


0.692 lb/yd³

0.692 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

Holes B7, B8, B9, where taken out of the shot due to being caved in before loading.

helper hours: 6.5 hours x 2

 <p>ORICA The Blasting Professionals™</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry:	Burlington	Blast Number:	19-007
		P.O. #:		Orica Order #:	2480529
		Blast Date:	2019-05-10	Blast Time:	12:55 PM

page 2

Blast Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast		43.40368	79.88241	0.757537	1.394211
Front Row Corner		43.40387	79.88250	0.757540	1.394213
Back Row Corner		43.40348	79.88223	0.757534	1.394208
Average (Centre of Blast)		43.40368	79.88238	0.757537	1.394211

1st Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40245	79.87814	0.757516	1.394137
2nd Reading					
Average		43.40245	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)		369.0	m		
Post Blast Data:		ppV: did	mm/s	Trigger set at: 2.0	mm/s
		frequency: not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: trigger	dB	Trigger set at: 115	dB
2450 2nd Line					

2nd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40605	79.89400	0.757578	1.394413
2nd Reading					
Average		43.40605	79.89400	0.757578	1.394413
Distance (2nd Seis. From Centre of Blast)		976.5	m		
Post Blast Data:		ppV: did	mm/s	Trigger set at: 2.0	mm/s
		frequency: not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: trigger	dB	Trigger set at: 115	dB
Colling Rd & Blind Line Bruce Trail					

3rd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)		0.0	m		
Post Blast Data:		ppV: 0.0	mm/s	Trigger set at: 2.0	mm/s
		frequency: 0.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 0.0	dB	Trigger set at: 115	dB

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(369)^2}{30^2} \text{ kg} \\
 &= \frac{136,161}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = kg

Orica

Blaster-in-charge:

jim bray

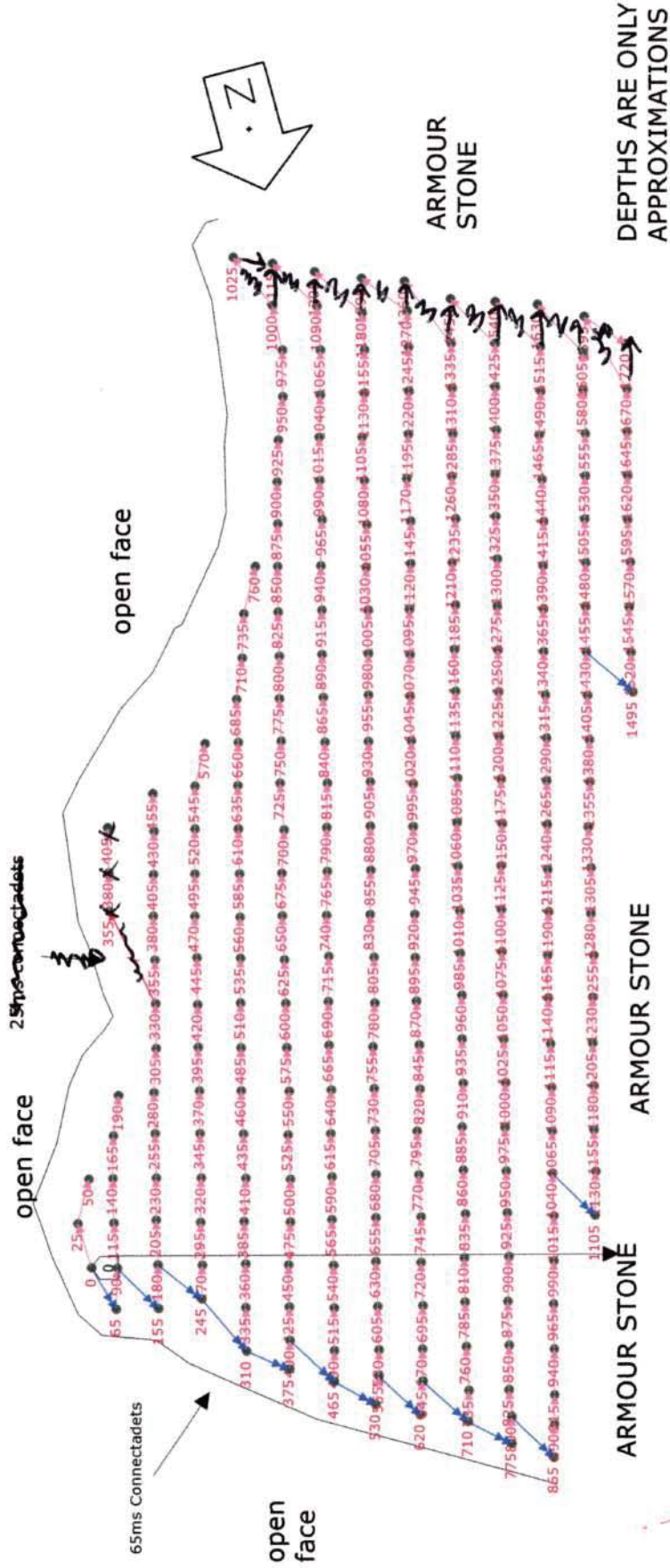
Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft Spacing: 11.5ft Subdrill: 0.0ft Stemming: 5.5ft
 1st row burden: 11.5ft Hole Diameter: 4.0in Number of holes: 283 Hole angle: 0.0°
 Total drilled: 4211.9ft



9FLR007 Design Partial Fnl - 4" Blast Hole 11.5 x 11.5 253 and 248.6 ELEV
 DRILLER NAME:

DRILL TO SHALE



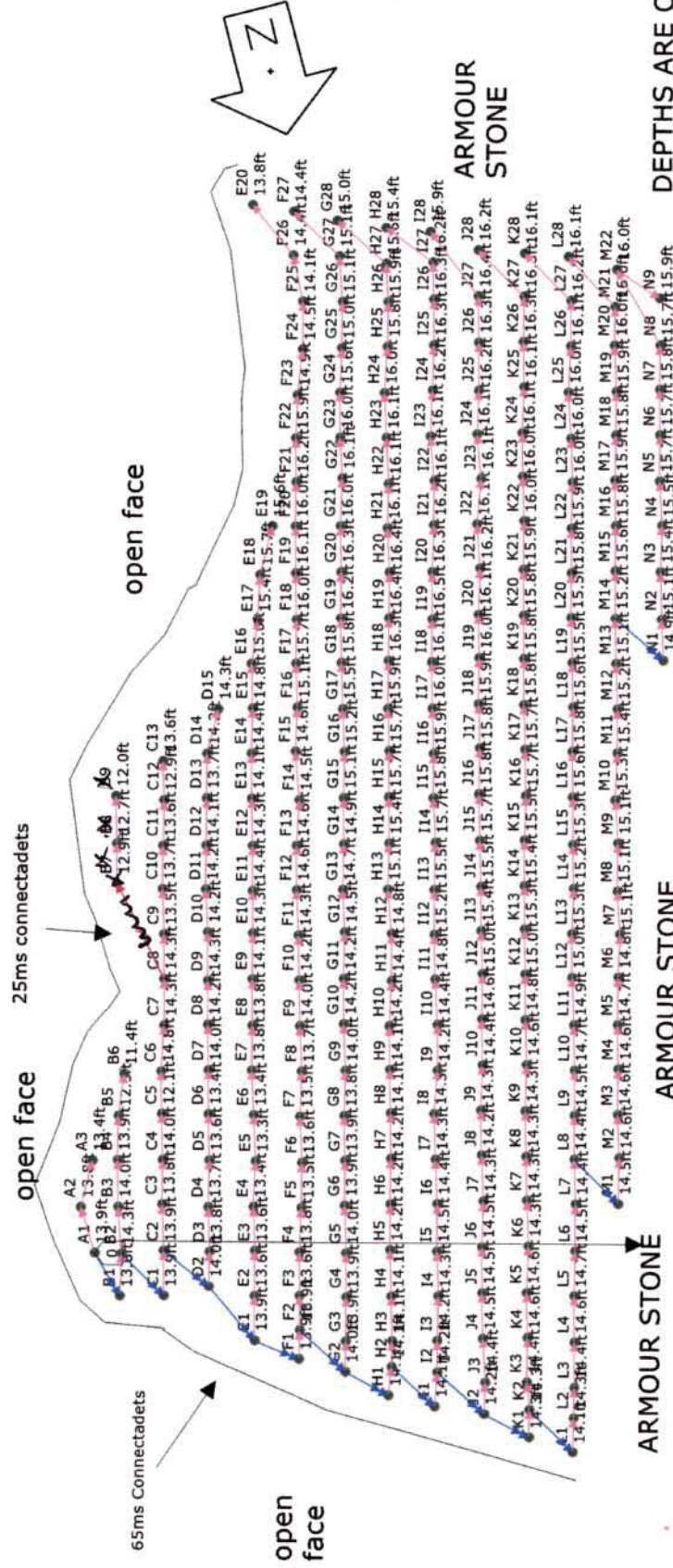
SHOTPlus™ Professional 5.7.6.1	5/9/2019
Mine	Burlington
Location	FLOOR SHOT NEXT TO 9FLR004
Title/author	9FLR007 Partial Design Fnl
Filename	Burlington 2019-05-10 Blast 19-007 Floor.spf

Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 283	Hole angle: 0.0°
Total drilled: 4211.9ft			



DEPTHS ARE ONLY APPROXIMATIONS

ARMOUR STONE

9FLR007 Design Partial Fnl - 4" Blast Hole 11.5 x 11.5 253 and 248.6 ELEV
DRILLER NAME:

DRILL TO SHALE



SHOTPlus™ Professional 5.7.6.1	5/9/2019
Mine	Burlington
Location	FLOOR SHOT NEXT TO 9FLR004
Title/author	9FLR007 Partial Design Fnl
Filename	Burlington 2019-05-10 Blast 19-007 Floor.spf

Not to scale



Blast Design

Nelson Aggregate

Quarry: **Burlington**
P.O. #:
Design Date: **2019-05-10**

Blast Number: **19-007**
Orica Order #:

page 1

Blaster-in-charge: **Kevin Toplis** (Print Name)

Blast Location: **Floor** (Bench / Face)

GPS Coordinates: **43.40368** °N Latitude **79.88238** °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: **35,821** te
Total Holes Loaded: **283** holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: **13** rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: **101.6** mm **0**° # Holes: **283** = 4,245.0 ft (4 " diam)
Secondary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm **0**° # Holes: = 0.0 ft (" diam)
Nominal Bit Diameter:

- Design Pattern (Front Row)-

Burden: **11.5** ft avg
Spacing: **11.5** ft avg
Holes: **7** front row

- Design Pattern (Main Body) -

Burden: **11.5** ft avg
Spacing: **11.5** ft avg
Holes: 276 main body
Bench Height: **13.0** ft avg
Sub-drill: **2.0** ft avg
Hole Depth: 15.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: **7.0** ft avg
Main Body: **7.0** ft avg
Material used: **3/4" Clear**

- Design Charge Length -

Front Row: 8.0 ft avg
Main Body: 8.0 ft avg

- Design Charge Weight -

Front Row: 23.3 kg/hole
Main Body: 23.3 kg/hole
Max Chge Wt / delay: **25.0** kg/delay

Required kg Loaded: 8,096 kg
Rock Density: **2.60** g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.226 kg/te (actual)
Front row: 0.184 kg/te (theoretical)
Main Body: 0.184 kg/te (theoretical)
"KPI" PF: 0.184 kg/te (theoretical)

0.808 lb/yd³
0.808 lb/yd³
0.808 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

Bulk Expl. Required:

kg
CENTRA GOLD 70 8,000

Pkgd Expl. Required:

kg

Boosters Required:

kg/u # used kg
PENTEX 12 (OR EQUIVALENT) 0.34 **283** 96.2

total explosives weight in Blast (kg): 8,096
Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators Required:

ms # req'd
EXEL HANDIDET 9m 283
UNITRONIC 600 6M 1
CONNECTADET 9M 65 ms 27

Cord & Access. Req'd:

U of M # req'd
WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services Req'd:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	1.0
BORETRACK	Enter hours	0.0



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 5/10/2019

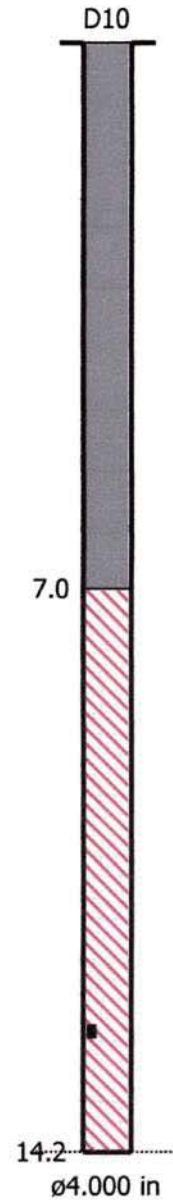
Blast Number: 19-007
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



HANDIDET 500ms 23ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Kevin Toplis

Quarry Manager:

Nick Heap

Signature required, indicating
sign off on Blast Design.



Blast Report

Nelson Aggregate

Quarry:

Burlington

P.O. #:

Blast Date: 2019-05-30

Blast Number:

19-008

Orica Order #:

2488743

Blast Time:

11:55 AM

page 1

Blaster-in-charge: Mike der Kinderen (Print Name)

Blast Location: Floor (Bench / Face)

GPS Coordinates: 43.40286 °N Latitude 79.88663 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 10 kph Temperature: 16 to 20 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 23.061 ft

- Drilling Information -

Primary Bit diam: 101.6 mm 0 # Holes: 229 = 4,243.8 ft (4 " diam)
Secondary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	26,810	19,270	7,540

Packaged Explosives:

	cs shipped	cs returned	kg
FORTELE PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	227	77.2

total explosives weight in Blast (kg): 7,617

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
EXEL HANDIDET 9m		25/500	227
CONNECTADET 9M		65 ms	18

Cord & Accessories:

	U of M	# used
	units	
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	0.0
HELPER HOURS	Enter total Helper man-hours	0.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	1.0
BORETRACK	Enter hours	0.0

Tonnes Blasted: 40,960 te 15,754 m3
Total tonnes per day: 40,960 te NF-02 Rate Code
Total Holes Loaded: 227 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 18 rows

- Pattern (Front Row) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 20 front row

- Pattern (Main Body) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 207 main body

Bench Height: 18.5 ft avg

Sub-drill: 0.0 ft avg

Hole Depth: 18.5 ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Decks: per blast

- Collar Stemming -

Front Row: 8.0 ft avg

Main Body: 8.0 ft avg

Material used: 1/2" Clear

- Charge Length -

Front Row: 10.5 ft avg

Main Body: 10.5 ft avg

- Charge Weight -

Front Row: 30.7 kg/hole

Main Body: 30.7 kg/hole

Max. per delay: 45.0 kg/delay

SD () Equation: 526.2 kg/delay

Total kg Loaded: 7,617 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.186 kg/te (actual)

Front row: 0.170 kg/te (theoretical)

Main Body: 0.170 kg/te (theoretical)

"KPI" PF: 0.170 kg/te (theoretical)


0.815 lb/yd³

0.746 lb/yd³

0.746 lb/yd³

0.746 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-008
		P.O. #: 	Orica Order #: 2488743
		Blast Date: 2019-05-30	Blast Time: 11:55 AM

page 2

Blast Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast		43.40292	79.88668	0.757524	1.394286
Front Row Corner		43.40298	79.88617	0.757525	1.394277
Back Row Corner		43.40269	79.88704	0.757520	1.394292
Average (Centre of Blast)		43.40286	79.88663	0.757523	1.394285

1st Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40245	79.87814	0.757516	1.394137
2nd Reading					
Average		43.40245	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)		688.2 m			
Post Blast Data:		ppV: 1.3 mm/s	Trigger set at: 2.0 mm/s		
		frequency: 35.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
		air overpressure: 104.2 dB	Trigger set at: 115 dB		
2450 2nd Line					

2nd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.39339	79.88880	0.757358	1.394323
2nd Reading					
Average		43.39339	79.88880	0.757358	1.394323
Distance (2nd Seis. From Centre of Blast)		1068.8 m			
Post Blast Data:		ppV: Did mm/s	Trigger set at: 2.0 mm/s		
		frequency: Not Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
		air overpressure: Trigger dB	Trigger set at: 115 dB		
SouthWest Corner of Property					

3rd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading					
2nd Reading					
Average		0.00000	0.00000	0.000000	0.000000
Distance (3rd Seis. From Centre of Blast)		0.0 m			
Post Blast Data:		ppV: 0.0 mm/s	Trigger set at: 2.0 mm/s		
		frequency: 0.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
		air overpressure: 0.0 dB	Trigger set at: 115 dB		

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(688.2)^2}{30^2} \text{ kg} \\
 &= \frac{473,619}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 526 kg

Orica

Blaster-in-charge:

jim bray

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

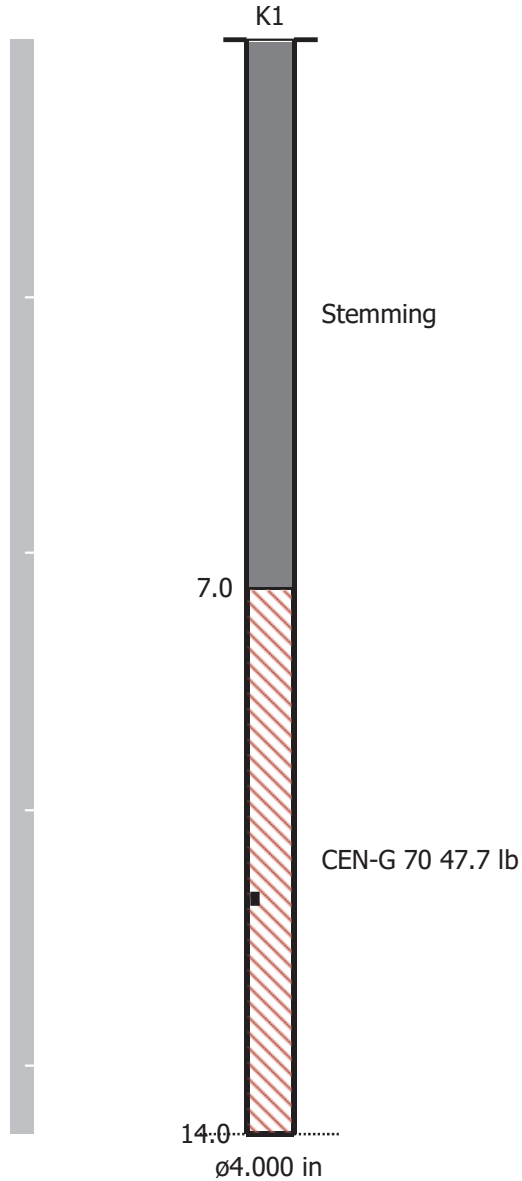
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 5/30/2019

Blast Number: 19-008
Orica Order #: 2488743

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nick Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 11:55:15 May 30, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.0 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 Line 2
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

In front Yard by tree stump
 N-43.40245, W-79.87814

Microphone Linear Weighting

PSPL 104.2 dB(L) at 0.481 sec

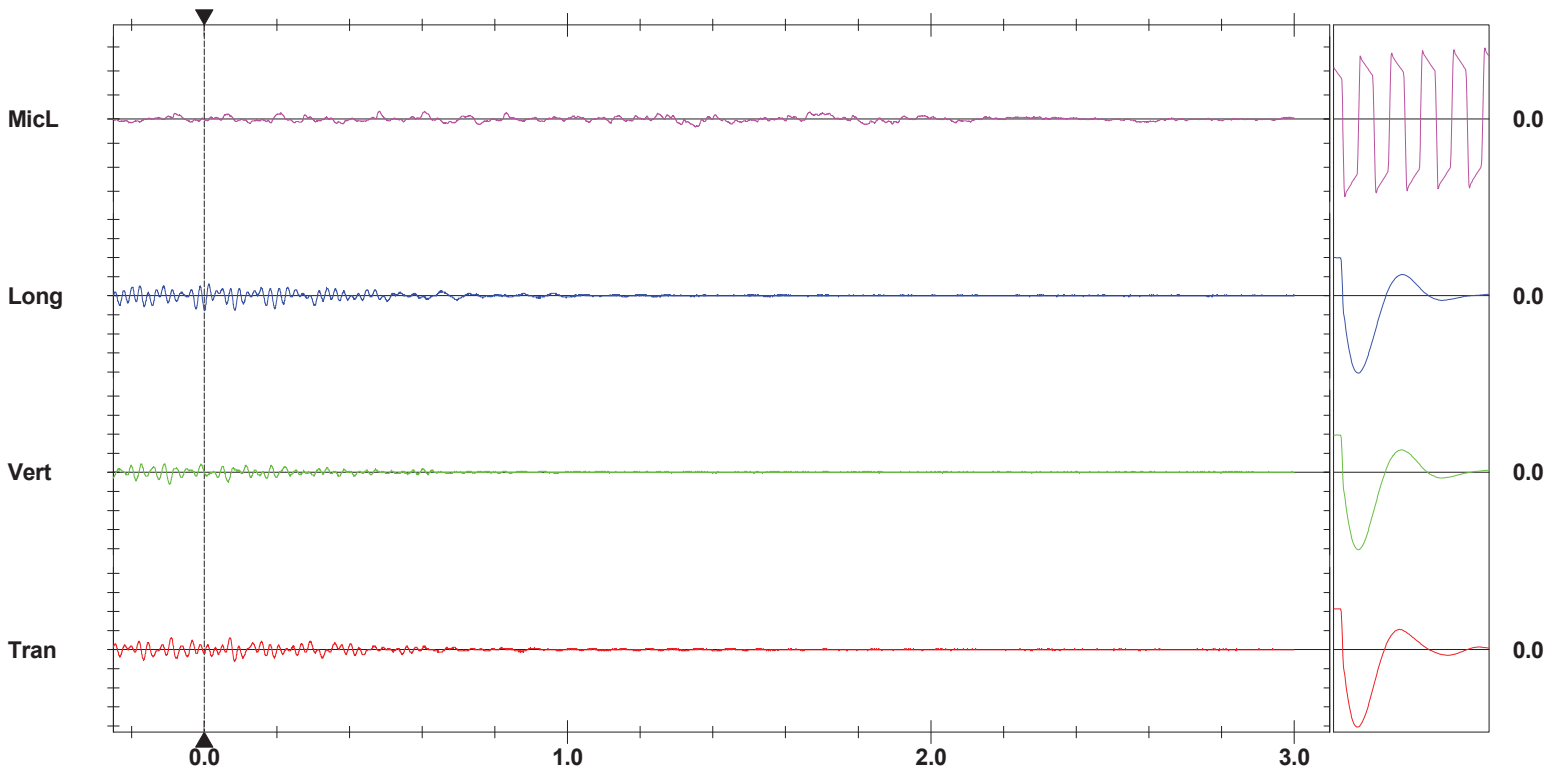
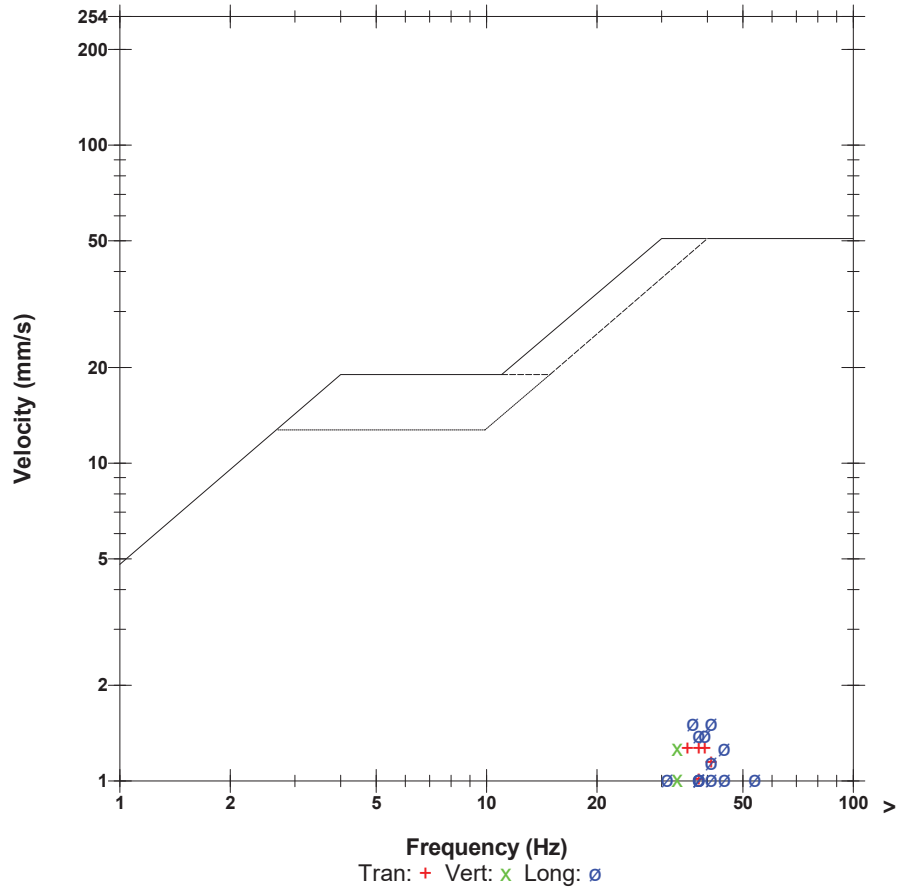
ZC Freq 20 Hz

Channel Test Passed (Freq = 20.5 Hz Amp = 566 mv)

	Tran	Vert	Long	
PPV	1.270	1.270	1.524	mm/s
ZC Freq	35	33	41	Hz
Time (Rel. to Trig)	-0.092	-0.096	0.000	sec
Peak Acceleration	0.053	0.053	0.053	g
Peak Displacement	0.006	0.006	0.007	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.3	Hz
Overswing Ratio	3.9	3.5	3.7	

Peak Vector Sum 2.020 mm/s at 0.083 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

**Nelson Aggregate
Across rod from 2102 Road 2
Burlington 2019-05-30 Blast 19-008 Floor**

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

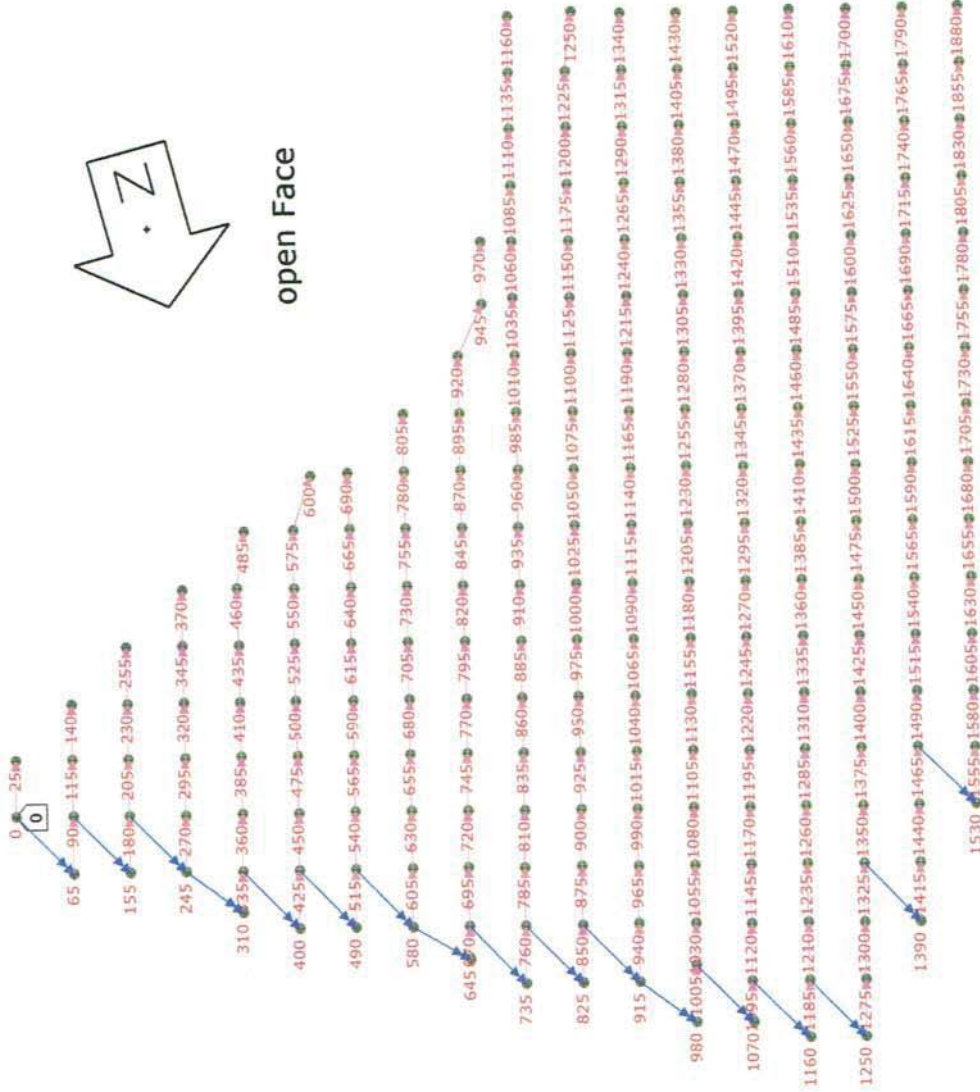
Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6859
May 30 /19 05:22:36		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
May 30 /19 05:22:36	May 30 /19 12:21:22	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic:

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft Spacing: 11.5ft Subdrill: 0.0ft Stemming: 5.5ft
 1st row burden: 11.5ft Hole Diameter: 4.0in Number of holes: 229 Hole angle: 0.0°
 Total drilled: 3206.0ft

Ramp



Road

SHOTPlus™ Professional 5.7.4.4 5/29/2019

Mine	Burlington
Location	
Title/author	9FLR008 Final
Filename	Burlington 2019-05-30 Blast 19-008 Floor.spf



Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 11.5ft Spacing: 11.5ft Subdrill: 0.0ft Stemming: 5.5ft
 1st row burden: 11.5ft Hole Diameter: 4.0in Number of holes: 229 Hole angle: 0.0°
 Total drilled: 3206.0ft

Ramp

R1 R2
 14.0ft 14.0ft
 Q1 Q2 Q3 Q4
 14.0ft 14.0ft 14.0ft 14.0ft
 P1 P2 P3 P4 P5
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 O1 O2 O3 O4 O5 O6
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 N1 N2 N3 N4 N5 N6 N7 N8
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 M1 M2 M3 M4 M5 M6 M7 M8
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 L1 L2 L3 L4 L5 L6 L7 L8 L9
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 K1 K2 K3 K4 K5 K6 K7 K8 K9 K10
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 J1 J2 J3 J4 J5 J6 J7 J8 J9 J10 J11 J12
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 I1 I2 I3 I4 I5 I6 I7 I8 I9 I10 I11 I12 I13 I14
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 H1 H2 H3 H4 H5 H6 H7 H8 H9 H10 H11 H12 H13 H14 H15 H16 H17 H18
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 G1 G2 G3 G4 G5 G6 G7 G8 G9 G10 G11 G12 G13 G14 G15 G16 G17 G18
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12 F13 F14 F15 F16 F17 F18 F19
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11 E12 E13 E14 E15 E16 E17 E18 E19
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft
 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15
 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft 14.0ft



9FLR008 Final
 4" Blasthole
 11.5 X 11.5' Pattern

DRILL TO SHALE

Road



Not to scale

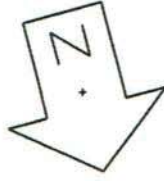
SHOTPlus™ Professional 5.7.4.4	5/29/2019
Mine	Burlington
Location	
Title/author	9FLR008 Final
Filename	Burlington 2019-05-30 Blast 19-008 Floor.spf

SHOTPlus 5 Plan

Blast Summary Data

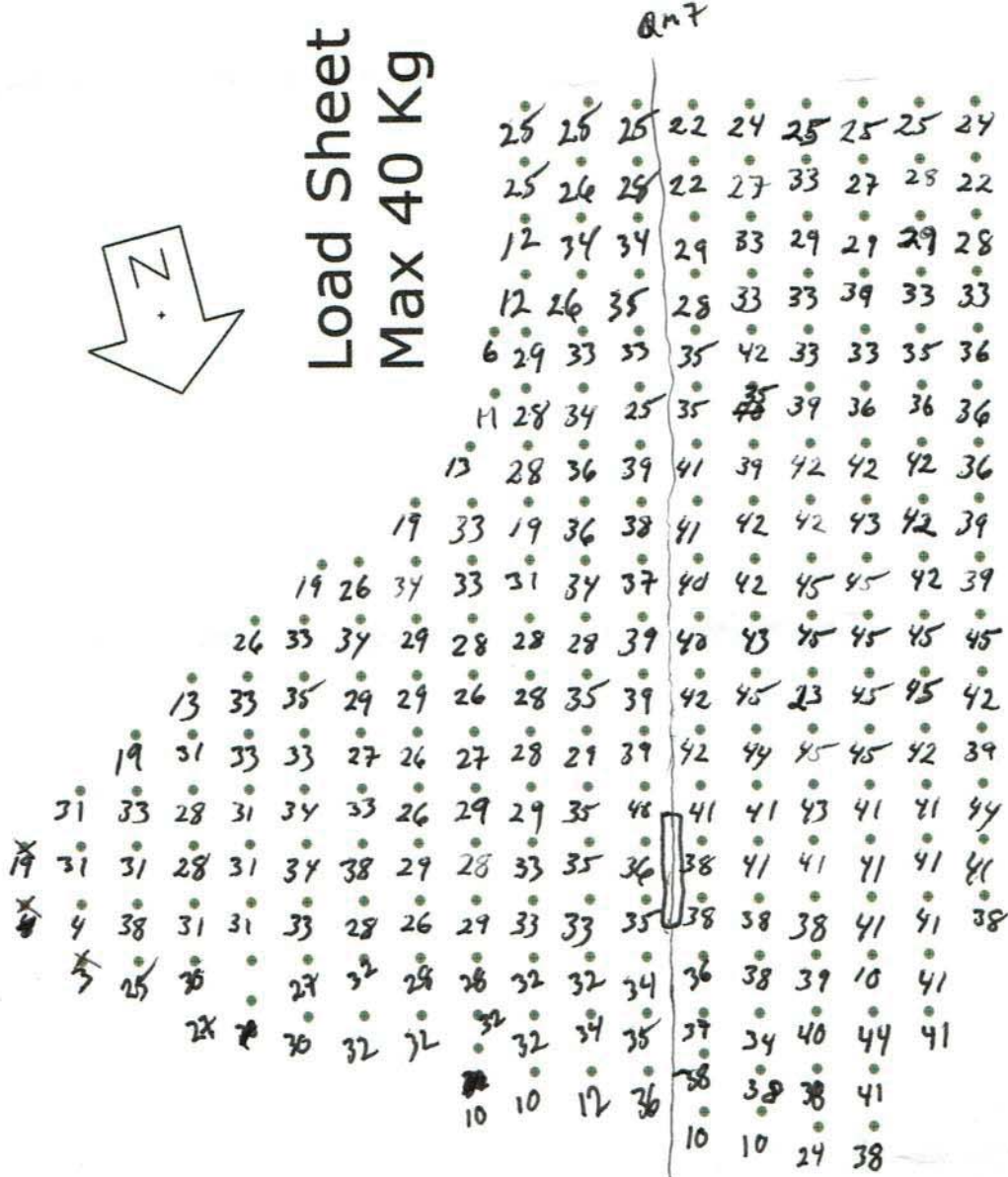
Burden: 11.5ft
 1st row burden: 11.5ft
 Total drilled: 3206.0ft
 Spacing: 11.5ft
 Hole Diameter: 4.0in
 Stemming: 5.5ft
 Subdrill: 0.0ft
 Number of holes: 229
 Hole angle: 0.0°

Ramp



Load Sheet
 Max 40 Kg

74/6 - P.C.



Road

SHOTPlus™ Professional 5.7.4.4	5/29/2019
Mine	Burlington
Location	
Title/author	9FLR008 Final
Filename	Burlington 2019-05-30 Blast 19-008 Floor.spf



Not to scale



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-06-06

Blast Number: 19-009

Orica Order #: 2491485

Blast Time: 12:07 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40361 °N Latitude 79.88191 °W Longitude
Centre of Blast Centre of Blast

Wind from the: S at kph Temperature: 16 to 20 °C

Clear: Rain: Overcast: Partly Cloudy: X Snow: Inversion: Ceiling 3,169 ft

- Drilling Information -

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0 # Holes: 52 = 3,754.9 ft (4 " diam)
Secondary Bit diam: 92.1 mm 0 # Holes: 1 = 72.2 ft (3 5/8 " diam)
Tertiary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,970	22,050	11,920

Packaged Explosives:

	cs shipped	cs returned	kg
FORTELE PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	55	12.5
PENTEX 12 (OR EQUIVALENT)	0.34	55	18.7

total explosives weight in Blast (kg): 11,951

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			53
UNITRONIC 600 20M			2
UNITRONIC 600 25M			55

Cord & Accessories:

	U of M	# used
HARNESSE WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	5

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	5.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Tonnes Blasted: 27,603 te 10,616 m3
Total tonnes per day: 27,603 te NB80-01 Rate Code
Total Holes Loaded: 53 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 3 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg
Spacing: 10.0 ft avg
Holes: 19 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg
Spacing: 10.0 ft avg
Holes: 34 main body

Bench Height: 70.2 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 72.2 ft avg

- Stone Decking -

Front Row: 8.0 ft avg

Main Body: 0.0 ft avg

Decks: 2 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 57.2 ft avg

Main Body: 65.2 ft avg

- Charge Weight -

Front Row: 166.8 kg/hole

Main Body: 190.1 kg/hole

Max. per delay: 230.0 kg/delay

SD () Equation: 122.0 kg/delay

Total kg Loaded: 11,951 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.433 kg/te (actual)


Front row: 0.269 kg/te (theoretical)

Main Body: 0.409 kg/te (theoretical)

"KPI" PF: 0.362 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

2 Stone decks were added due to voids identified on drill log

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry:	Burlington	Blast Number:	19-009
		P.O. #:		Orica Order #:	2491485
		Blast Date:	2019-06-06	Blast Time:	12:07 PM

page 2

Blast Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast		43.40362	79.88191	0.757536	1.394202
Front Row Corner		43.40341	79.88199	0.757532	1.394204
Back Row Corner		43.40381	79.88183	0.757539	1.394201
Average (Centre of Blast)		43.40361	79.88191	0.757536	1.394202

1st Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40245	79.87814	0.757516	1.394137
2nd Reading					
Average		43.40245	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)		331.4	m		
Post Blast Data:		ppV: 9.7	mm/s	Trigger set at: 2.0	mm/s
		frequency: 11.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 116.9	dB	Trigger set at: 115	dB
2450 2nd Line					

2nd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40605	79.89400	0.757578	1.394413
2nd Reading					
Average		43.40605	79.89400	0.757578	1.394413
Distance (2nd Seis. From Centre of Blast)		1014.8	m		
Post Blast Data:		ppV: 0.2	mm/s	Trigger set at: 2.0	mm/s
		frequency: 15.5	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 121.7	dB	Trigger set at: 115	dB
Colling Rd & Blind Line Bruce Trail					

3rd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.39339	79.88880	0.757358	1.394323
2nd Reading					
Average		43.39339	79.88880	0.757358	1.394323
Distance (3rd Seis. From Centre of Blast)		1267.4	m		
Post Blast Data:		ppV: Did	mm/s	Trigger set at: 2.0	mm/s
		frequency: Not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB	Trigger set at: 115	dB
SouthWest Corner of Property					

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(331.4)^2}{30^2} \text{ kg} \\
 &= \frac{109,826}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.

Date/Time Long at 12:07:12 June 6, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 Sideroad
 Client: Nelson Aggregate
 User Name: Orica Canada Inc.
 General: Burlington

Extended Notes

43.40245 -79.87814
 Beside tree stump in front yard

Microphone Linear Weighting

PSPL 116.9 dB(L) at 2.322 sec

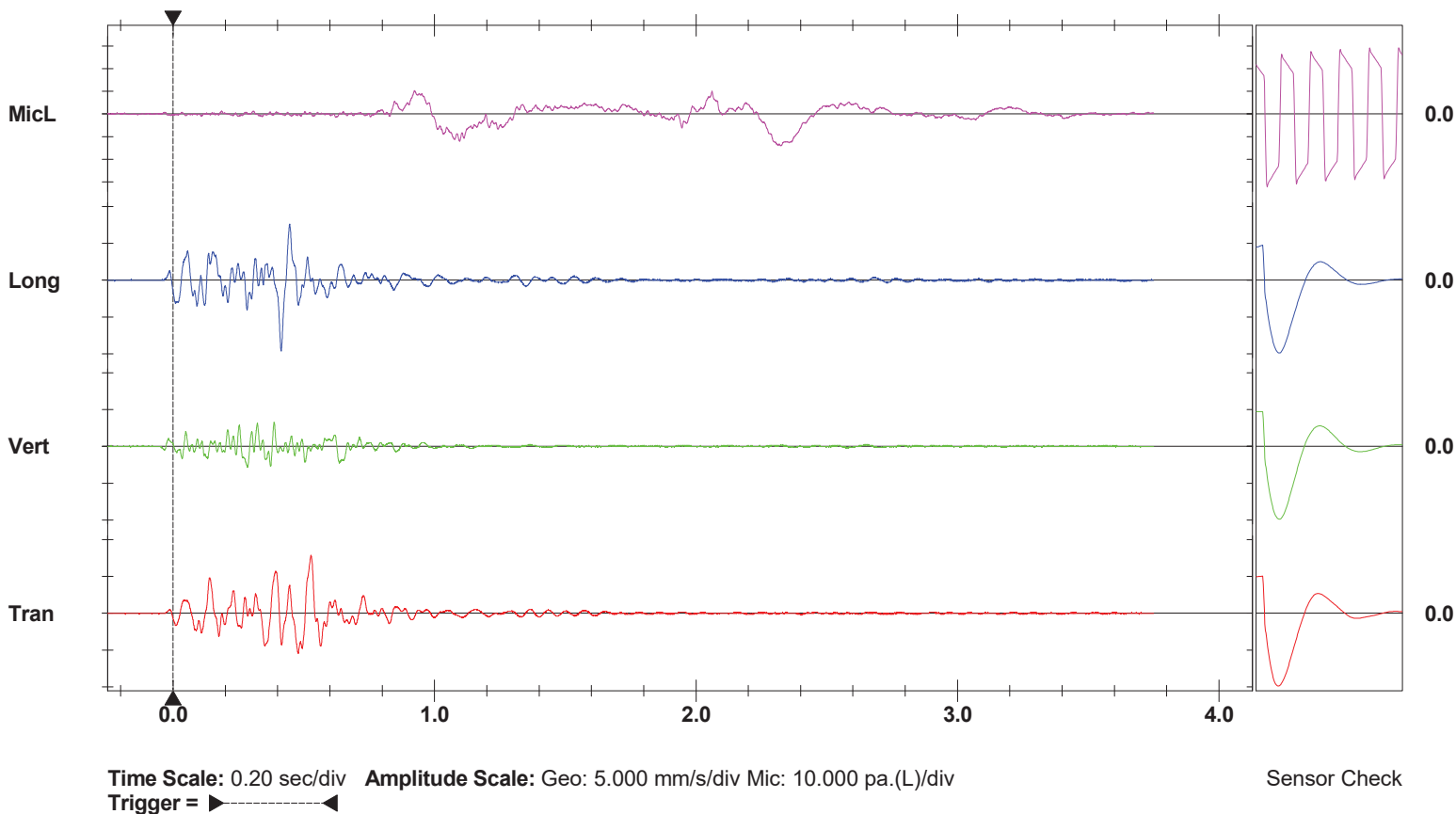
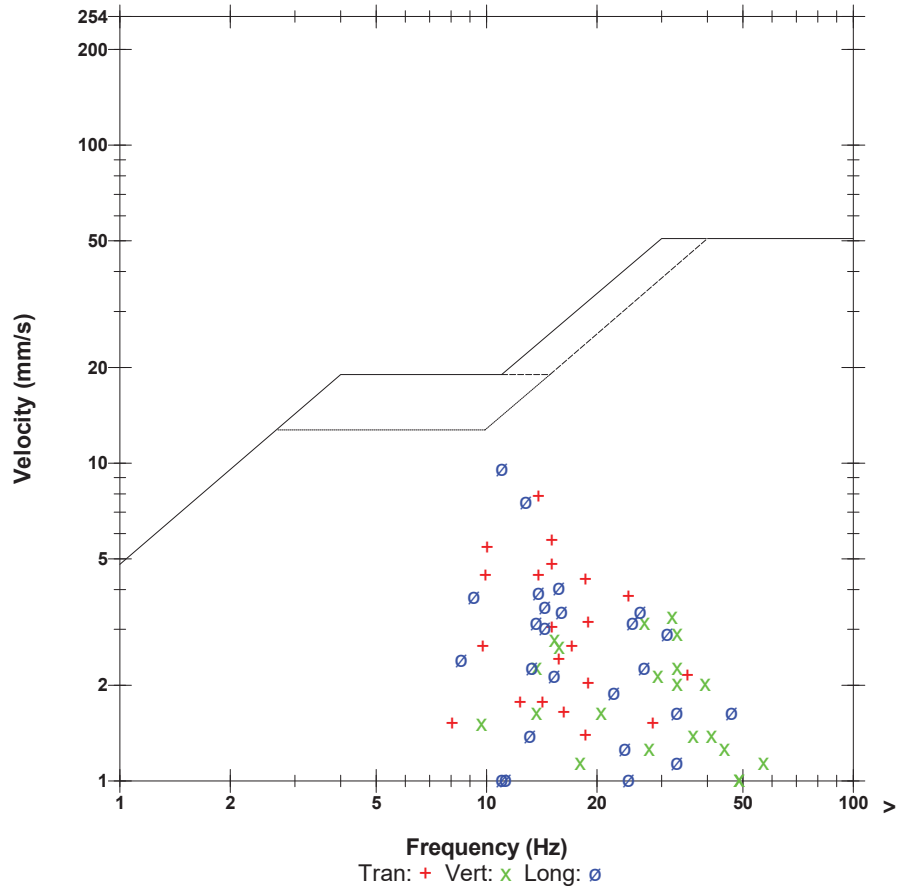
ZC Freq 2.3 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 571 mv)

	Tran	Vert	Long	
PPV	7.874	3.302	9.652	mm/s
ZC Freq	13.8	32	11.0	Hz
Time (Rel. to Trig)	0.527	0.386	0.413	sec
Peak Acceleration	0.106	0.080	0.106	g
Peak Displacement	0.089	0.029	0.089	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.5	7.3	Hz
Overswing Ratio	3.8	3.6	4.0	

Peak Vector Sum 10.53 mm/s at 0.414 sec

USBM RI8507 And OSMRE



Date/Time MicL at 12:07:14 June 6, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.353 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20190606120714.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

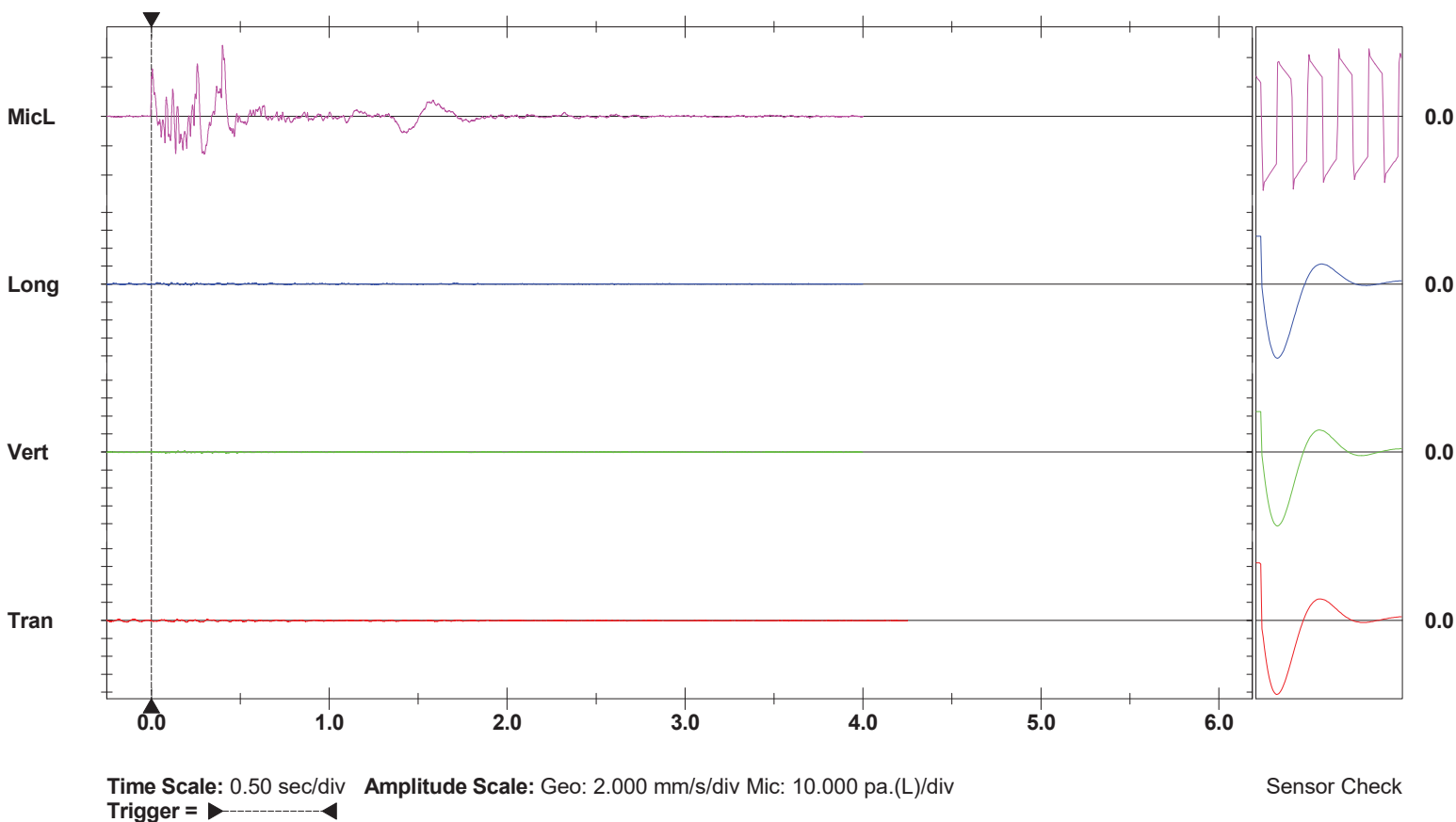
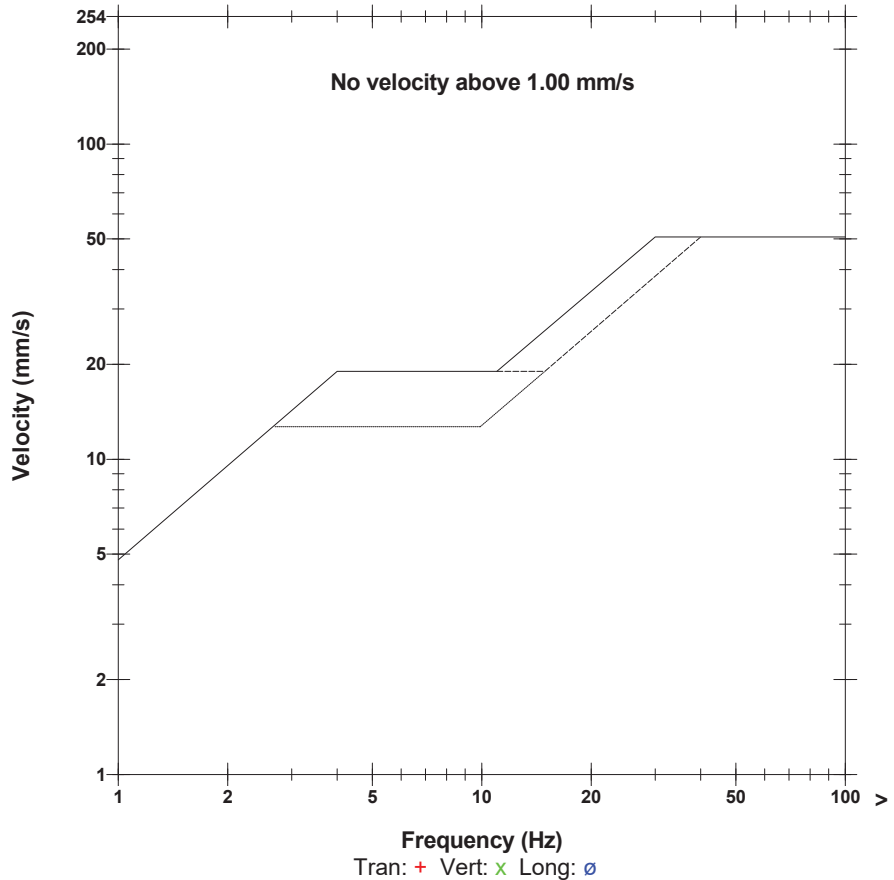
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 121.7 dB(L) at 0.400 sec
ZC Freq 5.6 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1345 mv)

	Tran	Vert	Long	
PPV	0.213	0.126	0.173	mm/s
ZC Freq	15.5	14.4	25	Hz
Time (Rel. to Trig)	0.200	0.081	0.114	sec
Peak Acceleration	0.010	0.012	0.016	g
Peak Displacement	0.009	0.002	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.4	3.4	3.7	

Peak Vector Sum 0.232 mm/s at 0.200 sec

USBM RI8507 And OSMRE



**Nelson Aggregate
SW Corner of Property
Burlington 2019-06-06 Blast 19-009 Upper Middle**

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6859
Jun 6 /19 05:55:30		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
Jun 6 /19 12:29:39	Jun 6 /19 12:29:41	Event recorded. Trigger Level Long: 1.50 mm/s
Jun 6 /19 12:29:41	Jun 6 /19 12:29:49	Event recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic: 121.0 c

SHOTPlus 5 Plan

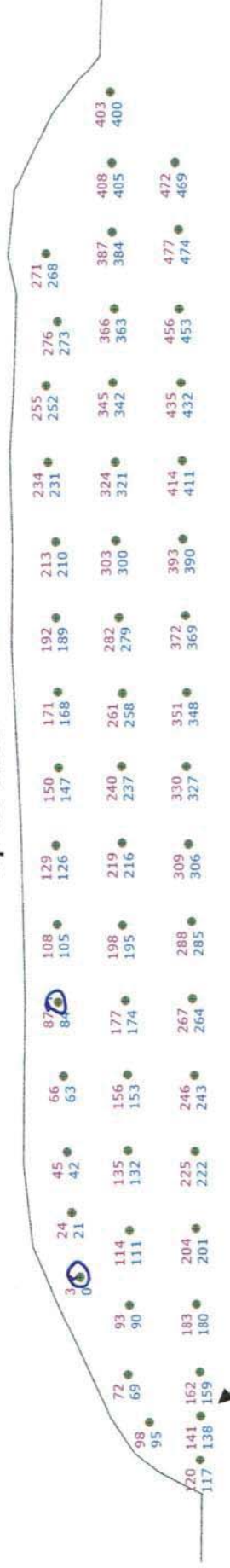
Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 3827.1ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Stemming: 7.0ft
 Subdrill: 2.0ft
 Number of holes: 53
 Hole angle: 0.0°

O = Deck



open face



C2 3.625" DIA HOLE



Not to scale

SHOTPlus™ Professional 5.7.4.4	6/5/2019
Mine	Burlington
Location	UPPER MIDDLE
Title/author	9UPMD009 Design Fnl
Filename	Burlington 2019-06-06 Blast 19-009 Upper Mig

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 53
 Total drilled: 3827.1ft Hole angle: 0.0°

Load Sheet
 Max 230 Kg



open face

89 226 218 217 103 210 215 225 214 221 216 218 221 219 217
 94 224 229 219 223 222 212 220 230 225 222 223 225 226 226 215
 210 216 206 219 230 228 232 221 214 217 220 230 218 223 218 221 222 225 222
 149

C2 3.625" DIA HOLE



Not to scale

SHOTPlus™ Professional 5.7.4.4	6/5/2019
Mine	Burlington
Location	UPPER MIDDLE
Title/author	9UPMD009 Design Fnl
Filename	Burlington 2019-06-06 Blast 19-009 Upper Mic

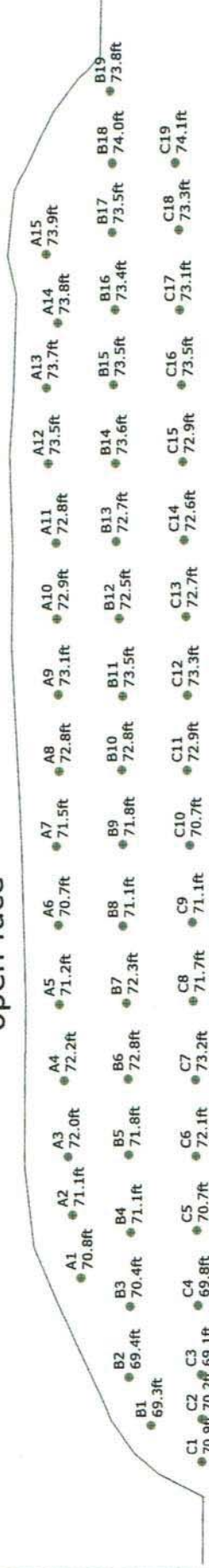
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 Spacing: 10.0ft
 Stemming: 7.0ft
 1st row burden: 12.0ft
 Hole Diameter: 4.0in
 Number of holes: 53
 Hole angle: 0.0°
 Total drilled: 3827.1ft



open face



9UPMD009 Design Fnl - 3.625" and 4" Blast Holes 12x10 9x10 272 and 250 + .6 S
 DRILLER NAME: _____

C2 3.625" DIA HOLE



Not to scale

SHOTPlus™ Professional 5.7.4.4	6/5/2019
Mine	Burlington
Location	UPPER MIDDLE
Title/author	9UPMD009 Design Fnl
Filename	Burlington 2019-06-06 Blast 19-009 Upper Mid



Blast Design

Nelson Aggregate

Quarry: **Burlington**
P.O. #:
Design Date: **2019-06-06**

Blast Number: **19-009**
Orica Order #:

page 1

Blaster-in-charge: **Mike Derkinderen** (Print Name)

Blast Location: **Upper Middle** (Bench / Face)

GPS Coordinates: **43.40361** °N Latitude **79.88191** °W Longitude
Centre of Blast Centre of Blast

Design to Blasted: **27,603** te
Total Holes Loaded: **53** holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: **3** rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: **101.6** mm **0°** # Holes: **52** = 3,754.9 ft (4 " diam)
Secondary Bit diam: **92.1** mm **0°** # Holes: **1** = 72.2 ft (3 5/8 " diam)
Tertiary Bit diam: mm **0°** # Holes: = 0.0 ft (" diam)

- Design Pattern (Front Row) -

Burden: **12.0** ft avg
Spacing: **10.0** ft avg
Holes: **19** front row

- Design Pattern (Main Body) -

Burden: **9.0** ft avg
Spacing: **10.0** ft avg
Holes: **34** main body
Bench Height: **70.2** ft avg
Sub-drill: **2.0** ft avg
Hole Depth: **72.2** ft avg

- Design Stone Decking -

Front Row: **0.0** ft avg
Main Body: **0.0** ft avg

- Design Collar Stemming -

Front Row: **7.0** ft avg
Main Body: **7.0** ft avg
Material used: **.75" Clear**

- Design Charge Length -

Front Row: **65.2** ft avg
Main Body: **65.2** ft avg

- Design Charge Weight -

Front Row: **190.1** kg/hole
Main Body: **190.1** kg/hole
Max Chge Wt / delay: **230.0** kg/delay

Required kg Loaded: **12,550** kg
Rock Density: **2.60** g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: **0.455** kg/te (actual)
Front row: **0.307** kg/te (theoretical)
Main Body: **0.409** kg/te (theoretical)
"KPI" PF: **0.375** kg/te (theoretical)

1.343 lb/yd³

1.791 lb/yd³

1.642 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

Bulk Expl. Required:

CENTRA GOLD 70 kg **12,500**

Pkgd Expl. Required:

FORTEL PRO 75X400 kg **2** **50**

Boosters Required:

kg/u # used kg
PENTEX 8 (OR EQUIVALENT) 0.23
PENTEX 12 (OR EQUIVALENT) 0.34

total explosives weight in Blast (kg): **12,550**

Pkgd Prod (50 kg) % of Total kg: **0.4%**

Detonators Required:

ms # req'd

UNITRONIC 600 6M

UNITRONIC 600 25M

Cord & Access. Req'd:

U of M # req'd

WIRE DUPLEX (6 PACK) 400M units **1**

Resource Deployment:

of Blasts today (this Quarry) **1**

of Blasters (this Blast) **1**

of Helpers (this Blast) **1**

of MMU's (this Blast) **1**

Services Req'd:

BULK TRUCK CHARGE **1.0**

BLASTER HOURS Enter Blaster hours **0.0**

HELPER HOURS Enter total Helper man-hours **0.0**

SHOT LAYOUT FEE Enter # trips extra beyond 1 **0.0**

ADVANCED BLAST DESIGN Enter hours **0.0**

BORETRACK Enter hours **0.0**



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-06-20

Blast Number: 19-010

Orica Order #: 2496865

Blast Time: 12:11 PM

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor 011 (Bench / Face)

GPS Coordinates: 43.40226 °N Latitude 79.88668 °W Longitude
Centre of Blast Centre of Blast

Wind from the: N at 5 kph Temperature: 16 to 20 °C

Clear: Rain: Overcast: X
Partly Cloudy: Snow: Inversion: Ceiling 30,000 ft

- Drilling Information -

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0 # Holes: 272 = 4,678.4 ft (4 " diam)
Secondary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	35,630	29,410	6,220

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	272	92.5

total explosives weight in Blast (kg): 6,312

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
EXEL HANDIDET 12m		25/500	24
CONNECTADET 9M		25 ms	11
CONNECTADET 9M		33 ms	2
CONNECTADET 9M		65 ms	36
EXEL HANDIDET 9m		25/500	248

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.5
HELPER HOURS	Enter total Helper man-hours	12.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Tonnes Blasted: 45,552 te 17,520 m3
Total tonnes per day: 45,552 te NF-02 Rate Code
Total Holes Loaded: 272 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 17 rows

- Pattern (Front Row) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 40 front row

- Pattern (Main Body) -

Burden: 11.5 ft avg

Spacing: 11.5 ft avg

Holes: 232 main body

Bench Height: 17.2 ft avg

Sub-drill: 0.0 ft avg

Hole Depth: 17.2 ft avg

- Stone Decking -

Front Row: ft avg

Main Body: ft avg

Decks: 0 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: 1/2" Clear

- Charge Length -

Front Row: 10.2 ft avg

Main Body: 10.2 ft avg

- Charge Weight -

Front Row: 29.7 kg/hole

Main Body: 29.7 kg/hole

Max. per delay: 32.0 kg/delay

SD () Equation: 530.4 kg/delay

Total kg Loaded: 6,312 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.139 kg/te (actual)

Front row: 0.178 kg/te (theoretical)

Main Body: 0.178 kg/te (theoretical)

"KPI" PF: 0.178 kg/te (theoretical)

0.607 lb/yd³


0.778 lb/yd³

0.778 lb/yd³

0.778 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

helper hours 2x6=12hrs

 The Blasting Professionals [®]	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-010
		P.O. #: 	Orica Order #: 2496865
		Blast Date: 2019-06-20	Blast Time: 12:11 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40226	79.88684	0.757512	1.394288
Front Row Corner	43.40197	79.88588	0.757507	1.394272
Back Row Corner	43.40255	79.88732	0.757517	1.394297
Average (Centre of Blast)	43.40226	79.88668	0.757512	1.394286

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	690.9	m		
	Post Blast Data:	ppV: did	mm/s	Trigger set at: 2.0	mm/s
		frequency: not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: trigger	dB	Trigger set at: 115	dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (2nd Seis. From Centre of Blast)	1002.0	m		
	Post Blast Data:	ppV: did	mm/s	Trigger set at: 2.0	mm/s
		frequency: not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: trigger	dB	Trigger set at: 115	dB
	SouthWest Corner of Property				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading				
	2nd Reading				
	Average	0.00000	0.00000	0.000000	0.000000
	Distance (3rd Seis. From Centre of Blast)	0.0	m		
	Post Blast Data:	ppV: 0.0	mm/s	Trigger set at: 2.0	mm/s
		frequency: 0.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 0.0	dB	Trigger set at: 115	dB

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(690.9)^2}{30^2} \text{ kg} \\
 &= \frac{477,343}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 530 kg

Orica

Blaster-in-charge:

jim bray

Kevin Toplis

Signature required, indicating that
Blast Report is Complete & Accurate.

