

TECHNICAL MEMO

EGRT Construction
Suite 500 - 745 Thurlow Street
Vancouver | British Columbia
Canada | V6E 0C5
Telephone: (604) 662-3555
Fax: (604) 662-7688

TO: Jeff Spruston **DATE:** 28 Nov 2017
CC: Dave Weatherby, Will Gowen, Ronan Spillane **FROM:** Meiric Preece
EGRT Technical Director
PROJECT: Evergreen Line Rapid Transit Project - 511325 **DOCUMENT NO:** 511325-12220-S2SL-43EB-0001_(0)
SUBJECT: Inspection report for Bored Tunnel Liner Segments with Concrete Curing Temperatures over 70 C

Background

During the curing of the bored tunnel liners some of the segments reached temperatures over 70 C and were subsequently installed in error. The CSA requirement was not to exceed 60 C (CSA with the issue of A23.4-16 raised this back up to 70 C which is consistent with most other jurisdictions). The CSA requirement is set so that all concrete materials and environments for the installed precast elements are considered. EGRT asked for a variance accepting these segments. A report from Dr Langley that provided a review of the materials used for the segments and the conditions the segments would be in during their life was provided. The Specialist Materials Consultant Dr Wilbert Langley P.Eng and the Engineer of Record Andrew McGlenn P.Eng. (McMillen Jacobs) supported this request. The Owner declined this request and an extended warranty was agreed upon.

The concern is for delayed ettringite formation (DEF) which causes the concrete to deteriorate. It needs to be noted that there has been no recorded occurrence of DEF in North America. This is very significant as there is always pressure to achieve the release concrete strength for precast element production so the casting schedule is met and internal concrete temperatures were not routinely measured in the past.

As of now the segments are approximately 4 years old and have been installed for about 3 years.

Inspection November 18 & 19, 2017

All the segments listed in the extended warranty document for tunnel liners were tested with a Schmidt Hammer and visually observed. The reports are attached.

Meiric Preece P.Eng performed a close proximity visual inspection on all the specified segments and the segments nearby. There was no indication of any deterioration of the concrete on any of the segments inspected. These segments are all in as-installed condition as expected as these segments are not subjected to abrasion, weathering or corrosive materials.




The Schmidt Hammer test results, done by Metro Testing, confirm the segments still have the specified strength of 50 MPa. The specified strength was to facilitate the installation loading on the segments which is significantly higher than any loading anticipated on the installed segments. Note there is one segment that is listed as 47+- 6.5 MPa. This is an acceptable result. If DEF was occurring the concrete strength would be much lower than the specified strength and there would be significant visual evidence.

Note that Segment F3 in Ring 11 was visually inspected but the Schmidt Hammer test was not performed. This is not considered to be a significant omission for the inspection considering the results of the inspection and the number of segments inspected.

Discussion

We thank BCRTC staff for facilitating this inspection in an efficient and professional manner. We fully understand the value of the limited track time available for inspection and maintenance.

At this time it is recommended that EGRT sit down with the Owner and discuss modifying the frequency of these inspections going forward. As the Technical Director I stand by our original request for a variance to use as is. Currently the requirement in the extended warranty is for yearly inspections which we consider excessive. We suggest that repeat inspections in 2021 and 2026 would be more than adequate.

| | | |
|--------------|--|---|
| Prepared by: | Meiric Preece P.Eng. Technical Director |  |
| Reviewed by: | Ronan Spillane, EGRT Warranty Manager |  Nov 28, 2017 |
| Approved by: | Meiric Preece P. Eng. Technical Director |  |
| | Name, Title | Signature |

Attachments:

- 1) Simplified Map for finding Overheated Segments on Walkthrough in Evergreen Tunnel (1 page)
- 2) Metro testing Schmidt Hammer Testing Results (2 pages)
- 3) Overheated Tunnel Liner Inspection Sheets (54 pages)
- 4) Supplemental Agreement #1 fully executed on Oct 31, 2016 (10 pages)

