## Derkson, Debra TRAN:EX

From: Sent: To: Cc: Subject: Bowen, Blair TRAN:EX Sunday, November 14, 2004 10:20 AM Ahola, Rob TRAN:EX; 'Gord. Baglier (E-mail)'; Gohl, Ed E TRAN:EX 'Ryan Tones (E-mail)' FW: Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

#### Gentlemen

Here is an additional e-mail received saturday night at 8:32. As we did not blast saturday and it was my understanding that Scott Parker reviewed S22 property on Saturday, it leaves me somewhat confused about timeline. Therefore, prior substantiating S22 claims it is imperative that the drilling program and blast schedule be detailed for what has happened to date and for future dates (specifically as per Rob Ahola 's request as indicated below).

How much drilling will occur at night?

How many blasts will occur at night?

How many stat holidays will you work?

His issues seam to be summed up as:

- 1) Surface noise from down the creek channel.
- 2) Vibration of the house foundation.
- 3) Working on a Stat Holiday.

4) Working in non business hours.

Can 1) and 2) be substantiated?

Will 3) reoccur?

4) is difficult but if 1) and 2) are within reasonable limits them 4) should go away.

My understanding is that PKS is set to blast at 10 am Monday morning. Look forward to seeing everybody bright and early Monday morning.

1

Blair Bowen, Project Coordinator Sea-to-Sky Highway Improvement Project (604) 818-3895 blair.bowen@gems8.gov.bc.ca

> Page 1 TRA-2012-00300

----Original Message----From: S22 Sent: Saturday, November 13, 2004 8:32 PM To: <u>colin.taylor@kiewit.ca</u>; Bowen, Blair TRAN:EX Subject: Drilling and Blasting - Sea to Ski Highway at Montizambert Creek Importance: High

To: Colin Taylor and Blair Bowen

From:

Subject: Drilling S22

I am extremely distressed about being woken up on a Statutory Holiday by your drilling (November 11). The noise funnels and amplifies down the creek bed as well permeating throughout the whole house from the vibration through the bedrock the house is sitting on. The resultant noise in the house is intolerable.

S22

S22 drilling and blasting during non business hours and

S22

I am demanding a cease and desist of all S22

S22

November 13, 2004

s22 and in the morning by blasting and drilling. Aside from another s22 l also found more damage to the house. The blasting is totally out of control. An 8 in rock hit another part of the roof, crushing it. I did a survey of the yard and found 10 rocks ranging in size from ½" to six inches in 120 square feet of grass. Based on this average, I estimate that over 330 rocks have hit the roof. I found more rocks on the roof, but most would have bounced or rolled off after leaving a chip, ding or scratch in the roof to rust later. Estimating the trajectory of the rock to go upward from the blast zone before plummeting on the house and yard, the rock would be falling many hundreds of feet. This can not go on. Some of the rocks are big enough traveling fast enough to go though a skylight or window.

S22

2

## Derkson, Debra TRAN:EX

From: Sent: To: Subject: Gord Baglier [gord.baglier@kiewit.ca] Thursday, November 18, 2004 8:10 AM Ahola, Rob TRAN:EX RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

Rob:

Notices seem to be of confusion. I think schedule changes make it difficult. A board is being put up at the mail boxes. Durations should be put on not specific times.

Seismograph was not put on the last blast as we are not picking up vibration. We will put it back as public queries requires.

#6 clearing I will try to find out???

S22

Blasting mats and matting was addressed very seriously. I can assure you it is being done correctly. We also brought more in.

From: Ahola, Rob TRAN:EX [mailto:Rob.Ahola@gems1.gov.bc.ca] Sent: Wednesday, November 17, 2004 10:56 AM To: 'Gord Baglier (E-mail)'; Ryan Tones; 'Colin Taylor (E-mail)'; Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX Subject: FW: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek Importance: High

Gord,

Can you find out if:

- Notices were/are being issued to residents,

- The seismograph registered any large vibration S22
- Not sure which property is #6 or what clearing was done
- Not sure what problem he is referring to, the first blast, or does he think last night was a problem?
- Regarding blasting mats I thought you were producing other mats

Rob

----Original Message----From: S22 Sent: Wednesday, November 17, 2004 10:20 AM To: <u>colin.taylor@kiewit.ca</u>; Bowen, Blair TRAN:EX; Ahola, Rob TRAN:EX; Gohl, Ed E TRAN:EX Subject: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek Importance: High

Gentlemen:

Where are we on restricting the work hours of the construction? S22 from the construction work done outside of normal business hours. Rob had promised that all the residents would be warned in advance of the biasts and that there would be a posting of the blast schedule. This has not happened. Yesterday I saw no such notice on the mail box and despite talking to Eric Oddy and Grayson Doyle for an hour last night from 8 to 9, no one told me that there was going to be a sizable blast at 9:47 pm. The whole house shock from the blast, S22 1

S22

S22

Rob also said in a different meeting that there would be no trees cut down. west of the highway, S22 This was part of the

agreement with the community, which has been broken.

· ·

It is very clear from my Eric/Grayson meeting last night that root cause of the blasting problems has NOT been determined. They related to me some of the contributory circumstances, but root cause was not among them. Obviously without an understanding of the root cause, this accident will happen again to everyone's detriment. Please forward to me a copy of the report completed by Grayson's supervising P.Eng, on the accident, its root cause, the change to the safety procedures and any other pertinent details to ensure that this does not happen again. Rob had said that the blasting contractor has doubled the number of mats going forward and the blasting contractor says that there is no such plan.

Thank you.

S22

-----Original Message-----

S22

#### From:

Sent: Friday, November 19, 2004 5:40 PM To: Ahola, Rob TRAN:EX; colin.taylor@kiewit.ca; Bowen, Blair TRAN:EX; Gohl, Ed E TRAN:EX; Gord Baglier (E-mail); ryan.tones@kiewit.ca Cc: Hyde, Rick TRAN:EX Subject: RE: November 16, Drilling and Blacting - Sea to Ski Highway at Montizembert Creek

Subject: RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

Rob:

Thank you for your response. Please forward a copy of the P.Eng.'s report analyzing the blast accident to me. Your causal info is totally unrelated to what I was told by the head of the blasting company and the Kiewit engineer, who both knew nothing of new mats, a couple of days ago. I am not sure exactly what property the trees were on, but I am sure the felling was recent and they were on the west side of the highway. Any noise abatement is good, but to put the noise in perspective, the 10 pm blast the other night caught me totally by surprise. I did not hear any of the warning air horns, before or after. (I was S22 The blasts and drilling however are very evident. Backup tones are not audible in the house either, but the scraping of the bucket and its digging into rock are very intrusive. I am telling you, S22

from blasting, drilling and moving rock. The changes you speak of are Band-Aids on a much bigger issue. What are you doing about restricting the Noisy work to 8am to 4pm on week days? Thank you for the sign. An improvement might be to use black ink which is much easier to see in the night, than the red being used.

With enough sleep I may have some patience, but with out the former, I have none of the latter.

S22

#### From: Ahola, Rob TRAN:EX [mailto:Rob.Ahola@gems1.gov.bc.ca] Sent: Friday, November 19, 2004 2:16 PM

**To:** S22 colin.taylor@kiewit.ca; Bowen, Blair TRAN:EX; Gohl, Ed E TRAN:EX; 'Gord Baglier (E-mail)'; 'ryan.tones@kiewit.ca'

Cc: Hyde, Rick TRAN:EX

Subject: RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

S22

I apologize that we did not get back to you sconer on your email. To answer your questions, the following steps have been taken, or are being implemented.

- A notice board has been implemented that is to be updated daily. It is located by the mail boxes at the entrance.
- We did not remove any trees on the # 6 property. We are determining if trees were removed on the MoT right of way adjacent to the # 6 property.
- The root cause of the initial blast was due to under charged holes not being able to dissipate energy into the rock, thereby transferring energy to the surface mats.
- Additional mats have been received and implemented in subsequent blasts.

Subsequent blasts have not produced any fly rock.

Additional steps to mitigate the construction impacts are being initiated by Kiewit as follows.

- Applied to the Workers' Compensation Board for permission to eliminate the use of backup alarms on construction vehicles for night work.
- Applied to the WCB for permission to eliminate the use of air horns for blast signals at night.
- Instructed crews to minimize the use of engine compression retarders.

 All equipment is checked by mechanics to ensure noise-reduction devices are in good working condition.

A noise consultant has been retained to analyze noise levels.

We appreciate your patience and we will continue to try and reduce impacts as construction proceeds.

#### Rob Ahola

Sea to Sky Highway Improvement Project p: 604.605.5943 f: 604.605.5936 c: 604.816.4779 e: rob.ahola@gems1.gov.bc.ca www.seatoskyimprovements.ca

-----Original Message-----

From: S22 Sent: Friday, November 19, 2004 9:20 AM

To: colin.taylor@kiewit.ca; Bowen, Blair TRAN:EX; Ahola, Rob TRAN:EX; Gohl, Ed E TRAN:EX

Subject: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

Importance: High

Rob Ahola: S22 I have not had any responses to any of my emails. Please have all my questions from my emails and discussions answered by 4 pm today to my email address.

S22

#### Gentlemen:

Where are we on restricting the work hours of the construction? S22 from the construction work done outside of normal business hours. Rob had promised that all the residents would be warned in advance of the blasts and that there would be a posting of the blast schedule. This has not happened. Yesterday I saw no such notice on the mail box and despite talking to Eric Oddy and Grayson Doyle for an hour last night from 8 to 9, no one told me that there was going to be a sizable blast at 9:47 pm. The whole house shook from the blast, S22 and knocked over a clipboard S22

Rob also said in a different meeting that there would be no trees cut down, west of the highway, S22

S22 This was part of the agreement with the community, which has been broken.

It is very clear from my Eric/Grayson meeting last night that root cause of the blasting problems has NOT been determined. They related to me some of the contributory circumstances, but root cause was not among them. Obviously without an understanding of the root cause, this accident will happen again to everyone's detriment. Please forward to me a copy of the report completed by Grayson's supervising P.Eng, on the accident, its root cause, the change to the safety procedures and any other pertinent details to ensure that this does not happen again. Rob had said that the blasting contractor has doubled the number of mats going forward and the blasting contractor says that there is no such plan.

Thank you.

S22

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From:Ahola, Rob TRAN:EXSent:Sunday, November 21, 2004 10:23 AMTo:Bowen, Blair TRAN:EX; Gohl, Ed E TRAN:EX; Gord. Baglier (E-mail)Cc:Hyde, Rick TRAN:EXSubject:RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

Gord,

As suggested by Blair perhaps Scott and yourself discuss the safety aspects of the blasting with S22 . A copy of the report is up to you but the issues of the first blast, matting, air horns, etc could be discussed so he has the latest info in that regard.

Rob

-----Original Message-----From: Bowen, Blair TRAN:EX Sent: Sat 11/20/2004 6:10 AM To: Ahola, Rob TRAN:EX; Gohl, Ed E TRAN:EX; Gord. Baglier (E-mail) Cc: Hyde, Rick TRAN:EX Subject: RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

Interesting,

Have we done any blasts without airhorns yet? and is he is reffering to blast that took place at 9:47 the other night (November 15), if so can PKS confirm that these were done with airhorn.

It also appears that he does not have any real information/knowledge about trees and S22

Also PKS should consider limiting who is addressing the public and make it a single source with a single message. When I spoke with Eric Oddy he said that they did not discuss mats (you should confirm this with Grayson). Either way you see what happens when there is multiple information sources.

As for the P. Eng report I would suggest that Scott Parker and Gord sit and discuss what happened with him for ten minutes (I am sure PKS will be reluctant to provide a written report).

Oh ya and switch to black ink or some sort of flourescent that glows in the dark.

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-----Original Message-----From: S22 Sent: Friday, November 19, 2004 5:40 PM To: Ahola, Rob TRAN:EX; colin.taylor@kiewit.ca; Bowen, Blair TRAN:EX; Gohl, Ed E TRAN:EX; Gord Baglier (E-mail); ryan.tones@kiewit.ca Cc: Hyde, Rick TRAN:EX

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## Derkson, Debra TRAN:EX

 From:
 Ahola, Rob TRAN:EX

 Sent:
 Monday, November 22, 2004 5:11 PM

 To:
 S22
 '; 'colin.taylor@kiewit.ca'; Bowen, Blair TRAN:EX; Gohl, Ed E TRAN:EX; 'Gord Baglier (E-mail)'; 'ryan.tones@kiewit.ca'; Dash, Evan TRAN:EX

 Cc:
 Hyde, Rick TRAN:EX

 Subject:
 RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

S22

I apologize for the confusion about the additional blasting mats. I gather that the members of the blasting and construction crew you spoke with hadn't been told that additional blasting mats were ordered. Gord Baglier arranged for securing additional mats after the November 10 blast, and they have been used since November 18.

I will provide a summary report to you, or have Kiewit's blast consultant discuss the report and changes in safety procedures with you. We are confident that the changes being made will ensure that there are no further incidents of this kind. Air horns have been in use continuously and will be used until WCB provides a variance.

Regarding our construction schedule, we are unable to adjust it to restrict "noisy work" to the hours between 8 am to 4 pm, as you requested, in order to have this section completed on time. Consequently, the current work of drilling, rock removal and rock placement will continue for the next three to four weeks and potentially a few weeks required in the spring. Once these activities have been completed in the spring, we will still need to place gravel and begin the actual road construction. Although this will generate some noise, it is quieter work than the work we are currently doing.

Finally, let me assure you that we will continue to mitigate noise to the highest degree possible, while striving to complete this phase of the work as quickly as possible.

#### **Rob Ahola**

Sea to Sky Highway Improvement Project p: 604.605.5943 f: 604.605.5936 c: 604.816.4779 e: rob.ahola@gems1.gov.bc.ca www.seatoskyimprovements.ca

> -----Original Message-----From: S22 Sent: Friday, November 19, 2004 5:40 PM To: Ahola, Rob TRAN:EX; colin.taylor@kiewit.ca; Bowen, Blair TRAN:EX; Gohl, Ed E TRAN:EX; Gord Baglier (Email); ryan.tones@kiewit.ca Cc: Hyde, Rick TRAN:EX Subject: RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

Rob:

Thank you for your response. Please forward a copy of the P.Eng.'s report analyzing the blast accident to me. Your causal info is totally unrelated to what I was told by the head of the blasting company and the Kiewit engineer, who both knew nothing of new mats, a couple of days ago. I am not sure exactly what property the trees were on, but I am sure the felling was recent and they were on the west side of the highway. Any noise abatement is good, but to put the noise in perspective, the 10 pm blast the other night caught me totally by surprise. I did not hear any of the warning air horns, before or after.

S22 The blasts and drilling however are very evident. Backup tones are not audible in the house either, but the scraping of the bucket and its digging into rock are very intrusive. I am telling you, S22 rom blasting, drilling and moving rock. The changes you speak of are Band-Aids on a much bigger issue. What are

Dana 0

## Derkson, Debra TRAN:EX

From:Ahola, Rob TRAN:EXSent:Monday, November 22, 2004 3:38 PMTo:Hyde, Rick TRAN:EXSubject:RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert CreekAttachments:DraftEmail.doc

Attached are some small revisions. Still need to confirm that we will not be sending out the report.

Rob

-----Original Message-----From: Hyde, Rick TRAN:EX Sent: Monday, November 22, 2004 11:51 AM To: Ahola, Rob TRAN:EX Subject: RE: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

This looks good overall. However, I suggest the following changes, which I have highlighted inred.S22however, I'd be interested in your comments.Thanks....Rick

S22

I apologize for the confusion about the additional blasting mats. I gather that the members of the construction crew you spoke with hadn't been told that additional blasting mats were being used. Gord Baglier arranged for the use of the additional mats after the November 16 blast, and they have been used since that date.

I will have Kiewit discuss the Grayson report and changes in safety procedures with you. We are confident that the changes being made will ensure that there are no further incidents of this kind.

Regarding our construction schedule, we are unable to adjust it to restrict "noisy work" to the hours between 8 am to 4 pm, as you requested, in order to have this section completed on time. Consequently, the current work of drilling, rock removal and rock placement will continue for the next two to three weeks. Once these activities have been completed, we will still need to place gravel and begin the actual road construction. Although this will generate some noise, it is quieter work than the work we are currently doing.

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Finally, let me assure you that will continue to mitigate noise the highest degree possible, while striving to complete this phase of the work as guickly as possible.

----Original Message----From: Ahola, Rob TRAN:EX Sent: Monday, November 22, 2004 10:50 AM To: Hyde, Rick TRAN:EX Cc: Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX Subject: FW: November 16 - Drilling and Blasting - Sea to Ski Highway at Montizambert Creek

Rick,

Here is a draft of the email to S22

S22

It appears the information on the additional blasting mats was not communicated to the the individuals you spoke with. Gord Baglier initiated the production of the mats after the November 16 blast, and they were utilized on blasts last week.

I will either have Kiewit provide the report to you or have them discuss the safety issues with you. I can assure you that every effort is being made to ensure that the blasting operations are safe.

On the much larger issue of restricting noisy work to 8 am to 4 pm, we are obligated to proceed outside these hours in order to maintain schedule. The work we will continue with over the next few weeks into December and potentially again in the spring will be the noisier drilling, blasting and rock placement. Once we are complete these activities the noise levels will be reduced. There will still be work required for placing gravel and actual road construction which will generate noise, but not to the extent you are currently experiencing.

We will continue to mitigate noise as best we can while trying to complete the work as guickly as possible.

Ed, do we have a copy of Scott's report where we can quote what steps have been taken? Did Ryan/Gord say he would provide it to S22 ? We are not obligated to provide it, however can we say that the incident was referred to WCB as required and they are satisfied wit the steps taken? I don't really want to send him over to WCB looking for info.

Rob

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S22

I apologize for the confusion about the additional blasting mats. I gather that the members of the <u>blasting and</u> construction crew you spoke with hadn't been told that additional blasting mats were <u>being used</u>ordered. Gord Baglier arranged for the use of the additional mats after the November <u>16-10</u> blast, and they have been used since <u>that dateNovember 18</u>.

I will have Kiewit discuss the Grayson report and changes in safety procedures with you. We are confident that the changes being made will ensure that there are no further incidents of this kind. <u>(Need</u> <u>to check this report)</u>

Regarding our construction schedule, we are unable to adjust it to restrict "noisy work" to the hours between 8 am to 4 pm, as you requested, in order to have this section completed on time. Consequently, the current work of drilling, rock removal and rock placement will continue for the next <u>two-three</u> to <u>threefour</u> weeks. (<u>Most likely will being doing some more blasting in</u> <u>the spring after the winter traffic regime is lifted</u>) Once these activities have been completed, we will still need to place gravel and begin the actual road construction. Although this will generate some noise, it is quieter work than the work we are currently doing.

Finally, let me assure you that will continue to mitigate noise the highest degree possible, while striving to complete this phase of the work as quickly as possible.

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## Derkson, Debra TRAN:EX

 From:
 colin taylor [colin.taylor@kiewit.ca]

 Sent:
 Tuesday, January 18, 2005 10:07 AM

 To:
 David Wallace; Document Control; Ryan Tones; Gohl, Ed E TRAN:EX; Bowen, Blair

 TRAN:EX; Grayson Doyle; Ahola, Rob TRAN:EX

 Subject:
 west van blasting stuff...

 Attachments:
 WV blasting bylaw.pdf; WV Noise bylaw summary.pdf; WV Noise bylaws.pdf

Thanks,

CT

From: Andrew Allan [mailto:aallan@hatfieldgroup.com] Sent: Tuesday, January 18, 2005 9:01 AM To: 'colin taylor' Subject: RE: EMP

Colin,

Here are the blasting and noise bylaws for WV. Duane will be out Thursday to do some readings. Do your blasters have a blasting permit from WV?

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Page 13

## THE CORPORATION OF THE DISTRICT OF WEST VANCOUVER

## BLASTING BYLAW NO. 4024. 1996 A bylaw to regulate and prohibit the use of explosive agents for blasting, and require persons engaged in blasting to give security for damage.

The Council of the Corporation of the District of West Vancouver, in open meeting assembled, hereby enacts as follows:

### DEFINITIONS

- 1. In this bylaw:
  - (a) "Affected Owners" means the owners or occupiers of parcels of land referred to in Section 5(k);
  - (b) "Application" means a document in the form set out in Schedule A;
  - (c) "blast" or "blasting" means the use of explosives for the purpose of moving, displacing or breaking rock or other material;
  - (d) "Blaster" means the person, firm or corporation engaged by the Owner to conduct Blasting and includes an agent, contractor or employee of the Blaster;
  - (e) "Control Measures/Blasting Plan" means a document that complies with the requirements set out in Section 5(h);
  - (f) "Director" means the Director of Operations of the District and any person designated by the Director to exercise the Director's powers under this bylaw;
  - (g) "District" means The Corporation of the District of West Vancouver;
  - (h) "Engineer" means a professional engineer who specializes in rock mechanics and has expertise in blasting in urban areas, and is independent of the Blaster and acceptable to the Director and who is retained to carry out the duties under Section 7;
  - (i) "Hospital" means a hospital or licensed hospital under the Hospital Act;

Document #: 5519

 (j) "Letter(s) of Assurance" means a document or documents, in the form set out in Schedule "E", to be completed, executed and delivered by the Engineer under Section 5(g);

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- (k) "Owner" means the person registered in the Land Title Office as entitled to the fee simple of a parcel, holders of a registered right to purchase a parcel, or holders of a right of way in favour of a statutory authority on or over which the person proposes to Blast and a person authorized in writing by the Owner to act as the Owner's agent for purposes of this bylaw;
- (i) "Permit" means a document, in the form set out in Schedule B, to permit Blasting to be conducted;
- (m) "Public Lands Application" means an "Application" by a person other than the District, to Blast on a highway, park, right of way or other area that is owned or controlled by the District.

## PROHIBITIONS

- 2. Blasting is prohibited unless permitted by and carried out in accordance with the terms of this bylaw.
- 3. Without limiting the generality of Section 2, no person shall blast unless there is a valid Permit with regard to such blasting.
- 4. No person shall fail to comply strictly with the terms and conditions of a Permit issued under this bylaw.