Blast Summary Data

Burden: 11.5ft	Spacing: 11.5ft	Subdrill: 0.0ft	Stemming: 5.5ft
1st row burden: 11.5ft	Hole Diameter: 4.0in	Number of holes: 273	Hole angle: 0.0°
Total drilled: 4368.0ft			



9FLR11 Design
4" Blasthole
11.5' X 11.5' Pattern
DRILL TO SHALE

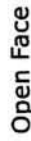
SHOTPlus™ Professional 5.7.7.8	6/19/2019
Mine Burlington	
Location	
Title/author 9FLR11 Design	
Filename Burlington 2019-06-20 Blast 19-010 Floor.spf	

Not to scale



Blast Summary Data

Spacing: 11.5ft
Hole Diameter: 4.0in
Subdrill: 0.0ft
Number of holes: 273



Armour Stones

9FLR11 Design
4" Blasthole
11.5' X 11.5' P
DRILL TO SHA

SHOTPlus™ Professional 5.7.7.8

Mine	Burlington
------	------------

Location

Title/author	9FLR11 Design

Filename	Burlington 2019-06-20 Blast 19-010 Floor.spf
----------	--

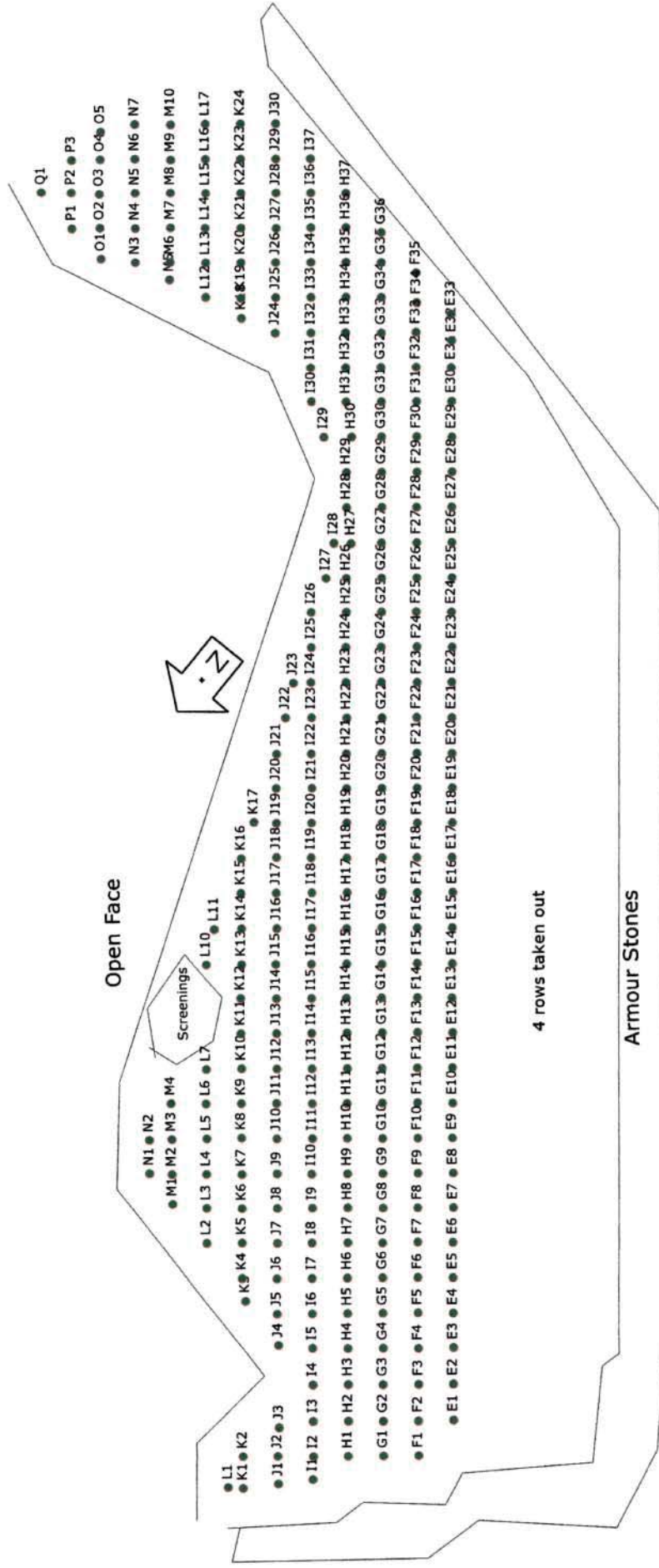
Not to scale



SHOTPlus Plan

Blast Summary Data

Burden: 11.5ft Spacing: 11.5ft Stemming: 5.5ft
 1st row burden: 11.5ft Subdrill: 0.0ft
 Total drilled: 4368.0ft Hole Diameter: 4.0in Number of holes: 273 Hole angle: 0.0°



9FLR11 Design
 4" Blasthole
 11.5' X 11.5' Pattern
 DRILL TO SHALE

SHOTPlus™ Professional 5.7.7.8	6/19/2019
Mine	Burlington
Location	
Title/author	9FLR11 Design
Filename	Burlington 2019-06-20 Blast 19-010 Floor.spf



Not to scale



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Design Date: 2019-06-20

Blast Number: 19-010
Orica Order #:

page 1

Blaster-in-charge: Kevin Toplis (Print Name)

Blast Location: Floor 011 (Bench / Face)
GPS Coordinates: 43.40226 °N Latitude 79.88668 °W Longitude
Centre of Blast Centre of Blast

Design te Blasted: 61,536 te
Total Holes Loaded: 395 holes
... including: Dead Holes
... and: Helper Holes
Helper Hole Collar: ft avg
Rows Blasted: 17 rows

- Drilling Information -

Angle from Vertical
Primary Bit diam: 101.6 mm 0° # Holes: 395 = 6,320.0 ft (4 " diam)
Secondary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)
Nominal Bit Diameter:

- Design Pattern (Front Row) -

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 40 front row

- Design Pattern (Main Body) -

Burden: 11.5 ft avg
Spacing: 11.5 ft avg
Holes: 355 main body
Bench Height: 16.0 ft avg
Sub-drill: 0.0 ft avg
Hole Depth: 16.0 ft avg

- Design Stone Decking -

Front Row: ft avg
Main Body: ft avg

- Design Collar Stemming -

Front Row: 7.0 ft avg
Main Body: 7.0 ft avg

Material used: 3/4" Clear

- Design Charge Length -

Front Row: 9.0 ft avg
Main Body: 9.0 ft avg

- Design Charge Weight -

Front Row: 26.2 kg/hole
Main Body: 26.2 kg/hole
Max Chge Wt / delay: 45.0 kg/delay

Required kg Loaded: 184 kg
Rock Density: 2.60 g/cc = te/m³

- Design Powder Factor -

Expected Yield PF: 0.003 kg/te (actual)
Front row: 0.168 kg/te (theoretical)
Main Body: 0.168 kg/te (theoretical)
"KPI" PF: 0.168 kg/te (theoretical)

0.738 lb/yd³
0.738 lb/yd³
0.738 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

Drilling to shale, final depths to be determined once shot has been measured

Bulk Expl. Required:

kg

CENTRA GOLD 70

Pkgd Expl. Required:

kg

FORTELE PRO 75X400

2

50

Boosters Required:

kg/u # used kg

PENTEX 12 (OR EQUIVALENT)

0.34

395

134.3

total explosives weight in Blast (kg): 184

Pkgd Prod (50 kg) % of Total kg: 27.1%

Detonators Required:

ms # req'd

UNITRONIC 600 6M

2

EXEL HANDIDET 12m

25/500

395

CONNECTADET 9M

25 ms

3

CONNECTADET 9M

33 ms

1

CONNECTADET 9M

65 ms

24

Cord & Access. Req'd:

U of M # req'd

WIRE DUPLEX (6 PACK) 400M

units

1

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services Req'd:

BULK TRUCK CHARGE 1.0
BLASTER HOURS Enter Blaster hours 0.0
HELPER HOURS Enter total Helper man-hours 0.0
SHOT LAYOUT FEE Enter # trips extra beyond 1 0.0
ADVANCED BLAST DESIGN Enter hours 0.0
BORETRACK Enter hours 0.0



Blast Design

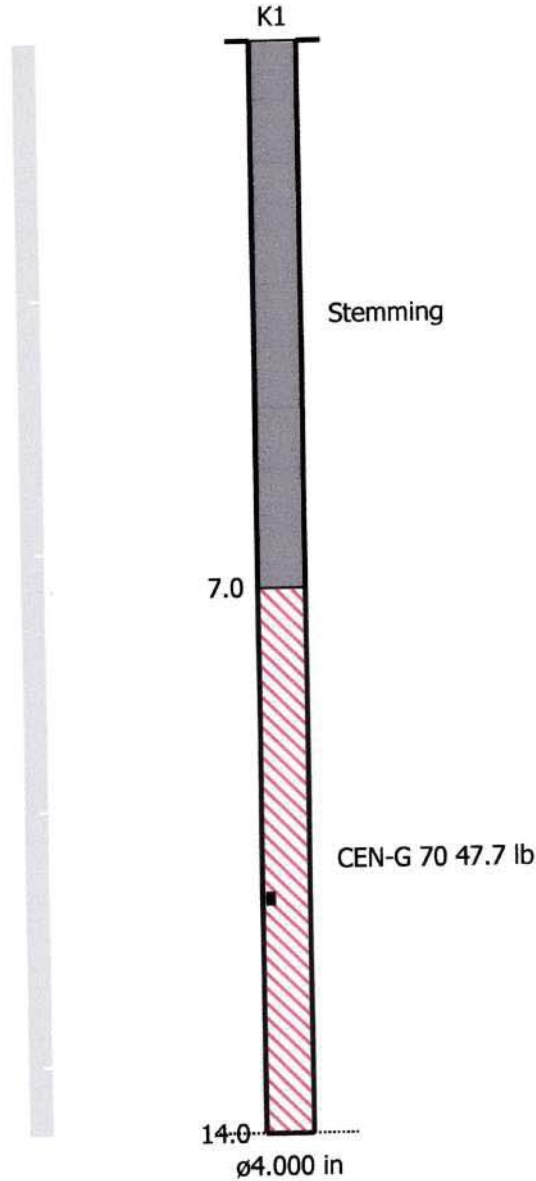
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 6/20/2019

Blast Number: 19-010
Orica Order #:

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Kevin Toplis

Quarry Manager:

Nick Heap

Signature required, indicating
sign off on Blast Design.



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-07-04

Blast Number: 19-011

Orica Order #: 2503180

Blast Time: 11:04 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle North (Bench / Face)

GPS Coordinates: 43.40499 °N Latitude 79.88175 °W Longitude
Centre of Blast Centre of Blast

Wind from the: SE at 10 kph Temperature: 26 to 30 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0 # Holes: 53 = 3,205.4 ft (4 " diam)
Secondary Bit diam: 92.1 mm 0 # Holes: 4 = 241.9 ft (3 5/8 " diam)
Tertiary Bit diam: mm 0 # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,440	19,700	7,740
CENTRA GOLD 70	34,450	32,820	1,630

Packaged Explosives:

	cs shipped	cs returned	kg
FORTELE PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	57	12.9
PENTEX 12 (OR EQUIVALENT)	0.34	57	19.4

total explosives weight in Blast (kg): 9,402

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			57
UNITRONIC 600 20M			25
UNITRONIC 600 25M			32

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	5

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Tonnes Blasted: 23,372 te 8,989 m3
Total tonnes per day: 23,372 te NB60-07 Rate Code
Total Holes Loaded: 57 holes
... including: 3 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 3 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 20 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 37 main body

Bench Height: 58.5 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 60.5 ft avg

- Stone Decking -

Front Row: 0.0 ft avg

Main Body: 0.0 ft avg

Decks: 0 per blast

- Collar Stemming -

Front Row: 8.0 ft avg

Main Body: 8.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 52.5 ft avg

Main Body: 52.5 ft avg

- Charge Weight -

Front Row: 153.0 kg/hole

Main Body: 153.0 kg/hole

Max. per delay: 187.0 kg/delay

SD () Equation: 183.3 kg/delay

Total kg Loaded: 9,402 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.402 kg/te (actual)

Front row: 0.296 kg/te (theoretical)

Main Body: 0.395 kg/te (theoretical)

"KPI" PF: 0.362 kg/te (theoretical)

1.763 lb/yd³

1.298 lb/yd³


1.731 lb/yd³

1.586 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

F-16 Was measured at 61' the morning of the blast and brought to Nick Heap's attention

8' Collars were used due to excessive over burden

 ORICA The Blasting Professionals™	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-011
		P.O. #: 	Orica Order #: 2503180
		Blast Date: 2019-07-04	Blast Time: 11:04 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40505	79.88168	0.757561	1.394198
Front Row Corner	43.40470	79.88175	0.757555	1.394200
Back Row Corner	43.40521	79.88182	0.757564	1.394201
Average (Centre of Blast)	43.40499	79.88175	0.757560	1.394199

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	406.2	m		
	Post Blast Data:	ppV:	3.3 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	20.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	113.5 dB	Trigger set at: 115 dB	
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	998.1	m		
	Post Blast Data:	ppV:	0.2 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	9.1 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	115.3 dB	Trigger set at: 115 dB	
	Colling Rd & Blind Line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (3rd Seis. From Centre of Blast)	1411.7	m		
	Post Blast Data:	ppV:	Did mm/s	Trigger set at: 2.0 mm/s	
		frequency:	Not Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	Trigger dB	Trigger set at: 115 dB	
	SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(406.2)^2}{30^2} \text{ kg} \\
 &= \frac{164,998}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 183 kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 7/4/2019

Blast Number: 19-011
Orica Order #: 2503180

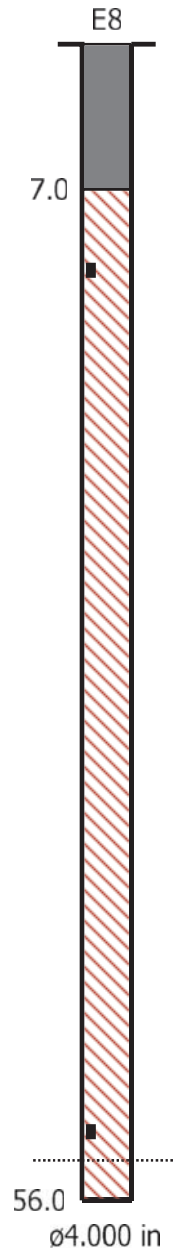
page 2

Paste ShotPlus Diagram inside Rectangle:



UNI Tronic (?)ms 20ft
PENTEX BC 7 * 200 x1

UNI Tronic (?)ms 66ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Mike derkinderen

Quarry Manager:

Nick Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 11:04:45 July 4, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.4 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 Road
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

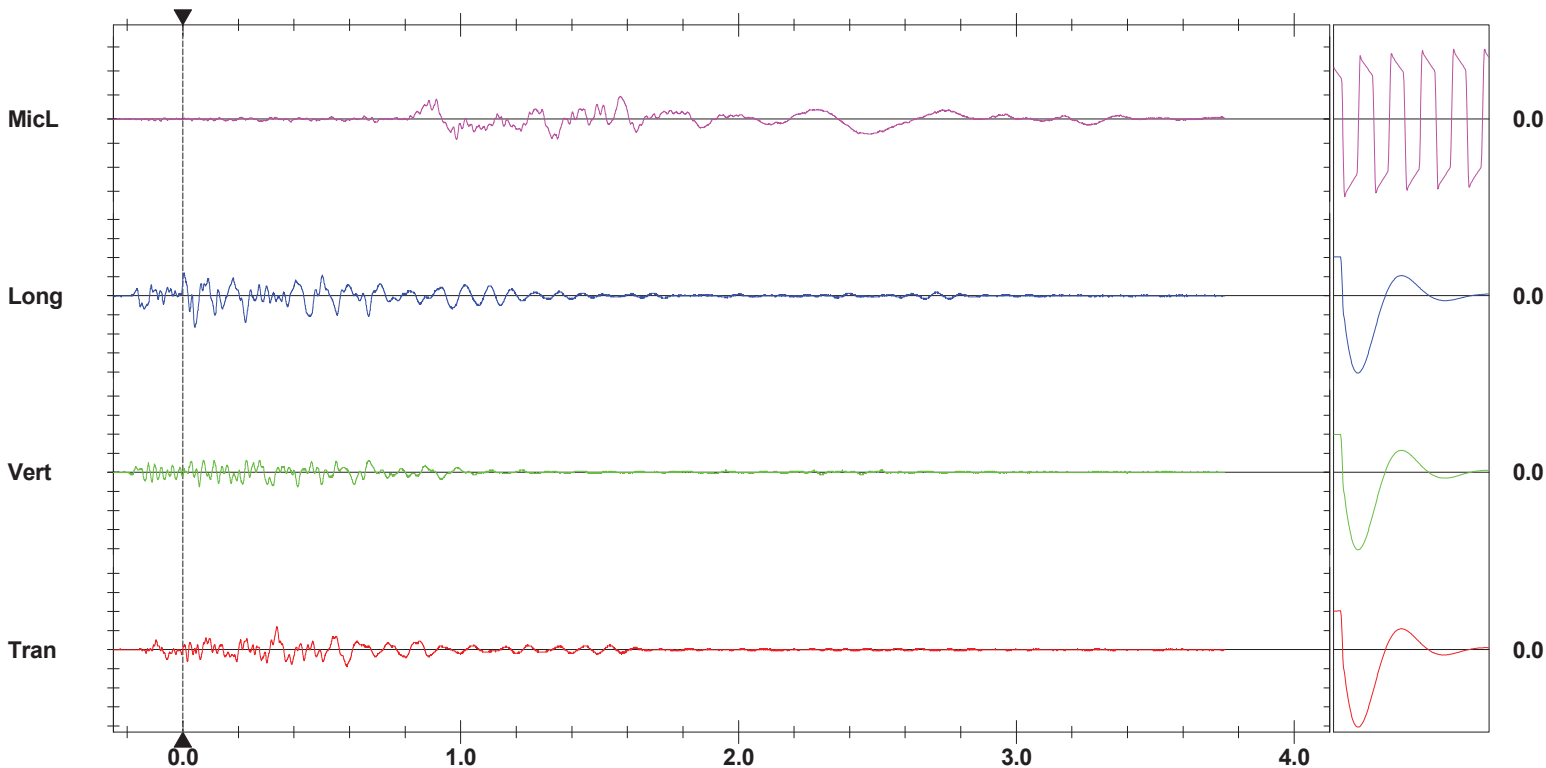
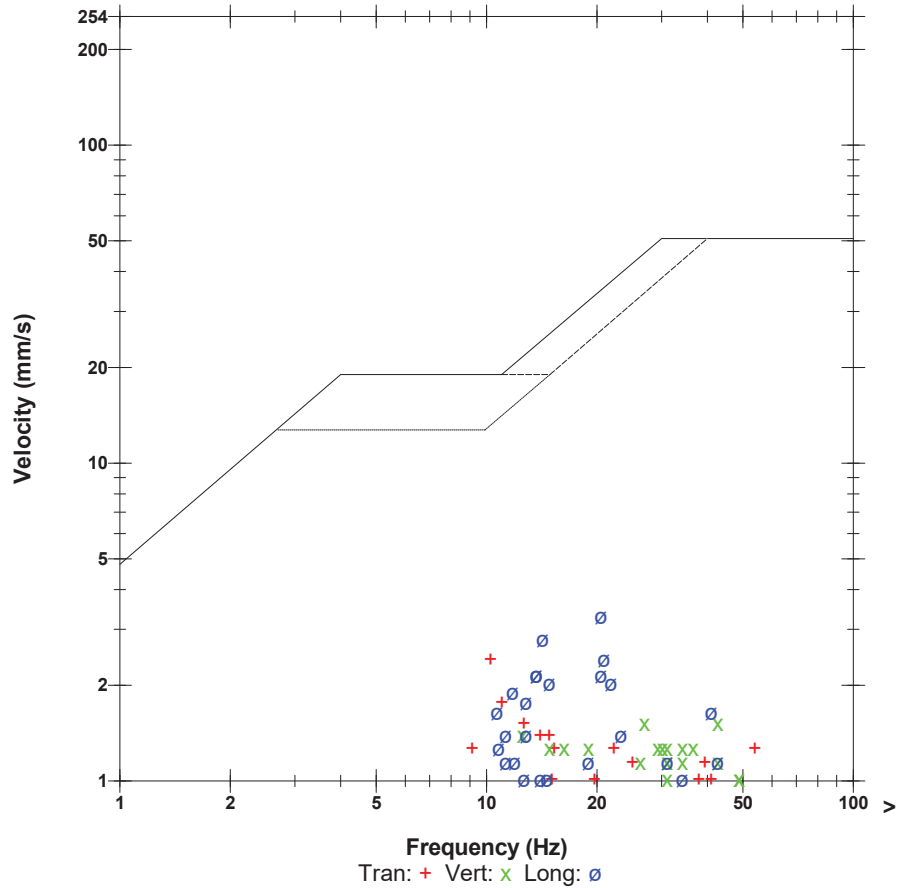
N43.40245;W-79.87814

Microphone Linear Weighting
PSPL 113.5 dB(L) at 1.575 sec
ZC Freq 9.1 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 514 mv)

	Tran	Vert	Long	
PPV	2.413	1.524	3.302	mm/s
ZC Freq	10.2	43	20	Hz
Time (Rel. to Trig)	0.338	0.059	0.042	sec
Peak Acceleration	0.053	0.053	0.080	g
Peak Displacement	0.026	0.019	0.029	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.4	Hz
Overswing Ratio	3.8	3.6	3.9	

Peak Vector Sum 3.326 mm/s at 0.042 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time MicL at 11:04:45 July 4, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.009 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20190704110445.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

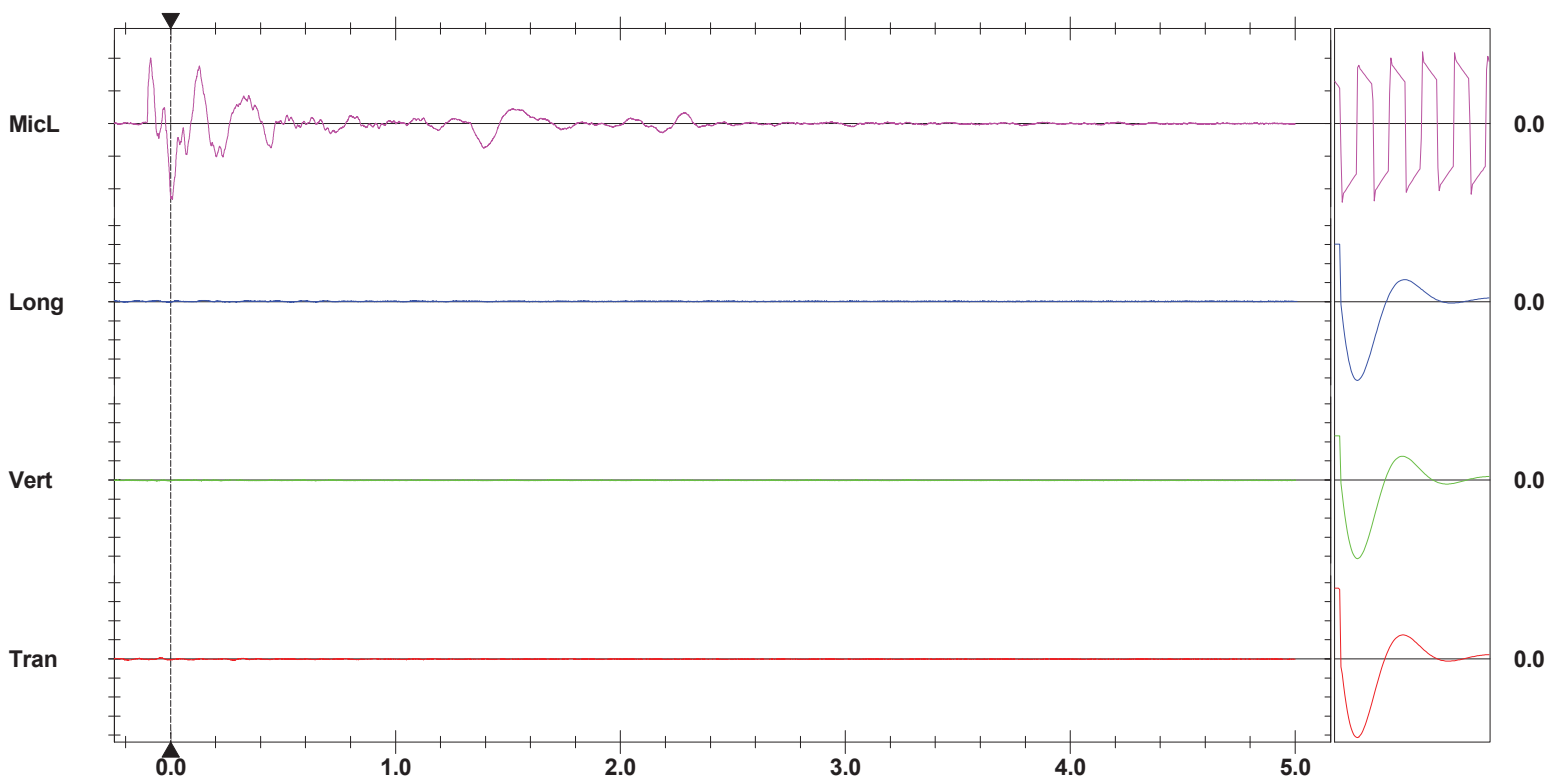
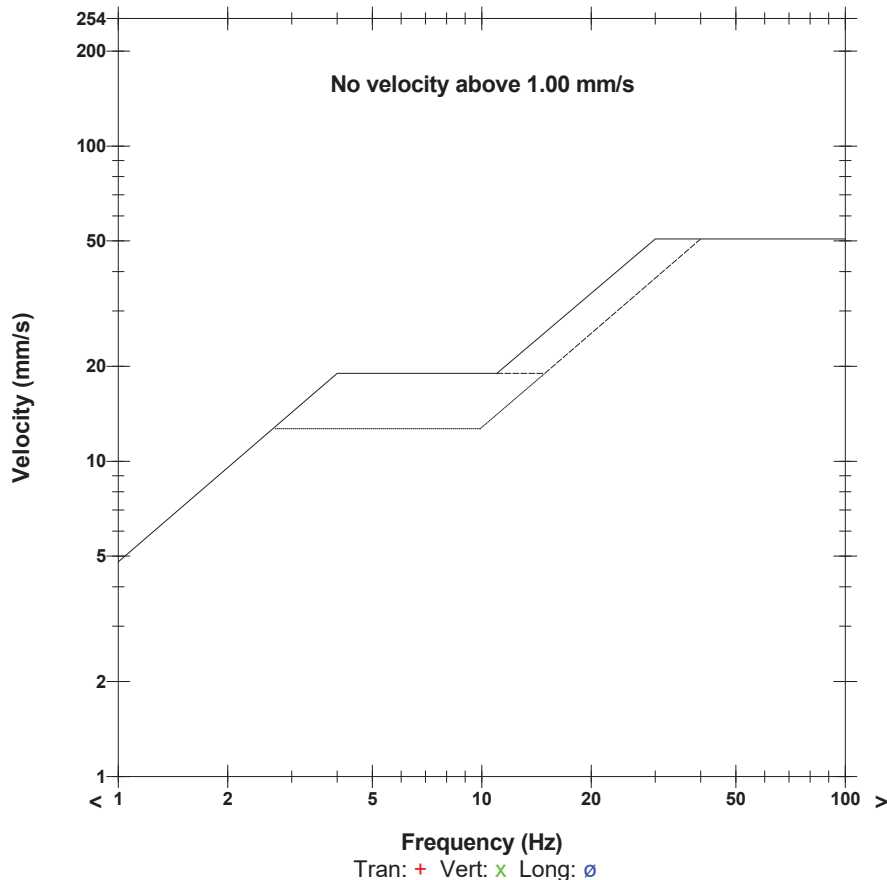
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 115.3 dB(L) at 0.007 sec
ZC Freq 4.5 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1273 mv)

	Tran	Vert	Long	
PPV	0.150	0.102	0.150	mm/s
ZC Freq	9.1	4.9	7.2	Hz
Time (Rel. to Trig)	-0.188	-0.104	0.141	sec
Peak Acceleration	0.010	0.012	0.012	g
Peak Displacement	0.003	0.016	0.012	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.3	3.3	3.5	

Peak Vector Sum 0.166 mm/s at -0.060 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

**Southwest Corner of property
Nelson Aggregate
Burlington 2019-07-04 Blast 19-011 Upper Middle**

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

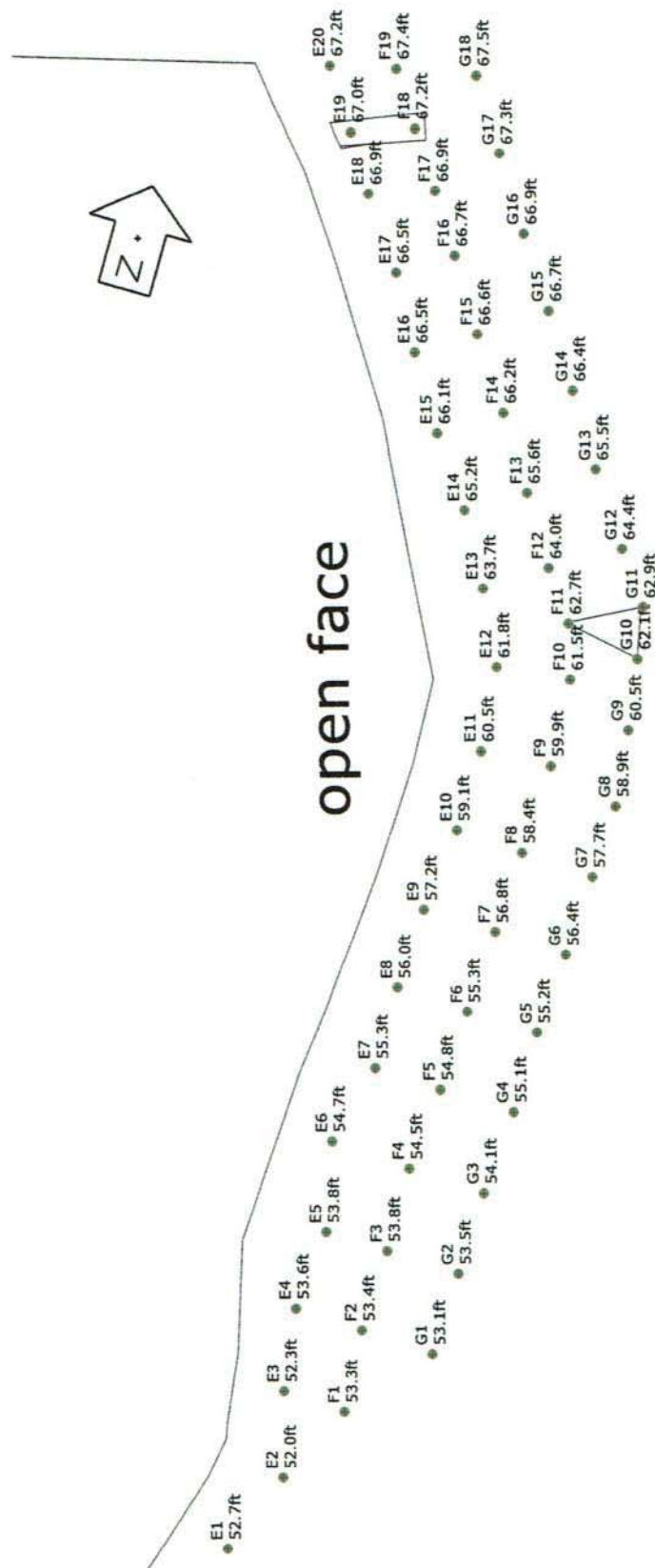
Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6859
Jul 4 /19 10:13:22		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
Jul 4 /19 10:13:22	Jul 4 /19 11:37:50	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic: 121.0 dB



SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Subdrill: 2.0ft	Hole angle: 0.0°
Total drilled: 3447.4ft	Hole Diameter: 4.0in	Number of holes: 57



E19 F11 F18 G10 G11 are 3.625" DIA HOLES
PAINTED PINK MARKER STONES

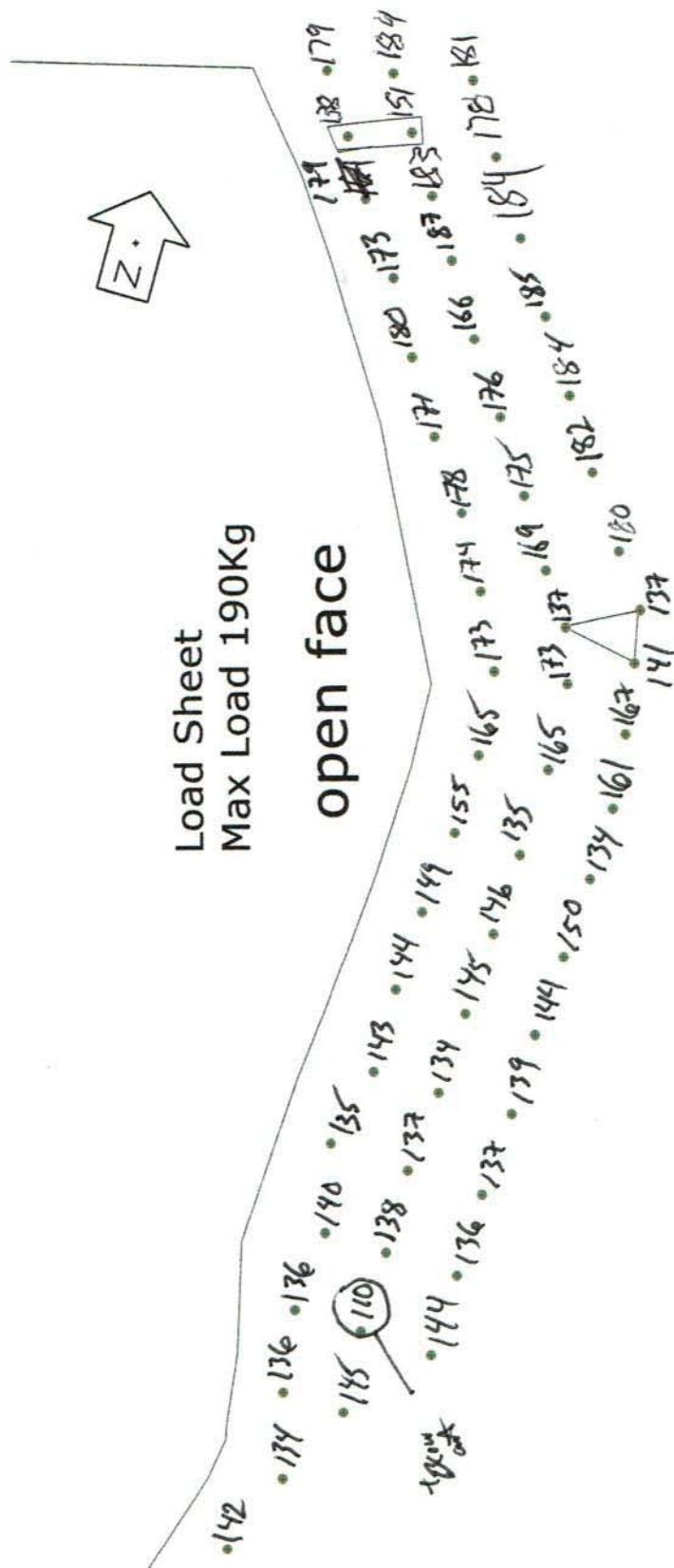


Not to scale

SHOTPLUS 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 57	Hole angle: 0.0°
Total drilled: 3447.4ft			



E19 F11 F18 G10 G11 are 3.625" DIA HOLES
PAINTED PINK MARKER STONES

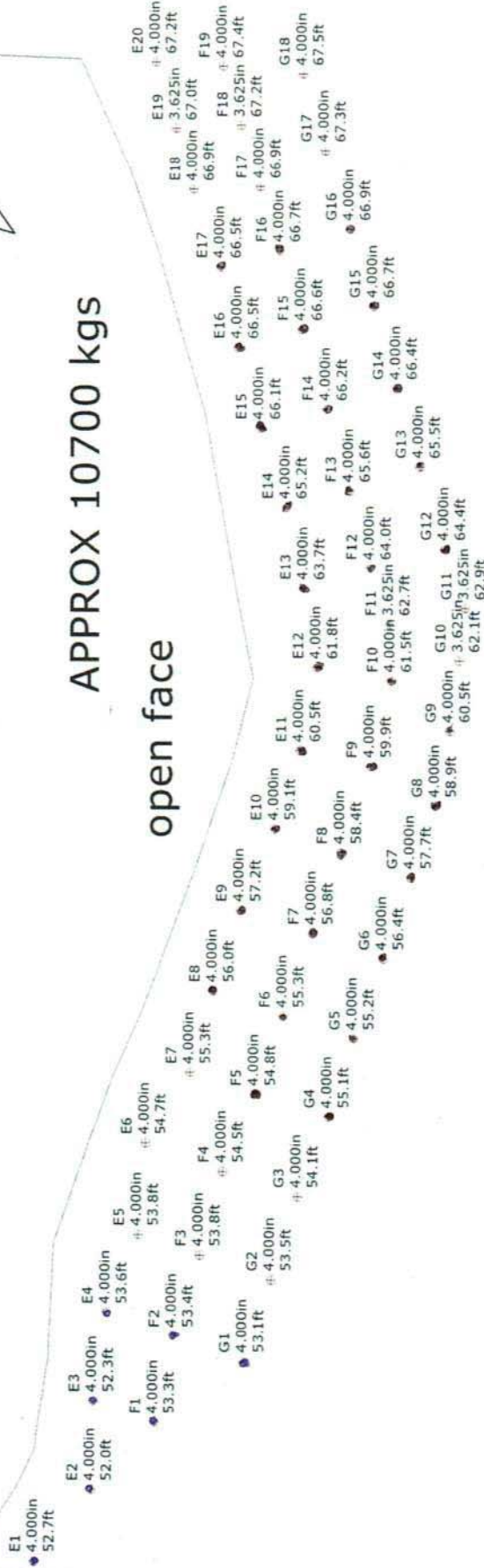


Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Subdrill: 2.0ft Hole angle: 0.0°
 Total drilled: 3447.4ft Hole Diameter: 4.0in Number of holes: 57



9NECRNR010 Design Fnl- 3.625" and 4" Blast Holes 12x10 9x10 266 and 250 + .6 SUB ELEV

E19 F11 F18 G10 G11 are 3.625" DIA HOLES
 PAINTED PINK MARKER STONES

SHOTPlus™ Professional 5.7.4.4	6/12/2019
Mine	Burlington
Location	N E Corner along haul road
Title/author	9NECRNR010 Design Fnl
Filename	



Scale 1:250



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-07-11

Blast Number: 19-012

Orica Order #: 2505549

Blast Time: 11:01 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40358 °N Latitude 79.88181 °W Longitude
Centre of Blast Centre of Blast

Wind from the: SW at 5 kph Temperature: 26 to 30 °C

Clear: ☐

Rain: ☒

Overcast: ☒

Partly Cloudy: ☐

Snow: ☐

Inversion: ☐

Ceiling 29,209 ft

- Drilling Information -

	Angle from Vertical	Nominal Bit Diameter:
Primary Bit diam: 101.6 mm	0°	# Holes: 51 = 3,662.6 ft (4 " diam)
Secondary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm	0°	# Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,890	22,660	11,230

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	2	0

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	52	11.8
PENTEX 12 (OR EQUIVALENT)	0.34	53	18.0

total explosives weight in Blast (kg): 11,260

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			48
UNITRONIC 600 15M			4
UNITRONIC 600 25M			53

Cord & Accessories:

	U of M	# used
HARNESSE WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	5

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Tonnes Blasted:	24,817 te	9,545 m3
Total tonnes per day:	24,817 te	NB80-02 Rate Code
Total Holes Loaded:	51 holes	
... including:	3 Dead Holes	
... and:	0 Helper Holes	
Helper Hole Collar:	0.0 ft avg	
# Rows Blasted:	3 rows	

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 18 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 33 main body

Bench Height: 69.8 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 71.8 ft avg

- Stone Decking -

Front Row: 4.0 ft avg

Main Body: 4.0 ft avg

Decks: 3 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 60.8 ft avg

Main Body: 60.8 ft avg

- Charge Weight -

Front Row: 177.3 kg/hole

Main Body: 177.3 kg/hole

Max. per delay: 242.0 kg/delay

SD () Equation: 115.2 kg/delay

Total kg Loaded: 11,260 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.454 kg/te (actual)


Front row: 0.287 kg/te (theoretical)

Main Body: 0.383 kg/te (theoretical)

"KPI" PF: 0.351 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Hole E18's top detonator showed an error at blast time (NCO) All holes are double primed so we continued to fire the blast.

