



April 6, 2018

Reference No. 11155201

Ms. Annie Dumas, P. Eng.  
Project Manager, Energy  
Aecom Consultants Inc.  
85 Sainte Catherine Street West  
Montreal, Quebec H2X 3P4

Dear Ms. Dumas:

**Re: Concrete Core Testing – Hogs Back Dam  
Hogs Back Dam, Ottawa, Ontario**

## 1. Introduction

GHD was retained by Ms. Annie Dumas of Aecom Consultants Inc. to undertake a concrete coring and laboratory testing program for the Hogs Back Dam located in Ottawa, Ontario. Four cores samples were sampled from various structural elements of the Hogs Back Dam and underwent further laboratory analysis. The field work was complete on March 1, 2018 and the laboratory was completed in accordance with clients requirements summarized in GHD's proposal number 11103730LaFlamme-1 dated November 20, 2017.

## 2. Site and Project Description

The Hogs Back Dam is located in Ottawa, Ontario and is part of the Rideau River. The Dam is on the north side of Hogs Back Road and is adjacent to the Hogs Back Lock Station which is part of the Rideau Canal. See attached Corehole Location Plan attached as Figure 1.

It is our understanding the work is part of a proposed repair program for the Hogs Back Dam and the scope of work was completed in accordance with the requirements provided by Mr. Martin LaFlamme of Aecom.

## 3. Field and Laboratory Program

### 3.1 Field

The coring took place on March 1, 2018 and followed the approved sampling program described below as well as the Environmental Protection Plan issued February 22, 2018 and Pedestrian Management Plan issued February 21, 2018.

Aecom selected the core locations and GHD assisted with selection of final position based on site conditions, such as reinforcing steel and bearing pad locations. A GHD subcontractor under GHD's supervision completed the coring and patching of the core holes with an approved grout product.



The coring program consisted of sampling 100mm diameter concrete cores from the following locations and depths:

- (CH1) Pier 2 – 1100 mm depth – cored through the pedestrian deck and into the pier.
- (CH2) Pier 5 – 850 mm depth – cored through the precast pedestrian deck and into the pier.
- (CH3) Pier 7 – 850 mm depth – cored through the precast pedestrian deck and into the pier.
- (CH4) East Abutment – 850 mm depth – cored through the pedestrian deck and into the abutment.

### **3.2 Laboratory**

Upon completion of the field-coring program the samples were delivered to GHD's laboratory for photo logging, compression strength testing, mass density, carbonation, and alkali silica reaction (ASR). The results are summarized below and included in Attachment B.

## **4. Summary of Laboratory Results**

### **4.1 Compressive Strength**

The two tests for compressive strength of each core were selected from the upper 300 mm and then lower 300 mm from the top of deck. The purpose of the two tests were to collect results on the precast concrete deck that is on top of Pier 5 and 7 as well as the cast in place concrete that is on top of Pier 2 and the East Abutment. The precast deck for Pier 5 and 7 compressive strengths averaged 61.5 MPa, and the results for the upper 300 mm for Pier 2 and the East Abutment were 60.6 MPa and 45.3 MPa. Respectively the average compressive strength for the concrete below 300 mm in all the structures was 41.3 MPa. A full results table is provided in Attachment B.

### **4.2 Mass Density**

The cores selected for compressive strength testing were also measured to determine their mass density. The average for the precast concrete of Pier 5 and 7 was 2371 kg/m<sup>3</sup>. The average for the cast in place concrete for all remaining cores was 2378 kg/m<sup>3</sup>. All results can be found in the compressive strength tables below in Attachment B

### **4.3 Carbonation**

The cast in place concrete for each structure was analyzed for the presence of carbonation. There was no observable presence of carbonation found in the cores except for the presence of early onset carbonation observed in the first 1 mm of the East Abutment. The summary of carbonation tables is provided in Attachment B.



#### 4.4 Alkali Silica Reaction (ASR)

The cast in place concrete for each structure was visually examined for the presence of ASR. The full summary tables for the ASR screening tests can be found in Attachment B. In general no observable evidence of ASR was found in the concrete.

Should you have any questions on the above, please do not hesitate to contact us.

Sincerely,

GHD

A handwritten signature in blue ink, appearing to read "EB", with a horizontal line extending to the right.

Eric Bennett, C.E.T.

A handwritten signature in blue ink, appearing to read "GC", with a horizontal line extending to the right.


Gerardo Cardenas, P. Eng., MAsc.