### APPLICATION FOR PERMIT

- 5. When an Owner proposes to blast, the Owner shall first apply to the Director for a Permit by providing each of the following:
  - (a) a completed Application;
  - (b) a copy of a valid Blasting Certificate issued to the Blaster by the Workers' Compensation Board (the original of which must be produced for inspection if required by the Director);
  - (c) an indemnity from the Owner in the form and with the content of that attached as Schedule C;
  - (d) a certificate of insurance providing coverage for the Blaster, the Owner and the other parties as specified in Schedule D against liability for loss or damage to persons or property as a result of blasting, which insurance shall remain in force while a Permit is valid;
  - (e) the fee set out in Schedule F, except that no fee is payable for an extension of a Permit in good standing;

- (f) if required by the Director, a topographic survey of the parcel (or the portion thereof) where the blasting is to be carried out, prepared by a B.C.L.S. or a professional engineer;
- (g) Letter(s) of Assurance;
- (h) a Control Measures/Blasting Plan, prepared by the Blaster and accepted in writing by the Engineer, which shall consist of a sketch of the blasting pattern and include the sequence of detonation and the maximum weight of explosives to be detonated per delay and shall specify measures designed to minimize potential injury to any person and avoid, control or minimize the impact of the blasting. If blasting is not proposed within 150 metres of any structure, utility line, railway, public or private road, street, lane, driveway or walkway or is not expected to produce a rock cut over 3.5 metres high, then the Director may waive the requirement for a Control Measures/Blasting Plan. During the continuance of the Permit, the Director may authorize amendments to the Control Measures/Blasting Plan which are approved in writing by the Engineer;
- a report detailing how drill rigs and compressors are to be muffled, and the Director may require use of equipment to reduce or control noise levels;
- (j) information on the purpose for which blasting is being undertaken, the amount of material proposed to be removed, and such other information as is necessary to enable the Director to determine the amount of material permitted to be removed under the provisions of the Soil Removal and Deposit Bylaw or any other bylaw or policy of the District;
- (k) a report on the results of a preblast survey which shall be made of all principal structures and outbuildings, swimming pools, retaining walls, patios and driveways on any parcel of land within such distance of the blasting as the Engineer may specify. The Blaster shall cause the survey to be conducted after notice in writing to the Affected Owners (being the owners of the properties to be surveyed) and after giving the Affected Owners a reasonable opportunity to be present or to have an agent present. The report of the preblast survey shall identify by words and/or pictorially all observed damage to structures existing on the property inspected and anything that may be susceptible to damage from blasting and shall be signed by the person conducting the survey and by the Affected Owners. If any Affected Owner has refused entry to inspect or has not cooperated to arrange an inspection within 2 weeks of notice being given, or if the Affected Owner will not sign the survey despite a reasonable opportunity to do so, then the Director may, at the Director's option, waive this requirement.
- (1) For a Public Lands Application, the persons seeking permission to blast shall sign all forms, complete all requirements and bear all responsibilities, liabilities and costs under the bylaw and otherwise, as if they were the Owner, and the Director shall determine what will be required before the Director will accept the Application.

### PERMIT

- 6. (a) The Director may issue a Permit if the Owner has complied with Section 5 and if the Director is satisfied that the blasting is safe and complies with this and all other bylaws.
  - (b) Authority to blast under a Permit expires fourteen (14) days after the date of issuance of the Permit.
  - (c) The Director may, at the request of the Owner and upon receiving such information as the Director may require, extend from time to time the authority to blast under a Permit. The Director shall be satisfied that any policy of insurance or security provided under Sections 5(c) or (d) will remain in effect.
  - (d) The Director may cancel or suspend the authority to blast under a Permit if there are reasonable grounds to believe that the Owner or Blaster has done anything in violation of this bylaw or the Permit, or in violation of any agreement made pursuant to Sections 5(c) and (d). No person who has had his or her authority to bast under a Permit cancelled or suspended shall engage in or carry on blasting in the District unless special written permission to do so is given by the Director.

## MONITORING OF BLASTING

- 7. (a) The Owner shall, at the Owner's cost, retain the Engineer to act on the Owner's behalf to: complete the requirements of Section 5 that relate to the Engineer, to monitor the blasting and to ensure that the Blasting complies with the Blasting Plan, the Permit and the requirements of this bylaw.
  - (b) The Engineer shall immediately notify the Director if he or she has direct or indirect knowledge of a contravention of the Control Measures/Blasting Plan, the Permit, or the provisions of this bylaw.
  - (c) Ground vibration measurements shall be made while blasting, at the closest structure to the blast and at any other structure considered to be sensitive to ground vibrations, as determined by the Engineer. All records pertaining to the safety aspects of the entire rock removal project and its impact on neighbouring properties, including vibration records, Control Measures/Blasting Plan(s) and delay patterns, shall be retained by the Blaster for a period of six years.
  - (d) The Engineer shall be present at the first blast that is of the full magnitude specified in the Control Measures/Blasting Plan. During the course of blasting, the Blaster shall forward to the Engineer, all blast records and the Engineer shall review the blast records and confirm to the Director, if requested, that blasting is being carried out in accordance with the Control Measures/Blasting Plan, and shall immediately report any problems, unusual circumstances or inconsistencies to the Director.

(e) In no circumstances shall ground vibration at any structure exceed a particle velocity of 50 millimetres per second or any lower limit for any given structure specified by the Engineer and made a condition of the Permit. The Blaster will immediately report to the Engineer, and the Engineer shall forthwith report to the Director, any instance when, and under what circumstances, vibrations exceeded the specified maximum limits.

## HOURS AND CONDITIONS

- 8. Blasting shall only be done:
  - (a) on Monday to Friday, not including holidays, and only within the hours permitted under Noise Control Bylaw No. 3908, 1994;
  - (b) when atmospheric or other conditions permit a clear observation at a radius of not less than 100 metres from the place where the blasting is to be carried out.

#### NOTIFICATION

- 9. (a) All Affected Owners shall be notified by the Blaster, in writing, prior to blasting. The number of owners to be notified or the area of notification may be increased at the discretion of the Director and once increased, then all subsequent notification of Affected Owners required under this bylaw shall apply to those Owners or the increased area. The notice shall describe the work to be done, the approximate quantity of rock to be removed, the expected date of commencement, the estimated duration of the project, methods to be used to safeguard persons and property, the warning methods to be used to signal an impending blast, and the name and phone number of the representative of the Blaster or Owner who will provide additional information.
  - (b) At least 48 hours notice shall be given of the commencement of any blasting, and at least one week's notice shall be given of any blasting expected to continue for more than two days.
  - (c) No blasting shall be done within 300 metres of a School or Hospital until notice as required in 9(a) and 9(b) has also been given to the senior administrator of the School or Hospital, as the case may be, and has been provided to the Director. Further notice must be given to the senior administrator, or his or her designate, at least two hours prior to each actual blast, stating the approximate time of the blast.

## BLASTING SAFETY

- 10. (a) The Blaster shall ensure that a security person (equipped with and trained in the use of warning and signalling devices approved by the Workers' Compensation Board) shall be posted at every location where vehicles or pedestrians might be affected by a blast. Prior to any blast, this security person shall signal vehicles and pedestrians to prevent them from entering an area which may be affected by the blast. No blasting shall be done until all persons and vehicles vacate the area affected by the blast.
  - (b) Prior to a blast adjacent to a travelled highway, the Blaster shall cause an effective warning to be given (in accordance with the Workers' Compensation Board regulations) in sufficient time to enable persons or vehicles to move to a safe distance from the area that may be affected by the blast. When a blast is completed, the Blaster shall cause the area affected by the blast to be inspected to ensure that it is free of unexploded charges, explosive material or other material which the blasting has caused to be a danger or a potential hazard. When the Blaster's inspection is completed, the security person shall restore normal vehicular and pedestrian traffic as soon as reasonably practicable.
  - (c) While blasting is being carried on, the Blaster shall provide at least one competent assistant and as many additional competent assistants as circumstances may require and cause them to warn and implement all reasonable precautions to safeguard the occupants of buildings who may be affected by the blast.

### POST BLAST REQUIREMENTS

- 11. (a) The Owner shall notify or cause to be notified, the Director and each Affected Owner, in writing, when the blasting to be carried out under the Permit has been completed.
  - (b) At any time within sixty days after the date of notice given under section 11(a), an Affected Owner may give notice to the Owner or the Blaster that the Affected Owner's property has sustained damage as a consequence of the blasting. Upon receipt of such notice, the Owner or the Blaster shall conduct a post-blast survey of the property under the direction of the Engineer. The Affected Owner or an authorized agent shall be given notice of and a reasonable opportunity to be present during the post-blast survey. If the Affected Owner doesn't permit entry to the property within two weeks of the notice being given, or cooperate in the post-blast survey, then it shall be presumed that the Affected Owner's allegation of damage has been satisfied. The Engineer shall complete the post-blast survey without delay and submit a report of the survey to the Director who shall provide copies to the Owner and the Affected Owner.

(c) The amount of any loss or damage within the scope of an indemnity under Section 5(c) that remains unpaid to the District six months after the date of the post-blast survey shall be deemed to be a debt due to the District which shall be recovered by the District in the same manner as taxes due on the parcel of land where the blasting was carried out.

#### EXEMPTION

- 12. Notwithstanding the provisions hereof:
  - (a) Blasting may be exempted by the Director from the provision of Sections 5(g) (i), 5(k), 7, 9 and 11 of this Bylaw where:
    - (i) less than 10 cubic metres of rock or other material is to be blasted by means of detonating not more than 0.3 kilograms of explosive per delay; or
    - (ii) the rock to be blasted consists entirely of boulders separate from bedrock;
  - (b) Blasting shall be exempt from all provisions of Bylaw:
    - (i) if the blasting is specifically authorized by a statute or regulation other than the <u>Municipal Act</u>; or
    - (ii) if the blasting is, in the Director's opinion, required on an urgent basis to lessen or eliminate an imminent threat to life, safety, property damage or public transportation routes and communication systems.

#### OFFENCE

- 13. (a) Every person who violates any of the provisions of this bylaw or who suffers or permits any act or thing to be done in contravention of this bylaw or who neglects to do or refrains from doing anything required to be done by any of the provisions of this bylaw, commits an offence.
  - (b) Every person who commits an offence against this bylaw is liable to a fine and penalty of not more than \$10,000 for each offence and each day that an offence continues shall constitute a separate offence.
- 14. Council may, by bylaw adopted following a public meeting respecting the matter, suspend or prohibit the application of any section(s) of this bylaw within an area of the District for a period of time specified in such bylaw.
- 15. Nothing in this bylaw limits the application of other bylaws, and in particular, the Soil Removal and Deposit Regulation Bylaw, to the blasting of rock.

## SCHEDULE "A" TO BLASTING BYLAW NO. 4024, 1996

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# THE CORPORATION OF THE DISTRICT OF WEST VANCOUVER

## APPLICATION FOR A BLASTING PERMIT

1.	L, , of		
	(Print full name of Owner) (address)		
	am the registered owner of the following lands (phone no.)		
	(street address)		
	(legal description)		
	(rogar dosorrphon)		
2	I hereby authorize		
	(Print full name of Owner's Agent)		
	of,		
	(company name) (phone no.)		
•	to act as my agent pursuant to the bylaw.		
•			
3.	The purpose of the blasting is:		
	a. road and utilities d. utility connections		
	D. nouse of garage c. power pole		
	c. diriveway of paralling area 1. Other (describe)		
4	Parking area m <sup>2</sup> width of driveway m		
- <b>1</b> -	i aiking aloain, width of unvowayin.		
5.	Building footprint of house and garage shown on plan for which building permit applied		
	for:m <sup>2</sup> less building footprint of previous house and garagem <sup>2</sup>		
	= net building footprintm <sup>2</sup> .		
~	Designed and the second		
0.	removed based on section 5 above: m <sup>2</sup> . Remaining fock allowed to be		
7.	Volume of rock to be removed within footprint of house and garage and above finished		
	floor slabs elevation as certified by BCLS $m^3$ .		
8.	Estimated total volume of rock to be blastedm <sup>3</sup> (include overblast below		
	floor slab surface and outside of foundation walls).		
0	Exposted data of starting of duilling		
7.	Expressed date of starting of diffinity Estimated duration		
10.	The fee as required by the bylaw is enclosed.		
-1 - 7			

- The following documentation is provided in support of this application: a) A title search conducted within the last 30 days. 11.

  - A copy of a valid blasting certificate issued by the Workers' Compensation Board to the blaster who will undertake the work. b)

  - い日の日の日
  - to the blaster who will undertake the work. The indemnity as required by Schedule C of the bylaw. A certificate of insurance as required by Schedule D of the bylaw. A topographic survey prepared by BCLS or engineer (if required). Letters of Assurance in the form of Schedule E of the bylaw: A Control Measures/Blasting plan. Preblast survey report (including a plan of the area showing the affected parcels and those parcels requiring notification) prepared in compliance with the bylaw.
  - i) A report on noise control as required by the bylaw.
- 12. The above information is certified to be correct:

(Owner's Agent signature)

(Owner's signature(s) or Authorized Signatory if a Corporation)

# TITLE

16. This Bylaw may be cited for all purposes as the "Blasting Bylaw No. 4024, 1996".

REPEAL

17. "Blasting Bylaw No. 3785, 1992" is repealed.

PASSED by Council on 1996 November 18.

RECONSIDERED AND ADOPTED by Council on 1996 November 25.

MAYOR

## MUNICIPAL CLERK

#### SCHEDULE "B" TO BLASTING BYLAW NO. 4024, 1996

#### THE CORPORATION OF THE DISTRICT OF WEST VANCOUVER BLASTING PERMIT

This permit authorizes the Blaster referred to in the Blasting Certificate provided in relation to the above application to blast at the Owner's property referred to in the above application for a period of fourteen calendar days from the date of issue in accordance with: the provisions of the West Vancouver Blasting Bylaw No. 4024, 1996, Control Measures/Blasting Plan submitted and the recommendations in the Letter of Assurance filed with the Application.

Changes from the specifications referred to in the application are listed below and are part of this Permit:

Permit Approved: Director of Operations	Date of Permit:
Extension Approved:	Date of Extension:

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## SCHEDULE "C" TO BLASTING BYLAW NO. 4024, 1996

## THE CORPORATION OF THE DISTRICT OF WEST VANCOUVER BLASTING PERMIT INDEMNITY

		Date:	
To:	The Director of Operations THE CORPORATION OF THE DISTRICT OF WEST VANCOUVER 750 - 17th Street West Vancouver, B.C. V7V 3T3		
Re:	Address of Project (print)		

Legal Description of Project (print)

The undersigned hereby indemnifies The Corporation of the District of West Vancouver with respect to all actions, causes of actions, claims, demands, costs and expenses (including legal fees) arising from or in any way connected to the activities on the above referenced property for which a blasting permit is applied for pursuant to Blasting Permit Bylaw No. 4024, 1996 or any acts or omissions of the blaster, the undersigned agent or their employees and agents relating thereto.

Owner's Name (print)

Owner's signature (If owner is a corporation the signature of a signing officer must be given here.)

Owner's Agent signature

Т

#### SCHEDULE "D" TO BLASTING BYLAW NO. 4024, 1996

#### INSURANCE REQUIREMENTS

#### Insurance

The Owner shall provide to the Director of Operations with a certificate of insurance to insure damage to persons or property that may be injured by the blasting. This insurance shall be public liability and property damage insurance in a form satisfactory to the Municipal Solicitor, with Five Million Dollars (\$5,000,000) coverage inclusive for loss or damage in respect of injury or death of any person or person and/or damage to property from any one accident or occurrence. There shall be no third party deductible for bodily injury or property damage loss and no space warranty clause. The District, the Director of Operations, any engineer hired as a consultant by the District in relation to a particular application, and the company employing the holder of the blasting certificate shall be named insureds. Notification will be given by the insurer to the Director of Operations by registered mail not less that 30 days prior to material change, cancellation or termination of the insurance.

#### SCHEDULE "E" TO BLASTING BYLAW NO. 4024, 1996

#### LETTERS OF ASSURANCE

## CONFIRMATION OF COMMITMENT BY OWNER AND BY ENGINEER

Date:

- Re: Verification of Control Measures/Blasting Plan and Monitoring of Blasting by a Registered Professional
- To: The Director of Operations THE CORPORATION OF THE DISTRICT OF WEST VANCOUVER 750 17th Street West Vancouver, B.C. V7V 3T3

Dear Sir:

Re:

Address of Project (print)

Legal Description of Project (print)

The undersigned Owner has retained \_\_\_\_\_\_ as an Engineer to review a Control Measures/Blasting Plan and to monitor the blasting as required by Blasting Bylaw No. 4024, 1996 (the "Bylaw").

The Owner and the Engineer have read the Bylaw. The Owner and the Engineer acknowledge their responsibility to each notify the Director of Operations if the Engineer ceases to be retained by the Owner either before the date the Engineer ceases to be retained or, if that is not possible, then as soon possible.

The Owner and the Engineer understand that where the registered professional ceases to be retained at any time during construction, work on the above project will cease until such time as

- a) a new registered professional is retained, and
- b) a new letter in the form set out in Schedule E to the Bylaw is filed with the Director of Operations.

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The Engineer hereby gives assurance that the Control Measures/Blasting Plan reviewed by this registered professional in support of the application for the blasting permit substantially complies with the Blasting Bylaw and other applicable enactment's respecting safety and meets all reasonable criteria for safety of life and property and will provide the further written assurance required by section 5(h) of the Blasting Bylaw.

The Engineer hereby undertakes to be responsible for field reviews of the blasting as required in the Blasting Bylaw.

The Engineer also undertakes to notify the Director of Operations in writing as soon as possible if the Engineer's contract for field review is terminated at any time.

The undersigned Engineer certifies that he or she is licensed to practice as a professional engineer under the Engineers and Geoscientists Act and is specialized in rock mechanics.

Registered Professional	Owner
Registered Professional's Name (print)	Owner's Name (print)
Registered Professional's Signature           Address (print)	Owner's or Owner's appointed agent's signature. (If owner is a corporation the signature of a signing officer must be given here.)

(If the Registered Professional is a member of a firm, complete the following.)

I am a member of the firm\_\_\_\_\_\_ and I sign this letter on behalf of the firm. (print name of firm)

# SCHEDULE "F" TO BLASTING BYLAW NO. 4024, 1996

## FEE SCHEDULE

The fees that apply are as follows:
 where the Director permits exemption in accordance with Section 12(a) .....\$ 60.00
 except where i) applies, for blasting <50<sup>3</sup> rock and it is not for construction of a building .....\$100.00
 in all other cases: ......\$500.00

# **Progressive Blasting Plan**

# **Montizambert Rock Cuts**

# Ministry of Transportation Project No. 099WP02 Sunset to Lions Bay



**Developed** for:

Oddy Construction Ltd Mr. Eric Oddy Project Manager

Developed by:

R Scott Parker AScT Explosives and Rockwork Technologies Ltd 890 Porteau Place, North Vancouver BC V7H 2S3

# **Progressive Blasting Plan Model**

# Montizambert North Rock Cut

## **General Work Area**

Montizambert Creek rock cuts are divided into those cuts south of the creek and those cuts to the north of Creek. The progressive blasting plan will address the methodology and progressive testing procedures required to undertake the work to comply with the contract requirements and quite specifically the traffic management plan.

The plan shall outline a performance based process and testing procedure that considers the following items to be addressed, these items were identified as a requirement of J4.3 of the Traffic Management Plan:

- 1. Physical Relationship between the Highway and Blast Location
- 2. Natural Conditions of the Rock
- 3. Volume of Blasted Material
- 4: Rock Blasting
- 5. Movement of Excavated Material
- 6. Traffic Management

Montizambert Creek has been shortened to Monti Creek for reference purposes and has been referenced as such in the drawings and will hereafter be referred to in this report.

The District of West Vancouver Municipal boundary appears to be on the south abutment of Montizambert Creek.

The northern rock cut is undergoing stripping of the overburden sand and gravel from the top of the cut as this report is being written, this will be the first rock cut blasted along the grade on this section of the project, The plan will address this area first, with the Monti South rock cut progressive work plan being modeled and modified from the lessons gleamed from the practical lessons learned from the northern cuts. Monti South to follow.

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#### Project Constraints – Traffic Management and Blasting Activities

#### Traffic Stoppages Blasting:

- Random 20 Minute Stoppages: a scheduled stoppage of traffic of no more than 20minutes in one or both directions for the purposes of blasting rock or other Work.
- Random 10 Minute Stoppages: a brief stoppage of traffic of no more than 10 minutes in one or both directions. <u>Some debris</u>
- Random 2 minute stoppages, a very brief stoppage of traffic of no more than 2 minutes, in one or both directions <u>No Debris</u>
- Free flow Traffic –when the traffic queue is cleared

#### Scheduled

- Random 20, Minute Stoppages daytime to Nov 30,2004 10am-2:00pm Monday to Thursday March 1,2005 to Nov 30,2005 daytime 10am-2:00pm Monday to Thursday
- Random 20 Minute nighttime till Nov 30,2004 evenings 10pm-6am Monday to Friday morning March 1,2005 to Nov 30,2005 evenings 10pm-6am

Monday to Friday morning

Random 10 Minute Day or Night Stoppage
 Nov 30,2004 9am-5pm, 8pm to 6am

Monday to Friday Noon

 Random 2 minute Stoppage Daytime or Nighttime Monday 9:00am to 12noon Friday

9:00am to 5:00pm Sat and Sunday 10pm to 6:00am weekends

- Notes: 1 20 minute delay permitted in one hour, 10 minute queue clearing time, effective time for blast = 10 minutes, Traffic Stoppages at the Hour
- Single lane alternating traffic of no greater than 10 minutes in each direction between:
  - 10am to 2pm during the day
  - 10pm to 6am during evenings
  - During 10 minute random closures

Therefore scheduled blasting times will be preferably at 10am or on the hour thereafter With a scheduled 20minute closure, as necessary opening the road to single lane alternating traffic as required every 5 minutes, with a maximum 10 minute queue time or there is free flow traffic, till 2pm. See haulage

## Monti North

#### Physical Relationship Between the Highway and Blast Location

: Reference Drawings 41DD- D802-0103 Rev1 Detailed Design Plan Sta 105+170 – Sta 105+780 Dated Oct 2004

The road cut is on the east side of the road between stations 105+590 and station 105+850, the cut in rock appears to be from station 105+730 (5mH x7 mW) to 105+610 (20mH x 9mW) the maximum cut height appears at Sta 105+630 at 22.5m in height while the widest cuts appear at Sta 105+675 where the width of the cut is 18.5m. The overall cut being some 260 m, there being 120 lineal m of continuous rock in length, with several sliver cuts thereafter. The rock cut parallels the road which roughly runs roughly south to north in this area with the inside lane closest to the rock wall facing north, driving in the direction of Lions Bay. <u>How far off</u> the road?? Sounds like immediately adjacent.