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-012
		P.O. #: 	Orica Order #: 2505549
		Blast Date: 2019-07-11	Blast Time: 11:01 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40361	79.88180	0.757536	1.394200
Front Row Corner	43.40336	79.88190	0.757532	1.394202
Back Row Corner	43.40377	79.88172	0.757539	1.394199
Average (Centre of Blast)	43.40358	79.88181	0.757535	1.394201

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	322.0	m		
	Post Blast Data:	ppV:	7.9 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	13.1 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	119.7 dB	Trigger set at: 115 dB	
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	1024.0	m		
	Post Blast Data:	ppV:	0.3 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	10.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	120.3 dB	Trigger set at: 115 dB	
	Colling Rd & Blind Line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (3rd Seis. From Centre of Blast)	1267.6	m		
	Post Blast Data:	ppV:	Did mm/s	Trigger set at: 2.0 mm/s	
		frequency:	Not Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	Trigger dB	Trigger set at: 115 dB	
	SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(322)^2}{30^2} \text{ kg} \\
 &= \frac{103,684}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 115 kg

Orica

Blaster-in-charge:

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date:

Blast Number: 19-012
Orica Order #: 2505549

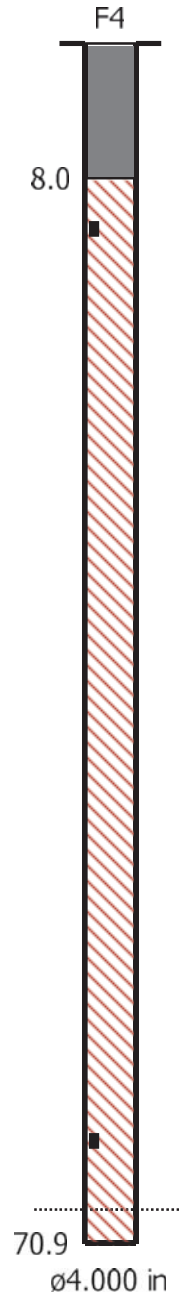
page 2

Paste ShotPlus Diagram inside Rectangle:



UNI Tronic (?)ms 20ft
PENTEX BC 7 * 200 x1

UNI Tronic (?)ms 82ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 11:01:03 July 11, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.0 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 Road
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

N43.40245;W-79.87814

Microphone Linear Weighting

PSPL 119.7 dB(L) at 1.034 sec

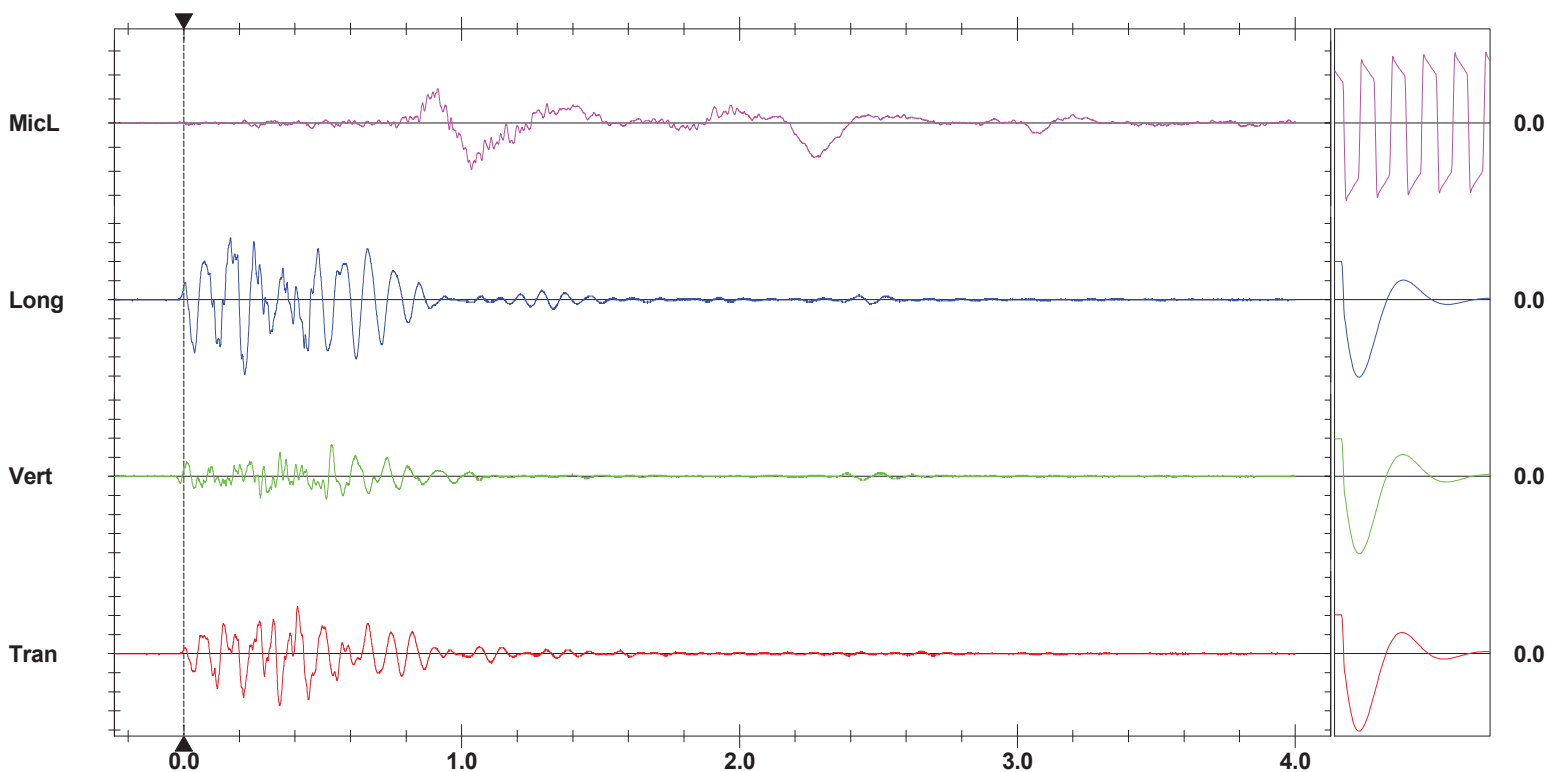
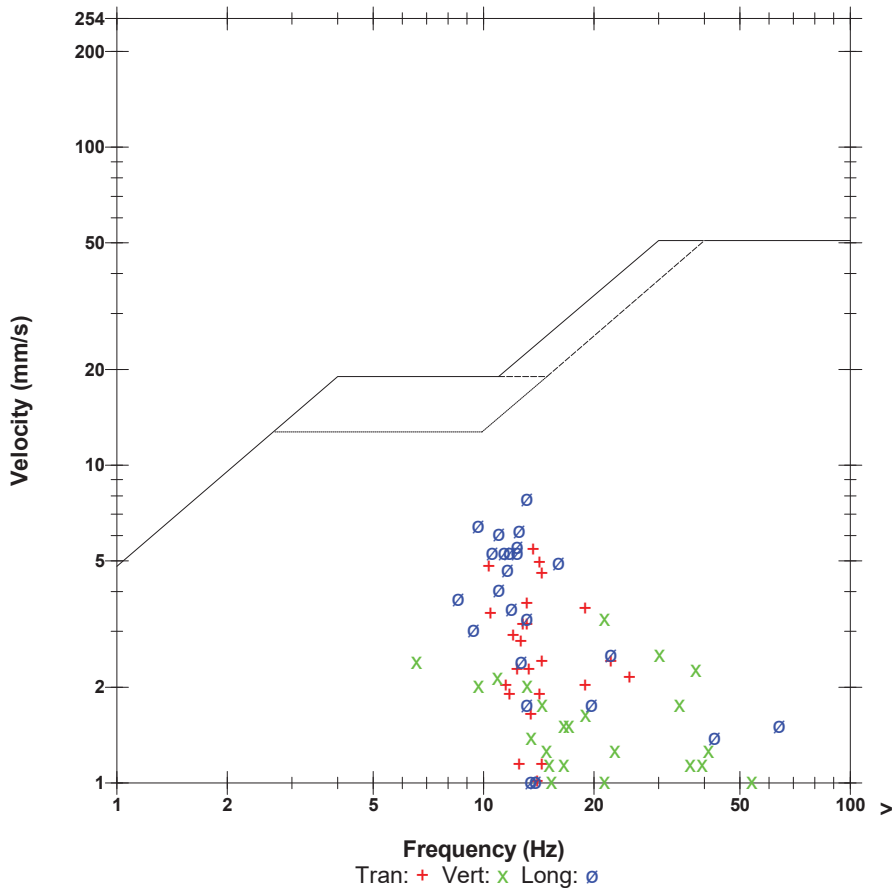
ZC Freq 1.9 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 543 mv)

	Tran	Vert	Long	
PPV	5.461	3.302	7.874	mm/s
ZC Freq	13.7	21	13.1	Hz
Time (Rel. to Trig)	0.344	0.530	0.218	sec
Peak Acceleration	0.080	0.080	0.133	g
Peak Displacement	0.063	0.037	0.111	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.7	3.6	4.0	

Peak Vector Sum 8.807 mm/s at 0.218 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time MicL at 11:01:04 July 11, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.133 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.6 Volts
Unit Calibration January 15, 2019 by Instantel
File Name UM6857_20190711110104.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

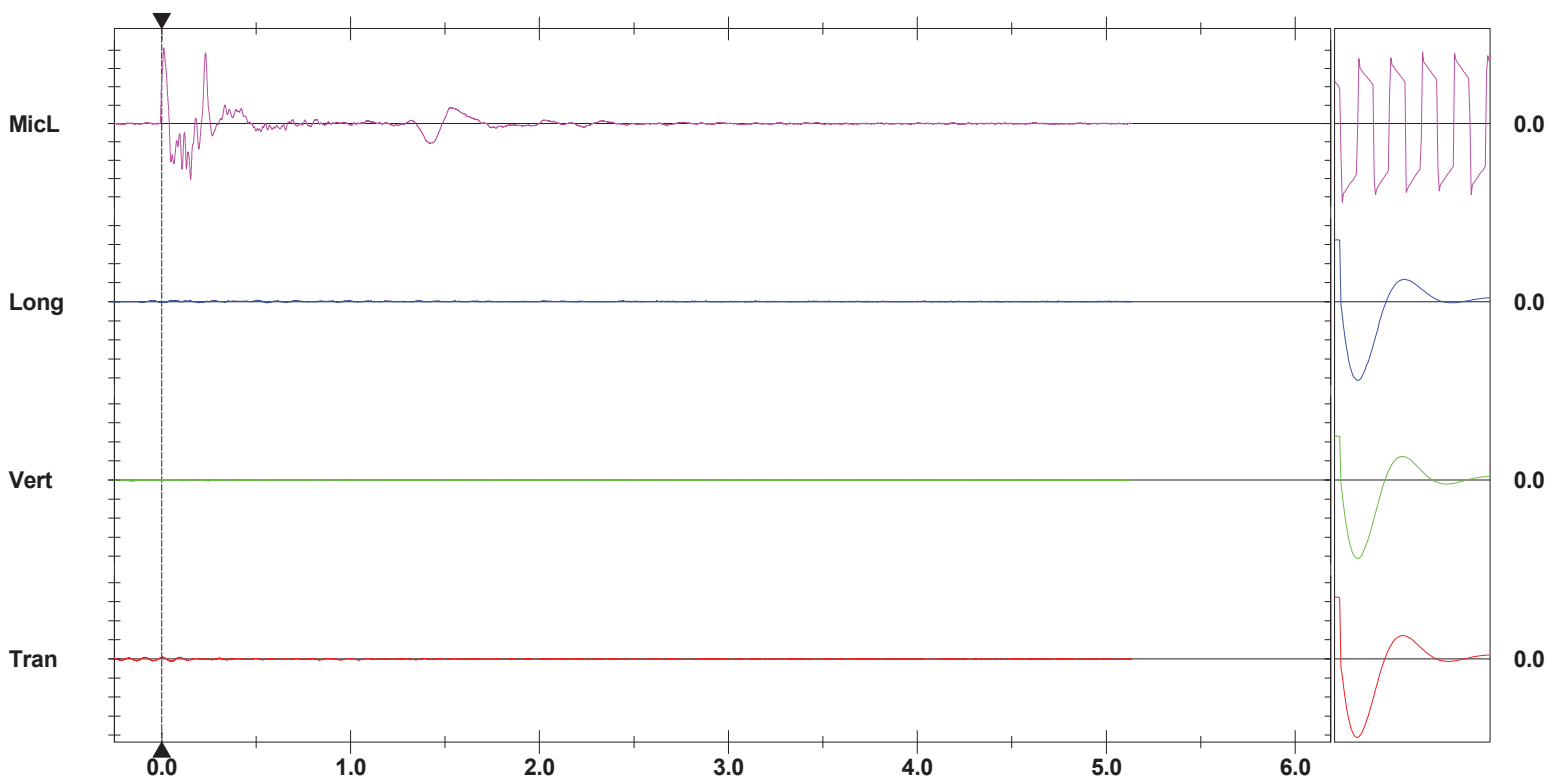
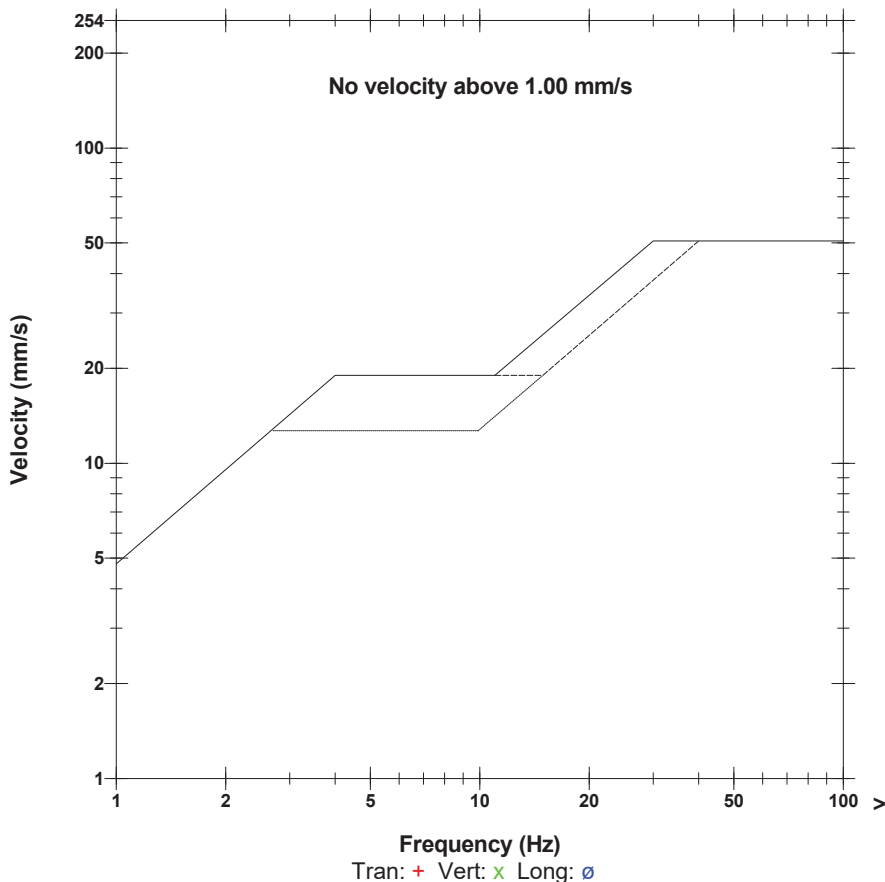
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 120.3 dB(L) at 0.011 sec
ZC Freq 10.6 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1329 mv)

	Tran	Vert	Long	
PPV	0.252	0.102	0.158	mm/s
ZC Freq	10.0	6.4	9.0	Hz
Time (Rel. to Trig)	0.046	-0.164	0.511	sec
Peak Acceleration	0.010	0.010	0.012	g
Peak Displacement	0.004	0.002	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.4	3.3	3.5	

Peak Vector Sum 0.275 mm/s at 0.053 sec

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

**Southwest Corner of property
Nelson Aggregate
Burlington 2019-07-11 Blast 19-12 Upper Middle**

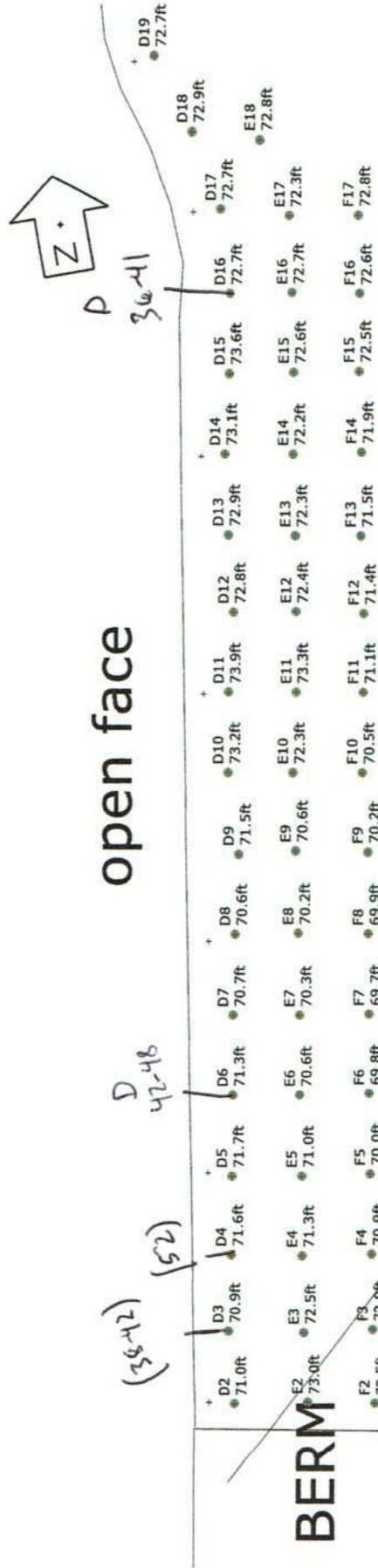
Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6859
Jul 11 /19 06:21:03		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
Jul 11 /19 06:21:02	Jul 11 /19 11:33:15	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic: 121.0 dB

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 51	Hole angle: 0.0°
Total drilled: 3662.6ft			



Not to scale

SHOTPlus 5 Plan

Blast Summary Data

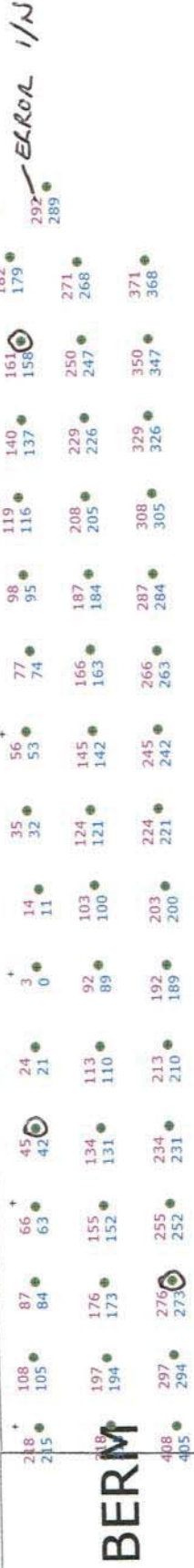
Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 3662.6ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 51
 Stemming: 7.0ft
 Hole angle: 0.0°

O = Deck

PLANT



open face



Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Hole angle: 0.0°
Total drilled: 3662.6ft	Number of holes: 51	

Load Sheet 245
Max Load 230Kg
open face



230 230 235 229 227 229 222 226 229 229 220 223 225 100 150
 227 230 228 224 232 222 226 222 232 227 226 222 219 221 228 225
 230 225 242 219 217 219 223 220 216 217 211 230 225 216 220

BERM



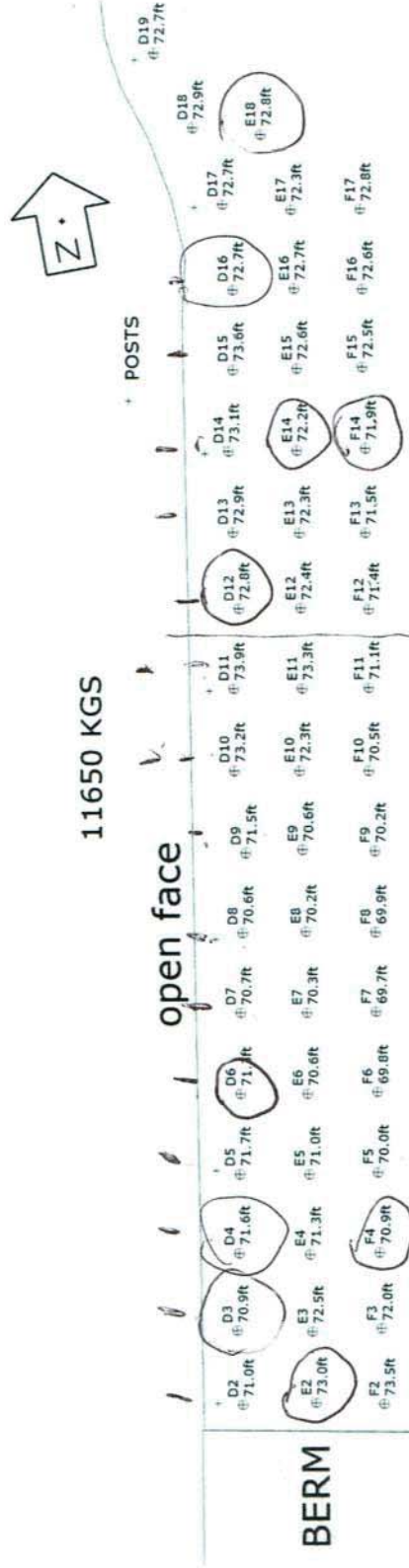
Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 Spacing: 10.0ft
 Stemming: 7.0ft
 1st row burden: 12.0ft
 Subdrill: 2.0ft
 Hole angle: 0.0°
 Hole Diameter: 4.0in
 Number of holes: 51
 Total drilled: 3662.6ft

11650 KGS



9UPMD012 Design Fnl - 4" Blast Hole 12x10 9x10 271.5 and 250 + .6 SUB ELEV
 DRILLER NAME:



Scale 1:300

SHOTPlus™ Professional 5.7.4.4	7/5/2019
Mine	Burlington
Location	UPPER MIDDLE NEXT TO OLD WHEEL WASH
Title/author	9UPMD012 Design Fnl
Filename	



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-07-30

Blast Number: 19-014

Orica Order #: 2512320

Blast Time: 12:20 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40355 °N Latitude 79.88169 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 5 kph Temperature: 26 to 30 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 2,552 ft

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: 101.6 mm 0° # Holes: 45 = 3,113.3 ft (4 " diam)
Secondary Bit diam: mm ° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

in (kg) out (kg) kg

CENTRA GOLD 70 36,290 26,610 9,680

Packaged Explosives:

cs shipped cs returned kg

FORTEL PRO 75X400 2 1 25

Boosters:

kg / unit # used kg

PENTEX 8 (OR EQUIVALENT) 0.23 46 10.4
PENTEX 12 (OR EQUIVALENT) 0.34 46 15.6

total explosives weight in Blast (kg): 9,731

Pkgd Prod (25 kg) % of Total kg: 0.3%

Detonators:

case #'s ms # used

UNITRONIC 600 6M 45
UNITRONIC 600 15M 2
UNITRONIC 600 25M 45

Cord & Accessories:

U of M # used

HARNESS WIRE DUPLEX (6 PACK) 400M units 1
MINI STEM PLUGS - 6015 (4") units

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services:

BULK TRUCK CHARGE 1.0
BLASTER HOURS Enter Blaster hours 7.0
HELPER HOURS Enter total Helper man-hours 11.0
SHOT LAYOUT FEE Enter # trips extra beyond 1 0.0
ADVANCED BLAST DESIGN Enter hours 0.0
BORETRACK Enter hours 0.0

Tonnes Blasted: 21,052 te 8,097 m3
Total tonnes per day: 21,052 te NB60-07 Rate Code
Total Holes Loaded: 45 holes
... including: 3 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 3 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 17 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 28 main body

Bench Height: 67.2 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 69.2 ft avg

- Stone Decking -

Front Row: 0.0 ft avg

Main Body: 5.0 ft avg

Decks: 1 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 62.2 ft avg

Main Body: 57.2 ft avg

- Charge Weight -

Front Row: 181.3 kg/hole

Main Body: 166.7 kg/hole

Max. per delay: 209.0 kg/delay

SD () Equation: 108.4 kg/delay

Total kg Loaded: 9,731 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.462 kg/te (actual)

Front row: 0.305 kg/te (theoretical)

Main Body: 0.375 kg/te (theoretical)

"KPI" PF: 0.352 kg/te (theoretical)

2.026 lb/yd³


1.339 lb/yd³

1.641 lb/yd³

1.541 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

Hole I5 received a 5' stone deck due to void identified while loading

 The Blasting Professionals™	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry:	Burlington	Blast Number:	19-014
		P.O. #:		Orica Order #:	2512320
		Blast Date:	2019-07-30	Blast Time:	12:20 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40354	79.88170	0.757535	1.394199
Front Row Corner	43.40376	79.88168	0.757539	1.394198
Back Row Corner	43.40336	79.88170	0.757532	1.394199
Average (Centre of Blast)	43.40355	79.88169	0.757535	1.394199

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	312.4	m		
	Post Blast Data:	ppV:	7.7 mm/s	Trigger set at:	2.0 mm/s
		frequency:	12.8 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	120.7 dB	Trigger set at:	115 dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	1033.6	m		
	Post Blast Data:	ppV:	0.2 mm/s	Trigger set at:	2.0 mm/s
		frequency:	8.9 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	120.5 dB	Trigger set at:	115 dB
	Colling Rd & Blind Line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (3rd Seis. From Centre of Blast)	1269.2	m		
	Post Blast Data:	ppV:	Did mm/s	Trigger set at:	2.0 mm/s
		frequency:	Not Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	Trigger dB	Trigger set at:	115 dB
	SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(312.4)^2}{30^2} \text{ kg} \\
 &= \frac{97,594}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 7/30/2019

Blast Number: 19-014
Orica Order #: 2512320

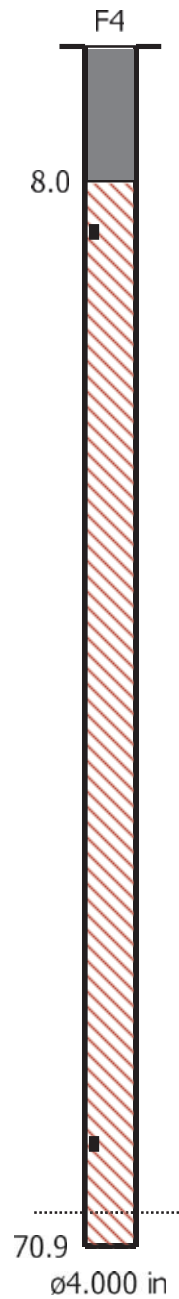
page 2

Paste ShotPlus Diagram inside Rectangle:



UNI Tronic (?)ms 20ft
PENTEX BC 7 * 200 x1

UNI Tronic (?)ms 82ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 12:20:36 July 30, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.0 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 Sideroad
 Client: Nelson Aggregate
 User Name: Orica Canada Inc.
 General: Burlington

Extended Notes

Sand Bagged
 N43.40245W-79.87814

Microphone Linear Weighting

PSPL 120.7 dB(L) at 1.059 sec

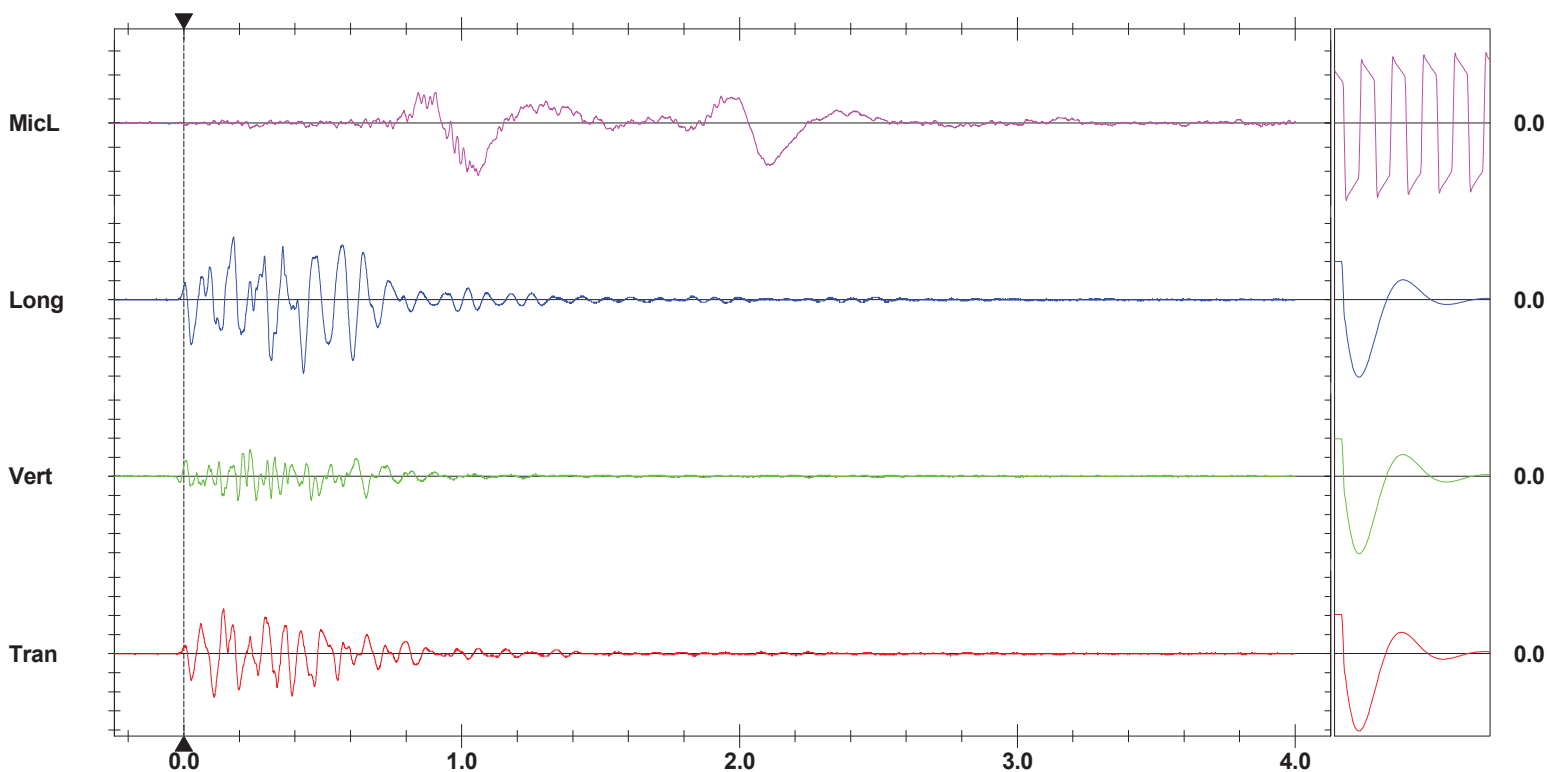
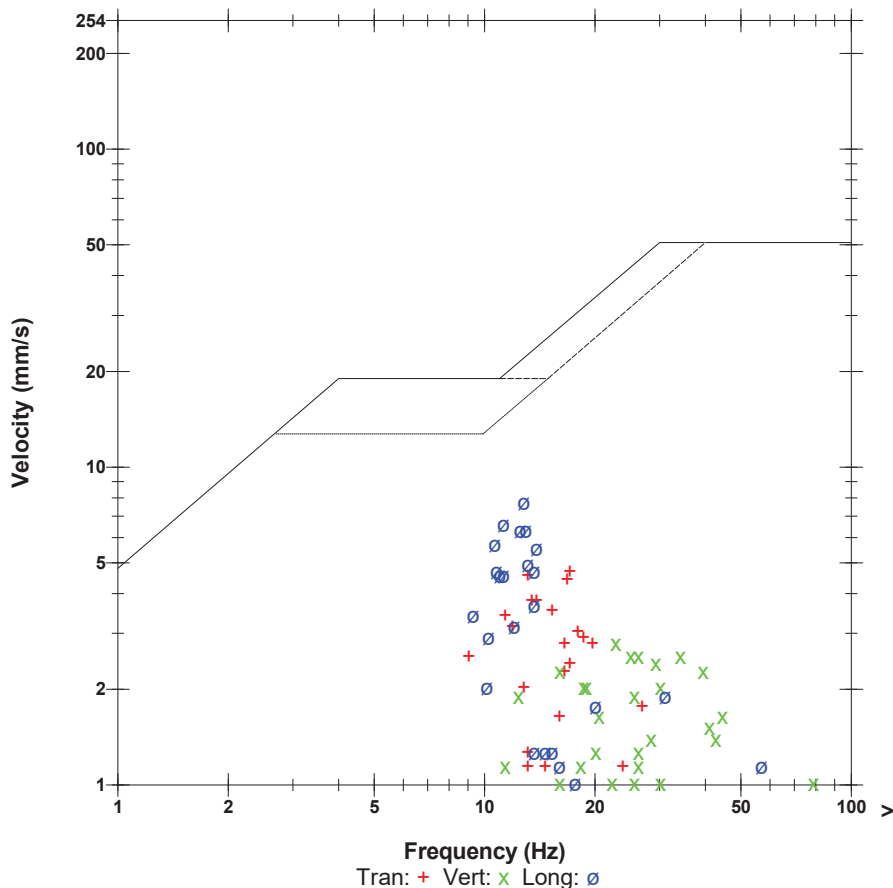
ZC Freq 2.7 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 556 mv)

	Tran	Vert	Long	
PPV	4.699	2.794	7.747	mm/s
ZC Freq	17.1	23	12.8	Hz
Time (Rel. to Trig)	0.143	0.237	0.430	sec
Peak Acceleration	0.080	0.080	0.106	g
Peak Displacement	0.049	0.023	0.091	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.3	Hz
Overswing Ratio	3.7	3.6	4.0	

Peak Vector Sum 7.832 mm/s at 0.430 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time MicL at 12:20:37 July 30, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.147 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.5 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20190730122037.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

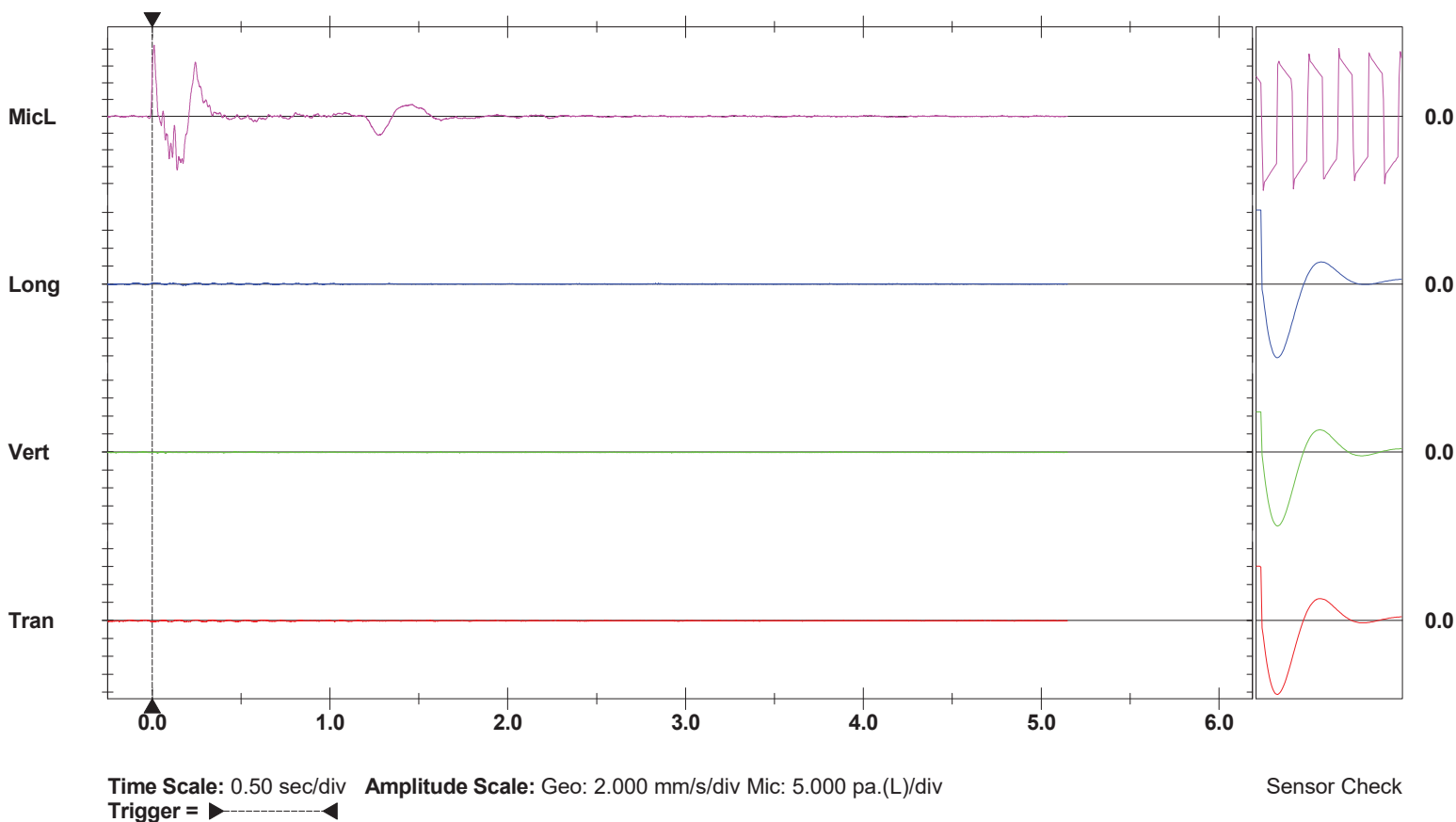
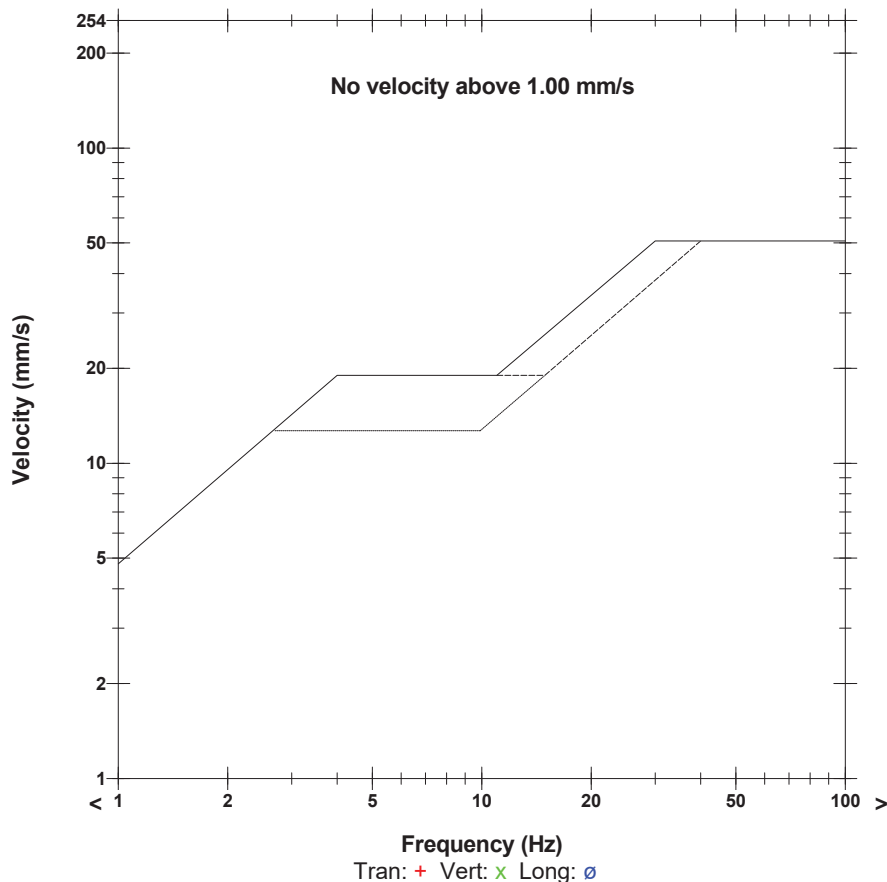
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 120.5 dB(L) at 0.011 sec
ZC Freq 11.0 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1301 mv)

	Tran	Vert	Long	
PPV	0.166	0.102	0.150	mm/s
ZC Freq	8.9	5.4	8.1	Hz
Time (Rel. to Trig)	0.185	-0.232	0.012	sec
Peak Acceleration	0.010	0.010	0.013	g
Peak Displacement	0.018	0.044	0.003	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.4	3.3	3.3	

Peak Vector Sum 0.209 mm/s at 0.185 sec

USBM RI8507 And OSMRE



**South west corner of property(N43.39339W-79.88880)
Nelson Aggregate
Burlington 2019-07-30 Blast 19-014**

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

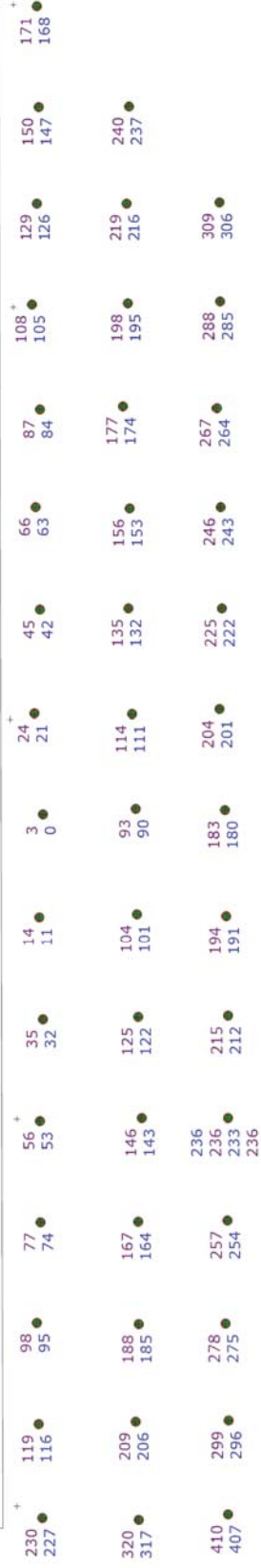
Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6859
Jul 30 /19 05:43:58		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 121.0 dB
Jul 30 /19 11:20:23	Jul 30 /19 11:20:26	Event recorded. Trigger Level Long: 1.50 mm/s
Jul 30 /19 12:43:42	Jul 30 /19 12:43:46	Event recorded. Trigger Level Tran: 1.50 mm/s
Jul 30 /19 12:43:46	Jul 30 /19 12:43:53	Event recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic: 121.0

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 7.0ft
1st row burden: 12.0ft Hole Diameter: 4.0in Subdrill: 2.0ft Hole angle: 0.0°
Total drilled: 3113.3ft Number of holes: 45

open face



Not to scale

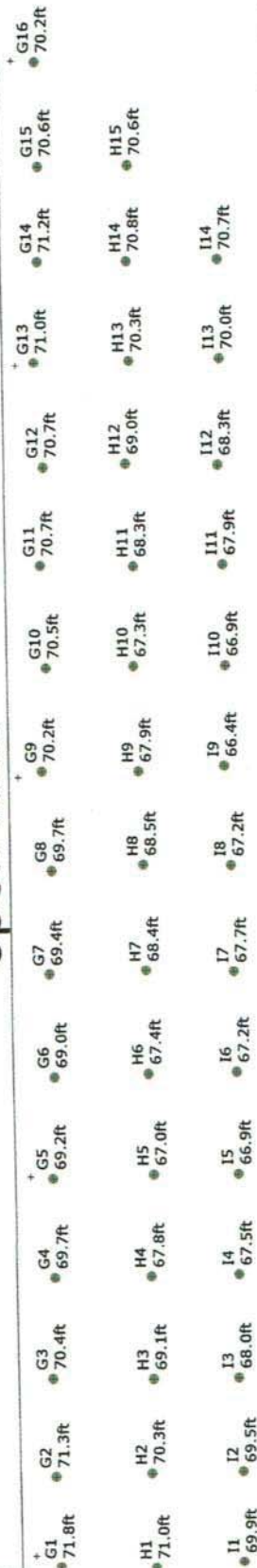
SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 3113.3ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 45
 Stemming: 7.0ft
 Hole angle: 0.0°

N

open face



9UPMD015 Design Fnl - 4" Blast Hole 12x10 9x10 270 and
 DRILLER NAME:



Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 3113.3ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 45
 Stemming: 7.0ft
 Hole angle: 0.0°

N

Load Sheet 230Kg Max open face

214	203	241	207	197	197	309	244	203	196	203	197	194	181	202	198
210	206	242	198	184	180	203	196	192	196	197	198	203	207	203	
204	190	200	198	198	120	196	205	196	187	187	188	241	175	+	Blow

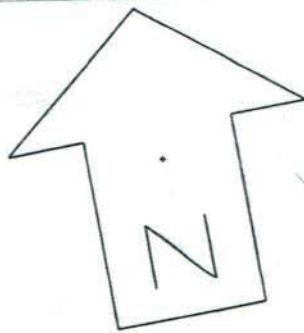


Not to scale

SHOTPlus 5 Plan

Blast Summary Data

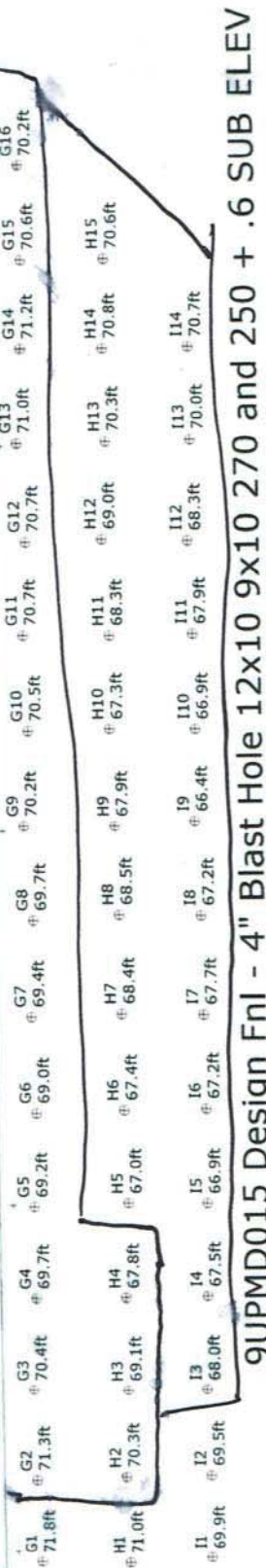
Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 3113.3ft
 Spacing: 10.0ft
 Subdrill: 2.0ft
 Number of holes: 45
 Stemming: 7.0ft
 Hole angle: 0.0°



APPROX 10000 KGS

open face

POSTS



9UPMD015 Design Fnl - 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV

DRILLER NAME: Mike Keller

Start July 25/19

Finish July 29/19



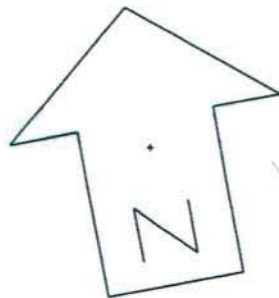
Scale 1:250

SHOTPlus™ Professional 5.7.4.4		7/29/2019
Mine	Burlington	
Location		
Title/author	9UPMD015 Design Partial	
Filename	9UPMD015 Design Fnl.spf	

SHOTPlus 5 Plan

Blast Summary Data

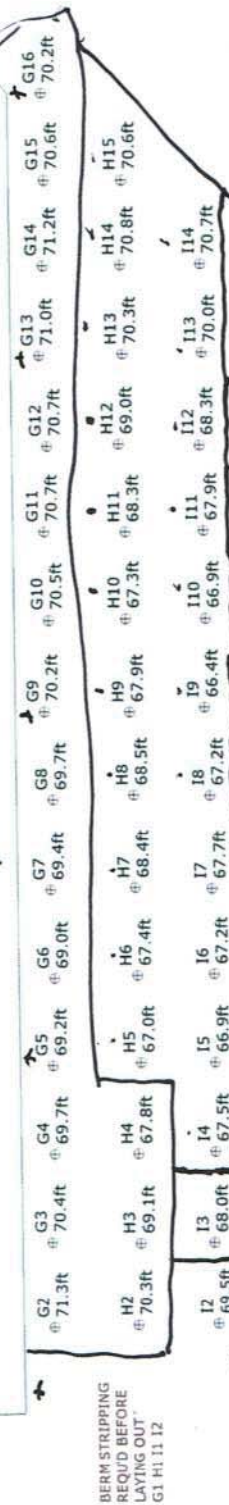
Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 2900.7ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Stemming: 7.0ft
 Subdrill: 2.0ft
 Number of holes: 42
 Hole angle: 0.0°



APPROX 10000 KGS

+ poss

open face



BERM STRIPPING
 REQ'D BEFORE
 LAYING OUT
 G1 H1 I1 J1

9UPMD015 Design Partial - 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV

DRILLER NAME:

NOT MARKED



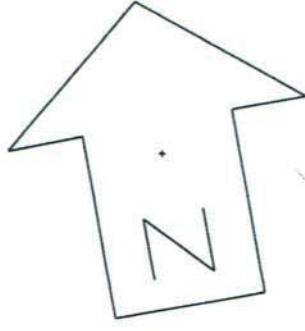
SHOTPlus™ Professional 5.7.4.4	7/26/2019
Mine	Burlington
Location	
Title/author	9UPMD015 Design Partial
Filename	9UPMD015 Design Partial Fnl.spf

Scale 1:275

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 29
 Total drilled: 2016.5ft Hole angle: 0.0°



*G1 to bed str. face
 G1 after*

open face

G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	G16
71.3ft	70.4ft	69.7ft	69.2ft	69.0ft	69.4ft	69.7ft	70.2ft	70.5ft	70.7ft	70.7ft	71.0ft	71.2ft	70.6ft	70.2ft
H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14	H15	
70.3ft	69.1ft	67.8ft	67.0ft	67.4ft	68.4ft	68.5ft	67.9ft	67.3ft	68.3ft	69.0ft	70.3ft	70.8ft	70.6ft	

9UPMD015 Design Partial - 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV
 DRILLER NAME: Michael Keller

Start July 25/19



Scale 1:250

SHOTPlus™ Professional 5.7.4.4	7/25/2019
Mine	Burlington
Location	
Title/author	9UPMD015 Design Partial
Filename	



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-08-12

Blast Number: 19-015

Orica Order #: 2517100

Blast Time: 12:10 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40432 °N Latitude 79.88176 °W Longitude
Centre of Blast Centre of Blast

Wind from the: N at 0 kph Temperature: 21 to 25 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0° # Holes: 64 = 3,799.9 ft (4 " diam)
Secondary Bit diam: 92.1 mm 0° # Holes: 2 = 118.7 ft (3 5/8 " diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,850	22,690	11,160

Packaged Explosives:

	cs shipped	cs returned	kg

Boosters:

	kg / unit	# used	kg
PENTEX 8 (OR EQUIVALENT)	0.23	69	15.7
PENTEX 12 (OR EQUIVALENT)	0.34	69	23.5

total explosives weight in Blast (kg): 11,199

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			65
UNITRONIC 600 20M			43
UNITRONIC 600 25M			30

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1
MINI STEM PLUGS - 6015 (4")	units	2

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Tonnes Blasted: 28,893 te 11,113 m3
Total tonnes per day: 28,893 te NB60-06 Rate Code
Total Holes Loaded: 66 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 3 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 30 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 36 main body

Bench Height: 57.4 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 59.4 ft avg

- Stone Decking -

Front Row: 8.0 ft avg

Main Body: 0.0 ft avg

Decks: 3 per blast

- Collar Stemming -

Front Row: 8.0 ft avg

Main Body: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 43.4 ft avg

Main Body: 52.4 ft avg

- Charge Weight -

Front Row: 126.5 kg/hole

Main Body: 152.7 kg/hole

Max. per delay: 238.0 kg/delay

SD () Equation: 143.8 kg/delay

Total kg Loaded: 11,199 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.388 kg/te (actual)

Front row: 0.250 kg/te (theoretical)

Main Body: 0.402 kg/te (theoretical)

"KPI" PF: 0.351 kg/te (theoretical)

1.699 lb/yd³


1.093 lb/yd³

1.760 lb/yd³

1.538 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

3 Stone decks were added due to voids identified by driller on the drill log.

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry:	Burlington	Blast Number:	19-015
		P.O. #:		Orica Order #:	2517100
		Blast Date:	2019-08-12	Blast Time:	12:10 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40437	79.88178	0.757549	1.394200
Front Row Corner	43.40390	79.88181	0.757541	1.394201
Back Row Corner	43.40470	79.88170	0.757555	1.394199
Average (Centre of Blast)	43.40432	79.88176	0.757548	1.394200

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	359.7	m		
	Post Blast Data:	ppV:	3.9 mm/s	Trigger set at:	2.0 mm/s
		frequency:	11.6 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	112.8 dB	Trigger set at:	115 dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40605	79.89400	0.757578	1.394413
	2nd Reading				
	Average	43.40605	79.89400	0.757578	1.394413
	Distance (2nd Seis. From Centre of Blast)	1008.2	m		
	Post Blast Data:	ppV:	Did mm/s	Trigger set at:	2.0 mm/s
		frequency:	Not Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	Trigger dB	Trigger set at:	115 dB
	Colling Rd & Blind Line Bruce Trail				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39329	79.88868	0.757356	1.394321
	2nd Reading				
	Average	43.39329	79.88868	0.757356	1.394321
	Distance (3rd Seis. From Centre of Blast)	1349.6	m		
	Post Blast Data:	ppV:	Did mm/s	Trigger set at:	2.0 mm/s
		frequency:	Not Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	Trigger dB	Trigger set at:	115 dB
	SouthWest Corner of Property				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(359.7)^2}{30^2} \text{ kg} \\
 &= \frac{129,384}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = kg

Orica

Blaster-in-charge:

jim bray

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 8/12/2019

Blast Number: 19-015
Orica Order #: 2517100

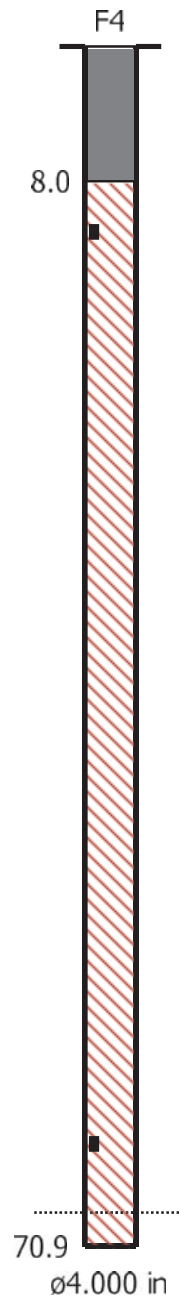
page 2

Paste ShotPlus Diagram inside Rectangle:



UNI Tronic (?)ms 20ft
PENTEX BC 7 * 200 x1

UNI Tronic (?)ms 82ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 12:10:05 August 12, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.25 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 2nd Line, Burlington, On
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

Sand Bagged
 N43.40245:W-79.87814

Microphone Linear Weighting

PSPL 112.8 dB(L) at 1.056 sec

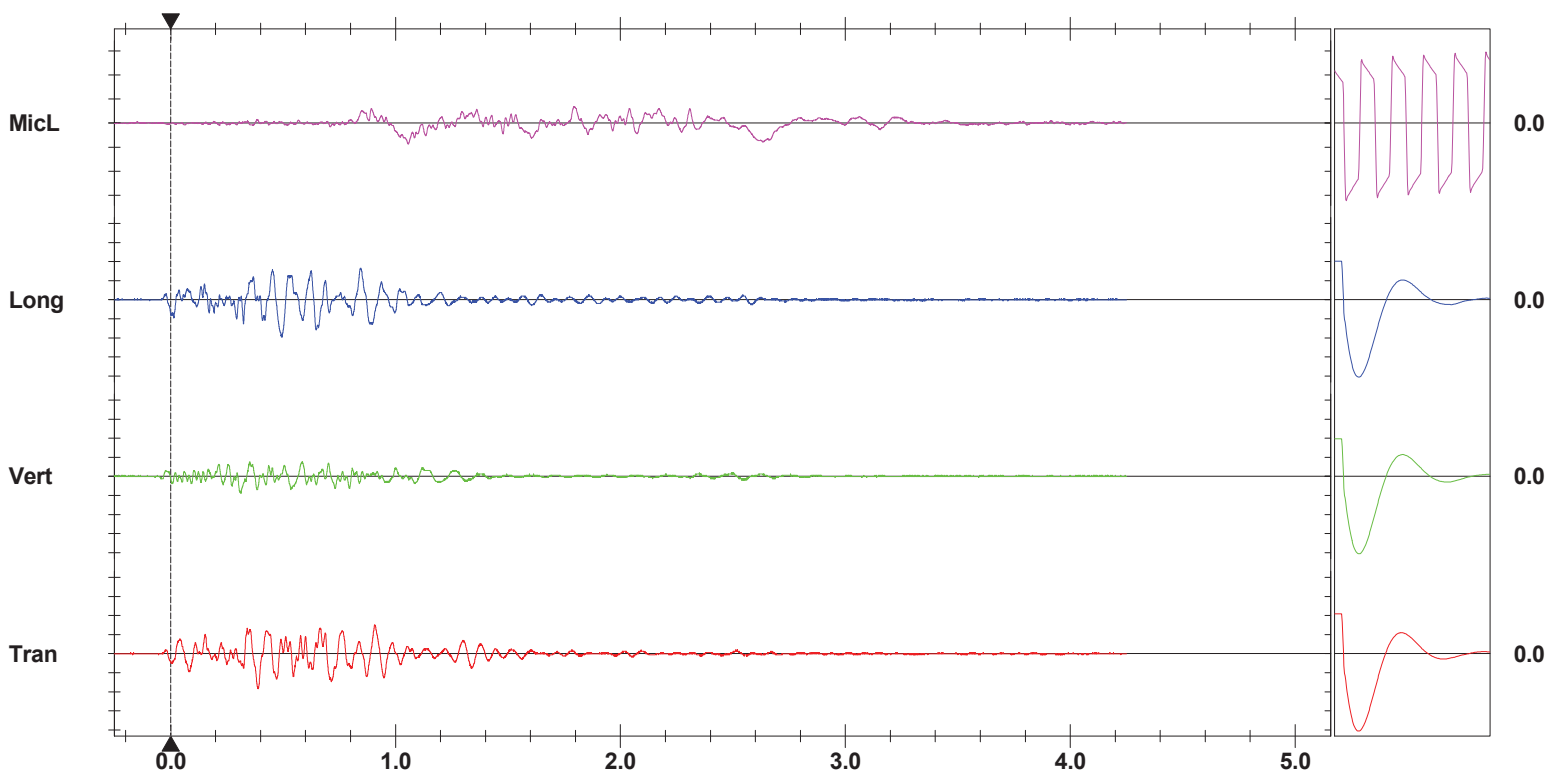
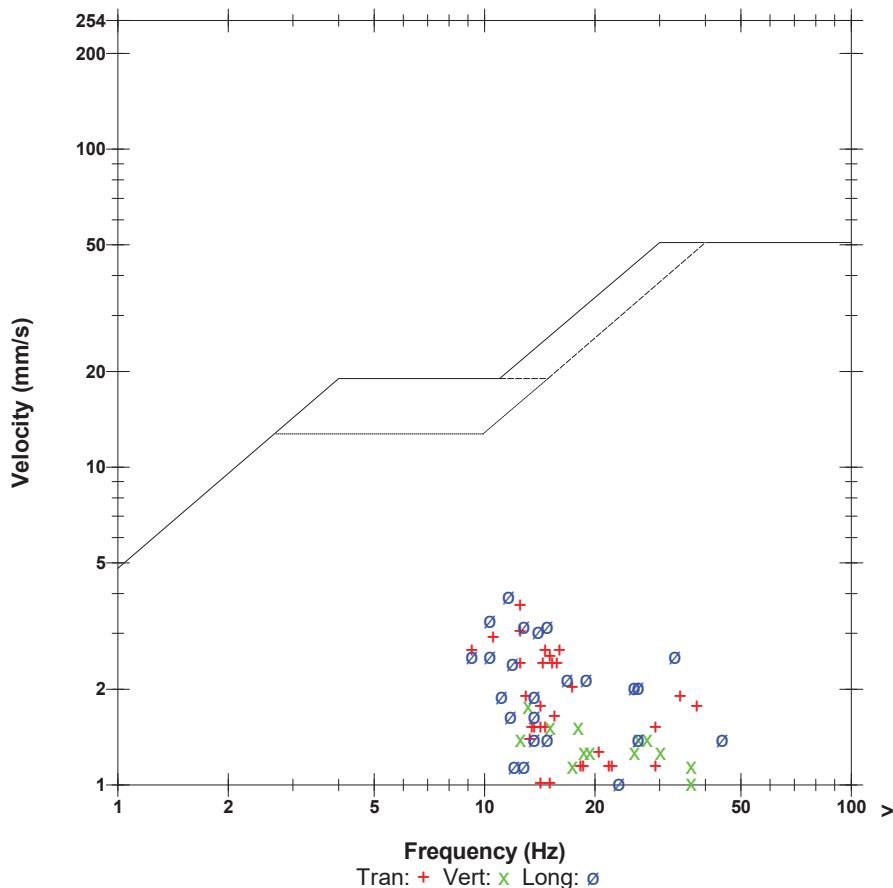
ZC Freq 2.4 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 533 mv)

	Tran	Vert	Long	
PPV	3.683	1.778	3.937	mm/s
ZC Freq	12.5	13.1	11.6	Hz
Time (Rel. to Trig)	0.388	0.312	0.494	sec
Peak Acceleration	0.053	0.053	0.080	g
Peak Displacement	0.044	0.018	0.052	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.4	Hz
Overswing Ratio	3.8	3.6	4.0	

Peak Vector Sum 4.111 mm/s at 0.491 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

**Coling rd & Blind Line (Bruce Trail)
Nelson Aggregate
Burlington 2019-08-12 Blast 19-015 Upper Middle**

Event Report: Monitor Log - Micromate ISEE # UM6857-Compliance

Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6857
Aug 12 /19 06:04:45		Start Monitoring Waveform Geo: 2.00 mm/s Mic: 115.0 dB
Aug 12 /19 06:04:45	Aug 12 /19 12:42:41	No events recorded. (Keyboard Exit) Waveform Geo: 2.00 mm/s Mic:

**SW Corner of Property
Nelson Aggregate
Burlington 2019-08-12 Blast 19-015 Upper Middle**

Event Report: Monitor Log - Micromate ISEE # UM6859-Compliance

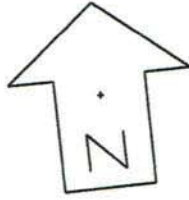
Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6859
Aug 12 /19 06:09:14		Start Monitoring Waveform Geo: 1.50 mm/s Mic: 115.0 dB
Aug 12 /19 06:09:14	Aug 12 /19 12:38:37	No events recorded. (Keyboard Exit) Waveform Geo: 1.50 mm/s Mic:

SHOTPlus Plan

Blast Summary Data

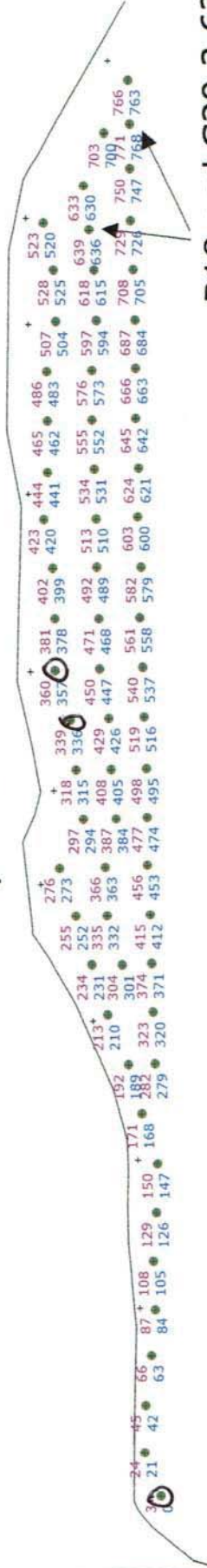
Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 3918.7ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 66
 Stemming: 7.0ft
 Hole angle: 0.0°

D = Deck



Load Sheet
Max 75 Kg

open face



B18 and C29 3.625" DIA



Not to scale

SHOTPlus Plan

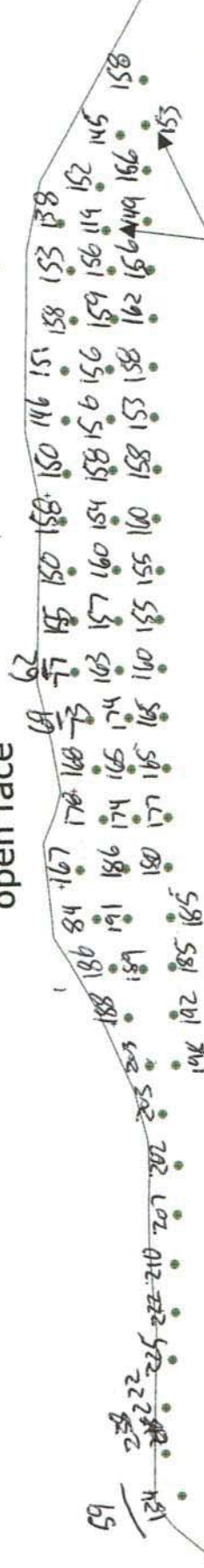
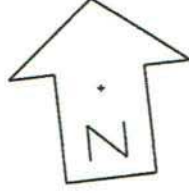
Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 3918.7ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 66
 Stemming: 7.0ft
 Hole angle: 0.0°

310

Load Sheet
 Max 75 Kg

open face



B18 and C29 3.625" DIA.

