Appendix F: SUBSTRUCTURE CONDITION SURVEY REPORT

MEMORANDUM

MORRISON HERSHFIELD

TO:	Damir Muhurdarevic, P.Eng. Bridge Projects Engineer Engineering Division Bridge Planning and Operations Branch City of Winnipeg	**FROM:**	Troy Hengen, P.Eng. Structures Project Manager / Bridge Engineer
		PROJECT No.:	210351000
RE:	St. Vital Red River Bridge Substructure Condition Assessment Memo Report	**DATE:**	12/13/2022

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Damir,

As per our proposal, this memo report presents Morrison Hershfield's findings from the substructure condition assessment survey of the St. Vital Red River Bridge. A written summary of our inspection findings is contained in the body of this memo report and the following appendices are attached to the report for reference information. Note the memo report is to be read in conjunction with the supporting appendices.

- Appendix O.1 - Detailed Condition Survey Drawings (including defect mapping, concrete material testing results summary, and rebar cover measurements)
- Appendix O.2 – Inspection Photos
- Appendix O.3 – Core Sketches
- Appendix O.4 – Core Logs
- Appendix O.5 - Laboratory Test Results
- Appendix O.6 – Rapid Chloride Test Results
- Appendix O.7 – Corrosion Potential Survey Results

Regards,

Troy Hengen, P.Eng.
Structures Project Manager / Bridge Engineer

1. Background and Scope of Work

Morrison Hershfield (MH) completed the preliminary design (PD) of the St. Vital Red River Bridge rehabilitation in 2021 – 2022. The PD assignment scope included determining a recommended scope for the bridge substructure condition assessment to be completed after the bridge deck condition survey and Ontario Structure Inspection Manual (OSIM) inspection of the structure, which were completed in 2021. MH recommended a substructure condition assessment be completed with the following scope of work:

1) Preparation of detailed condition survey drawings,

2) Completing delamination and surface defect mapping surveys,

3) Completing rebar cover surveys,

4) Corrosion potential surveys on the road facing side of Pier 1 and 8 and the abutments, and

5) A coring / concrete testing program, including concrete material testing for the following items:

    a) Compressive Strength – four abutment cores and six pier cores (in accordance with CSA A23.2-14C - Obtaining and Testing Drilled Cores for Compressive Strength),

    b) Concrete Unit Weight – four abutment cores and six pier cores,

    c) Acid Soluble Chloride Content Testing (on cores) – six abutment cores (in accordance with Alberta Transportation Test Method TLT-520),

    d) Rapid Chloride Testing (Powder Samples) – thirty-seven (37) abutment and eighteen (18) pier test locations, (in accordance with Alberta Transportation Level 2 BIM manual chloride testing guidelines),

    e) Air Void Analysis – five abutment cores and four pier cores, (in accordance with ASTM C457 – Test Method for Microscopical Determination of Parameters of the Air Void System in Hardened Concrete),

    f) Petrographic Analysis – one abutment core and one pier core, (in accordance with ASTM G856 - Standard Practice for Petrographic Examination of Hardened Concrete),

g) Chloride Permeability Testing – one abutment core and one pier core (in accordance with CSA A23.2-23C; Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration), and

h) pH Testing – four tests completed on cores, in accordance with Carter 16.2/SM 4500-H+ B; Determination of pH Value in Solids.

Field work for the substructure condition assessment was completed in June to September 2022.

2. Summary of Significant Findings

North Abutment Wall

Surface Defects and Key Findings

The north abutment wall was generally found in fair to poor condition overall with a localized large delamination between Columns 2-3 under the Southbound (SB) lanes, and small localized delaminations between Columns 1-2 (under SB lanes) and Columns 7-8 (Northbound (NB) Lanes). Localized delaminations were noted on the cap beam between Columns 4-7 in between the NB and SB lanes. Expansion joint leakage was evident at the north abutment under both the NB and SB sections of the abutment.

A concrete “refacing” was noted during field assessment between Columns 3-4 under the SB lanes and between Columns 7-8, 8-9, and 9-10 under the Northbound (NB) lanes (e.g. one of three bays between the columns were refaced under the SB lanes and three of three bays between the columns were refaced under the NB lanes). No drawings were available on the north abutment concrete refacing details.

Coring through the refacing locations determined the concrete refacing was 120 to 160 mm thick, with an estimated average thickness of 140 mm. The refacing is estimated to be reinforced with 10M to 15M rebars at 300 mm o/c from coring findings and rebar cover survey results. Narrow horizontal and vertical cracking was noted at all concrete refacing locations. Coring inspection and rebar cover survey inspection results found the noted narrow cracking generally coincided with the refacing rebar locations.

Material Testing Results

A summary of key findings from the materials testing is as follows:

- Compressive Strength and Unit Weight
    - A10 core = 73.5 MPa (refacing concrete)
    - A12 core = 42.9 MPa (original abutment concrete)

- Unit Weight
    - A10 core = 2358 kg/m3 (refacing concrete)
    - A12 core = 2391 kg/m3 (original abutment concrete)

- Chloride Content (Acid Soluble Method on Concrete Cores)
    - Chloride content test results presented in this report are the chloride content including background chloride content; background chloride content was determined to be 0.008% by mass of concrete.
    - Cores A17, 18, and 19 – chloride contents were above the Ontario Structures Rehabilitation Manual (OSRM) corrosion initiation threshold of 0.05% chloride content by mass of concrete at all test depth locations except 150-160 mm and 170-180 mm depths on Core A18 and 170-180 mm depth on Core A19.

- Rapid Chloride Testing (RCT)
    - RCT was completed using a Germann Instruments RCT testing kit in general accordance with Alberta Transportation Level 2 Bridge Inspection Chloride Testing Specifications
    - 19 RCT locations were sampled on the north abutment wall (five locations in the NB portion (RCT 20, 22, 24, 62, and 64), five locations in the SB portion (RCT 14, 16, 18, 69, and 71), and three locations in the median portion (RCT 25, 26, and 66)
        - RCT 14, 16, 18, and 20 (tests in portions of abutment that had concrete refacing): chloride content >0.05% at 160-180 mm test depth (deepest test depth measured).
        - Original abutment concrete locations
            - RCT 22 and 24 (taken on abutment wall locations between columns):>0.05% chloride content at the 90-110 mm and 130-150 mm test depths, respectively, and were below the corrosion initiation threshold at deeper test depths
            - RCT 62 and 71 - chloride content >0.05% at 130-150 mm test depths.

- Air Void Analysis
    - Cores A15 and A16 met CSA limits for frost resistant concrete of 3.0% minimum total air content and spacing factors of less than 230 μm average.
- Petrographic Analysis
    - Core A9 - no issues were noted based on the petrographic analysis report
- Rapid Chloride Permeability
    - Core was taken in refacing location (Core A8 between Column 8-9) and into original concrete.
    - Original abutment concrete testing indicated moderate chloride ion penetrability rating
    - Refacing concrete had a very low chloride ion penetrability rating
- pH Testing
    - Core A18 has a pH level of 12.45 at 70-80 mm depth from top of core (at the approximate level of the rebar closest to the abutment wall surface).
    - The pH level measured is within the anticipated level of 12-13 for new condition concrete.

Corrosion Potential Surveys

A corrosion potential survey was attempted to be completed on the North abutment however the test was abandoned due to inaccurate readings being caused by the abutment wall refacing concrete being reinforced, e.g. corrosion potential reading were unable to be read on the original abutment concrete rebar or the refacing concrete in the refaced bays due to the multiple layers of rebar.

Rebar Cover Survey Results

Rebar cover surveys were completed with a handheld rebar locator (typical for both abutments and Piers 1, 2, 3, 7, and 8). The following table is a summary of the key findings from the rebar cover survey for the south abutment.

North Abutment - Cover at Columns	
Specified Cover	80 ± 20 mm
Maximum	90 mm
Minimum	30 mm
Average	60 mm
North Abutment - Cover at Abutment Wall (Between Columns)	
Specified Cover	80 ± 20 mm
Maximum	100 mm
Minimum	39 mm
Average	80 mm

The rebar cover measured was generally in accordance with the specified cover on the design drawings with localized areas of low cover. A summary of the locations with the lowest cover are as follows:

- North abutment columns (48mm) - measured at Column 5 between the NB and SB lanes
- North abutment wall (between columns) (39mm) – measured between Columns 6 and 7 between the NB and SB lanes.

South Abutment Wall

Surface Defects and Key Findings

The South abutment wall was generally found in overall fair to poor condition with localized large delaminations between Columns 8-10 under the Southbound (SB) lanes, and small localized delaminations on Columns 1, 2, 4, 8, and 9. Expansion joint leakage was evident at the South abutment on abutment sections under both the NB and SB lanes.

Material Testing Results

A summary of key findings from the materials testing is as follows:

- Compressive Strength
  - A2 core = 53.1 MPa
  - A5 core = 41.1 MPa
- Unit Weight
  - A2 core = 2364 kg/m^3
  - A5 core = 2392 kg/m^3
- Chloride Content (Acid Soluble Method on Concrete Cores)
  - Cores A20, 21, and 22: >0.05% chloride content at 100 to 110 mm test depth and below 0.05% at deeper test depths.
- Rapid Chloride Testing
  - RCT 2, 4, 6, 8, 10, 12, and 46 were taken from the abutment wall between the columns
    - RCT 2, 4, 6, and 12: >0.05% chloride content at 90-110 mm test depth and chloride contents were below 0.05% at all deeper test depths
    - RCT 8 and 10: >0.05% chloride content at 40-60 mm test depth and chloride contents were below 0.05% at all deeper test depths
    - RCT 46 – all chloride contents measured were below 0.05% at all test depths
  - RCT 50, 52, 54, 55, and 61 were taken from columns
    - RCT 55 and 61: >0.05% chloride content at 40-60 mm test depth and chloride contents were below 0.05% at all deeper test depths
    - RCT 50: >0.05% chloride content at 130-150mm depth (0.052% by mass of concrete); the chloride content when adjusted for background chloride content is 0.044% (under OSRM corrosion initiation threshold)
    - RCT 52 and 54: all chloride contents measured were below 0.05%
- Air Void Analysis
  - Cores A1 and A4 met CSA limits for frost resistant concrete of 3.0% minimum total air content and spacing factors of less than 230 μm average.

- Petrographic Analysis
    - No cores were tested for petrographic analysis on the South abutment.
- Rapid Chloride Permeability
    - No cores were tested for rapid chloride permeability on the South abutment.
- pH Testing
    - Core A20 has a pH level of 12.52 at 70-80 mm depth from top of core (at the approximate level of the rebar closest to the abutment wall surface)
    - The pH level noted is within the anticipated level of 12-13 which is typical in new condition concrete

Corrosion Potential Surveys

The following table is a summary of the corrosion potential survey findings for the south abutment. Note the more positive the corrosion potential reading, the lower the probability of corrosion potential of the rebar and the more negative the corrosion potential reading, the higher the probability of corrosion potential of the rebar.

South Abutment – Corrosion Potential Summary	
Average Corrosion Potential Reading	-272 mV/CSE
Highest Positive Corrosion Potential Reading	179 mV/CSE
Lowest Negative Corrosion Potential Reading	-589 mV/CSE
Area in < -350 mV/CSE Range (highest corrosion potential range)	31.5%
Area in -350 to -200 mV/CSE Range (transition corrosion potential range)	31.5%
Area in > -200 mV/CSE Range (lowest corrosion potential range)	37.0%

Locations with the highest corrosion potential were found at ground level between the columns under NBL and SBL structures (ranging from -583 to -470 mV/CSE), and at the top of Columns 2 and 9 (-589 and -508 mV/CSE respectively).

Rebar Cover Survey Results

South Abutment - Cover at Columns	
Specified Cover	80 ± 20 mm
Maximum	86 mm
Minimum	42 mm
Average	66 mm
South Abutment - Cover at Walls	
Specified Cover	80 ± 20 mm
Maximum	93 mm
Minimum	39 mm
Average	71 mm

The rebar cover measured was generally in accordance with the specified cover on the design drawings with localized areas of low cover. A summary of the locations of the lowest cover are as follows:

- South abutment columns (42mm) - measured at ground level on Column 3 under the NB lanes
- South abutment wall (between columns) (39mm) – measured at mid height between Columns 2 and 3 under the NB lanes.

North and South Ballast Walls

Surface Defects and Key Findings

Both the north and south abutment ballast walls (portion of the abutment from the bearing seat to the underside of joints) are noted to have been partially reconstructed during the 1988 bridge rehabilitation. It appears the ballast walls were demolished from the top of the original ballast wall height to approximately 200 – 450 mm above the abutment column bearing seats as part of previous rehabilitation works. Both the north and south ballast walls had narrow to medium horizontal cracking and isolated small delaminations. Expansion joint leakage was evident at both abutments under the NB and SB portions of the abutments.

Material Testing Results

A summary of key findings from the materials testing is as follows:

Only rapid chloride testing was completed on the ballast walls as representative cores were taken on the abutment walls for all other test methods in the project.

- Rapid Chloride Testing
    - RCT 1, 3, 5, 7, 9, and 11 were taken from the south abutment ballast wall
        - RCT 3 had chloride content >0.05% at 90-100 mm test depth and chloride content below 0.05% at the 130-150 mm test depth
        - RCT 1, 5, and 7 had chloride content >0.05% at 40-60 mm test depth and chloride content below 0.05% at all deeper test depths
        - RCT 9 and 11 had chloride content >0.05% at 5-20 mm test depth and chloride content below 0.05% at all deeper test depths
    - RCT 13, 15, 17, 19, 21, and 23 were taken from the north abutment ballast wall
        - RCT 13 had chloride content >0.05% at 90-100 mm test depth and chloride content below 0.05% at 130-150 mm.
        - RCT 19, 21, and 23 had chloride content >0.05% at 40-60 mm test depth and chloride contents below 0.05% at all deeper test depths
        - RCT 15 had chloride content >0.05% at 5-20 mm test depth and chloride contents below 0.05% at all deeper test depths
        - RCT 17 had chloride content below 0.05% at all test depths
    - RCT 25 and 26 were taken on the north abutment bearing seat level between the NB and SB lanes (reported with ballast walls due to similar location / exposure)
        - RCT 25 and 26 had chloride contents >0.05% at the 40-60 mm test depth and chloride contents below 0.05% at all deeper test depths

Piers 1 and 8 (Piers Adjacent to Churchill Drive and Kingston Row (Respectively))

Surface Defects and Key Findings

Piers 1 and 8 were generally found in overall good condition with localized narrow to medium vertical cracks near top of piers located near girder locations, and small localized delaminations near the top of piers.

Material Testing Results

A summary of key findings from the materials testing is as follows:

- Compressive Strength
  - P2 core = 42.0 MPa (Pier 8, NBL, south face)
  - P5 core = 57.7 MPa (Pier 8, SBL, south face)
  - P10 core = 53.4 MPa (Pier 1, NBL, north face)
  - P15 core = 43.8 MPa (Pier 1, SBL, north face)
- Unit Weight
  - P2 core = 2370 kg/m^3 (Pier 8, NBL, south face)
  - P5 core = 2411 kg/m^3 (Pier 8, SBL, south face)
  - P10 core = 2391 kg/m^3 (Pier 1, NBL, north face)
  - P15 core = 2363 kg/m^3 (Pier 1, SBL, north face)
- Chloride Content (Acid Soluble Method on Concrete Cores)
  - No cores were tested for chloride content using the acid soluble method on Piers 1 and 8.
- Rapid Chloride Testing
  - RCT 27, 28, 29, 30, 31, and 32 were taken from the north face of Pier 1 in the Churchill Drive splash zone.
    - RCT 31 had chloride content >0.05% at the 40-60 mm test depth and chloride contents below 0.05% at all deeper test depths
    - RCT 28, 29, 30, and 32 had chloride contents >0.05% at the 5-20 mm test depth and chloride contents below 0.05% at all deeper test depths
    - RCT 27 had chloride contents below 0.05% at all test depths

  - RCT 33, 34, 35, 36, 37, and 38 were taken from the south face of Pier 8 in the Kingston Row splash zone.
    - RCT 33, 34, and 35 had chloride contents >0.05% at the 40-60 mm test depth and chloride contents below 0.05% at all deeper test depths
    - RCT 36, 37, and 38 had chloride contents >0.05% at 5-20 mm test depth and chloride contents below 0.05% at all deeper test depths
- Air Void Analysis
  - Cores P1 and P6 (Pier 8 south face), and P11 (Pier 1 north face) met CSA limits for frost resistant concrete of 3.0% minimum total air content and spacing factors of less than 230 um average.
- Petrographic Analysis
  - Core P9 - no issues were noted based on the petrographic analysis report
- Rapid Chloride Permeability
  - No cores were tested for rapid chloride permeability on Piers 1 and 8.
- pH Testing
  - Core P3 (Pier 8, NBL, South face) has a pH level of 12.54 at 90-100 mm depth from top of core (at the approximate level of the rebar closest to the pier surface) which is within the anticipated level of 12-13 for new condition concrete.

Corrosion Potential Survey

The following table provides a summary of the key findings for the corrosion potential survey of Pier 1 north face and Pier 8 south face:

Pier 1 (NBL and SBL Results Combined)	
Average Corrosion Potential	-161 mV/CSE
Maximum Corrosion Potential	102 mV/CSE
Minimum Corrosion Potential	-368 mV/CSE
Area in > -350 mV/CSE Range	11.9%
Area in -350 - -200 mV/CSE Range	28.6%
Area in > -200 mV/CSE Range	59.5%
Pier 8 (NBL and SBL Results Combined)	
Average Corrosion Potential	-106 mV/CSE
Maximum Corrosion Potential	249 mV/CSE
Minimum Corrosion Potential	-698 mV/CSE
Area in < -350 mV/CSE Range	14.3%
Area in -350 to -200 mV/CSE Range	11.9%
Area in > -200 mV/CSE Range	73.8%

Pier 1 highest corrosion potential areas were located in the bottom 1.5m of the pier height (-365 mV/CSE), predominantly under the SB lanes. Pier 8 highest corrosion potential areas were located at the mid height of Pier 8 NBL (-546 mV/CSE), and at mid height closer to the West end of Pier 8 SBL (-698 mV/CSE).

Rebar Cover Survey Results

Cover at Pier 1	
Specified Cover	80 ± 20 mm
Maximum	100 mm
Minimum	30 mm
Average	73 mm
Cover at Pier 8	
Specified Cover	80 ± 20 mm
Maximum	113 mm
Minimum	24 mm
Average	79 mm

The rebar cover measured was generally in accordance with the specified cover on the design drawings with localized areas of low cover noted. A summary of the lowest cover locations are as follows:

- Pier 1 (30mm) - measured at mid height (30mm) under the NBL structure.
- Pier 8 (24mm) – measured at lower 1.5m of Pier 8, NBL, North face.

Piers 2, 3, and 7 (Land Piers Away From Under Passing Roads)

Surface Defects

Piers 2, 3, and 7 were generally found in overall good condition with localized narrow to medium cracks near top of piers near girder locations, and a localized large delamination near the top of Pier 7, SBL, South face.

Material Testing Results

A summary of key findings from the materials testing is as follows:

- Compressive Strength
  - P7 core = 40.4 MPa (Pier 7, SBL, south face)
  - P21 core = 40.5 MPa (Pier 2, SBL, north face)
- Unit Weight
  - P7 core = 2392 kg/m^3 (Pier 7, SBL, south face)
  - P21 core = 2386 kg/m^3 (Pier 2, SBL, north face)
- Chloride Content (Acid Soluble Method on Concrete Cores)
  - No cores were tested for chloride content using the acid soluble method on Piers 2, 3, and 7.
- Rapid Chloride Testing
  - No rapid chloride testing was completed for Piers 2, 3, and 7.
- Air Void Analysis
  - Core P18 met CSA limits for frost resistant concrete of 3.0% minimum total air content and spacing factors of less than 230 μm average).
- Petrographic Analysis
  - No cores were tested for petrographic analysis on Piers 2, 3, and 7.