- The south end of the rock cut daylights 30m north of the northern bridge abutment over Montizambert Creek.
- The powerlines and fiber optic lines have been relocated to the west shoulder of the road 10m from the bottom of the cut along the grade.
- There appears to be two test hole on the cut that will have to be stemmed prior to blasting in the area.
- A culvert to be abandoned appears in the grade at approx. sta 105+760
- There is a culturally modified tree above the top of the shear line at approx 105+625 which will be protected from harm.
- Houses accessed from the Sunset Marina basin and along Lawrence road appear along the waterfront

Southern Edge of Cut - 60m to the edge of structure situated on Lot 2 Plan 7016 Northern Edge of Cut -78m to the edge of the structure situated on Lots G & H Plan 11180

There appears to be at least eleven identifiable structures identified in the plan, some of these structures may be outbuildings. The structural outlines in the drawings would suggest that the structures appear to be at least 60m from the edge of the blasted cut, and at least 25m lower then the highway grade. A screen of trees blocks the view from the rock cut, it should be noted that as the fall frosts approach the deciduous trees will loose there leaves and will become more visible from the cut.

 The BC Rail line is situated below the western edge of the road typically offset 40m west of the rock cut; 20m lower then the edge of the existing grade. The slope above the rail grade in the southern area of the rock cut appears oversteepened and there is a risk of rock fall onto the tracks, either being dislodged by natural events, ie heavy rainfall etc or from the cut. Post blast inspection on the rail should be undertaken after each blast.

- The rock cut 120 m in length is illustrated in the cross sectional drawings Reference 41DD-DB02-CS43 Rev 1 Oct 2004 and others in this series.
- In General blasting will occur between
  - Sta.105+730 to Sta 105+615 with a small sliver cut at Sta 105+595.
  - Blasting will progress from south to north.
  - First Blast Test Blast No.1 estimated at between 300 and 600cubic meters, location of this blast is still pending and is dependent on overburden removal
  - Test Blast Area to 105+685
  - Rock removal in a series of Benched blasts, max 8m in bench height
  - the small rock cuts on the north end of the site can be shot and left in place, or used for ramps
  - South end of North Cut should be advanced to last round from breakthrough; the breakthrough shall be carefully orchestrated in small controlled shots to minimize rock spilling out into the rode.
  - Estimated Production Blast beyond sta 105+685, 1600m3 per blast ( direct conversation with Peter Kiewit site personnel re: Estimate Of The Volume Of Material That Can Be Moved Per Day With The Equipment On Site.)

#### Natural Conditions of the Rock

- rock is a hard quartz diorite of the Mesozoic Coast Plutonic Complex R4-R5
- buried valley behind the cut, the effect on the presheared wall at this time is unknown
- dominant joint planes steeply dipping out of the cut on the east side, failures are anticipated with forces of >1g from the blast shockwaves impacting the face, Mechanics of failure are present with Stress Relief Joins Dipping at 51 to 54 degrees toward the road, and other steeply tectonic sets 82-88 degrees providing the remaining failure surfaces.
- Cohesion and asperities to be overcome by G values greater then 1, note high frequencies could loosen the material, after the shoot, but without the low frequency component displacement may be low, delayed catastrophic failure of blocks after the shot may occur. Time frame unknown. (impose setback for pedestrian traffic below cuts, scale face as required)
- Open jointed and blast damaged faces may vent
- Water table in substrate unknown at the time of inspection raining heavily, free draining, surface water into the boreholes is anticipated,
- Water in open joints indeterminate, some weepage/ seepage from rock face, porosity of intact rock anticipated 10<sup>4</sup>-6

#### Volume of Blasted Material

- The overall volume of the north cut between stations 105+730 (5mH x7 mW) to 105+610 (20mH x 9mW) appears to be 23,500 cubic meters of rock, with a swell factor of 1.2 the volume of broken rock to be moved will be 28,200 m3.
- The volume of rock to be moved each day is approximately the volume of broken material that is blasted up to 1920m3 will be moved through the day and evening.
- Potential number of blasts to be undertaken 23,500/1600= 15 shots, averaging smaller and larger shots the total number of recorded blasts will probably be closer to 20.

#### Rock Blasting

- For the purposes of this plan, Test Blasts will progressively increase in volume from 600 cubic meters to 900 cubic meters to 1600 cubic meters in volume.
- The intent of the test blast are six fold
  - 1. To optimize our road closure procedures, equipment, people, site distances, queue distances and timing
  - 2. To optimize our blasting procedures, scheduled time for shot, setting guards, firing the shot, checking the shot, all clear
  - 3. To verify our explosives loads for wall control. To optimize the shearline spacing, and hole verticality on the backline wall
  - To optimize our road clearing procedures, equipment, personal to clear the road of rock from the blast
  - 5. Fragmenting the outside web of rock adjacent to the highway without undo spillage of rock onto the road grade
  - 6. Road clearing and getting thru traffic back onto the grade all in accordance with the contractual requirements.
- Once the Progressing Blasting Plan has been achieved blasting 1600m3 of rock per day, will be targeted.

#### Model for Test Blasts

**Progressive Tests**— note subsequent blasts are to follow the same model until the rock volume blasted cannot be handled in the closure window, the methods are changed or the target values for volumes blasted per blast are achieved.

#### Progressive Test Blast 1

Sta 105+670... stripped area roughly 12 m above grade

Volume of material blasted 300 to 600m3 depending on surface rock contours Area Blasted 10x10 m
Depth of Blast 6m on E edge, shallow adjacent to highway Tentative Date and Time of Blast Nov 1 at 11pm (Note depends on clearing and stripping schedule)

Volume of Rock Anticipated to Impact Road between (best case) 5 and (worst case) 81m3

#### Steps Required: Time Study by QA /QC (Blasting Consultant)

- 1. Mobilize Drills Labour and Equipment to drill on Pattern Max 291 lineal m of hole
- 2. Time Required 2 days (to be Completed by 4PM no later then Saturday Oct 30/04
- 3. Explosives to Delivered to Site Friday Oct 29/04 by the end of shift/ inventoried to match loading requirements.
- 4. Planning Meeting Oct 30/04
- 5. Notice to be distributed to highways, residence re shot Monday AM
- 6. Line Up Flagman for Road Closure
- 7. Line up Heavy Equipment
- 8. Signage in place and Flagman on site by 8am the morning of the blast.
- 9. Blaster Load Shot, start at 7am -complete at 9:30 am
- 10. Set up shot, check signal horns, batteries etc 9:30am, roll out firing line
- 11. 10:15 Advance notice to contractors crew of cessation of work
- 12. 10:35 Clear Heavy Equipment To be timed, (within 10 minutes of notification)
- 13. 10:35 Flagman in Place
- 14. 10:40 Construction Personal cleared from area to be timed (within 5 min of notification)
- 15. 10:40 Blasting Guards in Place
- 16. 10:50 Security road sweep at each end of cut, between flag areas
- 17. 11:00 am Barricades go up, security sweep through site, back behind Blasting Guards, blaster ties in firing line to shot -Stop Watch Starts
- 18. 11:03 am 2 Minute Warning
- 19. 11:05 am Fire Shot
- 20. 11:07 All Clear to be timed
- 11.07 11:17 Equipment Clears Road to be timed
   11:19:55 Road Reopens Stop Watch Records Time <u>Make sure you overkill</u> the equipment - loader, grader, sweeper

Noon-Debriefing, evaluation

- Checklist of activities to e prepared and signed off.
- Peter Kiewit QA Manager to evaluate, leas with Blasting Superintendent, government representative

Material removed off site through random 10min closures, 9 am to 5pm and 8Pm to 6am -over the next two days. - Time study to be undertaken by QA

#### **Evaluation Criteria**

- Early Start...Late Finish of Each Activity to be Generated
- Cycle Time of Trucks and Loaders required for Clearing Road Generated
- Traffic released in what time based on what volume of rock deposited on road

from blast

- Lead time for men and equipment off site, overlapping activities and communications fan-out and compliance feedback
- Length of Line Up at north and south closure ends
- Queue time, north and south- decide which is to go first, ie longer lineups.

#### **Potential Problem Areas**

 Blasting Delays : in reality setting a set time for the initiation of a blast based on schedule has proven to be problematic, the blaster should have the time to check and double check his loads, protective measures and site security prior to detonating the blast, in the authors experience a well managed blasting program can systematically be punctual in there blasts, but all it takes is one blocked hole to throw a schedule out the window.

The hazards associated with blasting are many, the last thing you want to do is rush or pressure the blaster into shortcutting industry standard procedures. When the shot is ready it should be fired, if that means missing a "on the hour firing time" it would be prudent to wait until the next available window.

- Stability and Scaling Delays: Evaluation by the Geotechnical Engineering Staff
- Misfire Delays : are rare but they do happen, follow WCB procedure
- Weather delays, productivity suffers, forecast lightning :shuts down the blasting program until the hazard passes
- Flyrock Problems, root cause to be evaluated and steps taken to remove hazard

#### **Process Evaluation**

- · Float Time in Schedule= time available to increase blast volume
- Time to Move Rock from Road, cubic meters/min= predict cycle times for
- Equipment Selection based on demand

#### Recommendations based on evaluation

- Size of Next Blast based on Test Blast Performance
- Pattern Geometry changes required
- Stability Concerns/ Hazard Evaluation

#### Movement of Excavated Material

- Rock during the blast should move parallel with the road,
- An existing open area exists in the north area o the cut where crushers and screens where setup for Test Section WP1
- Material from the road will be trammed,/skidded into this area from the traveled surface of the road to facilitate opening of the road and loading and haulage by the heavy equipment

- As the cut is extended south this use of the cleared area will continue. Impact berms may be developed along the edge of the road
- Rock falling onto the road is approximated at a maximum 81m3 from the outside edge of the cut, 10% contingency for rock fall from surface failures on the cut, Note (at the south end of the north cut this percentage will increase to 20%, the blast volume design shall reflect these changes and the volume of rock will be adjusted in the shot to accommodate the load, haul cycle.
- · 988 Cat wheeled loader(s) or equivalent anticipated to clear road
- 235 or equivalent hydraulic excavator to machine scale face
- 25 Tonne articulated trucks to move broken rock, anticipated load between 10 and 12 cubic meters
- 20% of material will be between 1 and 2.5 cubic m oversize
- 5% of the material may require secondary blasting in the pit area.

#### Asphalt patch

#### Traffic Management

- Blast Guards inside of flag persons, non essential personal outside of guarded area, radio protocol
- Signage required, Blasting Ahead, Turn off Radio Ahead, No Stopping; Blasting Signals, Danger Blasting Area, Watch for Falling Rock
- Road, Vehicular Traffic, 400m closure each side of blast, radio protocols
- Emergency Vehicles: radio ahead to hold the shot or expedite one lane opening
- Pedestrian: prohibit
- Houses Below the Grade: are outside of the 60m one hole per delay radius, notification, guards at residences, keep back from windows etc.
- Guards on Rail Grade: notification to BC Rail, inspection of tracks after shot

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Trails in the Area: close, and flag

The Cycle for the Operation is more complex then usually anticipated, to get one large shot off per day the following has to be completed based on 1600 cu m

- Survey /Layout time 2 Hours
- Design of Shot 2 hours 24 hours prior to shot being drilled
- Drill
- Load and Shoot .5 shift
- Muck 1.5 shifts
- Scale variable from .5 to 3 hours

1.5 shifts

Stabilize: variable from 0 to 2 days

Note - Activities may run concurrently,



From: Sent: To: Cc: Subject: Ahola, Rob TRAN:EX Wednesday, December 1, 2004 9:51 AM 'Gord Baglier (E-mail)'; ryan.tones@kiewit.ca Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX Blasting Report

Gord,

Spoke with Scott Parker and he said you have produced a report on the first blast. This'is the report that MoT Claims Department needs and we need for our records. Can we receive a copy of it?

#### **Rob Ahola**

Sea to Sky Highway Improvement Project p: 604.605.5943 f: 604.605.5936 c: 604.816.4779 e: <u>rob.ahola@gems1.gov.bc.ca</u> www.seatoskyimprovements.ca

### TRANSMITTAL

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Atten: Ed Gohl (S	STS)	•	Roquiroq		FROM:	Kiewit –David W	failace
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Tel. 604-669-884	8 Fax, 604-6	605-5936					
Email. ed.gohl@	aems5.gov.	bc.ca		<u></u>	SUBIECT		
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#### Derkson, Debra TRAN:EX

From:David Wallace [David.Wallace@Kiewit.ca]Sent:Friday, February 11, 2005 3:29 PMTo:Bowen, Blair TRAN:EXCc:Gohl, Ed E TRAN:EX; Ahola, Rob TRAN:EX; 'Ryan Tones'; 'Jeff Raine'Subject:MoT Stop Work Order - Blasting

Blair:

Could you please send us an official letter outlining exactly what MoT is requesting and the reasons for the "stop work order(s)".

WCB, as a result of yesterday's incident meeting and review of our drill & blast procedures, did "not" issue a stop work order. We understand that we are generally compliant with WCB rules and regulations. We are expecting to issue the incident & corrective action report this afternoon.

It is uncommon practice (not a WCB requirement) to have a P.Eng. stamp surface blasting operations and there are not many qualified individuals in this field (unless you are talking underground mining engineering situations). Our drill & blast consultant, Scott Parker, is a licensed blaster and a recognized expert in the field.

Our blasts have been designed by Scott Parker in consultation with Oddy and PKS, we have built scale models of these rock cuts (which were shown to WCB and include the Kelvin South rock excavation that has started) and each blast has a drawing and numbered sequence.

Yesterday's discussion with WCB was not about wholesale changes in our drilling and blasting operation. Rather, we were discussing refinements (fine tuning) to prevent future flyrock incidents. These refinements were adopted immediately in our operations and are discussed in the incident and corrective action report to come.

David A. Wallace, P. Eng. Construction Manager Sea-to-Sky Highway Improvement Project - DB2 Sunset Beach to Lions Bay

Peter Kiewit Sons Co. 10651 Shellbridge Way, Suite 120 Richmond, B.C. V6X 2W8 Tel: 604-922-5622 Fax: 604-922-5623 Cell: S22 Email: David.Wallace@Kiewit.ca

-----Original Message-----From: Bowen, Blair TRAN:EX [mailto:Blair.Bowen@gems8.gov.bc.ca] Sent: Friday, February 11, 2005 10:44 AM To: 'David Wallace' Cc: Ahola, Rob TRAN:EX; 'Ryan Tones'; 'Jeff Raine'; Gohl, Ed E TRAN:EX; Allmans (E-mail)

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Subject: RE: Credibility and Disclosure

David,

Please ensure that the submitted incident and corrective action report indicated below is signed and sealed by a P.Eng. This report will be evaluated by the STS Field Representatives and Safety Auditor. Until such time that PKS has satisfied the STS Project Team that such an incident will not take place a third time, and/or WCB provides further input, blasting in the Montezambert area is suspended until further notice.

Also, we note that new drill and blast programs are imminent at Lone Tree and upcoming at Charles Creek and Ansell South . Therefore, we expect to see blast plans and a work program for these areas prior to any blasts taking place. We also expect these to be signed and sealed by a P.Eng.

If you have any questions feel free to call.

Blair Bowen, Project Coordinator Sea-to-Sky Highway Improvement Project (604) 818-3895 blair.bowen@gems8.gov.bc.ca

-----Original Message----From: David Wallace [mailto:David.Wallace@Kiewit.ca] Sent: Thursday, February 10, 2005 6:45 PM To: Gohl, Ed E TRAN:EX Cc: Ahola, Rob TRAN:EX; Bowen, Blair TRAN:EX; 'Ryan Tones'; 'Jeff Raine' Subject: RE: Credibility and Disclosure

Ed:

We discussed the follow-up incident investigation actions this morning by cell phone around 10:30. Scott Parker, our drill & blast consultant, spent the day at the site assisting our investigation. The blast site was fenced off and put under guard watch until the WCB could visit. WCB was contacted at 08:00 and Frank Nielsen and Dick Shaw came by just after lunch to visit the site and then meet with Oddy and our staff. We assembled in the PKS site meeting room around 15:00, Blair Bowen attended the entire meeting and you arrived when the meeting was in progress. Grayson Doyle, Eric Oddy, Gary (Oddy - Blaster) and Ross Taylor had prepared a preliminary incident report and had all our procedures and documentation ready for WCB. WCB had some comments and we discussed additional measures to prevent future fly rock incidents.

Grayson Doyle and Eric Oddv. with S22 permission, performed an inspection of the S22 subject S22 this afternoon by going up on a ladder. There was no evidence of damage, pictures were taken and WCB was contacted regarding the fact that there was no visible property damage. We agreed with WCB to deal with the blast cut-off pre-shear holes as soon as possible and this is scheduled for tonight as early as possible before 23:00.

WCB is allowing us to continue our drill and blast work. We are instituting additional measures to eliminate the chance of flyrock. A complete incident and corrective action report will be available tomorrow afternoon.

It is clear that our present drill & blast procedures are good. We have had over 60 blasts, since the first incident, with no flyrock to report. The flyrock that we found last night and today, pictures will be attached to our report, were 20-30 mm maximum size. We took pictures of 4-5 stones around a couple of the Montizambert residences. Nobody was hurt, there was no property damage. Our staff dealt with the incident in the proper manner.

It is regrettable that there was an incident last night. It is really really unfortunate that the same resident was involved. We will continue to be vigilant to improve our drill & shoot operations.

David A. Wallace, P. Eng. Construction Manager Sea-to-Sky Highway Improvement Project - DB2 Sunset Beach to Lions Bay

Peter Kiewit Sons Co. 10651 Shellbridge Way, Suite 120 Richmond, B.C. V6X 2W8 Tel: 604-922-5622 Fax: 604-922-5623 Cell: S22 Email: David.Wallace@Kiewit.ca

----Original Message----From: Gohl, Ed E TRAN:EX [mailto:Ed.Gohl@gems5.gov.bc.ca] Sent: Thursday, February 10, 2005 8:01 AM To: Ahola, Rob TRAN:EX; Ryan Tones (E-mail); 'David.wallace@kiewit.ca' Cc: Hyde, Rick TRAN:EX; Bowen, Blair TRAN:EX; Tattersfield, Pam TRAN:EX Subject: RE: Credibility and Disclosure

David, this situation is unnacceptable and cannot be repeated.

A complete investigation of the events of last night must take place before another blast occurs where even a remote risk of striking infrastructure including houses, bridges etc. is possible.

My office needs to see ALL the details of this investigation including but not limited to the Preblast plan, Scott Parker's analysis, WCB Report, the disposition of the blasting mats and efforts made to restrain them, powder factor and any other information that may help shed light on why this has happened again.

A complete review of all blasting procedures will also take place in the wake of this. This will include a series of test blasts when beginning operations in new areas to assess the condition of the rock, and a submission and review of the blast plans for each series of blasts by your blast consultant.

I am off site until this afternoon, but can be contacted by cell phone.

Ed Gohl - Ministry Representative
Sea to Sky Highway Improvement Project
S22 Cell
604-913-0825 Site Office
ed.gohl@gems5.gov.bc.ca

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# From: S22 Sent: Wednesday, February 09, 2005 10:45 PM To: Ahola, Rob TRAN:EX; Tattersfield, Pam TRAN:EX; Gohl, Ed E TRAN:EX Cc: Hyde, Rick TRAN:EX; Bowen, Blair TRAN:EX; A Vicki; harvey.oberfeld@globaltv.ca Subject: RE: Credibility and Disclosure

Rob Ahola: You promised to give me a copy of the report of the first blasting screw up. To date I have not received it. As I stated before, without a true root cause and corrective action, errors will be repeated. I indicated to you that I had not been told the true root cause and this has been proven tonight with another massive screw up.

At about 8:35 pm the night shift let off an ill prepared enormous charge that drastically shook my whole house. (There have been charges this big before and clearly they are too big and unsafe) Immediately after the blast there were 3 very solid loud rock hits on roof followed by a large number of smaller strikes. Usually when you blast after 11 pm we are asleep and unaware of rock strikes on the roof as our bedroom is two floors down from the roof. S22 I have been told that there was no more fly rock after the November fubar, but I now know this to be

untrue as the unsafe practices continue. S22

and the blast happened anyway. I spoke to the Kiewit safety officer Sherwin and the Superintendent Mark Diamond who told me that they would not be blasting again until there was a full investigation. I told him that I wanted a copy of the report and he agreed. Thus I expect there will be no more blasting until after I see the failure report. The P.Eng.

responsible is certainly due a disciplinary hearing. As I stated before, blasts after 7 pm are too late and again tonight S22 after the blast. Nothing gives you the right to treat us like this. Please forward Peter Milburn's email address to me so I may communicate directly with him.

S22

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#### Derkson, Debra TRAN:EX

From:Bowen, Blair TRAN:EXSent:Friday, February 11, 2005 2:26 PMTo:'Ryan Tones (E-mail)'Cc:Gohl, Ed E TRAN:EX; Ahola, Rob TRAN:EX; Dash, Evan TRAN:EXSubject:Blasting documents required

As per our conversation here is what we are expecting.

Montezambert:

• interim blast plan for remaining work (sealed) that includes the corrective actions to be taken, attach a copy of WCB report. This complete submission willbe reviewed by STS site staff and STS safety auditor.