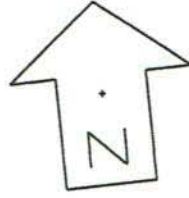


Not to scale

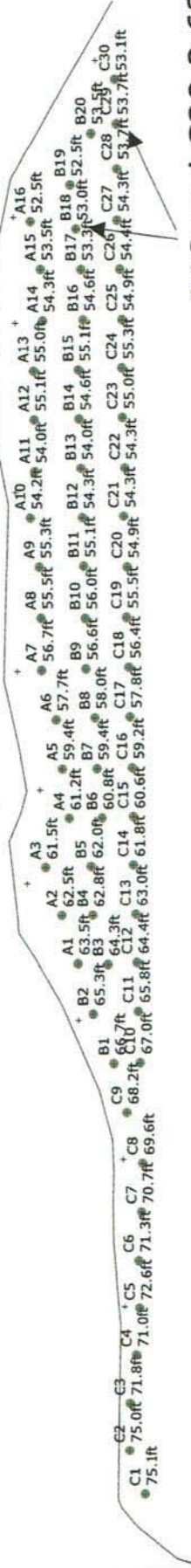
SHOTPLUS Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 66	Hole angle: 0.0°
Total drilled: 3918.7ft			



open face + POSTS



B18 and C29 3.625" DIA.



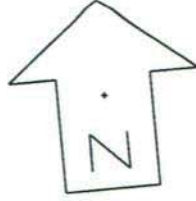
Not to scale

SHOTPlus 5 Plan

Blast Summary Data

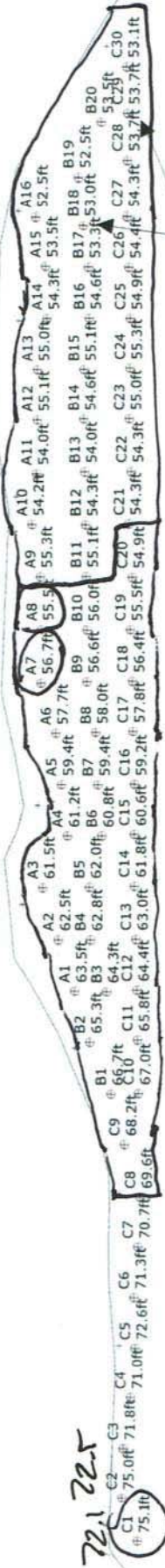
Burden: 9.0ft Spacing: 10.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Subdrill: 2.0ft
 Total drilled: 3918.7ft Hole Diameter: 4.0in Number of holes: 66 Hole angle: 0.0°

- 5.5'
 3913.2'



12165 KGS

open face POSTS



B18 and C29 3.625" DIA.

9MID014 Design Partial - 3.625 and 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV

DRILLER NAME: Michael Keller

Start July 29/19

Finish July 31/19

O = void
 see log



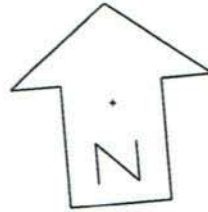
Scale 1:400

SHOTPlus™ Professional 5.7.4.4	7/29/2019
Mine	Burlington
Location	MID BETWEEN NECNR AND UPMD
Title/author	9MID014 Partial Design Fnl
Filename	9MID014 Partial Design Fnl.spf

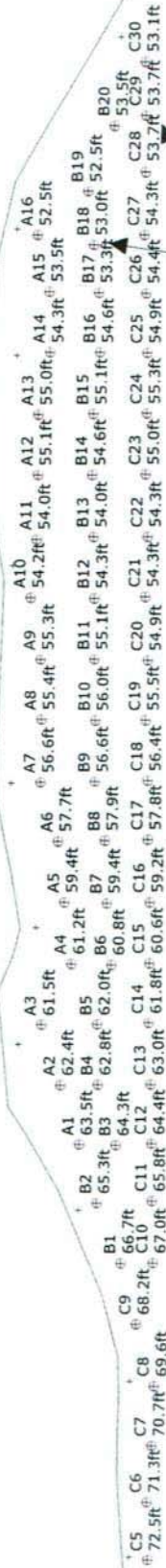
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 3624.7ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Stemming: 7.0ft
 Subdrill: 2.0ft
 Number of holes: 62
 Hole angle: 0.0°



open face POSTS



B18 and C29 3.625" DIA.

9MID014 Design Partial - 3.625 and 4" Blast Hole 12x10 9x10 270 and 250 + .6 SUB ELEV
 DRILLER NAME:



Scale 1:375

SHOTPlus™ Professional 5.7.4.4	7/29/2019
Mine	Burlington
Location	MID BETWEEN NECRNR AND UPMD
Title/author	9MID014 Partial Design Fnl
Filename	



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-08-22

Blast Number: 19-016

Orica Order #: 2521575

Blast Time: 12:04 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40434 °N Latitude 79.88168 °W Longitude
Centre of Blast Centre of Blast

Wind from the: NW at 15 kph Temperature: 21 to 25 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 9,144 ft

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: 101.6 mm 0° # Holes: 66 = 3,937.6 ft (4 " diam)
Secondary Bit diam: 114.3 mm 0° # Holes: 4 = 238.6 ft (4 1/2 " diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

in (kg) out (kg) kg

CENTRA GOLD 70 33,930 22,980 10,950

Packaged Explosives:

cs shipped cs returned kg

FORTEL PRO 75X400 2 1 25

Boosters:

kg / unit # used kg

PENTEX 12 (OR EQUIVALENT) 0.34 68 23.1
PENTEX DUO (OR EQUIVALENT) 0.45 70 31.8

total explosives weight in Blast (kg): 11,030

Pkgd Prod (25 kg) % of Total kg: 0.2%

Detonators:

case #'s ms # used

UNITRONIC 600 9M 23
UNITRONIC 600 15M 45
UNITRONIC 600 20M 18
UNITRONIC 600 25M 52
EXEL MS 18m 25 ms 25
EXEL MS 25m 25 ms 45

Cord & Accessories:

U of M # used

HARNESS WIRE DUPLEX (6 PACK) 400M units 1
MINI STEM PLUGS - 6015 (4") units 1

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services:

BULK TRUCK CHARGE 1.0
BLASTER HOURS Enter Blaster hours 6.0
HELPER HOURS Enter total Helper man-hours 10.0
SHOT LAYOUT FEE Enter # trips extra beyond 1 0.0
ADVANCED BLAST DESIGN Enter hours 0.0
BORETRACK Enter hours 0.0

Tonnes Blasted: 30,187 te 11,610 m3
Total tonnes per day: 30,187 te TBD
Total Holes Loaded: 70 holes
... including: 0 Dead Holes
... and: 2 Helper Holes
Helper Hole Collar: 35.0 ft avg
Rows Blasted: 2 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 34 front row

- Pattern (Back Row) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 36 back row

Bench Height: 57.7 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 59.7 ft avg

- Stone Decking -

Front Row: 4.0 ft avg

Back Row: 4.0 ft avg

Decks: 68 per blast

- Collar Stemming -

Front Row: 8.0 ft avg

Back Row: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 47.7 ft avg

Back Row: 48.7 ft avg

- Charge Weight -

Front Row: 139.0 kg/hole

Back Row: 141.9 kg/hole

Max. per delay: 130.0 kg/delay

SD () Equation: 5.0 kg/delay

Total kg Loaded: 11,030 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.365 kg/te (actual)

Front row: 0.273 kg/te (theoretical)


Main Body: 0.371 kg/te (theoretical)

"KPI" PF: 0.322 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Package was used to bring up collars

Rate code to be determined by sale rep.

	<h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p>	Quarry:	Burlington	Blast Number:	19-016
		P.O. #:		Orica Order #:	2521575
		Blast Date:	2019-08-22	Blast Time:	12:04 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40439	79.88167	0.757549	1.394198
Front Row Corner	43.40387	79.88176	0.757540	1.394200
Back Row Corner	43.40478	79.88161	0.757556	1.394197
Average (Centre of Blast)	43.40434	79.88168	0.757549	1.394198

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	355.8	m		
	Post Blast Data:	ppV:	7.2 mm/s	Trigger set at:	2.0 mm/s
		frequency:	12.5 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	116.7 dB	Trigger set at:	115 dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (2nd Seis. From Centre of Blast)	1348.6	m		
	Post Blast Data:	ppV:	1.5 mm/s	Trigger set at:	2.0 mm/s
		frequency:	41.0 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	111.3 dB	Trigger set at:	115 dB
	South West Corner of property				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40466	79.88098	0.757554	1.394186
	2nd Reading				
	Average	43.40466	79.88098	0.757554	1.394186
	Distance (3rd Seis. From Centre of Blast)	67.1	m		
	Post Blast Data:	ppV:	48.64 mm/s	Trigger set at:	2.0 mm/s
		frequency:	30 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	128.3 dB	Trigger set at:	115 dB
	Gas Line				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(67.1)^2}{30^2} \text{ kg} \\
 &= \frac{4,502}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date:

Blast Number: 19-016
Orica Order #: 2521575

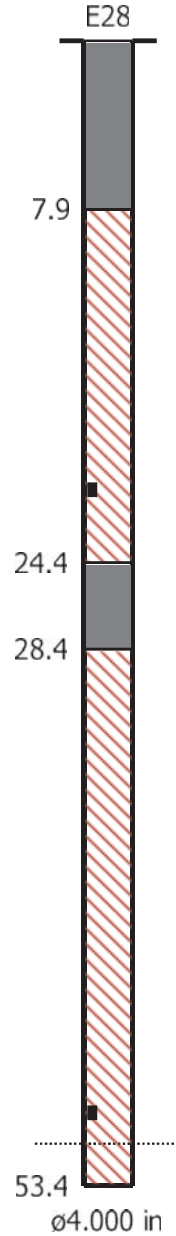
page 2

Paste ShotPlus Diagram inside Rectangle:



UNI Tronic (?)ms 33ft
PENTEX BC 12 * 340 x1

UNI Tronic (?)ms 66ft
Pentex DUO 16 * 454 x1



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 12:05:01 August 22, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.25 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 2nd Line
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

Sand Bagged
 N43.40245,W-79.87814

Microphone Linear Weighting

PSPL 116.7 dB(L) at 2.612 sec

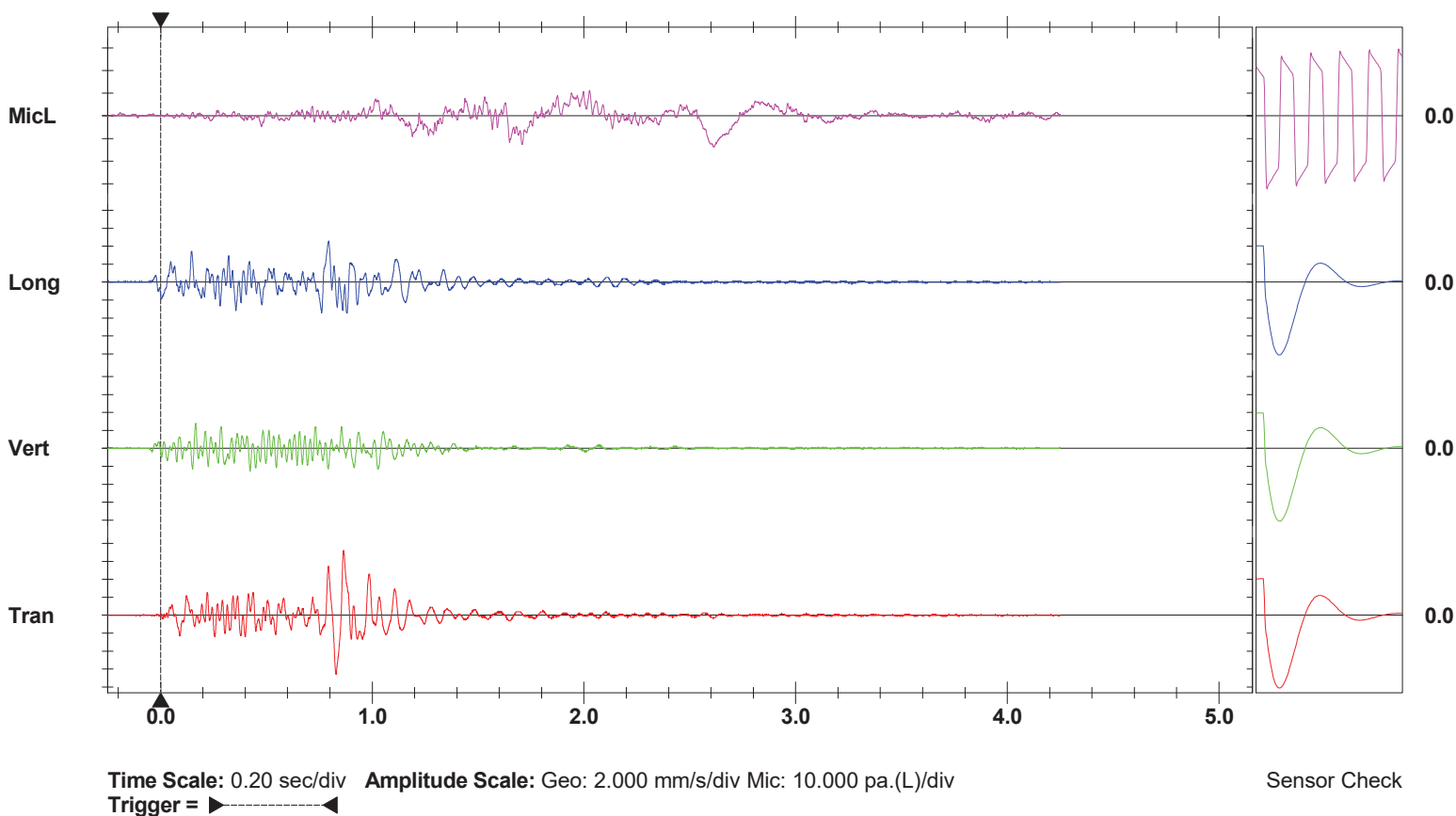
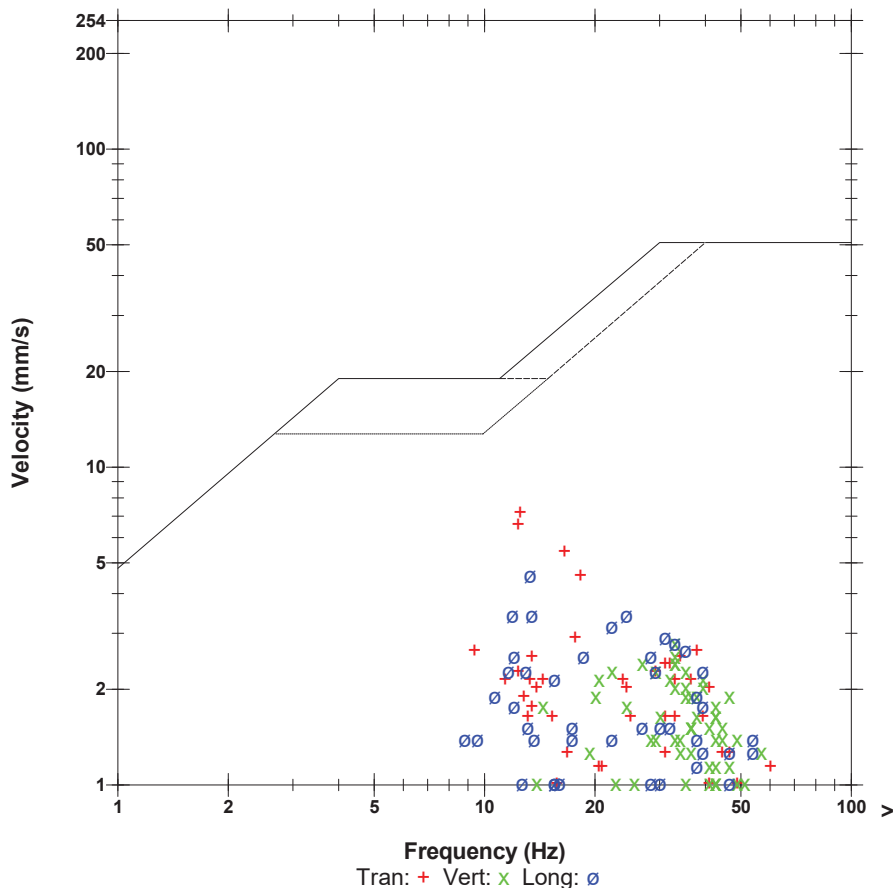
ZC Freq 2.6 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 530 mv)

	Tran	Vert	Long	
PPV	7.239	2.794	4.572	mm/s
ZC Freq	12.5	33	13.3	Hz
Time (Rel. to Trig)	0.864	0.165	0.793	sec
Peak Acceleration	0.106	0.080	0.080	g
Peak Displacement	0.079	0.019	0.050	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.8	3.6	3.9	

Peak Vector Sum 7.523 mm/s at 0.864 sec

USBM RI8507 And OSMRE



Date/Time Long at 12:04:56 August 22, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 121.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.0 sec (Auto=4Sec) at 2048 sps
Operator/Setup: Mike der Kinderen/Burlington SW.MMB

Serial Number UM6859 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration December 24, 2018 by InstanTel
File Name UM6859_20190822120456.IDFW

Notes

Location: SouthWest Corner of Quarry
Client: Nelsons Burlington
User Name: Orica Canada Inc.
General: Monitoring Vibration and Airblast

Extended Notes

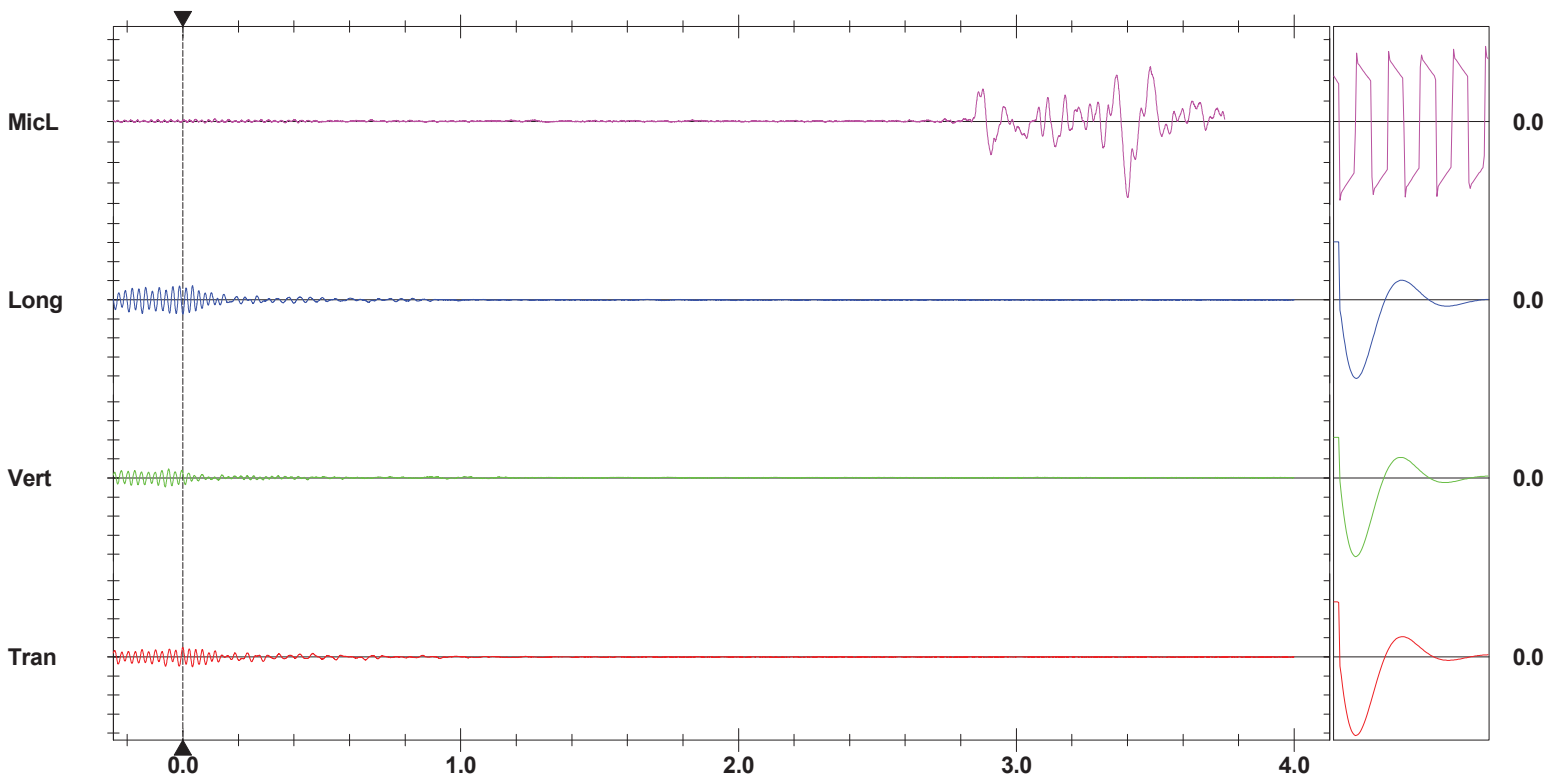
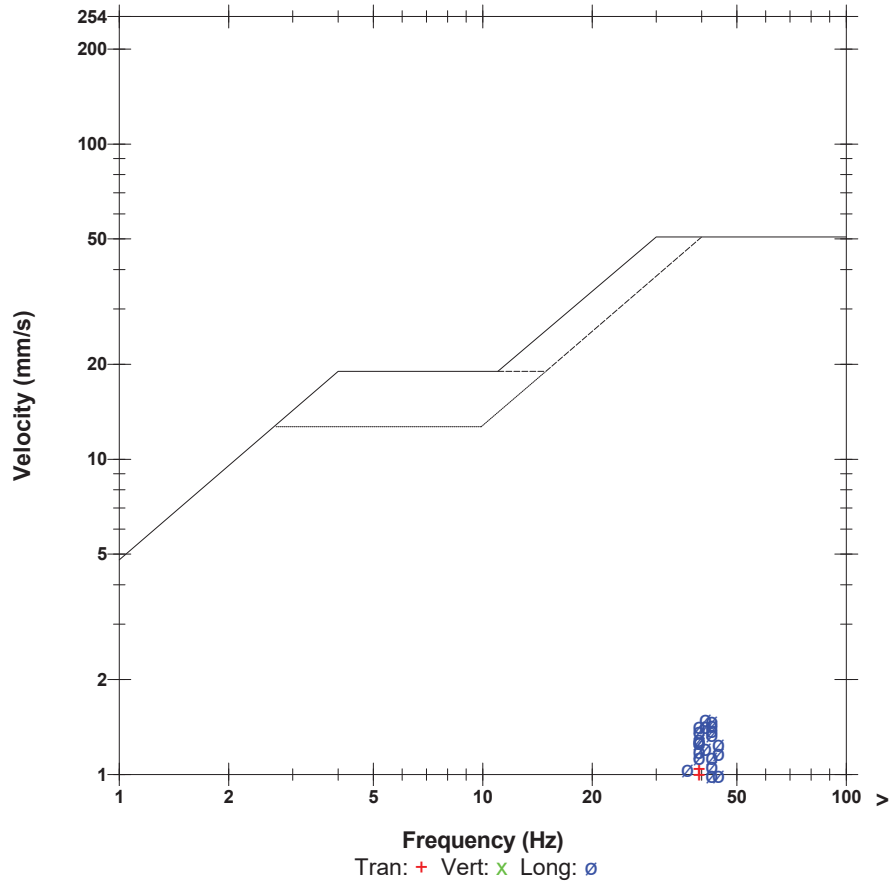
N 43.39339
 W 79.88880

Microphone Linear Weighting
PSPL 111.3 dB(L) at 3.400 sec
ZC Freq 7.7 Hz
Channel Test Passed (Freq = 20.5 Hz Amp = 1355 mv)

	Tran	Vert	Long	
PPV	1.040	0.938	1.498	mm/s
ZC Freq	39	43	41	Hz
Time (Rel. to Trig)	0.035	-0.063	0.000	sec
Peak Acceleration	0.028	0.033	0.064	g
Peak Displacement	0.004	0.004	0.006	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.1	Hz
Overswing Ratio	3.9	3.8	4.0	

Peak Vector Sum 1.884 mm/s at 0.000 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 2.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Vert at 12:05:00 August 22, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.25 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.3 Volts
Unit Calibration August 31, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: Gas Line 52 Meters Behind Blast
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

Extended Notes

Sand Bagged at gas line

Microphone Linear Weighting

PSPL 128.3 dB(L) at 0.199 sec

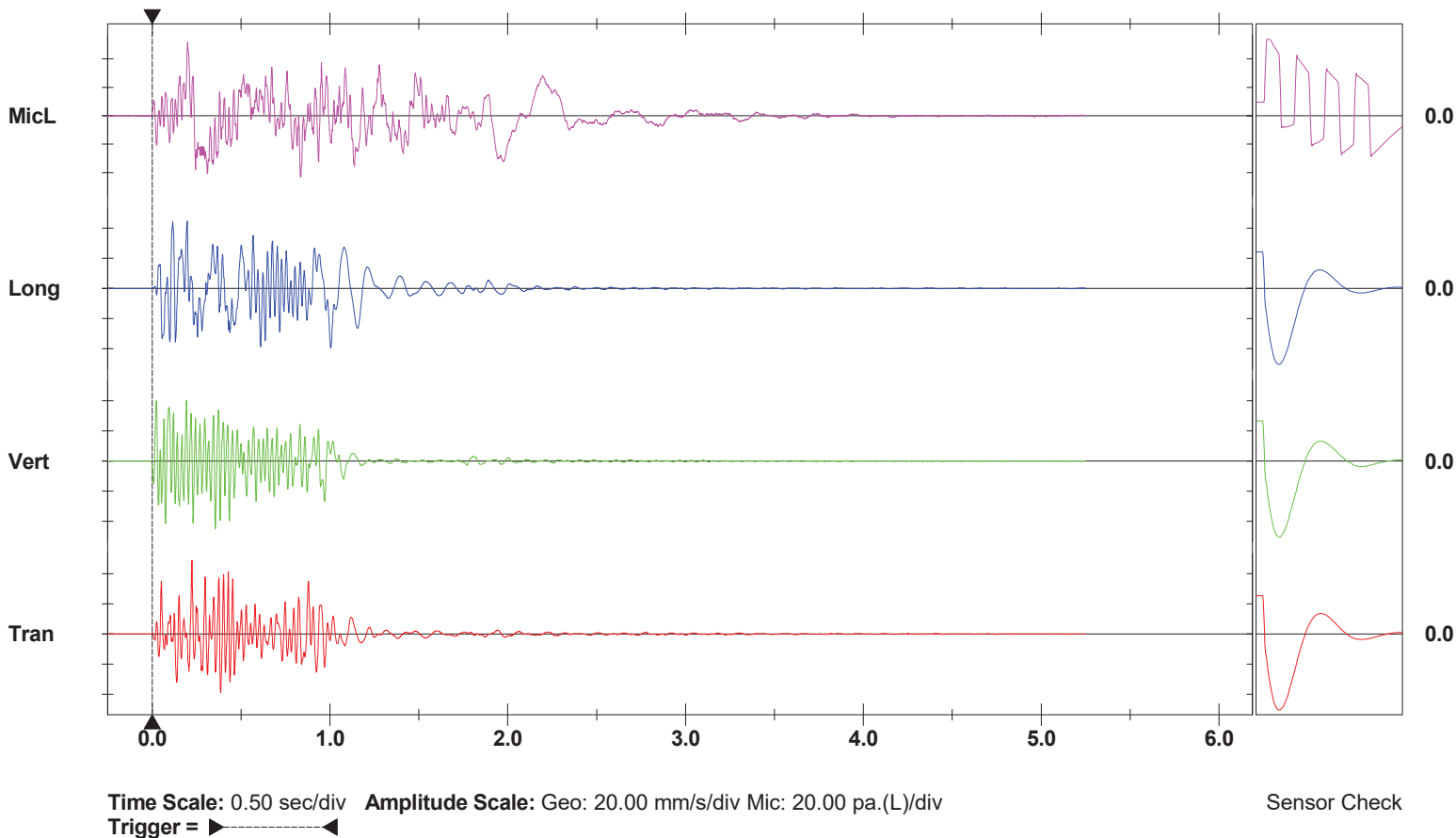
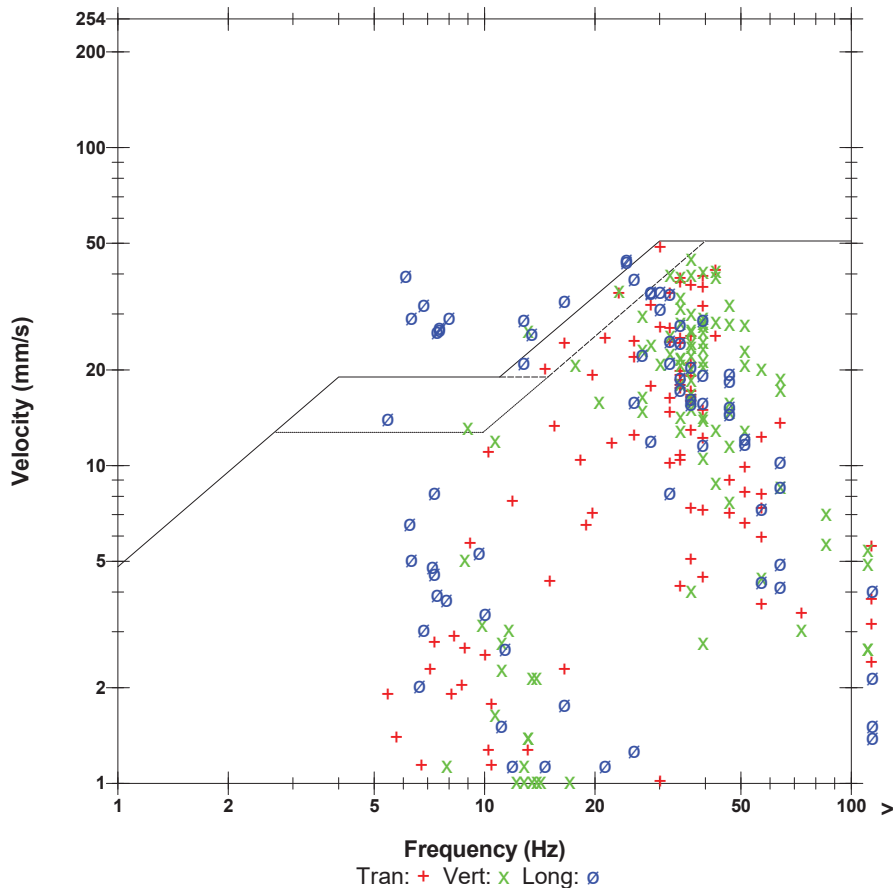
ZC Freq 10 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 683 mv)

	Tran	Vert	Long	
PPV	48.64	45.08	44.58	mm/s
ZC Freq	30	37	24	Hz
Time (Rel. to Trig)	0.224	0.355	0.196	sec
Peak Acceleration	1.644	1.591	1.259	g
Peak Displacement	0.227	0.301	0.675	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.4	Hz
Overswing Ratio	3.7	3.9	4.1	

Peak Vector Sum 56.13 mm/s at 0.194 sec

USBM RI8507 And OSMRE



**Blind line & Colling rd
Nelson Aggregate
Burlington 2019-08-22 Blast 19-016Middle**

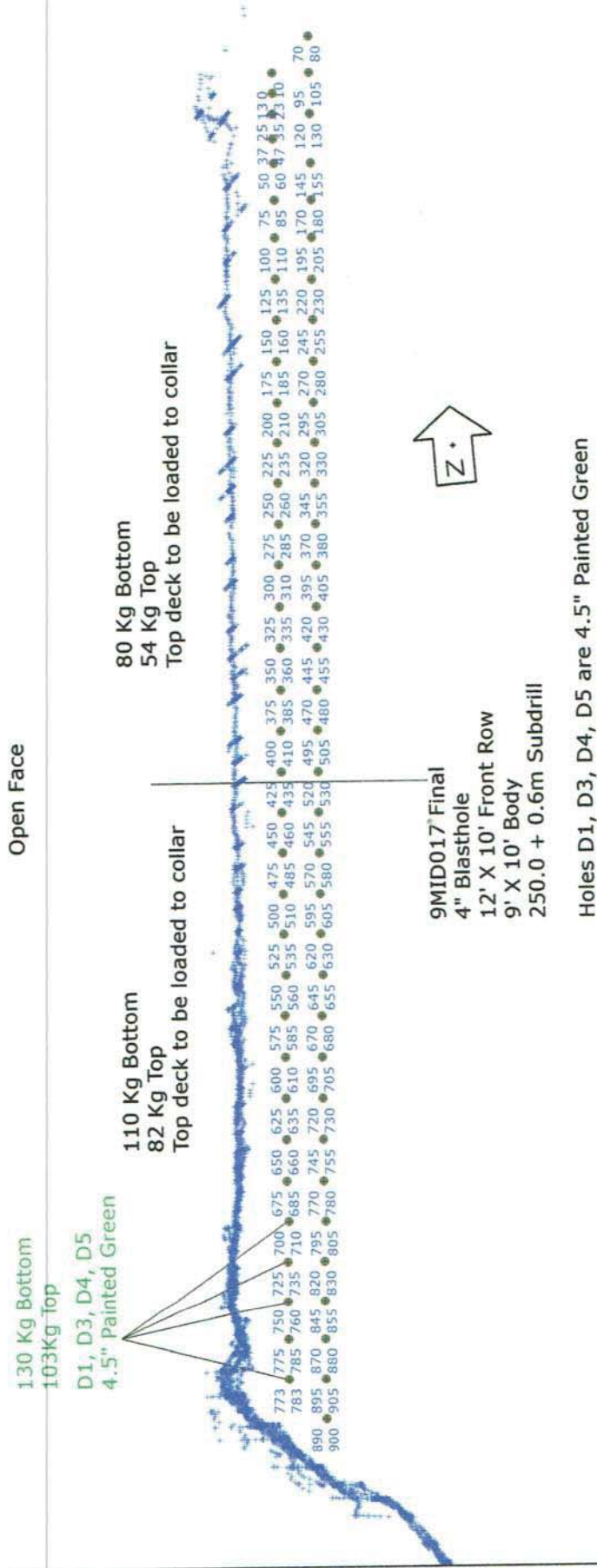
Event Report: Monitor Log - Micromate ISEE # UM6857-Compliance

Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6857
Aug 22 /19 11:20:47		Start Monitoring Waveform Geo: 2.00 mm/s Mic: 115.0 dB
Aug 22 /19 11:20:47	Aug 22 /19 12:41:21	No events recorded. (Keyboard Exit) Waveform Geo: 2.00 mm/s Mic:

SHOTPIUS Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 70	Hole angle: 0.0°
Total drilled: 4176.3ft			



Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Subdrill: 2.0ft	Hole angle: 0.0°
Total drilled: 4176.3ft	Hole Diameter: 4.0in	Number of holes: 70

Load Sheet

130 Kg Bottom
103Kg Top
D1, D3, D4, D5
4.5" Painted Green

110 Kg Bottom
82 Kg Top
Top deck to be loaded to collar

80 Kg Bottom
54 Kg Top
Top deck to be loaded to collar

TOE LOAD
ONE DECIC

Top deck to be loaded to collar

64

112 55 85 105 92 64 64 61 43 60 50 45 40 41 66 68 49 54 70 50 39 48 52 53 47 52 56 53 55 53 180 46 81 88 87 14 75 63 67 65 59 63 43 68 13 46 43 80 71 66 60 51 49 47 21 54 43 51 52 54 53 25 39 49 40 39



Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 70	Hole angle: 0.0°
Total drilled: 4176.3ft			

Open Face

130 Kg Bottom
103Kg Top

D1, D3, D4, D5
4.5" Painted Green

110 Kg Bottom
82 Kg Top
Top deck to be loaded to collar

80 Kg Bottom
54 Kg Top
Top deck to be loaded to collar



9MID017 Final
4" Blasthole
12' X 10' Front Row
9' X 10' Body
250.0 + 0.6m Subdrill

Holes D1, D3, D4, D5 are 4.5" Painted Green



Not to scale

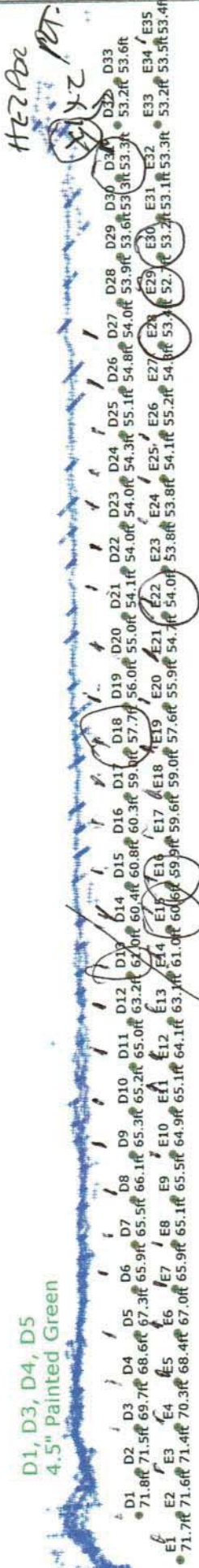
SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4069.7ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 68
 Stemming: 8.0ft
 Hole angle: 0.0°

Open Face

D1, D3, D4, D5
 4.5" Painted Green



9MID017 Final
 4" Blasthole
 12' X 10' Front Row
 9' X 10' Body
 250.0 + 0.6m Subdrill

Holes D1, D3, D4, D5 are 4.5" Painted Green



Not to scale



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-08-28

Blast Number: 19-017

Orica Order #: 2523993

Blast Time: 10:59 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40346 °N Latitude 79.88160 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 5 kph Temperature: 21 to 25 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: 101.6 mm 0° # Holes: 36 = 2,383.1 ft (4 " diam)
Secondary Bit diam: mm ° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

in (kg) out (kg) kg

CENTRA GOLD 70 34,180 27,010 7,170

Packaged Explosives:

cs shipped cs returned kg

FORTEL PRO 75X400 2 2 0

Boosters:

kg / unit # used kg

PENTEX 8 (OR EQUIVALENT) 0.23 35 7.9
PENTEX 12 (OR EQUIVALENT) 0.34 36 12.2

total explosives weight in Blast (kg): 7,190

Pkgd Prod (0 kg) % of Total kg: 0.0%

Detonators:

case #'s ms # used

UNITRONIC 600 6M 35
UNITRONIC 600 25M 36

Cord & Accessories:

U of M # used

HARNESS WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services:

BULK TRUCK CHARGE 1.0
BLASTER HOURS Enter Blaster hours 5.5
HELPER HOURS Enter total Helper man-hours 10.0
SHOT LAYOUT FEE Enter # trips extra beyond 1 0.0
ADVANCED BLAST DESIGN Enter hours 0.0
BORETRACK Enter hours 0.0

Tonnes Blasted: 15,727 te 6,049 m3
Total tonnes per day: 15,727 te NB60-08 Rate Code
Total Holes Loaded: 36 holes
... including: 3 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 2 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 13 front row

- Pattern (Back Row) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 23 back row

Bench Height: 64.2 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 66.2 ft avg

- Stone Decking -

Front Row: 0.0 ft avg

Back Row: 0.0 ft avg

Decks: 0 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Back Row: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 59.2 ft avg

Back Row: 59.2 ft avg

- Charge Weight -

Front Row: 172.6 kg/hole

Back Row: 172.6 kg/hole

Max. per delay: 237.0 kg/delay

SD () Equation: 22.5 kg/delay

Total kg Loaded: 7,190 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.457 kg/te (actual)

Front row: 0.304 kg/te (theoretical)

Main Body: 0.406 kg/te (theoretical)

"KPI" PF: 0.355 kg/te (theoretical)

2.004 lb/yd³


1.334 lb/yd³

1.778 lb/yd³

1.556 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

J-9 Only received a bottom primer due to hole bridging while retracting the hose

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-017
		P.O. #: 	Orica Order #: 2523993
		Blast Date: 2019-08-28	Blast Time: 10:59 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40346	79.88160	0.757533	1.394197
Front Row Corner	43.40333	79.88167	0.757531	1.394198
Back Row Corner	43.40360	79.88153	0.757536	1.394196
Average (Centre of Blast)	43.40346	79.88160	0.757533	1.394197

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	301.5	m		
	Post Blast Data:	ppV:	7.2 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	12.3 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	119.1 dB	Trigger set at: 115 dB	
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (2nd Seis. From Centre of Blast)	1263.8	m		
	Post Blast Data:	ppV:	0.1 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	10.1 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	117.4 dB	Trigger set at: 115 dB	
	Blind Line and Colling Road (Bruce Trail Entrance)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40466	79.88098	0.757554	1.394186
	2nd Reading				
	Average	43.40466	79.88098	0.757554	1.394186
	Distance (3rd Seis. From Centre of Blast)	142.4	m		
	Post Blast Data:	ppV:	34.4 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	30.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	131.6 dB	Trigger set at: 115 dB	
	Gas Line				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(142.4)^2}{30^2} \text{ kg} \\
 &= \frac{20,278}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 23 kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 8/28/2019

Blast Number: 19-017
Orica Order #: 2523993

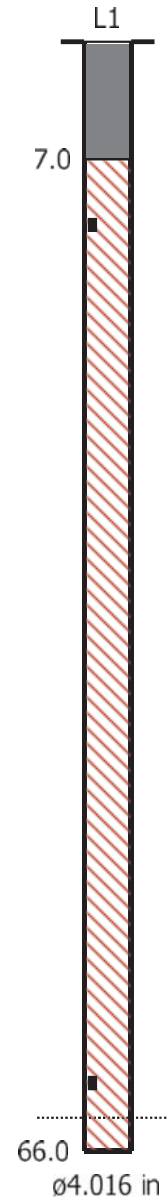
page 2

Paste ShotPlus Diagram inside Rectangle:



UNI Tronic (?)ms 20ft
PENTEX CD 8 * 227 x1

UNI Tronic (?)ms 82ft
PENTEX BC 12 * 340 x1



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Vert at 10:59:42 August 28, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.2 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 2nd Line
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

Sand Bagged
 N43.40245,W-79.87814

Microphone Linear Weighting

PSPL 119.1 dB(L) at 0.987 sec

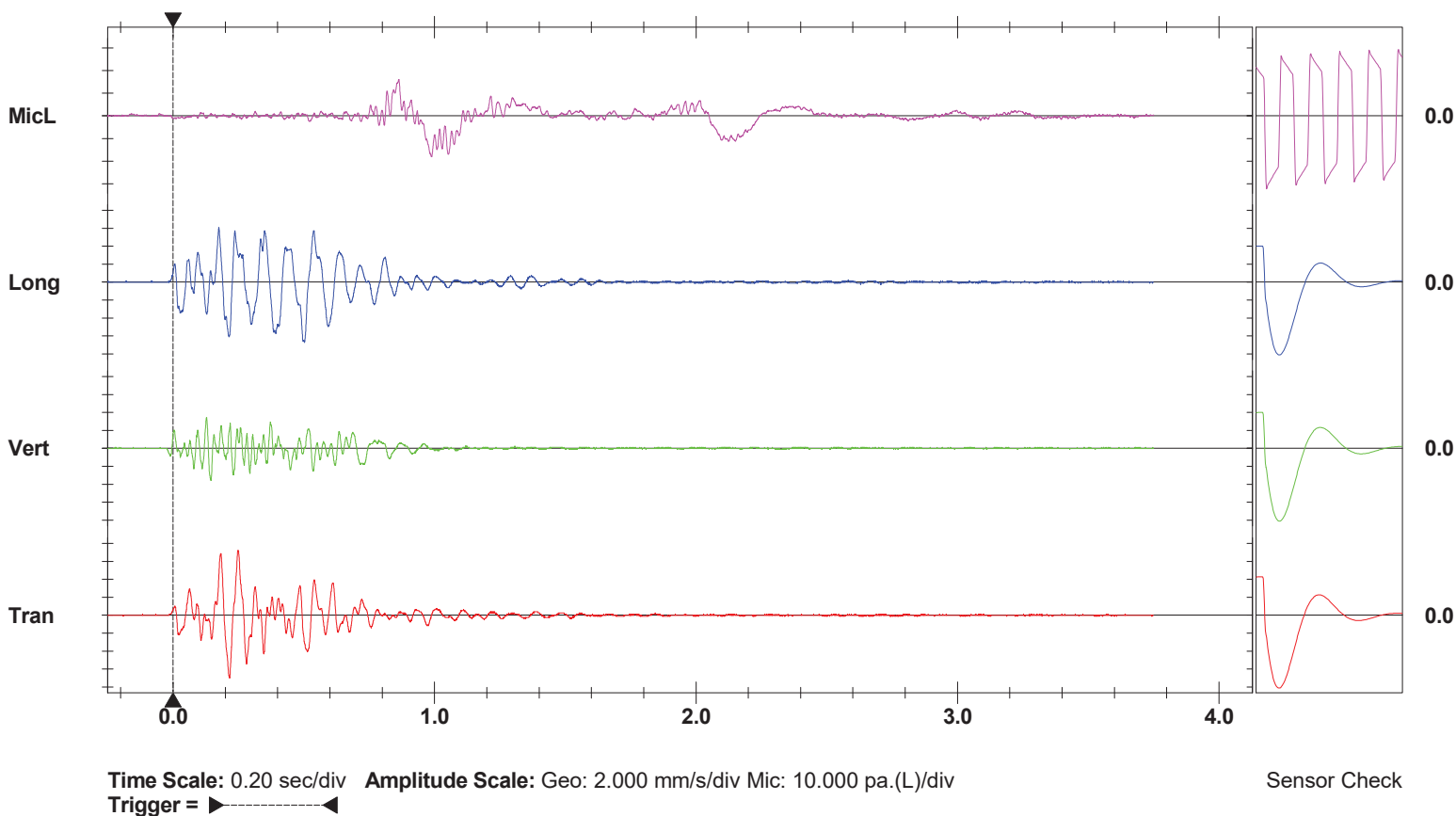
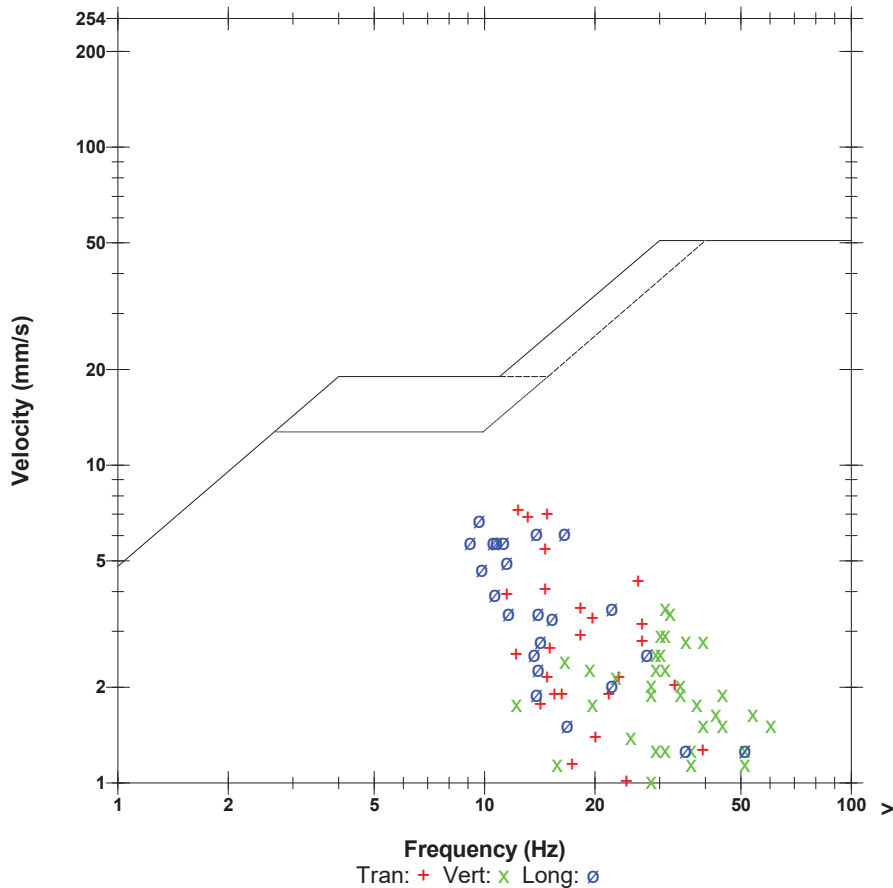
ZC Freq 3.0 Hz

Channel Test Passed (Freq = 20.5 Hz Amp = 520 mv)

	Tran	Vert	Long	
PPV	7.239	3.556	6.731	mm/s
ZC Freq	12.3	31	9.7	Hz
Time (Rel. to Trig)	0.248	0.144	0.502	sec
Peak Acceleration	0.106	0.106	0.106	g
Peak Displacement	0.073	0.027	0.094	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.3	Hz
Overswing Ratio	3.6	3.5	3.9	

Peak Vector Sum 9.410 mm/s at 0.216 sec

USBM RI8507 And OSMRE



Date/Time MicL at 10:59:42 August 28, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.088 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.5 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20190828105942.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

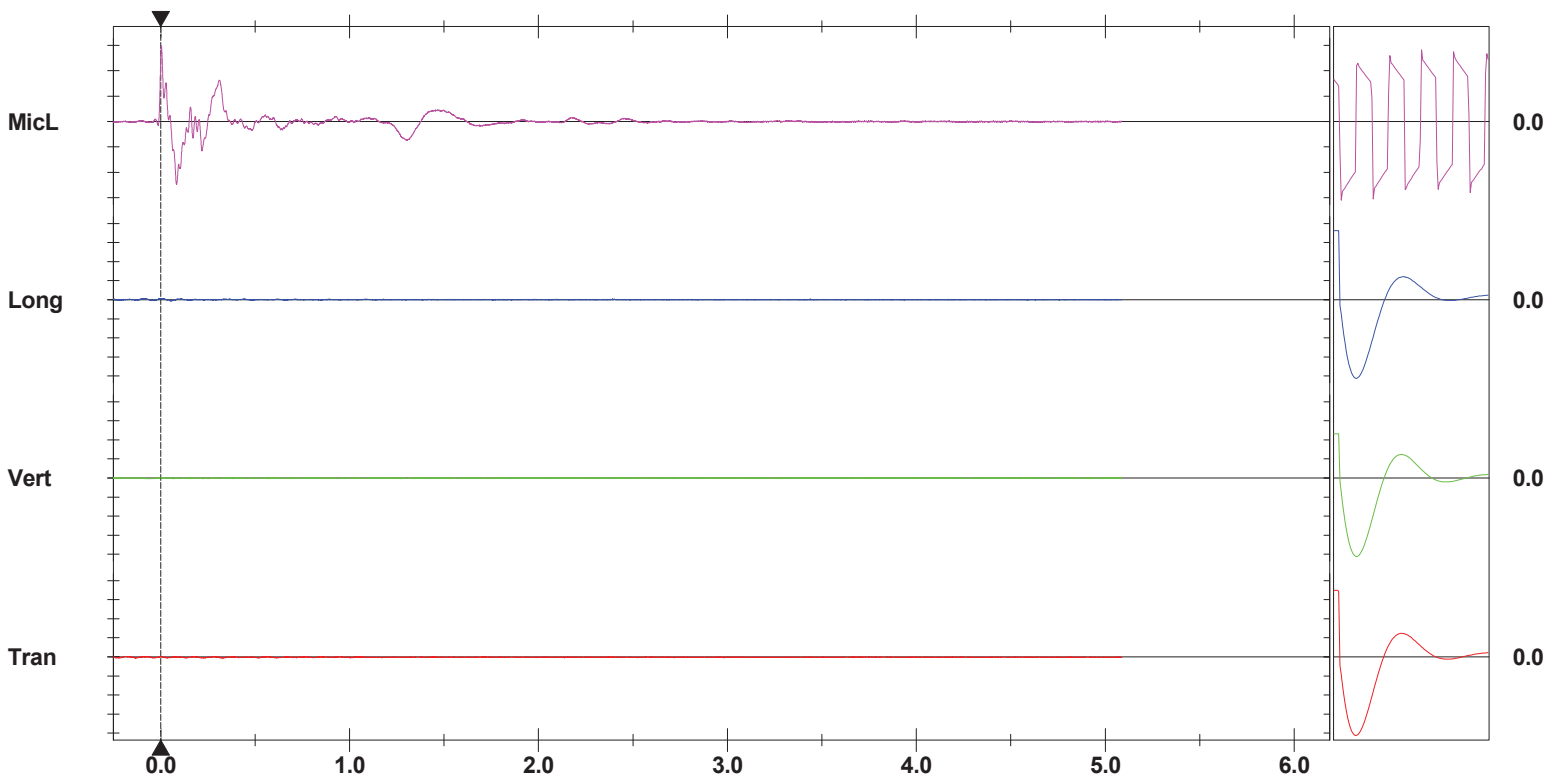
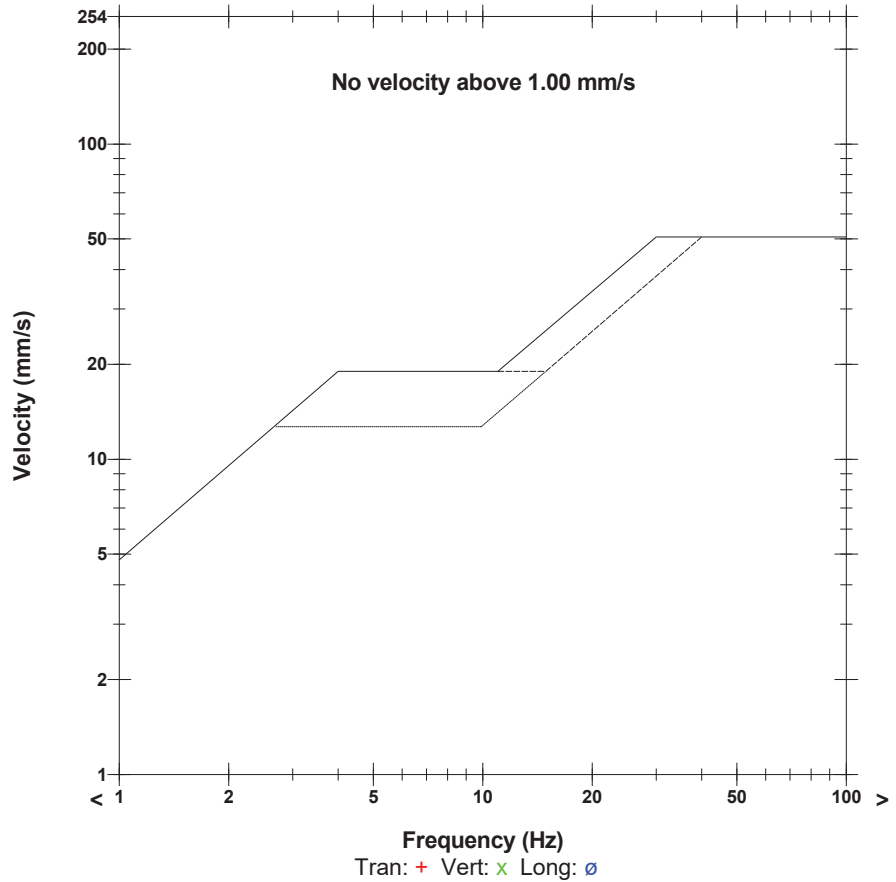
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 117.4 dB(L) at 0.004 sec
ZC Freq 8.0 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1338 mv)

	Tran	Vert	Long	
PPV	0.126	0.079	0.134	mm/s
ZC Freq	9.5	6.6	10.1	Hz
Time (Rel. to Trig)	-0.219	-0.071	-0.093	sec
Peak Acceleration	0.008	0.010	0.010	g
Peak Displacement	0.017	0.002	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.3	3.3	3.4	

Peak Vector Sum 0.146 mm/s at -0.088 sec

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Vert at 10:59:42 August 28, 2019
Trigger Source Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.4 Volts
Unit Calibration August 31, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