- Rapid Chloride Permeability
    - Rapid chloride permeability testing on core P17 (Pier 2, NBL, North face) indicated moderate chloride ion penetrability rating.
- pH Testing
    - Core P8 (Pier 7, SBL, South face) has a pH level of 12.54 at 90-100 mm depth from top of core (at the approximate level of the rebar closest to the pier surface) which is within the anticipated level of 12-13 for new condition concrete.

Corrosion Potential Surveys

No corrosion potential survey was completed for Piers 2, 3, and 7.

Rebar Cover Survey Results

Cover at Pier 2	
Specified Cover	80 ± 20 mm
Maximum	108 mm
Minimum	16 mm
Average	79 mm
Cover at Pier 3	
Specified Cover	80 ± 20 mm
Maximum	101 mm
Minimum	27 mm
Average	81 mm
Cover at Pier 7	
Specified Cover	80 ± 20 mm
Maximum	99 mm
Minimum	27 mm
Average	75 mm

The rebar cover measured was generally in accordance with the specified cover on the design drawings with localized areas of low cover noted. A summary of the locations of the lowest cover are as follows:

- Pier 2 (16mm) - measured at the bottom 1.5m of Pier 2, SBL, south face.
- Pier 3 (27mm) – measured at bottom 1.5m of Pier 3, SBL, north face.
- Pier 7 (27mm) - measured at the bottom 1.5m of Pier 7, SBL, south face.

Piers 4, 5, 6 (River Piers)

Surface Defects

Piers 4, 5, and 6 were inspected from both river ice, in March 2022, and using the City's underbridge crane, in June 2022. Piers 4, 5, and 6 were generally found to be in overall good condition overall with localized narrow to medium cracks and large areas of dark staining predominantly located on the infill section between SBL and NBL structures. The dark staining on the river piers, between the NB and SB portions of the piers, was noted to be roadway grit buildup / light organic growth. The staining was noted to not have affected the underlying concrete's condition, from visual assessment and hammer sounding. RCT locations were also taken in the dark staining area to confirm if higher chloride content was noted in these areas and no differences were found between stained and unstained locations. A localized length of wide vertical cracking was noted on Pier 4 north face. Light to medium scaling was noted on the Pier 6 bearing seat in between the NB and SB lanes.

Material Testing Results

A summary of key findings from the materials testing is as follows:

- Compressive Strength, Unit Weight, Chloride Content (Acid Soluble Method on Concrete Cores), Air Void Analysis, Petrographic Analysis, Rapid Chloride Permeability, and pH testing
    - No cores were tested for the above stated concrete materials test methods on Piers 4, 5, and 6. Core extraction was completed on the land piers and this data was taken as representative for the river piers due to river pier access constraints.
- Rapid Chloride Testing
    - RCT 40, 41, and 42 were taken from the south and top faces of Pier 4.
        - RCT 41 had chloride content >0.05% at 90-110 mm test depth and chloride contents below 0.05% at all deeper test depths

- RCT 40 had chloride contents >0.05% at 40-60 mm test depth and chloride contents below 0.05% at all deeper test depths
- RCT 42 had chloride contents > 0.05% at the 5-20 mm and 130 – 150 mm test depth levels; the 130-150 mm test depth was noted to be marginally over the 0.05% threshold when adjusted for background chlorides (adjusted chloride content = 0.056%)

- RCT 39, 43, and 44 were taken from the north face of Pier 5.
  - RCT 43 had chloride contents >0.05% at 40-60 mm test depth and chloride contents below 0.05% at all deeper test depths
  - RCT 39 had chloride content > 0.05% at 5-20 mm and chloride contents below 0.05% at all deeper test depths
  - RCT 44 had chloride content > 0.05% at 40-60 mm and chloride contents below 0.05% at all deeper test depths

Corrosion Potential Surveys

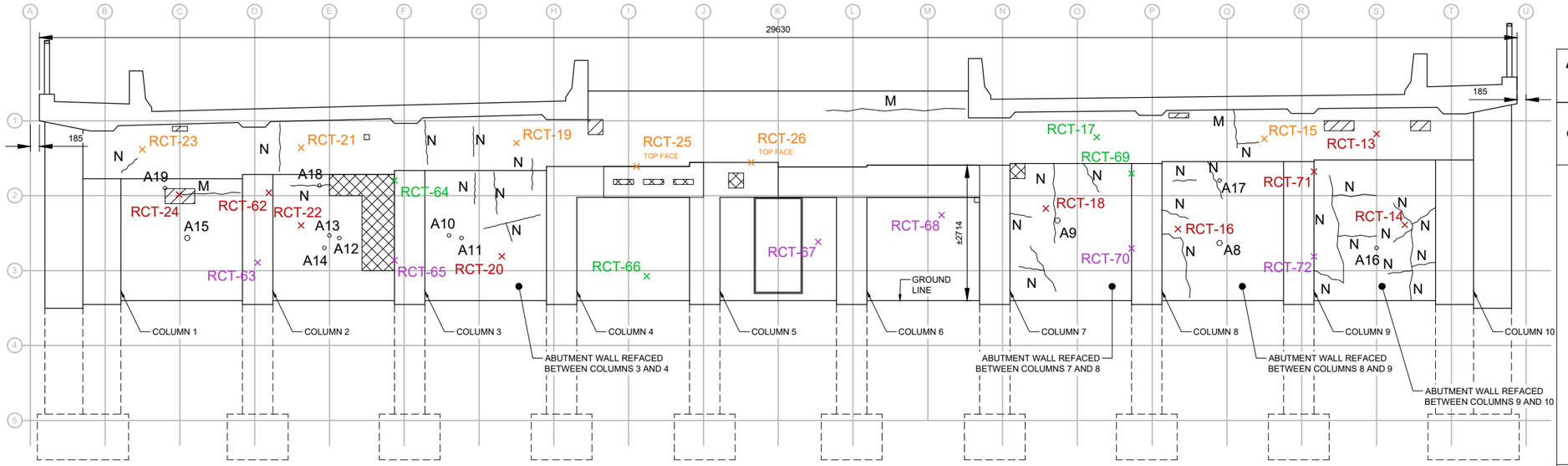
No corrosion potential survey was completed for Piers 4, 5, and 6. Assessment scope was limited to defect mapping and rapid chloride testing due to access constraints.

Rebar Cover Survey Results

No rebar cover survey was completed for Piers 4, 5, and 6. Data on land piers was taken as representative for the river piers due to access constraints.

APPENDIX O.1: SUBSTRUCTURE CONDITION ASSESSMENT

DETAILED CONDITION SURVEY DRAWINGS



WEST ← → **EAST**

NORTH ABUTMENT

SCALE: 1:100

NOTES:

1. INSPECTION COMPLETED IN JULY, 2022 FROM GROUND LEVEL NOTED.
2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.
3. TEST DEPTH IN MILLIMETERS AND MEASURED FROM SURFACE. RESULTS DISPLAYED IN RED ARE GREATER THAN 0.05% Cl^- BY CONCRETE MASS.
4. CHLORIDE CONTENT TEST RESULTS PRESENTED ARE TEST RESULTS INCLUDING BACKGROUND CHLORIDES (DETERMINED TO BE 0.008% BY MASS OF CONCRETE).

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP	RCT-X
% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH	RCT-X
% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS	RCT-X
CONCRETE SAMPLE NOT TESTED	RCT-X

DEFECTS LEGEND:

NARROW CRACK	N
MEDIUM CRACK	M
WIDE CRACK	W
DELAMINATION	
SPALL	

NORTH ABUTMENT RAPID CHLORIDE TEST RESULTS

RCT SAMPLE LOC'N		DEPTH (NOTE 3)				
NO.	ABUTMENT	5 - 20	40 - 60	90 - 110	130 - 150	160 - 180
13	NORTH	0.262	0.132	0.143	0.048	-
14	NORTH	0.097	0.024	0.014	0.134	0.124
15	NORTH	0.137	0.016	0.008	0.007	-
16	NORTH	0.109	0.014	0.018	0.105	0.165
17	NORTH	0.013	0.005	0.009	0.008	-
18	NORTH	0.022	0.017	0.010	0.105	0.140
19	NORTH	0.168	0.175	0.022	0.014	-
20	NORTH	0.407	0.023	0.014	0.101	0.089
21	NORTH	0.143	0.127	0.010	0.007	-
22	NORTH	0.442	0.239	0.061	0.028	0.014
23	NORTH	0.088	0.059	0.033	0.018	-
24	NORTH	0.345	0.521	0.194	0.079	0.043
25	NORTH	0.064	0.179	0.032	0.018	0.019
26	NORTH	0.249	0.134	0.025	0.019	0.016
62	NORTH	-	0.028	0.062	0.065	-
64	NORTH	-	0.007	0.007	0.008	-
66	NORTH	-	0.024	0.017	0.010	-
69	NORTH	-	0.007	0.008	0.042	-
71	NORTH	-	0.422	0.213	0.158	-

ACID SOLUBLE CHLORIDE CONTENT RESULTS ON EXTRACTED CORES (NOTE 3)

CORE	DEPTH (mm)	CHLORIDE CONTENT (% BY MASS)	pH LEVEL
A17	10-20	0.224	-
	30-40	0.130	-
	50-60	0.088	-
	70-80	0.062	-
	90-100	0.085	-
	110-120	0.060	-
	130-140	0.080	-
	150-160	0.128	-
	170-180	0.320	-
	190-200	0.206	-
	210-220	0.208	-
	240-250	0.132	-
A18	10-20	0.380	-
	30-40	0.428	-
	50-60	0.370	-
	70-80	0.220	0.220
	90-100	0.188	-
	110-120	0.112	-
	130-140	0.066	-
	150-160	0.025	-
	170-180	0.030	-
A19	10-20	0.597	-
	30-40	0.634	-
	50-60	0.455	-
	70-80	0.153	-
	90-100	0.148	-
	110-120	0.144	-
	130-140	0.085	-
	150-160	0.058	-
	170-180	0.037	-

NORTH ABUTMENT

CORE	TEST METHOD	RESULTS
A8	RAPID CHLORIDE ION PENETRABILITY	CHARGE PASSED IN ORIGINAL CONCRETE = 2063 (MODERATE)
		CHARGE PASSED IN CONCRETE RE-FACING = 168 (VERY LOW)
A9	PETROGRAPHIC	-
A10	COMPRESSIVE STRENGTH	73.5 MPa
A11	NOT TESTED	-
A12	COMPRESSIVE STRENGTH	42.9 MPa
A13	NOT TESTED	-
A14	NOT TESTED	-
A15	AIR VOID PARAMETERS	AIR CONTENT = 3.0%
A16	AIR VOID PARAMETERS	AIR CONTENT (ORIGINAL CONCRETE) = 4.0%
		AIR CONTENT (CONCRETE RE-FACING) = 7.8%
A17	ACID SOLUBLE CHLORIDE ION CONTENT	SEE TABLE ABOVE
A18	ACID SOLUBLE CHLORIDE ION CONTENT	SEE TABLE ABOVE
A19	ACID SOLUBLE CHLORIDE ION CONTENT	SEE TABLE ABOVE

MORRISON HERSHFIELD

Winnipeg

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NOTES

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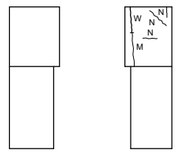
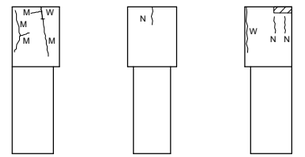
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

NORTH ABUTMENT
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: KMB



COLUMN 1
SCALE: 1:100



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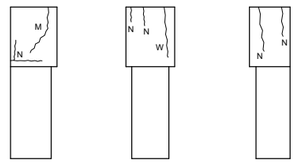

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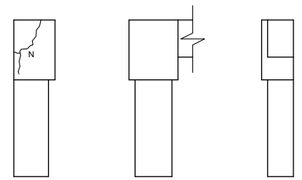

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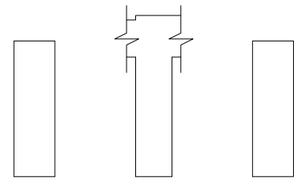

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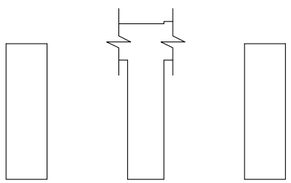

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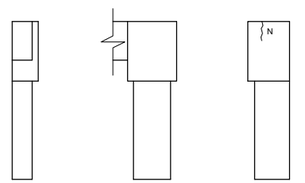

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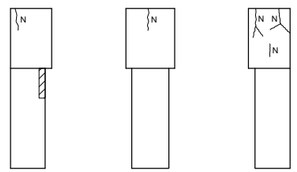

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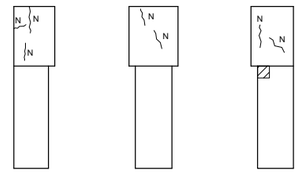
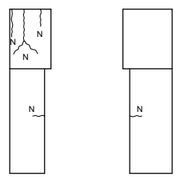


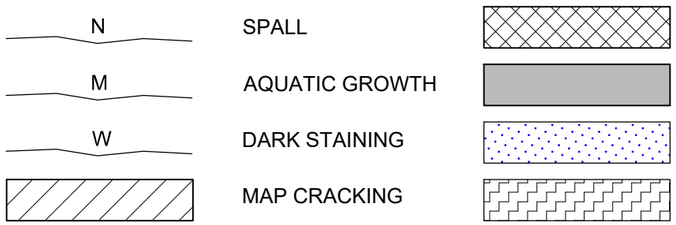
COLUMN 9
SCALE: 1:100



COLUMN 10
SCALE: 1:100

NORTH ABUTMENT

LEGEND:



NOTES:
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2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.

MORRISON HERSHFIELD

Winnipeg

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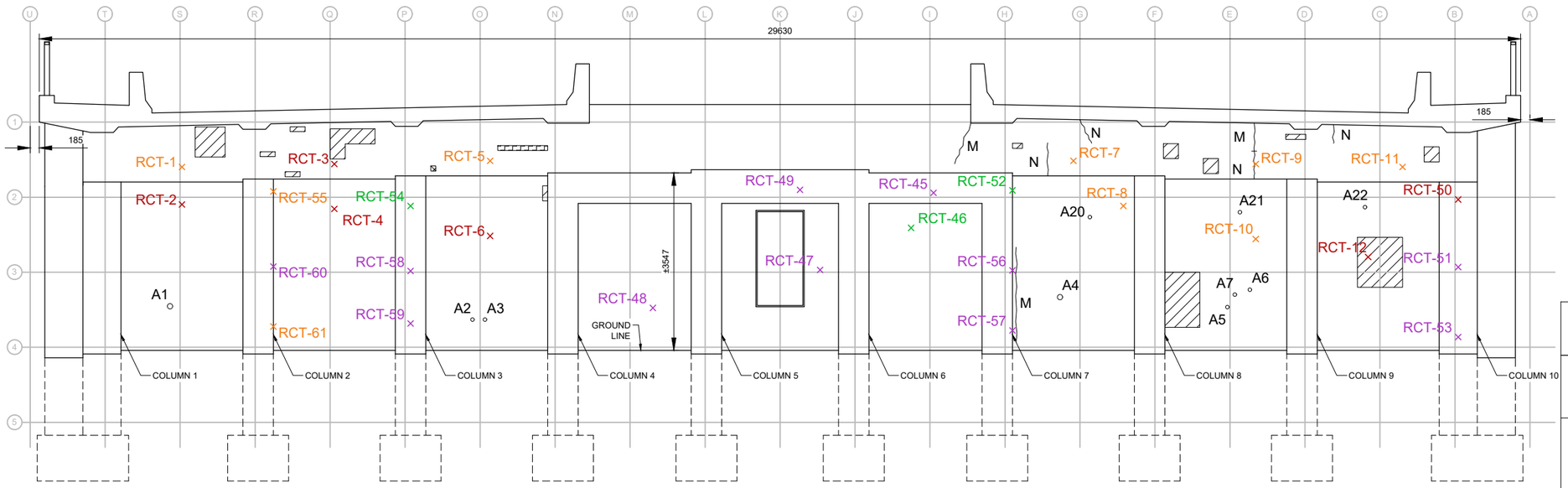
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

NORTH ABUTMENT COLUMN DETAILS

SCALE = AS SHOWN
DRAWN BY: KMB



EAST **WEST**

SOUTH ABUTMENT

SCALE: 1:100

NOTES:

1. INSPECTION COMPLETED IN JULY, 2022 FROM GROUND LEVEL NOTED.
2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.
3. TEST DEPTH IN MILLIMETERS AND MEASURED FROM SURFACE. RESULTS DISPLAYED IN RED ARE GREATER THAN 0.05% Cl^- BY CONCRETE MASS.
4. CHLORIDE CONTENT TEST RESULTS PRESENTED ARE TEST RESULTS INCLUDING BACKGROUND CHLORIDES (DETERMINED TO BE 0.008% BY MASS OF CONCRETE).