EB/v/3

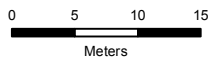
Encl.



**Legend**

 Corehole Location

Source: ESRI Basemap Imagery, Date Unknown



Coordinate System:  
NAD 1983 UTM Zone 18N



AECOM CONSULTANTS INC.  
HOGS BACK DAM  
OTTAWA, ONTARIO

COREHOLE LOCATION PLAN

11155201-B1  
Mar 26, 2018

FIGURE 1

# Attachment A Core Log Photographs



CH1-1 Pier 2 – 0 mm to 300 mm



CH1-2 Pier 2 – 300 mm to 430 mm



## Core Log Photographs



CH1-3 Pier 2 – 430 mm to 890 mm



CH1-3 Pier 2 – 890 mm to 1100 mm



## Core Log Photographs



CH2-1 Pier 5 – 0 mm to 300 mm



CH2-2 Pier 5 – 300 mm to 850 mm



## Core Log Photographs





CH3-1 – Pier 7 – 0 mm to 300 mm



CH3-2 – Pier 7 – 300 mm to 850 mm



## Core Log Photographs



CH4-1 – East Abutment – 0 mm to 300 mm



CH4-2 – East Abutment – 300 mm to 850 mm



## Core Log Photographs

# Attachment B Laboratory Results



AECOM Consultants Inc.  
85, rue Ste-Catherine Ouest  
Montréal, QC  
H2X 3P4

March 13, 2018

Re: Hogs Back Dam  
Our Project No. 11155201-B1

| <b>Summary of Concrete Core Test Results</b> |                                                                                                              |                       |                        |                       |                        |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------|------------------------|-----------------------|------------------------|
| <b>Core Data</b>                             | <b>Client Core #:</b>                                                                                        | CH1                   | CH1                    | CH2                   | CH2                    |
|                                              | <b>GHD Core #:</b>                                                                                           | CST-18-20A            | CST-18-20B             | CST-18-21A            | CST-18-21B             |
|                                              | <b>Core Location (depth of test)</b>                                                                         | Pier 2<br>15 to 220mm | Pier 2<br>520 to 725mm | Pier 5<br>15 to 220mm | Pier 5<br>685 to 890mm |
| <b>Laboratory Test Results</b>               | <b>Compressive Strength of Concrete Core</b>                                                                 |                       |                        |                       |                        |
|                                              | MPa                                                                                                          | 60.6                  | 36.6                   | 59.0                  | 38.2                   |
|                                              | L/D Ratio                                                                                                    | 2.00                  | 2.00                   | 1.92                  | 2.00                   |
|                                              | <b>Concrete Core Density kg/m<sup>3</sup></b>                                                                | 2387                  | 2343                   | 2367                  | 2343                   |
| <b>Remarks</b>                               | Testing Information:<br>Compressive Strength of Concrete Cores as per LS-410<br>Depths from surface of core. |                       |                        |                       |                        |

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Matt Rawlings, Laboratory Manager

**GHD Limited**

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| Summary of Concrete Core Test Results |                                                                                                              |                       |                        |                            |                             |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------|------------------------|----------------------------|-----------------------------|
| Core Data                             | Client Core #:                                                                                               | CH3                   | CH3                    | CH4                        | CH4                         |
|                                       | GHD Core #:                                                                                                  | CST-18-22A            | CST-18-22B             | CST-18-23A                 | CST-18-23B                  |
|                                       | Core Location (depth of test)                                                                                | Pier 7<br>20 to 225mm | Pier 7<br>530 to 735mm | E. Abutment<br>90 to 230mm | E. Abutment<br>320 to 530mm |
| Laboratory Test Results               | Compressive Strength of Concrete Core                                                                        |                       |                        |                            |                             |
|                                       | MPa                                                                                                          | 64.0                  | 41.8                   | 45.3                       | 48.7                        |
|                                       | L/D Ratio                                                                                                    | 1.97                  | 2.00                   | 1.27                       | 2.00                        |
|                                       | Concrete Core Density kg/m <sup>3</sup>                                                                      | 2375                  | 2385                   | 2386                       | 2424                        |
| Remarks                               | Testing Information:<br>Compressive Strength of Concrete Cores as per LS-410<br>Depths from surface of core. |                       |                        |                            |                             |

Matt Rawlings, Laboratory Manager



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March 12, 2018

Attention:

Re: Hogs Back Dam  
Our Project No. 11155201-B1

| <b>Summary of Carbonation Testing</b> |                                                                                                                                                                                              |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Core Data</b>                      | <b>Client Core #:</b> CH1                                                                                                                                                                    |
|                                       | <b>GHD Core #:</b> CST-18-20                                                                                                                                                                 |
|                                       | <b>Core Location</b> Pier 2                                                                                                                                                                  |
| <b>Laboratory Test Results</b>        | <b>Date Tested</b> Mar 12, 2018                                                                                                                                                              |
|                                       | <b>Diameter of Sample (mm)</b> 95mm                                                                                                                                                          |
|                                       | <b>Depth of Sample (mm)</b> 280 to 520mm                                                                                                                                                     |
|                                       | <b>Results of Carbonation Testing</b> With the addition of phenolphthalein a dark pink colour change was observed throughout the full depth of the test specimen.                            |
|                                       | <b>Conclusion</b> Based on our analysis, evidenced by the dark pink colour change, it is concluded that there is no observable evidence that carbonation has occurred in this test specimen. |
| <b>Remarks</b>                        | Testing Information:<br>Carbonation determined by application of phenolphthalein solution.                                                                                                   |
|                                       | No Surface membrane present                                                                                                                                                                  |

Matt Rawlings, Laboratory Manager

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| Summary of Carbonation Testing |                                                                                            |                                                                                                                                                                            |
|--------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Core Data                      | Client Core #:                                                                             | CH2                                                                                                                                                                        |
|                                | GHD Core #:                                                                                | CST-18-21                                                                                                                                                                  |
|                                | Core Location                                                                              | Pier 5                                                                                                                                                                     |
| Laboratory Test Results        | Date Tested                                                                                | Mar 12, 2018                                                                                                                                                               |
|                                | Diameter of Sample (mm)                                                                    | 95mm                                                                                                                                                                       |
|                                | Depth of Sample (mm)                                                                       | 280 to 430mm                                                                                                                                                               |
|                                | Results of Carbonation Testing                                                             | With the addition of phenolphthalein a dark pink colour change was observed throughout the full depth of the test specimen.                                                |
|                                | Conclusion                                                                                 | Based on our analysis, evidenced by the dark pink colour change, it is concluded that there is no observable evidence that carbonation has occurred in this test specimen. |
| Remarks                        | Testing Information:<br>Carbonation determined by application of phenolphthalein solution. |                                                                                                                                                                            |
|                                | No Surface membrane present                                                                |                                                                                                                                                                            |

Matt Rawlings, Laboratory Manager



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| Summary of Carbonation Testing |                                                                                            |                                                                                                                                                                            |
|--------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Core Data                      | Client Core #:                                                                             | CH3                                                                                                                                                                        |
|                                | GHD Core #:                                                                                | CST-18-22                                                                                                                                                                  |
|                                | Core Location                                                                              | Pier 7                                                                                                                                                                     |
| Laboratory Test Results        | Date Tested                                                                                | Mar 12, 2018                                                                                                                                                               |
|                                | Diameter of Sample (mm)                                                                    | 95mm                                                                                                                                                                       |
|                                | Depth of Sample (mm)                                                                       | 380 to 530mm                                                                                                                                                               |
|                                | Results of Carbonation Testing                                                             | With the addition of phenolphthalein a dark pink colour change was observed throughout the full depth of the test specimen.                                                |
|                                | Conclusion                                                                                 | Based on our analysis, evidenced by the dark pink colour change, it is concluded that there is no observable evidence that carbonation has occurred in this test specimen. |
| Remarks                        | Testing Information:<br>Carbonation determined by application of phenolphthalein solution. |                                                                                                                                                                            |
|                                | No Surface membrane present                                                                |                                                                                                                                                                            |

Matt Rawlings, Laboratory Manager





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| Summary of Carbonation Testing |                                                                                            |                                                                                                                                                                                                                             |
|--------------------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Core Data                      | Client Core #:                                                                             | CH4                                                                                                                                                                                                                         |
|                                | GHD Core #:                                                                                | CST-18-23                                                                                                                                                                                                                   |
|                                | Core Location                                                                              | East Abutment                                                                                                                                                                                                               |
| Laboratory Test Results        | Date Tested                                                                                | Mar 12, 2018                                                                                                                                                                                                                |
|                                | Diameter of Sample (mm)                                                                    | 100mm                                                                                                                                                                                                                       |
|                                | Depth of Sample (mm)                                                                       | 0 to 70mm                                                                                                                                                                                                                   |
|                                | Results of Carbonation Testing                                                             | With the addition of phenolphthalein a lighter pink colour change occurred at 0 to ~1mm from the surface of the test specimen, and a dark pink colour change was observed throughout the remaining depth.                   |
|                                | Conclusion                                                                                 | Based on our analysis, the observation of the lighter pink colouration indicates the early onset of carbonation at 0 to ~1mm. However, there is no observable evidence that carbonation has occurred beyond the ~1mm depth. |
| Remarks                        | Testing Information:<br>Carbonation determined by application of phenolphthalein solution. |                                                                                                                                                                                                                             |
|                                | No Surface membrane present                                                                |                                                                                                                                                                                                                             |