Lonetree:

• progressive blasting plan (sealed). This report is to be reviewed by STS site staff and copied to STS safety auditor for information.

Blair

# **Interim Blasting Plan**

Feb 18, 2005 Document Control Sea-to-Sky Highway Improvement Project Office

RECEIVED Ministry of Transportation

# **Montizambert Rock Cuts**

Ministry of Transportation Project No. 099WP02 Sunset to Lions Bay



# **Developed for:**

Oddy Construction Ltd Mr. Eric Oddy Project Manager

Developed by:

R Scott Parker AScT Explosives and Rockwork Technologies Ltd 890 Porteau Place, North Vancouver BC V7H 2S3

Reviewed by

Manohar Walia P.Eng.

# Interim Blasting Plan

## Montizambert North Rock Cut

## Dated: Friday, February 11, 2005

Based upon a site analysis of blasting operations to-date and a review of incident reports prepared by Peter Kiewit Sons (Prime Contractor and fully supported by Oddy Construction, the drilling and blasting subcontractor on this project), and the authors analysis of the incident the following Interim Blasting Plan is put forward.

#### Preamble on Existing Site Conditions and Blasting Incidents as of this Date

Nearly one hundred blasts both large and small have been completed on the grade to date. Much has been learned from these activities, as every blast in itself provides useful information on the structural response of the blasted slope. To date sheared walls have been completed successfully on the Monty South Area and on the complex structural geology of the Monty North upper rock slopes.

Vibrations emanating from the site have been predictable and are within established acceptable safe blasting criteria and all results are below the threshold of damage for structures in the area.

Blocky rock failures along the outside edge of the cuts have been frequent and problematic and were alluded to in the original blast plans and progressive blasting plans for this area, failures have occurred along steeply dipping daylighting open joints. The blocks have been mobilized or loosened to a point of failure or marginal stability by the induced shock energy emanating from the blast. The zone of influence is in the range less then 6m from the blast.

The southern end sliver cuts that daylight adjacent to the approaches of Montizambert Creek Bridge, represent a unique challenge to the blasting contractor. Shattered rock, poor access, open joints, the proximity of nearby structures and utilities pose real challenges on this project. These high angle cuts have been blasted previously during the construction of the existing road bed. Steeply dipping daylighting joint dominate the rock slopes; high angle dark basic andesitic dykes bisect the area. Adjacent to the chill margins of these intrusions, open joints predominate and are normal to the rock slope. The rock slope has been previously blasted and is probably subjected to lateral remnant stresses.

Slash blasting has proven to be the only practical way of removing the remnants of the old highwall in this area, Downholing the preferred method for shot design has been not possible due to geometric and design constraints. Controlled blasting methods have been and where successfully utilized without incident in this area to date to remove the rock to the lines and grades required to meet the design envelope. The remaining rock is being carefully removed in small controlled blasts, matting of the rock is crucial to containing the material on the high angle slopes. Unfortunately the resulting removal of the isolated blocks at first impression leaves the viewer with a much cluttered site, where larger blocks are littered about the grade and are being utilized as temporary impact blocks.

Blasting in the last few days has not been without incident, blasting mats were unable to

contain blasted rock within the blast area. A small volume of flyrock, more exactly small gravel size fragments were propelled out of the blast area and may have been projected down to the area of Montizambert Wynd a waterfront residential area some 60 m west and below the rockcut in question. An investigation is underway by the contractor's crews and the author to evaluate the mechanism of the lack of containment leading to the flyrock incident and what methods and procedures are required to reduce the potential for this type of mishap occurring in the future. Minor damage has been alleged in the area, (5/8 inch scrape in the paint of a parked car, ratting gravel on a metal roof) and is being addressed by Oddy Construction.

Therefore this re-assessment is required under contract, and is based on the requirement to control flyrock emanating outside of the blast area. The incident root has been evaluated and is based primarily upon a cutoff within a blast pattern on a blast bordering the southern edge of the rock cut advanced in the area north of Montizambert Creek Bridge.

The initial blast pattern was designed and implanted utilizing standard burden and spacing relationships that have been utilized successfully to date. Due to the high angle geometry of the slope pinned blasting mats being slung and hung by a crane shifted on the slope, the 3 tonne mats most likely pinched or cut the small diameter plastic shock tube assemblies of the nonel detonating assemblies. These blasting shock tube assemblies carry the firing shockwaves from surface delays to the downhole delay detonators. Due to the nature of the nonel system the system cannot be checked when mats are utilized. Cutoffs are rare but become more frequent on high angle terrain. When detonated the detonators set off the high explosive charges down hole, designed to break and move rock in a prescribed manner the "cutoff " of the pattern fractures the surrounding rock mass, to the point of cutoff and the remainder of the charges in the ground are not detonated. The well designed and loaded shot now becomes a very complex operation to remedy.

The original burden has been reduced by the detonated charges, while the original powder loads designed to fragment the rock in a controlled manner lead to an underburdened arrangement. The reduction in the designed burden in the blast caused by the incomplete detonation sequence has left the remaining unblasted face fractured. The blasting crew identified the misfired area and WCB misfire procedures where adhered to.

The blast was rewired and rematted with 25 blasting mats to control the shot. Toe venting has flipped up the bottom skirt of the slung mats allowing material to escape from under the mats.

The following steps are being adopted and have been included in this interim blasting plan to reduce the likely hood of a similar incident reoccurring in future.

- Redundant firing line system for shear line
- Cabling the mats back to more and fixed points
- Counter weighing the mats by extending the mat lengths with additional tethered mats
- Chaining the mats together to make the mats work as a unit.
- Fixing the mats onto the slope at intermediate points
- Endeavoring to understand the nature and potential venting areas generated by open fractures on the face.
- Reversing the firing direction to further reduce movement in unfavorable directions
- Reviewing nonel methods and procedures to further understand the strengths and weaknesses of this detonation sequence. (Blasting Consultant and the Supplier)

# Interim Blasting Plan to Completion Monti North Rock Cut

### The Work Area:

Montizambert Creek rock cuts are divided into rock cuts south of the creek and rock cuts located at north of the Creek. This Interim Blasting Plan will address the methodology and progressive procedures required to complete the work on the northern cut that has been undergoing since last November in the area to comply with the contract requirements which require Oddy / Kiewit to reassess drill and blast procedures at the request of the client as of this date.

The plan shall outline a performance based process and procedure that considers the following items to be addressed, these items were identified as a requirement of J4.3 of the Traffic Management Plan:

- 1. Physical Relationship between the Highway and Blast Location
- 2. Natural Conditions of the Rock
- 3. Volume of Blasted Material
- 4. Rock Blasting
- 5. Movement of Excavated Material
- 6. Traffic Management

Montizambert Creek has been shortened to Monti Creek for reference purposes and has been referenced as such in the drawings and will hereafter be referred to in this report.

The District of West Vancouver Municipal boundary appears to be on the south abutment of Montizambert Creek.

In part the upper two benches of the northern rock cut have been blasted to the design lines and grades, shearing along the highwall have been achieved after the rock tightened up below three meters of the original rock surface.

The progressive blasting plan for this cut has evaluated, the original plan called for the ridge of rock to be left along the edge of the road, failure of this blocky material along open steeply dipping joints has caused the members of the team to rework this concept. Reducing the size of the rock impacting onto the traveled surface has had to be considered with the resulting of high angle faces along and above the road grade being considered and implemented.

This plan has addressed the experiences learnt from the Monti South rock cut works now being completed.

#### Project Constraints – Traffic Management and Blasting Activities

#### Traffic Stoppages Blasting:

 Random 20 Minute Stoppages: a scheduled stoppage of traffic of no more than 20minutes in one or both directions for the purposes of blasting rock or other Work.

- Random 10 Minute Stoppages: a brief stoppage of traffic of no more than 10 minutes in one or both directions.
- Random 2 minute stoppages, a very brief stoppage of traffic of no more than 2 minutes, in one or both directions

#### Scheduled Stoppages

Random 20, Minute daytime	March 1,2005 to Nov 30,2005 daytime 10:00am-2:00pm
· · · ·	Monday to Thursday
Random 20 Minute nighttime	March 1,2005 to Nov 30,2005 evenings 10:00pm-6:00am
-	Monday to Friday morning
Random 10 Minute Nighttime	Dec 1, 2004 to Feb 28, 2005 11:00pm-5:00am
-	Sunday to Thursday
Random 2 minute Day or Nighttir	ne 9:00am to 12noon Monday to Friday
	9:00am to 5:00pm Sat and Sunday
	10:00pm to 6:00am weekends
	· · · · · · · · · · · · · · · · · · ·

# Monti North

#### Physical Relationship between the Highway and Blast Location

Reference Drawings 41DD- D802-0103 Rev1; and Detailed Design PlanSta 105+170 – Sta 105+780 Dated Oct 2004

The road cut is on the east side of the road between stations 105+590 and station 105+850, the cut in rock appears to be from station 105+730 (5mH x7 mW) to 105+610 (20mH x 9mW) the maximum cut height appears at Sta 105+630 at 22.5m in height while the widest cuts appear at Sta 105+675 where the width of the cut is 18.5m. The overall cut being some 260 m, there being 120 lineal m of continuous rock in length, with several sliver cuts thereafter. The rock cut parallels the road which roughly runs south to north in this area with the inside lane closest to the rock wall facing north, driving in the direction of Lions Bay. Completed to date 65% of the work, mass rock estimated to be removed primarily in the lower benches.

- The south end of the rock cut daylights 30m north of the northern bridge abutment over Montizambert Creek and is now being removed by controlled blasting methods, utilizing both downholing and trim slashing,
- The powerlines and fiber optic lines have been relocated to the west shoulder of the road 10m from the bottom of the cut along the grade and have not been impacted to date.
- There is a culturally modified tree above the top of the shear line at approx 105+625 which has been protected from harm.
- Houses accessed from Sunset Marina and Lawrence Road appear along the waterfront.

Southern Edge of Cut - 60m to the edge of structure situated on Lot 2 Plan 7016. Northern Edge of Cut -78m to the edge of the structure situated on Lots G & H Plan 11180.

There appears to be at least eleven identifiable structures in the plan, the structural outlines in the drawings would suggest that the structures appear to be at least 60m from the edge of the

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blasted cut, and at least 25m lower than the highway grade. A screen of trees blocks the view from the rock cut,

Pre-Blast Inspections have been completed on most of the structures, with two structures occupants being absent during the inspection period.

Minor complaints arising from perceived from damage have been addressed; one flyrock incident on the first blast caused some cosmetic damage to the metal roof structure on House No2. While alleged foundations complaints investigated by the author have been related to differential settlement older cracks that the resident of the house had not noticed before. This is currently in discussion with the owners.

#### The following note address the Blasting Pattern:

- The rock cut, approximately 120 m in length is illustrated in the cross sectional drawings Reference 41DD-DB02-CS43 Rev 1 Oct 2004 and others in this series.
- More complaints have arisen out of the residents being inconvenienced and bothered by construction activities and blasting noise. It may be noted that the background and sound level records are being taken by a third party consultant to Peter Kiewit.
- The BC Rail line is situated below the western edge of the road typically offset 40m west of the rock cut, 20m lower then the edge of the existing grade. The slope above the rail grade in the southern area of the rock cut appears oversteepened and there have been rock falls onto the right of way, no known problems to the tracks, Post blast inspection on the rail should be undertaken after each blast.
- In general blasting will occur between:

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- Sta.105+730 to Sta. 105+615 with a small sliver cut at Sta 105+595.
- o Blasting will and should be progressed from north to south.
- o Rock removal in a series of Benched blasts, max 8m in bench height
- Small rock cuts on the north end of the site can be shot and left in place, or used for ramps
- South end of North Cut should be advanced to last round from breakthrough; the breakthrough shall be carefully orchestrated in small controlled shots to minimize rock spilling out into the road.
- Estimated Production Blast beyond sta 105+685, 686m<sup>3</sup> per blast (direct conversation with Peter Kiewit site personnel re: Estimate Of The Volume Of Material That Can Be Moved Matted Per shot, maximum volume that can be removed in one day approximately 1600m<sup>3</sup>, with the equipment on site)
- Natural Conditions of the Rock
  - Rock is comprised of hard quartz diorite of the Mesozoic Coast Plutonic Complex, of type R4-R5;
  - Buried valley behind the cut, the effect on the presheared wall at this time is unknown;
  - Dominant joint planes steeply dipping out of the cut on the east side, failures are anticipated and occurring with forces of >1g from the blast shockwaves impacting the face. Mechanics of failure are present with Stress Relief Joins Dipping at 51 to 54 degrees toward the road, and other steeply tectonic sets 82-88 degree dips,

Page 52 TRA-2012-00300 provide the remaining failure surfaces;

- Cohesion and asperities to be overcome by G values greater then 1, note high frequencies have and will continue to loosen the material, after the shot, but without the low frequency component displacement may be low, delayed catastrophic failure of blocks after the shot may occur. Time frame unknown. (impose setback for pedestrian traffic below cuts, scale face as required)
- · Open jointed and blast damaged faces have been vented;
- Watertable level in substrate is unknown. At the time of inspection, it was raining heavily and free draining surface water was flowing into the boreholes; and
- Water in open joints indeterminate, some weepage/ seepage from rock face, coefficient of rock mass permeability of intact rock is anticipated to be 1x10<sup>-6</sup> cm/s.

#### Volume of Blasted Material approximately 65% complete

- The overall volume of the north cut between stations 105+730 (5mH x7 mW) to 105+610 (20mH x 9mW) appears to be 23,500 m<sup>3</sup> of rock, with a swell factor of 1.2 the volume of broken rock to be moved will be 28,200 m<sup>3</sup>.
- The volume of rock to be moved each day is approximately the volume of broken material that is blasted up to 1600m<sup>3</sup> will be moved through the day and evening.
- Potential number of blasts to be undertaken 23,500/680= 35 shots, averaging smaller and larger shots the total number of recorded blasts will probably be closer to 45.

#### Rock Blasting

- For the purposes of this plan, Blasts will progressively increase in volume to a maximum 900m<sup>3</sup>, with an average volume of 668m<sup>3</sup>
- Blast Optimization is essential for the following reasons:
  - a) To optimize our road closure procedures, equipment, people, site distances, queue distances and timing have been undertaken.
  - b) To optimize our blasting procedures, scheduled time for shot, setting guards, firing the shot, checking the shot, all clear have been revised with variances submitted and approved by the WCB.
  - c) To Confirm and continue with our explosives loads for wall control.
  - d) Of our road clearing procedures, equipment, and the necessary personal to clear the road of rock from the blast.
  - e) For fragmenting the outside web of rock adjacent to the highway without undo spillage of rock onto the road grade, revised and rejected, may be reconsidered.
  - f) For road clearing and getting thru traffic back onto the grade all in accordance with the contractual requirements.

Once the Progressing Blasting Plan has been achieved blasting 686m<sup>3</sup> of rock per day, will be targeted.

#### Model for Test Blasts

**Progressive Tests**— note subsequent blasts are to follow the same model until the rock volume blasted cannot be handled in the closure window. The blasting method will only be changed if target values for volumes blasted per blast are not achieved.

#### Progressive Blast

Volume of material blasted 300m<sup>3</sup> to 600m<sup>3</sup> depending on surface rock contour Area Blasted 10x to a maximum 15m pattern,

Area to be matted: 150m<sup>2</sup>

Depth of Blast 8m on edge,

Volume of Rock Anticipated to Impact Road between (best case) 5m<sup>3</sup> and (worst case) 81m<sup>3</sup>.

### **Evaluation Criteria**

- Early Start and Late Finish Record of Each Activity to be Generated;
- Cycle Time of Trucks and Loaders required for Clearing Road to be Generated;
- Traffic released in what time based on what volume of rock deposited on road from blast;
- Lead time for men and equipment to go off site, overlapping activities and communications fan-out and compliance feedback;
- Length of Line Up at north and south at the end of road closure;
- Queue time, north and south-decide which is to go first, i.e. longer lineups.

## **Potential Problem Areas**

 Blasting Delays: in reality setting a set time for the initiation of a blast based on schedule has proven to be problematic, the blaster should have the time to check and double check his loads, protective measures and site security prior to detonating the blast. Based on Author's experience, a well managed blasting program can systematically be made punctual in there blasts, but all it takes is one blocked hole to throw off the schedule significantly.

The hazards associated with blasting are many. It is undesirable to rush or pressure the blaster into shortcutting industry standard procedures. When the shot is ready it should be fired, if that means missing a "on the hour firing time" it would be prudent to wait until the next available window.

- Stability and Scaling Delays: Time required for evaluation by the Geotechnical Engineering Staff;
- Misfire Delays: are rare but they do happen. In such cases, WCB procedures should be followed;
- Weather delays result in lower productivity, during lightning forecast, the blasting program is shut down until the hazard passes; and
- Flyrock Problems, cause to be evaluated and steps taken to remove hazard.

#### **Process Evaluation**

- Float Time in Schedule may be used as time available to increase blast volume,
- Time to Move Rock from Road, m<sup>3</sup>/min may be used for predicting cycle times,
- Equipment type may be selected based on demand.

#### Recommendations based on evaluation

- Size of Next Blast based on Test Blast Performance
- Pattern Geometry changes required

Stability Concerns/ Hazard Evaluation

### Movement of Excavated Material

- Rock during the blast should move parallel with the road,
- An existing open area exists in the north area of the cut where crushers and screens were setup for Section WP1,
- Material from the road will be trammed,/skidded into this area from the traveled surface of the road to facilitate opening of the road and loading and haulage by the heavy equipment,
- As the cut is extended south this use of the cleared area will continue. Impact berms may be developed along the edge of the road,
- Rock falling onto the road is approximated at a maximum 81m<sup>3</sup> from the cutside edge of the cut, 10% contingency for rock fall from surface failures on the cut, Note (at the south end of the north cut this percentage will increase to 20%, the blast volume design shall reflect these changes and the volume of rock will be adjusted in the shot to accommodate the load, haul cycle,
- Use of 980 Cat wheeled loader(s) or equivalent is anticipated to clear road,
- Use of 245 or equivalent hydraulic excavator is anticipated to machine scale face,
- Use of 30 Tonne articulated trucks to move broken rock, anticipated load between 10m<sup>3</sup> and 12m<sup>3</sup>,
- Approximately 20% of material will be between 1.0m<sup>3</sup> and 2.5m<sup>3</sup>.
- Approximately 5% of the material may require secondary blasting in the pit area.

#### Traffic Management

- Blast Guards inside of flag persons, non essential personal must remain outside of guarded area, radio protocol;
- Signage required informing Blasting Ahead, Turn off Radio Ahead, No Stopping, Blasting Signals, Danger Blasting Area, Watch for Falling Rock;
- Road, Vehicular Traffic closure, 400m on each side of blast, radio protocols;
- For passage of Emergency Vehicles: radio ahead to hold the shot or expedite one lane opening;
- Pedestrian to be prohibited to enter blast area;
- Houses Below the Grade: are outside of the 60m one hole per delay radius, all
  residents to be notified, guards placed at residences, all residents to keep back
  from windows etc.
- Guards on Rail Grade: notification to BC Rail, inspection of tracks after shot;
- Trails in the Area must be closed and flagged.

The Cycle for the Operation is more complex then usually anticipated, to get one large shot off per day the following has to be completed based on 1600m<sup>3</sup>

- Survey /Layout time 2 Hours
- Design of Shot 2 hours 24 hours prior to shot being drilled
- Drill 1.5 shifts
- Load and Shoot .5 shift
- Muck 1.5 shifts
- Scale variable from 0.5 to 3 hours
- Stabilize: variable from 0 to 2 days

# Note - Activities may run concurrently

#### Recommendation

I have reviewed the Interim Blasting Plan and concur with the findings outlined in this document.

I do recommend that the procedures outlined in this document be followed during blasting. It is further recommended that periodic inspection to check the blast results and the change in geological structures and consequent requirements of changes in blasting procedures be undertaken by the blasting experts

#### Prepared By:

R. Scott Parker AScT

Reviewed By:

Milalia W.A ٠.

Manohar L. Walia, P.Eng.

#### Page 56 TRA-2012-00300

# **Progressive Blasting Plan**

**Lonetree Rock Cuts** 

Ministry of Transportation Project No. 099WP02 Sunset to Lions Bay



Oddy Construction Ltd Mr. Eric Oddy Project Manager

# Developed by:

R Scott Parker AScT WCB Certified Blaster 481497 Explosives and Rockwork Technologies Ltd 890 Porteau Place, North Vancouver BC V7H 2S3

# Reviewed by:

Mr Mano Walia PEng

# **Progressive Blasting Plan Model**

# Lonetree South Rock Cut

# General Work Area

The Lonetree rock cuts are divided into two cuts one south and one north, both of these are south of Lions Bay. The Progressive Blasting Plan will address the methodology and progressive testing procedures required to undertake the work to comply with the contract requirements and quite specifically the traffic management plan.

The plan shall outline a performance based process and testing procedure that considers the following items to be addressed, these items were identified as a requirement of J4.3 of the Traffic Management Plan:

- 1. Physical Relationship between the Highway and Blast Location
- 2. Natural Conditions of the Rock
- 3. Volume of Blasted Material
- 4. Rock Blasting
- 5. Movement of Excavated Material
- 6. Traffic Management

Lonetree South for reference purposes Sta 109+920 to Sta 110+100 has been referenced as such in the drawings and will hereafter be referred to in this report.