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP	RCT-X
% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH	RCT-X
% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS	RCT-X
CONCRETE SAMPLE NOT TESTED	RCT-X

DEFECTS LEGEND:

NARROW CRACK	N
MEDIUM CRACK	M
WIDE CRACK	W
DELAMINATION	
SPALL	

SOUTH ABUTMENT RAPID CHLORIDE TEST RESULTS

RCT SAMPLE LOC'N		DEPTH (NOTE 3)				
NO.	ABUTMENT	5 - 20	40 - 60	90 - 110	130 - 150	160 - 180
1	SOUTH	0.392	0.117	0.024	0.012	-
2	SOUTH	0.108	0.348	0.108	0.039	-
3	SOUTH	0.480	0.223	0.075	0.023	-
4	SOUTH	0.443	0.308	0.066	0.034	-
5	SOUTH	0.362	0.143	0.020	0.008	-
6	SOUTH	0.078	0.242	0.075	0.029	-
7	SOUTH	0.143	0.117	0.019	0.016	-
8	SOUTH	0.232	0.262	0.039	0.020	-
9	SOUTH	0.197	0.039	0.014	0.011	-
10	SOUTH	0.305	0.186	0.048	0.018	-
11	SOUTH	0.362	0.046	0.008	0.007	-
12	SOUTH	0.360	0.152	0.101	0.030	-
46	SOUTH	-	0.011	0.010	0.013	-
50	SOUTH	-	0.029	0.026	0.052	-
52	SOUTH	-	0.009	0.010	0.014	-
54	SOUTH	-	0.013	0.013	0.018	-
55	SOUTH	-	0.067	0.014	0.042	-
61	SOUTH	-	0.158	0.036	0.014	-

ACID SOLUBLE CHLORIDE CONTENT RESULTS ON EXTRACTED CORES (NOTE 3)

CORE	DEPTH (mm)	CHLORIDE CONTENT (% BY MASS)	pH LEVEL
A20	10-20	0.323	-
	30-40	0.194	-
	50-60	0.303	-
	70-80	0.097	12.52
	90-100	0.050	-
	110-120	0.030	-
	130-140	0.029	-
A21	10-20	0.296	-
	30-40	0.344	-
	50-60	0.244	-
	70-80	0.155	-
	90-100	0.065	-
	110-120	0.038	-
	130-140	0.026	-
	150-160	<0.020	-
	170-180	0.026	-

CORE	DEPTH (mm)	CHLORIDE CONTENT (% BY MASS)	pH LEVEL
A22	10-20	0.375	-
	30-40	0.370	-
	50-60	0.263	-
	70-80	0.143	-
	90-100	0.084	-
	110-120	0.034	-
	130-140	0.028	-
	150-160	0.022	-
	170-180	0.028	-

SOUTH ABUTMENT

CORE	TEST METHOD	RESULTS
A1	AIR VOID PARAMETERS	AIR CONTENT = 4.4%
A2	COMPRESSIVE STRENGTH	53.1 MPa
A3	NOT TESTED	-
A4	AIR VOID PARAMETERS	AIR CONTENT = 7.3%
A5	COMPRESSIVE STRENGTH	41.1 MPa
A6	NOT TESTED	-
A7	NOT TESTED	-
A20	ACID SOLUBLE CHLORIDE ION CONTENT	SEE TABLE ABOVE
A21	ACID SOLUBLE CHLORIDE ION CONTENT	SEE TABLE ABOVE
A22	ACID SOLUBLE CHLORIDE ION CONTENT	SEE TABLE ABOVE

MORRISON HERSHFIELD

Winnipeg

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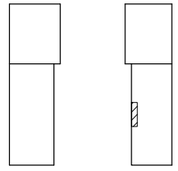
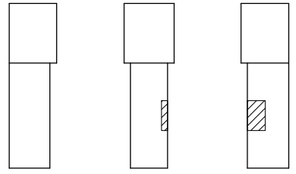
CLIENT: COW
MHL JOB NO. 210351000

SOUTH ABUTMENT
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: KMB



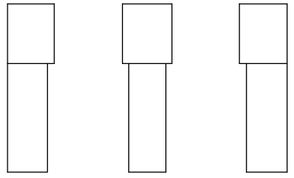
NORTH FACE | WEST FACE

COLUMN 1
SCALE: 1:100



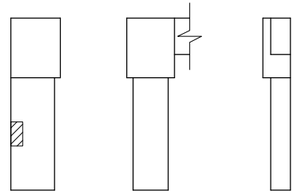
EAST FACE | NORTH FACE | WEST FACE

COLUMN 2
SCALE: 1:100



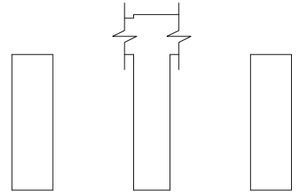
EAST FACE | NORTH FACE | WEST FACE

COLUMN 3
SCALE: 1:100



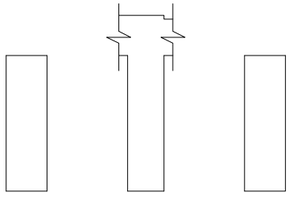
EAST FACE | NORTH FACE | WEST FACE

COLUMN 4
SCALE: 1:100



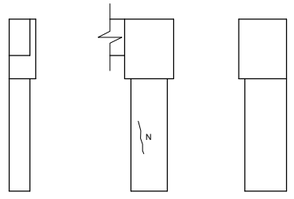
EAST FACE | NORTH FACE | WEST FACE

COLUMN 5
SCALE: 1:100



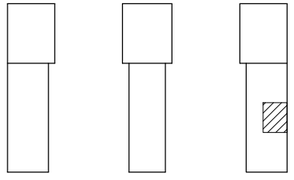
EAST FACE | NORTH FACE | WEST FACE

COLUMN 6
SCALE: 1:100



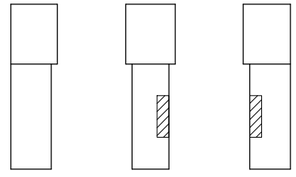
EAST FACE | NORTH FACE | WEST FACE

COLUMN 7
SCALE: 1:100



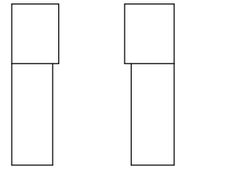
EAST FACE | NORTH FACE | WEST FACE

COLUMN 8
SCALE: 1:100



EAST FACE | NORTH FACE | WEST FACE

COLUMN 9
SCALE: 1:100



EAST FACE | NORTH FACE

COLUMN 10
SCALE: 1:100

SOUTH ABUTMENT

LEGEND:

NARROW CRACK	N	SPALL	
MEDIUM CRACK	M	AQUATIC GROWTH	
WIDE CRACK	W	DARK STAINING	
DELAMINATION		MAP CRACKING	

NOTES:
1. INSPECTION COMPLETED IN JULY, 2022 FROM GROUND LEVEL NOTED.
2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.

MORRISON HERSHFIELD | Winnipeg

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ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

SOUTH ABUTMENT COLUMN DETAILS

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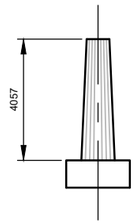
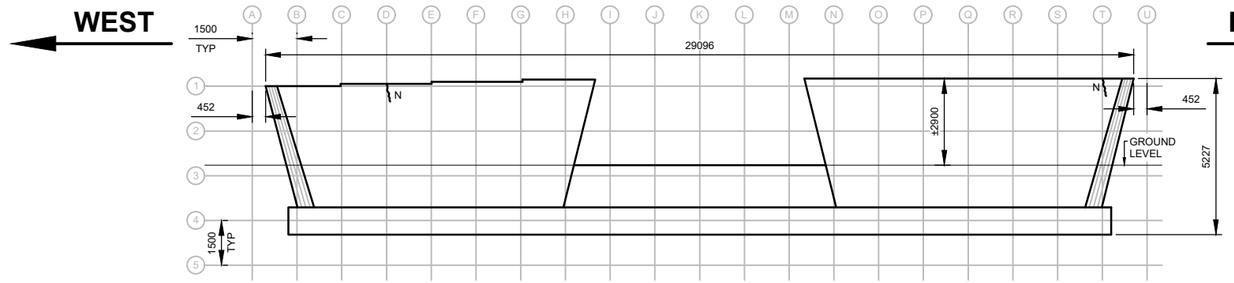


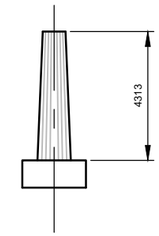
PIER 1 WEST END

SCALE: 1:200



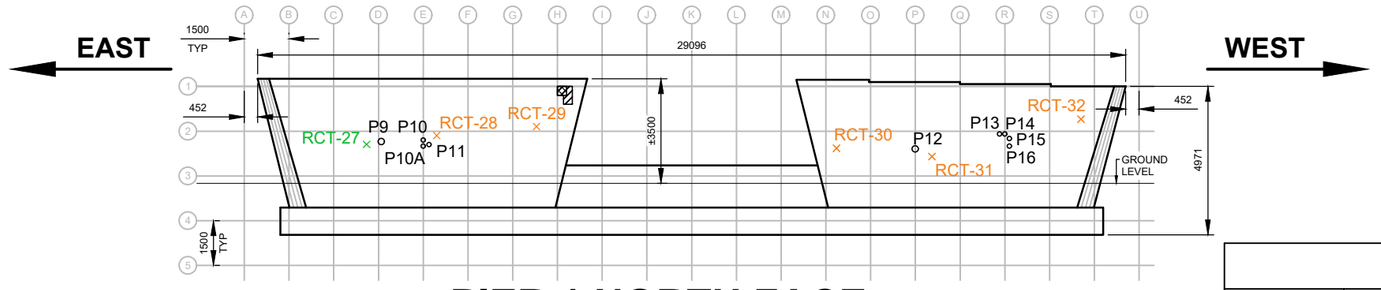
PIER 1 SOUTH FACE

SCALE: 1:200



PIER 1 EAST END

SCALE: 1:200



PIER 1 NORTH FACE

SCALE: 1:200

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP — RCT-X

% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH — RCT-X

% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS — RCT-X

DEFECTS LEGEND:

NARROW CRACK — N

MEDIUM CRACK — M

WIDE CRACK — W

DELAMINATION

SPALL

PIER 1 RAPID CHLORIDE TEST RESULTS

RCT SAMPLE LOC'N		DEPTH (NOTE 3)				
NO.	PIER	5 - 20	40 - 60	90 - 110	130 - 150	160 - 180
27	PIER 1 NBL	0.034	0.014	0.008	0.007	0.010
28	PIER 1 NBL	0.076	0.024	0.013	0.015	0.009
29	PIER 1 NBL	0.064	0.024	0.011	0.008	0.010
30	PIER 1 SBL	0.079	0.022	0.010	0.007	0.009
31	PIER 1 SBL	0.090	0.062	0.014	0.008	0.015
32	PIER 1 SBL	0.070	0.011	0.009	0.011	0.013

PIER 1

CORE	TEST METHOD	RESULTS
P9	PETROGRAPHIC	-
P10	COMPRESSIVE STRENGTH	53.4 MPa
P10A	NOT TESTED	-
P11	AIR VOID PARAMETERS	AIR CONTENT = 4.1%
P12	NOT TESTED	-
P13	NOT TESTED	-
P14	NOT TESTED	-
P15	COMPRESSIVE STRENGTH	43.8 MPa
P16	NOT TESTED	-

NOTES:

1. INSPECTION COMPLETED IN JULY, 2022 FROM GROUND LEVEL NOTED.
2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.
3. TEST DEPTH IN MILLIMETERS AND MEASURED FROM SURFACE. RESULTS DISPLAYED IN RED ARE GREATER THAN 0.05% Cl^- BY CONCRETE MASS.
4. CHLORIDE CONTENT TEST RESULTS PRESENTED ARE TEST RESULTS INCLUDING BACKGROUND CHLORIDES (DETERMINED TO BE 0.008% BY MASS OF CONCRETE).

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Winnipeg

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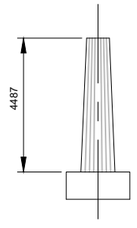
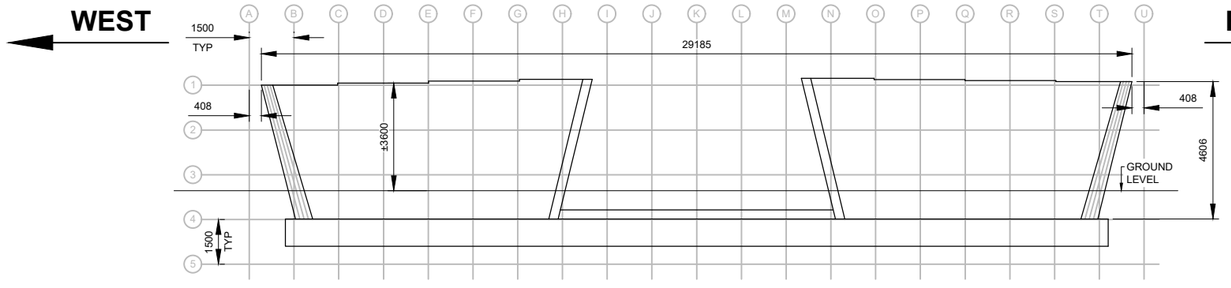
PIER 1
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: KMB



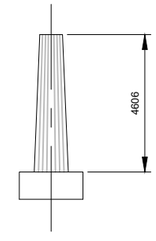
PIER 2 WEST END

SCALE: 1:200



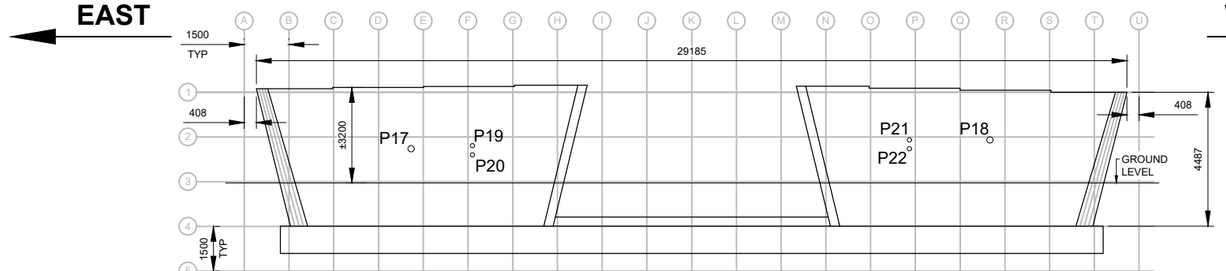
PIER 2 SOUTH FACE

SCALE: 1:200



PIER 2 EAST END

SCALE: 1:200



PIER 2 NORTH FACE

SCALE: 1:200

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP — RCT-X

% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH — RCT-X

% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS — RCT-X

DEFECTS LEGEND:

NARROW CRACK — N

MEDIUM CRACK — M

WIDE CRACK — W

DELAMINATION

SPALL

PIER 2

CORE	TEST METHOD	RESULTS
P17	RAPID CHLORIDE ION PENETRABILITY	AVERAGE TOTAL CHARGE PASSED = 2936 (MODERATE)
P18	AIR VOID PARAMETERS	AIR CONTENT = 6.2%
P19	NOT TESTED	-
P20	NOT TESTED	-
P21	COMPRESSIVE STRENGTH	40.5 MPa
P22	NOT TESTED	-

NOTES:

1. INSPECTION COMPLETED IN JULY, 2022 FROM GROUND LEVEL NOTED.
2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.
3. NO SIGNIFICANT DEFECTS NOTED.

MORRISON HERSHFIELD

Winnipeg

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NOTES

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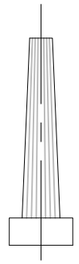
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

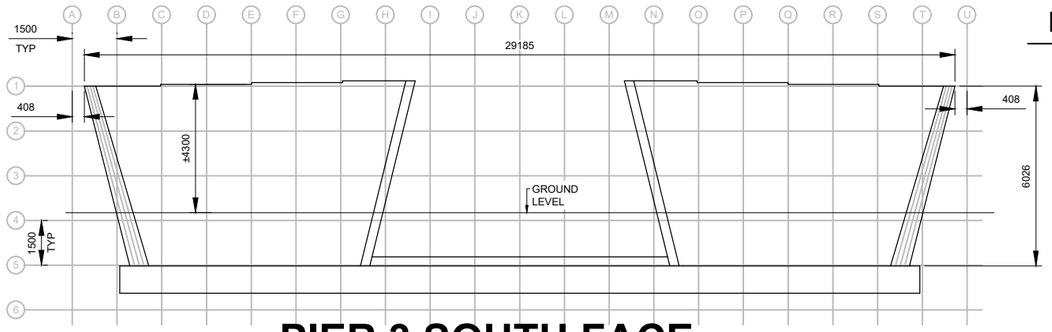
PIER 2
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: KMB



PIER 3 WEST END

SCALE: 1:200

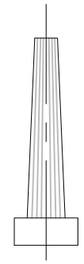
WEST



EAST

PIER 3 SOUTH FACE

SCALE: 1:200

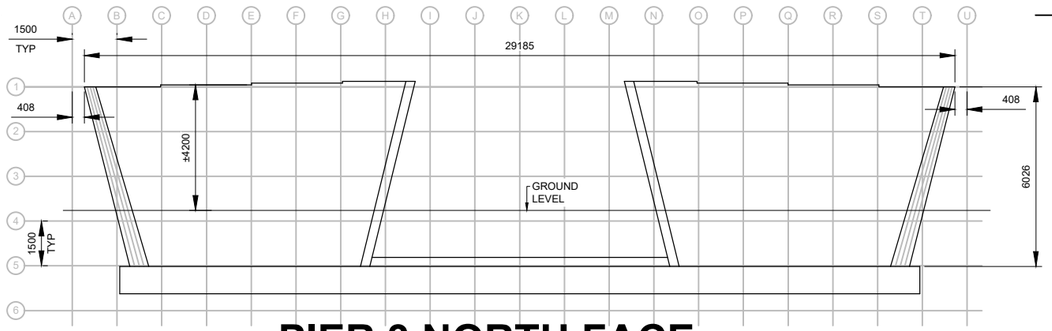


PIER 3 EAST END

SCALE: 1:200

EAST

WEST



PIER 3 NORTH FACE

SCALE: 1:200

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP	RCT-X
% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH	RCT-X
% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS	RCT-X

DEFECTS LEGEND:

NARROW CRACK	N
MEDIUM CRACK	M
WIDE CRACK	W
DELAMINATION	
SPALL	

NOTES:

1. INSPECTION COMPLETED IN JULY, 2022 FROM GROUND LEVEL NOTED.
2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.
3. NO SIGNIFICANT DEFECTS NOTED.

MORRISON HERSHFIELD

Winnipeg

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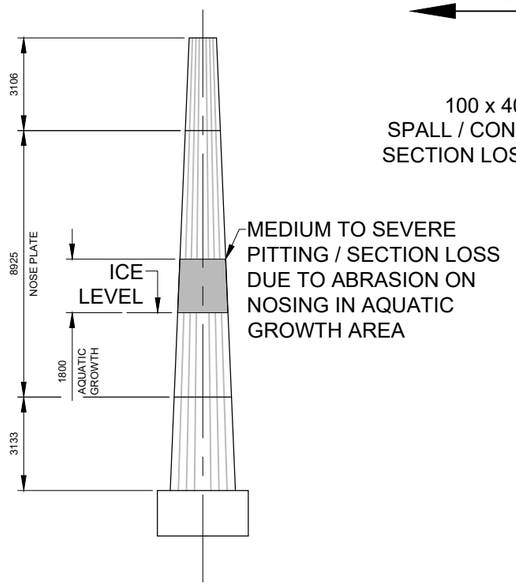
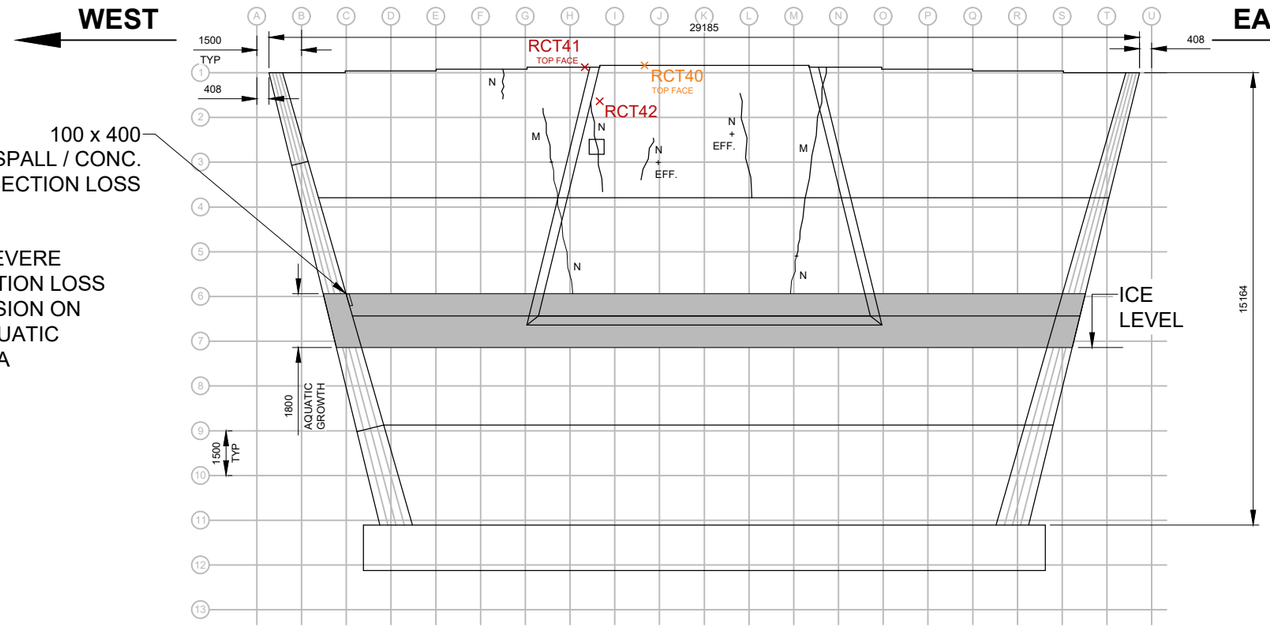
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 3
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: KMB