Extended Notes

Sand Bagged at gas line

Microphone Linear Weighting

PSPL 131.6 dB(L) at 0.717 sec

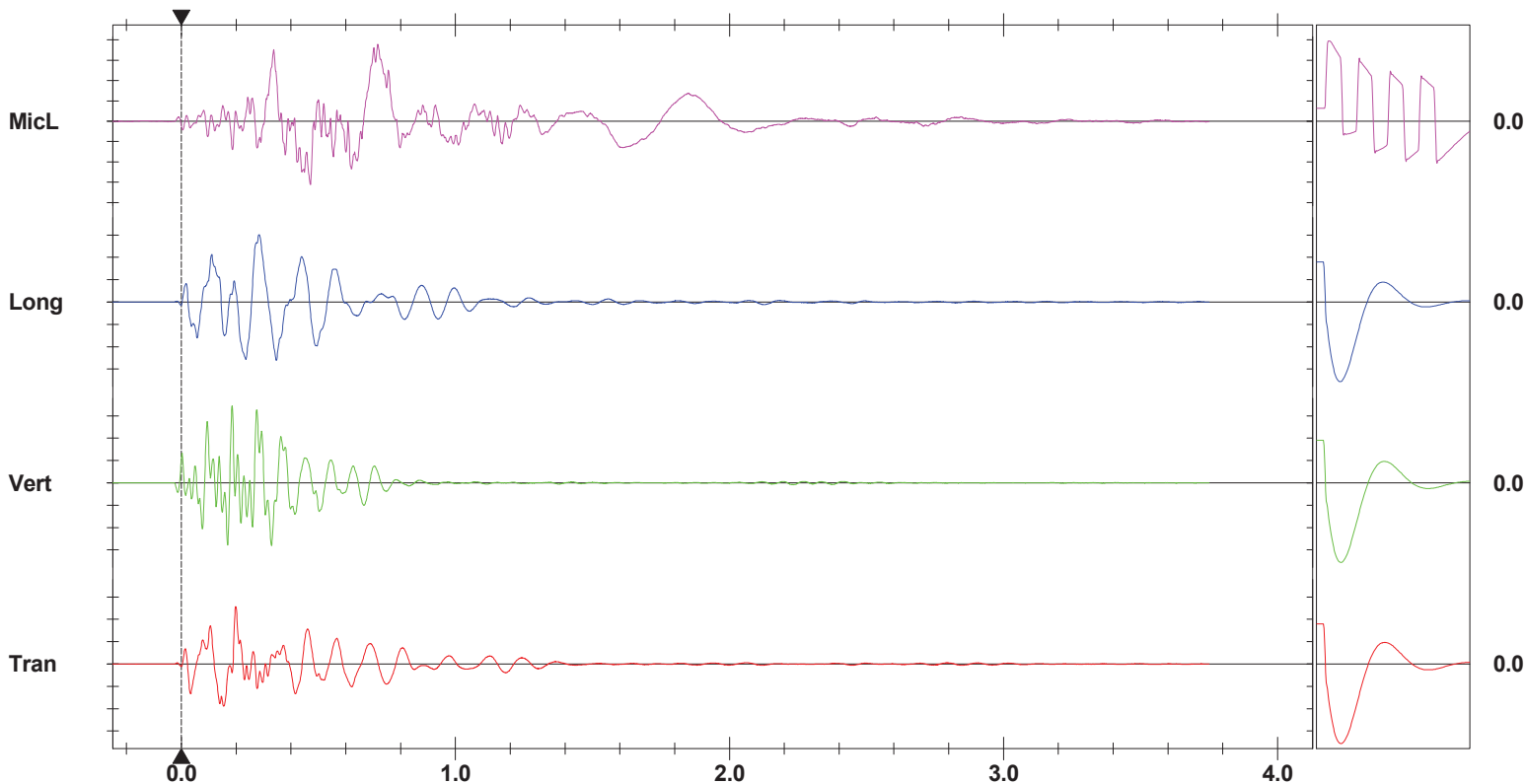
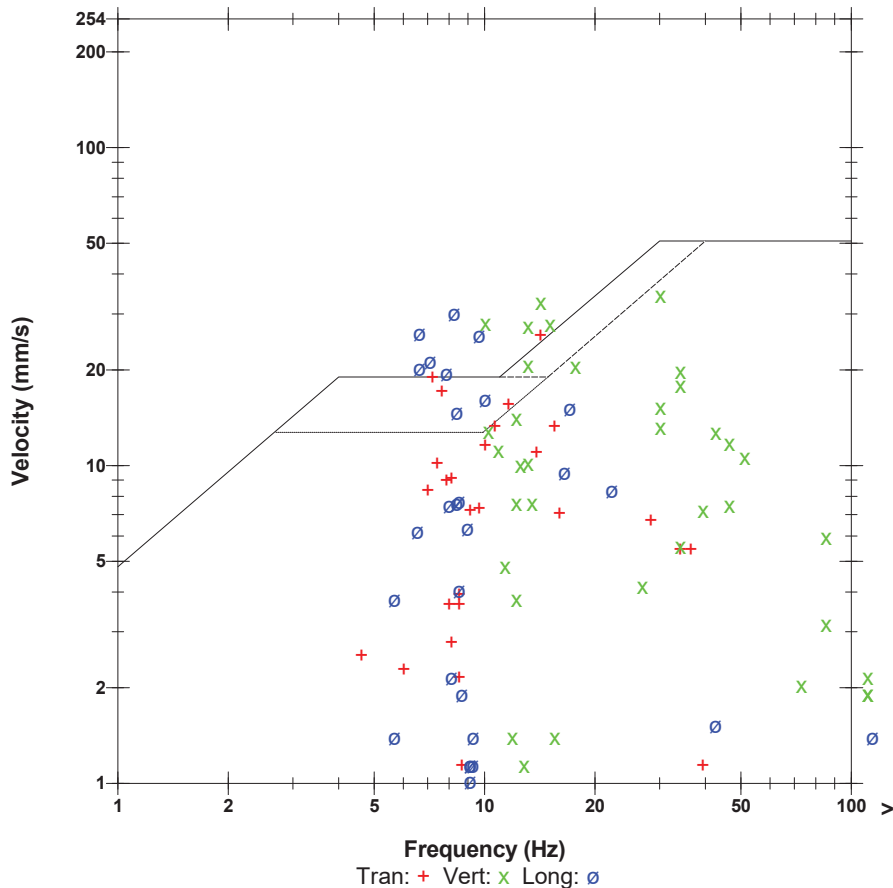
ZC Freq 4.1 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 695 mv)

	Tran	Vert	Long	
PPV	25.65	34.42	30.10	mm/s
ZC Freq	14	30	8.3	Hz
Time (Rel. to Trig)	0.198	0.186	0.282	sec
Peak Acceleration	0.424	0.663	0.278	g
Peak Displacement	0.333	0.340	0.556	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.2	7.3	7.5	Hz
Overswing Ratio	3.7	3.7	4.0	

Peak Vector Sum 43.35 mm/s at 0.275 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 10.000 mm/s/div Mic: 20.00 pa.(L)/div
Trigger =

Sensor Check

SHOTPLUS Plan

Blast Summary Data

Burden: 9.0ft
 Spacing: 10.0ft
 Stemming: 7.0ft
 1st row burden: 12.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Hole angle: 0.0°
 Number of holes: 36
 Total drilled: 2383.1ft



POSTS

open face

J1 66.5ft	J2 66.1ft	J3 65.7ft	J4 65.9ft	J5 66.3ft	J6 66.2ft	J7 65.7ft	J8 66.1ft	J9 66.2ft	J10 66.6ft	J11 68.2ft	J12 69.4ft	J13 70.6ft
K1 65.9ft	K2 65.6ft	K3 64.9ft	K4 65.4ft	K5 65.6ft	K6 65.5ft	K7 65.2ft	K8 66.4ft	K9 66.5ft	K10 66.3ft	K11 67.5ft	K12 68.4ft	
L1 66.0ft	L2 65.5ft	L3 65.2ft	L4 65.3ft	L5 66.2ft	L6 64.2ft	L7 64.7ft	L8 66.3ft	L9 65.3ft	L10 65.0ft	L11 66.8ft		

9UPMD016 Design Fnl - 4" Blast Hole 12x10 9x10 271 and 250 +
 DRILLER NAME: _____

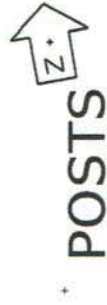


Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 7.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Hole angle: 0.0°
 Total drilled: 2383.1ft Number of holes: 36



open face



9UPMD016 Design Fnl - 4" Blast Hole 12x10 9x10 271 and 250 +
 DRILLER NAME: _____



Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 2383.1ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 36
 Stemming: 7.0ft
 Hole angle: 0.0°

Load Sheet

Max 225 Kg

open face



237		
224	219	
216	215	162 + hose
217	213	217
211	214	211
218	210	207
216	201	205
211	214	213
210	214	216
214	213	208
208	207	212
211	209	209
207	205	205



Not to scale

SHOTPlus 5 Plan

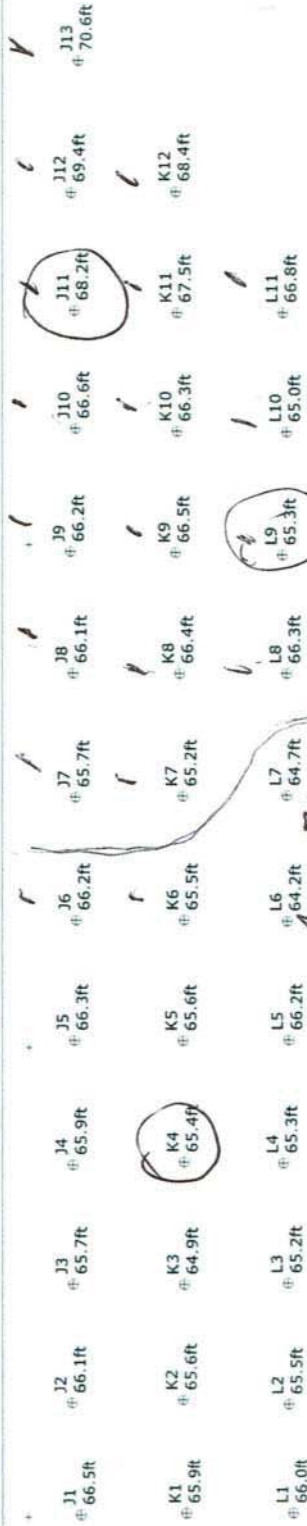
Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 2383.1ft
 Spacing: 10.0ft
 Subdrill: 2.0ft
 Number of holes: 36
 Stemming: 7.0ft
 Hole angle: 0.0°

open face

7500 KGS

POSTS



9UPMD016 Design Fnl - 4" Blast Hole 12x10 9x10 271 and 250 + .6 SUB ELEV
 DRILLER NAME:



Scale 1:200

SHOTPlus™ Professional 5.7.4.4	8/19/2019
Mine	Burlington
Location	UPPER MIDDLE SLOT NEXT TO OLD WHLWAS
Title/author	9UPMD016 Design Fnl
Filename	



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-09-09

Blast Number: 19-018

Orica Order #: 2528633

Blast Time: 12:37 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Middle (Bench / Face)

GPS Coordinates: 43.40434 °N Latitude 79.88160 °W Longitude
Centre of Blast Centre of Blast

Wind from the: NE at 15 kph Temperature: 16 to 20 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 2,400 ft

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: 101.6 mm 0° # Holes: 78 = 4,680.9 ft (4 " diam)
Secondary Bit diam: mm ° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

in (kg) out (kg) kg

CENTRA GOLD 70 33,710 22,210 11,500

Packaged Explosives:

cs shipped cs returned kg

FORTEL PRO 75X400 2 1 25

Boosters:

kg / unit # used kg

PENTEX 12 (OR EQUIVALENT) 0.34 79 26.9
PENTEX DUO (OR EQUIVALENT) 0.45 97 44.0

total explosives weight in Blast (kg): 11,596

Pkgd Prod (25 kg) % of Total kg: 0.2%

Detonators:

case #'s ms # used

UNITRONIC 600 9M 20
UNITRONIC 600 15M 78
UNITRONIC 600 20M 39
UNITRONIC 600 25M 54
EXEL MS 15m 19
EXEL MS 18m 39

Cord & Accessories:

U of M # used

HARNESS WIRE DUPLEX (6 PACK) 400M units 1
MINI STEM PLUGS - 6015 (4") units 4

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services:

BULK TRUCK CHARGE 1.0
BLASTER HOURS Enter Blaster hours 7.0
HELPER HOURS Enter total Helper man-hours 12.0
SHOT LAYOUT FEE Enter # trips extra beyond 1 0.0
ADVANCED BLAST DESIGN Enter hours 0.0
BORETRACK Enter hours 0.0

Tonnes Blasted: 35,108 te 13,503 m3
Total tonnes per day: 35,108 te NB60-16 Rate Code
Total Holes Loaded: 78 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 2 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 40 front row

- Pattern (Back Row) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 38 back row

Bench Height: 58.0 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 60.0 ft avg

- Stone Decking -

Front Row: 4.0 ft avg

Back Row: 4.0 ft avg

Decks: 97 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Back Row: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 49.0 ft avg

Back Row: 49.0 ft avg

- Charge Weight -

Front Row: 142.9 kg/hole

Back Row: 142.9 kg/hole

Max. per delay: 110.0 kg/delay

SD () Equation: 4.2 kg/delay

Total kg Loaded: 11,596 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.330 kg/te (actual)

Front row: 0.279 kg/te (theoretical)

Main Body: 0.372 kg/te (theoretical)

"KPI" PF: 0.325 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):


The first 19 Holes at the north end of the blast received 3 emulsion decks, the rest of the blast received 2 emulsion decks to control vibrations at the gas line and the near by shop.

Rate Code NB60-16 (19 decks in addition to the 78 built into the rate code)

Excel MS 25M 25ms---24 Used

15 additional 25M Unitronics were used instead of 25M ms because of limited stock

No additional charge should be added

 The Blasting Professionals™	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-018
		P.O. #: 	Orica Order #: 2528633
		Blast Date: 2019-09-09	Blast Time: 12:37 PM

page 2

Blast Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast		43.40436	79.88159	0.757549	1.394197
Front Row Corner		43.40381	79.88168	0.757539	1.394198
Back Row Corner		43.40486	79.88152	0.757558	1.394196
Average (Centre of Blast)		43.40434	79.88160	0.757549	1.394197

1st Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40245	79.87814	0.757516	1.394137
2nd Reading					
Average		43.40245	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)		349.9	m		
Post Blast Data:		ppV:	4.1 mm/s	Trigger set at:	2.0 mm/s
		frequency:	10.9 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	117.4 dB	Trigger set at:	115 dB
2450 2nd Line					

2nd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.39339	79.88880	0.757358	1.394323
2nd Reading					
Average		43.39339	79.88880	0.757358	1.394323
Distance (2nd Seis. From Centre of Blast)		1351.1	m		
Post Blast Data:		ppV:	0.1 mm/s	Trigger set at:	2.0 mm/s
		frequency:	14.0 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	116.4 dB	Trigger set at:	115 dB
Blind Line and Colling Road (Bruce Trail Entrance)					

3rd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40466	79.88098	0.757554	1.394186
2nd Reading					
Average		43.40466	79.88098	0.757554	1.394186
Distance (3rd Seis. From Centre of Blast)		61.5	m		
Post Blast Data:		ppV:	29.3 mm/s	Trigger set at:	2.0 mm/s
		frequency:	20.0 Hz	V / T / L :	? (Vertical, Transverse or Longitudinal)
		air overpressure:	128.2 dB	Trigger set at:	115 dB
Gas Line					

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(61.5)^2}{30^2} \text{ kg} \\
 &= \frac{3,782}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 4 kg

Orica

Blaster-in-charge:

jim bray

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

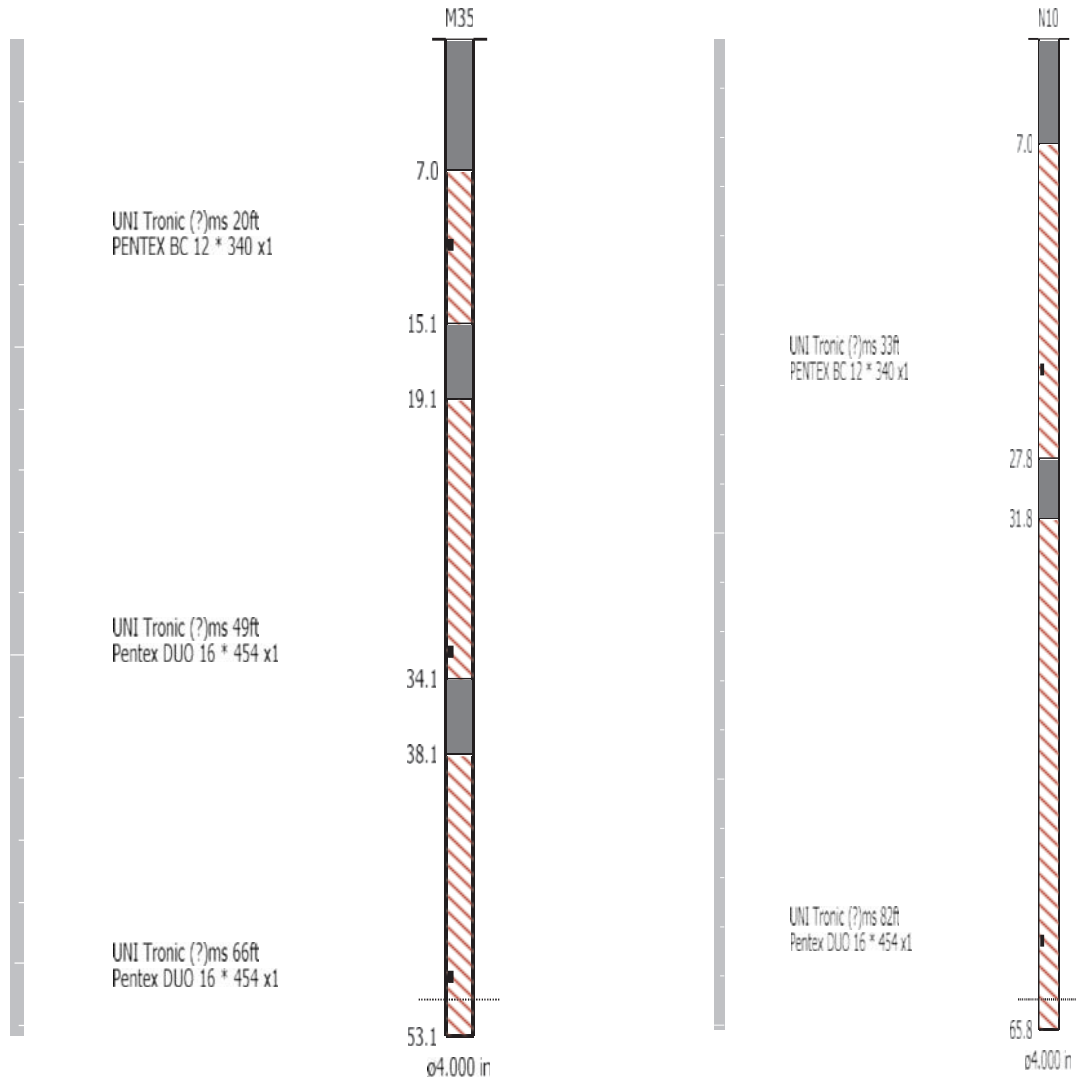
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 9/9/2019

Blast Number: 19-018
Orica Order #: 2528633

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 12:37:13 September 9, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.0 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.2 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 Road Burlington
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

Sand Bagged

Microphone Linear Weighting

PSPL 117.4 dB(L) at 2.425 sec

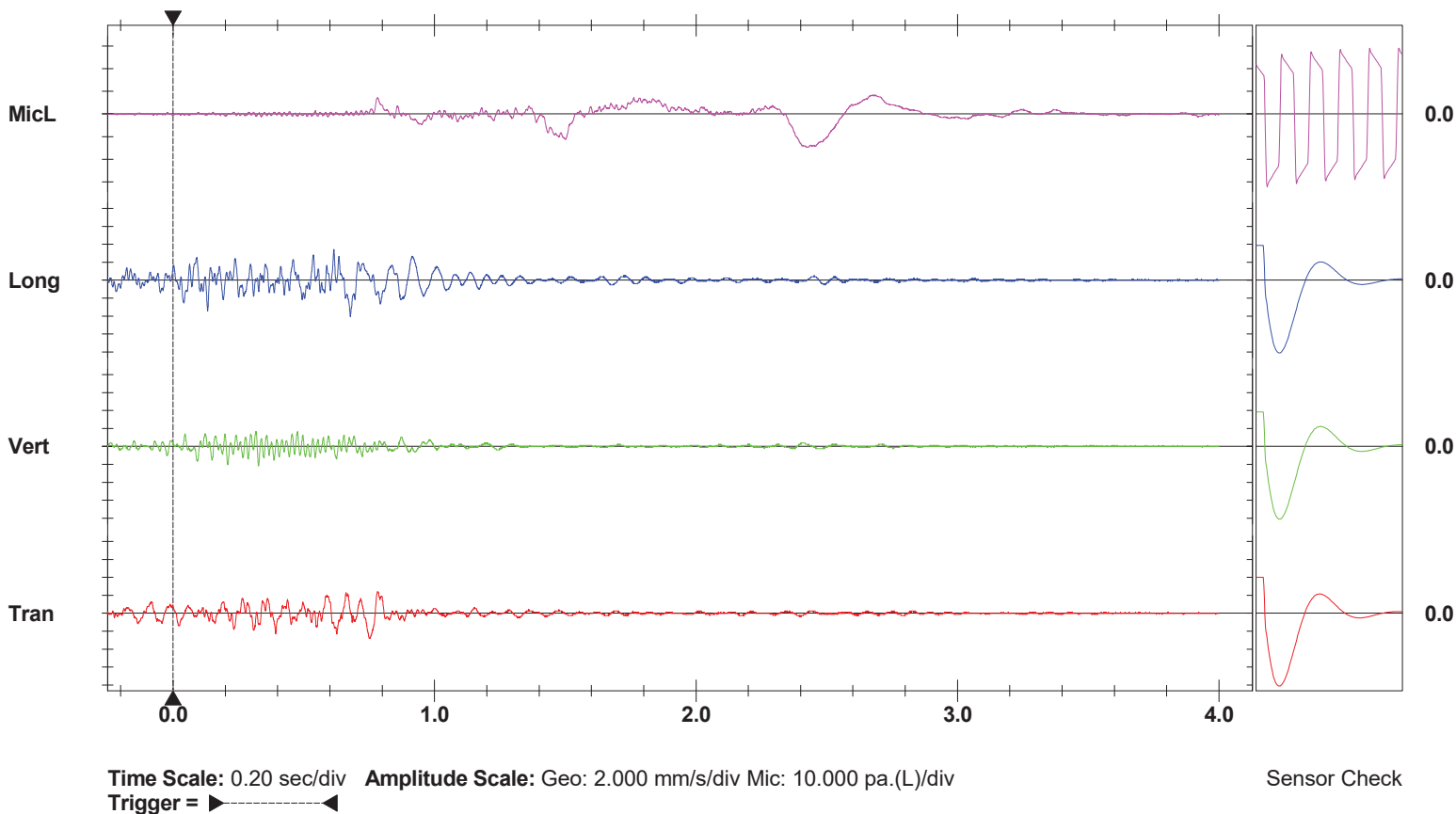
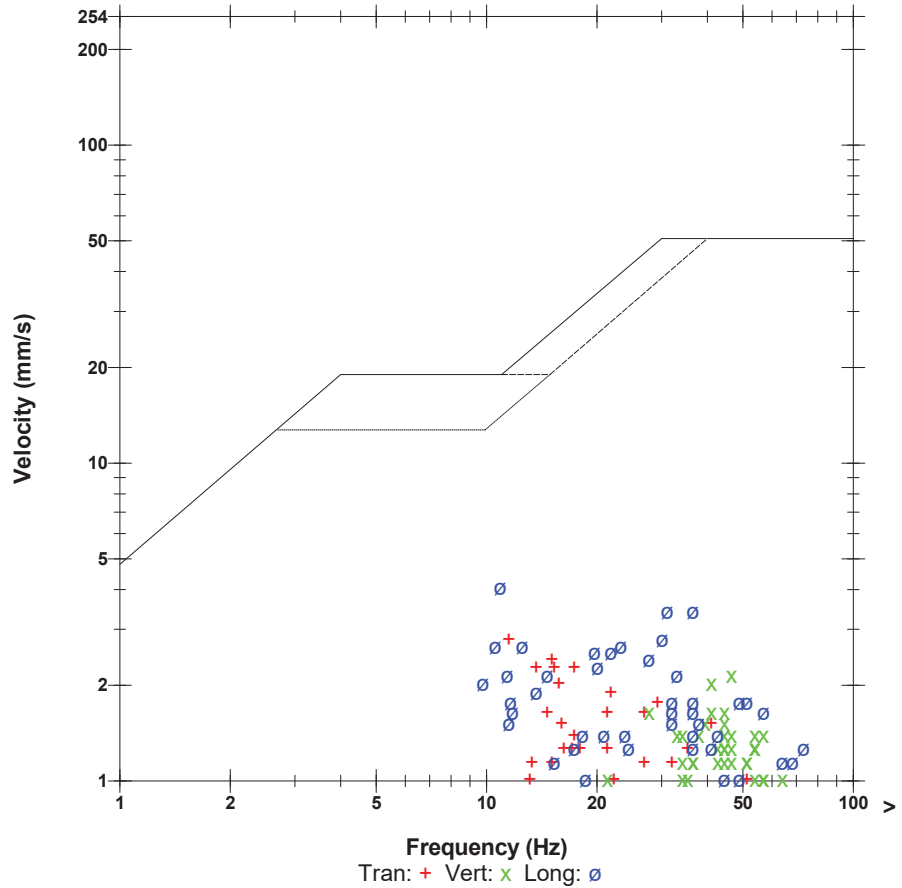
ZC Freq 2.3 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 599 mv)

	Tran	Vert	Long	
PPV	2.794	2.159	4.064	mm/s
ZC Freq	11.5	47	10.9	Hz
Time (Rel. to Trig)	0.750	0.326	0.678	sec
Peak Acceleration	0.053	0.080	0.106	g
Peak Displacement	0.036	0.010	0.048	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.3	7.2	Hz
Overswing Ratio	3.8	3.7	4.1	

Peak Vector Sum 4.098 mm/s at 0.678 sec

USBM RI8507 And OSMRE



Date/Time MicL at 12:37:15 September 9, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.012 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20190909123715.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

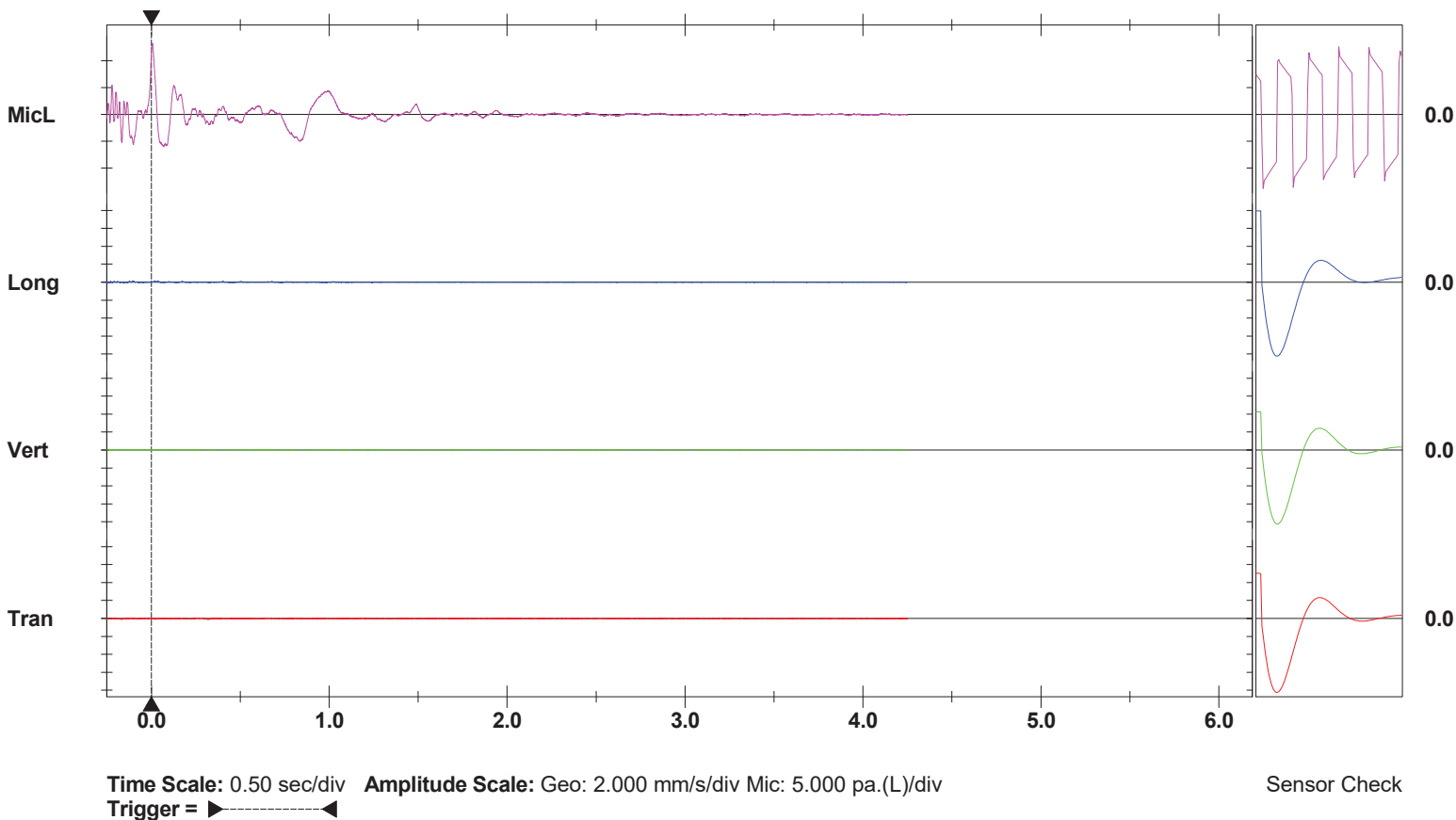
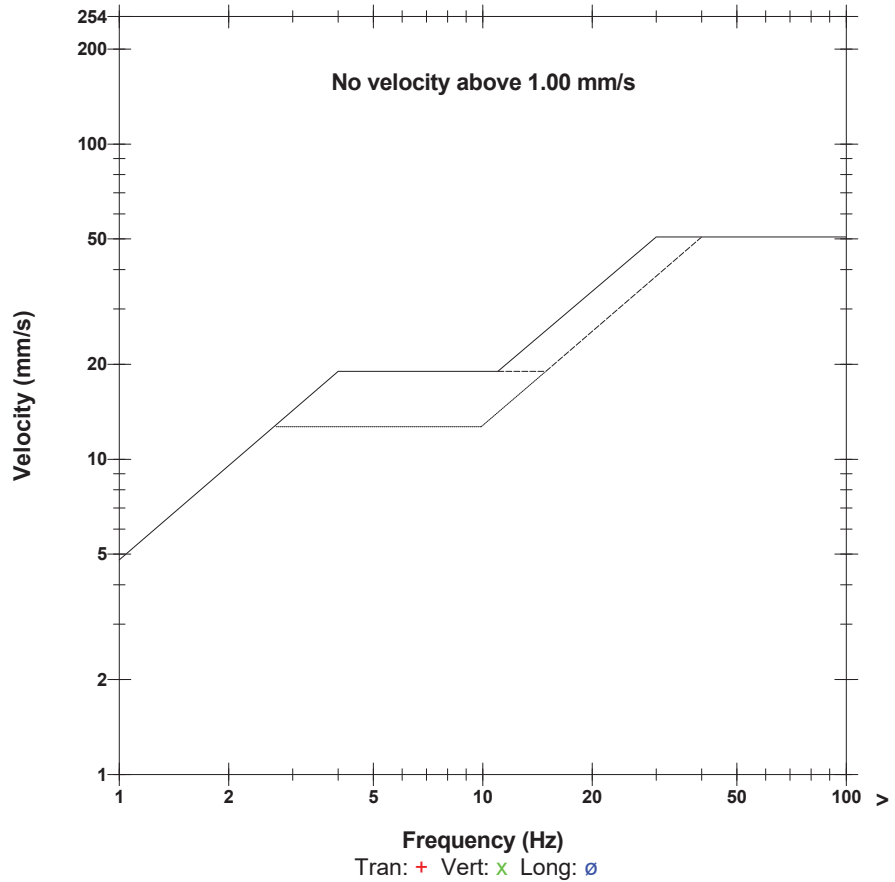
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 116.4 dB(L) at 0.007 sec
ZC Freq 7.0 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1392 mv)

	Tran	Vert	Long	
PPV	0.102	0.071	0.142	mm/s
ZC Freq	9.1	20	14.0	Hz
Time (Rel. to Trig)	-0.167	-0.214	-0.104	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.003	0.000	0.001	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.6	3.4	3.4	

Peak Vector Sum 0.151 mm/s at -0.104 sec

USBM RI8507 And OSMRE



Date/Time Vert at 12:35:20 September 9, 2019
Trigger Source Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.25 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.4 Volts
Unit Calibration August 31, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

Extended Notes

Sand Bagged at gas line

Microphone Linear Weighting

PSPL 128.2 dB(L) at 0.177 sec

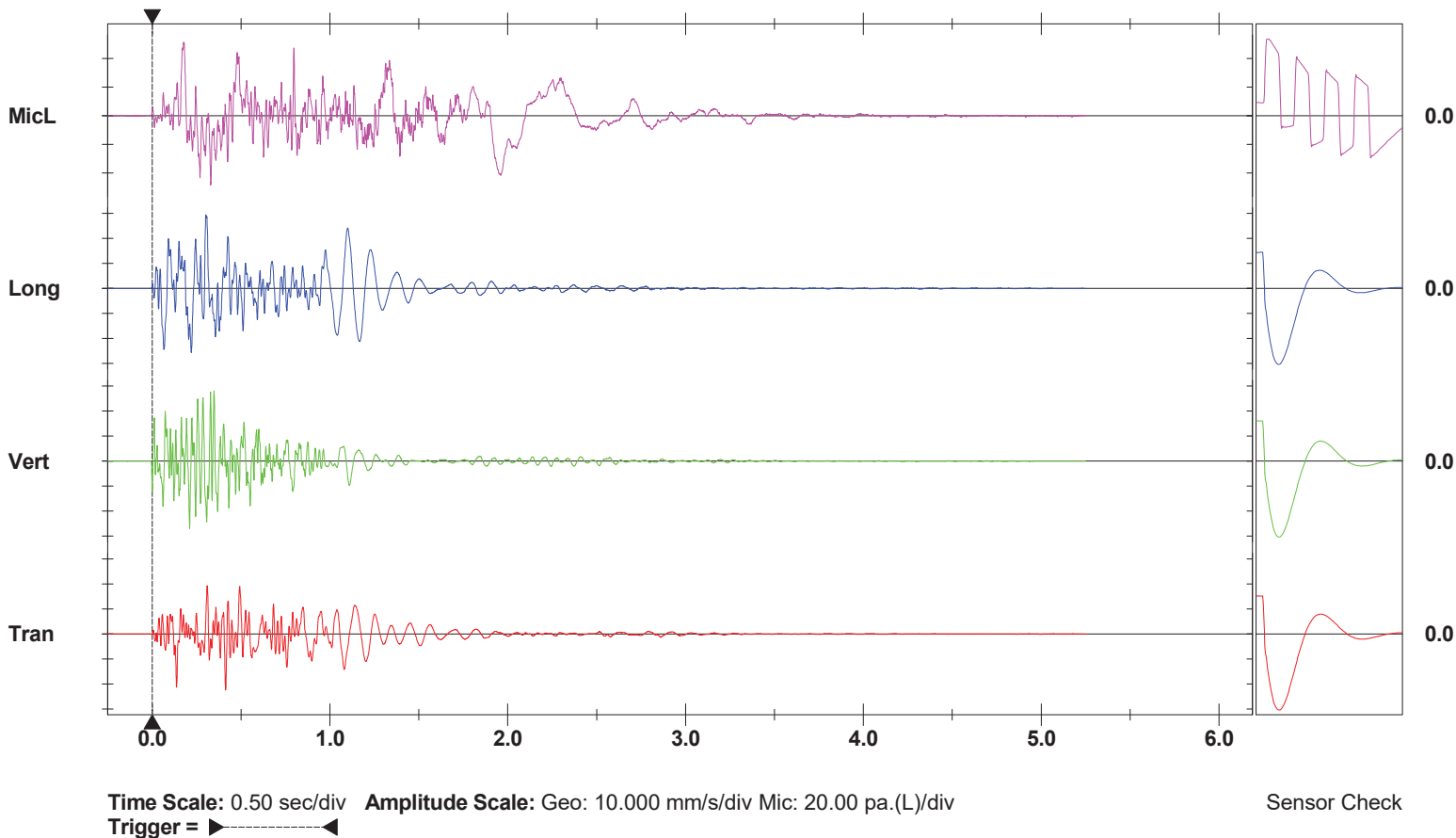
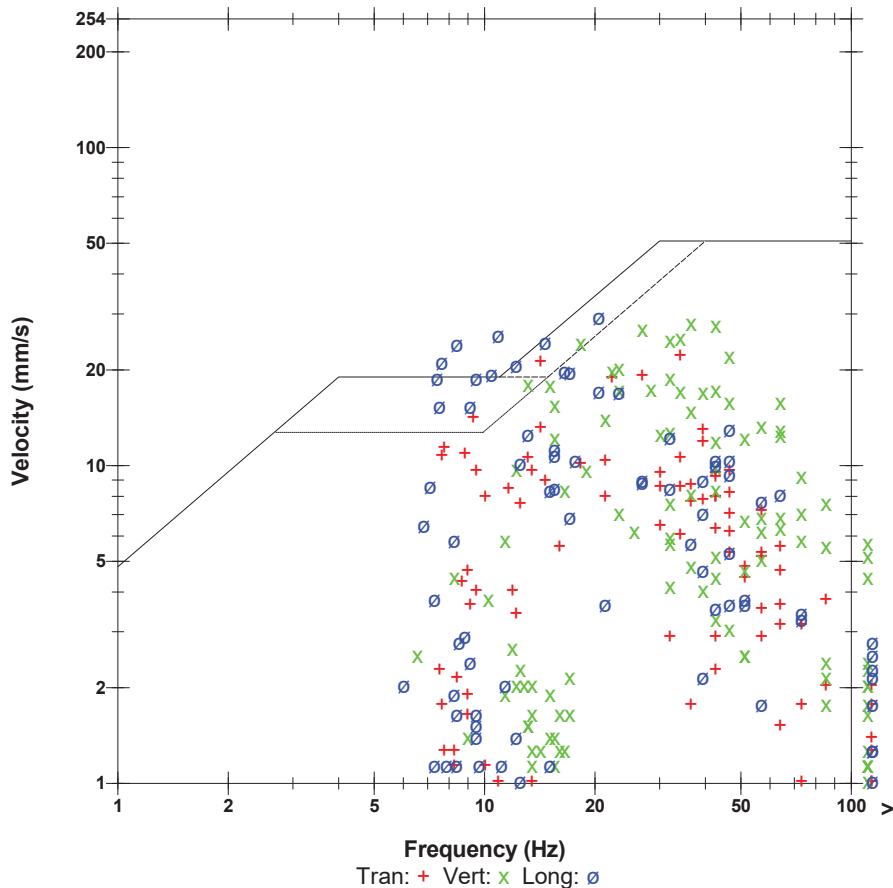
ZC Freq 16 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 624 mv)

	Tran	Vert	Long	
PPV	22.35	28.07	29.34	mm/s
ZC Freq	34	37	20	Hz
Time (Rel. to Trig)	0.414	0.349	0.303	sec
Peak Acceleration	0.464	0.862	0.583	g
Peak Displacement	0.224	0.195	0.444	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.4	Hz
Overswing Ratio	3.9	3.9	4.2	

Peak Vector Sum 41.10 mm/s at 0.308 sec

USBM RI8507 And OSMRE



SHOTPlus Plan

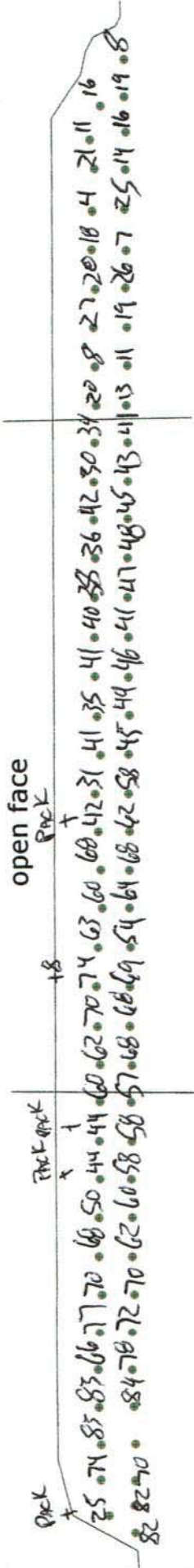
Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4681.0ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 78
 Stemming: 8.0ft
 Hole angle: 0.0°

2 decks
 78Kg
 110kg

2 decks
 68Kg
 85kg

3 decks
 32Kg
 48Kg
 48Kg



9MID018 Design Fnl -
 4" Blast Hole
 12x10 9x10 271.25 and 250 + .6 SUB ELEV
 DRILLER NAME:



Not to scale

SHOTPIus Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4681.0ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 78
 Stemming: 8.0ft
 Hole angle: 0.0°

2 decks
 78Kg
 110kg

2 decks
 68Kg
 85kg

3 decks
 32Kg
 48Kg
 48Kg

open face



9MID018 Design Fnl -
 4" Blast Hole
 12x10 9x10 271.25 and 250 + .6 SUB ELEV
 DRILLER NAME:



Not to scale

SHOTPLUS Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Hole angle: 0.0°
Total drilled: 4681.0ft	Number of holes: 78	

3 decks
32Kg
48Kg
48Kg

2 decks
68Kg
85kg

open face



9MID018 Design Fnl -
4" Blast Hole
12x10 9x10 271.25 and 250 + .6 SUB ELEV
DRILLER NAME: _____



Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 8.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 78 Hole angle: 0.0°
 Total drilled: 4681.0ft



open face

M1 71.0ft M2 71.0ft M3 71.0ft M4 71.0ft M5 71.0ft M6 71.0ft M7 71.0ft M8 71.0ft M9 71.0ft M10 71.0ft M11 71.0ft M12 71.0ft M13 71.0ft M14 71.0ft M15 71.0ft M16 71.0ft M17 71.0ft M18 71.0ft M19 71.0ft M20 71.0ft M21 71.0ft M22 71.0ft M23 71.0ft M24 71.0ft M25 71.0ft M26 71.0ft M27 71.0ft M28 71.0ft M29 71.0ft M30 71.0ft M31 71.0ft M32 71.0ft M33 71.0ft M34 71.0ft M35 71.0ft M36 71.0ft M37 71.0ft M38 71.0ft M39 71.0ft M40 71.0ft M41 71.0ft M42 71.0ft M43 71.0ft M44 71.0ft M45 71.0ft M46 71.0ft M47 71.0ft M48 71.0ft M49 71.0ft M50 71.0ft M51 71.0ft M52 71.0ft M53 71.0ft M54 71.0ft M55 71.0ft M56 71.0ft M57 71.0ft M58 71.0ft M59 71.0ft M60 71.0ft M61 71.0ft M62 71.0ft M63 71.0ft M64 71.0ft M65 71.0ft M66 71.0ft M67 71.0ft M68 71.0ft M69 71.0ft M70 71.0ft

9MID018 Design Fnl - 4" Blast Hole 12x10 9x10 271.25 and 250 + .6 SUB ELEV
 DRILLER NAME:



Scale 1:525

SHOTPlus™ Professional 5.7.4.4	8/29/2019
Mine	Burlington
Location	2 ROW MID WALL
Title/author	9MID018 Design Fnl
Filename	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4681.0ft
 Spacing: 10.0ft
 Subdrill: 2.0ft
 Stemming: 8.0ft
 Hole angle: 0.0°
 Hole Diameter: 4.0in
 Number of holes: 78

open face

M1 70.8ft M2 70.3ft M3 71.6ft M4 71.1ft M5 70.2ft M6 68.4ft M7 67.4ft M8 66.3ft M9 65.6ft M10 64.9ft M11 64.6ft M12 64.8ft M13 64.6ft M14 63.5ft M15 62.0ft M16 61.3ft M17 60.8ft M18 60.8ft M19 59.6ft M20 58.4ft M21 56.5ft M22 55.0ft M23 54.3ft M24 54.1ft M25 54.0ft M26 54.0ft
 N1 70.8ft N2 70.3ft N3 71.4ft N4 71.4ft N5 70.4ft N6 69.4ft N7 68.3ft N8 67.1ft N9 66.2ft N10 65.8ft N11 65.1ft N12 64.7ft N13 65.0ft N14 64.6ft N15 63.6ft N16 62.2ft N17 61.5ft N18 61.1ft N19 60.5ft N20 59.6ft N21 58.4ft N22 56.7ft N23 55.0ft N24 54.2ft N25 54.0ft N26 54.0ft

9MID018 Design Fnl - 4" Blast Hole 12x10 9x10 271.25 and 250 + .6 SUB ELEV
 DRILLER NAME: _____



Scale 1:325

SHOTPlus™ Professional 5.7.4.4	8/29/2019
Mine	Burlington
Location	2 ROW MID WALL
Title/author	9MID018 Design Fnl
Filename	

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4681.0ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 78
 Stemming: 8.0ft
 Hole angle: 0.0°



open face

M15 M16 M17 M18 M19 M20 M21 M22 M23 M24 M25 M26 M27 M28 M29 M30 M31 M32 M33 M34 M35 M36 M37
 62.0ft 61.3ft 61.3ft 60.8ft 60.8ft 58.4ft 58.4ft 55.0ft 54.3ft 54.1ft 54.1ft 55.2ft 55.9ft 55.2ft 52.3ft 52.1ft 52.3ft 52.9ft 52.9ft 52.9ft 53.1ft 53.7ft 54.3ft
 N16 N17 N18 N19 N20 N21 N22 N23 N24 N25 N26 N27 N28 N29 N30 N31 N32 N33 N34 N35 N36 N37 N38 N39 N40
 62.2ft 61.5ft 61.1ft 60.5ft 60.5ft 59.6ft 58.4ft 56.7ft 55.0ft 54.2ft 54.0ft 54.0ft 54.9ft 55.1ft 54.7ft 52.1ft 52.1ft 52.7ft 53.2ft 53.4ft 53.2ft 54.1ft 54.2ft 54.6ft 54.6ft

ole 12x10 9x10 271.25 and 250 + .6 SUB ELEV



SHOTPlus™ Professional 5.7.4.4	8/29/2019
Mine	Burlington
Location	2 ROW MID WALL
Title/author	9MID018 Design Fnl
Filename	

Scale 1:325



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-09-24

Blast Number: 19-019

Orica Order #: 2534945

Blast Time: 12:05 PM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Middle (Bench / Face)

GPS Coordinates: 43.40405 °N Latitude 79.88154 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 10 kph Temperature: 21 to 25 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: 101.6 mm 0° # Holes: 72 = 4,700.4 ft (4 " diam)
Secondary Bit diam: mm ° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

in (kg) out (kg) kg

CENTRA GOLD 70 36,500 23,730 12,770

Packaged Explosives:

cs shipped cs returned kg

FORTEL PRO 75X400 2 1 25

Boosters:

kg / unit # used kg

PENTEX 12 (OR EQUIVALENT) 0.34 74 25.2
PENTEX DUO (OR EQUIVALENT) 0.45 72 32.7

total explosives weight in Blast (kg): 12,853

Pkgd Prod (25 kg) % of Total kg: 0.2%

Detonators:

case #'s ms # used

UNITRONIC 600 6M 2
UNITRONIC 600 15M 72
UNITRONIC 600 20M 54
UNITRONIC 600 25M 90

Cord & Accessories:

U of M # used

HARNESS WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services:

BULK TRUCK CHARGE 1.0
BLASTER HOURS Enter Blaster hours 7.0
HELPER HOURS Enter total Helper man-hours 13.0
SHOT LAYOUT FEE Enter # trips extra beyond 1 0.0
ADVANCED BLAST DESIGN Enter hours 0.0
BORETRACK Enter hours 0.0

Tonnes Blasted: 32,416 te 12,468 m3
Total tonnes per day: 32,416 te NB60-16 Rate Code
Total Holes Loaded: 72 holes
... including: 3 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 3 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 26 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 46 main body

Bench Height: 63.3 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 65.3 ft avg

- Stone Decking -

Front Row: 4.0 ft avg

Main Body: 4.0 ft avg

Decks: 72 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 54.3 ft avg

Main Body: 54.3 ft avg

- Charge Weight -

Front Row: 158.3 kg/hole

Main Body: 158.3 kg/hole

Max. per delay: 110.0 kg/delay

SD () Equation: 7.5 kg/delay

Total kg Loaded: 12,853 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.396 kg/te (actual)

Front row: 0.283 kg/te (theoretical)

Main Body: 0.377 kg/te (theoretical)

"KPI" PF: 0.346 kg/te (theoretical)

1.738 lb/yd³


1.241 lb/yd³

1.654 lb/yd³

1.516 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

We had to use 2 unitronics per dou booster due to shortage of 25M Excel ms 25ms

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-019
		P.O. #:	Orica Order #: 2534945
		Blast Date: 2019-09-24	Blast Time: 12:05 PM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40407	79.88154	0.757544	1.394196
Front Row Corner	43.40376	79.88161	0.757538	1.394197
Back Row Corner	43.40432	79.88148	0.757548	1.394195
Average (Centre of Blast)	43.40405	79.88154	0.757544	1.394196

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	327.9	m		
	Post Blast Data:	ppV: 6.7	mm/s	Trigger set at: 2.0	mm/s
		frequency: 16.5	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 116.7	dB	Trigger set at: 115	dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (2nd Seis. From Centre of Blast)	1324.1	m		
	Post Blast Data:	ppV: Did	mm/s	Trigger set at: 2.0	mm/s
		frequency: Not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB	Trigger set at: 115	dB
	Blind Line and Colling Road (Bruce Trail Entrance)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40466	79.88098	0.757554	1.394186
	2nd Reading				
	Average	43.40466	79.88098	0.757554	1.394186
	Distance (3rd Seis. From Centre of Blast)	81.9	m		
	Post Blast Data:	ppV: 37.3	mm/s	Trigger set at: 2.0	mm/s
		frequency: 30.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 131.9	dB	Trigger set at: 115	dB
	Gas Line				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(81.9)^2}{30^2} \text{ kg} \\
 &= \frac{6,708}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 7 kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

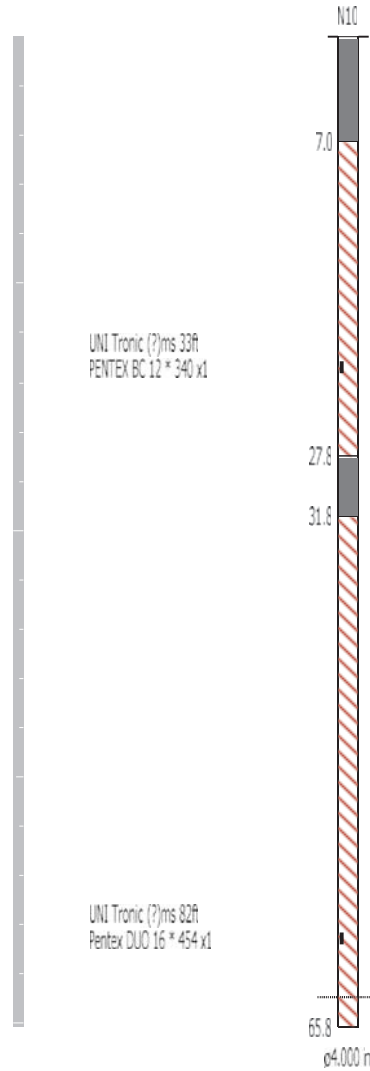
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 9/9/2019

Blast Number: 19-019
Orica Order #: 2534945

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 12:06:02 September 24, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.0 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 road, Burlington
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

Sand Bagged
 N43.40245 W-79.87814

Microphone Linear Weighting

PSPL 116.7 dB(L) at 1.080 sec

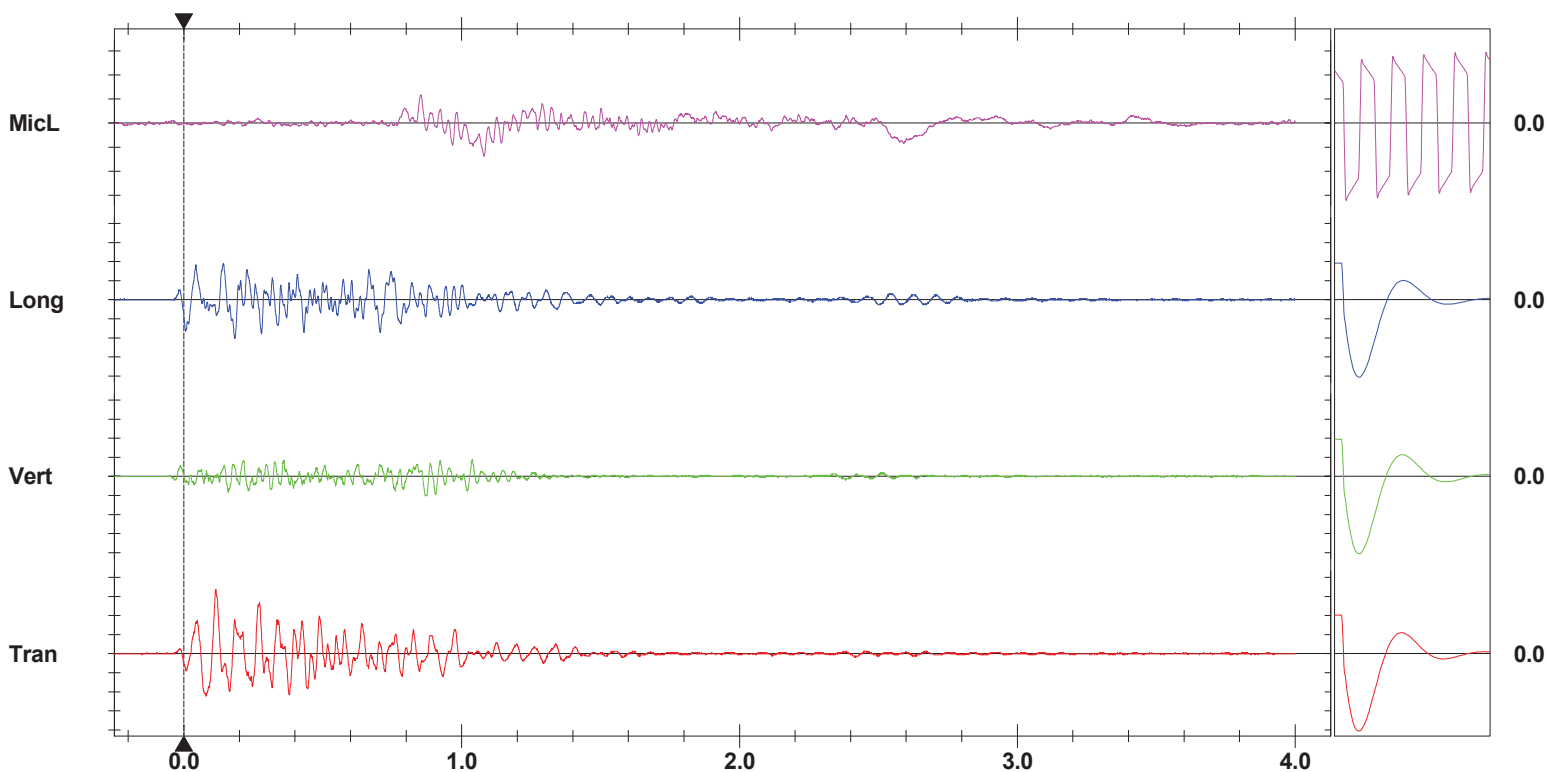
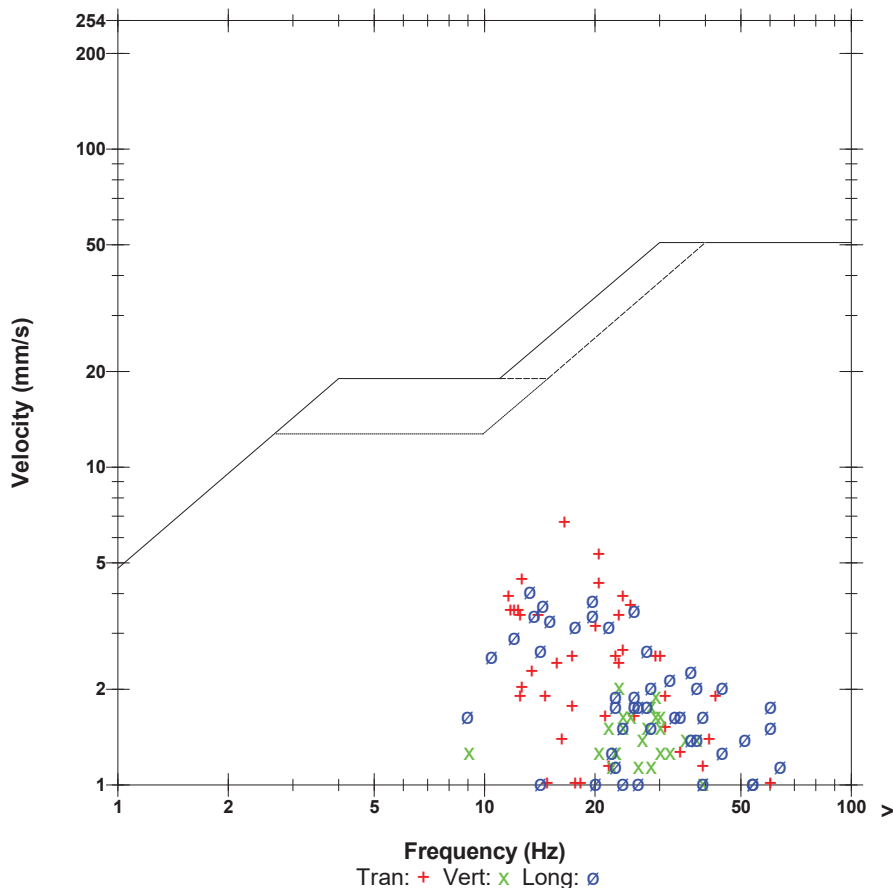
ZC Freq 3.8 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 570 mv)