| Simplified Map for finding Overheated Segments on Walkthrough in Evergreen Tunnel | | | | | | | | | | | |
|---|------------------------|----------------|----------|----------|--------|----------|----------|--------|--------|--|---|
| Key Position | Segment Type - R=Rebar | Segment ID No. | Ring No. | Outbound | | | Inbound | | | | Comments |
| | | | | Low | Middle | High | High | Middle | Low | | |
| 4 | F2--R | 179 | 2 | | | | | | | | Totally buried |
| 4 | B3--R | 548 | 2 | | | Straddle | Straddle | | | | Both sides of centre wall. Label on OB side? |
| 13 | F3-- R | 166 | 3 | | | | | | | | Up high |
| 13 | C3--R | 612 | 5 | | | | | | | | Totally buried |
| 9 | G3--R | 595 | 6 | | | Straddle | Straddle | | | | 80% IB side of centre wall. Label on IB side |
| 22 | G1--R | 863 | 8 | | | | | | | | partially buried |
| 7 | C3--R | 549 | 9 | | | | | | | | Totally buried |
| 11 | G3-- R | 884 | 10 | | | Straddle | Straddle | | | | Both sides of centre wall. Label on OB side? |
| 11 | E2-- R | 898 | 10 | | | | | | | | partially buried |
| 7 | E3--R | 635 | 11 | | | | | | | | Probably totally buried |
| 7 | F3--R | 636 | 11 | | | | | | XXXXXX | | Low - DID NOT TEST THIS SEGMENT IN NOV 2017 |
| 7 | A1-- R | 734 | 11 | | | | | | | | Will need lift |
| 7 | B3--R | 845 | 11 | | | | | | | | Fully exposed & low |
| 7 | G2-- R | 871 | 11 | | | | | | | | high/middle |
| 13 | E2-- R | 840 | 13 | | | | | | | | Fully exposed & low |
| 13 | F2-- R | 841 | 13 | | | | | | | | Middle/high |
| 13 | F2--R | 406 | 15 | | | | | | | | Middle/high |
| 13 | A3--R | 655 | 15 | | | | | | | | Low |
| 13 | G2--R | 932 | 15 | | | | | | | | Top (80% OB side) |
| 9 | G1--R | 992 | 16 | | | Straddle | Straddle | | | | Top (80% IB side). Label on IB side. |
| 17 | H1--R | 219 | 18 | | | | | | | | Low (partially buried) |
| 17 | D3--R | 729 | 18 | | | | | | | | Low (partially buried) |
| 17 | E3--R | 730 | 18 | | | | | | | | Middle (lift required) |
| 17 | F3--R | 731 | 18 | | | Straddle | Straddle | | | | Both sides of centre wall. Label on IB side. |
| 7 | F2-- R | 676 | 19 | | | | | | | | Low |
| 16 | A3--R | 873 | 20 | | | | | | | | Totally buried |
| 13 | B3--R | 727 | 21 | | | | | | | | Probably totally buried |
| 9 | G2-- R | 772 | 22 | | | Straddle | Straddle | | | | Top (80% IB side) Label on IB side. |
| 9 | A3-- R | 881 | 22 | | | | | | | | Middle (lift required) |
| 9 | E2--R | 930 | 22 | | | | | | | | partially buried |
| 9 | F3--R | 948 | 22 | | | | | | | | Low/middle |
| 9 | C3--R | 967 | 22 | | | | | | | | Totally buried |
| 13 | F2-- R | 747 | 23 | | | | | | | | Middle/High |
| 13 | G3--R | 949 | 23 | | | Straddle | Straddle | | | | Top (90% OB side). Labekl |
| 9 | E3-- R | 706 | 24 | | | | | | | | partially buried |
| 9 | F3-- R | 707 | 24 | | | | | | | | Low/middle |
| 14 | F3-- R | 883 | 25 | | | | | | | | partially buried |
| 14 | G3-- R | 978 | 25 | | | | | | | | Totally buried |
| 9 | E1--R | 667 | 26 | | | | | | | | Low (partially buried) |
| 9 | G3--R | 732 | 26 | | | Straddle | Straddle | | | | Top (80% IB side) Label on IB side. |
| 17 | F2-- R | 246 | 28 | | | Straddle | Straddle | | | | Both sides of centre wall. Label on OB side? |
| 17 | A1-- R | 857 | 28 | | | | | | | | Totally buried |
| 7 | D2-- R | 244 | 29 | | | | | | | | Totally buried |
| 17 | E3--R | 882 | 30 | | | | | | | | Middle (lift required) |
| 7 | A3-- R | 162 | 31 | | | | | | | | Middle (lift required) |
| 18 | A1-- R | 65 | 33 | | | | | | | | Totally buried |
| 11 | F2-- R | 224 | 34 | | | | | | | | Middle (lift required) |
| 11 | B2-- R | 242 | 34 | | | | | | | | Low (partially buried) |
| 11 | C2-- R | 243 | 34 | | | | | | | | Totally buried |
| 7 | A1-- R | 71 | 35 | | | | | | | | Middle (lift required) |
| 7 | F3--R | 209 | 35 | | | | | | | | Low/middle |
| 7 | E2-- R | 245 | 35 | | | | | | | | Totally buried |
| 7 | B1--R | 316 | 35 | | | | | | | | Low/middle |
| 15 | A2-- R | 81 | 41 | | | | | | | | Totally buried |
| 15 | B1--R | 363 | 41 | | | | | | | | Totally buried |
| 11 | F2-- R | 286 | 42 | | | | | | | | Middle (lift required) |
| 21 | H1 | 624 | 56 | | | | | | | | Totally buried |
| 9 | D1 | 4655 | 58 | | | | | | | | Totally buried |
| 1 | D1 | 4518 | 61 | | | | | | | | Totally buried |
| 1 | C1 | 4051 | 63 | | | | | | | | Low/middle |
| 1 | D1 | 4052 | 63 | | | | | | | | Totally buried |
| 1 | E1 | 4053 | 63 | | | | | | | | Totally buried Note: Segment shown as visible on other list. |
| 1 | B2 | 4058 | 63 | | | | | | | | Middle/high |
| 1 | F2 | 4061 | 63 | | | | | | | | Totally buried |
| 1 | G2 | 4062 | 63 | | | | | | | | Low/middle |
| 1 | H2 | 4063 | 63 | | | | | | | | Middle/high |
| 2 | F1 | 3827 | 105 | | | | | | | | Totally buried |
| 22 | G2 | 3880 | 112 | | | | | | | | Low /middle |
| 1 | D1 | 3871 | 113 | | | | | | | | Totally buried |
| 11 | A3 | 3798 | 114 | | | | | | | | Low/middle |
| 7 | C1 | 3870 | 115 | | | | | | | | Totally buried |
| 7 | H3 | 4071 | 115 | | | | | | | | Top (80% OB side) |
| 11 | F1 | 4054 | 116 | | | | | | | | Middle (lift required) |
| 11 | C2 | 4059 | 116 | | | | | | | | Totally buried |
| 11 | A3 | 4133 | 116 | | | | | | | | Low/middle |
| 17 | B1 | 4050 | 120 | | | | | | | | Totally buried |
| 17 | G1 | 4055 | 120 | | | | | | | | Middle (lift required) |
| 17 | A3 | 4064 | 120 | | | | | | | | Totally buried |
| 5 | D1 | 4911 | 123 | | | | | | | | Totally buried |
| 12 | D1 | 4614 | 274 | | | | | | | | Low/middle - Location confirmed on Nov 2017 inspections |
| 18 | C1 | 4565 | 335 | | | | | | | | Middle (lift required) Location confirmed on Nov 2017 inspections |
| 21 | D1 | 4075 | 351 | | | | | | | | Low/middle |

- Notes:
- Green cells above help locate the overheated segments
 - HIGH is at very top of tunnel (STRADDLE indicates where segment is both side of dividing wall)
 - MIDDLE may require lift to access.
 - LOW is close to floor of tunnel (maybe only partially exposed)
 - CHECK in the Low column indicates that segment is most likely buried but possibly partially exposed
 - Checked by Ronan on Aug 18, 2017. Some edits completed on Nov 20, 2017
 - Labels on segments should be cleaned in 2018 to ensure they remain visible for future inspections.



Metro Testing Laboratories (Burnaby)
A Division of CCMET INC.
HEAD OFFICE
6991 Curragh Avenue
Burnaby, BC V5J 4V6

t 604.436.9111
tf 1.877.436.9117
f 604.438.5317
e info@metrotesting.ca
w metrotesting.ca