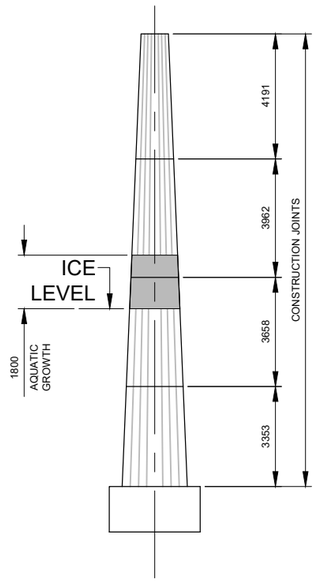
PIER 4 WEST END

SCALE: 1:200



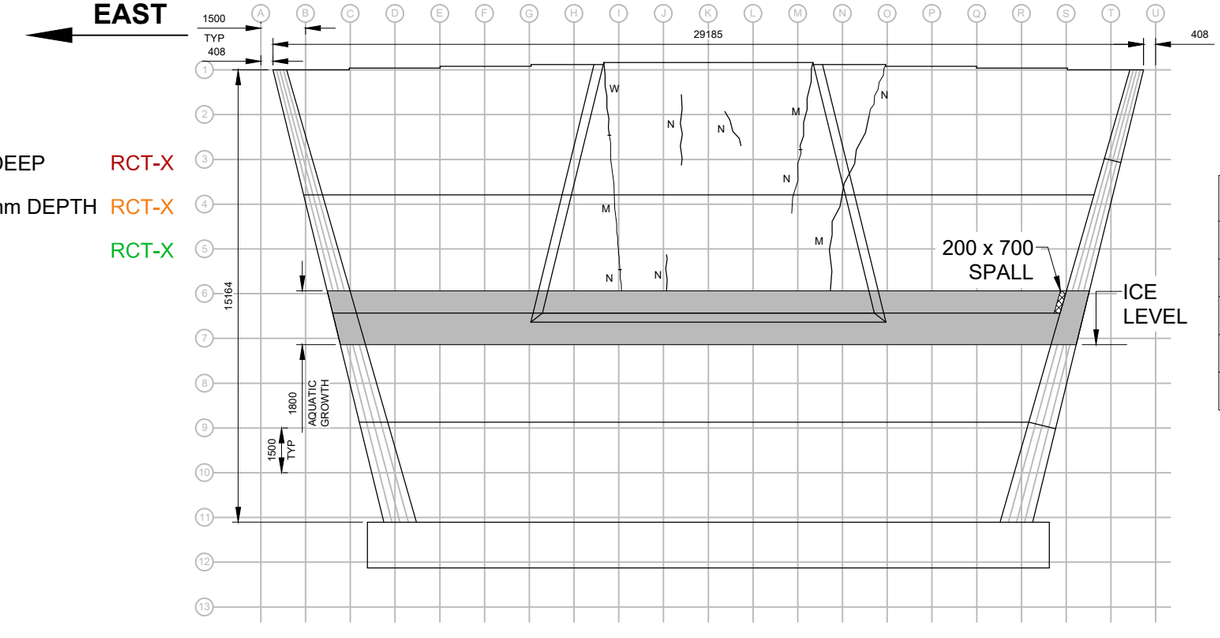
PIER 4 SOUTH FACE

SCALE: 1:200



PIER 4 EAST END

SCALE: 1:200



PIER 4 NORTH FACE

SCALE: 1:200

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP — RCT-X

% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH — RCT-X

% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS — RCT-X

DEFECTS LEGEND:

NARROW CRACK — N

MEDIUM CRACK — M

WIDE CRACK — W

DELAMINATION

SPALL

AQUATIC GROWTH

DARK STAINING

PIER 4 RAPID CHLORIDE TEST RESULTS

RCT SAMPLE LOC'N		DEPTH (NOTE 3)				
NO.	PIER	5 - 20	40 - 60	90 - 110	130 - 150	160 - 180
40	PIER 4	0.176	0.168	0.024	0.014	0.016
41	PIER 4	0.208	0.191	0.076	0.023	0.025
42	PIER 4	0.161	0.037	0.019	0.064	0.015

NOTES:

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2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.
3. TEST DEPTH IN MILLIMETERS AND MEASURED FROM SURFACE. RESULTS DISPLAYED IN RED ARE GREATER THAN 0.05% Cl^- BY CONCRETE MASS.
4. CHLORIDE CONTENT TEST RESULTS PRESENTED ARE TEST RESULTS INCLUDING BACKGROUND CHLORIDES (DETERMINED TO BE 0.008% BY MASS OF CONCRETE).

MORRISON HERSHFIELD

Winnipeg

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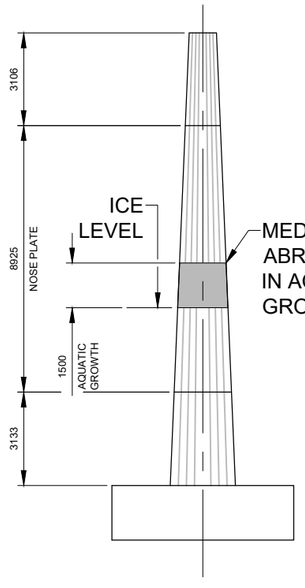
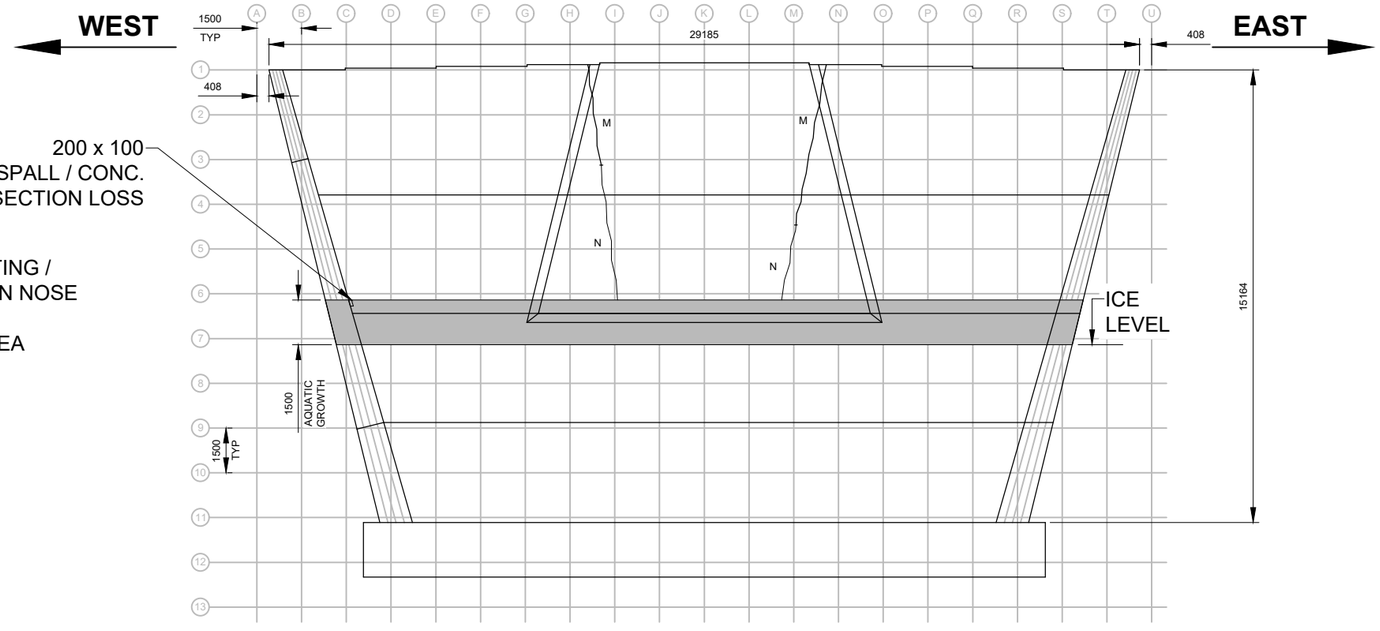
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 4
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: ALP



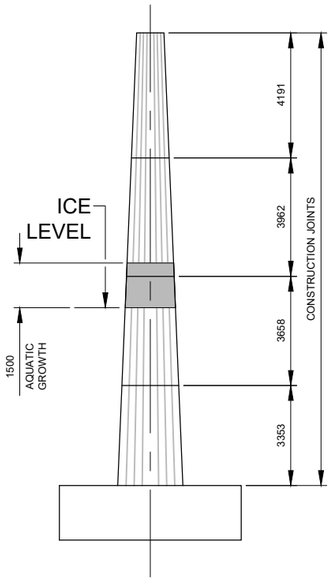
PIER 5 WEST END

SCALE: 1:200



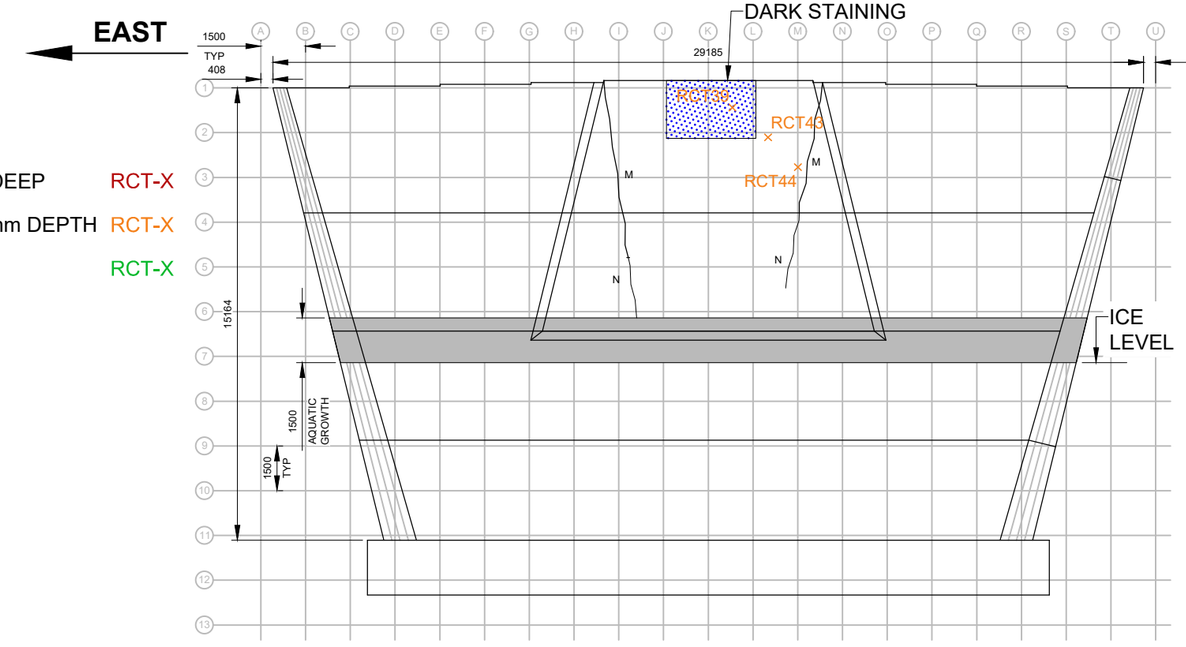
PIER 5 SOUTH FACE

SCALE: 1:200



PIER 5 EAST END

SCALE: 1:200



PIER 5 NORTH FACE

SCALE: 1:200

RCT LEGEND:

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% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH — RCT-X

% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS — RCT-X

DEFECTS LEGEND:

NARROW CRACK — N

MEDIUM CRACK — M

WIDE CRACK — W

DELAMINATION

SPALL

AQUATIC GROWTH

DARK STAINING

PIER 5 RAPID CHLORIDE TEST RESULTS

RCT SAMPLE LOC'N		DEPTH (NOTE 3)				
NO.	PIER	5 - 20	40 - 60	90 - 110	130 - 150	160 - 180
39	PIER 5	0.120	0.036	0.029	0.020	0.017
43	PIER 5	0.098	0.076	0.020	0.017	0.017
44	PIER 5	0.039	0.064	0.039	0.016	0.018

NOTES:

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3. TEST DEPTH IN MILLIMETERS AND MEASURED FROM SURFACE. RESULTS DISPLAYED IN RED ARE GREATER THAN 0.05% Cl^- BY CONCRETE MASS.
4. DARK STAINING ON PIER APPEARS TO BE ORGANIC / AQUATIC GROWTH. CONCRETE WAS SOUND UNDERNEATH STAINING.
5. CHLORIDE CONTENT TEST RESULTS PRESENTED ARE TEST RESULTS INCLUDING BACKGROUND CHLORIDES (DETERMINED TO BE 0.008% BY MASS OF CONCRETE).

MORRISON HERSHFIELD

Winnipeg

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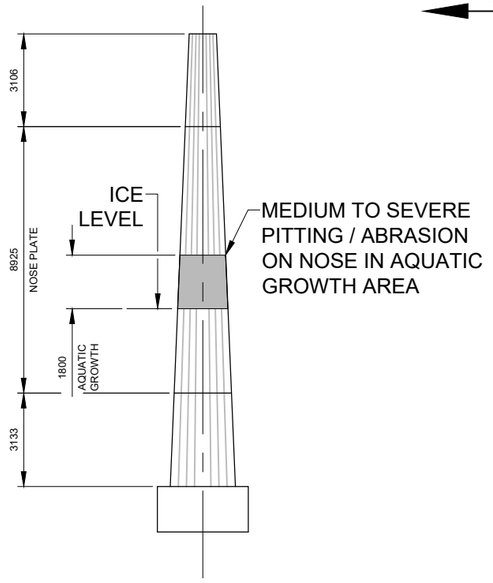
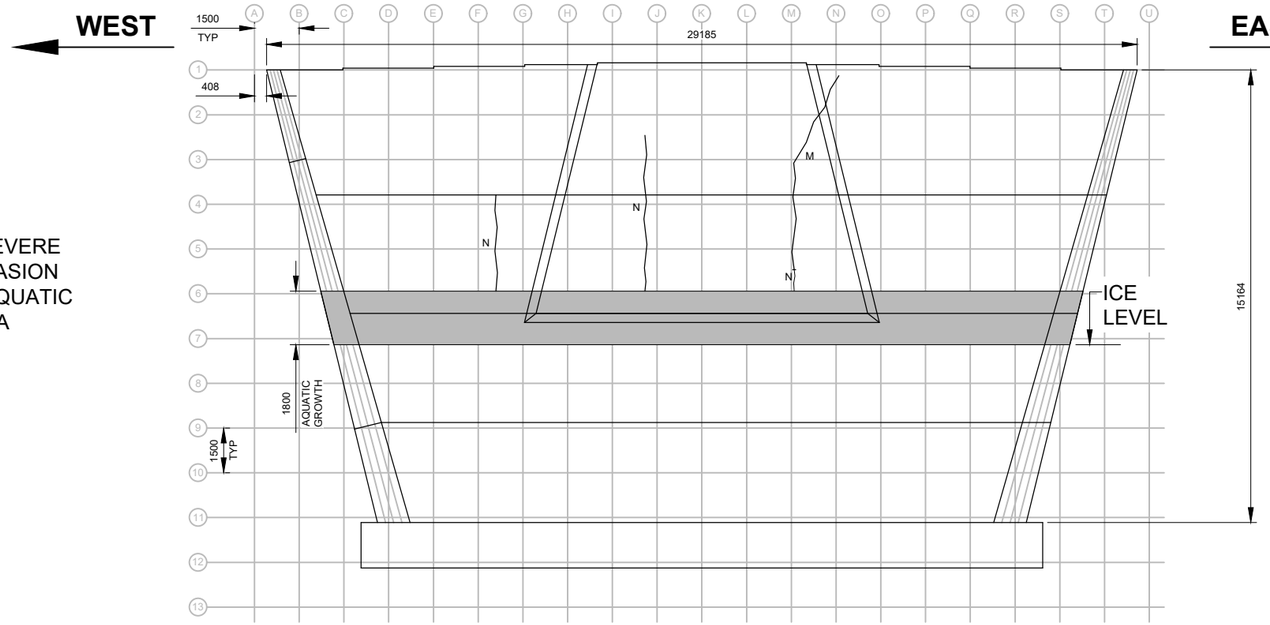
MHL JOB NO. 210351000

PIER 5
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: ALP



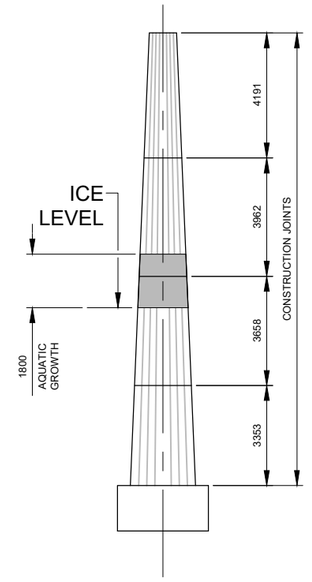
PIER 6 WEST END

SCALE: 1:200



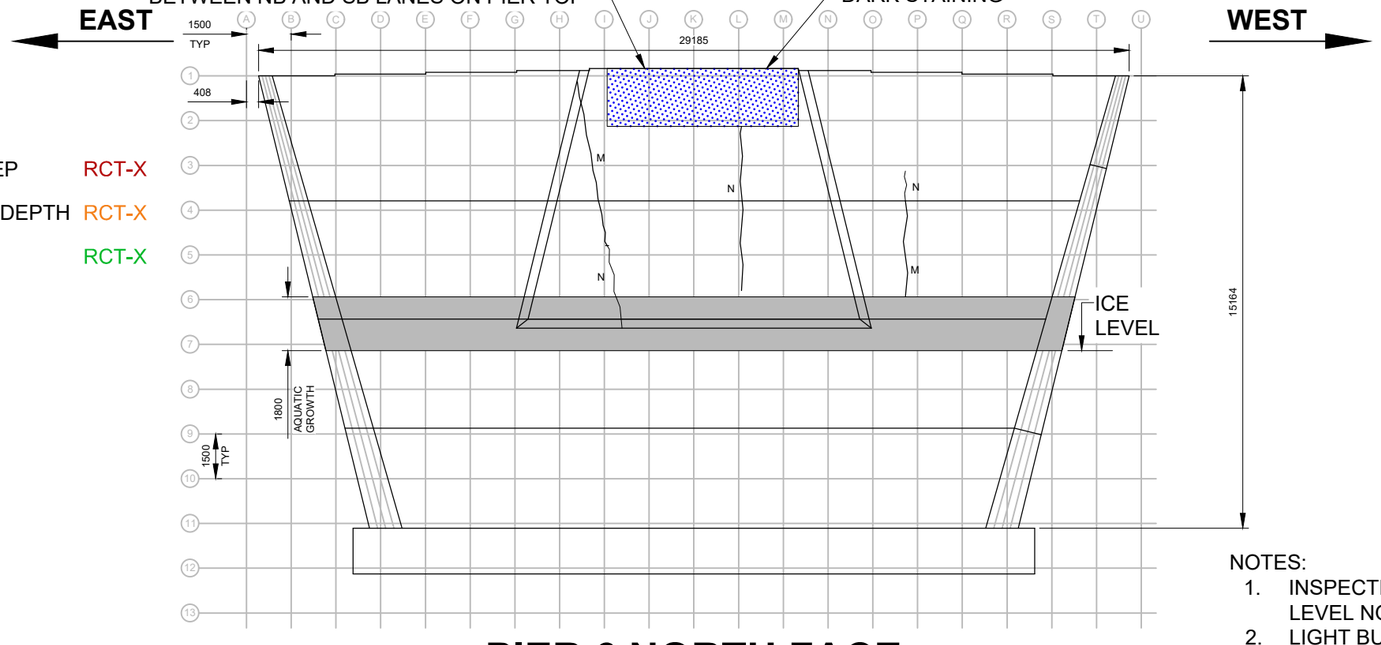
PIER 6 SOUTH FACE

SCALE: 1:200



PIER 6 EAST END

SCALE: 1:200



PIER 6 NORTH FACE

SCALE: 1:200

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP	RCT-X
% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH	RCT-X
% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS	RCT-X

DEFECTS LEGEND:

NARROW CRACK	N
MEDIUM CRACK	M
WIDE CRACK	W
DELAMINATION	
SPALL	
AQUATIC GROWTH	
DARK STAINING	

NOTES:

1. INSPECTION COMPLETED MARCH 8, 2022 FROM ICE / GROUND LEVEL NOTED.
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MORRISON HERSHFIELD

Winnipeg

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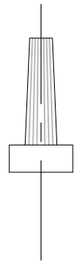
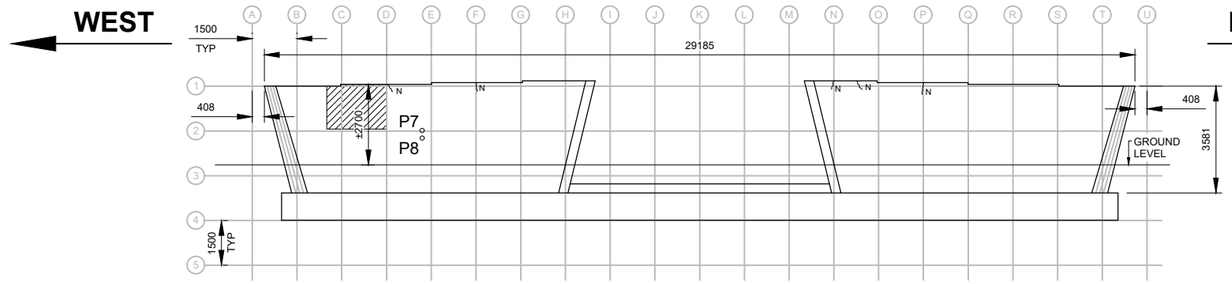
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 6
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: ALP



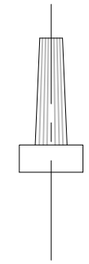
PIER 7 WEST END

SCALE: 1:200



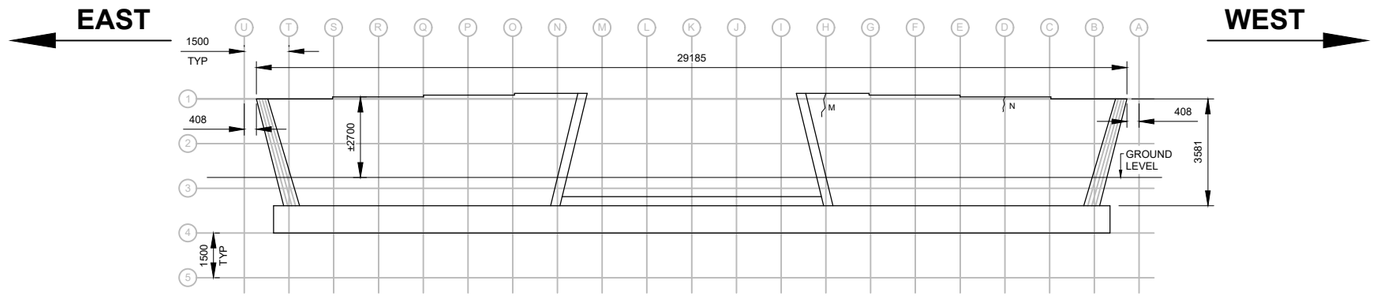
PIER 7 SOUTH FACE

SCALE: 1:200



PIER 7 EAST END

SCALE: 1:200



PIER 7 NORTH FACE

SCALE: 1:200

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP	RCT-X
% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH	RCT-X
% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS	RCT-X

DEFECTS LEGEND:

NARROW CRACK	N
MEDIUM CRACK	M
WIDE CRACK	W
DELAMINATION	
SPALL	

PIER 7		
CORE	**TEST METHOD**	**RESULTS**
P7	COMPRESSIVE STRENGTH	40.4 MPa
P8	pH LEVEL	12.54

NOTES:
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2. LIGHT BUG HOLES AND POP OUTS NOTED THROUGHOUT.
3. NO SIGNIFICANT DEFECTS NOTED.

MORRISON HERSHFIELD

Winnipeg

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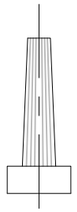
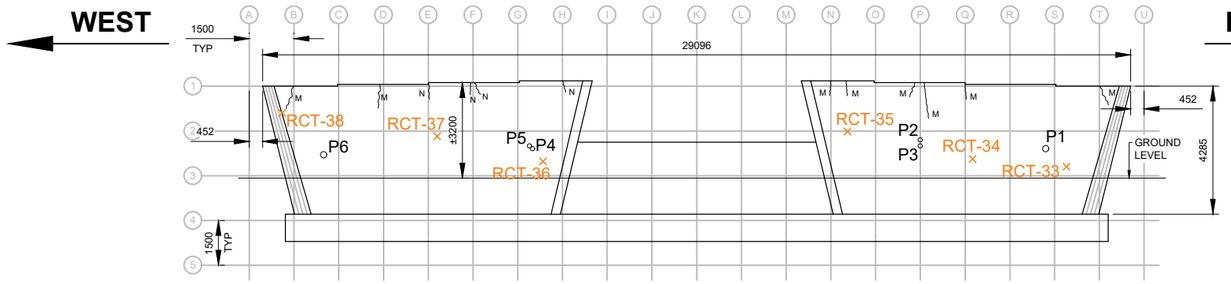
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 7
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
DRAWN BY: KMB



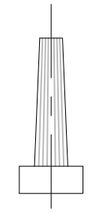
PIER 8 WEST END

SCALE: 1:200



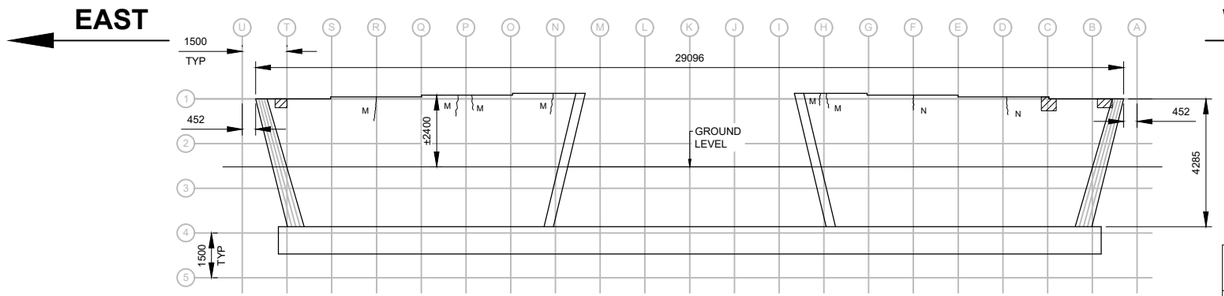
PIER 8 SOUTH FACE

SCALE: 1:200



PIER 8 EAST END

SCALE: 1:200



PIER 8 NORTH FACE

SCALE: 1:200

RCT LEGEND:

% Cl^- BY WEIGHT > 0.05% AT GREATER THAN 60mm DEEP — RCT-X

% Cl^- BY WEIGHT > 0.05% UP TO AND INCLUDING 60mm DEPTH — RCT-X

% Cl^- BY WEIGHT LESS THAN 0.05% AT ALL DEPTHS — RCT-X

DEFECTS LEGEND:

NARROW CRACK — N

MEDIUM CRACK — M

WIDE CRACK — W

DELAMINATION

SPALL

PIER 8 RAPID CHLORIDE TEST RESULTS

RCT SAMPLE LOC'N		DEPTH (NOTE 3)				
NO.	PIER	5 - 20	40 - 60	90 - 110	130 - 150	160 - 180
33	PIER 8 NBL	0.208	0.120	0.046	0.023	0.013
34	PIER 8 NBL	0.142	0.137	0.037	0.018	0.012
35	PIER 8 NBL	0.148	0.083	0.010	0.014	0.014
36	PIER 8 SBL	0.064	0.026	0.020	0.017	0.006
37	PIER 8 SBL	0.073	0.020	0.011	0.014	0.018
38	PIER 8 SBL	0.191	0.044	0.018	0.018	0.014

PIER 8

CORE	TEST METHOD	RESULTS
P1	AIR VOID PARAMETERS	AIR CONTENT = 4.3%
P2	COMPRESSIVE STRENGTH	42.0 MPa
P3	pH LEVEL	12.54
P4	NOT TESTED	-
P5	COMPRESSIVE STRENGTH	57.7 MPa
P6	AIR VOID PARAMETERS	AIR CONTENT = 3.9%

NOTES:

1. INSPECTION COMPLETED IN JULY, 2022 FROM GROUND LEVEL NOTED.
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3. TEST DEPTH IN MILLIMETERS AND MEASURED FROM SURFACE. RESULTS DISPLAYED IN RED ARE GREATER THAN 0.05% Cl^- BY CONCRETE MASS.
4. CHLORIDE CONTENT TEST RESULTS PRESENTED ARE TEST RESULTS INCLUDING BACKGROUND CHLORIDES (DETERMINED TO BE 0.008% BY MASS OF CONCRETE).

MORRISON HERSHFIELD

Winnipeg

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SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 8
DEFECTS AND TESTING LOCATIONS
SCALE = AS SHOWN
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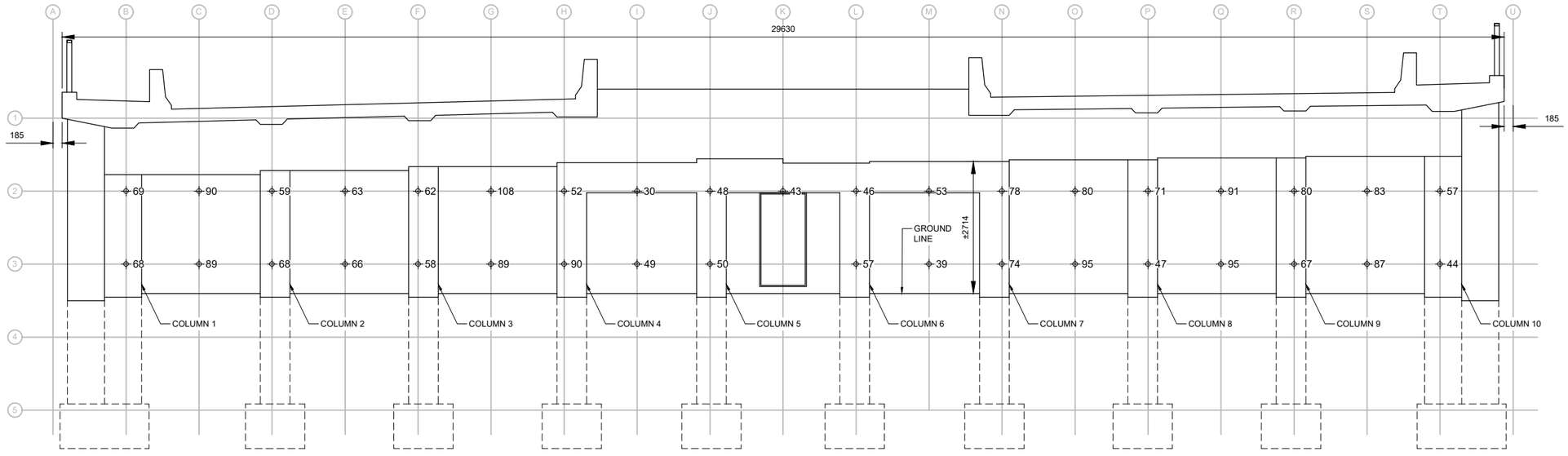

WEST **EAST**

NORTH ABUTMENT

SCALE: 1:100

NOTES:
1. COVER SURVEY COMPLETED IN JUNE 2022.

DEFECTS LEGEND:

NARROW CRACK N

MEDIUM CRACK M

WIDE CRACK W

DELAMINATION

SPALL

MORRISON HERSHFIELD | Winnipeg

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SUBSTRUCTURE CONDITION SURVEY
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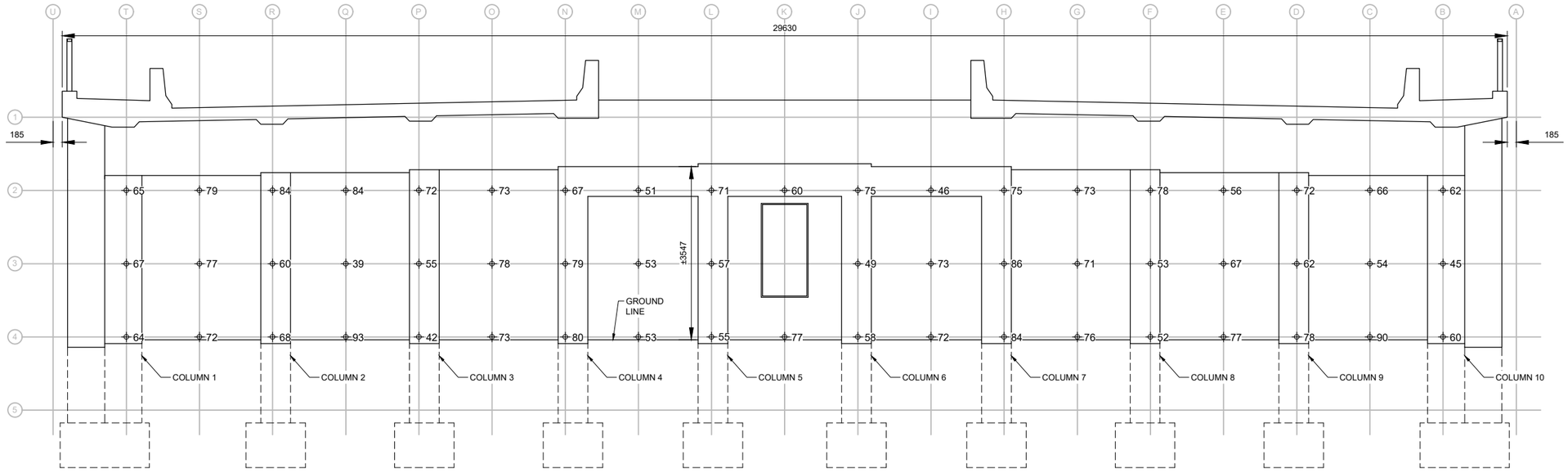
NORTH ABUTMENT
COVER SURVEY
SCALE = AS SHOWN
DRAWN BY: KMB



EAST **WEST**

SOUTH ABUTMENT

SCALE: 1:100

NOTES:
1. COVER SURVEY COMPLETED IN JUNE 2022.

DEFECTS LEGEND:

NARROW CRACK N

MEDIUM CRACK M

WIDE CRACK W

DELAMINATION

SPALL

MAP CRACKING

MORRISON HERSHFIELD | Winnipeg

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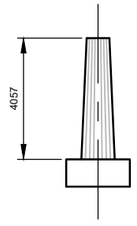
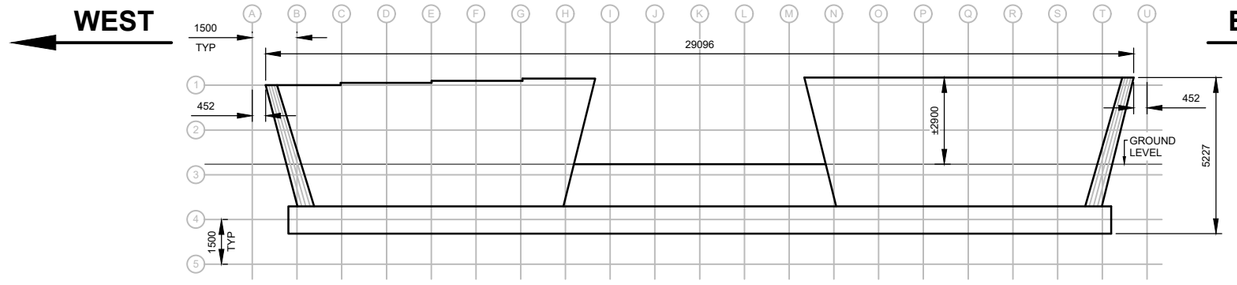
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

SOUTH ABUTMENT
COVER SURVEY
SCALE = AS SHOWN
DRAWN BY: KMB



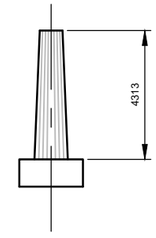
PIER 1 WEST END

SCALE: 1:200



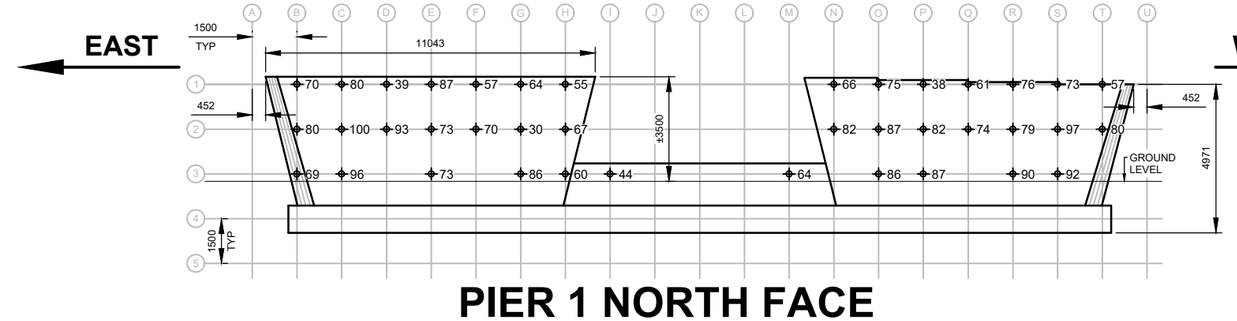
PIER 1 SOUTH FACE

SCALE: 1:200



PIER 1 EAST END

SCALE: 1:200



PIER 1 NORTH FACE

SCALE: 1:200

NOTES:
1. COVER SURVEY COMPLETED IN JUNE 2022.

DEFECTS LEGEND:

NARROW CRACK — N

MEDIUM CRACK — M

WIDE CRACK — W

DELAMINATION

SPALL

MORRISON HERSHFIELD

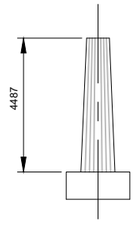
Winnipeg

Last Saved: December 13, 2022, by alazcanoperez Plotted: December 13, 2022, by Andrei Lazcano Perez

NOTES
- THIS SKETCH IS PRELIMINARY AND IS NOT FOR CONSTRUCTION.
- DIMENSIONS ARE IN MILLIMETERS (mm)

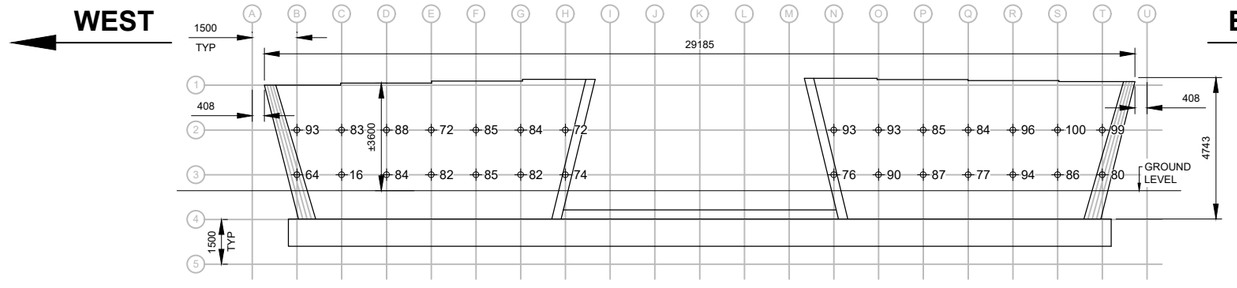
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 1
COVER SURVEY
SCALE = AS SHOWN
DRAWN BY: KMB



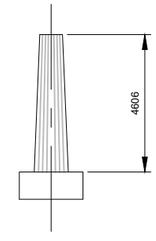
PIER 2 WEST END

SCALE: 1:200



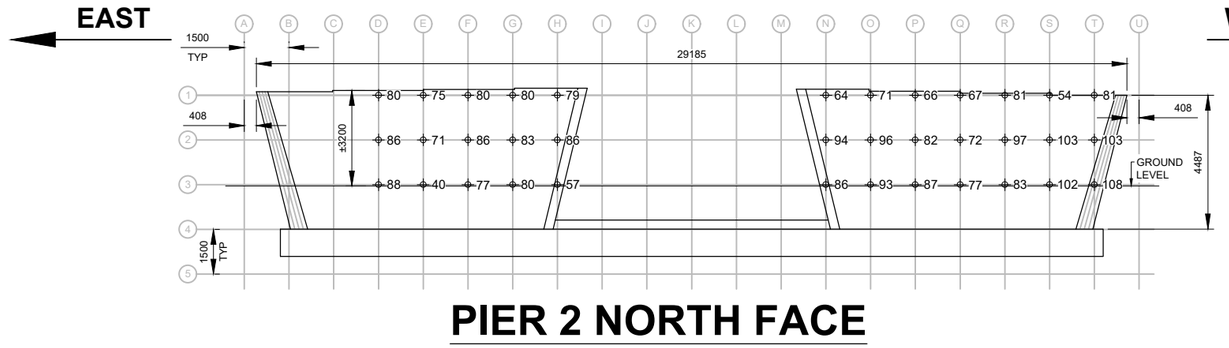
PIER 2 SOUTH FACE

SCALE: 1:200



PIER 2 EAST END

SCALE: 1:200



PIER 2 NORTH FACE

SCALE: 1:200

NOTES:
1. COVER SURVEY COMPLETED IN JUNE 2022.