Lonetree North for reference purposes Sta 110+100 to Sta 110+300 has been referenced as such in the drawings and will hereafter be referred to in this report

These rock cuts are undergoing stripping of the overburden sand and gravel from the top of the cut as this report is being written, this will be the first rock cut blasted along the grade on this section of the project,

# Project Constraints – Traffic Management and Blasting Activities

#### Traffic Stoppages Blasting:

- Random 20 Minute Stoppages: a scheduled stoppage of traffic of no more than 20minutes in one or both directions for the purposes of blasting rock or other Work.
- Random 10 Minute Stoppages: a brief stoppage of traffic of no more than 10 minutes in one or both directions.
- Random 2 minute stoppages, a very brief stoppage of traffic of no more than 2 minutes, in one or both directions

### Scheduled

Random 20, Minute Stoppages March 1,2005 to Nov 30,2005 daytime 10am-2:00pm

Monday to Thursday

Random 20 Minute nighttime

March 1,2005 to Nov 30,2005 evenings 10pm-6am Monday to Friday morning

Random 10 Minute Night Stoppage
 Dec 1, 2004 to Feb 28, 2005 11pm-5am

Sunday to Thursday

 Random 2 minute Stoppage Daytime or Nighttime Monday 9:00am to 12noon Friday

> 9:00am to 5:00pm Sat and Sunday 10pm to 6:00am weekends

# Lonetree South

Physical Relationship Between the Highway and Blast Location

: Reference Drawings 41DD- D802-0110 Rev1 Detailed Design Plan

Lonetree South for reference purposes Sta 109+920 to Sta 110+100 Lonetree North for reference purposes Sta 110+100 to Sta 110+300



The road cut is on the east side of the road between Stations 109+920 to Sta 110+100, the cut in rock appears to be up to (18m in height and 14 meters in width.. The overall cut of Lonetree south being some 80 m in length, while Lonetree north being 200m in length. The total volume of rock to be shot in these two areas is 31600 cubic meters. The rock cut parallels the road which roughly runs roughly south to north in this area with the inside lane closest to the rock wall facing north, driving in the direction of Lions Bay.

- The north end of the rock cut daylights roughly 100 m from the nearest structure located to the north- north west on the western downhill side of Highway 99, while the nearest house on the uphill side of the road is 170m NNE of the end of the cut.
- The power lines and fiber optic lines have been relocated to the west shoulder of the road 10m from the bottom of the cut along the grade.
- Houses to the north of the cut are accessed from Tidewater Way and Kalvin Grove Way
- The BC Rail line is situated below the western edge of the road typically offset 50m west of the rock cut, 20m lower then the edge of the existing grade. The slope above the rail grade in the southern area of the rock cut appears oversteepened and there is a risk of rock fall onto the tracks, either being dislodged by natural events, ie heavy rainfall etc or from the cut. Post blast inspection on the rail should be undertaken after each blast.
  - Bench Blasting on the south cut will progress top down, from north to south with 18 planned blasting sections on the benches to be removed. These planned sequences may be subdivided into discreet blast blocks that are no longer then 10m in length and a max 15m in width, this variance in the planned activity is based on blasting mat coverage of 150 sq m of surface coverage per blast, the structural integrity of the rock mass and the access for the hydraulic excavator to place the mats.
  - The first blast blocks are estimated at between 300 and 600cubic meters, location of this blast is still pending and is dependent on overburden removal.
  - Blast dynamics dictate a free face is required for the blast to break to. The
    development of the free face is created by opening up an engineered small
    area to which to blast to. These free face areas will be progressed and
    developed for each blast, it is imperative that the blast is allowed o move out in
    the designed direction of progressive relief. Failure to generate this relief will
    result in a " chocked " shot, with lateral forces being laterally transferred into
    the back walls and destabilization of the final wall, this chocked shot will also
    produce unwanted lateral mass movement out onto the area of the road
    instead of parallel to the alignment.
  - Rock removal in a series of Benched blasts, max 8m in bench height
  - the small rock cuts along the approaches of the site will be shot and left in place, or used for ramps
  - South end of the cut should be advanced to last round from breakthrough; the breakthrough shall be carefully orchestrated in small controlled shots to minimize rock spilling cut into the road.

## Natural Conditions of the Rock

- dominant joint planes some steeply dip out of the cut on the east side, failures are anticipated with forces of >1g from the blast shockwaves impacting the face.
   Mechanics of failure are present with Stress Relief and other steeply tectonic sets providing the surfaces.
- Cohesion and asperities to be overcome by G values greater then 1, note high frequencies could loosen the material, after the shoot, but without the low frequency component displacement may be low, delayed catastrophic failure of blocks after the shot may occur. Time frame unknown. (impose setback for pedestrian traffic below cuts, scale face as required)
- · Open jointed and blast damaged faces may vent
- Water table in substrate unknown at the time of inspection raining heavily, free draining, surface water into the boreholes is anticipated,
- Water in open joints indeterminate, some weepage/ seepage from rock face, porosity of intact rock anticipated 10^-6

#### Volume of Blasted Material

- The overall volume of the north cut between stations Sta 109+920 to Sta 110+100 appears to be 6684cubic meters of rock, with a swell factor of 1.2 the volume of broken rock to be moved will be 8021m3.
- Potential number of biasts to be undertaken = 18 shots, averaging smaller and larger shots the total number of recorded blasts will probably be closer to 22.
- The overall volume of the north cut between stations Sta 110+100 to Sta 110+300 appears to be 23000\_cubic meters of rock, with a swell factor of 1.2 the volume of broken rock to be moved will be 27,600m3.
- Potential number of blasts to be undertaken = 36 shots, averaging smaller and larger shots the total number of recorded blasts will probably be closer to 42.
- The volume of rock to be moved each day is approximately the volume of broken material averaging 638m3 per shot, multiple areas may be worked on per shift and up 1600 m3 of blasted rock may be moved through the day and evening.

## **Rock Blasting**

- For the purposes of this plan, Blasts will progressively increase in volume from 400 cubic meters, to 900 cubic meters, the volume of rock shot is dependent on the blasters availability to mat the shot and shoot rock down the road and not onto the road.
- Blasting volumes on these cuts is dependent on several factors:

- 1. Optimization of road closure, procedures, equipment, people, site distances, queue distances and timing
- Access to the top of the cut, pioneering bench widths and the competency of the rock to maintain a bench to hold the drills.
- 3. Ramp geometry
- 4. The availability of a free face to shoot to,
- Optimization of our blasting procedures, matting requirements, scheduling times for shot, setting guards, firing the shot, checking the shot, all clear
- The blast explosives loads that have been optimized for wall control.
- 7. Road clearing, scaling and getting thru traffic back onto the grade all in accordance with the contractual requirements.

#### Progressive Blasts

**Progressive Blasts**—note subsequent blasts are to follow the same model until the rock volume blasted cannot be handled in the closure window, the methods are changed or the target values for volumes blasted per blast are achieved.

#### Progressive Blast 1 (Test on Next and Subsequent Blasts Taken along these Cuts)

Sta 109+920 to Sta 110+100...

Volume of material blasted 400 to 900m3 depending on surface rock contours Area Blasted 15x10 m

Volume of Rock Anticipated to Impact Road between (best case) 5 and (worst case) 81m3

#### **Evaluation Criteria**

- Early Start...Late Finish of Each Activity to be Generated
- Cycle Time of Trucks and Loaders required for Clearing Road Generated
- Traffic released in what time based on what volume of rock deposited on road from blast
- Lead time for men and equipment off site, overlapping activities and communications fan-out and compliance feedback
- Length of Line Up at north and south closure ends
- Queue time, north and south- decide which is to go first, ie longer lineups.

#### Potential Problem Areas

 Blasting Delays : in reality setting a set time for the initiation of a blast based on schedule has proven to be problematic, the blaster should have the time to check and double check his loads, protective measures and site security prior to detonating the blast, in the authors experience a well managed blasting program can systematically punctual, but all it takes is one blocked hole to throw a schedule out the window.

The hazards associated with blasting are many, the last thing you want to do is rush or pressure the blaster into shortcutting industry standard procedures. When the shot is ready it should be fired, if that means missing a "on the hour firing time" it would be prudent to wait until the next available window.

- Stability and Scaling Delays: Evaluation by the Geotechnical Engineering Staff
- Misfire Delays : are rare but they do happen, follow WCB procedure
- Weather delays, productivity suffers, forecast lightning :shuts down the blasting program until the hazard passes
- Flyrock Problems, root cause to be evaluated and steps taken to remove hazard

## **Process Evaluation**

- Float Time in Schedule= time available to increase blast volume
- Time to Move Rock from Road, cubic meters/min= predict cycle times for
- Equipment Selection based on demand

## Recommendations based on evaluation

- Size of Next Blast based on Previous Blast Performance
- Pattern Geometry changes required
- Stability Concerns/ Hazard Evaluation

# Movement of Excavated Material

- Rock during the blast should move parallel with the road, north as much as possible
- Material from the road will be trammed,/skidded into this area from the traveled surface of the road to facilitate opening of the road and loading and haulage by the heavy equipment
- As the cut is extended south this use of the cleared area will continue. Impact berms may be developed along the edge of the road
- Rock falling onto the road is approximated at a maximum 81m3 from the outside edge of the cut, 10% contingency for rock fall from surface failures on the cut, Note (at the south end of the north cut this percentage will increase to 20%, the blast volume design shall reflect these changes and the volume of rock will be adjusted in the shot to accommodate the load, haul cycle.
- 980 Cat wheeled loader(s) or equivalent anticipated to clear road
- 345 or equivalent hydraulic excavator to machine scale face
- 30 Tonne articulated trucks to move broken rock, anticipated load between 10 and 12 cubic meters
- 20% of material will be between 1 and 2.5 cubic m oversize
- 5% of the material may require secondary blasting in the pit area.

#### Traffic Management

- Blast Guards inside of flag persons, non essential personal outside of guarded area, radio protocol
- Signage required, Blasting Ahead, Turn off Radio Ahead, No Stopping, Blasting Signals, Danger Blasting Area, Watch for Falling Rock
- Road, Vehicular Traffic, 400m closure each side of blast, radio protocols
- Emergency Vehicles: radio ahead to hold the shot or expedite one lane opening
- Pedestrian: prohibit
- Houses Below the Grade: are outside of the 60m one hole per delay radius, notification, guards at residences, keep back from windows etc.
- Guards on Rail Grade: notification to BC Rail, inspection of tracks after shot
- Trails in the Area: close, and flag

The Cycle for the Operation is more complex then usually anticipated, to get one large shot off per day the following has to be completed based on 1600 cu m

- Survey /Layout time 2 Hours
- Design of Shot 2 hours 24 hours prior to shot being drilled
- Drill 1.5 shifts
- Load and Shoot .5 shift
- Muck 1.5 shifts
- Scale variable from .5 to 1 hours
- Stabilize: variable from 0 to 2 days

Note - Activities may run concurrently

#### Blast Design

Sheared Back Wall, protected by buffer line, production holes based on pattern of holes with an optimal bench depth of 8m, burden and spacing 1.5x1.5m.

Hole diameter 63.5mm, hole loaded with detonator sensitive NG based explosive product. Load 2, 2 Cartridges of NG (Unimax 50mm) in diameter in toe, 0.3 wooden spacer, alternate cartridges and spacer to within 2 m of surface, clear 15mm stemming to surface.

Detonation and timing 25 surface /500ms downhole delay detonators, 1 hole per delay, 17ms between rows

Preshear to be detonated 300ms prior to any adjacent hole. No more then 5 holes per delay on shearline, redundant det cord path. Post shear sliver cuts, 25ms accumulative delay after the last pattern hole, redundant det cord path no more then 5 holes per delay on shearline.

ROCK CUTS

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# INCIDENT INVESTIGATION REPORT

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Actual Severity: 👽 Minor	🗆 Serious 🗆 Major	Potential S	everity: 🗆 Minor	🗆 Serious 🖓 Maje	<i>7</i> 7
BAVMERS PROZEDUCA COMPLEX					
			*		Present . Scene
Team Member	Name	•	Title		Yes/No
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Foreman - BLASTT NG	JASON DOR	>47	BLAST	ForcemAn	Y 255
Safety Committee Member	DAVE FUDLE	<u>}</u>	Course	GNT OPERATOR	125
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# INCIDENT INVESTIGATION REPORT

Date of Incident: WORNESDAY FOR 9, 2005 Time: 8:35 AM/PM PM
Date Investigation Began: WORNESDAY REB 9, 2005 Time: 16:00 AM/PM PM.
Witness to the Incident and their employers: <u>Inson Onry - 0004</u> Construction Yes No Morrie Antononso - P.E.S., Desi fumilie - ORDY Construction
Others involved and their employers: <u>GH49502 Douce - P.K.S. Soor Pracese</u> & I Yes I No GANY NICEER - GODY CONSTRUCTION. LOSS TANKOR - PKS.
Struck by or Against 1 Caught on or Between 1 Exposure 1 Slip 1 Trip
<sup>1</sup> Fall Same Level <sup>1</sup> Fall From Elevation <sup>1</sup> Contact With <sup>1</sup> Overexertion
Foreign Body Other Fix Rock Mc103~1.
Estimated Number of Days Away from Work:
Estimated Number of Restricted Duty Days:
Nature of Injury or Illness:
Part of Body Affected: (be specific, indicate left or right area if applicable, Le. right index finger)
Did Employee Report to First Aid for Treatment? 1 Yes IND Date:/A
If Yes, By Whom: Qualifications:
Was the Injury or Illness reported to the Supervisor and initialed on timecard? I Yes No Date:N/A If No, Explain:
Worker Report of Injury (form # 1102) completed and attached? \Yes A
Was Authorization for Initial Treatment and Release of Medical Information Form (form # 1103) issued to Worker and attached? Ves (No) If No, Explain:
Name, Address and Phone Number of Hospital/Doctor:

FORM 1104 Revised: January 02, 2004 2 of 6

WESTERN CANADA DISTRICT



# INCIDENT INVESTIGATION REPORT

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Causative Agen conditions) Was Weather a FORM 11	t most direc 27 Rot C factor? 04 Revised: Jan	fly related to fr 1 Yes	icident: (O	· · · · · · ·	nce, material If yes, exj WES	, machinery plain: TERN CANAD.	, equipment A DISTRICT


# INCIDENT INVESTIGATION REPORT

Was this a Quality related injury? Yes INO If yes, explain:	)
Was this a Maintenance related injury? Ves To If yes, explain:	•
Unsafe act by injured and/or others contributing to incident: (be specific)	
Personal Factors: (lack of knowledge or skills, slow reaction, fatigue, etc.)	
Personal Protective Equipment Required: (Indicate Yes, No or N/A)	
Eye/Face Protection 403 Seat Belt 10 Safety Boots 405 Gloves 405.	
Gloves 455 Hard Hat 455 Respirator 2/4 Hearing Protection 4253.	
Was injured using all the required equipment? (Indicate Vestor No) If no, explain:	
Job being performed at time of occurrence: BLASTING @ MONTINATORIAT NORTH ROCK CUT.	
Was a hazard analysis prepared covering the task being was performing? IVes 1 No Date of Last Job Hazard Analysis: Attach Copy of JHA	<u> </u>
If No, Explain:	
Is a revision of the job hazard analysis required? IPes INo	
If Yes, Date for Completion: FEBRUARY 12,2005	
Explain why or why not:	
	•
(use additional sheets as required)	1
BLAST PROTECTION WAS ADEQUATE BASS ON ORIGINAL	-
BURDER. THE MISMIRE CREATED AN UNDER	-
ALONG FRACTURED PLANTES.	~
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FORM 1104 Revised: January 02, 2004 4 of 6 WESTERN CANADA DISTRICT	****

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## INCIDENT INVESTIGATION REPORT

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FORM 1104 Revised: January 02, 2004

5 of 6

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WESTERN CANADA DISTRICT



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# INCIDENT INVESTIGATION REPORT

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#### 9) DESCRIPTION OF EVENT:

February 08: Placed mats on blast using 50 T crane, blast went off, a cut off occurred (portion of the blast went off). Blast left guarded overnight.

February 09: Assessed cut off, retied six shear line and four production holes. The blast was re-matted with excavator on day shift. Two additional blast mats added to toe for additional protection for weight. Blast initiated at 8:35pm, fly rock witnessed from lower blast mats that flipped upwards. Fly rock was noted in a southwestern pattern on roadway. Guard stationed near Monitzambert Creek heard and seen small rock enter into guarded area.

Resident from S22 approached guard and stated that he heard three rocks hit his roof, followed by a small patter. Resident was directed to talk to the blaster and site superintendent. Resident was informed that no more blasting would occur for the evening. The incident would be followed up and measures taken. Roadway was cleaned and cleared and traffic was reopened.

Initial investigation of Montizambert Wynd showed small (1/2-1") of fly rock on south side S22

Blast area secured, cordoned off and guarded overnight as there was a secondary cut off. Began initial investigation and witness statements taken.

#### **13) CORRECTIVE ACTIONS**

- Blaster or record (shot firer) will load the shot, mat the shot, and fire the shot for consistency of the blasting operations.
- A loading diagram will be used to address typical loading and any untypical holes. This will be incorporated into our QC program and will be a requirement of Oddy Construction. This will be performed for each blast. Please see attached diagram.
- Mats on steep slope angles will be chained back to pins. Chains will be utilized in place of the wire rope slings, which are not adjustable.
   Mats on slopes will also have pins drilled into the face so that when mats are placed over them they will not slip. See sketch #1
   Mats draped over a face will be chained to additional mats for dead weight to stop mats. Artificial burden will also be used in certain situations. See Sketch #2
- To reduce potential cut offs in the shear line for a post shear blast. The unidirectional 17 MS connectors in the shear line will be replaced with bidirectional 17 MS connectors. With the use of this bidirectional connector, it will enable the shear line to fire from both directions. See attached wiring diagram.
- Blast direction of the North Monty cut will be reversed. Blast will be fired parallel to the highway and to the north.

MATTING DIAGRAMS.

CHANS DHILL. STEEL TAILL STEEL ETCH = [ - MATS CHRINEP BACK & PINS IN SLOPES DANL STEEL OFILL STEEL . - CHAIN Onice Hocs CHAIN SKETCH # Z- ARTIFICIAL OVERBURDEN AND MATS CHAINED TOGETHER HORIZONTALLY.



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BLAST # 60 DATE Feb 3 TIME BLASTED 11:00 P.M.	BEFORE THE BLAST:
DISTANCE from nearest structure/readway? 80.00	Wero all accessos guarded? Wero guards fully instructed? Were werds shalls of en? Yes No Yes No
MATERIAL BLASTED; CHAMI'LE	SKETCH OF LOADING PATTERN
EXPLOSIVES: TYPO/Size 50 K400 UN/Mak	
INITIATION DEVICE: E.B. Cap S.F. Assembly Other <u>IV. T. C.</u> ELECTRICAL: Ohms/setles Caps per series	
No. of sories Ohms in circuit BLASTING DEVICE:	
Hole Depth Burden Spacing Delays Sticks 28 7m 1.5 1.5 7m 200	Initial Was Ily material controlled?
	Were all mistines & other unsate Yes No conditions corrected? Was the all-clear signal given? Yes No NOTES & REMARKS:
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BLAST #       61       DATE ECD \$ TIME BLASTED	BEFORE THE BLAC Were eli circuits che Were all accosses g Were guards fully in Were warding signal SKETCH OF LOADI Were varing signal SKETCH OF LOADI Were all missing and the Was liy material cont Were all missings & o conditions corrected Was the all clear sign NOTES & REMARKS UXSCRAIL GaryIVICK	ST: rckod? used? uarded? situcted? situcted? NG PATTERN NG PATTERN Uollod? uollod? vos real given? vos s: Alea was secure uoith by my Sup e. On cross Shi	No No No No No No No No No No No No ed. mt. Cut or c et.		۵ ۱ ۱
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	BLAST # 62 DATE Feb-9 TIME BLASTED 8:35p.M. LOCATION MONTY NOTH - Sea to SEY DISTANCE from nearest structure/roadway? 80 m WEATHER: Clear (hight) WIND: 0 mph MATERIAL BLASTED: OYANITE EXPLOSIVES: Type/Size SOXYGO 40K400 UNIMAX INITIATION DEVICE: E.B. Cap S.F. Assambly Other No. 76. Tol.		BEFORE THE BLAST: Wore blasting mats used? Were blasting mats used? Were all accessos guarded? Wore guards fully instructed? Wore wanning signals given? SKETCH OF LOADING PATTERN THE FORM OF LOADING PATTERN	
-	Hola Depin Burden Spacing No. of Delays UDANALID- Blast Was mailed and Loaded by Cross Shift I was shot firer Only please refer to GARY Mickels	والمتعادية والمتعادية والمستعرب والمستعرب والمستعدين والمستعمل والمتعادية والمتعادية والمتعادية والمتعادية والمعالية	Was liv material controlled? Was liv material controlled? Was liv material controlled? Was live all missifies & other unsate conditions corrected? Was the all clear signal given? Was the all clear signal given? Max the all c	
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	Occupation: <u>BLASTETS HELPER</u> Occupation Experience (# of years): <u>S22</u>																								
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Page 88 TRA-2012-00300

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#### INCIDENT STATEMENT (Please print)

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I believe the preceding statement to be true to the best of my knowledge.

Date: S22 91 Signature: \_ FORM 1105 2 of 2 WESTERN CANADA DISTRICT JANUARY 02, 2004

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	Date: <u>Feb - 9-</u>	05	Time:10:45	ρ.μ.	
	Project: #993	Sea to sky	Location: No	6th Mont?	
	Statement of:	S22	. •		
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	Occupation: Bla	ster	Occupation Exp	perience (# of years):_ S22	
	Employer: 000	Construction	Address: <u>Box 1588</u>	Golden B.C. VOA-240	
,	Date of Incident:	feb-9-05	Time of Incident	: <u>8:35 p.m.</u>	
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:)	<u>Bo inch spo</u> holes fire	icing that were First and th	tied in to do a f en the Shearline)	<u>cest Shear C all producti</u>	<u>io</u> n
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#### INCIDENT STATEMENT (Please print)

by me at 11:40 p.m. Feb- 8-05. ODon sas initiated post blast inspection it was evident that approx only half the blast had fired, because of time restraint, Chlasting can only Commence on North Monty until 12:00 A.M.) I was not able to refire blast. Myself and my helper (Desi Larwill) spent appox 2 hrs muck pile removing unfired powder, after which Desi left to guard the unblasted material and all kiewith personell cleared from. the area. My Supervisor, Gary Nickel, was alerted of the situation On the Job site at approx 7:00 A.M. to relieve guard and arrived and deal with situation. I returned to Job site at approx 6:45 p.m. on Feb 9 05 the blast was re-matted and ready to fire. Gary told me the blast had been retied and all problems dealt with and was adequatly matted and ready to fire At 8:35 pm I insticted blast, Mats on the South face blew away from wall Causing fly rock of Size ranging from approx. size of a softball to size of a fingernail. The guard I lane (Desi Larwill) which is approx som west placed on Montizambert uses instructed to scan area for any FIY rock. During this OF blast site procedure Desi was approached by S22 and told that S22 roof was hit 3 times substantially followed by small finkles of rock. Upon immediate investigation small pieces or blast rock approx I inch in diameter where evident in his drive way and on (Ogdy 2) leading to his Driveway

I believe the preceding statement to be true to the best of my knowledge.