To : **SNC Lavalin Inc.**
Suite 500-745 Thurlow Street
Vancouver, BC V6E 0C5

Project #: 22270
Date: 23-Nov-17
Page: 1 of 2

Attn: **Mr. Ronan Spillane**

Project: **Inbound and outbound sides of Evergreen Tunnel, Coquitlam**

Subject: ASTM C805 Standard Test Method for Rebound Number of Hardened Concrete

Surface Condition: Dry

Hammer Model(s): Proceq Type NR-10

Hammer Serial No.: 67930

Test date: 18 & 19 Nov 2017

Tested By: AS

Surface Preparation: Hand grinded

| Side of Tunnel | Test Date | No. | Ring# | Segment# | Impact Direction | Average Rebound Value (R) | St. Dev (R) | Est. Strength (MPa)* | Disper. (MPa) |
|----------------|------------|-----|-------|----------|------------------|---------------------------|-------------|----------------------|---------------|
| Inbound | 18-11-2017 | 1 | 2 | B3 | ↑ | 56 | 1.3 | 63 | ±6.5 |
| | | 2 | 3 | F3 | ↑ | 55 | 1.6 | 60 | ±6.5 |
| | | 3 | 6 | G3 | ↑ | 57 | 2.0 | 64 | ±6.5 |
| | | 4 | 10 | G3 | ↑ | 55 | 1.6 | 61 | ±6.5 |
| | | 5 | 11 | G2 | ↑ | 57 | 1.4 | 66 | ±6.5 |
| | | 6 | 13 | F2 | ↑ | 57 | 1.3 | 65 | ±6.5 |
| | | 7 | 13 | E2 | ← | 57 | 1.2 | 64 | ±7 |
| | | 8 | 15 | F2 | ↑ | 60 | 2.2 | 72 | ±7 |
| | | 9 | 16 | G1 | ↑ | 55 | 2.3 | 60 | ±6.5 |
| | | 10 | 18 | F3 | ↑ | 58 | 1.7 | 68 | ±6.5 |
| | | 11 | 18 | E3 | ↑ | 58 | 1.3 | 68 | ±6.5 |
| | | 12 | 22 | G2 | ↑ | 57 | 1.9 | 65 | ±6.5 |
| | | 13 | 22 | F3 | ↑ | 57 | 1.6 | 64 | ±6.5 |
| | | 14 | 23 | F2 | ↑ | 55 | 1.8 | 61 | ±6.5 |
| | | 15 | 24 | F3 | ↑ | 57 | 1.7 | 64 | ±6.5 |
| | | 16 | 26 | G3 | ↑ | 57 | 1.1 | 64 | ±6.5 |
| | | 17 | 28 | F | ↑ | 56 | 1.5 | 62 | ±6.5 |
| | | 18 | 30 | E3 | ↑ | 57 | 1.5 | 65 | ±6.5 |
| | | 19 | 34 | F2 | ↑ | 56 | 1.2 | 61 | ±6.5 |
| | | 20 | 42 | F2 | ↑ | 56 | 1.8 | 63 | ±6.5 |
| | | 21 | 63 | H2 | ↑ | 55 | 1.8 | 60 | ±6.5 |
| | | 22 | 63 | G2 | ↑ | 57 | 1.6 | 65 | ±6.5 |
| | | 23 | 116 | F1 | ↑ | 56 | 1.9 | 63 | ±6.5 |
| | | 24 | 351 | D1 | ↑ | 56 | 1.3 | 63 | ±6.5 |
| | | 25 | 335 | C1 | ↑ | 58 | 1.2 | 66 | ±6.5 |
| | | 26 | 35 | F3 | ← | 49 | 1.8 | 47 | ±6.5 |
| | 19-11-2017 | 27 | 10 | E2 | ← | 54 | 1.2 | 57 | ±6.5 |
| | | 28 | 11 | F3 | No test result | | | | |
| | | 29 | 18 | D3 | ← | 56 | 1.4 | 60 | ±7 |
| | | 30 | 22 | E2 | ← | 55 | 1.4 | 59 | ±6.5 |
| | | 31 | 19 | F2 | ← | 56 | 1.8 | 60 | ±7 |



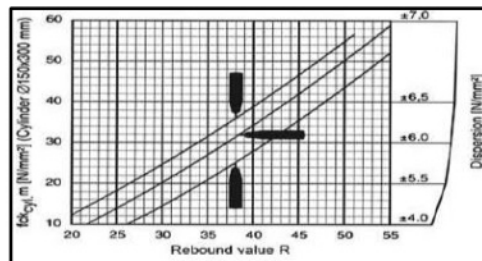
Materials Testing & Engineering | Environmental & Geotechnical Engineering | Concrete Restoration | Total Quality Management

| Side of Tunnel | Test Date | No. | Ring# | Segment# | Impact Direction | Average Rebound Value (R) | St. Dev (R) | Est. Strength (MPa)* | Disper. (MPa) |
|----------------|------------|-----|-------|----------|------------------|---------------------------|-------------|----------------------|---------------|
| Outbound | 19-11-2017 | 32 | 24 | E3 | ← | 56 | 2.0 | 62 | ±7 |
| | | 33 | 26 | E1 | ← | 55 | 1.0 | 59 | ±6.5 |
| | | 48 | 274 | D1 | ← | 56 | 1.5 | 60 | ±7 |
| | | 34 | 11 | A1 | ↑ | 58 | 1.6 | 66 | ±6.5 |
| | | 35 | 22 | A3 | ↑ | 54 | 1.7 | 59 | ±6.5 |
| | | 36 | 15 | G2 | ↑ | 56 | 1.7 | 62 | ±6.5 |
| | | 37 | 23 | G3 | ↑ | 57 | 1.4 | 65 | ±6.5 |
| | | 38 | 31 | A3 | ↑ | 51 | 2.0 | 53 | ±6.5 |
| | | 39 | 35 | A1 | ↑ | 54 | 1.8 | 58 | ±6.5 |
| | | 40 | 35 | B1 | ↑ | 53 | 2.0 | 56 | ±6.5 |
| | | 41 | 63 | C1 | ↑ | 58 | 1.2 | 67 | ±6.5 |
| | | 42 | 63 | B2 | ↑ | 58 | 1.3 | 67 | ±6.5 |
| | | 43 | 112 | G2 | ↑ | 55 | 2.0 | 60 | ±6.5 |
| | | 44 | 114 | A2 | ↑ | 54 | 0.8 | 58 | ±6.5 |
| | | 45 | 115 | H3 | ↑ | 58 | 1.3 | 68 | ±6.5 |
| | | 46 | 116 | A3 | ← | 56 | 1.5 | 62 | ±7 |
| | | 47 | 120 | G1 | ← | 55 | 1.9 | 59 | ±6.5 |
| | | 49 | 34 | B2 | ← | 56 | 1.8 | 61 | ±7 |
| | | 50 | 25 | E3 | ← | 53 | 2.2 | 55 | ±6.5 |
| | | 51 | 18 | H1 | ← | 53 | 1.4 | 56 | ±6.5 |
| | | 52 | 15 | A3 | ← | 52 | 2.2 | 54 | ±6.5 |
| | | 53 | 11 | B3 | ← | 56 | 1.5 | 61 | ±7 |
| | | 54 | 8 | G1 | ← | 55 | 2.0 | 59 | ±6.5 |

* Estimated compressive strength based on below manufacturer's conversion chart equation

Specified Concrete Strength: 50 MPa @ 28 days

Aggregate Size: 12 mm



Notes:

(i) Manufacturer conversion curves covers rebound values up to 55, Metro has calculated estimated strength based on curve equations.

(ii) Clause 5.5 of ASTM C805/C805M-08 (standard test method for rebound hammer of hardened concrete) states that, rebound hammer test method is not suitable as the basis for acceptance or rejection of concrete.

Per: 

Amit Sayal
Materials Technician

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 18, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

2

~~B3~~ B3

Identifier Label visible?

Y / N

maybe on OB side?

Whole segment visible?

Y / N

straddles wall.

Key Position #:

4

Segment Location?

High

/ Middle / Low

Access by?

Crane

/ Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

all good

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 18, 2017

Location of segment:

Tunnel Direction? Inbound / Outbound

Ring #: 3 F3

Identifier Label visible? Y / N

Whole segment visible? Y / N

Key Position #: 13

Segment Location? High / Middle / Low

Access by? Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017

| | | |
|--|--------------------------------|-------------------------------------|
| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 18, 2017 |
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 6 G3 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N partially straddled | |
| Key Position #: | 9 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| All good . | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: | Date: Nov 18, 2017 | |

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 18, 2017

Location of segment:

Tunnel Direction? Inbound / Outbound

Ring #: 10 G3

Identifier Label visible? Y / N *maybe other side of web*

Whole segment visible? Y / N

Key Position #: 11

Segment Location? High / Middle / Low

Access by? Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017

5

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 18, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

~~11~~ 11 G2

Identifier Label visible?

Y / N

G2 on Label + imprint in concrete.

Whole segment visible?

Y / N

Key Position #:

7.

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Leaking - testing close to wet area.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS. Date: Nov 18, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 18, 2017

Location of segment:

Tunnel Direction? Inbound / Outbound

Ring #: 13 F2

Identifier Label visible? Y / N

Whole segment visible? Y / N

Key Position #: 13

Segment Location? High / Middle / Low

Access by? Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Minor seepage at Southend

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017.

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

13 E2

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

13

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All ok.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS

Date: Nov 19, 2017.