	Tran	Vert	Long	
PPV	6.731	2.032	4.064	mm/s
ZC Freq	16.5	23	13.3	Hz
Time (Rel. to Trig)	0.114	0.869	0.184	sec
Peak Acceleration	0.106	0.080	0.106	g
Peak Displacement	0.063	0.018	0.039	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.4	7.2	Hz
Overswing Ratio	3.8	3.7	4.1	

Peak Vector Sum 6.901 mm/s at 0.116 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

**Blind Line & Colling rd
Nelson Aggregate
Burlington 2019-09-24 Blast 19-019 Middle**

Event Report: Monitor Log - Micromate ISEE # UM6857-Compliance

Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6857
Sep 24 /19 06:03:57		Start Monitoring Waveform Geo: 2.00 mm/s Mic: 115.0 dB
Sep 24 /19 06:03:57	Sep 24 /19 13:17:31	No events recorded. (Keyboard Exit) Waveform Geo: 2.00 mm/s Mic:

Date/Time Long at 12:06:01 September 24, 2019
Trigger Source Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.25 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.3 Volts
Unit Calibration August 31, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

Extended Notes

Sand Bagged at gas line

Microphone Linear Weighting

PSPL 131.9 dB(L) at 1.840 sec

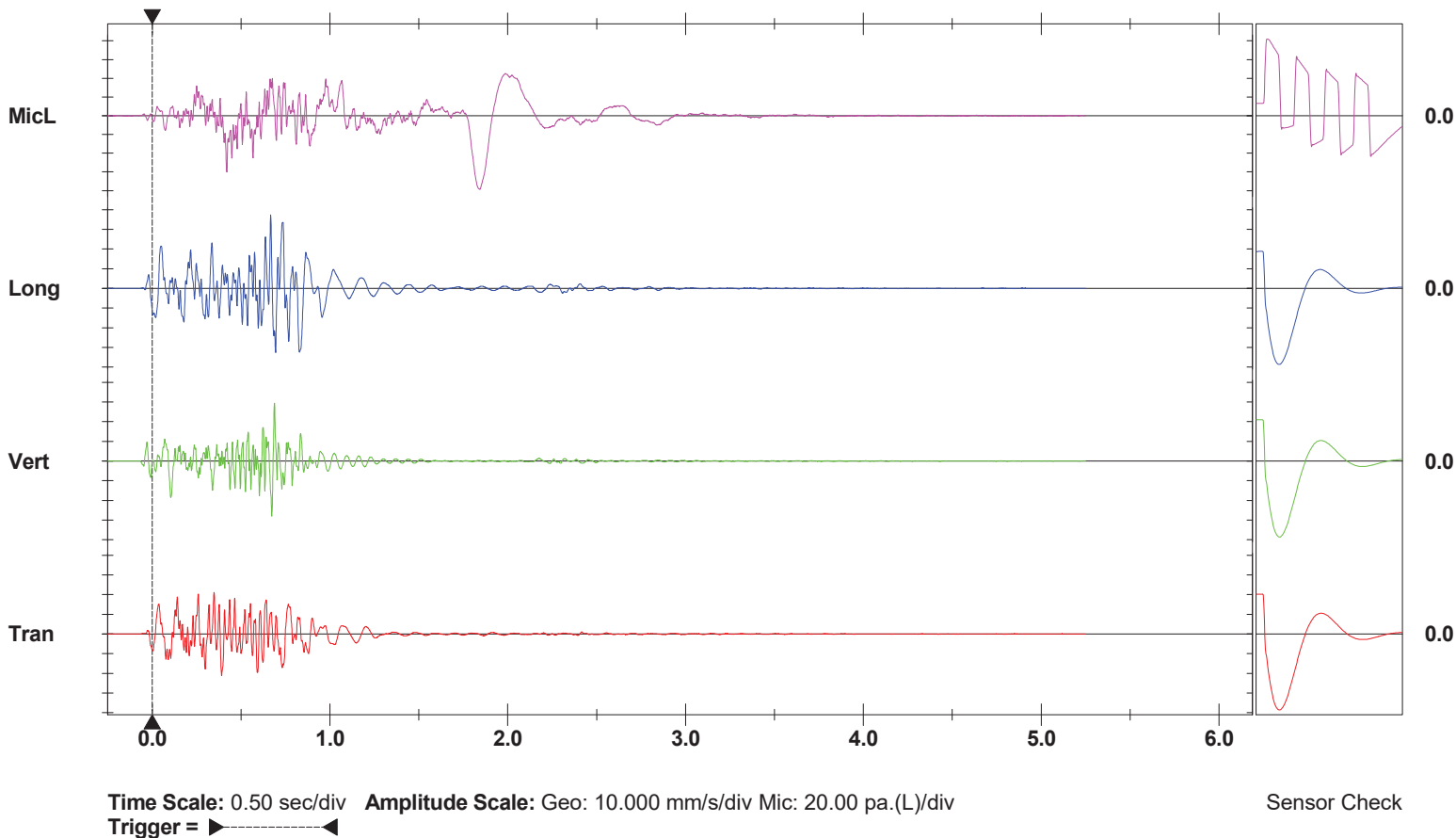
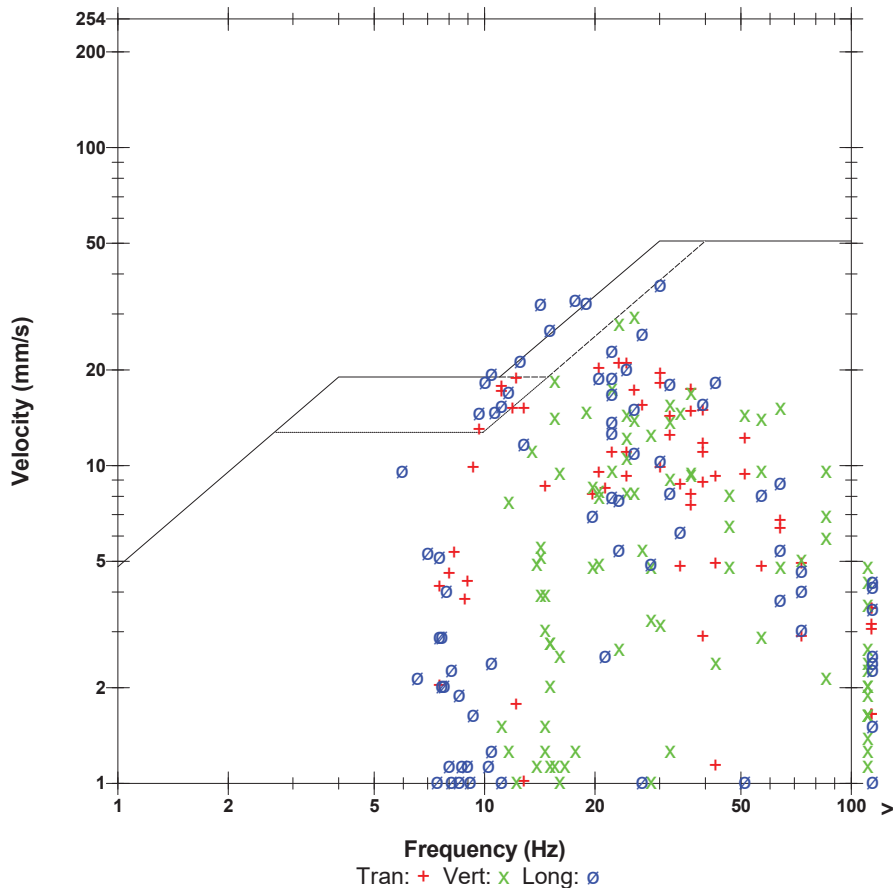
ZC Freq 3.5 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 611 mv)

	Tran	Vert	Long	
PPV	21.08	29.46	37.34	mm/s
ZC Freq	24	26	30	Hz
Time (Rel. to Trig)	0.349	0.688	0.667	sec
Peak Acceleration	0.490	0.742	0.623	g
Peak Displacement	0.235	0.167	0.378	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	3.7	3.7	4.1	

Peak Vector Sum 42.02 mm/s at 0.667 sec

USBM RI8507 And OSMRE

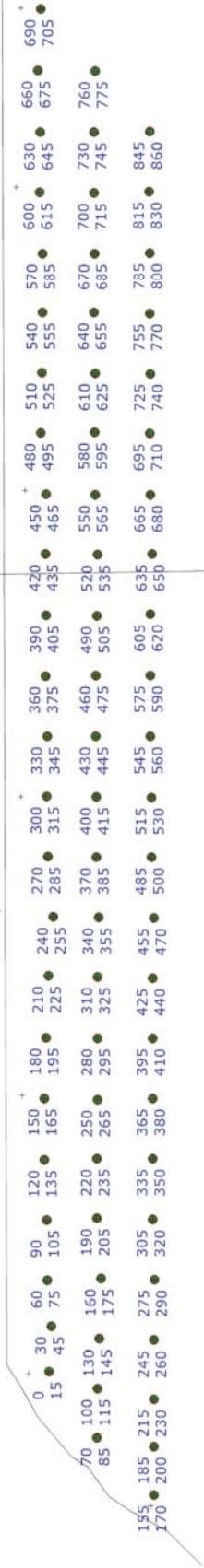


SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 8.0ft
1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 72 Hole angle: 0.0°
Total drilled: 4700.5ft

82Kg/delay 25M/25M 85Kg/Delay 20M/18M,ms
110Kg/delay 15M/15M,ms 85Kg/Delay 15M/15M,ms
open face



9MID019 Design Fnl - 4" Blast Hole 12x10 9x10 271 266 and 250 + .6 SUB ELEV
DRILLER NAME: _____

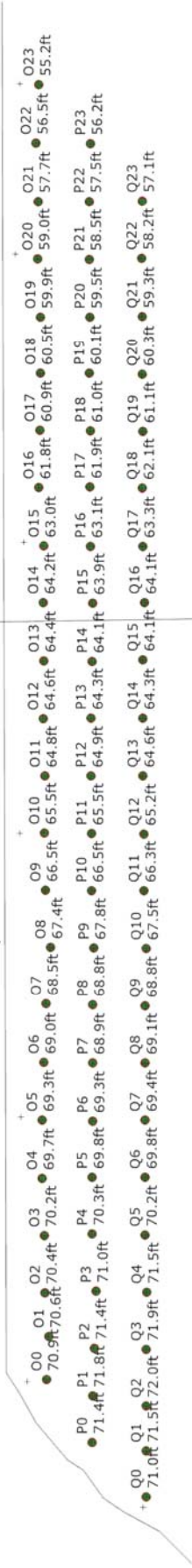


Not to scale

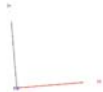
SHOTPlus Plan

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 72	Hole angle: 0.0°
Total drilled: 4700.5ft			

82Kg/delay	25M/25M	85Kg/Delay	20M/18M,ms
110Kg/delay	15M/15M,ms	85Kg/Delay	15M/15M,ms
	open face		



9MID019 Design Fnl - 4" Blast Hole 12x10 9x10 271 266 and 250 + .6 SUB ELEV
DRILLER NAME: _____



Not to scale

SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4700.5ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Number of holes: 72
 Stemming: 8.0ft
 Hole angle: 0.0°

→ N

POSTS

open face

00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
 70.9ft 70.6ft 70.4ft 70.2ft 69.7ft 69.3ft 68.9ft 68.5ft 67.4ft 66.5ft 65.5ft 64.8ft 64.6ft 64.4ft 64.2ft 63.0ft 61.8ft 60.9ft 60.5ft 59.9ft 59.0ft 57.7ft 56.5ft 55.2ft
 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
 71.4ft 71.8ft 71.4ft 71.0ft 70.3ft 69.8ft 69.3ft 68.9ft 68.8ft 67.8ft 66.5ft 65.5ft 64.9ft 64.3ft 64.1ft 63.9ft 63.1ft 61.9ft 61.0ft 60.1ft 59.5ft 58.5ft 57.5ft 56.2ft
 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
 71.0ft 71.5ft 72.0ft 71.9ft 71.5ft 70.2ft 69.8ft 69.4ft 69.1ft 68.8ft 67.5ft 66.3ft 65.2ft 64.6ft 64.3ft 64.1ft 64.1ft 63.3ft 62.1ft 61.1ft 60.3ft 59.3ft 58.2ft 57.1ft

9MID019 Design Fnl - 4" Blast Hole 12x10 9x10 271 266 and 250 + .6 SUB ELEV

DRILLER NAME:

11-785'
 28-1904'
 16-1014.3'
 17-997.4'



SHOTPlus™ Professional 5.7.4.4	9/11/2019
Mine	Burlington
Location	SOUTH OPEN END
Title/author	9MID019 Design Fnl
Filename	

Scale 1:350



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-09-30

Blast Number: 19-020

Orica Order #: 2537318

Blast Time: 11:56 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Middle (Bench / Face)

GPS Coordinates: 43.40469 °N Latitude 79.88146 °W Longitude
Centre of Blast Centre of Blast

Wind from the: NE at 15 kph Temperature: 16 to 20 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: 101.6 mm 0° # Holes: 64 = 3,370.0 ft (4 " diam)
Secondary Bit diam: mm ° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	27,320	20,030	7,290

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	0	50

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	65	22.1
PENTEX DUO (OR EQUIVALENT)	0.45	64	29.1

total explosives weight in Blast (kg): 7,391

Pkgd Prod (50 kg) % of Total kg: 0.7%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 6M			1
UNITRONIC 600 9M			64
UNITRONIC 600 15M			64
UNITRONIC 600 20M			64
EXEL MS 15m			64
EXEL MS 18m			64

Cord & Accessories:

	U of M	# used
	units	
	units	
	units	

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	6.0
HELPER HOURS	Enter total Helper man-hours	12.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Tonnes Blasted: 24,167 te 9,295 m3
Total tonnes per day: 24,167 te NB60-17 Rate Code
Total Holes Loaded: 64 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 3 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 24 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 40 main body

Bench Height: 50.7 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 52.7 ft avg

- Stone Decking -

Front Row: 4.0 ft avg

Main Body: 4.0 ft avg

Decks: 128 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 41.7 ft avg

Main Body: 41.7 ft avg

- Charge Weight -

Front Row: 121.5 kg/hole

Main Body: 121.5 kg/hole

Max. per delay: 40.0 kg/delay

SD () Equation: 1.7 kg/delay

Total kg Loaded: 7,391 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.306 kg/te (actual)

Front row: 0.271 kg/te (theoretical)

Main Body: 0.362 kg/te (theoretical)

"KPI" PF: 0.332 kg/te (theoretical)

1.340 lb/yd³


1.189 lb/yd³

1.586 lb/yd³

1.454 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

64 Addition decks on top of rate code

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry:	Burlington	Blast Number:	19-020
		P.O. #:		Orica Order #:	2537318
		Blast Date:	2019-09-30	Blast Time:	11:56 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40469	79.88146	0.757555	1.394195
Front Row Corner	43.40444	79.88153	0.757550	1.394196
Back Row Corner	43.40493	79.88140	0.757559	1.394193
Average (Centre of Blast)	43.40469	79.88146	0.757555	1.394195

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	366.2	m		
	Post Blast Data:	ppV: 2.8	mm/s	Trigger set at: 2.0	mm/s
		frequency: 26.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 111.8	dB	Trigger set at: 115	dB
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (2nd Seis. From Centre of Blast)	1390.6	m		
	Post Blast Data:	ppV: Did	mm/s	Trigger set at: 2.0	mm/s
		frequency: Not	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: Trigger	dB	Trigger set at: 115	dB
	Blind Line and Colling Road (Bruce Trail Entrance)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40466	79.88098	0.757554	1.394186
	2nd Reading				
	Average	43.40466	79.88098	0.757554	1.394186
	Distance (3rd Seis. From Centre of Blast)	39.3	m		
	Post Blast Data:	ppV: 30.4	mm/s	Trigger set at: 2.0	mm/s
		frequency: 20.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 129.9	dB	Trigger set at: 115	dB
	Gas Line				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(39.3)^2}{30^2} \text{ kg} \\
 &= \frac{1,544}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

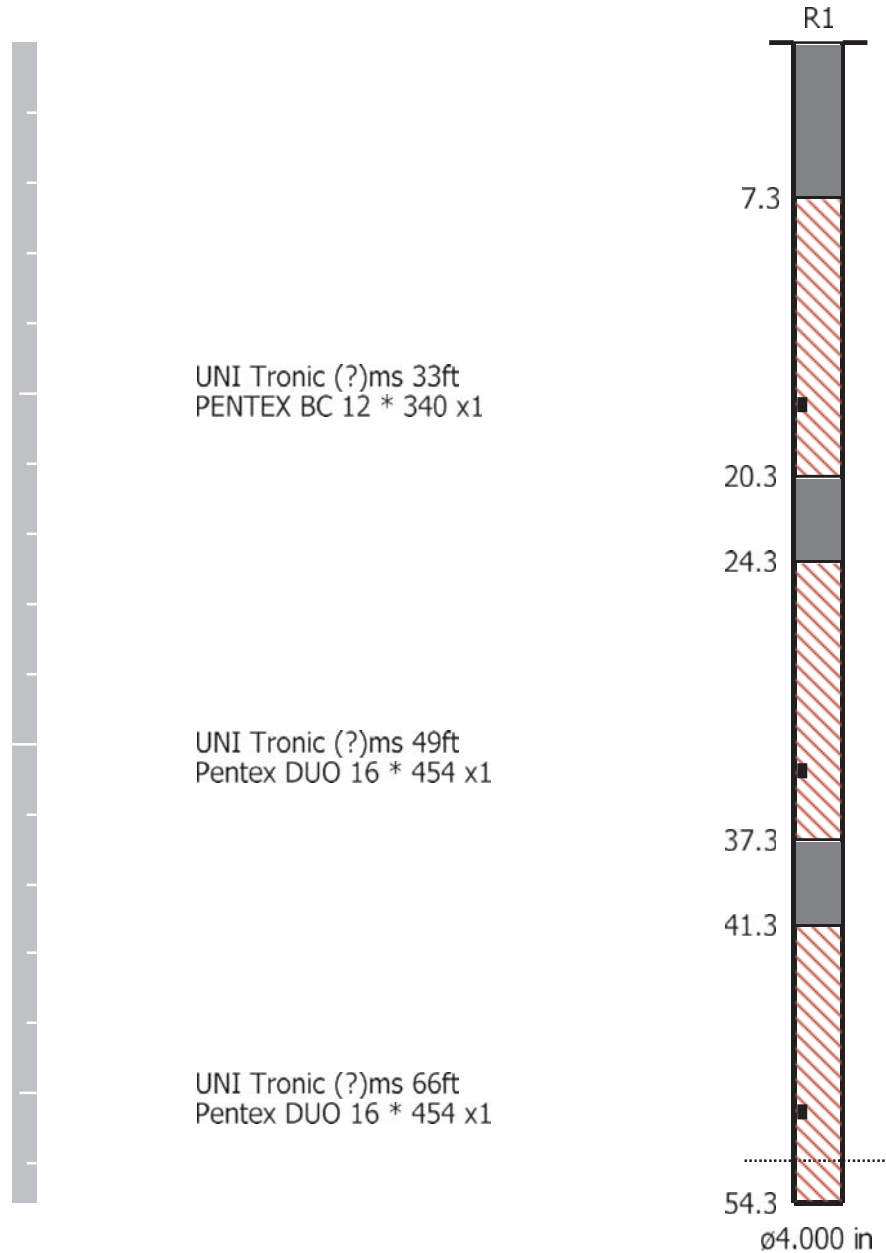
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 9/30/2019

Blast Number: 19-020
Orica Order #: 2537318

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Vert at 11:56:54 September 30, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.0 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.2 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 road, Burlington
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

Sand Bagged
 N43.40245 W-79.87814

Microphone Linear Weighting

PSPL 111.8 dB(L) at 0.757 sec

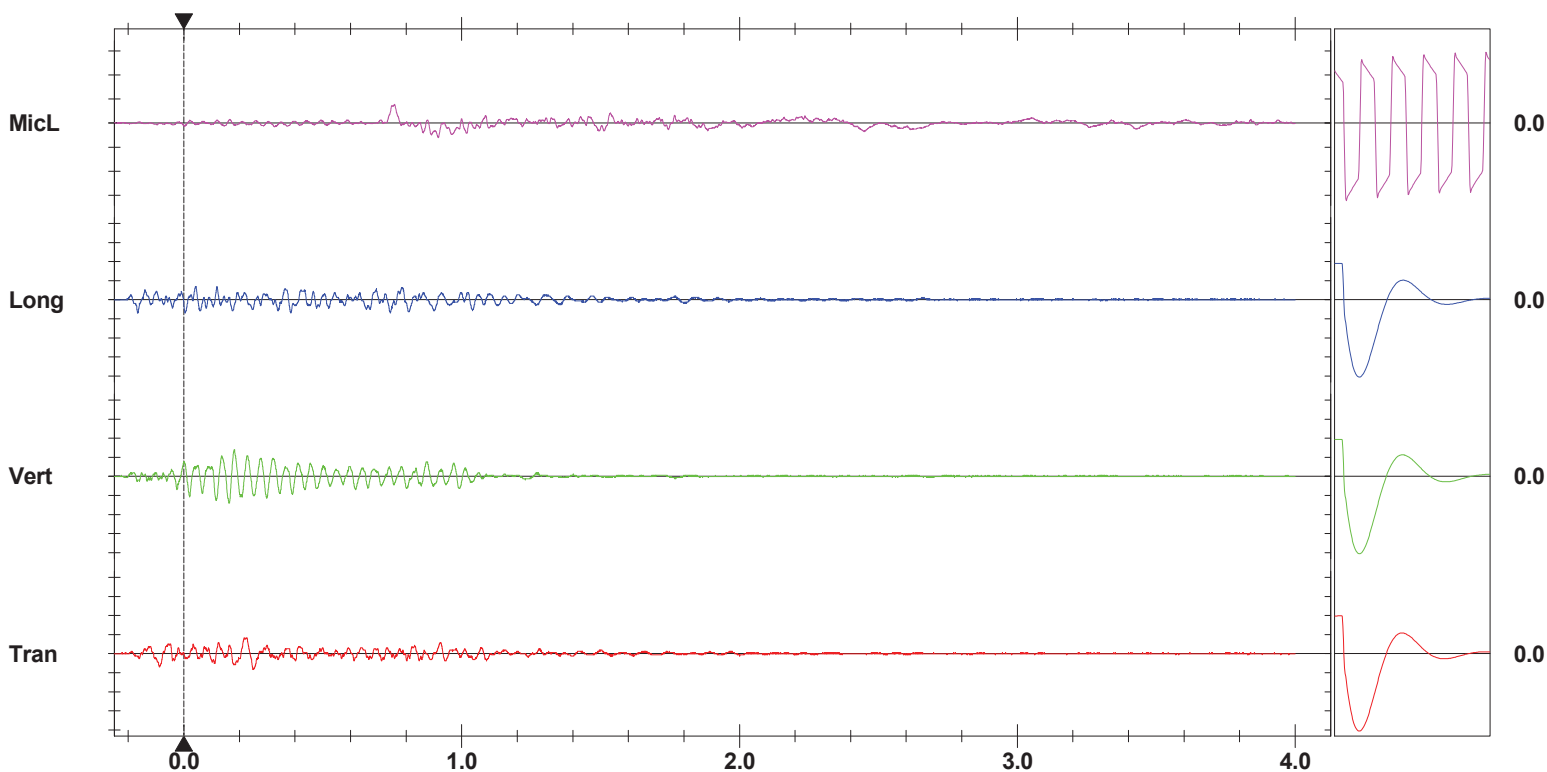
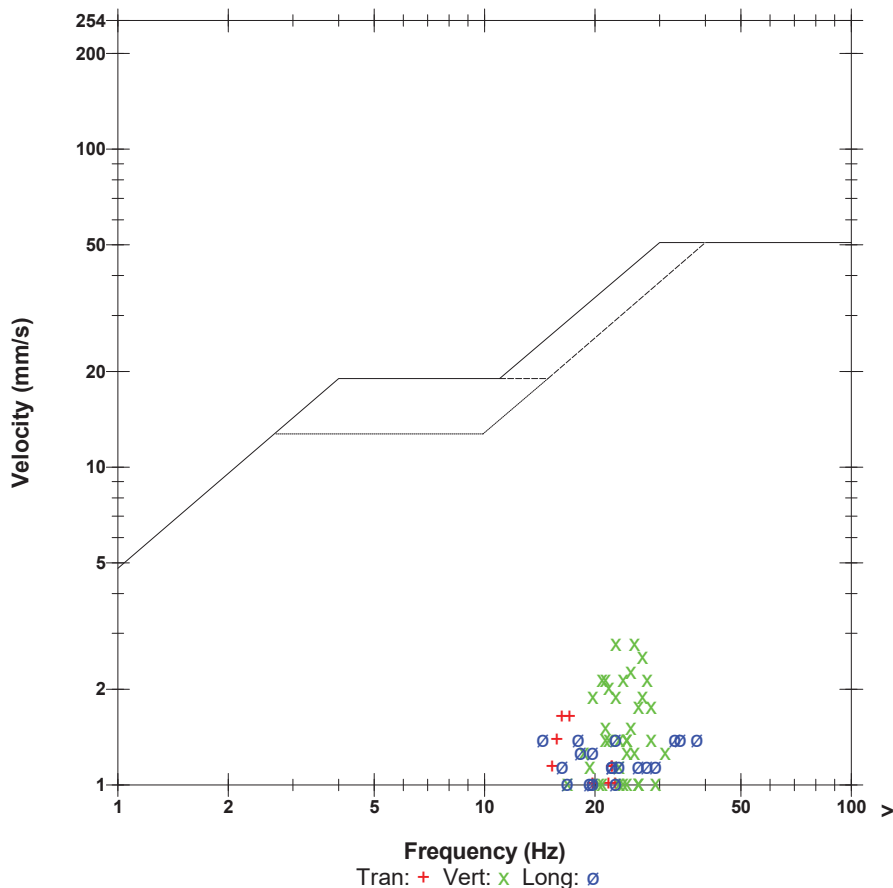
ZC Freq 10.8 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 574 mv)

	Tran	Vert	Long	
PPV	1.651	2.794	1.397	mm/s
ZC Freq	16.3	26	18.0	Hz
Time (Rel. to Trig)	0.216	0.161	-0.167	sec
Peak Acceleration	0.053	0.080	0.053	g
Peak Displacement	0.018	0.019	0.012	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.3	Hz
Overswing Ratio	3.8	3.7	4.0	

Peak Vector Sum 3.113 mm/s at 0.181 sec

USBM RI8507 And OSMRE



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

**Blind Line & Colling road
Burlington
Burlington 2019-09-30 Blast 19-020 Middle**

Event Report: Monitor Log - Micromate ISEE # UM6857-Compliance

Start Time	End Time	Status
-----	-----	SERIAL NUMBER: UM6857
Sep 30 /19 06:17:01		Start Monitoring Waveform Geo: 2.00 mm/s Mic: 115.0 dB
Sep 30 /19 10:16:29	Sep 30 /19 10:16:34	Event recorded. Trigger Level MicL: 115.0 dB
Sep 30 /19 10:16:34	Sep 30 /19 12:25:24	Event recorded. (Keyboard Exit) Waveform Geo: 2.00 mm/s Mic: 115.

Date/Time Vert at 11:56:52 September 30, 2019
Trigger Source Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.25 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.3 Volts
Unit Calibration August 31, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

Extended Notes

Sand Bagged at gas line

Microphone Linear Weighting

PSPL 129.9 dB(L) at 0.182 sec

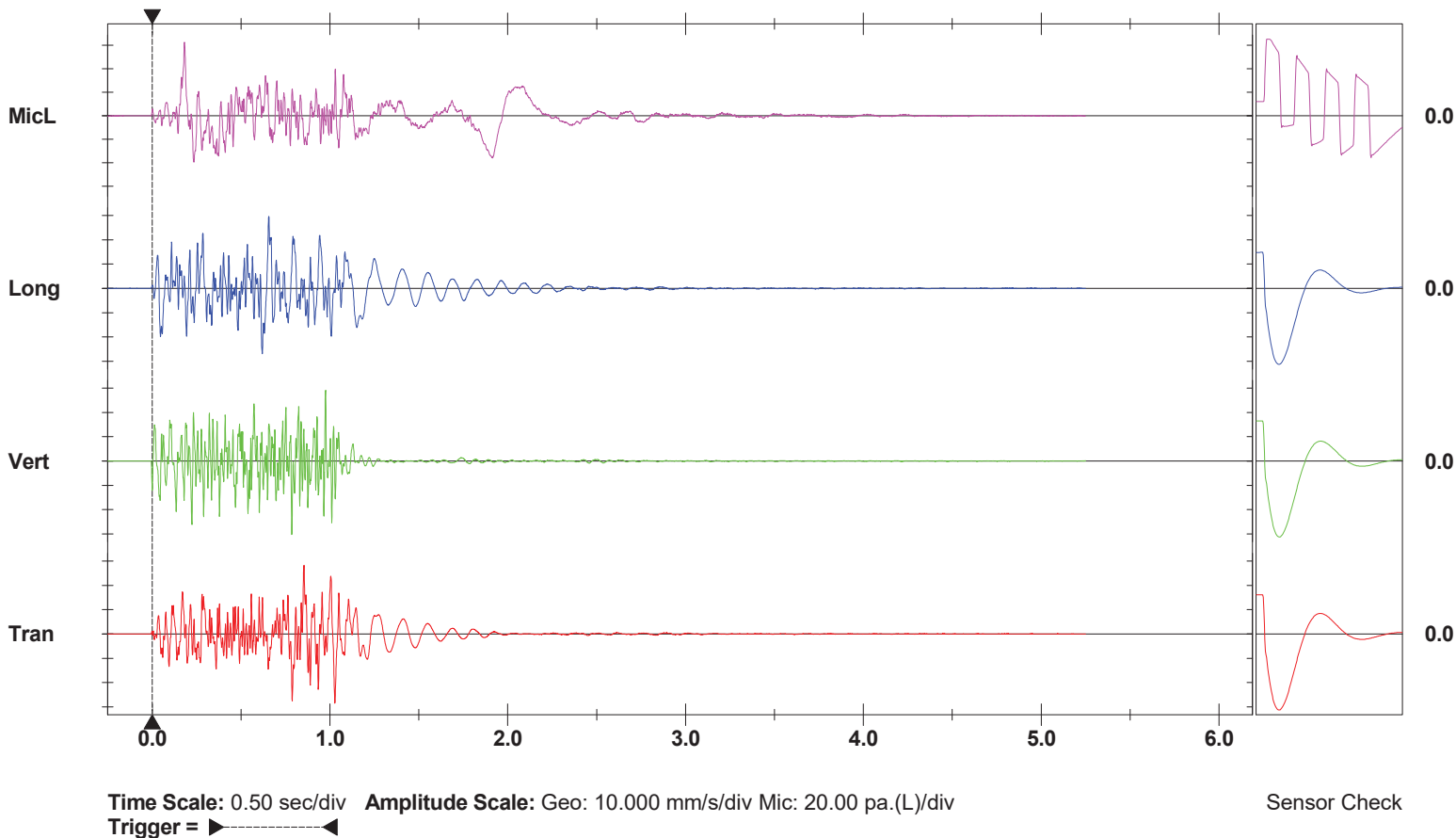
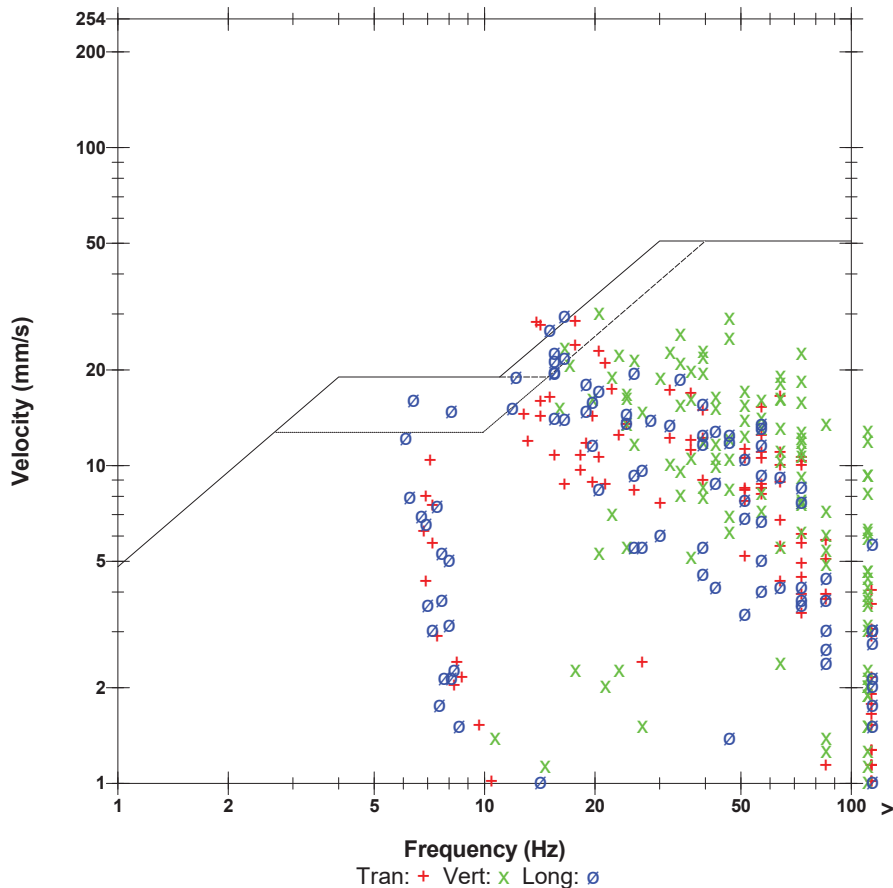
ZC Freq 10 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 644 mv)

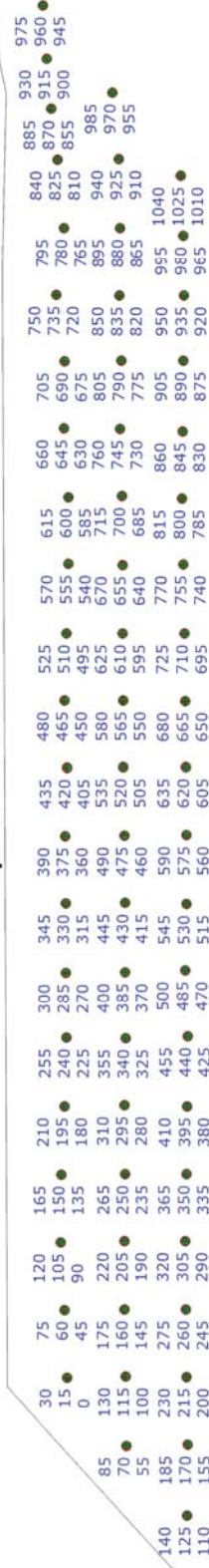
	Tran	Vert	Long	
PPV	28.57	30.35	29.72	mm/s
ZC Freq	18	20	17	Hz
Time (Rel. to Trig)	1.027	0.785	0.656	sec
Peak Acceleration	0.610	1.418	0.663	g
Peak Displacement	0.246	0.144	0.403	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.3	7.3	Hz
Overswing Ratio	3.7	3.9	4.2	

Peak Vector Sum 40.18 mm/s at 0.787 sec

USBM RI8507 And OSMRE



Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 73	Hole angle: 0.0°
Total drilled: 4105.8ft			

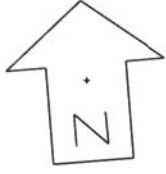


Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 73	Hole angle: 0.0°
Total drilled: 4105.8ft			



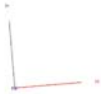
open face

POSTS

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22
52.3ft	52.3ft	52.1ft	52.1ft	51.7ft	51.7ft	51.6ft	51.8ft	51.8ft	51.8ft	51.7ft	52.1ft	52.2ft	52.5ft	52.5ft	53.2ft	53.2ft	53.3ft	53.5ft	54.0ft	54.9ft	54.7ft
S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	
52.7ft	52.3ft	51.9ft	51.9ft	51.5ft	51.4ft	51.7ft	52.3ft	52.6ft	52.3ft	51.8ft	52.0ft	52.2ft	52.4ft	52.5ft	52.6ft	53.0ft	53.8ft	53.3ft	55.1ft		
T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	
53.5ft	52.6ft	52.2ft	51.9ft	51.3ft	51.7ft	52.1ft	52.8ft	52.6ft	52.2ft	51.7ft	51.6ft	52.0ft	52.2ft	52.3ft	52.2ft	52.5ft	53.3ft	54.0ft	53.6ft	53.3ft	

9MID020 Design Fnl - 4" Blast Hole 12x10 9x10 266 and 250 + .6 SUB ELEV

DRILLER NAME: _____



Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4105.8ft
 Spacing: 10.0ft
 Subdrill: 2.0ft
 Number of holes: 73
 Stemming: 8.0ft
 Hole angle: 0.0°

25



Load Sheet
 3 Decks
 40 Kg/ Delay

33 *
 *
 29 * 35 * 37 *
 36 * * *
 29 * 29 * 27 *
 31 * 33 * 26 *
 23 * 26 * 29 *
 29 * 33 * 28 *
 33 * 26 * 29 *
 29 * 33 * 30 *
 23 * 18 * 23 *
 24 * 23 * 25 *
 25 * 19 * 29 *
 23 * 22 * 22 *
 28 * 30 * 29 *
 29 * 33 * 30 *
 32 * 24 * 33 *
 32 * 33 * 34 *
 38 * 36 * 40 *
 25 * 31 * 19 *
 22 * 29 * 31 *
 8 * 40 *
 37 * 27 *
 1810m
 6m



Not to scale

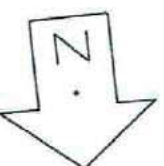
SHOTPlus 5 Plan

Blast Summary Data

Burden: 9.0ft Spacing: 10.0ft Stemming: 8.0ft
 1st row burden: 12.0ft Hole Diameter: 4.0in Number of holes: 64 Hole angle: 0.0°
 Total drilled: 3489.7ft

open face

POSTS



9MID020 Design Fnl - 4" Blast Hole 12x10 9x10 266 and 250 + .6 SUB ELEV
 DRILLER NAME: _____

10-543.8



Scale 1:350

SHOTPlus™ Professional 5.7.4.4	9/11/2019
Mine	Burlington
Location	NORTH CLOSED END
Title/author	9MID020 Design Fnl
Filename	



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-10-15

Blast Number: 19-021

Orica Order #: 2543361

Blast Time: 11:55 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40362 °N Latitude 79.88148 °W Longitude
Centre of Blast Centre of Blast

Wind from the: S at 5 kph Temperature: 11 to 15 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: 101.6 mm 0° # Holes: 56 = 3,832.6 ft (4 " diam)
Secondary Bit diam: 92.1 mm 0° # Holes: 3 = 205.3 ft (3 5/8 " diam)
Tertiary Bit diam: mm 0° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

in (kg) out (kg) kg

CENTRA GOLD 70 33,740 24,140 9,600

Packaged Explosives:

cs shipped cs returned kg

FORTEL PRO 75X400 2 1 25

Boosters:

kg / unit # used kg

PENTEX 12 (OR EQUIVALENT) 0.34 56 19.0
PENTEX DUO (OR EQUIVALENT) 0.45 54 24.5

total explosives weight in Blast (kg): 9,669

Pkgd Prod (25 kg) % of Total kg: 0.3%

Detonators:

case #'s ms # used

UNITRONIC 600 15M 54
UNITRONIC 600 25M 54
EXEL MS 25m 54
UNITRONIC 600 6M 2

Cord & Accessories:

U of M # used

HARNESS WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services:

BULK TRUCK CHARGE 1.0
BLASTER HOURS Enter Blaster hours 6.5
HELPER HOURS Enter total Helper man-hours 10.0
SHOT LAYOUT FEE Enter # trips extra beyond 1 0.0
ADVANCED BLAST DESIGN Enter hours 0.0
BORETRACK Enter hours 0.0

Tonnes Blasted: 26,561 te 10,216 m3
Total tonnes per day: 26,561 te NB60-17 Rate Code
Total Holes Loaded: 53 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 3 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 22 front row

- Pattern (Main Body) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 31 main body

Bench Height: 66.4 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 68.4 ft avg

- Stone Decking -

Front Row: 8.0 ft avg

Main Body: 0.0 ft avg

Decks: 2 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Main Body: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 53.4 ft avg

Main Body: 61.4 ft avg

- Charge Weight -

Front Row: 155.8 kg/hole

Main Body: 179.2 kg/hole

Max. per delay: 107.0 kg/delay

SD () Equation: 16.7 kg/delay

Total kg Loaded: 9,669 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.364 kg/te (actual)

Front row: 0.265 kg/te (theoretical)


Main Body: 0.407 kg/te (theoretical)

"KPI" PF: 0.360 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Nick Heap and I decided it was best to cut 6 holes off to the south due to a hole that was 20' short in depth.

Package was use to load through lean burden

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-021
		P.O. #: 	Orica Order #: 2543361
		Blast Date: 2019-10-15	Blast Time: 11:55 AM

page 2

	Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	Mid Blast	43.40365	79.88148	0.757537	1.394195
	Front Row Corner	43.40332	79.88155	0.757531	1.394196
	Back Row Corner	43.40390	79.88141	0.757541	1.394194
	Average (Centre of Blast)	43.40362	79.88148	0.757536	1.394195

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	300.1 m			
	Post Blast Data:	ppV: 6.0 mm/s	Trigger set at: 2.0 mm/s		
		frequency: 14.6 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
		air overpressure: 112.8 dB	Trigger set at: 115 dB		
	2450 2nd Line				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.39339	79.88880	0.757358	1.394323
	2nd Reading				
	Average	43.39339	79.88880	0.757358	1.394323
	Distance (2nd Seis. From Centre of Blast)	1283.8 m			
	Post Blast Data:	ppV: 0.2 mm/s	Trigger set at: 2.0 mm/s		
		frequency: 9.1 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
		air overpressure: 117.0 dB	Trigger set at: 115 dB		
	Blind Line and Colling Road (Bruce Trail Entrance)				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40466	79.88098	0.757554	1.394186
	2nd Reading				
	Average	43.40466	79.88098	0.757554	1.394186
	Distance (3rd Seis. From Centre of Blast)	122.6 m			
	Post Blast Data:	ppV: 18.8 mm/s	Trigger set at: 2.0 mm/s		
		frequency: 15.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)		
		air overpressure: 129.7 dB	Trigger set at: 115 dB		
	Gas Line				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(122.6)^2}{30^2} \text{ kg} \\
 &= \frac{15,031}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 17 kg

Orica

Blaster-in-charge:

jim bray

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

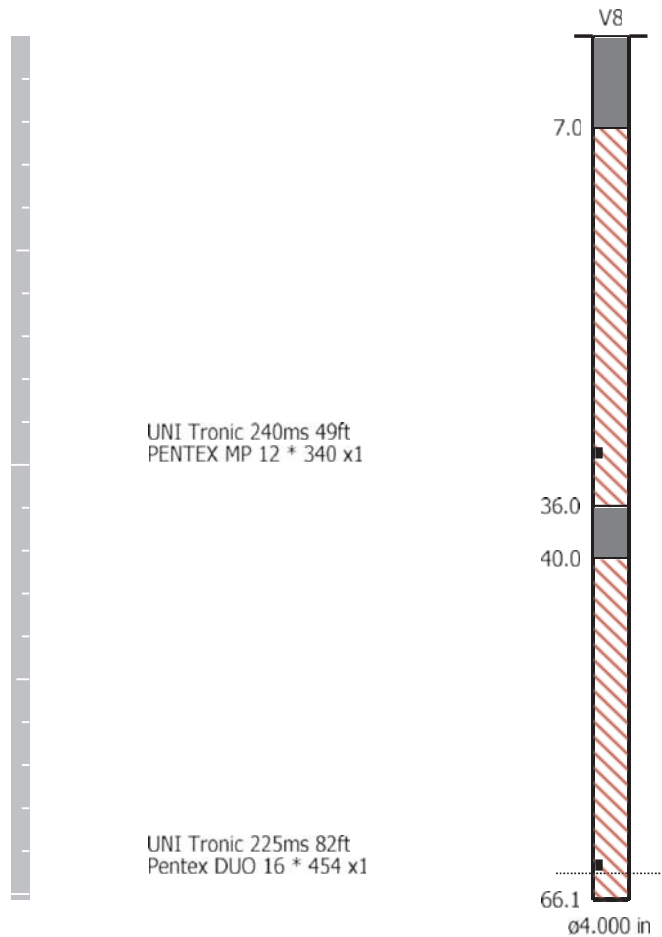
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 10/15/2019

Blast Number: 19-021
Orica Order #: 2543361

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Vert at 11:55:04 October 15, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.25 sec (Auto=3Sec) at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.3 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 road, Burlington
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington, On

Extended Notes

Sand Bagged
 43.40245 -79.87814

Microphone Linear Weighting

PSPL 112.8 dB(L) at 1.290 sec

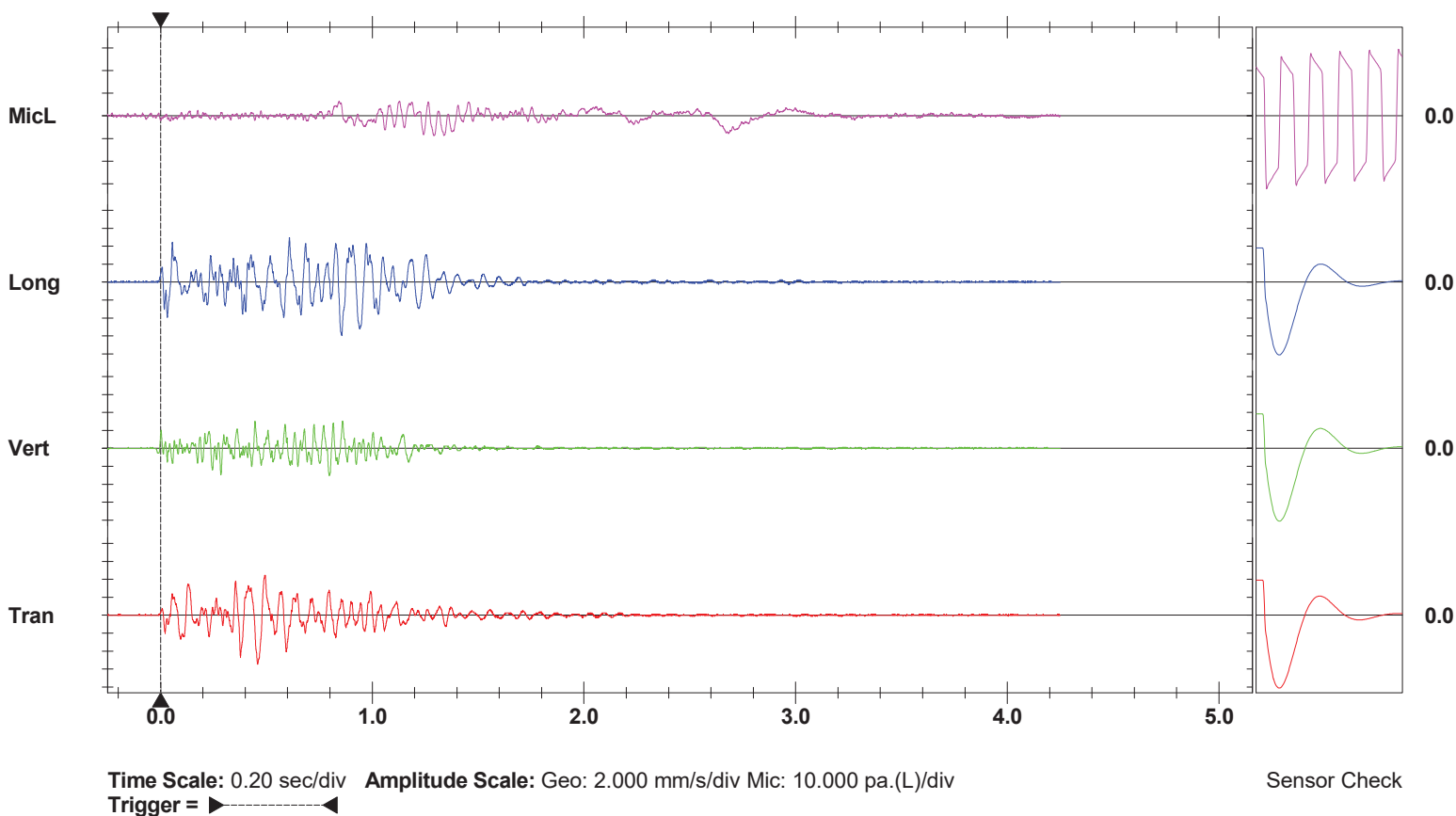
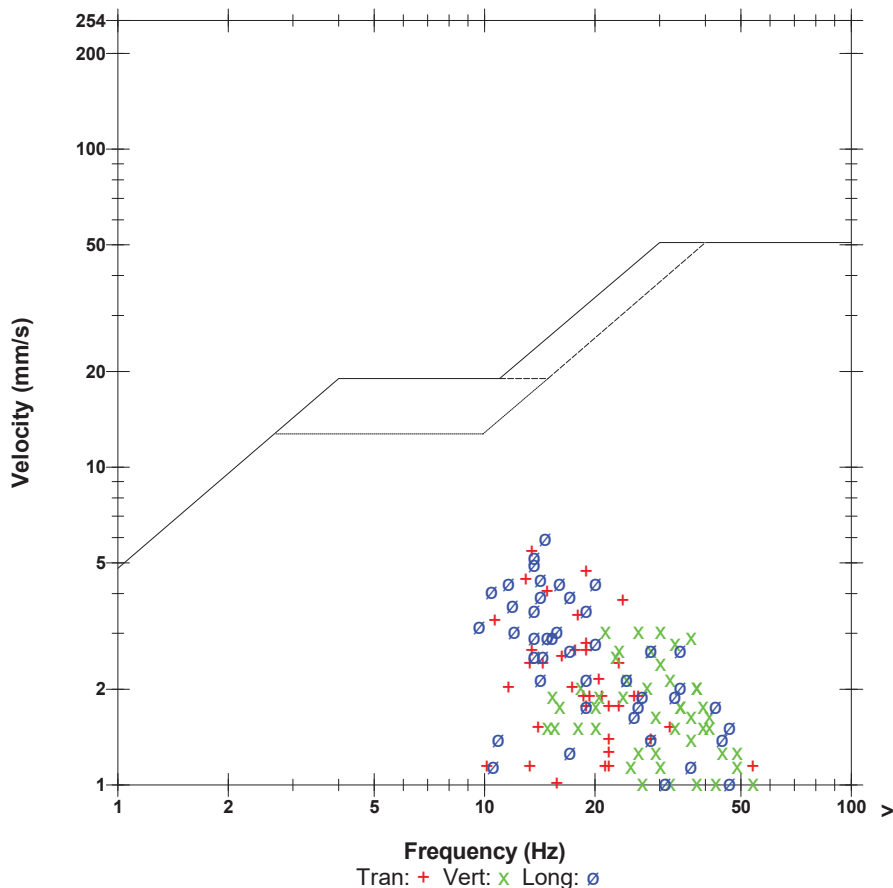
ZC Freq 15.3 Hz

Channel Test Passed (Freq = 20.5 Hz Amp = 627 mv)

	Tran	Vert	Long	
PPV	5.461	3.048	5.969	mm/s
ZC Freq	13.5	30	14.6	Hz
Time (Rel. to Trig)	0.458	0.446	0.855	sec
Peak Acceleration	0.080	0.080	0.106	g
Peak Displacement	0.064	0.019	0.065	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.3	7.2	Hz
Overswing Ratio	3.9	3.7	4.1	

Peak Vector Sum 6.571 mm/s at 0.856 sec

USBM RI8507 And OSMRE



Date/Time MicL at 11:55:03 October 15, 2019
Trigger Source Geo: 2.000 mm/s, Mic: 115.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.054 sec (Auto=5Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington Bruce TRL.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.6 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20191015115503.IDFW

Notes

Location: COLLING RD & BLINDLINE
Client: NELSON AGGREGATES
User Name: ORICA CANADA
General:

Extended Notes

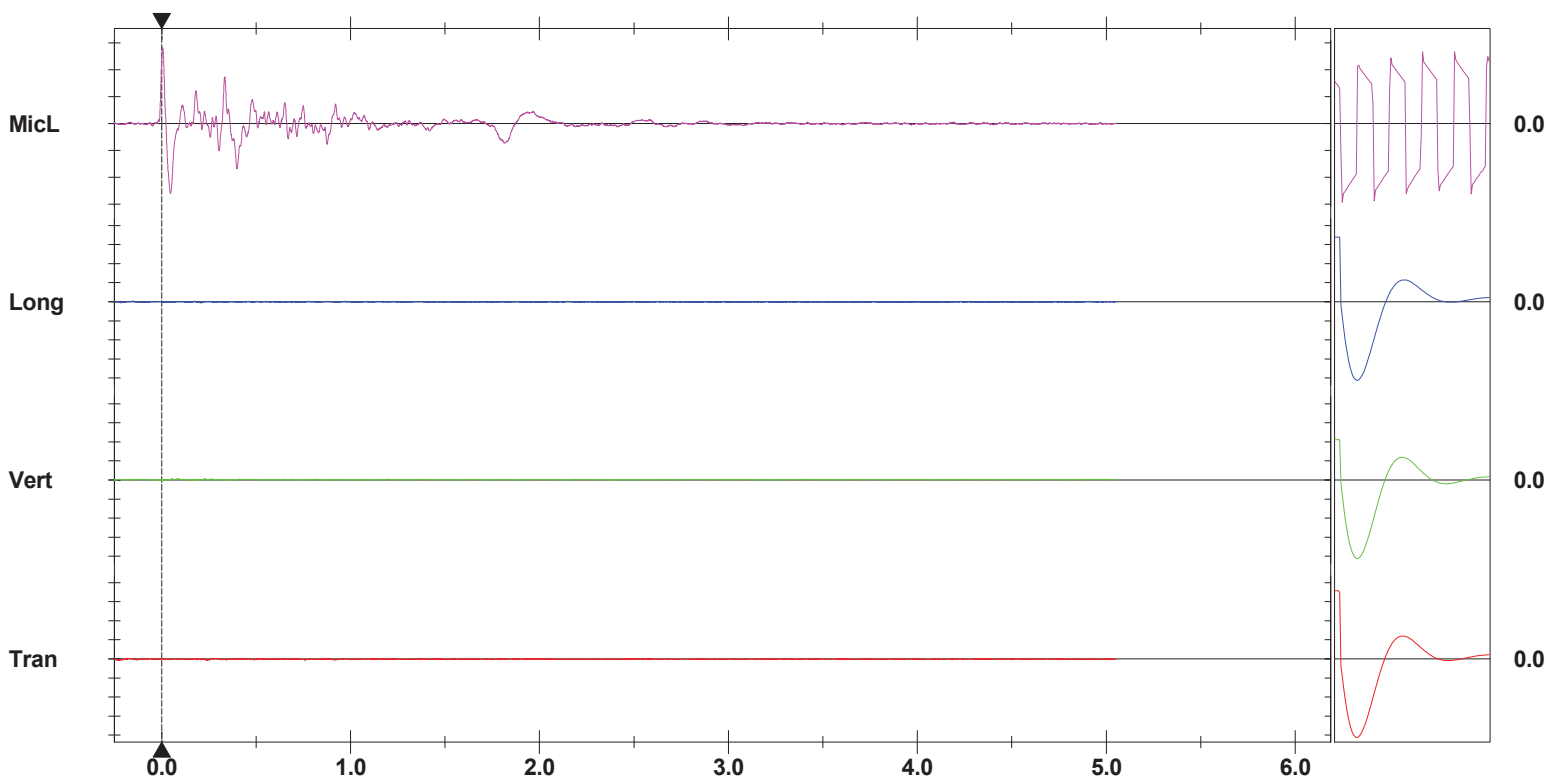
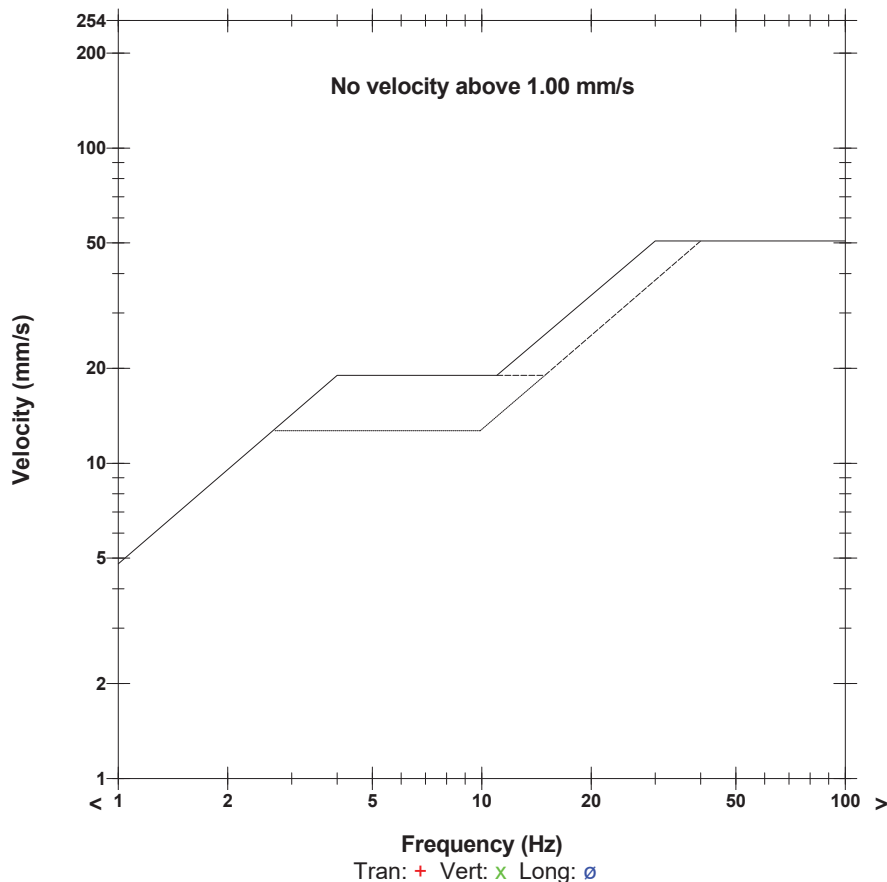
N 43.31617
 W 80.02664