DEFECTS LEGEND:

NARROW CRACK N

MEDIUM CRACK M

WIDE CRACK W

DELAMINATION

SPALL

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Winnipeg

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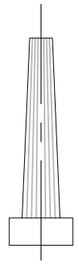
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 2
COVER SURVEY
SCALE = AS SHOWN
DRAWN BY: KMB



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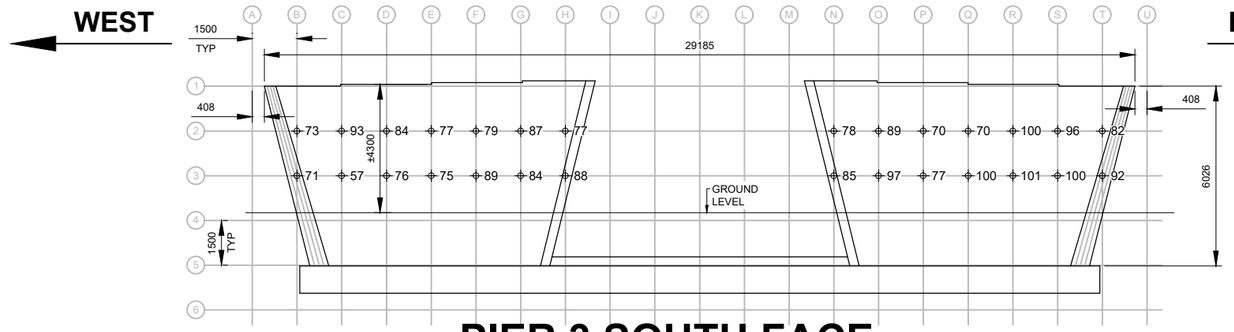
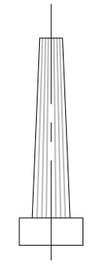
SCALE: 1:200



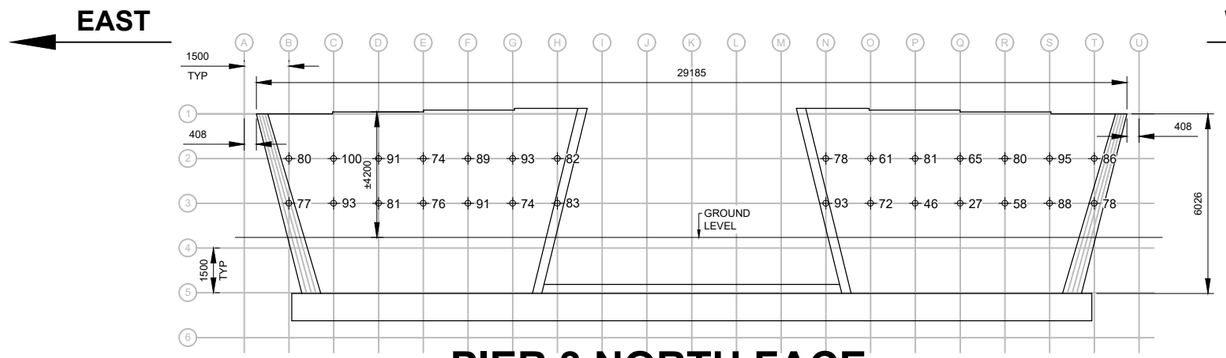
PIER 3 SOUTH FACE

SCALE: 1:200



PIER 3 EAST END

SCALE: 1:200



PIER 3 NORTH FACE

SCALE: 1:200

NOTES:
1. COVER SURVEY COMPLETED IN JUNE 2022.

DEFECTS LEGEND:

NARROW CRACK	N
MEDIUM CRACK	M
WIDE CRACK	W
DELAMINATION	
SPALL	

NOTES
- THIS SKETCH IS PRELIMINARY AND IS NOT FOR CONSTRUCTION.
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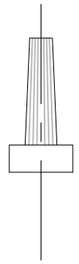
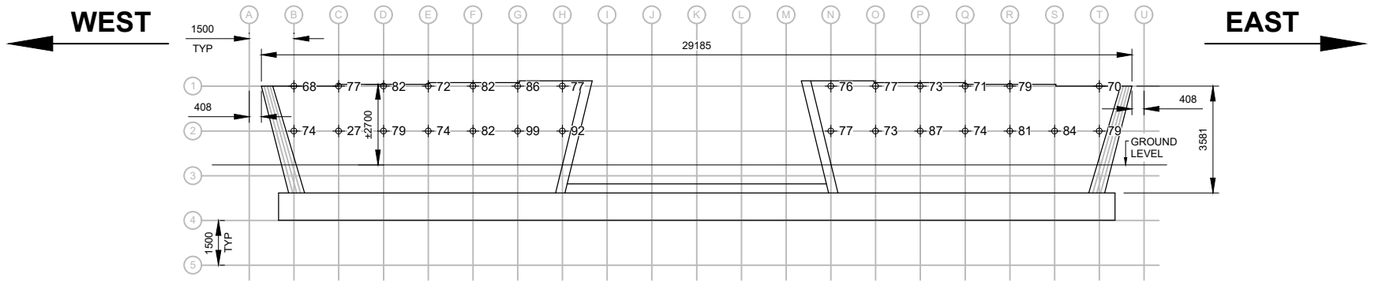
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 3
COVER SURVEY
SCALE = AS SHOWN
DRAWN BY: KMB



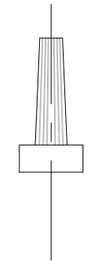
PIER 7 WEST END

SCALE: 1:200



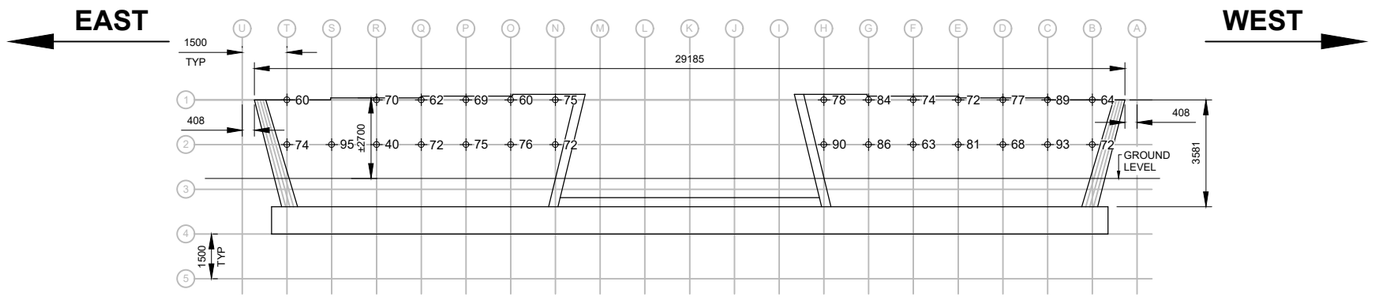
PIER 7 SOUTH FACE

SCALE: 1:200



PIER 7 EAST END

SCALE: 1:200



PIER 7 NORTH FACE

SCALE: 1:200

NOTES:
1. COVER SURVEY COMPLETED IN JUNE 2022.

DEFECTS LEGEND:

NARROW CRACK N

MEDIUM CRACK M

WIDE CRACK W

DELAMINATION

SPALL

MORRISON HERSHFIELD

Winnipeg

Last Saved: December 13, 2022, by alazcanoperez Plotted: December 13, 2022, by Andrei Lazcano Perez

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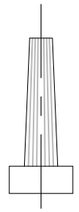
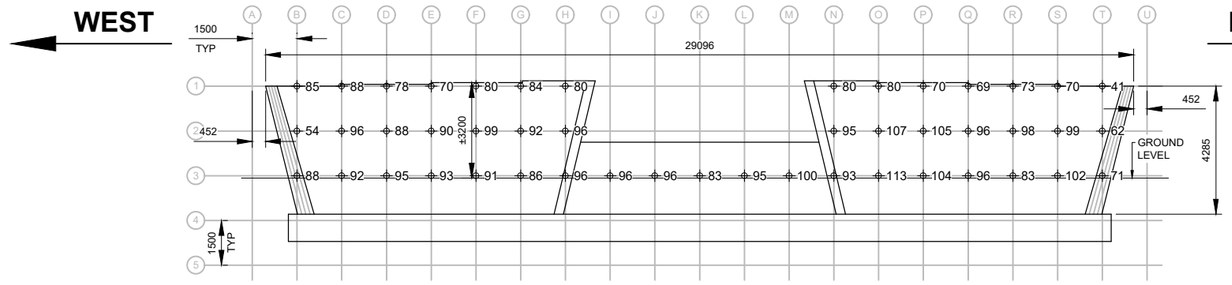
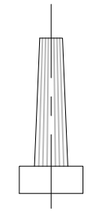
ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 7
COVER SURVEY
SCALE = AS SHOWN
DRAWN BY: KMB







PIER 8 WEST END

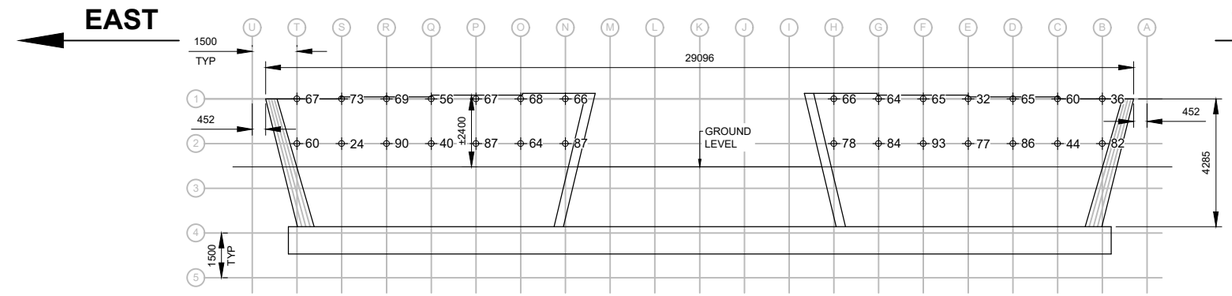
SCALE: 1:200

PIER 8 SOUTH FACE

SCALE: 1:200

PIER 8 EAST END

SCALE: 1:200



PIER 8 NORTH FACE

SCALE: 1:200

NOTES:
1. COVER SURVEY COMPLETED IN JUNE 2022.

DEFECTS LEGEND:

NARROW CRACK N

MEDIUM CRACK M

WIDE CRACK W

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SPALL

MORRISON HERSHFIELD

Winnipeg

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ST. VITAL BRIDGE
SUBSTRUCTURE CONDITION SURVEY
CLIENT: COW
MHL JOB NO. 210351000

PIER 8
COVER SURVEY
SCALE = AS SHOWN
DRAWN BY: KMB

APPENDIX O.2: SUBSTRUCTURE CONDITION ASSESSMENT

PHOTOS

Photo 01 - North abutment wall, between NB and SB lanes

Photo 02 - North abutment NB Lanes

Photo 03 - North abutment SB Lanes

Photo 04 - North abutment NB, Column 1 cap, narrow to wide cracking

Photo 05 - North abutment wall, between Column 1-2, medium horizontal crack and localized delamination

Photo 06 - North abutment NB, Column 2 cap west face, medium to wide cracking

Photo 07 - North abutment NB, Column 2 cap east face, medium to wide cracking

Photo 08 - North abutment wall, between Column 2-3, large delaminations and spalling

Photo 09 - North abutment wall, Column 3 cap south face, narrow to wide cracking

Photo 10 - North abutment wall between NB and SB – localized spalls, light scaling, and medium honeycomb on cap beam between Column 4 – 6

Photo 11 - North abutment, Column 7-8 (under NB lanes), narrow vertical cracking on abutment wall refacing and small localized spall near top of Column 7

Photo 12 - North abutment Columns 8-9 (under NB lanes), joint leakage staining and narrow cracking in concrete refacing

Photo 13 - North abutment, Column 8-10, narrow vertical and horizontal cracking on abutment wall refacing

Photo 14 - North ballast wall – localized delamination at east end of SB lanes

Photo 15 - North abutment wall refacing locations, narrow cracking is partially obscured by anti-graffiti coating

Photo 16 - South abutment wall, between NB and SB lanes

Photo 17 - South abutment wall, NB

Photo 18 - South abutment wall, SB

Photo 19 - South abutment wall, NB, at Column 2, localized delamination

Photo 20 - South abutment wall, NB, between Columns 2 and 3, joint leakage / staining, and large areas of delamination on ballast wall

Photo 21 - South abutment wall, NB, at Column 4, localized small delaminations

Photo 22 - South abutment wall, SB, near Column 7, medium cracking between column

Photo 23 - South abutment wall, between NB and SB lanes, Column 6 – 7, localized spall on the underside of cap beam

Photo 24 - South abutment wall, SB, between Column 8 and 9, localized delaminations on column bottoms

Photo 25 - South abutment wall, SB, between Column 8 and 9, large delamination and spalling near Column 8

Photo 26 - South abutment wall, SB, between Column 9-10, large delamination and spalling

Photo 27 - Pier 1 NB, north face

Photo 28 - Pier 1 SB, north face

Photo 29 - Pier 1 NB South Face

Photo 30 - Pier 1 SB South Face

Photo 31 - Pier 1 NB, north face, localized spall at top of pier near west end

Photo 32 - Pier 2 NB, north face

Photo 33 - Pier 2 SB, north face

Photo 34 - Pier 2 SB South face

Photo 35 - Pier 3 NB South Face

Photo 36 - Pier 3 SB North Face

Photo 37 - Pier 3 SB South Face

Photo 38 - Pier 7 NB, north face, note recent modification from forced main sewer

Photo 39 - Pier 7 SB, north face

Photo 40 - Pier 7 NB, south face, note recent modification from forced main sewer

Photo 41 - Pier 7 SB, south face

Photo 42 - Pier 7 SB, south face, localized delamination near west end at top of pier

Photo 43 - Pier 8 NB, north face

Photo 44 - Pier 8 SB, north face

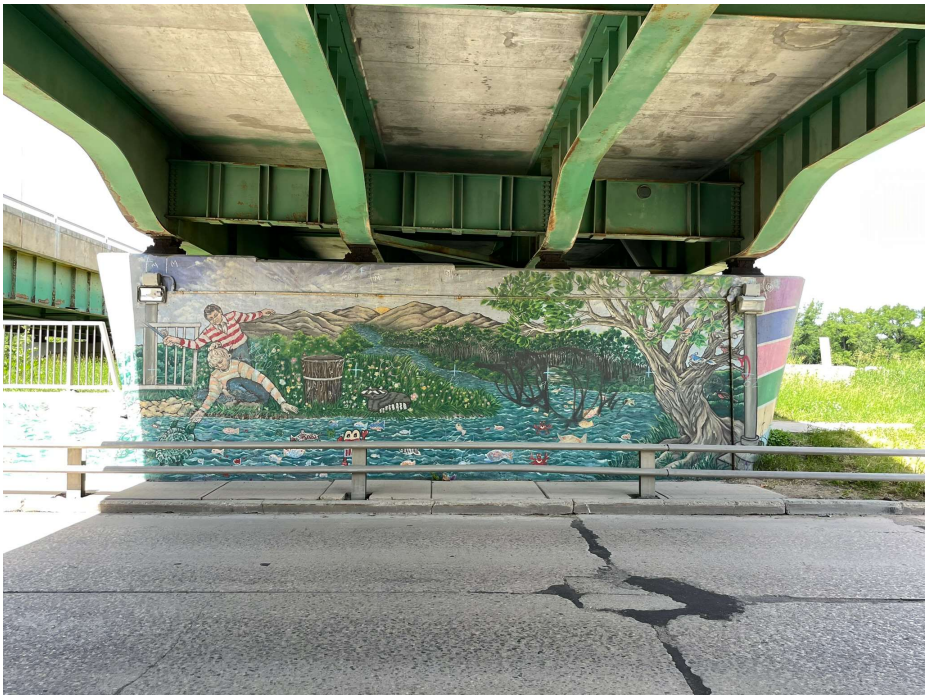


Photo 45 - Pier 8 NB, south face

Photo 46 - Pier 8 SB, south face

Photo 47 - Pier 8 NB, north face, localized delamination under eastmost bearing

Photo 48 - Pier 8 SB, north face, localized small delaminations near top of pier at west end and at 1st bearing seat step from West end

Photo 49 - Typical medium vertical cracks under bearing locations

Photo 50 - Typical medium vertical cracks under bearing locations, additional view

ST. VITAL BRIDGE PIER INSPECTION
APPENDIX A - INSPECTION PHOTOS
2022-03-08

Photo 01 - Pier 4 North Face

Photo 02 - Pier 4 North Face East Section
1 of 22

ST. VITAL BRIDGE PIER INSPECTION
APPENDIX A - INSPECTION PHOTOS
2022-03-08

Photo 03 - Pier 4 North Face Middle Section

Photo 04 - Pier 4 North Face West Section

Photo 05 - Pier 4 South Face

Photo 06 - Pier 4 South Face East Section
3 of 22

Photo 07 - Pier 4 South Face Middle Section

Photo 08 - Pier 4 South Face West Section

Photo 09 - Pier 4 East End

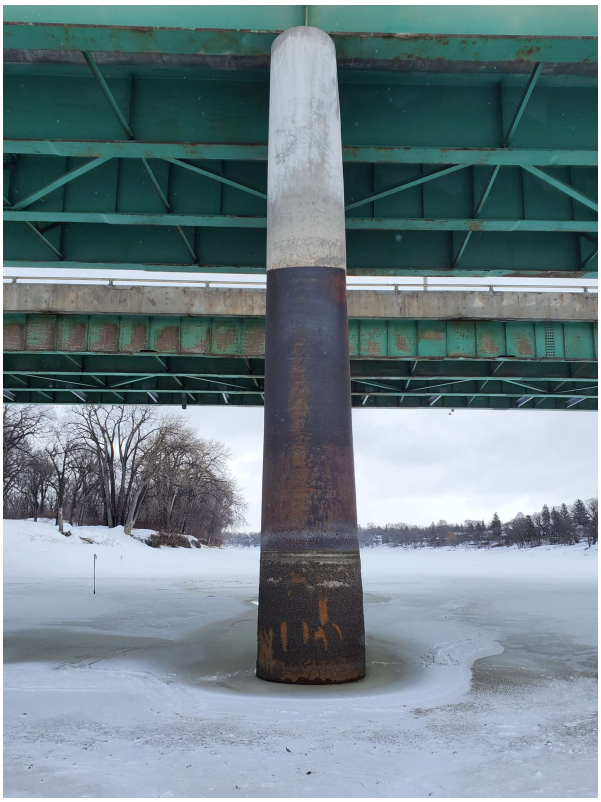


Photo 10 - Pier 4 West End

Photo 11 - Pier 5 North Face

Photo 12 - Pier 5 North Face East Section
6 of 22

Photo 13 - Pier 5 North Face Middle Section

Photo 14 - Pier 5 North Face West Section

Photo 15 - Pier 5 South Face

Photo 16 - Pier 5 South Face East Section
8 of 22

Photo 17 - Pier 5 South Face Middle Section

Photo 18 - Pier 5 South Face West Section

Photo 19 - Pier 5 East End

Photo 20 - Pier 5 West End

Photo 21 - Pier 6 North Face

Photo 22 - Pier 6 North Face East Section

Photo 23 - Pier 6 North Face Middle Section

Photo 24 - Pier 6 North Face West Section

Photo 25 - Pier 6 South Face

Photo 26 - Pier 6 South Face East Section

Photo 27 - Pier 6 South Face Middle Section

Photo 28 - Pier 6 South Face West Section

Photo 29 - Pier 6 East End

Photo 30 - Pier 6 West End

Photo 31 - Pier 4 North Face Wide Crack

Photo 32 - Pier 4 South Face Medium Crack

NOTE: Red lines added to photos showing cracks to illustrate location, typical.