Date: 760-9-05

FORM 1105 JANUARY 02, 2004

Signature:

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WESTERN CANADA DISTRICT

<del>Page 92</del> TRA-2012-00300

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то:	Sea to Sky			-	Action Required	Delivery	DATE:	Feb. 12, 2005	Page 1 of 1
	Atten: Ed Go	hi (STS)					FROM:	Kiewit – Kevin Ya	ang
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#### Derkson, Debra TRAN:EX

From:Gohl, Ed E TRAN:EXSent:Saturday, February 12, 2005 11:56 AMTo:'David Wallace'; Bowen, Blair TRAN:EXCc:Ahola, Rob TRAN:EX; 'Ryan Tones'; 'Jeff Raine'Subject:RE: MoT Stop Work Order - Blasting

David, with respect to your request for a stop work order, please direct your attention to Schedule J Sections J3.0 to J4.3 and then ask the question again.

Ed

-----Original Message-----From: David Wallace [mailto:David.Wallace@Kiewit.ca] Sent: Saturday, February 12, 2005 11:10 AM To: Bowen, Blair TRAN:EX Cc: Gohl, Ed E TRAN:EX; Ahola, Rob TRAN:EX; 'Ryan Tones'; 'Jeff Raine' Subject: RE: MoT Stop Work Order - Blasting

(... slight correction)

Blair:

Your concerns below are addressed in the WCB report.

We reiterate the statement that WCB has not issued a stop work order and are satisfied with our drill & blast program, the handling of the incident and the corrective measures that we are bringing to our procedures. We are looking at minor fine tuning and not wholesale changes.

Your January 27th (not February 24th) directive has limited our drilling & blasting operations to the point that we went from 2-3 blasts per day to 0-1 blast per day. We went from mucking 7,552 m3 the week of January 16-22 to 2,712 m3 last week. This week our mucking operation has caught up with the available blasted material. Given the pending stop work order, there is no more blasted rock to excavate. We were ramping up to 10,000 m3 per week with the mobilization of 7 Volvo articulated 30 & 35 th haul units to meet our budget constraints.

We require confirmation by letter that MoT has issued a stop work order. If we are to send home 100 employees and park \$10M worth of equipment while we sort out these new constraints, we want an official letter from MoT.

David A. Wallace, P. Eng. Construction Manager Sea-to-Sky Highway Improvement Project - DB2 Sunset Beach to Lions Bay

Peter Kiewit Sons Co. 10651 Shellbridge Way, Suite 120 Richmond, B.C. V6X 2W8 Tel: 604-922-5622 Fax: 604-922-5623 Cell: S22 Email: David.Wallace@Kiewit.ca

----Original Message-----

From: Bowen, Blair TRAN:EX [mailto:Blair.Bowen@gems8.gov.bc.ca]
Sent: Friday, February 11, 2005 5:10 PM
To: 'David Wallace'
Cc: Gohl, Ed E TRAN:EX; Ahola, Rob TRAN:EX; 'Ryan Tones'; 'Jeff Raine'
Subject: RE: MoT Stop Work Order - Blasting

David,

Sorry I did not get back to right away as I with Eric Oddy inspecting a vehicle at S22 for possible flyrock damage.

However, to address your e-mail below. My understanding was that WCB was awaiting PKS's report and that the gentlemen attending on WCB's behalf were going to discuss the issue with their manager upon receipt of the report. That said, we on site feel that our request to review the blast plan for the remaining work in the Montezambert Creek area, along with corrective actions and the WCB submittal, prior to the start-up of the blasting program is not only reasonable but warranted considering events over the last couple of days.

In addition to the flyrock incidentthe traffic delay caused by the blast was 21 minutes before the release of the northbound lane (clear 82 cars before the release of the south bound lanes). If we consider Schedule J 3.0 "Stoppage Compliance" this stoppage is considered non compliant in all possible Schedule J scenarios, let alone this particular circumstance.

As such, the contractor is to "review the Traffic Management Plan and, if applicable, the Blasting Plan to determine the cause and prevent future non compliance." This is also again stated in J4.3 which further states that a new Blasting Plan and updated TMP shall be submitted for:

1. Non-compliant stoppages.

2. Changes in natural rock characteristics such as geology, faults

and

fractures.

3. When a new rock excavation location or face is initiated.

4. When the proximity of the rock excavation to the travelled

roadway

or height of rock excavation changes, either of which may not permit continuation of the current stoppage duration.

5. As required by the Ministry Representative

To this end we are only asking that the blast plan be resubmitted to expedite the return to work in the Montezambert area and that a progressive blasting plan be submitted for work at Lone Tree. It was felt that this would expedite the return to work rather than us asking for the resubmission of entire TMP and the Blast Plan as allowed under the contract.

I have spoken with Ryan and Grayson, they understand what is required for the initiation of work at Lone Tree and resumption of work at the Montezambert area. As is indicated below and also inin a seprate e-mail to Ryan (hardcopy to Grayson), as well as in an inperson discussion with Ryan, Grayson, Scott Parker Eric Oddy this afternoon in the PKS meeting room.

As per Mr. Parker's credentials we agree that they are first rate and we at the Project would feel a greater level of comfort if PKS took it upon themselves to have Oddy's blast consultant play a larger role on site. I am sure his many years of experience would complement the eagerness of the junior engineers and EITs. However, with reference to requiring an engineer's seal for the blast plans we feel it prudent that the blast plans should have one just as the TMP has one.

> Page 95 TRA-2012-00300

<u>,</u>

Flease call if you have further questions. It is likely that a letter will be issued Monday, if required.

Blair Bowen, Project Coordinator Sea-to-Sky Highway Improvement Project (604) 818-3895 blair.bowen@gems8.gov.bc.ca

-----Original Message-----From: David Wallace [mailto:David.Wallace@Kiewit.ca] Sent: Friday, February 11, 2005 3:29 PM To: Bowen, Blair TRAN:EX Cc: Gohl, Ed E TRAN:EX; Ahola, Rob TRAN:EX; 'Ryan Tones'; 'Jeff Raine' Subject: MoT Stop Work Order - Blasting

Blair:

Could you please send us an official letter outlining exactly what MoT is requesting and the reasons for the "stop work order(s)".

WCB, as a result of yesterday's incident meeting and review of our drill & blast procedures, did "not" issue a stop work order. We understand that we are generally compliant with WCB rules and regulations. We are expecting to issue the incident & corrective action report this afternoon.

It is uncommon practice (not a WCB requirement) to have a P.Eng. stamp surface blasting operations and there are not many qualified individuals in this field (unless you are talking underground mining engineering situations). Our drill & blast consultant. Scott Parker, is a licensed blaster and a recognized expert in the field. S22

Our blasts have been designed by Scott Parker in consultation with Oddy and PKS, we have built scale models of these rock cuts (which were shown to WCB and include the Kelvin South rock excavation that has started) and each blast has a drawing and numbered sequence.

Yesterday's discussion with WCB was not about wholesale changes in our drilling and blasting operation. Rather, we were discussing refinements (fine tuning) to prevent future flyrock incidents. These refinements were adopted immediately in our operations and are discussed in the incident and corrective action report to come.

David A. Wallace, P. Eng. Construction Manager Sea-to-Sky Highway Improvement Project - DB2 Sunset Beach to Lions Bay

Peter Kiewit Sons Co. 10651 Shellbridge Way, Suite 120 Richmond, B.C. V6X 2W8

Tel: 604-922-5622 Fax: 604-922-5623 Cell: S22 Email: David.Wallace@Kiewit.ca

-----Original Message-----From: Bowen, Blair TRAN:EX [mailto:Blair.Bowen@gems8.gov.bc.ca] Sent: Friday, February 11, 2005 10:44 AM To: 'David Wallace' Cc: Ahola, Rob TRAN:EX; 'Ryan Tones'; 'Jeff Raine'; Gohl, Ed E TRAN:EX; Allmans (E-mail) Subject: RE: Credibility and Disclosure

David,

Please ensure that the submitted incident and corrective action report indicated below is signed and sealed by a P.Eng. This report will be evaluated by the STS Field Representatives and Safety Auditor. Until such time that PKS has satisfied the STS Project Team that such an incident will not take place a third time, and/or WCB provides further input, blasting in the Montezambert area is suspended until further notice.

Also, we note that new drill and blast programs are imminent at Lone Tree and upcoming at Charles Creek and Ansell South . Therefore, we expect to see blast plans and a work program for these areas prior to any blasts taking place. We also expect these to be signed and sealed by a P.Eng.

If you have any questions feel free to call.

Blair Bowen, Project Coordinator Sea-to-Sky Highway Improvement Project (604) 818-3895 blair.bowen@gems8.gov.bc.ca

-----Original Message-----From: David Wallace [mailto:David.Wallace@Kiewit.ca] Sent: Thursday, February 10, 2005 6:45 PM To: Gohl, Ed E TRAN:EX Cc: Ahola, Rob TRAN:EX; Bowen, Blair TRAN:EX; 'Ryan Tones'; 'Jeff Raine' Subject: RE: Credibility and Disclosure

Ed:

We discussed the follow-up incident investigation actions this morning by cell phone around 10:30. Scott Parker, our drill & blast consultant, spent the day at the site assisting our investigation. The blast site was fenced off and put under guard watch until the WCB could visit. WCB was contacted at 08:00 and Frank Nielsen and Dick Shaw came by just after lunch to visit the site and then meet with Oddy and our staff. We assembled in the PKS site meeting room around 15:00, Blair Bowen attended the entire meeting and you arrived when the meeting was in progress. Grayson Doyle, Eric Oddy, Gary (Oddy - Blaster) and Ross Taylor had prepared a preliminary incident report and had all our procedures and documentation ready for WCB. WCB had some comments and we discussed additional measures to prevent future fly rock incidents.

Grayson Doyle and Eric Oddv. with S22 permission, performed an inspection of the S22 subject S22 this afternoon by going up on a ladder. There was no evidence of damage, pictures were taken and WCB was contacted regarding the fact that there was no visible property damage. We agreed with WCB to deal with the blast cut-off

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pre-shear holes as soon as possible and this is scheduled for tonight as early as possible before 23:00.

WCB is allowing us to continue our drill and blast work. We are instituting additional measures to eliminate the chance of flyrock. A complete incident and corrective action report will be available tomorrow afternoon.

It is clear that our present drill & blast procedures are good. We have had over 60 blasts, since the first incident, with no flyrock to report. The flyrock that we found last night and today, pictures will be attached to our report, were 20-30 mm maximum size. We took pictures of 4-5 stones around a couple of the Montizambert residences. Nobody was hurt, there was no property damage. Our staff dealt with the incident in the proper manner.

It is regrettable that there was an incident last night. It is really really unfortunate that the same resident was involved. We will continue to be vigilant to improve our drill & shoot operations.

David A. Wallace, P. Eng. Construction Manager Sea-to-Sky Highway Improvement Project - DB2 Sunset Beach to Lions Bay

Peter Kiewit Sons Co. 10651 Shellbridge Way, Suite 120 Richmond, B.C. V6X 2W8 Tel: 604-922-5622 Fax: 604-922-5623 Cell: S22 Email: David.Wallace@Kiewit.ca

-----Original Message-----From: Gohl, Ed E TRAN:EX [mailto:Ed.Gohl@gems5.gov.bc.ca] Sent: Thursday, February 10, 2005 8:01 AM To: Ahola, Rob TRAN:EX; Ryan Tones (E-mail); 'David.wallace@kiewit.ca' Cc: Hyde, Rick TRAN:EX; Bowen, Blair TRAN:EX; Tattersfield, Pam TRAN:EX Subject: RE: Credibility and Disclosure

David, this situation is unnacceptable and cannot be repeated.

A complete investigation of the events of last night must take place before another blast occurs where even a remote risk of striking infrastructure including houses, bridges etc. is possible.

My office needs to see ALL the details of this investigation including but not limited to the Preblast plan, Scott Parker's analysis, WCB Report, the disposition of the blasting mats and efforts made to restrain them, powder factor and any other information that may help shed light on why this has happened again.

A complete review of all blasting procedures will also take place in the wake of this. This will include a series of test blasts when beginning operations in new areas to assess the condition of the rock, and a submission and review of the blast plans for each series of blasts by your blast consultant.

I am off site until this afternoon, but can be contacted by cell phone.

Ed Gohl - Ministry Representative Sea to Sky Highway Improvement Project S22 Cell

604-913-0825 Site Office ed.gohl@gems5.gov.bc.ca

----Original Message----From: S22 Sent: Wednesday, February 09, 2005 10:45 PM To: Ahola, Rob TRAN:EX; Tattersfield, Pam TRAN:EX; Gohl, Ed E TRAN:EX Cc: Hyde, Rick TRAN:EX; Bowen, Blair TRAN:EX; A Vicki; harvey.oberfeld@globaltv.ca Subject: RE: Credibility and Disclosure

Rob Ahola: You promised to give me a copy of the report of the first blasting screw up. To date I have not received it. As I stated before, without a true root cause and corrective action, errors will be repeated. I indicated to you that I had not been told the true root cause and this has been proven tonight with another massive screw up. At about 8:35 pm the night shift let off an ill prepared enormous charge that drastically shook my whole house. (There have been charges this big before and clearly they are too big and unsafe) Immediately after the blast there were 3 very solid loud rock hits on roof followed by a large number of smaller strikes. Usually when you blast after 11 pm we are asleep and unaware of rock strikes on the roof as our bedroom is two floors down from the roof. S22 I have been told that there was no more fly rock after the November fubar, but I now know

have been told that there was no more fly rock after the November fubar, but I now know this to be untrue as the unsafe practices continue.

and the blast happened anyway. I spoke to the Kiewit safety officer Sherwin and the Superintendent Mark Diamond who told me that they would not be blasting again until there was a full investigation. I told him that I wanted a copy of the report and he agreed. Thus I expect there will be no more blasting until after I see the failure report. The P.Eng. responsible is certainly due a disciplinary hearing. As I stated before, blasts after 7 pm are too late and again tonight S22 upstairs after the blast. Nothing gives you the right to treat us like this. Please forward Peter Milburn's email address to me so I may communicate directly with him.

S22

Page 99 TRA-2012-00300

-		Suito # 120	), 10651 Shell	bridge Way (Bidg. 3), Richmond, BC	PROJECT NO.	TRANSMITT	AL NO.				
E	Peter Kiewit Sons Co.	Note: Tra	ansmittal fr	Tel. (804) 922-5622 Fax (604) 922-5623 om Jobsite Office	DB3019	TO-0	91				
TO;	Sea to Sky Atten: Ed Gohl (STS) 1300-1075 W. Georgia Vancouver BC V6E 3C9 Tel. 604-669-8848 Fax. 604-605-5936 Email. ed.gohl@gems8.gov.bc.ca	Action Required	Delivery Email	DATE: FROM:	Feb. 12, 2005 Kiewit –Kevin Y	Page 1 of 1 ang					
Coplest 1 2 3 4 5	e: Blair Bowen (STS) Stacy Bjornson (STS) Rob Ahola (STS)	ום ום ום	SUBJECT: Email Email Email Email								
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Document	No.	Rev No.	No. of Copies	Description/Title
			1	Interim Blasting Plan – Montizambert Rock Cuts
			1	Progressive Blasting Plan Lonetree Rock Cuts
			1	Incident Investigation Report – Feb 8, 2005 Fly Rock
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#### Derkson, Debra TRAN:EX

From:Rectin, Joseph F TRAN:EXSent:Monday, February 14, 2005 2:23 PMTo:'consult@aliman-safety.com'Cc:Bowen, Blair TRAN:EXSubject:EX0203 - Blasting Plans and Incident Investigation ReportAttachments:Incident Investigation Report - Feb 8 2005 Fly Rock.PDF; Progressive Blasting Plan -<br/>Lonetree Rock Cuts.PDF; Interim Blasting Plan - Monti Rock Cuts.PDF; EX0203.pdf

1

#### **Blasting Plans and Incident Investigation Report**

Joseph Rectin Document Control Sea-to-Sky Highway Improvement Project 1300-1075 W. Georgia St. Vancouver. B.C. V6E 3C9 Tel: (604)662-3555

#### Derkson, Debra TRAN:EX

From:	Bowen, Blair TRAN:EX
Sent:	Monday, February 14, 2005 12:21 PM
То:	'Ryan Tones (E-mail)'; 'Ross. Taylor (E-mail)'; 'David. Wallace (E-mail)'; 'Grayson Doyle (E- mail)': 'Kevin Yang (E-mail)'
Cc:	Gohl, Ed E TRAN: EX; Ahola, Rob TRAN: EX; 'Allmans (E-mail)'; Milburn, Peter R TRAN: EX
Subject:	Submitted Blasting Documentation
Importance:	High

Gentleman,

With respect to the aforementioned documentation the review by STS field staff and STS Safety Auditor is complete. There is one noted inconsistency between the corrective actions as noted in the PKS investigation for the WCB and the Progressive Blast plan. The investigation notes that "Blaster of record (shot firer) will load the shot, mat the shot, and fire the shot for consistency of the blasting operation."

This corrective action does not appear in the corrective actions noted in the Montizambert Progressive Blast Plan. We assume that this is simply an oversight and that this will be the practice. Please update the Montizambert Blast plan accordingly. Once updated PKS can consider the investigation and blast plan accepted as complete.

1

Blair Bowen, Project Coordinator Sea-to-Sky Highway Improvement Project (604) 818-3895 blair.bowen@gems8.gov.bc.ca

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			FROM:	Blair Bowen							
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TO:	Sea to Sky Atten: Ed Gohi (STS) 1300-1075 W, Georgia Vancouver BC V6E 3C9 Tel. 604-669-8848 Fax. 604-605-5936 Ernail, ed.gohl@gemsS.gov.bc.ca	Action Required D1	Dolivery Email	DATE: Feb. 14, 2005 Page 1 of 1 FROM: Kiewit –Kevin Yang									
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TO:	Rob Ahola		DATE:	Feb. 14, 2005	• • • • • • • • • • • • • • • • • • •	Page 1 of 1					
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Page 105 TRA-2012-00300

## Derkson, Debra TRAN:EX

From:	Ahola, Rob TRAN:EX
Sent:	Monday, February 14, 2005 11:11 AM
То:	S22
Cc;	Milburn, Peter R TRAN:EX; Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX; Hyde, Rick TRAN:EX
Subject:	Blasting Incident Report & Plan

S22

Attached is an Incident Investigation Report and Interim Blasting Plan. These have been prepared by a blasting expert and reviewed by a blasting P.Eng. The WCB has reviewed and accepted the changes. Our safety auditor has also reviewed the documents.

Based on these revised plans blasting will commence this evening. We are confident that the necessary steps have been taken to ensure safety is front and center.



Incident Interim Blasting vestigation Report Plan - Monti ...

**Rob Ahola** 

Sea to Sky Highway Improvement Project p: 604.605.5943 f: 604.605.5936 c: 604.816.4779 e: <u>rob.ahola@gems1.gov.bc.ca</u> www.seatoskyimprovements.ca

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2	Ed Gohl	DI	Į			
3	Blair Bowen	DI				
4	Ron Lee	DI				
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# Derkson, Debra TRAN:EX

From:	Rectin, Joseph F TRAN:EX
Sent:	Friday, February 18, 2005 3:35 PM
То:	Ahola, Rob TRAN:EX; Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX; Lee, Ron K TRAN:EX;
	Brown, Al TRAN:EX; Libsekal, Gebre H TRAN:EX; 'samson.chan@snclavalin.com';
	'richard.wong@snciavalin.com'
Subject:	IR0112 - Interim Blasting Plan - Monti Cut
Attachments:	IR0112,pdf; Interim Blasting Plan - Monti Rock Cuts (PEng Stamped).pdf

#### Interim Blasting Plan - Monti Cut

Joseph Rectin Document Control Sea-to-Sky Highway Improvement Project 1300-1075 W. Georgia St. Vancouver, B.C. VGE 3C9 Tel: (604)662-3555


Ministry of Transportation Sea-to-Sky Highway Improvement Project

## Review Procedure – Province Response

	,	······································	Reference Number:	RPPR-S	2S-Trans-092
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The following doo	cument(s) hav	e been submitted	by the Concessionaire in acc	cordance with	the Review Procedure:
Doc#: Progressi Progressi Progressi	Doc#: Progressive_Blasting_Plan_DB12_Rockcut_No4_2005-Sep-22.pdf Progressive_Blasting_Plan_DB12_Rockcut_No5_2005-Sep-22.pdf Progressive_Blasting_Plan_DB12_Rockcut_No7_2005-Sep-22.pdf				
PROVINCE RE	SPONSE				
In accordance with of the preceding of	th the Review document(s):	Procedure, the Pr	ovince Representative subm	its the followin	g response in respect
Received:					
Received with co	mments:				
Comments:					
initial blasts will be smaller in nature progressing to larger volumes. For future blasts, in this location or others, we would expect to see a more concise plan with clearly defined progressive blasting steps before blasting can procede. There should also be a method of providing a feedback loop to confirm actual blast results against the plan. Attachments: n/a					
Signed:	<u>Stere</u> B Province's Re	presentative	For		
Name:	Gary Webste	r, P.Eng.			
Date:					
Ministry of Transportation	Sea-to-Sky Improveme	Highway at Project	Location: Suite 1420 - 1111 West Georgia Vancouver, BC V6E 4M9 Telephone: (604) 775-1100 Facsimile: (604) 775-1144	Street	Web Address: www.scatoskyimprovements.ca

# **Progressive Blasting Plan**

## The Sea to Sky Highway Improvement Project (S2SHIP)

# Segment 1 Sta 99+210 to Sta 99+310 993 Retaining Wall Foundations

## **Developed for:**

Peter Kiewit Construction Sea to Sky Highway Investment Limited Partnership

## Developed by:

R Scott Parker AScT WCB Certified Blaster 481497 Explosives and Rockwork Technologies Ltd 890 Porteau Place, North Vancouver BC V7H 2S3



## **Progressive Blasting Plan Model**

#### General Work Segment 1 Sta 99+210 to Sta 99+310

Segment 1 Retaining Wall Foundations of the S2S Highway upgrade is located between stations Sta 99+210 and Sta 99+310 some 90 m in length, containing approximately 452 m<sup>3</sup> of rock insitu. The Progressive Blasting Plan will address the methodology and progressive procedures required to undertake the work to comply with the contract requirements and quite specifically the traffic management plan.