8

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 18, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 15 F2 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N | |
| Key Position #: | 13 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| All ok. | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 18, 2017. | | |

9

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 18, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 16 GL | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N <i>potially straddle</i> | |
| Key Position #: | 9 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| <p><i>All good.</i></p> | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane Initials: <i>RS</i> Date: <i>Nov 18, 2017</i> | | |

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 18, 2017

10

Location of segment:

Tunnel Direction? Inbound / Outbound

Ring #: 18 F3

Identifier Label visible? Y / N

Whole segment visible? Y / N straddled

Key Position #: 17

Segment Location? High / Middle / Low

Access by? Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 18, 2017

Location of segment:

Tunnel Direction? Inbound / Outbound

Ring #: 18 E3

Identifier Label visible? Y / N

Whole segment visible? Y / N

Key Position #:

17

Segment Location? High / Middle / Low

Access by? Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 18, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 22 G2 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N studdlers | |
| Key Position #: | 9 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| All good | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 18, 2017. | | |

13

| | | |
|--|---------------------------------------|--|
| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: <u>Nov 18, 2017</u> |
| Location of segment: | | |
| Tunnel Direction? | <u>Inbound</u> / Outbound | |
| Ring #: | <u>22</u> <u>F3</u> | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N | |
| Key Position #: | <u>9</u> | |
| Segment Location? | High / <u>Middle</u> / Low | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| <u>All good.</u> | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: <u>RS</u> | Date: <u>Nov 18, 2017</u> | |

14

Nov 18, 2017

Tunnel Direction?

Inbound / Outbound

23

F2

Y / N

Y / N

13

High / Middle / Low

Crane / Ladder / from guideway

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good

| |
|----------------------|
| Additional Comments: |
|----------------------|

Initials:

rs

Date:

Nov 18, 2017.

15

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 18, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

24 F3

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

9

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 18, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 26 63 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N straddle | |
| Key Position #: | 9 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| Minor leakage on Sattler | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 18, 2017 | | |



| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 18, 2017 |
|--|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 28 FL | |
| Identifier Label visible? | Y / N maybe other side of web | |
| Whole segment visible? | Y / N | |
| Key Position #: | 17 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| All good. | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 18, 2017. | | |

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 18, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

30 E3

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

17

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 17, 2017.

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 18, 2017

Location of segment:

Tunnel Direction? Inbound / Outbound

Ring #: 34 F2

Identifier Label visible? Y / N

Whole segment visible? Y / N

Key Position #:

Segment Location? High / Middle / Low

Access by? Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: _____ Date: _____

| | | |
|--|---------------------------------------|--|
| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: <u>Nov 18, 2017</u> |
| Location of segment: | | |
| Tunnel Direction? | <u>Inbound</u> / Outbound | |
| Ring #: | <u>42</u> <u>F2</u> | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N | |
| Key Position #: | <u>11</u> | |
| Segment Location? | High / <u>Middle</u> / Low | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: Ronan Spillane | | |
| Initials: _____ Date: _____ | | |

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 18, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

63 H2

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Some ^{minor} seepage + efflorescence. noted
Photo taken

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017.

22

| | | |
|--|---------------------------------------|--|
| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: <u>Nov 18, 2017</u> |
| Location of segment: | | |
| Tunnel Direction? | <u>Inbound</u> / Outbound | |
| Ring #: | <u>63</u> <u>G2</u> | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N | |
| Key Position #: | <u>1</u> | |
| Segment Location? | High / Middle / <u>Low</u> | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| <u>All good</u> | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: | <u>RS</u> Date: <u>Nov 18, 2017.</u> | |

| | | |
|--|---------------------------------------|--|
| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: <u>Nov 18, 2017</u> |
| Location of segment: | | |
| Tunnel Direction? | <u>Inbound</u> / Outbound | |
| Ring #: | <u>116</u> <u>F1</u> | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N <u>partially buried</u> | |
| Key Position #: | <u>11</u> | |
| Segment Location? | High / <u>Middle</u> / Low | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| <u>All good</u> | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: <u>RS</u> | Date: <u>Nov 18, 2017</u> | |

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 18, 2017

24

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

351 D1

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

21

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 18, 2017.

| | | |
|--|--|--|
| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: <u>Nov 18, 2017</u> |
| Location of segment: | | |
| Tunnel Direction? | <u>Inbound</u> / Outbound | |
| Ring #: | <u>335 C1</u> | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N | |
| Key Position #: | <u>18</u> | |
| Segment Location? | High / <u>Middle</u> / Low | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | <u>this was listed as IB or OB ? Confirmed IB on Nov 18, 2017.</u> | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: Ronan Spillane | | |
| Initials: <u>RS</u> Date: <u>Nov 18, 2017.</u> | | |

| | | |
|--|---------------------------------------|--|
| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: <u>Nov 18, 2017</u> |
| Location of segment: | | |
| Tunnel Direction? | <u>Inbound</u> / Outbound | |
| Ring #: | <u>35</u> <u>F3</u> | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / <u>N</u> | |
| Key Position #: | <u>7</u> | |
| Segment Location? | High / Middle / <u>Low</u> | |
| Access by? | Crane / Ladder / from <u>guideway</u> | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| <u>Seepage at Southend</u> <u>Photo taken.</u> | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: <u>RS</u> | Date: <u>Nov 18, 2017.</u> | |

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 19, 2017

Location of segment:

Tunnel Direction? Inbound / Outbound

Ring #: 10 E2

Identifier Label visible? Y / N

Whole segment visible? Y / N part buried

Key Position #:

Segment Location? 11 High / Middle / Low

Access by? Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

~~get it as right~~
All good.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

28

Location of segment:

Tunnel Direction? Inbound / Outbound

Ring #: 11 F3

Identifier Label visible? Y / N

Whole segment visible? Y / N

Key Position #: 7

Segment Location? High / Middle / Low

Access by? Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good.

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Schmidt Hammer test was not performed on this segment due to a miscommunication on the night.

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017.

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 18 D3 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N part buried | |
| Key Position #: | 17 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| All good. | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 19, 2017 | | |

29

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 22 E2 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N partial buried | |
| Key Position #: | 9 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| All good. | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 19, 2017. | | |

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|--|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 19 F2 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N | |
| Key Position #: | 7 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| All good | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 19, 2017. | | |

51

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 24 E3 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N put buried | |
| Key Position #: | 9 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| All good | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 19, 2017. | | |

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

26 E1

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

put bricks

Key Position #:

9

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017.

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

not OB!

3:37am

Ring #:

274 D-1

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

12 (not 21 as shown on original list)

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Looks good

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS

Date: Nov 19, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

2.31 am

54

Tunnel Direction?

~~Inbound~~ / Outbound

Ring #:

11

A1

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

7

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Seepage @ Southend - Photo @ 2.31 am

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

22 A 3

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

9

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Looks good .