Microphone Linear Weighting
PSPL 117.0 dB(L) at 0.006 sec
ZC Freq 10.0 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1474 mv)

	Tran	Vert	Long	
PPV	0.166	0.110	0.102	mm/s
ZC Freq	9.1	4.0	13.7	Hz
Time (Rel. to Trig)	-0.229	0.056	0.206	sec
Peak Acceleration	0.008	0.010	0.012	g
Peak Displacement	0.005	0.013	0.002	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.4	3.4	3.6	

Peak Vector Sum 0.177 mm/s at -0.229 sec

USBM RI8507 And OSMRE



Time Scale: 0.50 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Date/Time Tran at 11:52:41 October 15, 2019
Trigger Source Geo: 10.000 mm/s, Mic: 124.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 5.25 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.3 Volts
Unit Calibration August 31, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

Extended Notes

Sand Bagged at gas line

Microphone Linear Weighting

PSPL 129.7 dB(L) at 0.607 sec

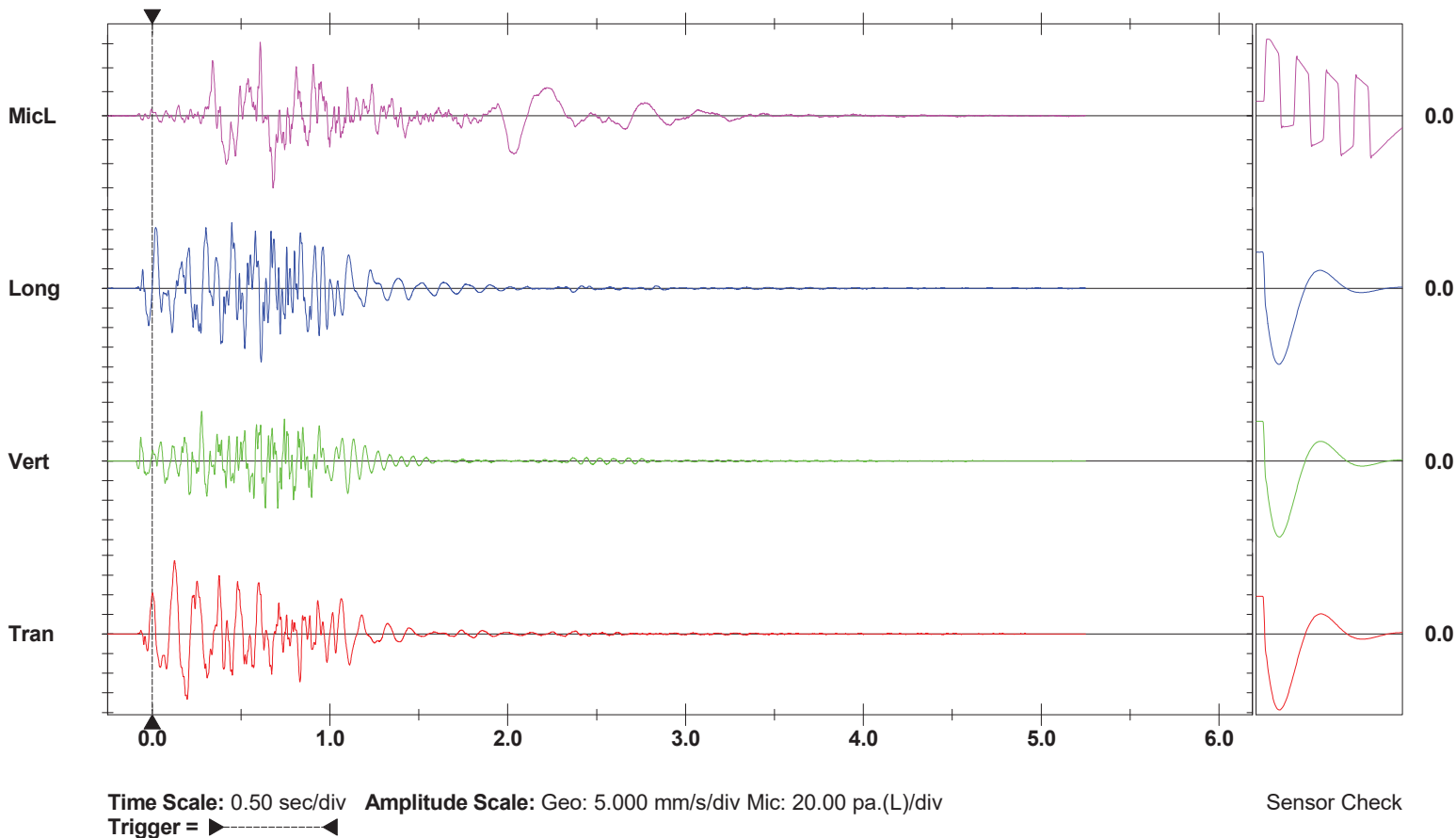
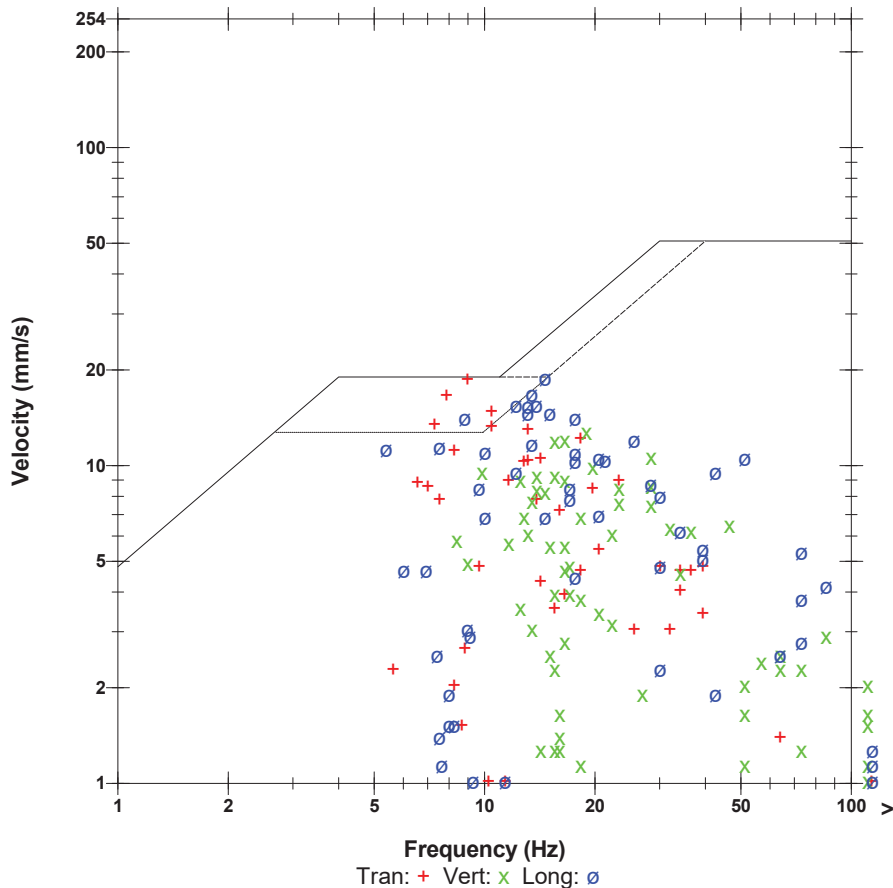
ZC Freq 16 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 627 mv)

	Tran	Vert	Long	
PPV	18.67	12.70	18.80	mm/s
ZC Freq	9.0	19	15	Hz
Time (Rel. to Trig)	0.125	0.278	0.613	sec
Peak Acceleration	0.199	0.318	0.318	g
Peak Displacement	0.323	0.112	0.234	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.4	Hz
Overswing Ratio	3.8	3.9	4.2	

Peak Vector Sum 22.37 mm/s at 0.610 sec

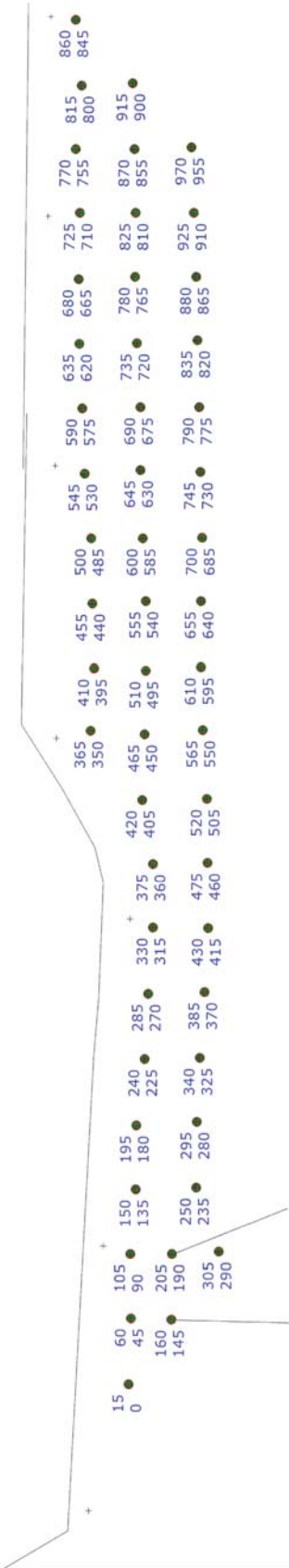
USBM RI8507 And OSMRE



SHOTPlus Plan

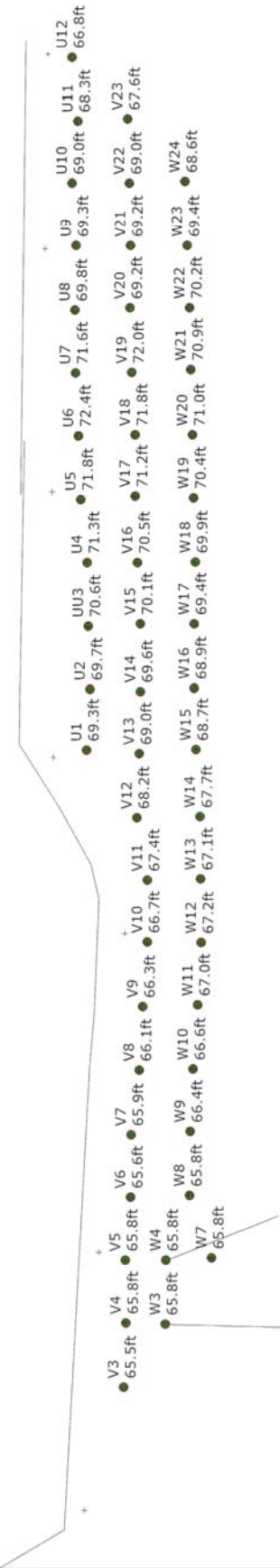
Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 3634.7ft			

open face



Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 53	Hole angle: 0.0°
Total drilled: 3634.7ft			

open face
Load Sheet
100 Kg Max
95Kg Bottom Deck



W2 W3 W4 3.625" DIA



SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft
 1st row burden: 12.0ft
 Total drilled: 4029.6ft
 Spacing: 10.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Number of holes: 59
 Stemming: 7.0ft
 Hole angle: 0.0°

open face

Load Sheet

100 Kg Max

95Kg Bottom Deck

31
60

WATCH
DECK

PREPARE

65	56	80	51	83	77	74	83	88	51	94	100	95	105	110	105	97	101	107	46	88
58	50	79	83	75	78	79	83	83	100	100	93	100	105	110	106	96	98	99	40	
79									96	96	86	98	105	108	110	98	96	94		

W2 W3 W4 3.625" DIA



Not to scale

SHOTPlus 5 Plan

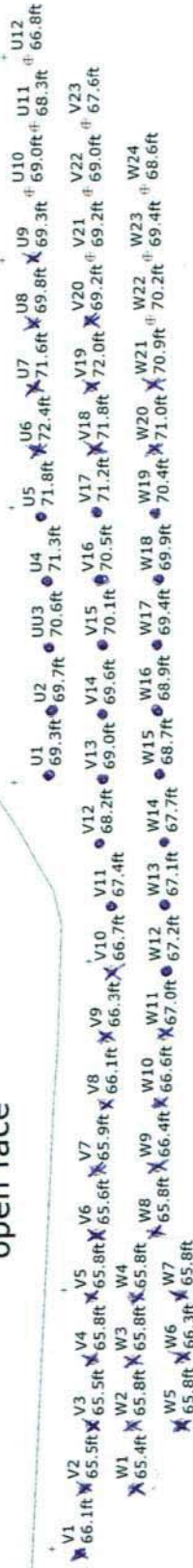
Blast Summary Data

Burden: 9.0ft
 Spacing: 10.0ft
 Stemming: 7.0ft
 1st row burden: 12.0ft
 Hole Diameter: 4.0in
 Subdrill: 2.0ft
 Hole angle: 0.0°
 Total drilled: 4029.6ft
 Number of holes: 59

APPROX 12300 KGS WITH NO DECKS

POSTS

open face



W2 W3 W4 3.625" DIA

9MID021 Design Fnl - 3.625 and 4" Blast Holes 12x10 9x10 271 and 250 + .6 SUB ELEV

DRILL TO DEPTH OR SHALE + 2 FEET



SHOTPlus™ Professional 5.7.4.4	9/25/2019
Mine	Burlington
Location	SOUTH WALL TO MID NEXT TO OLD WHL WS
Title/author	9MID021 Design Partial Fnl
Filename	9MID021 Design Partial Fnl.spf

Scale 1:350



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-10-23

Blast Number: 19-022

Orica Order #: 2547256

Blast Time: 11:59 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Middle (Bench / Face)

GPS Coordinates: 43.40443 °N Latitude 79.88139 °W Longitude
Centre of Blast Centre of Blast

Wind from the: W at 15 kph Temperature: 11 to 15 °C

Clear:

Rain:

Overcast:

Partly Cloudy: X

Snow:

Inversion:

Ceiling 30,000 ft

- Drilling Information -

Angle from Vertical

Nominal Bit Diameter:

Primary Bit diam: 101.6 mm 0° # Holes: 64 = 3,527.0 ft (4 " diam)
Secondary Bit diam: mm ° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

in (kg) out (kg) kg

CENTRA GOLD 70 33,760 24,820 8,940

Packaged Explosives:

cs shipped cs returned kg

FORTEL PRO 75X400 2 0 50

Boosters:

kg / unit # used kg

PENTEX 12 (OR EQUIVALENT) 0.34 66 22.4
PENTEX DUO (OR EQUIVALENT) 0.45 64 29.1

total explosives weight in Blast (kg): 9,041

Pkgd Prod (50 kg) % of Total kg: 0.6%

Detonators:

case #'s ms # used

UNITRONIC 600 6M 1
UNITRONIC 600 15M 64
UNITRONIC 600 20M 36
UNITRONIC 600 25M 29
EXEL MS 18m 25 ms 36
EXEL MS 25m 25 ms 28

Cord & Accessories:

U of M # used

HARNESS WIRE DUPLEX (6 PACK) 400M units 1

Resource Deployment:

of Blasts today (this Quarry) 1
of Blasters (this Blast) 1
of Helpers (this Blast) Note Exception 2
of MMU's (this Blast) 1

Services:

BULK TRUCK CHARGE 1.0
BLASTER HOURS Enter Blaster hours 6.0
HELPER HOURS Enter total Helper man-hours 12.0
SHOT LAYOUT FEE Enter # trips extra beyond 1 0.0
ADVANCED BLAST DESIGN Enter hours 0.0
BORETRACK Enter hours 0.0

Tonnes Blasted: 26,393 te 10,151 m3
Total tonnes per day: 26,393 te NB60-17 Rate Code
Total Holes Loaded: 64 holes
... including: 0 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 2 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 33 front row

- Pattern (Back Row) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 31 back row

Bench Height: 53.1 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 55.1 ft avg

- Stone Decking -

Front Row: 4.0 ft avg

Back Row: ft avg

Decks: 64 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Back Row: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 44.1 ft avg

Back Row: 48.1 ft avg

- Charge Weight -

Front Row: 128.6 kg/hole

Back Row: 140.3 kg/hole

Max. per delay: 85.0 kg/delay

SD () Equation: 2.0 kg/delay

Total kg Loaded: 9,041 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.343 kg/te (actual)

Front row: 0.274 kg/te (theoretical)


Main Body: 0.399 kg/te (theoretical)

"KPI" PF: 0.336 kg/te (theoretical)

NOTES (ANY VARIATION FROM STANDARD):

Drilled to dept od shale + 2'

2 Cases of package were used for X1 due to lean burden from 30' to collar

 ORICA The Blasting Professionals™	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-022
		P.O. #: 	Orica Order #: 2547256
		Blast Date: 2019-10-23	Blast Time: 11:59 AM

page 2

Blast Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast		43.40443	79.88138	0.757550	1.394193
Front Row Corner		43.40401	79.88147	0.757543	1.394195
Back Row Corner		43.40485	79.88133	0.757557	1.394192
Average (Centre of Blast)		43.40443	79.88139	0.757550	1.394193

1st Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40245	79.87814	0.757516	1.394137
2nd Reading					
Average		43.40245	79.87814	0.757516	1.394137
Distance (1st Seis. From Centre of Blast)		343.1	m		
Post Blast Data:		ppV: Memory	mm/s	Trigger set at: 2.0	mm/s
		frequency: was full	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: from high wind	dB	Trigger set at: 115	dB
2450 #2 Sideroad, Burlington, On					

2nd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40614	79.87455	0.757580	1.394074
2nd Reading					
Average		43.40614	79.87455	0.757580	1.394074
Distance (2nd Seis. From Centre of Blast)		585.1	m		
Post Blast Data:		ppV: 3.3	mm/s	Trigger set at: 2.0	mm/s
		frequency: 43.0	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: 104.6	dB	Trigger set at: 115	dB
2582 #2 Sideroad, Burlington, On					

3rd Seismograph Co-ordinates		Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
1st Reading		43.40466	79.88098	0.757554	1.394186
2nd Reading					
Average		43.40466	79.88098	0.757554	1.394186
Distance (3rd Seis. From Centre of Blast)		42.2	m		
Post Blast Data:		ppV: Memory	mm/s	Trigger set at: 2.0	mm/s
		frequency: was full	Hz	V / T / L : ?	(Vertical, Transverse or Longitudinal)
		air overpressure: from high wind	dB	Trigger set at: 115	dB
Gas Line					

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(42.2)^2}{30^2} \text{ kg} \\
 &= \frac{1,781}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 2 kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

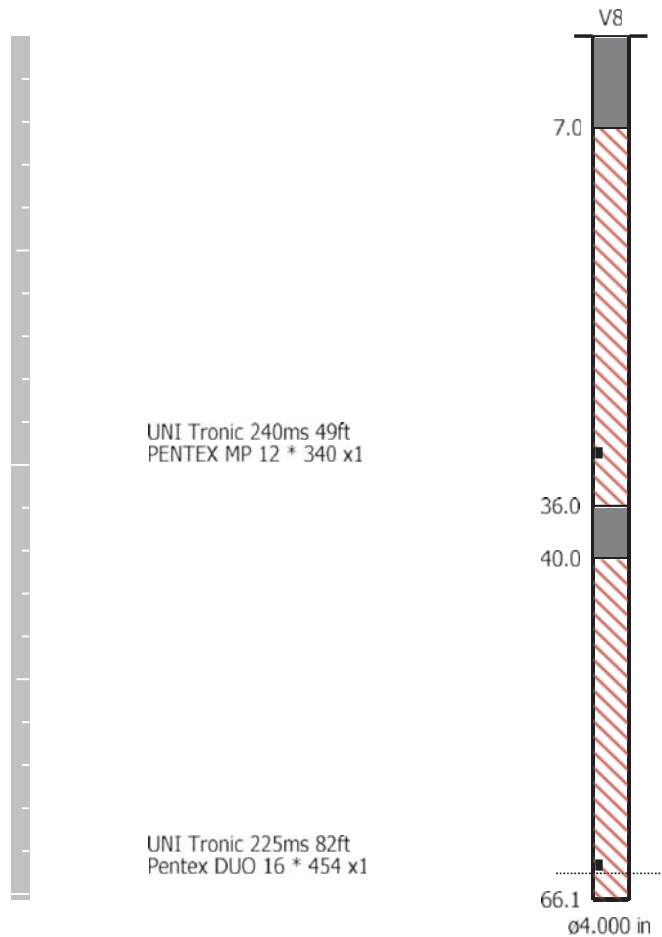
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 10/23/2019

Blast Number: 19-022
Orica Order #: 2547256

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Long at 11:59:19 October 23, 2019
Trigger Source Geo: 1.500 mm/s, Mic: 120.0 dB(L)
Range Geo: 254.0 mm/s
Record Time 4.875 sec (Auto=4Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington 2582.mmb

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.8 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20191023115919.IDFW

Notes

Location: 2582 #2 Sideroad, Mount Nemo, On
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Monitoring Vibration and Airblast

Extended Notes

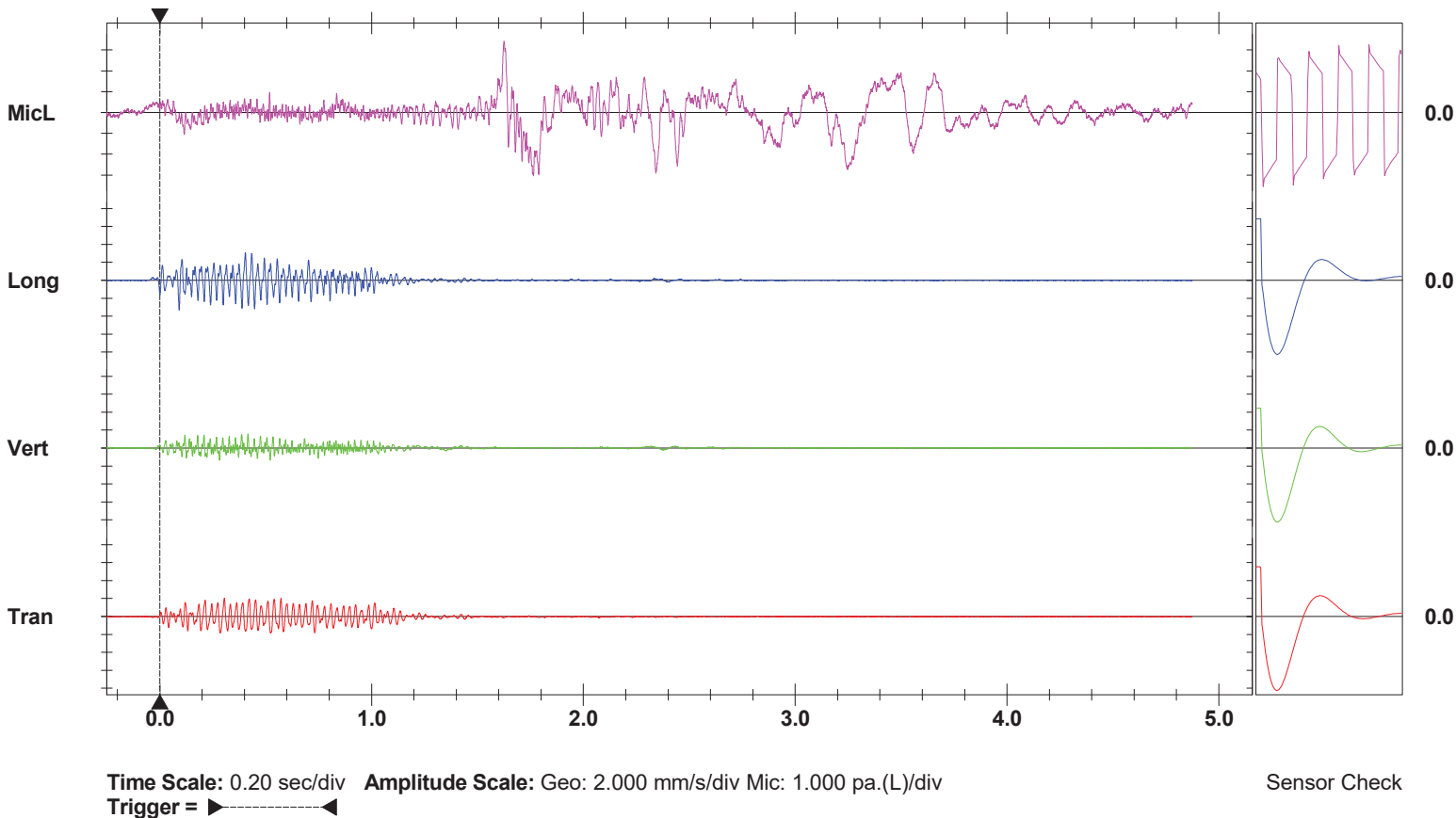
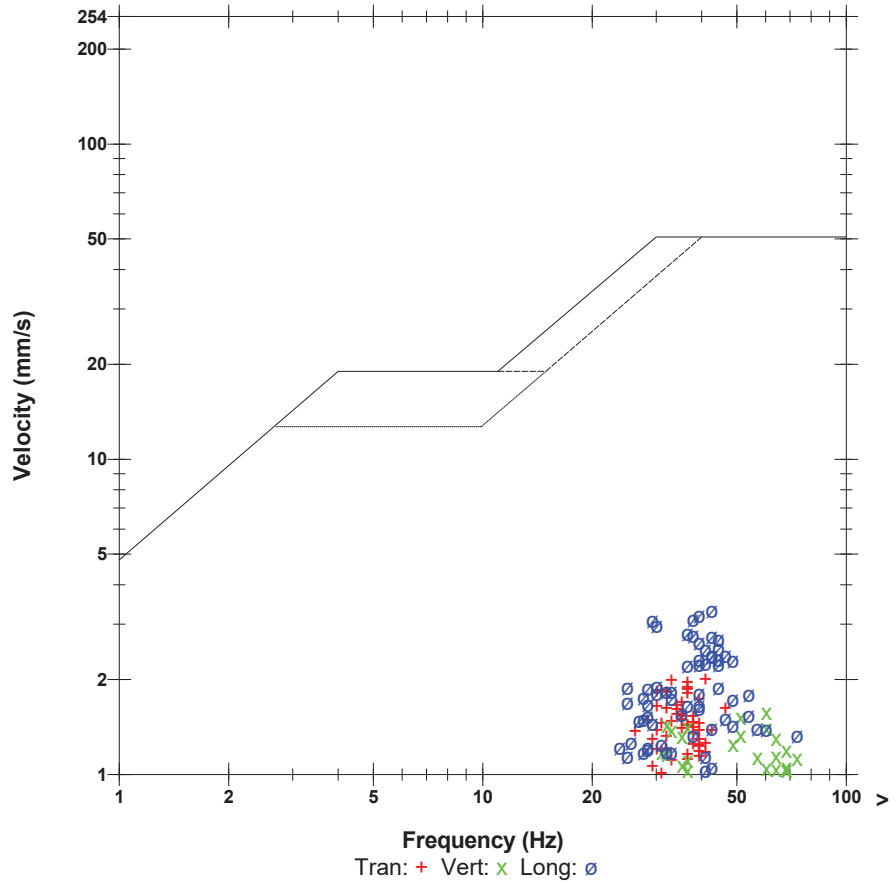
Sand Bagged
 N43.40614,W-79.87455

Microphone Linear Weighting
PSPL 104.6 dB(L) at 1.625 sec
ZC Freq 5.9 Hz
Channel Test Passed (Freq = 19.7 Hz Amp = 1484 mv)

	Tran	Vert	Long	
PPV	2.018	1.576	3.334	mm/s
ZC Freq	41	60	43	Hz
Time (Rel. to Trig)	0.572	0.417	0.091	sec
Peak Acceleration	0.064	0.077	0.145	g
Peak Displacement	0.011	0.005	0.013	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.5	3.4	3.6	

Peak Vector Sum 3.595 mm/s at 0.388 sec

USBM RI8507 And OSMRE



SHOTPlus Plan

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 63	Hole angle: 0.0°
Total drilled: 3628.0ft			



open face

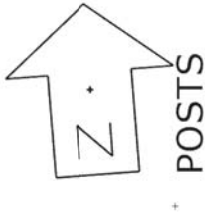
X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23	X24	X25	X26	X27	X28	X29	X30	X31	
64.3ft	63.9ft	64.1ft	64.2ft	64.1ft	63.3ft	61.9ft	60.8ft	59.6ft	58.6ft	57.3ft	57.0ft	56.4ft	55.3ft	54.6ft	54.0ft	53.6ft	53.2ft	53.3ft	53.9ft	54.6ft	55.6ft	54.8ft	54.2ft	54.1ft	54.7ft	55.1ft	55.2ft	55.7ft	56.4ft	56.4ft	
Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25	Y26	Y27	Y28	Y29	Y30	Y31	Y32
64.7ft	63.8ft	63.7ft	63.8ft	64.1ft	64.0ft	63.2ft	61.9ft	60.7ft	59.5ft	59.0ft	57.9ft	57.2ft	56.2ft	55.5ft	54.8ft	54.1ft	53.7ft	53.5ft	53.4ft	53.9ft	54.8ft	56.1ft	54.8ft	54.4ft	54.7ft	55.4ft	55.5ft	55.4ft	55.7ft	56.5ft	56.2ft



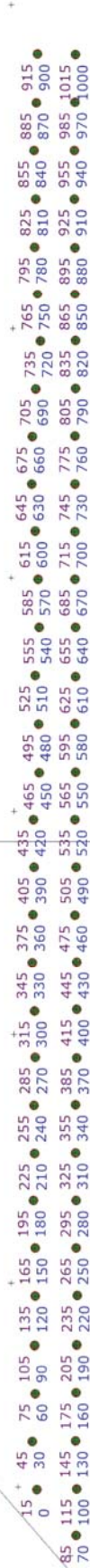
Not to scale

SHOTPlus Plan

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 63	Hole angle: 0.0°
Total drilled: 3628.0ft			



open face



Not to scale

SHOTPlus Plan

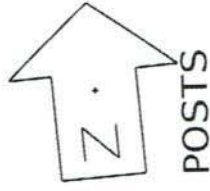
Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Stemming: 7.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Hole angle: 0.0°
Total drilled: 3628.0ft	Subdrill: 2.0ft	Number of holes: 63

Load Sheet

85 Kg / Top Deck
75 Kg / Bottom Deck

open face



85 85 82 73 75 64 76 65 58 56 61 75 51 47 64 48 52 53 59 57 69 55 75 70 62 53 57 59 53 57
 55 85 82 73 75 64 76 65 58 56 61 75 51 47 64 48 52 53 59 57 69 55 75 70 62 53 57 59 53 57



Not to scale

Blast Summary Data

Stemming: 7 off

Maximum: 7.00

Minimum: 0.00

incidence angle: 0.0°



open face

[illegible]

DRILLER NAME:

DRILL TO DEPTH OF SHALE + 2 FEET



Scale 1:500

Filename



Blast Report

Nelson Aggregate

Quarry: Burlington

P.O. #:

Blast Date: 2019-10-31

Blast Number: 19-023

Orica Order #: 2550103

Blast Time: 10:56 AM

page 1

Blaster-in-charge: Mike Derkinderen (Print Name)

Blast Location: Upper Middle (Bench / Face)

GPS Coordinates: 43.40370 °N Latitude 79.88137 °W Longitude
Centre of Blast Centre of Blast

Wind from the: E at 5 kph Temperature: 6 to 10 °C

Clear:

Rain:

Overcast: X

Partly Cloudy:

Snow:

Inversion:

Ceiling 18,000 ft

- Drilling Information -

Angle from Vertical Nominal Bit Diameter:
Primary Bit diam: 101.6 mm 0° # Holes: 41 = 2,753.0 ft (4 " diam)
Secondary Bit diam: mm ° # Holes: = 0.0 ft (" diam)
Tertiary Bit diam: mm ° # Holes: = 0.0 ft (" diam)

Bulk Explosives:

	in (kg)	out (kg)	kg
CENTRA GOLD 70	33,440	25,960	7,480

Packaged Explosives:

	cs shipped	cs returned	kg
FORTEL PRO 75X400	2	0	50

Boosters:

	kg / unit	# used	kg
PENTEX 12 (OR EQUIVALENT)	0.34	41	13.9
PENTEX DUO (OR EQUIVALENT)	0.45	41	18.6

total explosives weight in Blast (kg): 7,563

Pkgd Prod (50 kg) % of Total kg: 0.7%

Detonators:

	case #'s	ms	# used
UNITRONIC 600 15M			41
UNITRONIC 600 25M			82

Cord & Accessories:

	U of M	# used
HARNESS WIRE DUPLEX (6 PACK) 400M	units	1

Resource Deployment:

# of Blasts today (this Quarry)		1
# of Blasters (this Blast)		1
# of Helpers (this Blast)	Note Exception	2
# of MMU's (this Blast)		1

Services:

BULK TRUCK CHARGE		1.0
BLASTER HOURS	Enter Blaster hours	5.0
HELPER HOURS	Enter total Helper man-hours	10.0
SHOT LAYOUT FEE	Enter # trips extra beyond 1	0.0
ADVANCED BLAST DESIGN	Enter hours	0.0
BORETRACK	Enter hours	0.0

Tonnes Blasted: 19,709 te 7,580 m3
Total tonnes per day: 19,709 te NB60-18 Rate Code
Total Holes Loaded: 41 holes
... including: 2 Dead Holes
... and: 0 Helper Holes
Helper Hole Collar: 0.0 ft avg
Rows Blasted: 2 rows

- Pattern (Front Row) -

Burden: 12.0 ft avg

Spacing: 10.0 ft avg

Holes: 21 front row

- Pattern (Back Row) -

Burden: 9.0 ft avg

Spacing: 10.0 ft avg

Holes: 20 back row

Bench Height: 65.1 ft avg

Sub-drill: 2.0 ft avg

Hole Depth: 67.1 ft avg

- Stone Decking -

Front Row: 4.0 ft avg

Back Row: ft avg

Decks: 41 per blast

- Collar Stemming -

Front Row: 7.0 ft avg

Back Row: 7.0 ft avg

Material used: 3/4" Clear

- Charge Length -

Front Row: 56.1 ft avg

Back Row: 60.1 ft avg

- Charge Weight -

Front Row: 163.7 kg/hole

Back Row: 175.4 kg/hole

Max. per delay: kg/delay

SD () Equation: 13.9 kg/delay

Total kg Loaded: 7,563 kg

Rock Density: 2.60 g/cc = te/m³

- Powder Factor -

Yield PF: 0.384 kg/te (actual)

Front row: 0.284 kg/te (theoretical)

Main Body: 0.406 kg/te (theoretical)

"KPI" PF: 0.345 kg/te (theoretical)

1.682 lb/yd³


1.247 lb/yd³

1.781 lb/yd³

1.514 lb/yd³

NOTES (ANY VARIATION FROM STANDARD):

Unitronics were used instead of 25ms Excel MS in bottom deck due to an error on Orica.

	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <h2 style="margin: 0;">Blast Report</h2> <p style="margin: 0;">Nelson Aggregate</p> </div>	Quarry: Burlington	Blast Number: 19-023
		P.O. #: 	Orica Order #: 2550103
		Blast Date: 2019-10-31	Blast Time: 10:56 AM

page 2

Blast Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
Mid Blast	43.40370	79.88136	0.757537	1.394193
Front Row Corner	43.40345	79.88143	0.757533	1.394194
Back Row Corner	43.40395	79.88133	0.757542	1.394192
Average (Centre of Blast)	43.40370	79.88137	0.757537	1.394193

1st	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40245	79.87814	0.757516	1.394137
	2nd Reading				
	Average	43.40245	79.87814	0.757516	1.394137
	Distance (1st Seis. From Centre of Blast)	296.0	m		
	Post Blast Data:	ppV:	8.6 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	20.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	115.7 dB	Trigger set at: 115 dB	
	2450 #2 Sideroad, Burlington, On				

2nd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40614	79.87455	0.757580	1.394074
	2nd Reading				
	Average	43.40614	79.87455	0.757580	1.394074
	Distance (2nd Seis. From Centre of Blast)	615.0	m		
	Post Blast Data:	ppV:	3.3 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	28.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	Set to not trigger dB	Trigger set at: n/a dB	
	2582 #2 Sideroad, Burlington, On				

3rd	Seismograph Co-ordinates	Enter ° N Lat.	Enter ° W Long.	(N) Radians	(W) Radians
	1st Reading	43.40466	79.88098	0.757554	1.394186
	2nd Reading				
	Average	43.40466	79.88098	0.757554	1.394186
	Distance (3rd Seis. From Centre of Blast)	111.8	m		
	Post Blast Data:	ppV:	36.2 mm/s	Trigger set at: 2.0 mm/s	
		frequency:	26.0 Hz	V / T / L : ? (Vertical, Transverse or Longitudinal)	
		air overpressure:	130.5 dB	Trigger set at: 115 dB	
	Gas Line				

Scaling Factor denotes the degree of Blast confinement.

The higher the SF, the more confined the Blast.

A Scaling Factor of 30 is commonly used in the Scaled Distance formula for Quarry Bench Blasting:

Enter a scaling Factor: 30 Quarry Bench Blasting - 2 Free Faces

$$\begin{aligned}
 W &= \frac{D^2}{30^2} \\
 &= \frac{(111.8)^2}{30^2} \text{ kg} \\
 &= \frac{12,499}{900} \text{ kg}
 \end{aligned}$$

Maximum Indicated Charge Weight per Delay = 14 kg

Orica

Blaster-in-charge:

Mike derkinderen

Signature required, indicating that
Blast Report is Complete & Accurate.



Blast Design

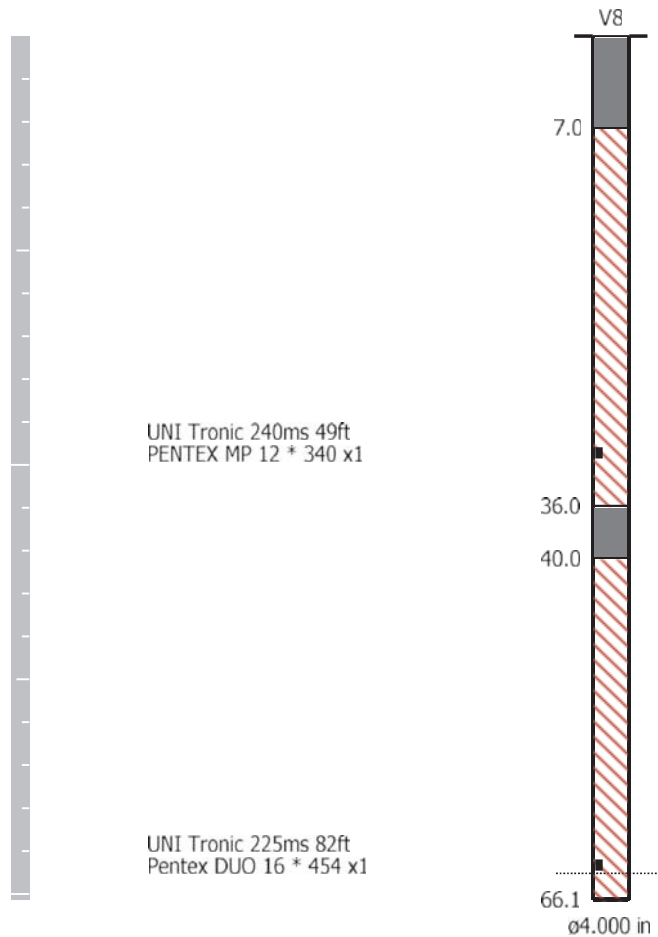
Nelson Aggregate

Quarry: Burlington
P.O. #:
Blast Date: 10/31/2019

Blast Number: 19-023
Orica Order #: 2550103

page 2

Paste ShotPlus Diagram inside Rectangle:



Orica

Blaster-in-charge:

Mike der Kinderen

Quarry Manager:

Nich Heap

Signature required, indicating
sign off on Blast Design.

Date/Time Vert at 10:56:06 October 30, 2019
Trigger Source Geo: 1.500 mm/s
Range Geo: 254.0 mm/s
Record Time 1.0 sec at 2048 sps
Job Number: 1

Serial Number BE12877 V 10.72-1.1 Minimate Blaster
Battery Level 6.1 Volts
Unit Calibration December 4, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: 2450 #2 Road, Burlington, On
Client: Nelson Aggregate
User Name: Orica Canada Inc.
General: Burlington

Extended Notes

Sand Bagged

Microphone Linear Weighting

PSPL 115.7 dB(L) at 0.821 sec

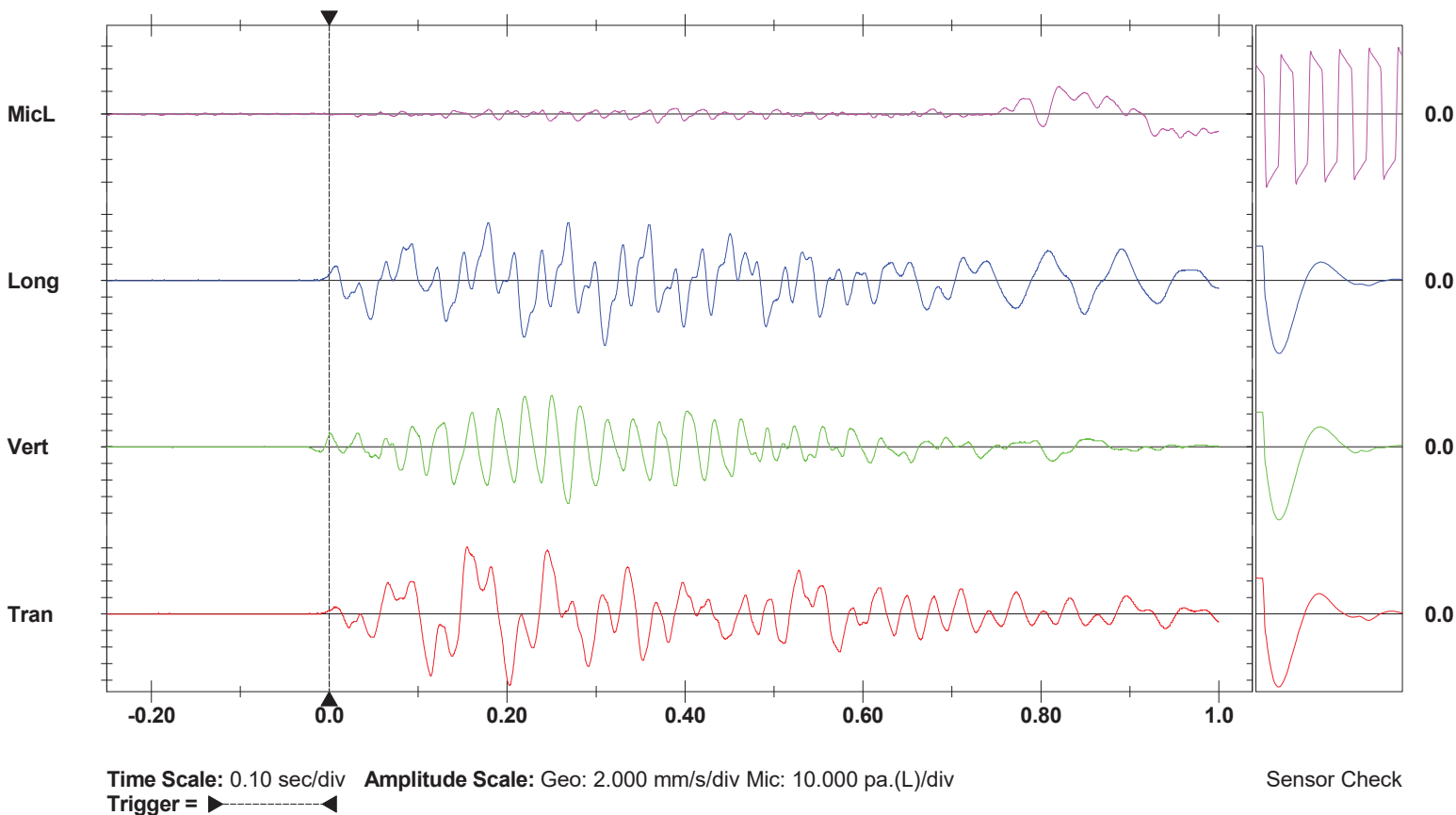
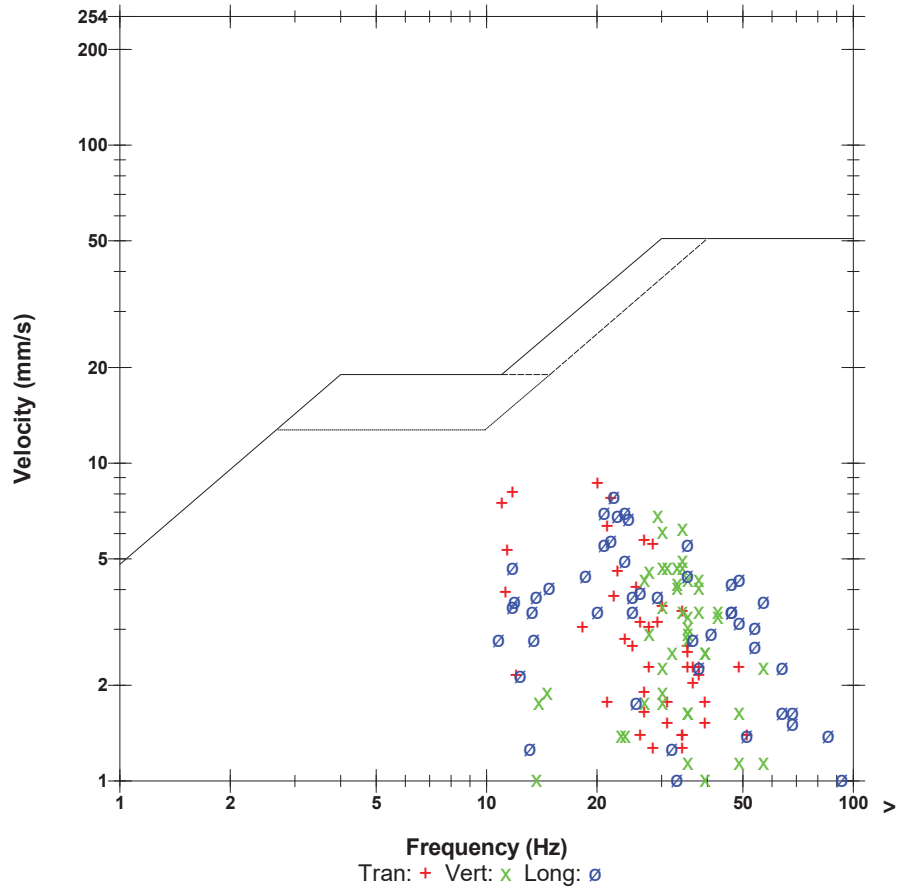
ZC Freq 6.0 Hz

Channel Test Passed (Freq = 20.5 Hz Amp = 612 mv)

	Tran	Vert	Long	
PPV	8.636	6.858	7.874	mm/s
ZC Freq	20	29	22	Hz
Time (Rel. to Trig)	0.202	0.268	0.310	sec
Peak Acceleration	0.159	0.159	0.186	g
Peak Displacement	0.102	0.037	0.048	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.4	7.2	Hz
Overswing Ratio	3.7	3.7	4.0	

Peak Vector Sum 9.809 mm/s at 0.269 sec

USBM RI8507 And OSMRE



Date/Time Long at 10:56:07 October 30, 2019
Trigger Source Geo: 1.500 mm/s
Range Geo: 254.0 mm/s
Record Time 4.756 sec (Auto=4Sec) at 2048 sps
Operator/Setup: MIKE DERKNDEREN/Burlington 2582.MMB

Serial Number UM6857 V 10-89 Micromate ISEE
Battery Level 3.8 Volts
Unit Calibration January 15, 2019 by InstanTel
File Name UM6857_20191030105607.IDFW

Notes

Location: 2582 #2 Sideroad, Mount Nemo, On
 Client: Nelson Aggregate
 User Name: Orica Canada Inc.
 General: Monitoring Vibration and Airblast

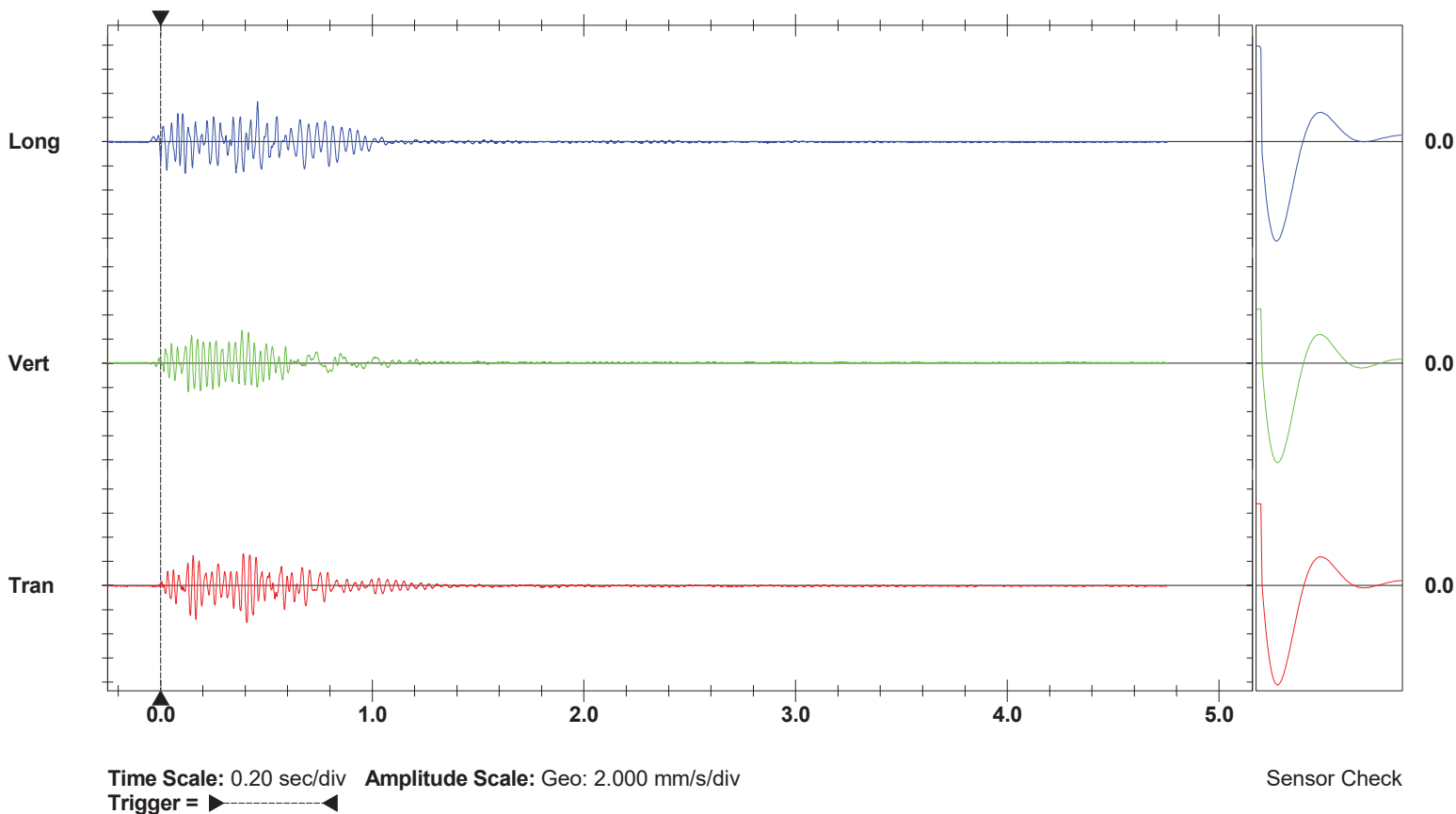
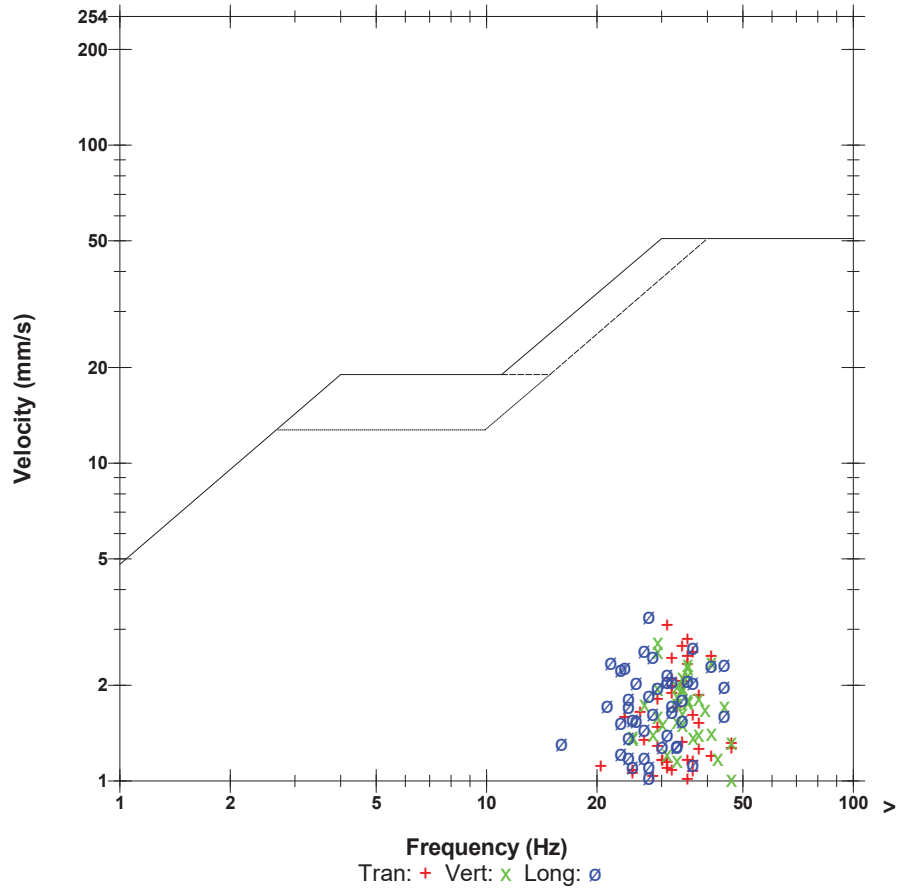
Extended Notes