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| Summary of ASR Screening |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Core Data                | Client Core #:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | CH1                       |
|                          | GHD Core #:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | CST-18-20                 |
|                          | Core Location                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Pier 2                    |
|                          | Sample Depth:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 280 to 520mm from surface |
| Laboratory Test Results  | <b>General Concrete Comments</b><br>The concrete test face was visually examined without magnification and the following comments were noted: <ul style="list-style-type: none"><li>The largest observable coarse aggregate within the concrete was 16 mm, consisting predominately of crushed particles.</li><li>The concrete paste was grey in colour</li><li>The paste was noted visually to contain several small to medium air voids, indicating the presence of air-entrainment</li><li>Complete, uneven horizontal fracture at a depth of ~405 to 440mm from surface of core</li><li>No visible micro-cracks travelling through or extending between aggregate particles</li><li>No visible ASR gel or reaction rims present in test sample</li></ul>                                                                                                                                                                                                                                             |                           |
|                          | <b>ASR Screening Test (SHRP-C-315 Comments)</b> <ul style="list-style-type: none"><li>After the addition of the yellow reagent there was no visible yellow colour change to the surface of the test face.</li><li>With the addition of the red reagent, areas around/within air voids located in the cement paste turned a bright yellowish-orange, however no bright red colouration was observed.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                           |
|                          | <b>Summary</b><br>The sample tested was comprised predominately of crushed aggregates with the largest observable size being 16 mm. There was no observable evidence of ASR prior to the conditioning of the test surface. Observation under UV light after the addition of the yellow reagent did not produce the bright yellow colouration that is indicative of ASR. The addition of the red reagent caused the areas around and within some of the air voids located in the cement paste to present as a bright yellowy-orange glow but did not express the bright red colouration under UV lighting indicative of advanced ASR. In accordance with SHRP-C-315 the above results show that there is no observable evidence that alkali silica reactivity has occurred in the concrete. Coupled with the test results there were no common identifiers to suggest ASR has/is occurring, such as: micro-cracks which extend through or between aggregates, observable reaction rims or ASR gel product |                           |

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March 13, 2018

Re: Hogs Back Dam  
Our Project No. 11155201-B1

| <b>Summary of ASR Screening</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Core Data</b>                | <b>Client Core #:</b> CH2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                 | <b>GHD Core #:</b> CST-18-21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                 | <b>Core Location</b> Pier 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                 | <b>Sample Depth:</b> 280 to 430mm from surface                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Laboratory Test Results</b>  | <b>General Concrete Comments</b><br>The concrete test face was visually examined without magnification and the following comments were noted: <ul style="list-style-type: none"><li>• The largest observable coarse aggregate within the concrete was 17 mm, consisting predominately of crushed particles.</li><li>• The concrete paste was grey in colour</li><li>• The paste was noted visually to contain several small to medium air voids, indicating the presence of air-entrainment</li><li>• No visible micro-cracks travelling through or extending between aggregate particles</li><li>• No visible ASR gel or reaction rims present in test sample</li></ul>                                                                                                                                                                                                                                                                                                                                 |
|                                 | <b>ASR Screening Test (SHRP-C-315 Comments)</b> <ul style="list-style-type: none"><li>• After the addition of the yellow reagent there was no visible yellow colour change to the surface of the test face.</li><li>• With the addition of the red reagent, areas around/within air voids located in the cement paste turned a bright yellowish-orange; however, no bright red colouration was observed.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                 | <b>Summary</b><br>The sample tested was comprised predominately of crushed aggregates with the largest observable size being 17 mm. There was no observable evidence of ASR prior to the conditioning of the test surface. Observation under UV light after the addition of the yellow reagent did not produce the bright yellow colouration that is indicative of ASR. The addition of the red reagent caused the areas around and within some of the air voids located in the cement paste to present as a bright yellowy-orange glow but did not express the bright red colouration under UV lighting indicative of advanced ASR. In accordance with SHRP-C-315 the above results show that there is no observable evidence that alkali silica reactivity has occurred in the concrete. Coupled with the test results there were no common identifiers to suggest ASR has/is occurring, such as: micro-cracks which extend through or between aggregates, observable reaction rims or ASR gel product |