The plan shall outline a performance based process and testing procedure that considers the following items to be addressed. These items were identified as a requirement of J4.3 of the Traffic Management Plan:

- 1. Physical relationship between the Highway and blast location
- 2. Natural conditions of the rock
- 3. Volume of blasted material
- 4. Rock blasting
- 5. Movement of excavated material
- 6. Traffic management
- 7. Vibration criteria

These cuts for the 993 Wall for reference purposes Sta 99+210 and Sta 99+310 have been referenced as such in the drawings and will hereafter be referred to in this report.



This rock cut is on the south side of the eastbound lanes of Highway 1, opposite the area locally referred to as Eagle Ridge Bluffs adjacent and below the 2592 structure that is to be removed. The purpose of these cuts is to key into the slope the shelves and ledges to seat the footings for the retaining wall. The surface area of this cut is relatively small, some 6 m in total width bounded on the south side of the cut by a steep drop-off to a populated wooded area below. A certain amount of localized stripping and grubbing of the vegetation is required. Access to this area will require the removal of the no-post guard rails, and carefully recovering loose blocks and talus materials within the cut area that are lying on the steep side slope in this area.

The rock will be drilled and blasted in a series of small controlled shots. The shots will be pulled west paralleling the existing 2592 structure. These heavily matted shots are designed to remain in place, very little lateral movement is anticipated and there should be little disruption to traffic except that required for excavation of the blasted material and placement of the blasting mats.



## Constraints

#### Project Constraints - Traffic Management and Blasting Activities

#### **DBFO Segment 1 Traffic Stoppages:**

Summer Stoppages (Mar 01/06 - Dec 01/06)

- 2 Min Stoppages
  - o 4pm-5pm M-Th
- 10 Min Stoppages
  - o 9am-4pm M-F(1200)
  - o 8pm-6am M-Th
- 20 Min and 2Hr Closures
  - To be scheduled ahead of time and approved by the Traffic Manager

#### Stability constraints - Rolling rock

The side slope of the cut drops of at an angle greater then 1.5:1 along several areas of the cut. Rock left on the slope or allowed to make its way onto this slope (gas venting along joints, adverse jointing, rock coming out from under a blasting mat or being inadvertently dropped by an excavator) will have a tendency when dislodged to roll down this slope and into the greenbelt area below. There appears to be several downhill areas where the grade either flattens (which might hold this material) or the natural vegetated slope may slow down the material to a point where it will tend to slide on the 1:5:1 angle of repose and come to rest.

A heavy rockfall fence should be constructed offset along the bottom of the cut line and should be cabled back to either the structure or to competent bedrock anchors. Lock blocks along the trail at the bottom of the slope on the portal access road are scheduled to be installed. Scalers should examine the slope below as several large boulders were seen to be lodged against trees in a very precarious attitude.

## Physical relationship between the Highway and blast location

Reference: Drawings 9450R-100 to 9450R-108 issued for 90% MOT Design Review and the sections developed along this cut.

The rock cut is on the south side of the road, between stations 99+210 to station 99+310 below and adjacent to highway structure 2592 which spans a shallow ravine along this section of the grade. Overburden and rubble infill masks the depth of cut to rock in the deepest point of the gulley trough; shallow cuts are anticipated in this area. The 2592 concrete structure is to be

removed as part of the highway reconstruction in this area. The footings of the old cantilevered structure are within 3 m of the area to be blasted. A certain amount of shock energy will be transferred into this structure from the blast; the structural integrity of theses foundations may suffer as we remove the lateral support from these foundations. Heavy equipment operations atop the structure may be compromised.

The cuts with the most volume are situated along the western flanks of the gulley adjacent to the western approaches and the 2592 structure. Cut depths on several benches are anticipated to be no greater then 8.5 m with cut widths on the lower bench not to exceed a width of 4.1 m. The upper benches are true sliver cuts with a nominal bench width of between 2.6 m maximum to 1.9 m in width. The width of theses cuts, the physical relative distance between the edge of the cut and the structure and the steepness of the slope preclude the mobilization of heavy drills onto the site.

The rock cut parallels the road which roughly runs west to east in this area with the outside lane closest to the rock facing north. Traffic will be detoured as far north as possible through this section to maximize the distance between the rock and the traveling public. The cut can be worked from either the east or west end, and I would suggest that Kiewit's forces opt for a west to east advance/development. Access appears possible from the western edge of the cut at sta 99+315 on the above plan. Some site pioneering, preliminary scaling, and loose boulders and rock recovery appears warranted along the top of the cut limits along the southern boundary.

#### Landforms and structures around the cut:

- Part of this cut is the outside remnant of the old eagle ridge bluff cut along this section of the THC Upper Levels Highway; a shallow gully appears to be normal to the bluff and appears along an erosional feature along several joint sets. The backslope of the cut falls off into a greenbelt area, populated with arbutus, fir and hemlock trees, scrub and shrubs. A pathway at the base of the cut appears to fall between the base of the slope and houses situated below. On the drawings this area may falls within Plan LMP 25925 designated as Park, West Vancouver.
- There are numerous structures located within 1 km of the cut. These structures are mainly downhill of the shot at the base of the slope. The Nelson Creek Bridge Structure is located 300 m east of the cut.
- Those residential structures that will be impacted with greater then 12.5mm per second will be subject to a pre-blast inspection within 45 days prior to the commencement of blasting. Note the structures are 135 m from the blast and according to the shot design should produce no more than 1.27 mm/sec. Having reviewed this data it still appears prudent to undertake inspections in this area because of the proximity of the houses to the toe of the slope and the nature of the decline above these structures.
- Seismic monitoring on the closest structures noted will be undertaken.
- BC Hydro Transmission lines run north along Eagle Ridge parallel to the cut, these lines are located no closer then 300 m to the north. There are also distribution and fiber-optic lines present in the area.
- The CN Rail line tunnel portal into the face west of the Nelson Creek bridge structure. The tracks are situated 282 m from the east end of the cut. The likelihood of flyrock coming into contact with the tracks is remote.

#### Blasting Methodology

- Access from the west can be attained by pioneering a short ramp from sta 99+310 eastward. Presently, shallow overburden covers 20% of the outcrop. A narrow path along the bridged structure provides immediate access onto this slope. High scalers working with smaller drills should be able to bench and widen this access ramp until a small airtrack has enough bench width to work. Alternately the whole cut may be undertaken utilizing a three man plugger crew working to 3 m cut depths. Some horizontal line holes are foreseen, drilled to develop the foundation notches. Blasted and loose material will be cleared off the slope utilizing smaller equipment, the presents of any unstable blocks or materials that may find its way inadvertently downhill may have to be temporarily restrained until it can be recovered.
- The estimated quantity that could be present, assuming 100% rock is 452 m<sup>3</sup>, and depends on the back slope cut section and the overburden rock contact in the gully. The first 35 lineal m of cut will be removed from the largest cuts with 307 m<sup>3</sup> of removed over a distance of 35 lineal m representing a volume of 8.7 cubic m of rock that will be blasted
- per every meter of advance. In the next 55 lineal meters of base preparation 45.7 m<sup>3</sup> of material will be removed, 2.6 m3 per meter of advance will be realized. The cut consists of relatively long narrow shelves to be cut into the sidehill to facilitate the MSE footing and foundation walls to be placed and anchored.
- The cuts can be blasted in a series of small lifts utilizing pluggers (hand held drills), and will take approximately eighteen blasts to complete. These planned sequences may be subdivided into discreet blast blocks that are no longer then 4.5 m in length and a max 4 m in width. The area will be completely covered in blasting mats which can be lowered onto the shot from the adjacent structure. The amount of area that may be shot at one time will be governed by the area that can be matted and the crew's ability to maintain rock on the slope without it rolling down the backslope. The location of the highway in relation to power lines and other structures, along with the scheduled road closures and the structural integrity of the rock, should allow for blasts of this magnitude to be permitted.
- The first areas to be blasted are estimated at between 10 and 20 m<sup>3</sup>. Location of this
  blast is still pending and is dependent on overburden removal and access development.
- Blast dynamics dictate that a free face is required for the blast to break to. The
  development of the free face is created by opening up an engineered small area to which
  to blast to. These free face areas will be progressed and developed for each blast. It is
  imperative that the blast be allowed to move out into the designed direction of progressive
  relief. Failure to generate this relief will result in a "chocked" shot. With lateral forces
  being laterally transferred into the back walls and destabilization of the final wall and
  unwarranted energy going into the adjacent concrete structure. This chocked shot will
  also produce unwanted lateral mass movement out onto the side slope instead of parallel
  to the alignment.
- Rock removal in a series of thin sliver cuts blasted to bench height and finally to grade.
- Access from the west end of the cut requires some ramping and small pioneering shots to open up this area. Presently, equipment is able to access the top of the cut from the 2592 structure and from the west after the no post guardrails are removed.

### Natural conditions of the rock

- Dominant joint planes at the west end of the cut are suspect, we should be cognizant of the possibility of high angle joints which may dip into the cut, and of a dominant joint set that dips into the cut and possibly out through the downhill finished cut wall. The gulley is probably an erosional feature developed along a set of intersecting dihedral joint planes which may adversely affect the stability of this cut if these joints daylight on the backslope. Failures along joint planes > 37.5 degrees are anticipated with forces of >1g from the blast shockwaves. This will impact the face in the sections where the joint planes are dipping at an angle >45. Mechanics of failure are present with stress relief (exfoliation doming) and other steeply tectonic sets providing the surfaces.
- Cohesion and asperities to be overcome by G values greater then 1. Note that high frequencies could loosen the material after the shot, but without the low frequency component displacement may be low and delayed catastrophic failure of blocks after the shot may occur. Time frame unknown. (Impose setback for pedestrian traffic below cuts, scale face as required).
- Open jointed and blast damaged faces may vent. The rock cuts in this area have a long history of flyrock venting along relatively flat lying joint planes.
- Water table in substrate unknown at the time of inspection. Free draining surface water into the boreholes is anticipated to be minimal, area seems dry but water may collect along the low parts of the gully.
- Water in open joints indeterminate and there may be some weepage/seepage from the rock face. Porosity of intact rock anticipated 10^-6 to 10^-2 along open joint sets.
- Rock primarily composed of a quartz diorite, part of the Pluton, with a RQD between 0 and 100 percent depending on joint spacing; rock hardness varies but typically is around R3.5-R5.

## Volume of blasted material

- The overall volume of the section between **Sta 99+210** and **Sta 99+310** some 90 m in length, containing 452 m<sup>3</sup> of rock insitu, with a swell factor of 1.2. The volume of broken rock to be moved will be 542.4 m<sup>3</sup>.
- Potential number of blasts to be undertaken = 18 shots, assume two shots per day.
- The volume of rock to be moved each day is approximately 30 m<sup>3</sup> (average).

## **Rock Blasting**

- For the purposes of this plan, blasts will progressively increase in volume from 10 m<sup>3</sup> to 20 m<sup>3</sup>. The volume of rock shot is dependent on the orientation of the rock with respect to the highway. All blasts will be preformed during the daylight closure timeframe.
- Blasting volumes on these cuts are dependent on several factors:
  - 1. Optimization of road closure, procedures, equipment, people, site distances, queue distances and timing.
  - 2. Access to the top of the cut, pioneering bench widths and the competency of the rock to maintain a bench to hold the drills.
  - 3. Ramp geometry.
  - 4. The availability of a free face to shoot to.
  - 5. Optimization of our blasting procedures, matting requirements, scheduling times for shot, setting guards, firing the shot, checking the shot, all clear.
  - 6. The blast explosives loads that have been optimized for wall control.
  - 7. Road clearing, scaling and getting thru traffic back onto the grade all in accordance with the contractual requirements.

### **Progressive blasts**

- Note: Subsequent blasts are to follow the same model until the rock volume blasted cannot be handled in the closure window, the methods are changed or the target values for volumes blasted per blast are achieved.

#### Progressive Blast 1 (Test on next and subsequent blasts taken along these cuts)

#### Stations 99+235

- Volume of material blasted 10 m3 depending on surface rock contours
- Area blasted 3.4 m in depth x 1.93 max width.

Volume of rock anticipated to impact road between (best case) 0  $m^3$  and (worst case) 1  $m^3$ .

#### **Evaluation Criteria**

- Early start...Late finish of each activity to be generated
- Cycle time of trucks and loaders required for clearing road generated
- Traffic release will be estimated on the time required to clear the road when we have an appreciation of the volume of rock that will be deposited on road from the blast
- Lead time for men and equipment off site, overlapping activities and communications fan-out and compliance feedback
- Length of line up at east and west closure ends.
- Ferry schedule, and impact on traffic volumes.
- Queue time, west and east- decide which is to go first, i.e. longer lineups.

#### Potential problem areas

 Blasting delays: Realistically, determining a set time for the initiation of a blast based on a schedule has proven to be problematic. The blaster should have the time to check and double check his loads, protective measures and site security prior to detonating the blast. In the author's experience, a well managed blasting program can be systematically punctual, but all it takes is one blocked hole to throw a schedule out the window.

The hazards associated with blasting are many, the last thing you want to do is rush or pressure the blaster into shortcutting industry standard procedures. When the shot is ready it should be fired, if that means missing an "on the hour firing time" it would be prudent to wait until the next available window.

- Stability and scaling delays: Evaluation by the Geotechnical Engineering Staff, some remedial scaling by either machine or by hand may be required.
- Misfire delays: are rare but they do happen, follow WCB procedure.
- Weather delays result in a decrease in productivity any forecasted lightning shuts down the blasting program until the hazard passes. This area is the first predominant headland off of the Gulf of Georgia and experiences many sudden squalls with the potential for lightning.
- Flyrock problems, the root cause to be evaluated and steps taken to remove the hazard, flyrock and face venting potential must be constantly evaluated.

#### Vibration criteria

- Vibration criteria at Nelson Creek Bridge 65 mm/sec at freq greater then 40Hz, 50 mm per second 20-40Hz, 25 mm/sec below 15 Hz.
- Vibration criteria at CN Tunnel Portal 100 mm/sec at freq greater 30 Hz, less then 20 Hz 65 mm/sec.
- Vibration criteria at nearest residence 50 mm/sec at freq greater then 40 Hz, for lower frequencies follow the Blasting Level Criteria, RI 8507, 1980 see figure no 1.0
- Overpressure and noise criteria :
  - From blast 134 dBL at the nearest habitable residence limits.
  - Recommend that noise levels 105 dB C-slow weighting scale on a sound level meter
  - Note: nuisance value for noise levels of values greater then 75dBA at night for people sleeping in Area.



Figure No 1 Blasting Level Criteria, RI 8507, 1980

#### Process evaluation

- Float time in schedule = time available to increase blast volume.
- Time to move rock from area, m<sup>3</sup>/min = predict cycle times for equipment selection based on demand.

#### **Recommendations based on evaluation**

- Size of next blast based on previous blast performance
- Pattern geometry changes required
- Stability concerns / hazard evaluation

### Movement of excavated material

- Rock during the blast should move parallel with the road and either west or east into the gulley area as much as possible.
- Material from below the road will be excavated from the blasted area and onto either holding areas or loaded out to receptive areas on the grade. This will facilitate the opening of the road and loading and haulage by the heavy equipment.
- As the cut is extended east, this use of the cleared area will continue, with due concern for overloading the slope. Impact berms may be developed along the edge of the road.
- Rock falling onto the road is not anticipated from these cuts.

- A 345 or equivalent hydraulic excavator to machine scale face, as required.
- 35 T articulated trucks to move broken rock, the anticipated load between 10 and 12 m<sup>3</sup>.
- 70% of material will be between 0.3 and 1 m<sup>3</sup>.
- 10% of the material may require secondary blasting, blockholing or hoe ramming allowed. No sandblasting will be allowed.
- Scaling, stabilization measures and trim blasting may be required along he designed cut; this area should be examined by the geotechnical engineers for this section.

## Traffic management and guarding of the shot

- Blast guards inside of flag persons, non essential personal outside of guarded area, radio protocol.
- Signage required, Blasting Ahead, Turn off Radio Ahead, No Stopping, Blasting Signals, Danger Blasting Area, Watch for Falling Rock, lower path ways to be closed, entrance to be signed.
- Guarding of the area will require liaison with guards on access points below the shot.
- Notification of residence, below the shot required.
- Road, Vehicular traffic, 400 m closure each side of blast, radio protocols. •
- Emergency vehicles: radio ahead to hold the shot or expedite one lane opening.
- Pedestrian: prohibit, suggest they close the seasonal south end of the Provincial Park.
- Trails in the area: close, guard and barricade, public notices may be required. ٠

The cycle for the operation is daily operations to accommodate two per day; the following has to be completed based on 20 m<sup>3</sup>.

- Survey /Layout time 1 hour detailed due the surgical precision on these cuts ٠
  - Design of Shot 1 hour, 24 hour notification required prior to shot being drilled
- Drill

.

- 3 hours per shot
- Load and Shoot 2 taking 1 hours to load
- Muck 1.5 hours
- variable from .5 to 1 hours Scale
- Stabilize: variable from 0 to 2 days

Note - Activities may run concurrently

## Blast design

Sheared back wall is required, post shearing or cushion blasting methods will be employed to produce the back wall lines. A simplified buffer line may be utilized to reduce the likelihood of shooting thru the backslope wall, and reducing the likelihood of rock falling or rolling downslope, production holes based on pattern of holes with an maximum depth of 3 m, burden and spacing  $0.75 \times 0.75$  maximum. (Pluggers or small drifters with rope thread steel)

#### **Cushion holes**

- Spacing 0.3 m, Burden, 0.8 m from inside edge to any lateral free face.
- Toe load 1.5 cartridges of high strength NG.
- Load 200 grain Primaflex in every hole between, to within 0.6m of surface, trace to surface with 25 grain detonating cord.
- Place a stemming plug at 0.6m and stem from 0.6m to surface with 4 mm sorted gap graded clean pea gravel,
- Every 3<sup>rd</sup> hole shall have a 25 ms surface detonator tied into the det cord.
- The cushion holes shall be fired off with the shot off the end of every third row or on smaller shots fired at the end of the shot. The intent is to peel away the back line after the main shot has fired.
- Note: if we can get an airtrack into this area, drilling should proceed full cut depth at 0.45m centers and fired full depth with light loads.

#### Buffer line

- Spacing 0.3 m, burden 0.45 or 0.8 m from outside edge to lateral free face.
- Load hole diameter 35 mm, hole loaded with detonator sensitive NG based explosive product.
- Load cartridges of NG (Unimax (or equivalent) 25mm) in diameter in toe, 0.3m long wooden spacer, alternate 25 mm cartridges and spacers to within 1.4 m of surface.
- NG's can be traced with cord, emulsions cannot. Product NG or high strength micro balloon detonator sensitive emulsion.

#### Production holes

- Pattern 0.65 m x 0.65 m, outside holes should have a burden of 0.8 m from outside edge to lateral free face; additional angled (stab) holes may be required on free faces to maintain explosives placement pattern intent and is dependent on the surface topography and setup of the drills.
- Detonation and timing 25 ms surface / 500 ms downhole delay detonators, 1 hole per delay, 17ms between rows, shall V zipper cut is preferred, echelon cuts may be required.

- Dry holes 2 cartridges detonator sensitive NG or Emulsion. Anfo will not be utilized on these cut. Load to within 0.4 m of collar, granular stemming to surface, no rock flour as stemming, 9 mm gap graded stemming required to lock the powder down hole in areas.
- All shots will be matted and all mats will be tied back and chained together to reduce the likelihood of losing the mats downhill.

#### Line drilling to develop foundation base areas

- The foundation walls be seated on notches cut into the sidehill as illustrated in the drawings, the success of this undertaking is wholly dependent on two issues:
  - The first being dependent on the rocks ability to hold the ledge, loose highly fractured rock will necessitate deepening the foundation footings into the slope and redesigning the wall in that area.
  - The second depends on the driller and the blasters ability to read the rock, drill the holes to the configuration required and blasting these areas with the optimal amount of explosives to remove the rock without damaging the surrounding rockmass.

Horizontal and vertical line holes drilled at spacings from 0.2 to 0.45 m apart are anticipated and may have to be changed regularly with the change in jointing, and rock strength. Det cord placed into water filled holes and plugged with clay may be utilized to ease the rock out of the notches. Tight angles are always portrayed on drawings, but are problematic in their execution, explosive traces a better curve then an angle, webs and rounded corners should be anticipated.

#### Vibration analysis

Loading based on 6 m drilled hole loads (double the load for plugger holes drilled to 3m) 98% confidence limits based on scaled distance relationship

Where PPV =Peak Particle Velocity K =site constant =200(Imperial) based on the authors experience for blasting this type of rock in West Vancouver SD= Scaled Distance Relationship = Distance / Square Root of Explosives detonated in a 8 ms timeframe

Predicted vibrations based on single hole loading at the distance from various structures to the blast are:

Load based on a max load of 3 kgs / delay

Houses below the shot	135 m	Predicted PPV = 0. 05 in/sec = 1.27 mm/sec
Hydro lines to the North	408 m	Predicted PPV = 0.009 in/sec = 0.23 mm/sec
CN portal entrance	282 m	Predicted PPV = 0.02 in/sec = 0.45 mm/sec
Nelson creek bridge structure	300 m	Predicted PPV = 0.02 in/sec = 0.51 mm/sec
North rock face along Highway	28 m	Predicted PPV = 0.65 in/sec = 16.51mm/sec

Footings on adjacent bridge structure 3 m Pathway to Portal, toe of slope 101 m Predicted PPV = 27 in/sec = 686 mm/sec Predicted PPV = 0.08 in/sec = 2 mm/sec

As can be seen from the above calculations and comparing these values to the stipulated vibration criteria, the load will not exceed any of the vibration criteria stipulated outside of a range of 14 m.