Sand Bagged
 N43.40614,W-79.87455

	Tran	Vert	Long	
PPV	3.090	2.743	3.302	mm/s
ZC Freq	31	29	28	Hz
Time (Rel. to Trig)	0.408	0.384	0.458	sec
Peak Acceleration	0.081	0.114	0.102	g
Peak Displacement	0.016	0.017	0.016	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.5	Hz
Overswing Ratio	3.5	3.4	3.4	

Peak Vector Sum 3.783 mm/s at 0.458 sec

USBM RI8507 And OSMRE



Date/Time Tran at 10:56:05 October 30, 2019
Trigger Source Geo: 10.000 mm/s
Range Geo: 254.0 mm/s
Record Time 3.75 sec (Auto=3Sec) at 1024 sps

Serial Number BE19461 V 10.72-8.17 MiniMate Plus
Battery Level 6.3 Volts
Unit Calibration August 31, 2018 by InstanTel
File Name __TEMP.EVT

Notes

Location: Gas Line
Client: Nelson Aggregates
User Name: Orica Canada
General: 43.40466,-79.88098

Extended Notes

Sand Bagged at gas line

Microphone Linear Weighting

PSPL 130.5 dB(L) at 0.421 sec

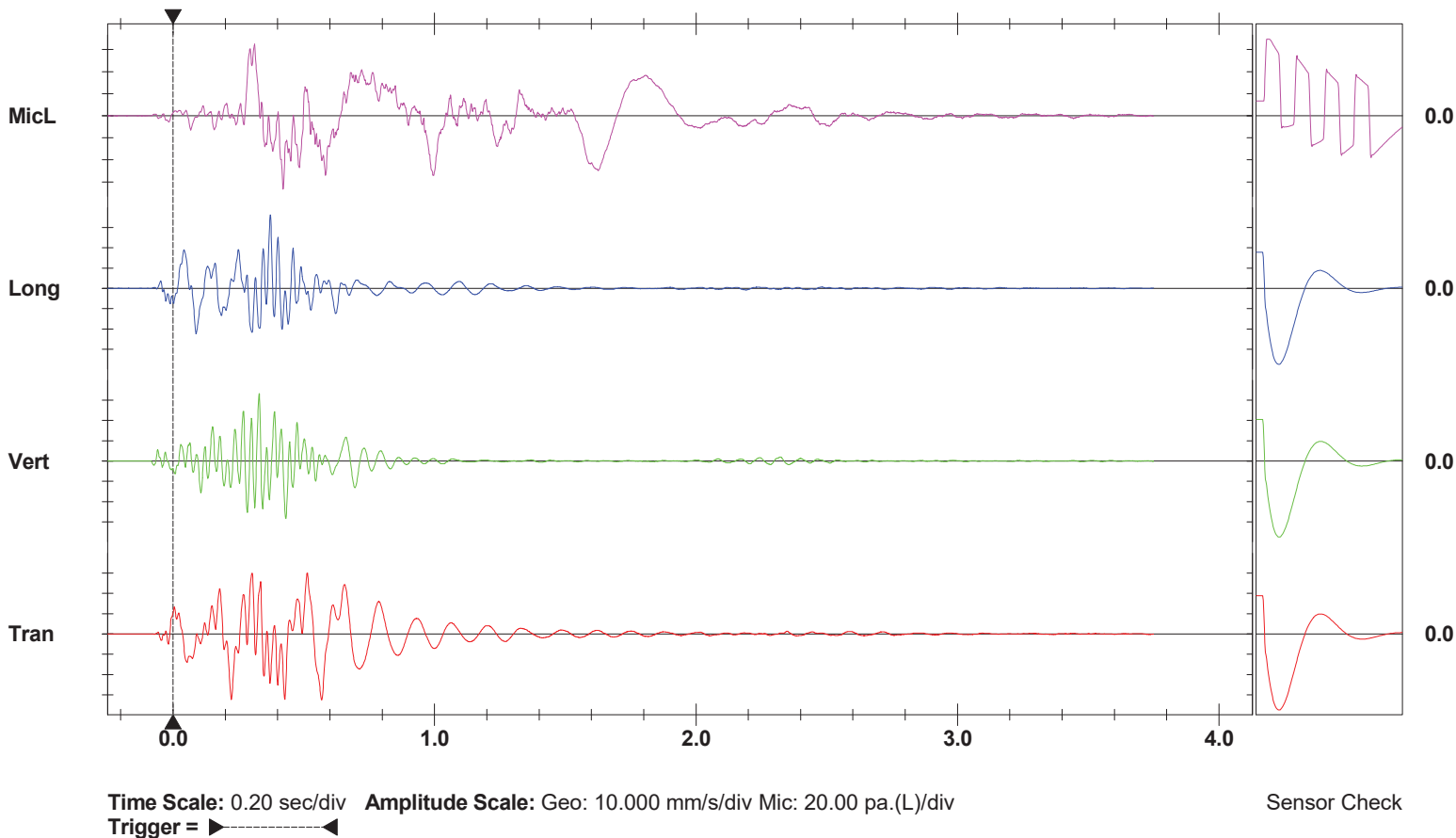
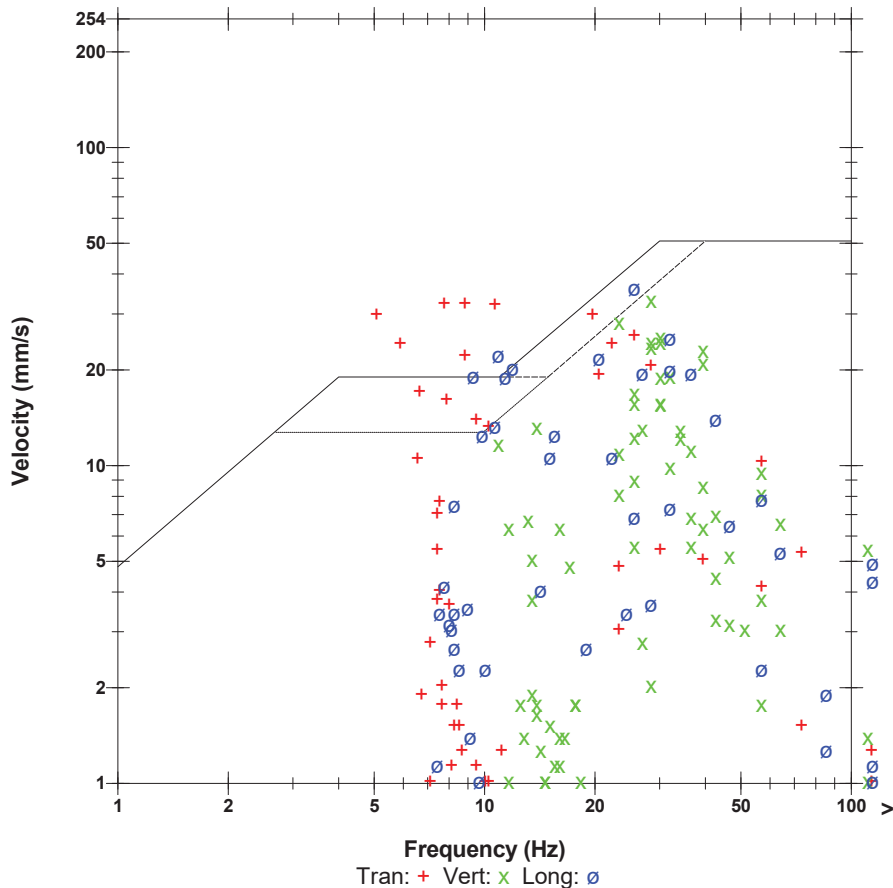
ZC Freq 9.0 Hz

Channel Test Passed (Freq = 20.1 Hz Amp = 658 mv)

	Tran	Vert	Long	
PPV	32.51	33.27	36.19	mm/s
ZC Freq	8.8	28	26	Hz
Time (Rel. to Trig)	0.568	0.329	0.372	sec
Peak Acceleration	0.610	0.848	0.623	g
Peak Displacement	0.579	0.182	0.257	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.4	7.3	7.4	Hz
Overswing Ratio	3.8	3.9	4.3	

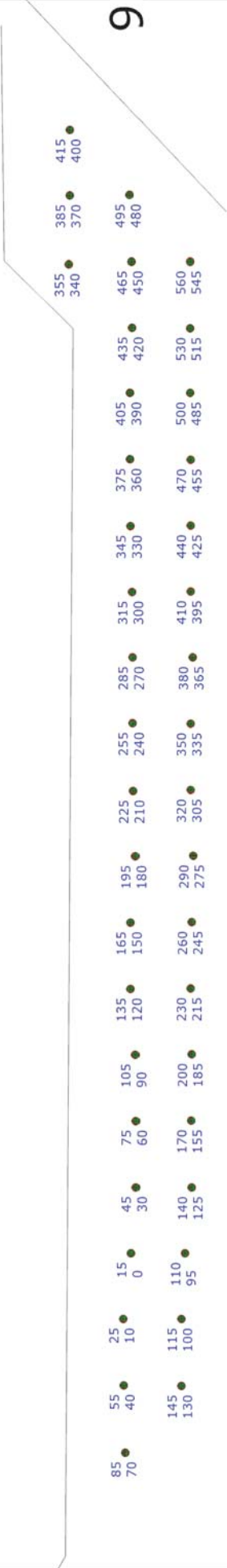
Peak Vector Sum 45.51 mm/s at 0.371 sec

USBM RI8507 And OSMRE



Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 41	Hole angle: 0.0°
Total drilled: 2774.7ft			

Open Face



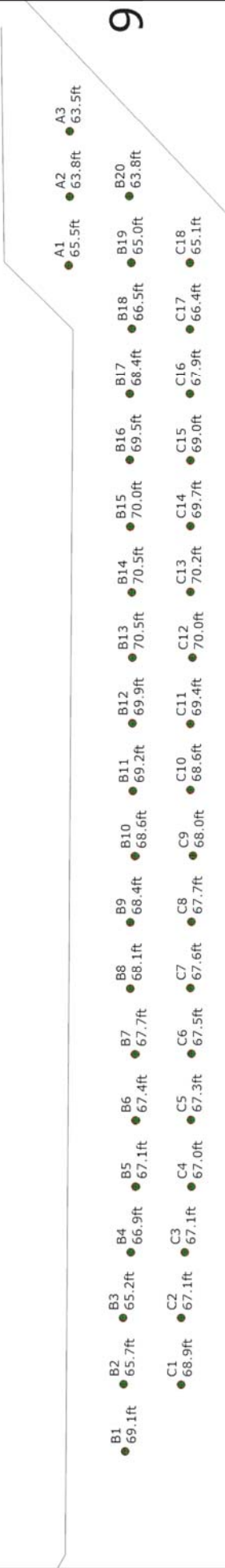
9MID023 Final
4" Blasthole
12 X 10, 9 X 10 Pattern
250 + 0.6m Subdrill
DRILL TO DEPTH OR SHALE + 2 FEET



Not to scale

Blast Summary Data			
Burden: 9.0ft	Spacing: 10.0ft	Subdrill: 2.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Number of holes: 41	Hole angle: 0.0°
Total drilled: 2774.7ft			

Open Face



9MID023 Final

4" Blasthole

12 X 10, 9 X 10 Pattern

250 + 0.6m Subdrill

DRILL TO DEPTH OR SHALE + 2 FEET



Not to scale

Blast Summary Data

Stemming: 8.0ft

Hole angle: 0.0°

[illegible]

DRILL TO DEPTH OR SHALE + 2 FEET



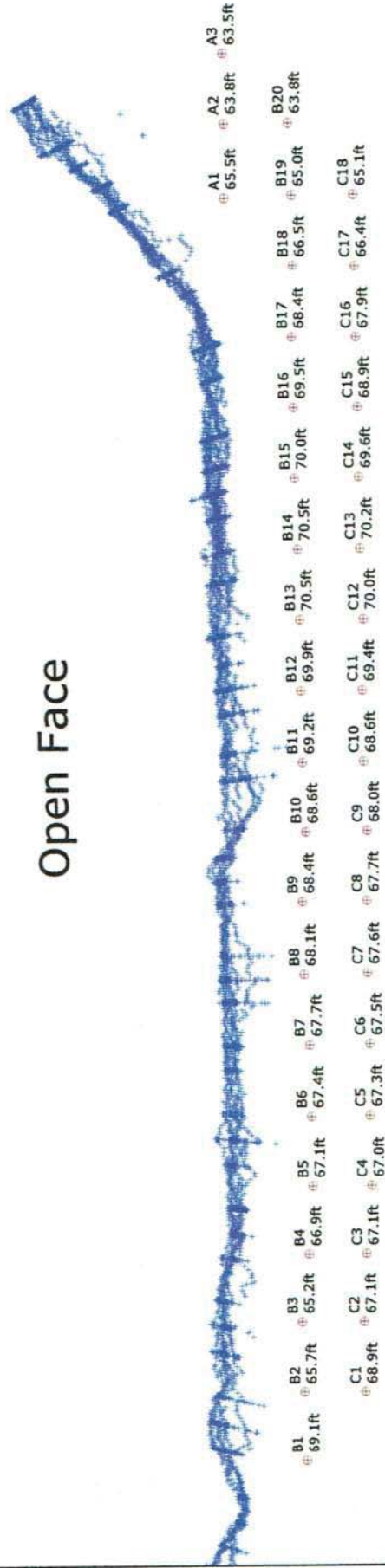
Not to scale

SHOTPlus Plan

Blast Summary Data

Burden: 9.0ft	Spacing: 10.0ft	Stemming: 8.0ft
1st row burden: 12.0ft	Hole Diameter: 4.0in	Hole angle: 0.0°
Total drilled: 2774.6ft	Subdrill: 2.0ft	
	Number of holes: 41	

Open Face



9MID023 Final
4" Blasthole
12 X 10, 9 X 10 Pattern
250.0 + 0.6m Subdrill



DRILL TO DEPTH OR SHALE + 2 FEET

Not to scale

Appendix D



Specialists in Explosives, Blasting and Vibration
Consulting Engineers

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
Northwest Territories and Nunavut Association of Professional Engineers (NAPEG)
International Society of Explosives Engineers (ISEE)
Ontario Stone Sand & Gravel Association (OSSGA)
Surface Blaster Ontario Licence 450109

SUMMARY OF EXPERIENCE

Over thirty five 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 ENGINEERING LTD.

Ottawa ♦ Sudbury ♦ Toronto ♦ Halifax

WWW.EXPLOTECH.COM

1-866-EXPLOTECH



Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Mitch Malcomson, P.Eng.
Consulting Engineer, Explotech Engineering Ltd.

EDUCATION

Bachelor of Engineering,
Civil Engineering with Concentration in Business Management,
Carleton University

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of Ontario (APEO)
Association of Professional Engineers and Geoscientists of BC (APEG)
International Society of Explosives Engineers (ISEE)
Ontario Stone Sand and Gravel Association (OSSGA)

SUMMARY OF EXPERIENCE

A Consulting Engineer and Project Manager for Explotech Engineering Ltd., Mitch holds a Bachelor of Engineering degree from Carleton University in Civil Engineering with a Concentration in Business Management. Mitch has strong analytical, technical, business and leadership skills. As a Project Manager, Mitch is responsible for operational strategies, scheduling and contract procurement. As a Consulting Engineer, the technical responsibilities include detailed blast designs, blast investigations and reviews, implementation of vibration monitoring programs, development of monitoring equipment/ technologies and building assessments for construction and the drilling and blasting portions of mining, quarrying and construction projects across Canada.

PROFESSIONAL RECORD

2008 – Present - Consulting Engineer / Project Manager, Explotech Engineering Ltd.



Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Mark Morelli, B.Eng.

Explotech Engineering Ltd.

EDUCATION

Bachelor of Engineering,
Civil Engineering, Carleton University

PROFESSIONAL AFFILIATIONS

International Society of Explosives Engineers (ISEE)

SUMMARY OF EXPERIENCE

A technician working for Explotech Engineering Ltd., Mark holds a Bachelor of Engineering degree in Civil Engineering and has strong technical, leadership, interpersonal, communication, and presentation skills. Recent focus on blast monitoring, data management, scheduling, job estimations, vibration analysis, damage complaint investigation and attenuation analysis.

PROFESSIONAL RECORD

- | | |
|----------------|--|
| 2006 – Present | - Technician, Explotech Engineering Ltd. |
| 2003 – 2004 | - Labourer, Hydracorp Canada Ltd. |
| 2002 – 2003 | - Labourer, Quad Construction |



Specialists in Explosives, Blasting and Vibration
Consulting Engineers

Michael Tobin, B.A.Sc.

Explotech Engineering Ltd.

EDUCATION

Bachelor of Applied Science,
Geological Engineering, Queen's University

PROFESSIONAL AFFILIATIONS

International Society of Explosives Engineers (ISEE)

SUMMARY OF EXPERIENCE

A technician working for Explotech Engineering Ltd., Michael holds a Bachelor of Applied Science degree from Queen's University in Geological Engineering. Michael has strong analytical, technical, and interpersonal skills. Recent projects have focused on blast monitoring, vibration analysis, job estimation, damage complaint investigation and equipment maintenance and repair.

PROFESSIONAL RECORD

2017 – Present - Technician, Explotech Engineering Ltd.

Appendix E



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.
Sensitive Receptor:	Sensitive land use may include recreational uses which are deemed by the municipality or provincial agency to be sensitive; and/or any building or associated amenity area (i.e. may be indoor or outdoor space) which is not directly associated with the industrial use, where humans or the natural environment may be adversely affected by emissions generated by the operation of a nearby industrial facility. For example, the building or amenity area may be associated with residences, senior citizen homes, schools,



day care facilities, hospitals, churches and other similar institutional uses, or campgrounds.

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 and loaded below the required grade
Toe Load:	The portion of explosive loaded below grade



References

Building Research Establishment, (1990), *"Damage to Structures From Ground-Borne Vibration"*, BRE Digest 353, Gaston, Watford, U.K.

Crum S. V., Siskind D. E., Pierce W. E., Radcliffe K. S., (1995) *"Ground Vibrations and Airblasts Monitored in Swedesburg, Pennsylvania, From Blasting at McCoy Quarry"*, Contract Research Rept. By the United States Bureau of Mines for the Pennsylvania Department of Environmental Resources, 120 pp.

Dowding C.H., (1985), *"Blast Vibration, Monitoring and Control"*, Prentice-Hall Canada Inc., 297 pp.

Dowding C.H., (1996), *"Construction Vibrations"*, Prentice-Hall, Upper Saddle, N.J., USA, 610 pp.

Du Pont Company, (1980), *"Blaster's Handbook"* Wilmington, Delaware, United States of America

Fletcher L.R., D'Andrea D.V., (1986) *"Control of Flyrock in Blasting"*, Proceedings of the Twelfth Annual Conference on Explosives and Blasting Technique, International Society of Explosives Engineers

Froedge D. T., (1983) *"Blasting Effects on Water Wells"*, Proceedings of the Ninth Annual Conference on Explosives and Blasting Technique, International Society of Explosives Engineers

Kopp J.W., (1994) *"Observation of Flyrock at Several Mines and Quarries"*, Proceedings of the Twentieth Annual Conference on Explosives and Blasting Technique, International Society of Explosives Engineers

Matheson G. M., Miller D. K., (1997) *"Blasting Vibration Damage to Water Supply, Well Water Quality and Quantity"*, Proceedings of the Twenty-Third Conference on Explosives and Blasting Technique, International Society of Explosive Engineers

Moore A.J., Richards A.B., (2005), *"Golden Pike Cut-Back Flyrock Control and Calibration of a Predictive Model"*, Terrock Consulting Engineers, Eltham, Victoria, Australia.



Nicholls H., Johnson C., Duvall W., (1970), "*Blasting Vibrations and their Effects on Structures*", United States Department of the Interior, Bureau of Mines, Bulletin 656

Oriard L.L., (1989) "*The Scale of Effects in Evaluating Vibration Damage Potential*" Fifteenth Conference on Explosives and Blasting Technique, International Society of Explosive Engineers

Oriard L.L., (2002) "*Explosives Engineering, Construction Vibrations and Geology*" International Society of Explosive Engineers, Cleveland, Ohio, United States of America

Robertson D. A., Gould J. A., Straw J. A., Dayton M. A., (1980) "*Survey of Blasting Effects on Ground Water Supplies in Appalachia*", United States Department of the Interior, Bureau of Mines, Contract No. J-0285029

Rose R., Bowles B., Bender W. L., (1991) "*Results of Blasting in Close Proximity to Water Wells at the Sleeper Mine*", Proceedings of the Seventeenth Annual Conference on Explosives and Blasting Technique, International Society of Explosive Engineers

Roth J., (1979) "*A Model for Determination of Flyrock Range as a Function of Shot Conditions*", United States Department of the Interior, Bureau of Mines, Report OFR 77-81

Siskind D.E., Stagg M.S., Kopp J.W., Dowding C.H., (1980), "*Structural Response and Damage Produced by Ground Vibration from Surface Mine Blasting*", United States Bureau of Mines RI 8507.

White, T.J., Farnfield, R.A., Kelly, M., (1993), "*The Effect of Low Level Blast Vibrations and the Environment on a Domestic Building*", Proceedings of the Ninth Annual Symposium on Explosives and Blasting Research, International Society of Explosives Engineers.

Wright D.G., Hopky G. E., (1998) "*Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters*", Canadian Technical Report of Fisheries and Aquatic Sciences 2107

Appendix F

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone 905-567-4444
Fax 905-567-6561



REPORT ON

**BLASTING IMPACT ASSESSMENT
PROPOSED NELSON AGGREGATE
NELSON QUARRY EXTENSION**

Submitted to:

Nelson Aggregate Co.
P.O. Box 1070
Burlington, Ont. L7R 4L8

DISTRIBUTION:

20 Copies - Nelson Aggregate Co.
2 Copies - Golder Associates Ltd.

April 2006

021-1238



EXECUTIVE SUMMARY

Blasting operations within the proposed extension of the Nelson quarry may be readily carried out in compliance with existing provincial environmental guideline limits with respect to ground and air vibrations. These effects are subject to recommended limits of 12.5 mm/s and 128 dBL respectively, as established by the Ontario Ministry of the Environment and outlined in Noise Pollution Control (NPC) publication 119 of the Model Municipal Noise Control By-Law, for operations where monitoring of these effects is carried out as a matter of routine.

Ground and air vibration attenuation characteristics were monitored and assessed from a number of routine production blasts within the existing Nelson quarry. The results indicate that the majority of the proposed extension may be excavated using the blast parameters currently being used in the existing quarry. These would include reducing the borehole diameter, reducing the bench height and reducing the explosive weight per delay period. The Nelson quarry would continue monitoring all blasts during extraction within the proposed extension area. The blasting operations within the proposed extension would have no impact on the integrity of adjacent water wells.

By ensuring that the ground and air vibration levels produced during blasting operations at the Nelson quarry continue to remain within the recommended provincial guideline limits, there would not be any noticeable cumulative effect on adjacent structures associated with the blasting operations within the proposed extension.

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
EXECUTIVE SUMMARY	I
TABLE OF CONTENTS	II
1.0 INTRODUCTION	1
2.0 EXISTING CONDITIONS	2
2.1 Site Description	2
2.2 Quarry Blasting Operations	2
3.0 PROPOSED EXTRACTION OF EXTENSION AREA	3
4.0 IMPACT IDENTIFICATION	4
5.0 QUARRY BLAST MONITORING	5
5.1 Attenuation Characteristics	5
5.1.1 Ground Vibrations	5
5.1.2 Air Vibrations	6
6.0 IMPACT ASSESSMENT	8
6.1 Compliance with NPC 119	8
6.2 Repeated Vibration Effects on Structures	8
6.3 Effects on Bedrock and Water Wells	9
7.0 CONCLUSIONS	11
REFERENCES	12
PUBLICATION NPC-119	1
Blasting	1
Scope 1	
Technical Definitions	1
Measurement Procedures	1
Concussion – Cautionary Limit	1
Concussion – Peak Pressure Level Limit	1
Vibration – Cautionary Limit	1
Vibration – Peak Particle Velocity Limit	1

LIST OF TABLES

Table 1	Existing Blast Details for Nelson Quarry Company Quarry
Table 2	Maximum Explosive Loads vs Distance for 12.5 mm/s and 128 dBL
Table 3	Strain Levels Induced by Household Activities, Environmental Changes and Blasting

LIST OF FIGURES

Figure 1	Key Location Plan Nelson Quarry
Figure 2	Proposed Nelson Quarry Extension Area
Figure 3	Description of Blasting Terms
Figure 4	Proposed Excavation Sequence of Nelson Quarry Extension Area
Figure 5	Nelson Quarry Ground Vibration Attenuation Curve
Figure 6	Nelson Quarry Air Vibration Attenuation Curve

LIST OF APPENDICES

Appendix A	Publication NPC 119
Appendix B	New Residence Receptor Location

1.0 INTRODUCTION

Golder Associates was retained by Nelson Aggregate Co. to carry out an impact assessment of the environmental effects from future blasting operations within the proposed extension of the existing licensed area of the Nelson Quarry Company quarry. The proposed extension would be located immediately south of No. 2 Sideroad on Part Lots 17 and 18, Concession 2 in the City of Burlington. The impact assessment specifically addresses whether the applicable Ontario Ministry of Environment guidelines with respect to ground and air vibration effects could be met at the residential properties closest to the proposed extension.

The investigation included monitoring a number of regularly scheduled production blasts at various receptor points around the blast site to assess site-specific ground and air vibration decay characteristics.

This report addresses the following topics:

- reviews existing provincial and federal guidelines for the assessment of environmental impacts from blasting,
- provides recommendations for the continued control of ground and air vibration effects,
- evaluates the potential impact of the blasting operations on bedrock strata and adjacent water wells,
- evaluates the long term impact of the blasting operations on surrounding structures.

2.0 EXISTING CONDITIONS

2.1 Site Description

The existing licensed Nelson Quarry Co. quarry (Nelson) is situated immediately north of No. 2 Sideroad and south of Colling Road between Guelph Line and Cedar Springs Road in the City of Burlington, Ontario in the Region of Halton (see Figure 1). The proposed extension area would encompass an area of approximately 82.3 Hectares immediately south of the existing quarry and No. 2 Sideroad, as seen in Figure 2.

As shown in Figures 2 and 4, the closest residential properties to the proposed extension consist of those residences to the east and west on the south side of No. 2 Sideroad. Compared to the existing quarry location, the proposed extension is relatively remote from the existing neighbouring properties. The closest residential receptors have been identified as the residences along No. 2 Sideroad (see Appendix B). The topography of the area generally consists of gently rolling hills.

2.2 Quarry Blasting Operations

The Nelson quarry currently operates a single bench which varies in height from approximately 19 to 26 m. Typical blast design details for the existing quarry are given in Table 1 while common quarry blasting terms and procedures are illustrated in Figure 3.

All blasting at the Nelson quarry is monitored for ground and air vibration effects. Monitoring is routinely being carried out at three locations along the south side of No. 2 Sideroad and occasionally within Mount Nemo Court, east of Guelph Line.

Blasting procedures within the proposed extension would be carried out in a manner similar to those currently being carried out for the existing Nelson quarry, as shown in Table 1.

3.0 PROPOSED EXTRACTION OF EXTENSION AREA

The proposed sequence of extraction for the extension is illustrated in Figure 4. Extraction within the proposed extension area would commence with the crossing of No. 2 Sideroad west of the existing office. Extraction of Phase 1 would see an approximately 100 m wide working face advanced in a westerly direction along the north side of the proposed extension, as shown in Figure 4. Phases 2 and 3 would see the entire west side of the extension extracted in a southerly direction before proceeding east along the south boundary.

Extraction of Phase 4 would be carried out in a northerly direction which would complete extraction of the west half of the proposed extension. Phases 5a and 5b would be carried out in an easterly direction in the southeast corner of the extension while the remainder of the property would be extracted as Phase 6 in a northerly direction, as seen in Figure 4.

4.0 IMPACT IDENTIFICATION

The environmental effects most often associated with blasting operations are ground vibrations and air concussion.

The intensity of ground vibrations, which is an elastic effect measured in units of peak particle velocity, is defined as the speed of excitation of particles within the ground resulting from vibratory motion. For the purposes of this report, peak particle velocity is measured in mm/s.

While ground vibration is an elastic effect, one must also consider the plastic or non-elastic effect produced locally by each detonation when assessing the effects on the bedrock strata and local water wells. The detonation of an explosive produces a very rapid and dramatic increase in volume due to the conversion of the explosive from a solid to a gaseous state. When this occurs within the confines of a borehole it has the following effect:

- The bedrock in the area immediately adjacent to the explosive product is crushed.
- As the energy from the detonation radiates outward from the borehole, the bedrock between the borehole and quarried face becomes fragmented and is displaced while the bedrock behind the borehole is fractured.
- Energy not used in the fracturing and displacement of the bedrock dissipates in the form of ground vibrations, sound and airblast. This energy attenuates rapidly from the blast site due to geometric spreading and natural damping.

Air concussion, or air vibrations, is a pressure wave traveling through the air produced by the direct action of the explosive on air or the indirect action of a confining material subjected to explosive loading. Air vibrations from surface blasting operations consist primarily of acoustic energy below 20 Hz, where human hearing is less acute (Siskind et al., 1980), while noise is that portion of the spectrum of the air vibration lying within the audible range from 20 to 2000 Hz. It is the lower frequency component (below 20 Hz) of air concussion, that which is less audible, that is of interest as it is often the source of secondary rattling and shaking within a structure. For the purposes of this report, air vibration is measured as decibels in the Linear or Unweighted mode (dBL). This differs from noise (above 20 Hz) which is measured in dBA.

Both ground and air vibration effects produced at private structures adjacent to surface or underground mining operations are subject to guidelines contained in Noise Pollution Control (NPC) publication 119 of the Model Municipal Noise Control By-Law, dated August, 1978, published by the Ontario Ministry of Environment. Under conditions where monitoring of the blasting operations is routinely carried out, as it is at the Nelson Quarry, the recommended ground and air vibration limitations at the nearest private structure would be 12.5 mm/s and 128 dBL respectively. A copy of Publication NPC 119 is reproduced in Appendix A.

5.0 QUARRY BLAST MONITORING

As part of this study, peak ground and air vibration levels were monitored during several typical quarry production blasts in the existing quarry at progressively increasing distances from the blast site. The blasts occurred both on the south and east faces of the quarry. Instrumentation consisted of Instantel DS-077 Minimates, Minimate Pluses and DS-477 Blastmates. These instruments measure and record ground vibration velocities in each of three orthogonal directions, as well as simultaneously recording air vibration levels. Instrumentation was generally set up in a line at distances ranging from about 100 to 600 m from the blast site. Specific instrument and blast locations were established using a Garmin GPS electronic navigation aid (NAVAID) to determine accurate distances between the blast and receptors.

5.1 Attenuation Characteristics

The rate at which ground vibrations attenuate or decrease with increased distance from a blast source depends on a variety of conditions, including the type and condition of the bedrock being blasted, depth and composition of the earth covering deposits (soil), and the general topography. Air vibration effects are less affected by these factors, being more influenced by the prevailing weather conditions at the time of the blast.

The following relationships were established from the blast monitoring results.

5.1.1 Ground Vibrations

The ground vibration attenuation characteristics established for the Nelson Quarry is presented in Figure 5 as a plot of the peak particle velocity against the Scaled Distance. Scaled Distance is defined as:

$$\text{Scaled Distance (SD)} = D/\sqrt{W}$$

where D = distance (m) between the blast and receptor

W = maximum weight of explosive (kg) detonated per delay period

As seen in Figure 5 the collection of points defining the rate of decay for the ground vibrations exhibits a degree of scatter that is inherent in all Scaled Distance plots. Factors responsible for these variations include the geologic conditions of the bedrock (type and structure), different wave types, errors in blast initiation timing, differences between types of explosives, degree of confinement, and differences in blast efficiencies.

The equation for the 95% regression line developed in Figure 5 can be expressed as:

$$PPV = 896(SD)^{-1.32}$$

where PPV = Peak Particle Velocity (mm/s)

SD = Scaled Distance (m/(kg^{0.5}))

The calculated Scaled Distance for a peak ground vibration level of 12.5 mm/s would equal 25.5 m/(kg^{0.5}). The purpose of this equation is not so much to predict what a given vibration level would be at a particular location for a given blast, but to indicate the probability that the peak vibration would fall below the level indicated by the equation for a given distance and maximum explosive weight. The equation is therefore a useful blast design tool in establishing maximum explosive charge weights per delay for various distances from a blast site for a given maximum ground vibration level.

5.1.2 Air Vibrations

Cube root scaling was used in establishing the air vibration decay characteristics as given in the following relationship:

Scaled Distance (SD) = $D/\sqrt[3]{W}$, where D and W are defined as previously described.

Figure 6 shows the Scaled Distance air vibration plot, which exhibits considerably more scatter and has a typically poorer correlation than that seen with the ground vibration results. This is primarily due to variable weather conditions during each blast, which are entirely independent of the blasting operations. Other factors influencing air vibration distribution from a blast include the length of collar and type of stemming material used, differences in explosive types and variations in burden distance.

The 95% regression curve given in Figure 6 can be expressed as:

$$APL = 181(SD)^{-0.0867}$$

where SD = as defined above

APL = air pressure level (dBL)

The calculated Scaled Distance for a peak air vibration level of 128 dBL would equal 53.0 m/(kg^{0.33}). The variability in the plot suggests that it is less reliable as a tool for guiding blast design.

Site specific Scaled Distance plots are commonly used as a blast design tool since peak vibration levels can be reasonably predicted at specified distances from a blast site. Based on the 95%

regression equations given in Figures 5 and 6, Table 2 shows the maximum suggested explosive loads for various distances from the blast site based on the provincial guideline limits of 12.5 mm/s and 128 dBL discussed previously. It can be seen that the ground vibration limit of 12.5 mm/s becomes the more restrictive guideline when determining maximum explosive loads beyond a distance of about 225 m for the quarry's blasting operations.

6.0 IMPACT ASSESSMENT

6.1 Compliance with NPC 119

It is evident from the regression equations discussed in Section 5 that the distance between the blast and the receptor and the amount of explosive detonated per delay period are the principal parameters in controlling ground and air vibration effects. The maximum explosive loads given in Table 2 for limiting peak ground and air vibration levels to 12.5 mm/s and 128 dBL respectively, indicate that the provincial guidelines may be complied with for all blasting beyond a distance of about 200 m from adjacent private residential properties. This represents a majority of the proposed extension and is based on a maximum explosive weight per delay of about 60 kg. When blasting approaches to within about 200 m of adjacent private residences, it may become necessary to reduce the maximum explosive weight detonated per delay period within the blast. Any one or combination of the following operations would achieve this:

1. Reducing the borehole diameter with a corresponding reduction in the drill pattern.
2. Introduce additional decked charges within each borehole, as illustrated on Figure 3.
3. Reduce the borehole length (depth) by reducing the bench height.

For example, a reduction in the borehole diameter from 127 mm to 76 mm would effectively reduce the explosive column weight per hole by about 65%. Decking the explosive column could further reduce the explosive column weight by an additional 50%. Additional decking and reductions in bench heights, as identified above, could achieve further reductions in maximum explosive weights.

As it is the intention of the Nelson quarry to continue monitoring all blasting operations, the attenuation curves discussed previously would be used in conjunction with the monitoring data collected at adjacent properties to dictate when changes to the blast procedure become necessary within the proposed extension. Although a reduction in the maximum instantaneous explosive load is anticipated as blasting approaches the residences to the east and west, the ground and air vibration guideline limits contained within NPC 119 would continue to be maintained.

6.2 Repeated Vibration Effects on Structures

Blast vibrations characteristically produce temporary transient strains within the various materials that makeup a residential structure. These strains would typically have durations of no more than one or two seconds for each blast as the vibration passed the structure. In addition to these temporary strains, Table 3 shows the strain levels produced in a household by changes in temperature and humidity (environmental changes), as well as those produced by regular household activities (Dowding, 1985), which occur on a recurring and often frequent basis. These strain levels are compared to equivalent levels of ground vibration produced from blasting

operations. It is evident from Table 3 that routine household activities and environmental changes can at times produce strains within a structure that are well in excess of those produced by blasting.

Several studies have also been carried out to look at the long-term effects of repeated blasting on structures (Stagg et al, 1984, Siskind et al, 1980). These studies concluded that repeated blasting over several decades, producing peak vibration levels well in excess of the provincial guideline limit, were required to cause cosmetic threshold cracking to occur. By ensuring that blasting continues to remain within the provincial guideline limits, there would not be any noticeable cumulative effect associated with the blasting operations within the extension area.

6.3 Effects on Bedrock and Water Wells

As discussed previously, under typical blasting conditions stresses introduced into the bedrock by the explosive detonation and the accompanying gas pressures create and extend fractures within the bedrock around each borehole. Fracture development is usually limited to the equivalent distance of about 20 times the borehole diameter. In the case of the blast procedures expected for the proposed extension, this would equate to about two to three metres for a 114 mm diameter hole. The gas pressures within the hole may extend micro-cracks or existing natural discontinuities within the bedrock, such as joints or bedding planes, beyond this distance.

Studies on crack development within bedrock from blast detonations (Keil et al., 1977) indicate that peak ground vibration levels of 300 to 600 mm/s are required to create micro-cracks or open existing discontinuities. Our own experience within the limestone of Southern Ontario indicates that such values would not be anticipated beyond a distance of about 10 to 20 m from the blast site, depending on such parameters as drill hole diameter and the type of explosive product. It is evident therefore that the creation or extension of fractures within the bedrock would remain confined to an area immediately around the blast site.

Several studies have been carried out to investigate the effects of blasting on ground water wells (Froedge, 1983). These studies have concluded that:

1. When blast induced ground vibrations are less than about 25 mm/s maximum resultant particle velocity, the response of the well is limited to a slight temporary variation in water level on the order of 3 to 6 cm either up or down. The specific capacity of the water well is unchanged based on drawdown tests.
2. Vibration measurements made at the surface and at the bottom of the observation wells indicate the vibration levels are always lower at the bottom of the well.
3. All of the data collected indicates that a ground vibration limit of 50 mm/s peak particle velocity is adequate to protect the wells from any significant damage. There is a possibility that temporary turbidity may be caused at lower levels periodically, although not at any constant threshold level.

The research consistently indicates that blast vibrations below 25 mm/s should have no adverse effects on nearby wells. As the maximum provincial guideline vibration limitation at the nearest residence is only half of this value, at 12.5 mm/s, the ground vibrations produced from the quarry's blasting operations within the proposed extension area would have no effect on the integrity of neighbouring water wells.

7.0 CONCLUSIONS

Based on the foregoing considerations, it is our opinion that blasting operations may be readily performed within the limits of the proposed extension of Nelson Quarry Company quarry in compliance with the current quarry blasting guidelines published by the Ministry of Environment. All blasting and blast monitoring would occur in accordance with the Aggregate Resources Act prescribed conditions in order to ensure compliance with the provincial guidelines.

GOLDER ASSOCIATES LTD.



Marcus V. van Bers, P. Eng.
Associate

MVVB/AC/ms/co

N:\ACTIVE\2002\1200\021-1238 - nelson aggreg-extension-burlington\report impact assessment\021-1238 09may06 impact assessment (2).doc

REFERENCES

Dowding, C. H., *Blast Vibration Monitoring and Control*, 1985.

Froedge, D. T. , *Blasting Effects on Water Wells*, Proc. Ninth Conf. on Explosives and Blasting Technique, Int. Soc. of Explosives Engineers, 1983.

Keil, L. D., Burgess, A. S., Nielson, N. M., Koropatrik, A., *Blast Vibration Monitoring of Rock Excavation*, Canadian Geotechnical Journal, Volume 14, 1977.

Ministry of Environment, Model Municipal Noise Control By-Law, Final Report, August, 1978.

Siskind, D. E., Stagg, M. S., Kopp, J. W., Dowding, C. H., *Structure Response and Damage Produced by Ground Vibration From Surface Mine Blasting*, U.S.B.M. Report RI8507, 1980.

Stagg, M. S., Siskind, D. E., Stevens, M. G., Dowding, C. H., *Effects of Repeated Blasting on a Wood-Frame House*, U.S.B.M. Report RI8896, 1984.

TABLES

TABLE 1
Existing Blast Details for Nelson Quarry Company

PARAMETER	NELSON QUARRY
Bench (face) height (m)	19 - 26
Drill hole pattern (m)	2.4 x 2.4 – 4.3 x 4.3
Drill hole diameter (mm)	76 – 114
Sub-drill depth (m)	0.6
Collar length (m)	1.7 – 3.0
Holes per blast	7 – 40
Explosive product(s) used	Emulsion/ANFO blend
Initiation system	Electric, Electronic
Delay timing (ms)	25ms (electric), 13ms (electronic)
Maximum explosive weight per delay period (kg)	30 – 279

Note: See Figure 3 for a description of blasting terms.

TABLE 2
Maximum Explosive Loads vs Distance
for 12.5 mm/s and 128 dBL

Distance (m)	PPV = 12.5 mm/s SD = 25.5 kg/m ^{0.5}	INL = 128 dBL SD = 53.0 kg/m ^{0.33}
100	15	7
150	35	23
200	61	54
250	96	105
300	138	181
400	246	429
500	384	838
600	553	1449

Note: See Section 5 of accompanying report.

TABLE 3

Strain Levels Induced by Household Activities, Environmental Changes and Blasting

Loading Phenomena	Site ^a	Microstrain Induced by Phenomena ($\mu\text{in.in.}$)	Corresponding Blast Vibration Level ^b (mm/s)
Daily environmental changes	K ₁	149	30.0
	K ₂	385	76.0
Household activities:			
1. Walking	S ₂	9.1	0.8
2. Heel drops	S ₂	16.0	0.8
3. Jumping	S ₂	37.3	7.1
4. Door slams	S ₁	48.8	12.7
5. Pounding nails	S ₁₂	88.7	22.4

^a K₁ and K₂ were placed across a taped joint between two sheets of gypsum wallboard.

^b Blast equivalent based on envelope line of strain vs ground vibration.

Source: Dowding (1985)

FIGURES

KEY LOCATION PLAN NELSON QUARRY

FIGURE 1



Date: **SEPTEMBER 2004**

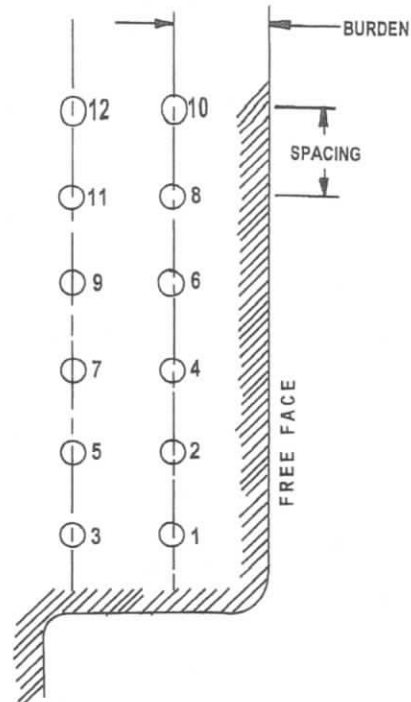
Project: **021-1238**

Golder Associates

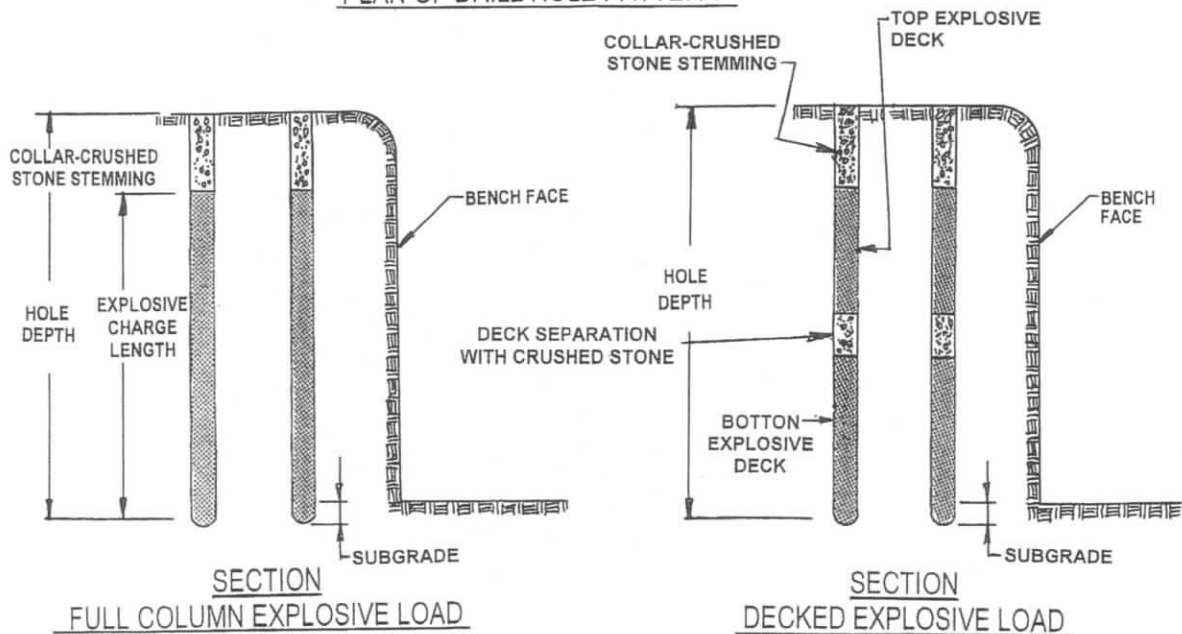
Drawn: **RJ**

Chkd: _____

NUMBERS SHOW SHORT PERIOD DELAY	EXAMPLE OF FIRING TIMES (MILLISECONDS)
PERIOD 1	25
PERIOD 2	50
PERIOD 3	75
PERIOD 4	100
PERIOD 5	125



PLAN OF DRILL HOLE PATTERN



Date: SEPTEMBER 2004

Project: 021-1238

Golder Associates

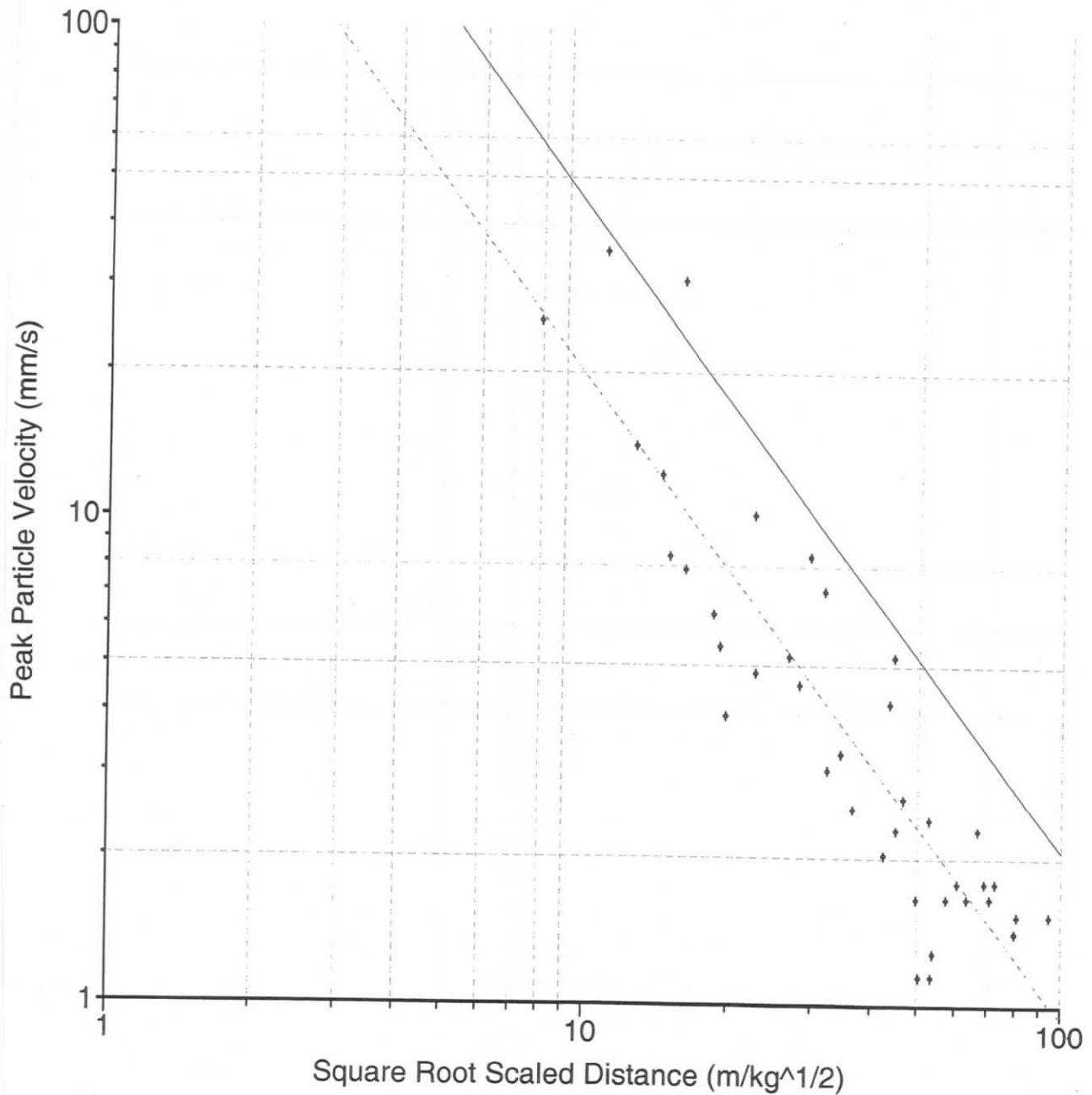
Drawn: RJ

Chkd:

NELSON QUARRY GROUND VIBRATION
ATTENUATION CURVE

FIGURE 5

Coefficient of Determination = 0.811 Standard Deviation = 0.172



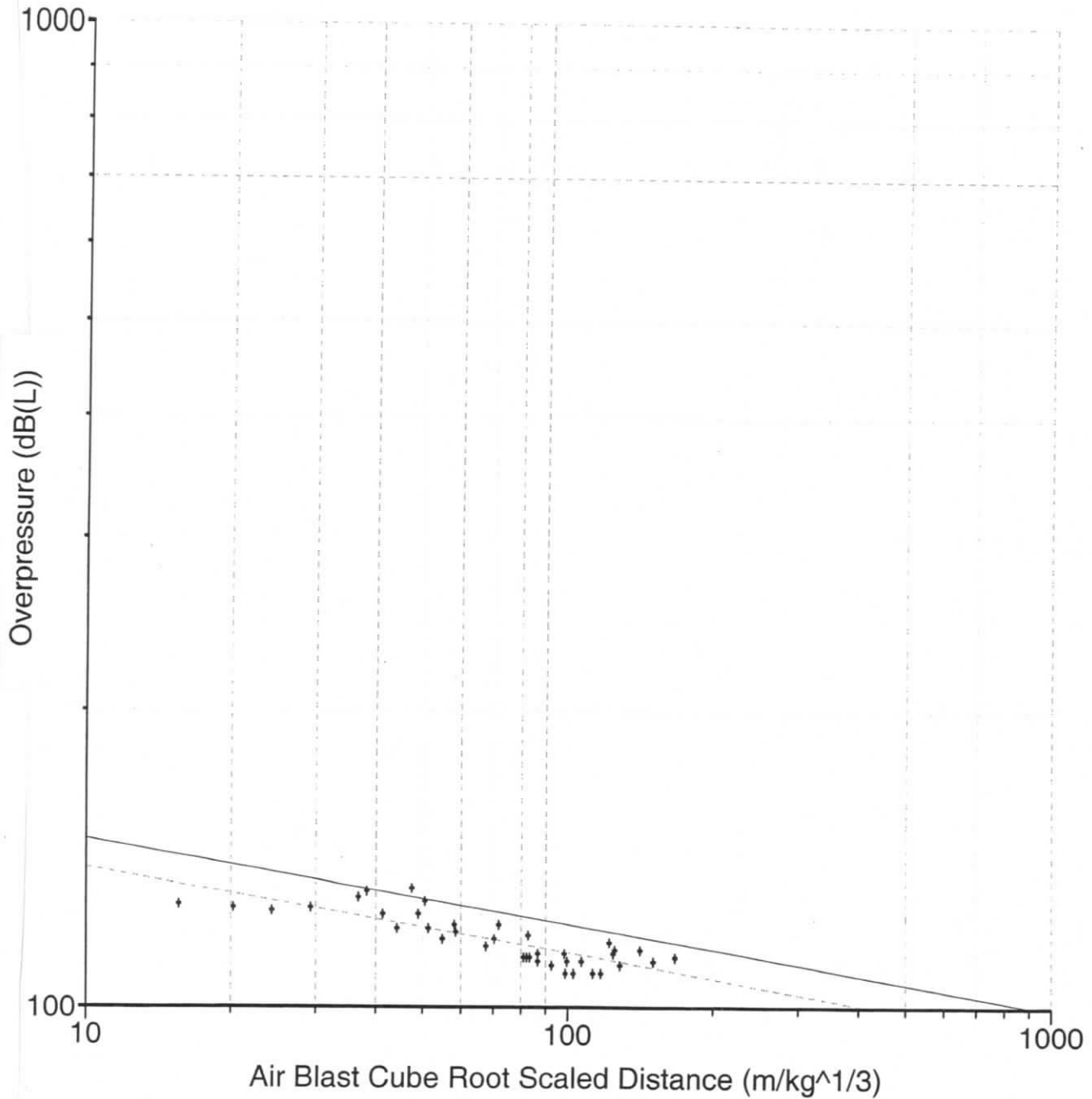
Date.....Aug 29/04.....
Project...021-1238.....

Drawn.....*mmB*.....
Chkd.....*mmB*.....

NELSON QUARRY AIR VIBRATION
ATTENUATION CURVE

FIGURE 6

Coefficient of Determination = 0.677 Standard Deviation = 0.0145



Date.....Aug 29/04.....
Project...021-1238.....

Drawn.....*MMB*.....
Chkd.....*MMB*.....

APPENDIX A
PUBLICATION NPC 119

PUBLICATION NPC-119

Blasting

Scope

This Publication refers to limits on sound (concussion) and vibration due to blasting operations.

Technical Definitions

The technical terms used in this Publication are defined in Publication NPC-101 – Technical Definitions.

Measurement Procedures

All measurements of peak pressure level and vibration velocity shall be made in accordance with the “Procedure for Measurement of Sound and Vibration due to Blasting Operations” set out in Publication NPC-103 – Procedures, section 5.

Concussion – Cautionary Limit

Subject to section 5 the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 120 dB.

Concussion – Peak Pressure Level Limit

If the person in charge of a blasting operation carries out routine monitoring of the peak pressure level, the peak pressure level limit for concussion resulting from blasting operations in a mine or quarry is 128 dB.

Vibration – Cautionary Limit

Subject to section 7, the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.00 cm/s.

Vibration – Peak Particle Velocity Limit

If the person in charge of a blasting operation carries out routine monitoring of the vibration the peak particle velocity limit for vibration resulting from blasting operations in a mine or quarry is 1.25 cm/s.

APPENDIX B
NEW RESIDENCE RECEPTOR LOCATION

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone 905-567-4444
Fax 905-567-6561



December 13, 2004

021-1238

Nelson Aggregate Co.
P.O. Box 1070
Burlington, Ontario
L7R 4L8

Attention: Mr. Tom Palko
Property Manager

**RE: BLASTING IMPACT ASSESSMENT PROPOSED NELSON AGGREGATE
NELSON QUARRY EXTENSION NEW RESIDENCE RECEPTOR LOCATION**

Dear Mr. Palko:

Further to our report entitled "Blasting Impact Assessment Proposed Nelson Aggregate Nelson Quarry Extension" dated September, 2004, it is our understanding that the closest residential receptor to the proposed Nelson Aggregate Nelson quarry extension has now been identified as the residence at 2416 No. 2 Sideroad, located in the northeast corner of the proposed extraction area. The residence and ancillary buildings at 2416 No. 2 Sideroad are located a minimum of 290 m from the Phase 1 extraction area and 370 m from the Phase 5B extraction area.

As stated in Section 6.0 Impact Assessment of the report identified above, the recommended Ontario provincial ground and air vibration guideline limits of 12.5 mm/s and 128 dBL respectively, may be complied with for all blasting beyond a distance of about 200 m. This indicates that the extraction of Phases 1 through 5B and part of Phase 6 may be carried out without any changes to the quarry's existing blasting procedures.



It is our opinion that blasting operations may be carried out within the proposed extension area in compliance with the current quarry blasting guidelines while the residence at 2416 No. 2 Sideroad is occupied. If you have any additional questions please do not hesitate to contact me.

Yours truly,

GOLDER ASSOCIATES LTD.

Marcus V. van Bers, P.Eng.
Associate

MVB/co
cc: Mr. Brian Zeman, MHBC Planning

n:\active\2002\1200\021-1238 - nelson aggreg-extension-burlington\reports\021-1238 ltr 04dec13 blasting impact assess-amendment.doc