Matt Rawlings, Laboratory Manager



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March 13, 2018

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| <b>Summary of ASR Screening</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Core Data</b>                | <b>Client Core #:</b> CH3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                 | <b>GHD Core #:</b> CST-18-22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                 | <b>Core Location</b> Pier 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                 | <b>Sample Depth:</b> 380 to 530mm from surface                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Laboratory Test Results</b>  | <b>General Concrete Comments</b><br>The concrete test face was visually examined without magnification and the following comments were noted: <ul style="list-style-type: none"><li>The largest observable coarse aggregate within the concrete was 19 mm, consisting predominately of crushed particles.</li><li>~20mm dia. re-enforcing steel present at ~520 to 540mm from surface of core</li><li>The concrete paste was grey in colour</li><li>The paste was noted visually to contain several small to medium air voids, indicating the presence of air-entrainment</li><li>No visible micro-cracks travelling through or extending between aggregate particles</li><li>No visible ASR gel or reaction rims present in the test sample</li></ul>                                                                                                                                                                                                                                                    |
|                                 | <b>ASR Screening Test (SHRP-C-315 Comments)</b> <ul style="list-style-type: none"><li>After the addition of the yellow reagent there was no visible yellow colour change to the surface of the test face.</li><li>With the addition of the red reagent, areas around/within air voids located in the cement paste turned a bright yellowish-orange, however no bright red colouration was observed.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                 | <b>Summary</b><br>The sample tested was comprised predominately of crushed aggregates with the largest observable size being 19.0mm. There was no observable evidence of ASR prior to the conditioning of the test surface. Observation under UV light after the addition of the yellow reagent did not produce the bright yellow colouration that is indicative of ASR. The addition of the red reagent caused the areas around and within some of the air voids located in the cement paste to present as a bright yellowy-orange glow but did not express the bright red colouration under UV lighting indicative of advanced ASR. In accordance with SHRP-C-315 the above results show that there is no observable evidence that alkali silica reactivity has occurred in the concrete. Coupled with the test results there were no common identifiers to suggest ASR has/is occurring, such as: micro-cracks which extend through or between aggregates, observable reaction rims or ASR gel product |

Matt Rawlings, Laboratory Manager



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| <b>Summary of ASR Screening</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Core Data</b>                | <b>Client Core #:</b> CH4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                 | <b>GHD Core #:</b> CST-18-23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                 | <b>Core Location</b> East Abutment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                 | <b>Sample Depth:</b> 0 to 70mm from surface                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Laboratory Test Results</b>  | <b>General Concrete Comments</b><br>The concrete test face was visually examined without magnification and the following comments were noted: <ul style="list-style-type: none"><li>• The largest observable coarse aggregate within the concrete was 16 mm, consisting predominately of crushed particles.</li><li>• The concrete paste was grey in colour</li><li>• The paste was noted visually to contain several small to medium air voids, indicating the presence of air-entrainment</li><li>• No visible micro-cracks travelling through or extending between aggregate particles</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                 | <b>ASR Screening Test (SHRP-C-315 Comments)</b> <ul style="list-style-type: none"><li>• After the addition of the yellow reagent there was no visible yellow colour change to the surface of the test face.</li><li>• With the addition of the red reagent, areas around/within air voids located in the cement paste turned a bright yellowish-orange, however no bright red colouration was observed.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                 | <b>Summary</b><br>The sample tested was comprised predominately of crushed aggregates with the largest observable size being 16 mm. There was no observable evidence of ASR prior to the conditioning of the test surface. Observation under UV light after the addition of the yellow reagent did not produce the bright yellow colouration that is indicative of ASR. The addition of the red reagent caused the areas around and within some of the air voids located in the cement paste to present as a bright yellowy-orange glow but did not express the bright red colouration under UV lighting indicative of advanced ASR. In accordance with SHRP-C-315 the above results show that there is no observable evidence that alkali silica reactivity has occurred in the concrete. Coupled with the test results there were no common identifiers to suggest ASR has/is occurring, such as: micro-cracks which extend through or between aggregates, observable reaction rims or ASR gel product |

Matt Rawlings, Laboratory Manager