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|--|--|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / <u>Outbound</u> | |
| Ring #: | 15 G-2 | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N water tunnel fan over | |
| Key Position #: | 13 | |
| Segment Location? | <u>High</u> / Middle / Low | |
| Access by? | <u>Crane</u> / Ladder / from guideway a little awkward for access | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| Looks good . | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: <u>RS</u> Date: <u>Nov 19, 2017</u> | | |

36

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | 2.48 am |
| Ring #: | 23 G-3 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N partial straddle | |
| Key Position #: | 13 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| Looks good. | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| Additional Comments: | | |
| Recorded by: | Ronan Spillane | |
| Initials: | Date: Nov 19, 2017. | |

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 19, 2017

Location of segment:

| | | | |
|---------------------------|---------------------------------------|-----------|----|
| Tunnel Direction? | Inbound / <u>Outbound</u> | 2-57 am | 38 |
| Ring #: | 31 | A-3 | |
| Identifier Label visible? | <u>Y</u> / N | | |
| Whole segment visible? | <u>Y</u> / N | small one | |
| Key Position #: | 7 | | |
| Segment Location? | High / <u>Middle</u> / Low | | |
| Access by? | <u>Crane</u> / Ladder / from guideway | | |
| Additional comments? | | | |

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Looks good .

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017 .

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

2:58am

(39)

Ring #:

35

A-1

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

small

Key Position #:

7

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Looks good .

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS

Date: Nov 19, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

35 B-1

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

Key Position #:

7

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

either.

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Looks good .

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017.

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|--|---------------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / <u>Outbound</u> | 308m 3.06m |
| Ring #: | 63 C-1 | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N | |
| Key Position #: | 1 | |
| Segment Location? | High / Middle / <u>Low</u> | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| all good. | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: <u>RS</u> Date: <u>Nov 19, 2017</u> | | |

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|--|--|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / <u>Outbound</u> | 3.07 amt |
| Ring #: | 63 B-2 | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N | |
| Key Position #: | 1 | |
| Segment Location? | High / Middle / <u>Low</u> | |
| Access by? | <u>Crane</u> / Ladder / from <u>guideway</u> | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| All good. | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: <u>RS</u> Date: <u>Nov 19, 2017.</u> | | |

42

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | (43) |
| Ring #: | 112 G-2 | 3.16 am |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N put barriers | |
| Key Position #: | 22 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: | Date: Nov 19, 2017 | |

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|--|---------------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / <u>Outbound</u> | |
| Ring #: | 113 114 A3 | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N small | |
| Key Position #: | 11 | |
| Segment Location? | High / <u>Middle</u> / Low | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: <u>RS</u> | Date: <u>Nov 19, 2017</u> | |

(44)

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|--|---------------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / <u>Outbound</u> | 3.19 am |
| Ring #: | 115 H3 | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | Y / <u>N</u> part straddled | |
| Key Position #: | 7 | |
| Segment Location? | <u>High</u> / Middle / Low | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: | Date: Nov 19, 2017 | |

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|--|---------------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / <u>Outbound</u> | |
| Ring #: | 116 4-3 3-22 am (46) | |
| Identifier Label visible? | <u>Y</u> / N | |
| Whole segment visible? | <u>Y</u> / N | |
| Key Position #: | 11 | |
| Segment Location? | High / <u>Middle</u> / Low | |
| Access by? | <u>Crane</u> / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| Minor seepage @ north end | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: <u>RS</u> Date: <u>Nov 19, 2017</u> | | |

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|---|----------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | 3:26 am (47) |
| Ring #: | 120 6-1 | |
| Identifier Label visible? | (Y) / N | |
| Whole segment visible? | (Y) / N | |
| Key Position #: | 17 | |
| Segment Location? | High / Middle / Low | |
| Access by? | (Crane) / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| all good. | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 19, 2017 | | |

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|--|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 34 B-2 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N partial burial | |
| Key Position #: | 11 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| <u>Visual Inspection Comments:</u> (inspection by Structural Engineer Meiric Preece) | | |
| | | |
| <u>Schmidt Rebound Hammer Results:</u> (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| | | |
| Recorded by: | Ronan Spillane | |
| Initials: | RS | |
| Date: | Nov 19, 2017 | |

49

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|---|--------------------------------|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | 3.54 am (50) |
| Ring #: | 25 F3 | |
| Identifier Label visible? | Y / N | |
| Whole segment visible? | Y / N | part buried |
| Key Position #: | 14 | |
| Segment Location? | High / Middle / Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| All good | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 19, 2017 | | |

| Evergreen Overheated Tunnel Liner Inspection Sheet | | Date of Inspection: Nov 19, 2017 |
|---|---|-------------------------------------|
| Location of segment: | | |
| Tunnel Direction? | Inbound / Outbound | |
| Ring #: | 18 H1 | |
| Identifier Label visible? | <input checked="" type="radio"/> Y / N | |
| Whole segment visible? | Y / <input checked="" type="radio"/> N partially buried | |
| Key Position #: | 17 | |
| Segment Location? | High / Middle / <input checked="" type="radio"/> Low | |
| Access by? | Crane / Ladder / from guideway | |
| Additional comments? | | |
| Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece) | | |
| All good | | |
| Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting) | | |
| | | |
| Additional Comments: | | |
| Recorded by: Ronan Spillane | | |
| Initials: RS Date: Nov 19, 2017 | | |

51

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:
Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

15 A-3

Identifier Label visible?

Y / N

Whole segment visible?

Y / N

small one

Key Position #:

13

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

All good

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

3.57
am

(53)

Ring #:

11

B-3

Identifier Label visible?

☒ Y / N

Whole segment visible?

☒ Y / N

Key Position #:

7

Segment Location?

High / Middle / ☒ Low

Access by?

Crane / Ladder / from ☒ guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Seepage @ South end

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RS Date: Nov 19, 2017

Evergreen Overheated Tunnel Liner Inspection Sheet

Date of Inspection:

Nov 19, 2017

Location of segment:

Tunnel Direction?

Inbound / Outbound

Ring #:

8 G1

4:00

Identifier Label visible?

Y / N

am

Whole segment visible?

Y / N

part buried

Key Position #:

22

Segment Location?

High / Middle / Low

Access by?

Crane / Ladder / from guideway

Additional comments?

Visual Inspection Comments: (inspection by Structural Engineer Meiric Preece)

Looks good

Schmidt Rebound Hammer Results: (Tester: Amit Sayal from MetroTesting)

Additional Comments:

Recorded by: Ronan Spillane

Initials: RSDate: Nov 19, 2017

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

**SUPPLEMENTAL AGREEMENT #1 TO DESIGN BUILD FINANCE AGREEMENT RE
TUNNEL LINER EXTENDED WARRANTY**

BETWEEN

**HER MAJESTY THE QUEEN
IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA,
(the "Province")**

- and -

**BC TRANSPORTATION FINANCING AUTHORITY
("BCTFA")**

- and -

**EVERGREEN RAPID TRANSIT HOLDINGS INC.
(the "Primary Contractor")**

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

**SUPPLEMENTAL AGREEMENT #1 TO DESIGN BUILD FINANCE AGREEMENT RE
TUNNEL LINER EXTENDED WARRANTY**

THIS SUPPLEMENTAL AGREEMENT dated as of October 31, 2016 is entered into:

BETWEEN:

**HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF
BRITISH COLUMBIA**, as represented by the Minister of Transportation and
Infrastructure

(the “**Province**”)

AND: BC TRANSPORTATION FINANCING AUTHORITY a corporation
continued under the Transportation Act

(“**BCTFA**”)

AND: EVERGREEN RAPID TRANSIT HOLDINGS INC.