Photo 33 - Pier 4 North Face Spall

Photo 34 - Medium to Severe Pitting on Pier 4 Nosing

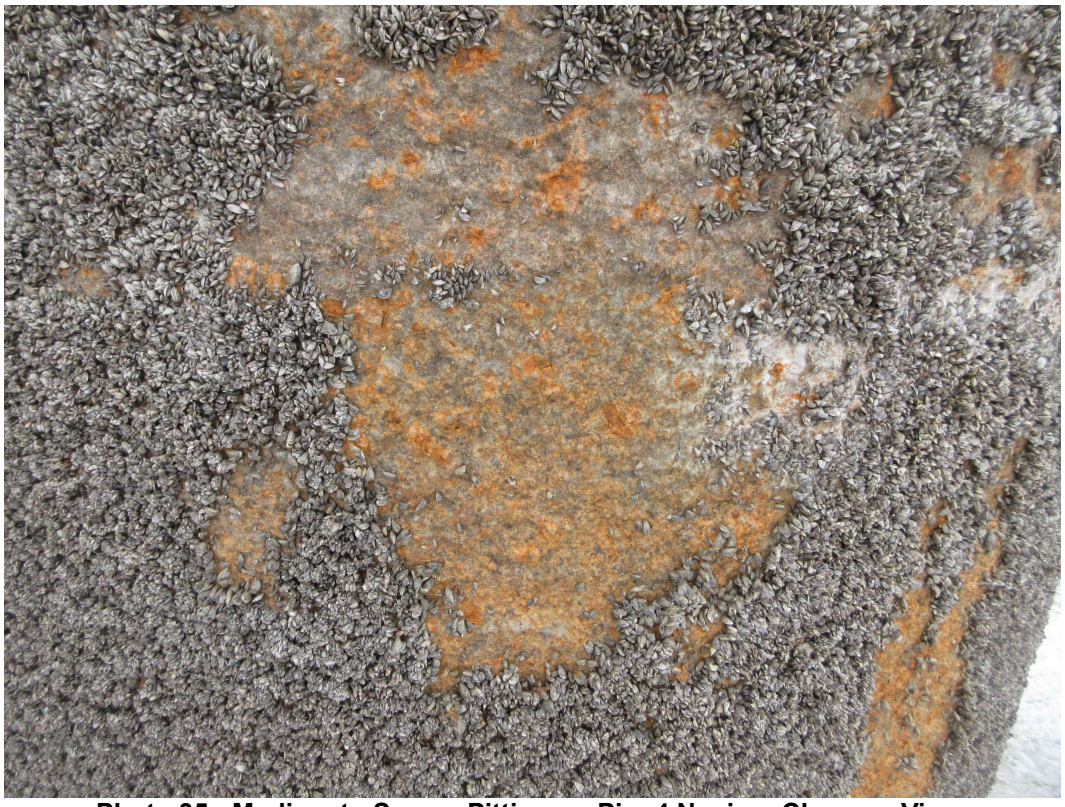


Photo 35 - Medium to Severe Pitting on Pier 4 Nosing, Close up View

Photo 36 - Pier 5 North Face Medium Crack

NOTE: Red lines added to photos showing cracks to illustrate location, typical.

ST. VITAL BRIDGE PIER INSPECTION
APPENDIX A - INSPECTION PHOTOS
2022-03-08

Photo 37 - Pier 5 North Face Medium Crack

Photo 38 - Medium Pitting on Pier 5 Nosing
19 of 22

NOTE: Red lines added to photos showing cracks to illustrate location, typical.

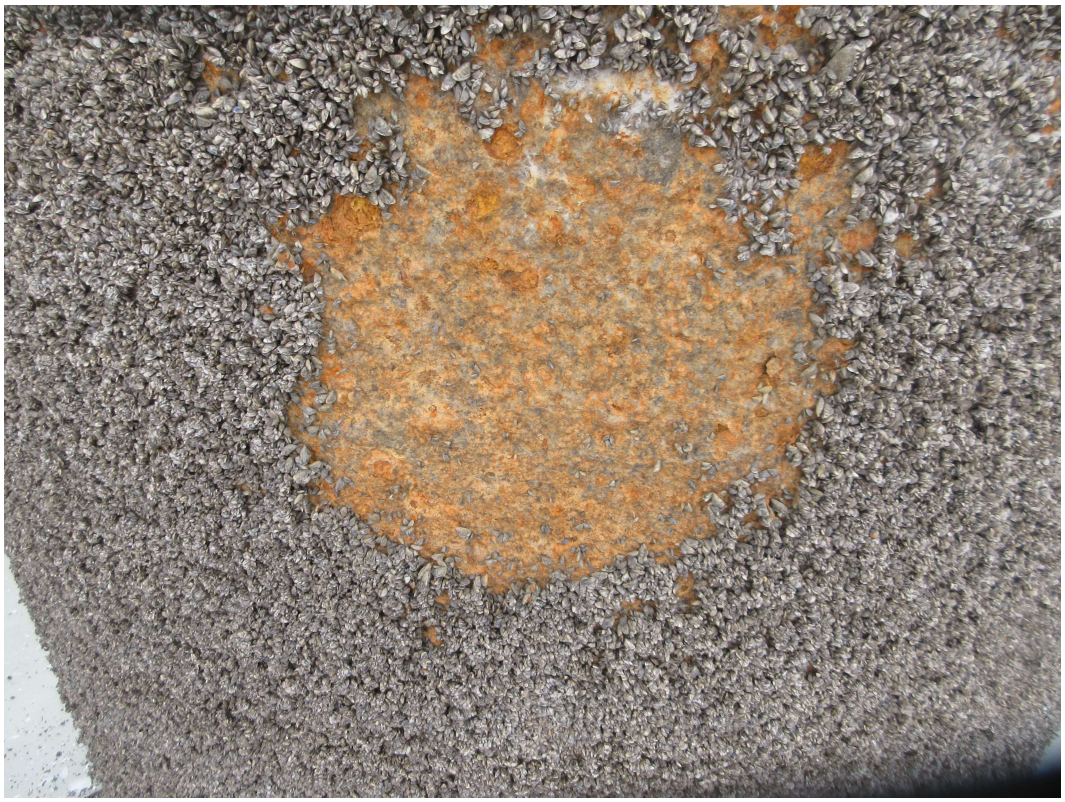


Photo 39 - Medium Pitting on Pier 5 Nosing, Close up View

Photo 40 - Pier 5 South Face Spall

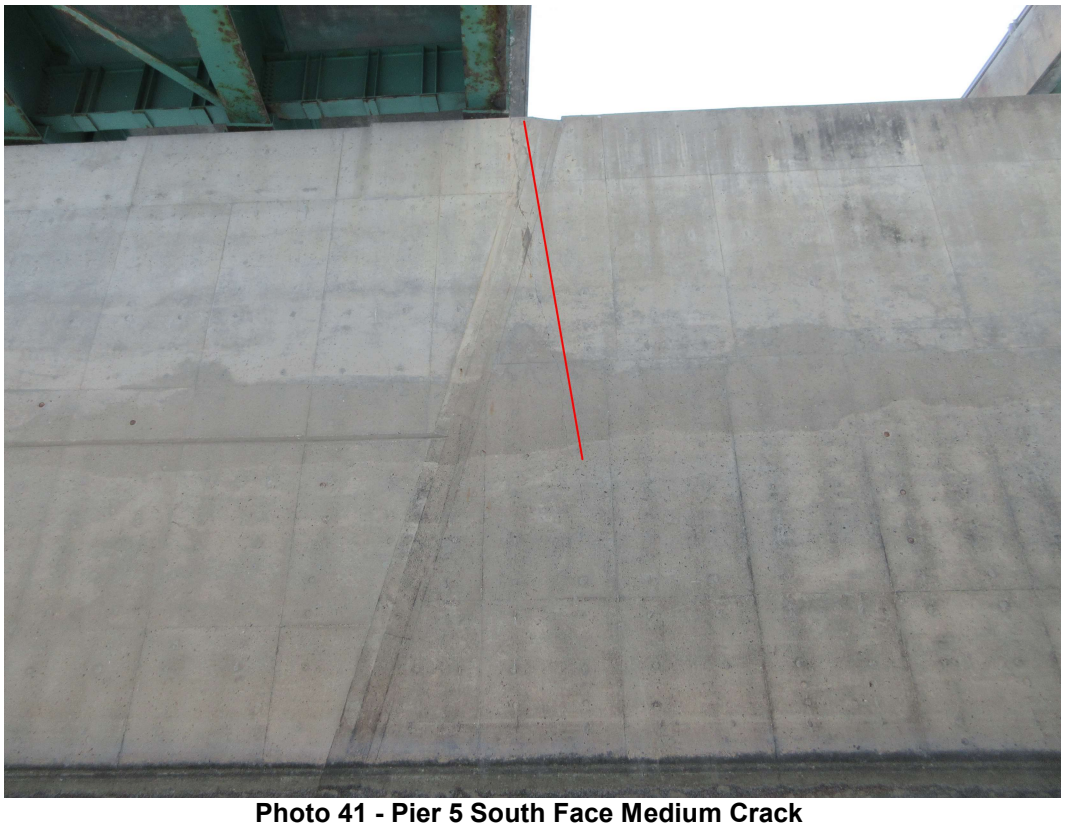


Photo 41 - Pier 5 South Face Medium Crack

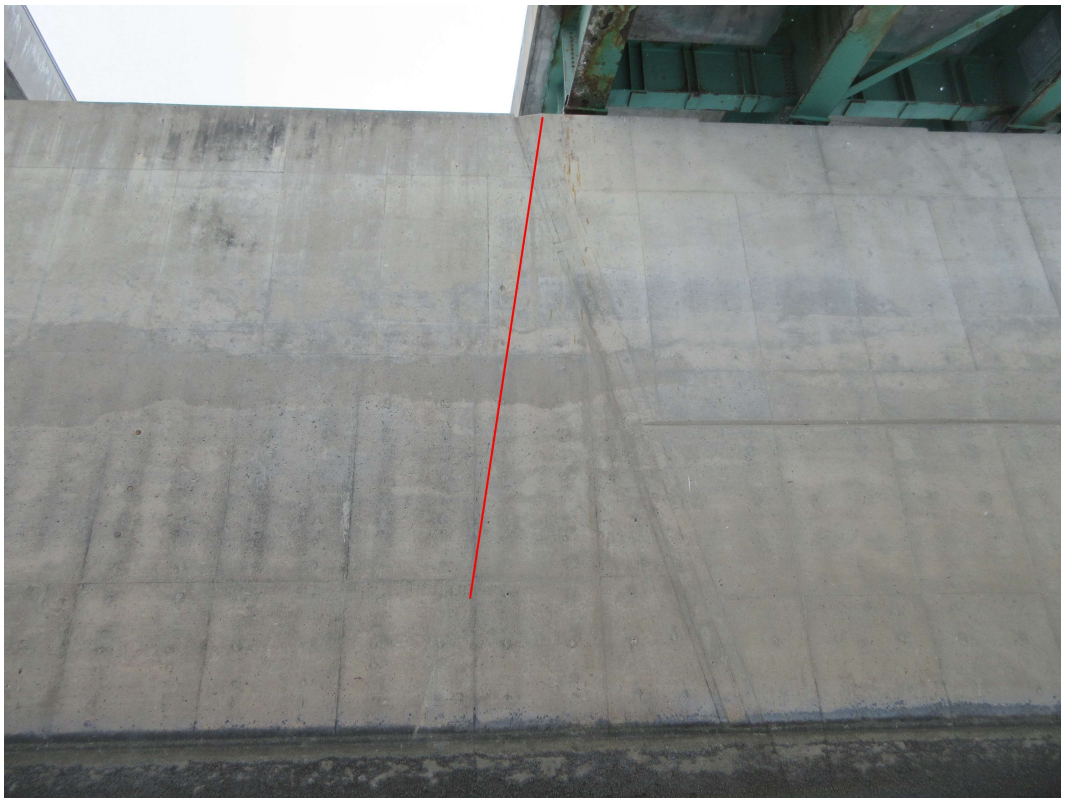


Photo 42 - Pier 5 South Face Medium Crack

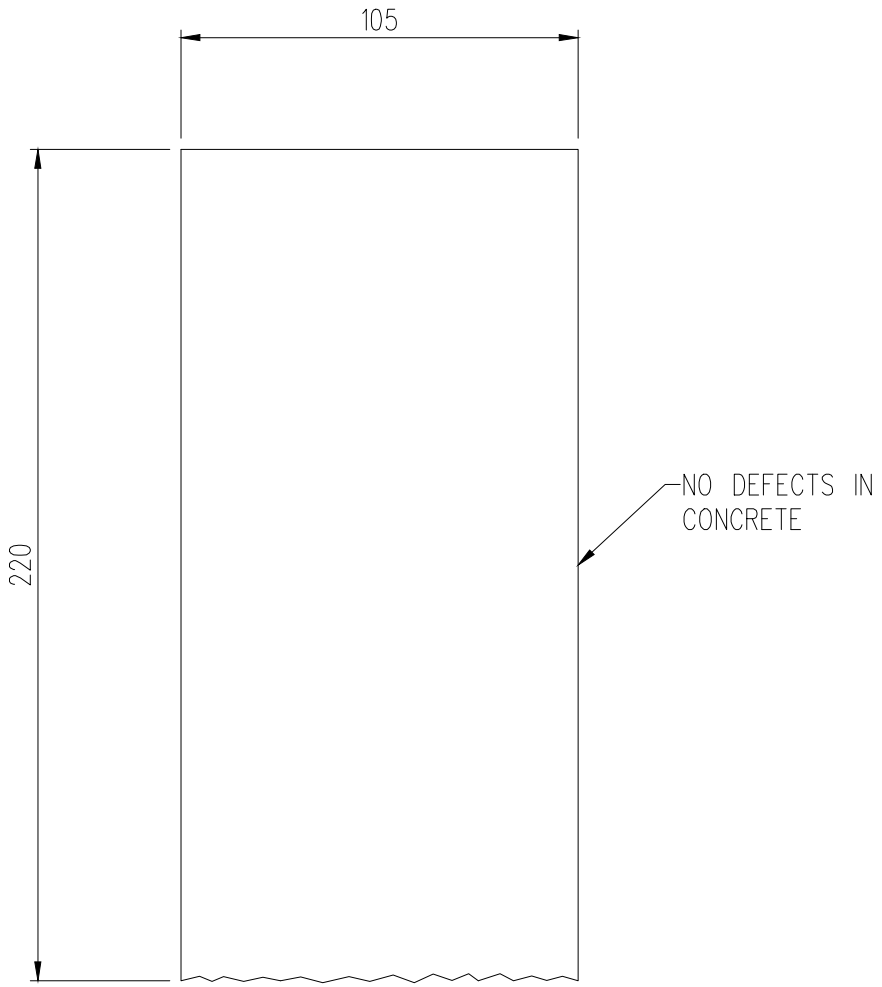
NOTE: Red lines added to photos showing cracks to illustrate location, typical.