Cracking of the concrete peers on structure 2592 immediately adjacent to the shots is anticipated, the structural integrity of the structure may be compromised. Adequate relief may be reducing the shock energy going into this structure significantly. Past experience suggests caution in loading heavy equipment this structure until the area is deemed safe.

Based on a load of 3 kgs/delay we can see that 5 m behind the back line of holes on the backslope of the cut facing south, there may be reason for concern ... based on:

• from Shearline on rockslope 5 m Predicted PPV = 10.7 in/sec = 272 mm/sec

-with a frequency of over 100-150 Hz at this distance we will produce 10-20 g's of acceleration, producing rock displacements up to 3 mm, enough to overcome any cohesion along any adverse joint planes...failures would be immanent along any definable high angle joints in this area.

See detailed blast plan for shot design -

R.Scott Parker ExRT Ltd Thursday, April 20, 2006 From: Sent: To: Subject: Ahola, Rob TRAN:EX Thursday, March 3, 2005 7:24 AM Milburn, Peter R TRAN:EX FW: Night Blasting Activities

Peter,

I can see why you asked the question about a 12:30 blast. The blast Tuesday night was delayed due to a late train arrival. That pushed it out of the 11:00 to 12:00 blasting window. This is what  $_{S22}$  picked up on.

Next time we will not fire it after the 11:00 to 12:00 window.

Rob

-----Original Message-----From: Ahola, Rob TRAN:EX Sent: Thu 3/3/2005 7:14 AM To: Dash, Evan TRAN:EX Cc: Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX; Hyde, Rick TRAN:EX Subject: RE: Night Blasting Activities

This is a problem at Montizambert on two fronts. We have been saying no blasts from 11:00 to maybe 12:00 midnight, This one at 12:19 is outside of that window and different than what the Minister has been communicating.

Also we thought the blast was at 10:00 and did not know any different as it was discussed with Peter. We can't let S22 have better info than we have.

How do we fix these problems?

Rob

----Original Message---From: Dash, Evan TRAN:EX
Sent: Thu 3/3/2005 5:54 AM
To: Ahola, Rob TRAN:EX
Cc: Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX; Hyde, Rick TRAN:EX
Subject: Night Blasting Activities

Guys;

Last night Mar. 01-02 we did have a late blast @ Monte North @ 12:19 a.m. The blast site was prepared to be fired prior to midnight but anytime is traintime. Train cleared site @ 12:08 a.m. This particular blast site had been on hold & guarded for 24 hrs. already. I was consulted with by Mark Diamond & Grayson Doyle and I gave them the go-ahead. A filter cloth cover was installed over blast site and didn't produce any kind of fly rocks or bits. I attended S22 property.

As for tonight there was NO blast or activity of any kind @ Monte North. There were 2 blasts tonight @ the Charles crk - Turpin crk cut. Maybe impacting on the residents of Strachan Pt. Drive.

From:Ahola, Rob TRAN:EXSent:Thursday, March 3, 2005 8:03 AMTo:Gohl, Ed E TRAN:EX; Dash, Evan TRAN:EXCc:Bowen, Blair TRAN:EX; Hyde, Rick TRAN:EX; Milburn, Peter R TRAN:EXSubject:RE: Night Blasting Activities

Further to this. At the direction of John Dyble ADM and the Minister no blasts after 11:00 at Montizambert regardless of the situation. We will let PKS know this morning as we are meeting with them. The Minister is on Raife Mair this morning.

Rob

----Original Message-----From: Gohl, Ed E TRAN:EX Sent: Thursday, March 03, 2005 7:24 AM To: Ahola, Rob TRAN:EX; Dash, Evan TRAN:EX Cc: Bowen, Blair TRAN:EX; Hyde, Rick TRAN:EX Subject: RE: Night Blasting Activities

I think that Evan summing up the nights activities by email will solve the problem. We then all have access to the needed information regardless of whether we communicate by tel etc in the morning.

Ed

-----Original Message----From: Ahola, Rob TRAN:EX Sent: Thursday, March 03, 2005 7:14 AM To: Dash, Evan TRAN:EX Cc: Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX; Hyde, Rick TRAN:EX Subject: RE: Night Blasting Activities

This is a problem at Montizambert on two fronts. We have been saying no blasts from 11:00 to maybe 12:00 midnight, This one at 12:19 is outside of that window and different than what the Minister has been communicating.

Also we thought the blast was at 10:00 and did not know any different as it was discussed with Peter. We can't let S22 have better info than we have.

How do we fix these problems?

Rob

-----Original Message----From: Dash, Evan TRAN:EX Sent: Thu 3/3/2005 5:54 AM To: Ahola, Rob TRAN:EX Cc: Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX; Hyde, Rick TRAN:EX Subject: Night Blasting Activities

From: Sent: To: Cc: Subject: Dash, Evan TRAN:EX Tuesday, March 1, 2005 3:37 AM Ahola, Rob TRAN:EX Gohl, Ed E TRAN:EX Monte North Blasting

Rob,

The blast tentatively scheduled for tonight @ Monte north has been put on hold & guarded. Blaster required more holes drilled.

It will be detonated tomorrow night. I lean agains S22 garage door every time there's a blast in his vicinity. (TARGET) No evidence of Global TV onsite tonight (raining).

One other blast @ Kelvin has not been detonated as of yet 3:30 am.

Nightcrawler

Evan

From: Sent: To: Cc: Subject: Dash, Evan TRAN:EX Thursday, March 3, 2005 5:54 AM Ahola, Rob TRAN:EX Gohl, Ed E TRAN:EX; Bowen, Blair TRAN:EX; Hyde, Rick TRAN:EX Night Blasting Activities

Guys;

Last night Mar. 01-02 we did have a late blast @ Monte North @ 12:19 a.m. The blast site was prepared to be fired prior to

midnight but anytime is traintime. Train cleared site @ 12:08 a.m. This particular blast site had been on hold & guarded for 24 hrs. already. I was consulted with by Mark Diamond & Grayson Doyle and I gave them the go-ahead. A filter cloth cover was installed over blast site and didn't produce any kind of fly rocks or bits. I attendec S22 property.

As for tonight there was NO blast or activity of any kind @ Monte North. There were 2 blasts tonight @ the Charles crk - Turpin crk cut. Maybe impacting on the residents of Strachan Pt. Drive. Blast @ 1:06 a.m. and 4:49 a.m. both clean shots which didn't produce any kind of fly rock or debris on Hwy.

Evan.



March 5, 2005

File: PKS-STS-LTR-045

Sea-To-Sky Highway Improvement Project Suite 1300 – 1075 West Georgia Street Vancouver, BC V6E 3C9

Attn: Rob Ahola Section Director - DB3019 Sunset Beach to Lion's Bay

#### RE: BLASTING - REVISED HOURS OF WORK

Dear Mr. Ahola

Pursuant to the meeting last Thursday morning between PKS's Frank Margitan, Jeff Raine and MoT's Peter Milburn and Rob Ahola, PKS received the following verbal directive:

- PKS cannot blast after 23:00 (11:00 pm);
- Drilling hours in the Ansell Place to Montizambert area are limited to 07:00 (7 am) to 19:00 (7 pm);

The objective of the directive was to reflect the media message from the Minister of Transportation regarding work hours that addresses the complaints by local residents.

The Contract refers PKS to the EAC Table of Commitments concerning the mitigation of noise. There is no clear reference to limiting hours of work. Municipal bylaws do not apply to Provincial highway work. Despite site measures, noise monitoring, etc. aimed at mitigating noise, S22 continue to express their displeasure

verbally, by emails, in the newspaper (the Province, the North Shore News), and television media (Global TV). The allegations of significant flyrock and major structure damage, for the most part, are unfounded as there have been 2 documented minor flyrock incidents. Reasonable measures are in-place, with the approval of WCB, to prevent flyrock event re-occurrence.

The contract is quite specific about the road closure regime (Schedule J). Blasting and mucking within these allowable time limits has been a challenge. PKS appreciates the latitude, cooperation and understanding that MoT has displayed on the length of night time closure limits. The actual costs and delays to MoT and the public have been minimal. This latitude has allowed the project to progress through the winter months and helped PKS catch-up to the original proposal schedule.

Peter Kiewit Sons Co. CONTRACTORS 120 – 10651 Shellbridge Way Richmond, BC V6X 2W8 Tel: 604-278-3331 Fax: 604-278-5729 1 of 2



Thursday (March 3<sup>rd</sup>) we held a meeting between 12:00 noon and 14:30 with PKS and MoT representatives to discuss the implications of the above directive. A number of points were made:

- 1. It is desirable to continue night time blasts (except for small boulder and high subgrade popping), between 20:00 (8 pm) and 23:00 (11 pm), to limit traffic disruption and allow sufficient time when there are challenging mucking situations;
- PKS, given the logistics of servicing blasts in different areas in a short time frame, has purchased 24 additional blasting mats. This will allow 2 blasts to be matted which allows 2 blasts to be performed between 20:00 and 23:00;
- PKS is bringing in another CAT Loader, probably a CAT990, (in addition to the CAT 966G and 980GII), a tractor-trailer equipment float and possibly another excavator to facilitate the blasting and mucking operations at two locations at the same time. Typically we rush, after the blast, to open single lane alternating. Then we continue mucking until 2-lanes are fully operational;
- The hours of work of the night shift crews involved with blasting, blast support and mucking have been changed so that we can start loading a blast around 17:00, start matting around 19:00 and blast from 20:00 to 23:00;
- 5. MoT representatives will contact residents at Strachan Point and then Kelvin Grove to determine whether they are hearing the blasts between 20:00 and 23:00. This information may form a basis for allowing later night time blasting in a particular area at a later date.

PKS has been affected by the MoT directive limiting drilling and blasting hours of work since January 27<sup>th</sup>. We frequently send home our drivers and park the Volvo truck fleet due to lack of available blasted rock. Yesterday we shut down most of our trucks around noon when we ran out of blasted rock. Montizambert North was originally schedule to be completed the 3<sup>rd</sup> week of February. Limiting the hours of work means that this work will now be completed in mid-March. Limiting the hours of work has meant fewer blasts and has necessitated accelerating the installation of detours and opening additional rock cuts to regain operational efficiency.

We appreciate the cooperation and assistance from MoT toward the successful completion of this project. PKS, to-date, is absorbing the costs and impacts of MoT directives limiting hours of work. As such, we reserve all our contract rights, under sections DB 40, 41, and 42 to present claims for additional costs and additional time. We trust that PKS and MoT will work together to help mitigate these costs and impacts.

Regards,

David Wallace, P.Eng Construction Manager Peter Kiewit Sons Co.

Peter Kiewit Sons Co. CONTRACTORS 120 - 10651 Shellbridge Way Richmond, BC V6X 2W8 Tel: 604-278-3331 Fax: 604-278-5729 2 of 2

From:Gohl, Ed E TRAN:EXSent:Friday, March 11, 2005 2:48 PMTo:Hyde, Rick TRAN:EX; Ahola, Rob TRAN:EXSubject:FW: Fw: Blasting between Charles Creek and Turpin Creek

-----Original Message-----From: s22 Sent: Fridav, March 11, 2005 1:47 PM To: S22 S22 Cc:

S22

Gohl, Ed E TRAN:EX; Gohl, Ed E TRAN:EX Subject: RE: Fw: Blasting between Charles Creek and Turpin Creek

I CONCUR.

-----Original Message-----From: S22 : [mailto: S22 Sent: Fridav. March 11, 2005 1:14 PM To: S22 Cc: S22

Subject: Re: Fw: Blasting between Charles Creek and Turpin Creek

Hi S22 - thanks for forwarding that response. It seems quite comprehensive and satisfies me for now - I personally don't have a need to meet with them

S22

**Ouotin**:

>

>

>

>

S22

> Strachan Point Residents

> You may want to take advantage of Ed Gohl's offer to meet and discuss > the blasting issue.

> They have promised to update the schedule and as soon as I have it > I'll let you know when the drilling and blasting is expected to end. >

S22

> ----- Original Message -----> From: S22

> To: "Gon1, Ed E IKAN:EX" <Ed.Gon1@gov.bc.ca>

> Sent: Friday, March 11, 2005 8:21 AM

> Subject: Re: Blasting between Charles Creek and Turpin Creek

> > > Thanks Ed > > > > I will forward your email along with a scan of one of your Event > Reports to the Strachan residents and mention that you and Blair > would be available to meet ( one on one or a group ). ≻ ≻ > > > Regards > > > S22 > > > > > > ----- Original Message -----> > From: "Gohl, Ed E TRAN:EX" <Ed.Gohl@gov.bc.ca> > > To: > > Cc: "Ahola, Rob TRAN:EX" <Rob.Ahola@gov.bc.ca>; "Bowen, Blair TRAN: EX" > > <Blair.Bowen@gov.bc.ca>; "Hyde, Rick TRAN:EX" <Rick.Hyde@gov.bc.ca>; >> "Dash, Evan TRAN:EX" <Evan.Dash@gov.bc.ca> > Sent: Thursday, March 10, 2005 2:39 PM > > Subject: Blasting between Charles Creek and Turpin Creek > > > > further to our meeting Wednesday March 9, I would like to >>> s22 > >> reiterate some of the points that we discussed. > >> > >> The contractor and its blasting consultant have concluded that > >> homes in Strachan Point are too far away from the blasting work >>> being done between Charles Creek and Turpin Creek to be damaged. > >> Nevertheless, I understand that some residents are concerned, so > >> would like to outline the parameters for this work. These >>> guidelines were developed by our drilling and blasting consultant > >> and are based on industry standards. > >> > >> To ensure that no problems are encountered, the following steps are > >> followed: > >> >>> \* A blast plan is developed for each area where the contractor > >> works to ensure that blasts are sized and oriented to minimize > >> disruption to nearby residents. > >> \* Each blast is monitored with a seismograph located at a house in > >> the community. This instrument measures and records the > >> acceleration of the blast wave (mm/sec), the intensity of the >>> overpressure (air movement), and the decibels (sound) level. > >> Locations for the seismograph are changed regularly to give us more > >> accurate mean values. > >> > >> The typical thresholds for damage to property are: > >> \* 50 mm/second, where damage to drywall is possible (cracking, nail > >> pops). > >> \* 250 mm/second, where damage to concrete structures is possible > >> (cracking). >>> To date, readings in the Strachan Point area have been the 6.5 to > >> 7.5 mm/second range, or about 14 percent of the damage threshold > >>

> >> Sound level for each blast are also recorded and those readings are

> >> in the > >> 88 to 90 decibel range. The CN trains record at over 95 decibels. > >> >>> What resident have likely felt during the blasts is the effect of > >> the overpressure from air movement. This causes the majority of the > >> discomfort you may be experiencing, but is unlikely to damage > >> property. The drilling and blasting will continue until the end of > >> April, but as work progresses, the work will move further north, > >> away from your community. This should lessen the impact on you and > >> your neighbours. There will likely be two or three blasts a week > >> until the work is finished. > >> > >> Because of concerns about the impact of this work on nearby > >> residents, we have changed our work schedule and blasts will now occur before 11pm. > >> Drilling, and excavation of blasted material may continue beyond > >> these hours. > >> > >> If you have any further questions, please call me anytime at > >> S22 > >> > >> > >> Ed Gohl - Ministry Representative > >> Sea to Skv Highway Improvement Project S22 > >> Cell > >> 604-913-0825 Site Office > >> ed.gohl@gems5.gov.bc.ca > >> > >> > >> > > >

SF

09901-0082

## Quality Control Check-off Form Drilling and Blasting

Sea to Sky Highway	Contractor: Oddy Construction Prime - Peter Kiewit Construction	Date:	Page 1 of 3
Location: From Station <u>(115</u> ) Area of Work: <u>104</u>	ell to north 600 104+700.	Blast Number: Novotat Assa Actual Time of Bl	he #//. last: 11:30
Verify the following items an Note: Any items not accepted	d indicate acceptance with initial and c are to be explained in the remarks section.	late: Accept/ Initial	. Date
REPORTED FOR	en niekster swas nieksten Passie		
<ol> <li>Have all applicable li approved?</li> </ol>	icences and permits been submitted	and Ro	man 24/05
2. Has a detailed blasting prior to the blast?	plan been submitted a minimum of 24 ho	ours	
<ol> <li>Have all agencies and blast?</li> </ol>	the applicable authorities been notified of	the Sn	Max 24/05
4. Are the required traffic / Highways Contacts / Comments	Utility control procedures in place? Hydro Rail		
5. Have all required sub	mittals and Certificates of Compliance	for	m41 2405
6. Are seismic monitor(s	and approved? ) calibrated and installed correctly in	the	<u>man 2405</u>
<ol><li>Have the appropriate I areas through out the p</li></ol>	MSDS's been posted in the designated roject site?	key <u>S1</u>	1496 24 55
<ol> <li>Belivery of Explosives for the second</li></ol>	or Shot to the Mag been complete? otified? Distribution of placarding and rac	dios 311	19791 24 05 Mgn 24 55
10. Bolts in proximity of blas	st allowed time to set?		
11. Pre-blast inspection cor	npleted in Area where SD < 60 ?	31	MAN 24 05
12. Measured distance from	n Max Charge /Delay to Monitor $60$ m.	(D) LC.	
13. Seismograph is A) Burie	ed in Soil.  B) Covered with a sandbag.	. <del>-</del> 31	1491 24 05
14. Have wet holes been id	entified on the blasting plan?	311	2461 24 05
15. Are blast mats being u have they neen moved placing these mats? Black	tilized for this blast to control fly rock? If to the site and a excavator been arranged asting hook for mats available?	f so   I for	
	·	BN	Max 24 05
16. Has a blast zone been the blast zone have bee	established? The services or utilities wi en evaluated and protection provided?	ithin SM	mar 2405

:    	Quality Control Check-off Form Drilling and Blasting	09901-0082	Page 3 of 3	ſ
	Sea to Sky Highway Sunset to Lions Bay	Date:	Blast No.	

All work relative to the location noted above has been performed in accordance with the requirements and criteria specified in the Contract, including the Owner's Requirements, the Approved Design Documents, Applicable Law, the EMP, and applicable permits, licenses and Approvals.

Superintendent	(print name)		Signature	<del></del>
Blasting Consultant/ Superintendent	(print náme)	/Time/	Signature	<u></u>
Environmental Consultant	(print name)	/Date/	Signature	ť.
QC Manager	Jain Feurby (print name)	Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Aprab.s_Apr	Signature	
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ROCK CUTS SECTION 204 1) AS-BUILT BLASTING RECORD File#: NonTH ANSELCH, 993 PROJECT NO. (TO BE SUBMITTED NOT MORE THAN 1 DAY AFTER EACH BLAST) GENERAL: DATE PREPARED <u>M4A 24 05</u> ACTUAL BLAST DATE <u>M4A 24 05</u> CONTRACTOR'S NAME OUL BLASTER'S NAME Galy BLAST#\_ BLASTER'S CERTIFICATE NUMBE HIGHWAY 1. . . . . north UTILITY PROTECTION OR STANDBY USED: (CIRCLE) YZS NO TYPE OF UTILITY PROTECTION SITE DETAILS: 65 HEIGHT ABOVE HWY <u>3</u> (m) SLOPE AN ROCK TYPE <u>Gran Fe</u> DISTANCE TO NEAREST STRUCTURE (UTILITY) SLOPE ANGLE SLOPE LENGTH (m) . (ൗ 20 (m) DRITLING DETAILS: 94 NUMBER OF BACKLINE HOLES TOTAL NUMBER OF HOLES HOLE DIAMETER 69 (mm) HOLE SPACING 25 (m) BURDEN 4 HOLE INCLINATION: (CIRCLE) VERTICAL HORIZ AVERAGE DEPTH \_ (m) BURDEN 15 NUMBER OF ROWS (m) VARIABLE MAXIMUM DEPTH \_(m) 9 TOTAL DEPTH \_ (m) BLAST DETAILS: 400 SO EXPLOSIVE TYPE UNIMEX EXPLOSIVE SIZE mm by mm. TOTAL NUMBER OF CARTRIDGES TOTAL WEIGHT (kg) TOTAL NUMBER OF DELAYS  $Q\bar{Q}$ DELAY TYPE AND LENGTH 12-<u>ZS-56(ms)</u> INITIATION DEVICE: (CIRCLE) E.B. CAPS SAFETY FUSE OTHER (SPECIFY) BLASTING MACHINE: TYPE CAPACITY 392 (m3) CT D VOLUME OF ROCK BLASTED BLAST SKETCH: SHOW THE FOLLOWING: PLAN VIEW: CROSS-SECTION VIEW: SCALE PLAN VIEW CROSS-SECTION ROCK GEOMETRY HOLE LOCATIONS HOLE DEPTH TIE-IN PATTERN ROW BY ROW DELAYS DETONATION DIRECTION HIGHWAY LOCATION UTILITY LOCATION NU NORTH ARROW アハイ 60 BLASTER'S SIGNATURE COMPANY <u>OND</u> COAL RECEIVED BY MINISTRY REPRESENTATIVE (SIGNATURE) (Use Additional Sheets if Necessary) 204 (10 of 10) 2004 BC - MOT

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06/21/2005 09:06 IFAX seatoskyfax@kiewit.ca JUN-21-05 89:24 AM B

May 31/05

BRYAN PETERSON CONTRACTING LTD. 26357-24<sup>10</sup> Avenue Langor, RC V4W 2V4

TIMESNEET: HIGHWALKER CONTRACTING LTD. JOHN KOCSIS 12940 BURNS ROAD MISSION, BC V2V 4JI PROTE: 604-526-0399 Fax: 604-514-3210

	DATE	Firs	PETAILS
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	MAY/2005		
v	ie	6	CLEAR ROAD - KIEWIT
$\mathbf{N}$	17	8	CLEAR ROAD
*	78	4	LOAD TRUCKS (4)