(the “**Primary Contractor**”)

WHEREAS:

- A. The Province, the BCTFA and the Primary Contractor entered into a Design Build Finance Agreement with respect to the Evergreen Line Rapid Transit Project (the “Project”) on December 11, 2012 (the “DBFA”) as amended pursuant to a Project Agreement Amending Agreement effective April 5, 2016.
- B. Certain pre-cast concrete tunnel liner segments, identified as manufactured and installed by or on behalf of the Primary Contractor for the Bored Tunnel components of the Project do not meet the required specifications of the Project Agreement, and specifically, the specifications pertaining to the maximum curing temperature for the precast tunnel liner segments and the potential for delayed ettringite formation (“DEF”) in overheated segments, as detailed in the Schedule to this Agreement (the “Affected Segments”) and constitute a Work Defect pursuant to the terms of Part 6 [Work and Warranties] of the DBFA.
- C. The remaining pre-cast concrete tunnel liner segments that were manufactured and installed by or on behalf of the Primary Contractor for the Bored Tunnel components of the Project and which do meet the required specifications of the Project Agreement are hereinafter referred to as the “Conforming Segments”.

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

- D. The parties wish to enter into this Agreement to document the agreements of the parties and the supplemental obligations of the Primary Contractor with respect to the Affected Segments.

NOW THEREFORE in consideration of the covenants and agreements of the parties contained in this Agreement and other good and valuable consideration, the receipt and sufficiency of which are hereby expressly acknowledged by each of the parties, the parties covenant and agree as follows:

PART 1 - INTERPRETATION

1.1 Definitions and Interpretation

Capitalized terms not otherwise defined herein have the meanings and be interpreted and construed in accordance with the provisions set out in Schedule 1 [Definitions and Interpretation] of the DBFA as if the same were expressly repeated herein. The provisions of Part 2 of Schedule 1 [Definitions and Interpretation] of the DBFA shall apply to this Agreement mutatis mutandis as if the same were expressly repeated herein.

1.2 Governing Law

This Agreement is governed exclusively by, and is to be enforced, construed and interpreted exclusively in accordance with, the laws of British Columbia and the laws of Canada applicable in British Columbia, and the laws of British Columbia and the laws of Canada applicable in British Columbia are the proper law of this Agreement.

PART 2 - EXTENDED WARRANTY

2.1 Warranty Extension

(a) The Primary Contractor covenants and agrees with the Province and the BCTFA, without prejudice to the terms of the DBFA, as follows:

- (i) The provisions of this Agreement are supplemental to the terms of the DBFA and not in substitution for or amendment of the provisions of the DBFA, including with respect to Latent Work Defects, which remain in full force and affect and unamended by the terms of this Agreement;
- (ii) The Affected Segments do not meet the requirements of the DBFA and constitute a Work Defect pursuant to the terms of Part 6 [Work and Warranties] of the DBFA and shall be addressed by the Primary Contractor in accordance with the terms of this Agreement; and
- (ii) The General Work Defect Warranty Period as defined in Part 6 [Work and Warranties] of the DBFA shall be extended with respect to the Affected Segments so that the General Work Defect Warranty Period with respect to the Affected Segments shall commence on the Substantial Completion Date and continue to and including the tenth anniversary of the Substantial Completion Date (the "Extended General Defect Warranty Period").

(b) In the event that the Affected Segments do not perform, solely as a result of the effect of DEF, in all respects in the same manner as the Conforming Segments, during the Extended General Defect Warranty Period, the Primary Contractor agrees to take such steps as may be required by the Province,

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

acting reasonably, including of remediation, repair and replacement to ensure that the Affected Segments perform and will perform in all respects in the same manner as the Conforming Segments.

(c) With respect to the Affected Segments, during the Extended General Defect Warranty Period, the Primary Contractor shall have the following supplemental obligations:

- (i) The Primary Contractor shall conduct an inspection, to the reasonable satisfaction of the Province, of the Affected Segments, including by reference to the condition of Conforming Segments, which shall include at a minimum:
 - a. Visual review for cracking, moisture infiltration, and water infiltration of all of the Affected Segments in order to verify the surface condition of the Affected Segments when compared with the Conforming Segments; and
 - b. Rebound hammer testing of all of the Affected Segments to ASTM C805/C805M-13a Standard Test Method for Rebound Number of Hardened Concrete, as amended or updated from time to time, in order to verify the compressive strength of the Affected Segments when compared with the Conforming Segments,

every 12 months, during the Extended Defect Warranty Period, commencing on the 31st of October 2017 and on each anniversary of such date with participation and input as may be reasonably required by the Province. The Primary Contractor shall provide not less than 21 days prior notice in writing to the Province of the date and time of such inspection and testing.

- (ii) Promptly following each inspection, the Primary Contractor shall, prepare an annual inspection report, the scope of which shall first be agreed in writing by the Province and which shall be addressed to the Province and signed and sealed by a Professional Engineer acceptable to the Province, which approval will not unreasonably be withheld (the "Affected Segment Annual Inspection Report"). The Affected Segment Annual Inspection Report shall note the condition and performance of all Affected Segments, including, at a minimum, the result of the visual review and rebound hammer testing referred to in Section 2.1(d)(i) and identify any Affected Segments which have performed differently or deteriorated, solely as a result of the effect of DEF or which appear to be performing differently or deteriorating, solely as a result of the effect of DEF, when compared with the Conforming Segments.
- (iii) The Primary Contractor acknowledges and agrees the scope, form and content of the Affected Segment Annual Inspection Report must be reasonably satisfactory to the Province in all respects.
- (iv) The Primary Contractor shall submit each Affected Segment Annual Inspection Report to the Province within four weeks of the date of the relevant inspection.
- (v) If deterioration or different performance in the Affected Segments, solely as a result of the effect of DEF, is observed or suspected by the Professional Engineer referred to in Section 2.1(d)(ii), the Primary Contractor shall forthwith prepare a remedial works report which shall be addressed to the Province and signed and sealed by a Professional Engineer acceptable to the Province, which approval will not unreasonably be withheld

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

(the "Remedial Works Report"). The Remedial Works Report shall provide recommendations for remediating the observed deterioration or difference in performance identified in the Affected Segment Annual Inspection Report, so as to ensure that the Affected Segments perform in all respects in the same manner as the Conforming Segments. The Primary Contractor acknowledges and agrees that any recommendations shall be required to ensure that the Affected Segments are not subject to future or ongoing monitoring, repair, rehabilitation, treatment, maintenance requirements, costs or other impacts including those which may affect the use and operation of the tunnel or of the Evergreen Line.

- (vi) The Primary Contractor shall submit each Remedial Works Report to the Province within four weeks of the date of the relevant inspection for the review and written approval of the Province acting reasonably.
 - (vii) The Province may object to any recommendations contained in a Remedial Works Report for any reason acting reasonably, and the Primary Contractor shall promptly take such steps as may be required to respond to and address any such objection on the part of the Province to the reasonable satisfaction of the Province.
 - (viii) Within four weeks of the date of the Province's written approval pursuant to Section 2.1(d)(vi), the Primary Contractor shall commence and thereafter diligently complete all works in accordance with the recommendations of the Remedial Works Report to the reasonable satisfaction of the Province and at the sole cost and risk of Primary Contractor. All works shall be completed as soon as possible following submission of the Remedial Work Report on a schedule to be agreed with the Province.
- 6
- (ix) In the penultimate year of the Extended General Defect Warranty Period, the Primary Contractor shall provide to the Province a supplemental report addressed to the Province and signed and sealed by a Professional Engineer acceptable to the Province, which approval will not unreasonably be withheld, to confirm that the Affected Segments, taking account as applicable of any works carried out by the Primary Contractor pursuant to any Remedial Works Report, will perform or continue to perform for the remainder of their design life as required and at least in all respects in the same manner as the Conforming Segments.

(d) Without prejudice to the terms of Section 2.1(c) and Section 2.1(d) of this Agreement, upon receipt by the Primary Contractor of written notice from the Province to the Primary Contractor of any failure, or apparent failure in the Affected Segments to perform, solely as a result of the effect of DEF, in all respects in the same manner as the Conforming Segments, the Primary Contractor shall forthwith remedy such failure to the reasonable satisfaction of the Province.

(e) At least three months prior to the end of the Extended General Defect Warranty Period, the Province and the Primary Contractor shall jointly inspect all of the Affected Segments to identify all Work Defects and potential Work Defects, caused solely as a result of the effect of DEF, which are identifiable on visual inspection and shall compile a list of any such Work Defects and potential Work Defects, caused solely as a result of the effect of DEF. The Primary Contractor shall forthwith commence and thereafter diligently complete all such Work Defects to the reasonable satisfaction of the Province.

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

(f) The Primary Contractor acknowledges and agrees that any access to the tunnel required by or on behalf of the Primary Contractor pursuant to the terms of this Agreement:

- (i) shall be co-ordinated with TransLink (or its successor) and the requirements from time to time of TransLink; and
- (ii) shall be without disruption of, delay to or interference with the operation of the Evergreen Line and without prejudice to the generality of the forgoing, the Primary Contractor acknowledges and agrees that access will be outside the revenue service hours of the Evergreen Line as determined by TransLink, or its successor, from time to time.

(g) If the Primary Contractor, fails to perform or delays in the performance of its obligations pursuant to the terms of this Agreement, or any works on the part of the Primary Contractor required pursuant to the terms of this Agreement are not completed to the reasonable satisfaction of the Province, the Province may, but without having any obligation to do so, upon five Business Days' written notice to the Primary Contractor, perform some or all of the remedial work required, either through its own forces or through the use of contractors designated by the Province, in which case all reasonable direct costs incurred by the Province (including costs of the Province's own personnel, materials and services) in carrying out such remedial works shall, on demand, be immediately payable by the Primary Contractor to the Province.

(h) All works required of the Primary Contractor pursuant to the terms of this Agreement shall for all purposes be treated as and deemed to be work carried out by the Primary Contractor pursuant to the terms of the DBFA, including Section 6.8 [Correction of Work Defects], to which all applicable provisions of the DBFA shall apply to the same extent as if the same were repeated herein, including the provisions of Section 11.1 of the Project Agreement.

PART 3 – PARENT COMPANY GUARANTEE

3.1 The Primary Contractor agrees that it is a condition of this Agreement that it shall provide a parent company guarantee of its obligations under this Agreement from its parent company, SNC-Lavalin Group Inc. (the "Guarantor"), in a form acceptable to the Province, in consideration of the benefit the Guarantor will realize from its ownership of SNC-Lavalin Constructors (Pacific) Inc., given the design build contract that exists between SNC-Lavalin Constructors (Pacific) Inc. and the Primary Contractor with respect to the Project.

PART 4 - GENERAL

4.1 No amendment to this Agreement shall be binding unless it is in writing and signed by each of the parties hereto.

4.2 Except as expressly provided otherwise in this Agreement, any waiver of any provision of this Agreement shall only be effective if in writing signed by the waiving party, and no failure by any party at any time to exercise a right or remedy under or to enforce any provision of this Agreement or to require performance by any other party of any of the provisions of this Agreement shall be construed as a waiver of any such provision and shall not affect the validity of this Agreement or any part thereof or the right of any party to enforce any provision in accordance with its terms. Any waiver shall only apply to the specific matter waived and only in the specific instance and for the specific purpose for which it is given.

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

4.3 The parties shall do, execute and deliver, or shall cause to be done, executed and delivered, all such further acts, documents, assignments, waivers, licenses and things as the other may reasonably request for the purpose of giving effect to this Agreement or for the purpose of establishing compliance with the parties' respective obligations under this Agreement.

4.4 The Schedule to this Agreement is incorporated into and form part of this Agreement. Obligations of the parties set out in the Schedule are included in the obligations of the parties under this Agreement.

4.5 The words "include", "includes" or "including" shall be construed as meaning "include without limitation", "includes without limitation" and "including without limitation", respectively, and the words following "include", "includes" and "including" shall not be considered to set forth an exhaustive list.

4.6 Time is of the essence of this Agreement, and remains of the essence in respect of any extension of time given.

4.7 The headings and sub-headings, and references to them, in this Agreement are for convenience of reference only, do not constitute a part of this Agreement, and shall not be taken into consideration in the interpretation or construction of, or affect the meaning of, this Agreement.


4.8 This Agreement may be executed in any number of counterparts, each of which when executed and delivered is an original but all of which taken together constitute one and the same instrument; any party may execute this Agreement by signing any counterpart of it and may communicate such signing by telecopier or otherwise.

IN WITNESS WHEREOF the parties have executed this Agreement as of the day and year first above written.

SIGNED on behalf of **HER MAJESTY**)
THE QUEEN IN RIGHT OF THE)
PROVINCE OF BRITISH COLUMBIA)
by a duly authorized representative of)
the **MINISTER OF TRANSPORTATION**)
AND INFRASTRUCTURE in the)
presence of:)

Name: _____

Julia Anthony
Julia Anthony


Grant Main
Deputy Minister, Ministry of Transportation and
Infrastructure

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

BC TRANSPORTATION FINANCING AUTHORITY

by its authorized signatory:

Per:



Name: Grant Main
Title: Chief Executive Officer


EVERGREEN RAPID TRANSIT HOLDINGS INC.

Per:



Name: JEFF SPRUSTON
Title: PRIMARY CONTRACTOR REPRESENTATIVE


Per:



Name: JUSSI JÄRVELÄ
Title: DIRECTOR


**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

**SCHEDULE
AFFECTED SEGMENTS WORK DEFECT**

|  | | Evergreen Line Rapid Transit Project | | | | |
|---|--------------------|---|----------|--------------|----------------|--|
| | | Project No: 511328 | | | | |
| | | List of Total Segments cured over 71 °C and Installed in the tunnel | | | | |
| Item No | Total Segment Nos. | Segment Type - R=Rebar | Ring No. | Key Position | Invert Level * | Remarks |
| | 82 | | | | | |
| 1 | 65 | A1-R | 33 | 18 | BIL | Segment no visible (buried below invert) |
| 2 | 71 | A1-R | 35 | 7 | AIL | Segment visible |
| 3 | 81 | A2-R | 41 | 15 | BIL | Segment no visible (buried below invert) |
| 4 | 162 | A3-R | 31 | 7 | AIL | Segment visible |
| 5 | 166 | F3- R | 3 | 13 | AIL | Segment visible |
| 6 | 179 | F2-R | 2 | 4 | BIL | Segment no visible (buried below invert) |
| 7 | 209 | F3-R | 35 | 7 | AIL | Segment visible |
| 8 | 219 | H1-R | 18 | 17 | AIL | Segment visible |
| 9 | 224 | F2-R | 34 | 11 | AIL | Segment visible |
| 10 | 242 | B2-R | 34 | 11 | MIL | Segment visible |
| 11 | 243 | C2-R | 34 | 11 | BIL | Segment no visible (buried below invert) |
| 12 | 244 | D2-R | 29 | 7 | BIL | Segment no visible (buried below invert) |
| 13 | 245 | E2-R | 35 | 7 | BIL | Segment no visible (buried below invert) |
| 14 | 246 | F2-R | 28 | 17 | AIL | Segment visible |
| 15 | 286 | F2-R | 42 | 11 | AIL | Segment visible |
| 16 | 316 | B1-R | 35 | 7 | AIL | Segment visible |
| 17 | 363 | B1-R | 41 | 15 | BIL | Segment no visible (buried below invert) |
| 18 | 406 | F2-R | 15 | 13 | AIL | Segment visible |
| 19 | 548 | B3-R | 2 | 4 | AIL | Segment visible |
| 20 | 549 | C3-R | 9 | 7 | BIL | Segment no visible (buried below invert) |
| 21 | 595 | G3-R | 6 | 9 | AIL | Segment visible |
| 22 | 612 | C3-R | 5 | 13 | BIL | Segment no visible (buried below invert) |
| 23 | 624 | H1 | 56 | 21 | BIL | Segment no visible (buried below invert) |
| 24 | 635 | E3-R | 11 | 7 | MIL | Segment no visible (buried below invert) |
| 25 | 636 | F3-R | 11 | 7 | AIL | Segment visible |
| 26 | 655 | A3-R | 15 | 13 | AIL | Segment visible |
| 27 | 667 | E1-R | 26 | 9 | MIL | Segment visible |
| 28 | 676 | F2-R | 19 | 7 | AIL | Segment visible |
| 29 | 706 | E3-R | 24 | 9 | MIL | Segment visible |
| 30 | 707 | F3-R | 24 | 9 | AIL | Segment visible |
| 31 | 727 | B3-R | 21 | 13 | BIL | Segment no visible (buried below invert) |
| 32 | 729 | D3-R | 18 | 17 | AIL | Segment visible |
| 33 | 730 | E3-R | 18 | 17 | AIL | Segment visible |
| 34 | 731 | F3-R | 18 | 17 | AIL | Segment visible |
| 35 | 732 | G3-R | 26 | 9 | AIL | Segment visible |
| 36 | 734 | A1-R | 11 | 7 | AIL | Segment visible |
| 37 | 747 | F2-R | 23 | 13 | AIL | Segment visible |
| 38 | 772 | G2-R | 22 | 9 | AIL | Segment visible |
| 39 | 840 | E2-R | 13 | 13 | AIL | Segment visible |
| 40 | 841 | F2-R | 13 | 13 | AIL | Segment visible |
| 41 | 845 | B3-R | 11 | 7 | AIL | Segment visible |
| 42 | 857 | A1-R | 28 | 17 | BIL | Segment no visible (buried below invert) |

**EVERGREEN LINE RAPID TRANSIT PROJECT
SUPPLEMENTAL AGREEMENT RE TUNNEL LINER
EXTENDED WARRANTY**

**SCHEDULE - continued
AFFECTED SEGMENTS WORK DEFECT**

|  | | Evergreen Line Rapid Transit Project | | | | |
|---|--------------------|---|----------|--------------|----------------|--|
| | | Project No: 511328 | | | | |
| | | List of Total Segments cured over 71 °C and Installed in the tunnel | | | | |
| Item No | Total Segment Nos. | Segment Type - R=Rebar | Ring No. | Key Position | Invert Level * | Remarks |
| 43 | 863 | G1-R | 8 | 22 | AIL | Segment visible |
| 44 | 871 | G2-R | 11 | 7 | AIL | Segment visible |
| 45 | 873 | A3-R | 20 | 16 | BIL | Segment no visible (buried below invert) |
| 46 | 881 | A3-R | 22 | 9 | AIL | Segment visible |
| 47 | 882 | E3-R | 30 | 17 | AIL | Segment visible |
| 48 | 883 | F3-R | 25 | 14 | MIL | Segment visible |
| 49 | 884 | G3-R | 10 | 11 | AIL | Segment visible |
| 50 | 898 | E2-R | 10 | 11 | AIL | Segment visible |
| 51 | 930 | E2-R | 22 | 9 | AIL | Segment visible |
| 52 | 932 | G2-R | 15 | 13 | AIL | Segment visible |
| 53 | 948 | F3-R | 22 | 9 | AIL | Segment visible |
| 54 | 949 | G3-R | 23 | 13 | AIL | Segment visible |
| 55 | 967 | C3-R | 22 | 9 | BIL | Segment no visible (buried below invert) |
| 56 | 978 | G3-R | 25 | 14 | BIL | Segment no visible (buried below invert) |
| 57 | 992 | G1-R | 16 | 9 | AIL | Segment visible |
| 58 | 3798 | A3 | 114 | 11 | AIL | Segment visible |
| 59 | 3827 | F1 | 105 | 2 | BIL | Segment no visible (buried below invert) |
| 60 | 3870 | C1 | 115 | 7 | BIL | Segment no visible (buried below invert) |
| 61 | 3871 | D1 | 113 | 1 | BIL | Segment no visible (buried below invert) |
| 62 | 3880 | G2 | 112 | 22 | AIL | Segment visible |
| 63 | 4050 | B1 | 120 | 17 | BIL | Segment no visible (buried below invert) |
| 64 | 4051 | C1 | 63 | 1 | AIL | Segment visible |
| 65 | 4052 | D1 | 63 | 1 | BIL | Segment no visible (buried below invert) |
| 66 | 4053 | E1 | 63 | 1 | MIL | Segment visible |
| 67 | 4054 | F1 | 116 | 11 | AIL | Segment visible |
| 68 | 4055 | G1 | 120 | 17 | AIL | Segment visible |
| 69 | 4058 | B2 | 63 | 1 | AIL | Segment visible |
| 70 | 4059 | C2 | 116 | 11 | BIL | Segment no visible (buried below invert) |
| 71 | 4061 | F2 | 63 | 1 | BIL | Segment no visible (buried below invert) |
| 72 | 4062 | G2 | 63 | 1 | AIL | Segment visible |
| 73 | 4063 | H2 | 63 | 1 | AIL | Segment visible |
| 74 | 4071 | H3 | 115 | 7 | AIL | Segment visible |
| 75 | 4075 | D1 | 351 | 21 | AIL | Segment visible |
| 76 | 4133 | A3 | 116 | 11 | AIL | Segment visible |
| 77 | 4518 | D1 | 61 | 1 | BIL | Segment no visible (buried below invert) |
| 78 | 4655 | D1 | 58 | 9 | BIL | Segment no visible (buried below invert) |
| 79 | 4911 | D1 | 123 | 5 | BIL | Segment no visible (buried below invert) |
| 80 | 4064 | A3 | 120 | 18 | BIL | Segment no visible (buried below invert) |
| 81 | 4565 | C1 | 335 | 5 | AIL | Segment visible |
| 82 | 4614 | D1 | 274 | 12 | AIL | Segment visible |

*** Legend:**

AIL: Segment installed at Above Invert Level = 50 Segments
MIL: Segment installed at Middle Invert Level = 6 Segments

BIL: Segment installed at Below Invert Level= 26 Segments