Photo 43 - Medium to Severe Pitting on Pier 6 Nosing

Photo 44 - Medium to Severe Pitting on Pier 6 Nosing, Close up View

APPENDIX O.3: SUBSTRUCTURE CONDITION ASSESSMENT

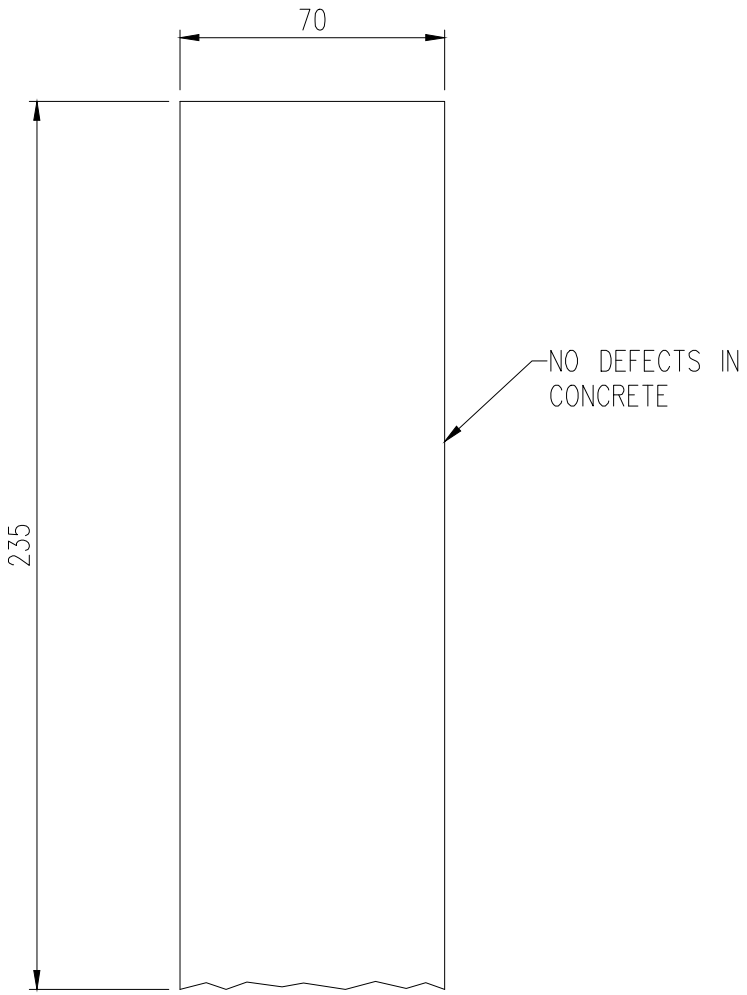
CORE SKETCHES



LEGEND

ORIGINAL CONCRETE

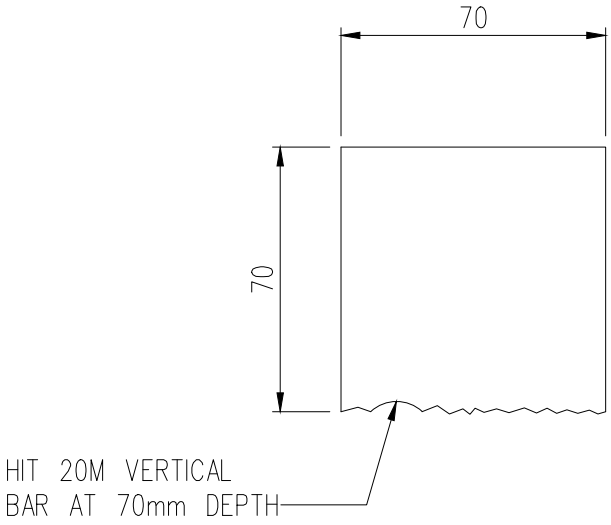
ABUTMENT WALL REFACING

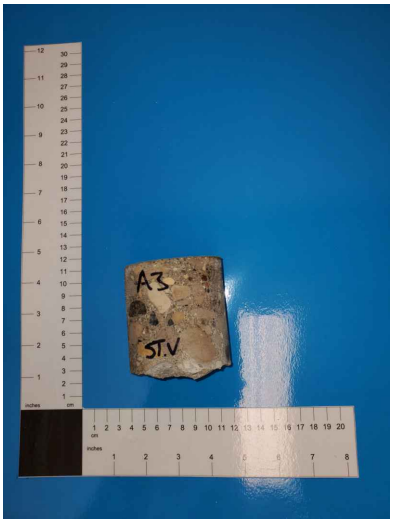


LEGEND

ORIGINAL CONCRETE

ABUTMENT WALL REFACING

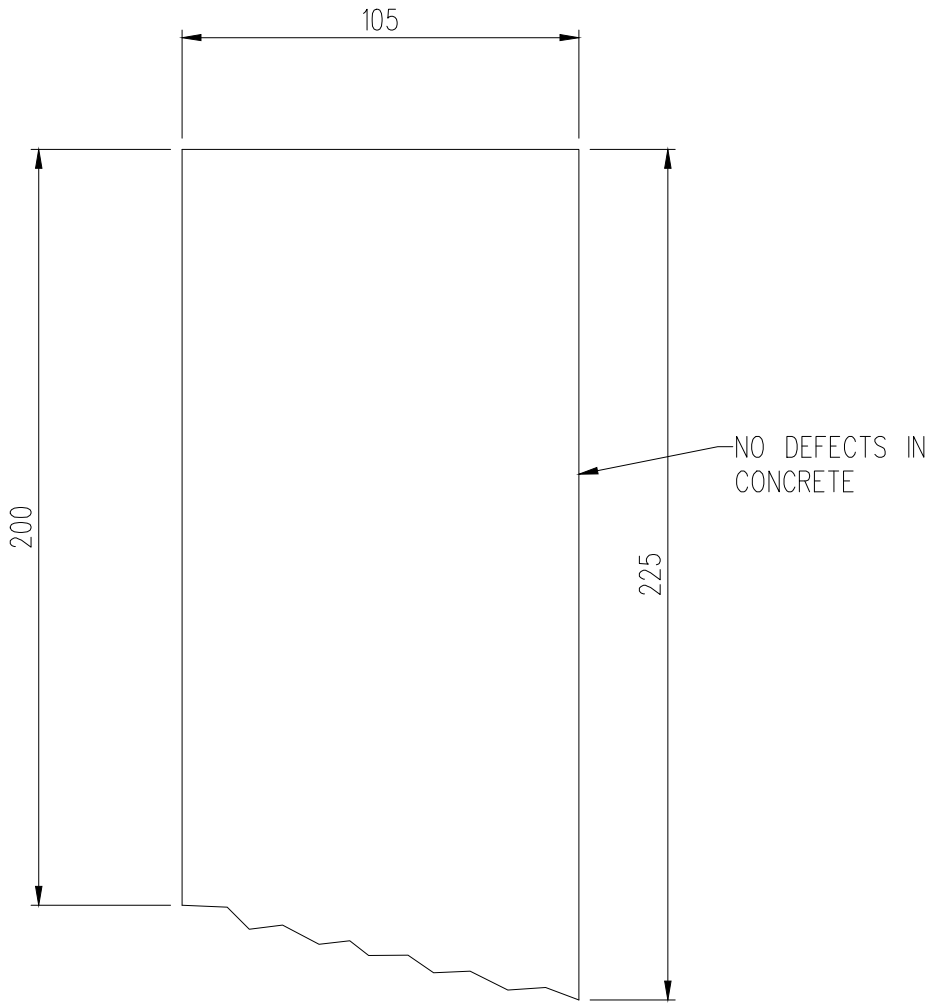


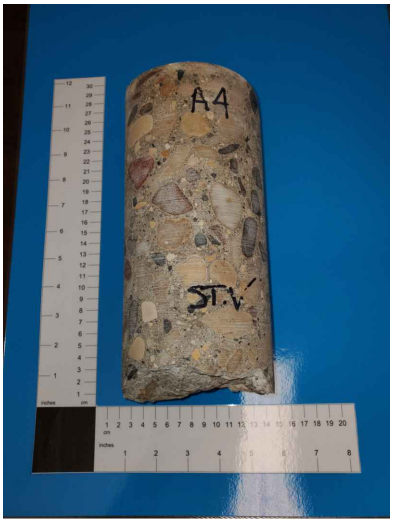


LEGEND

ORIGINAL CONCRETE

ABUTMENT WALL REFACING

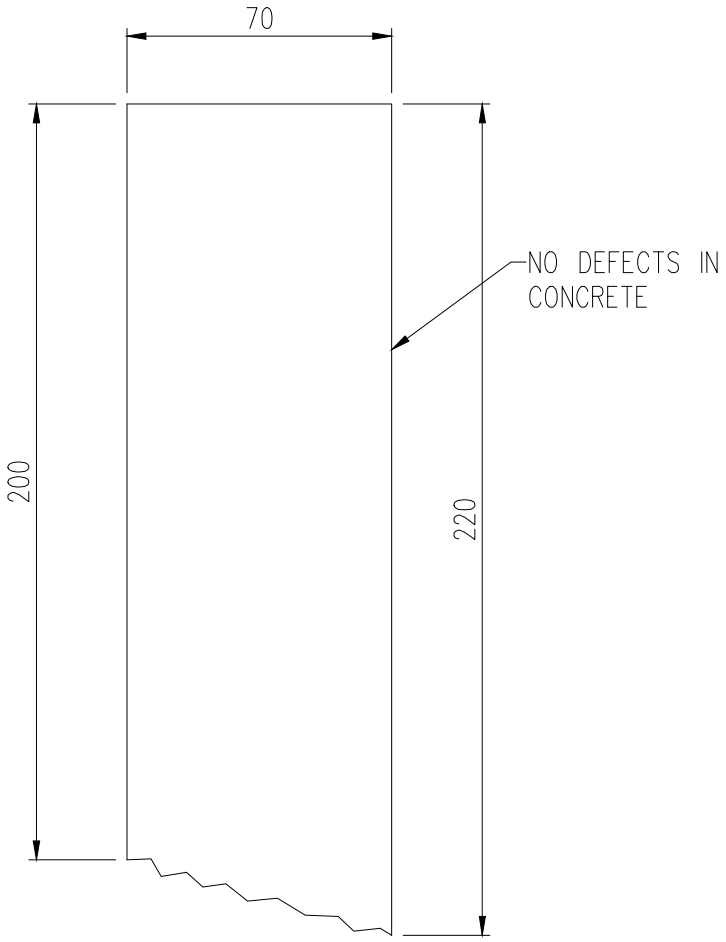




LEGEND

ORIGINAL CONCRETE

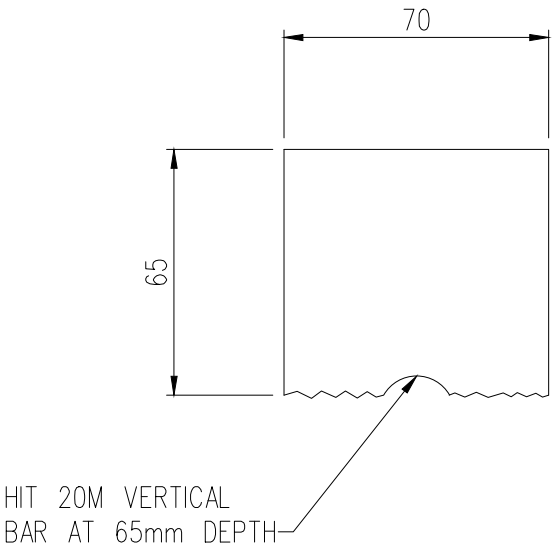
ABUTMENT WALL REFACING

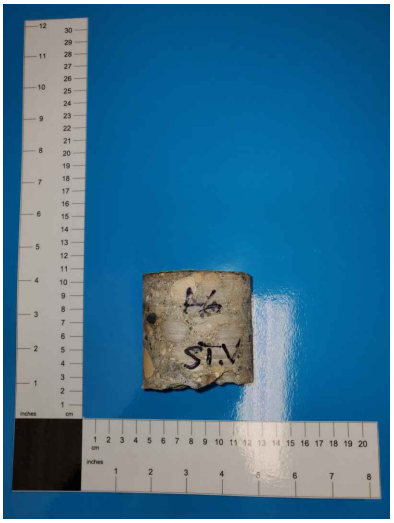


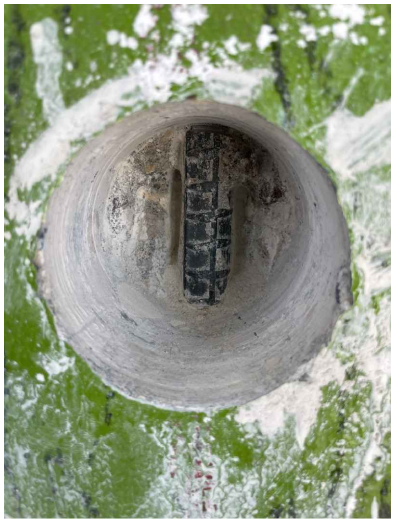
LEGEND

ORIGINAL CONCRETE

ABUTMENT WALL REFACING



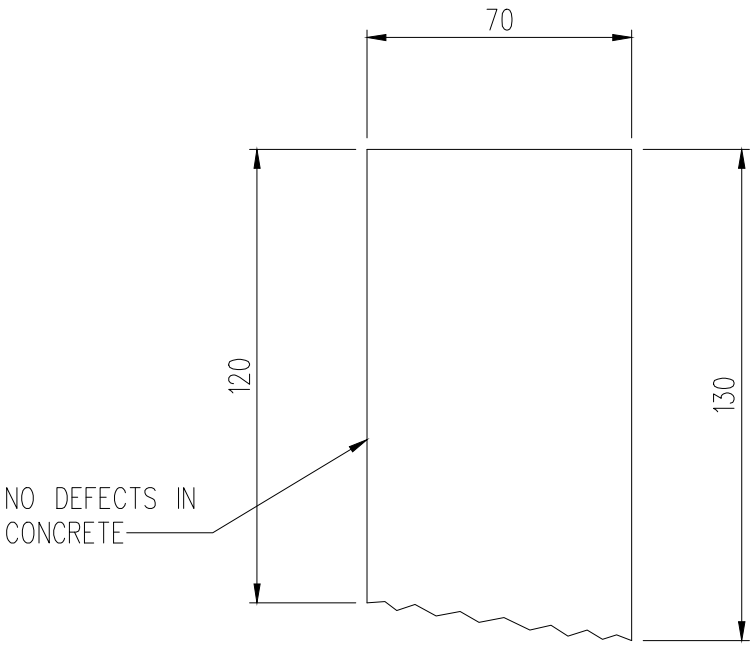




LEGEND

ORIGINAL CONCRETE

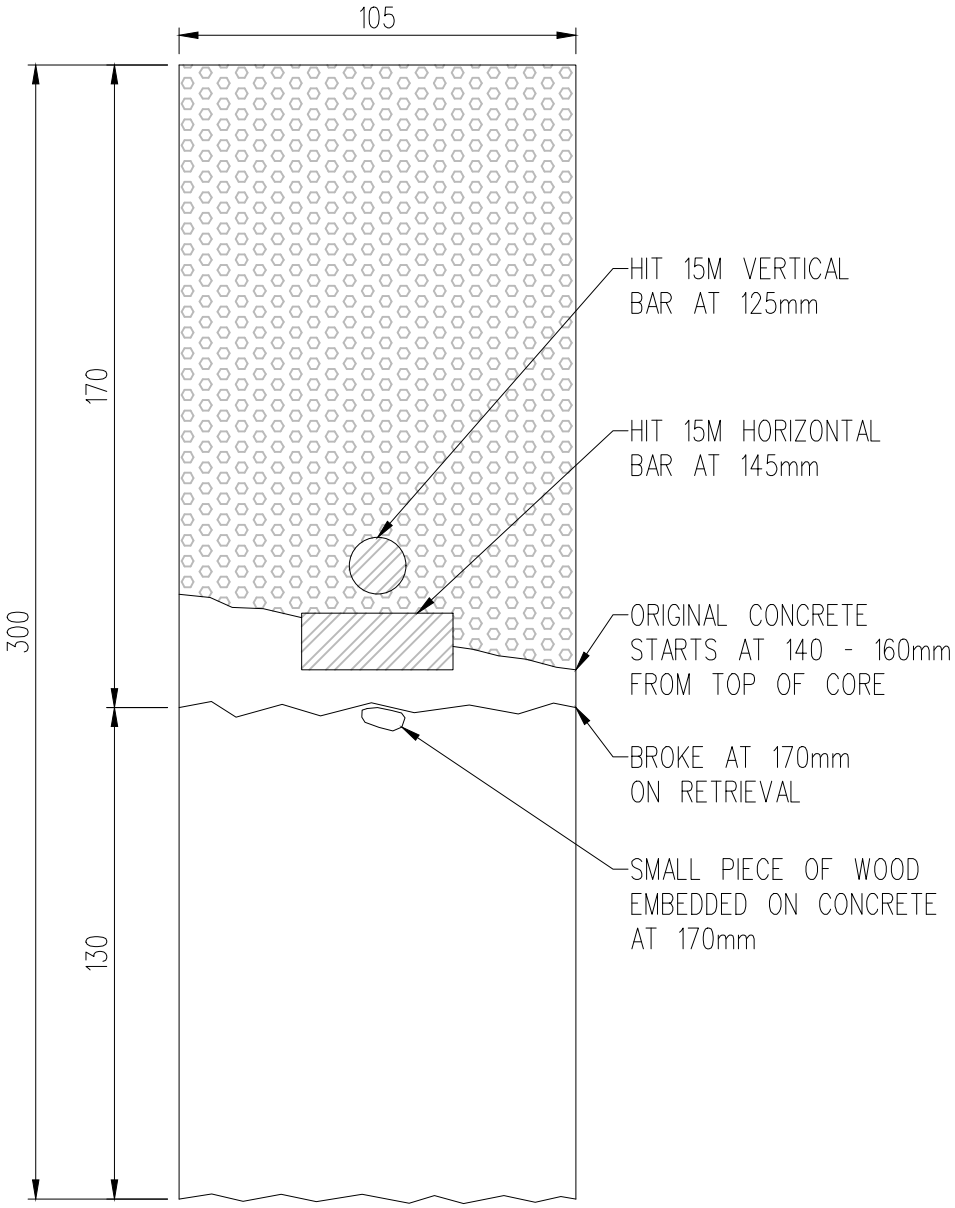
ABUTMENT WALL REFACING



LEGEND

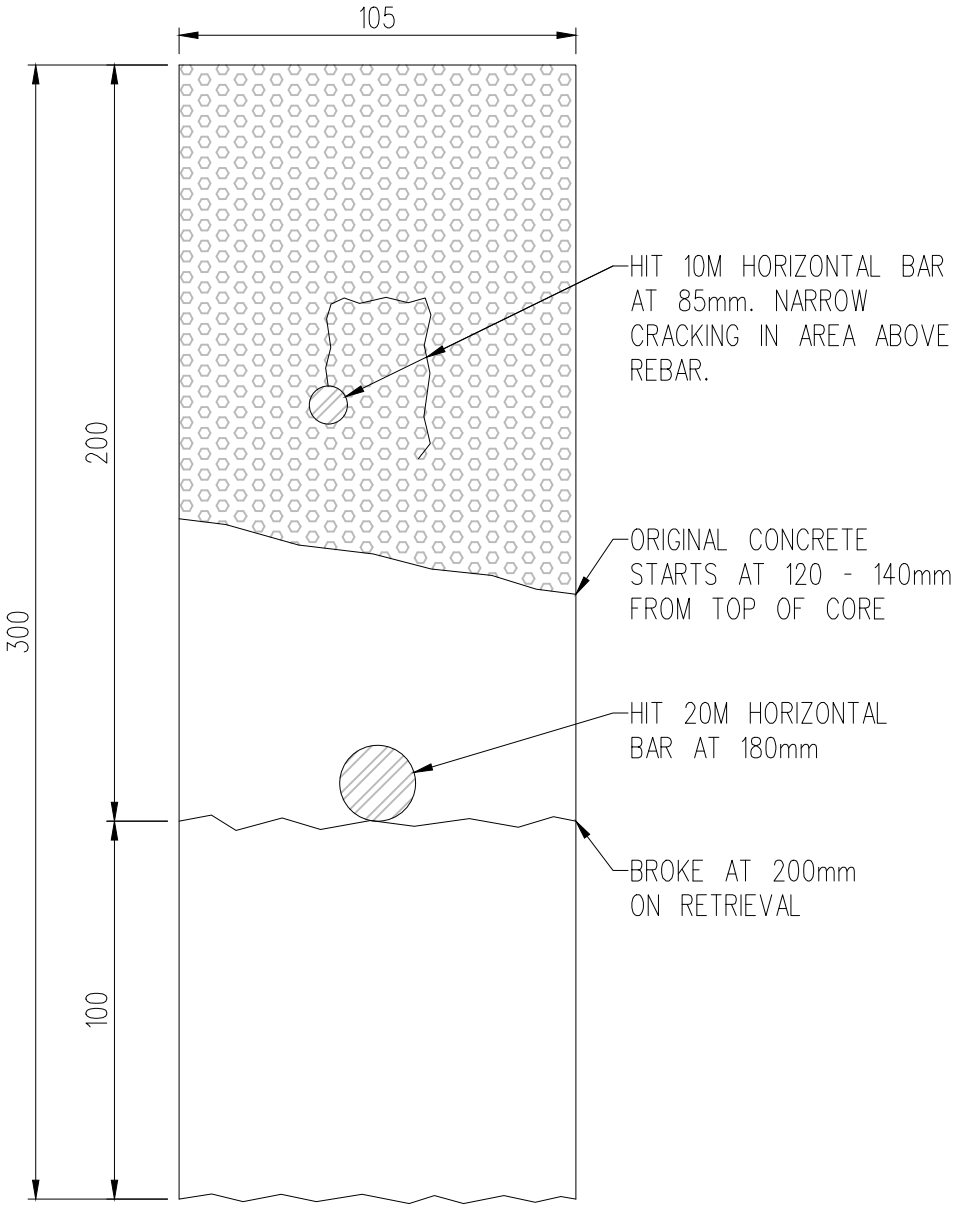
ORIGINAL CONCRETE

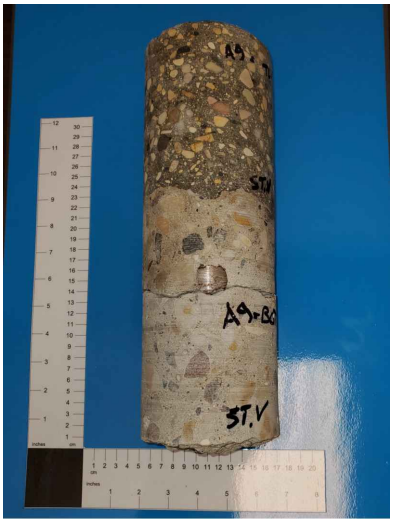
ABUTMENT WALL REFACING



LEGEND

ORIGINAL CONCRETE | ABUTMENT WALL REFACING | STEEL REINFORCEMENT



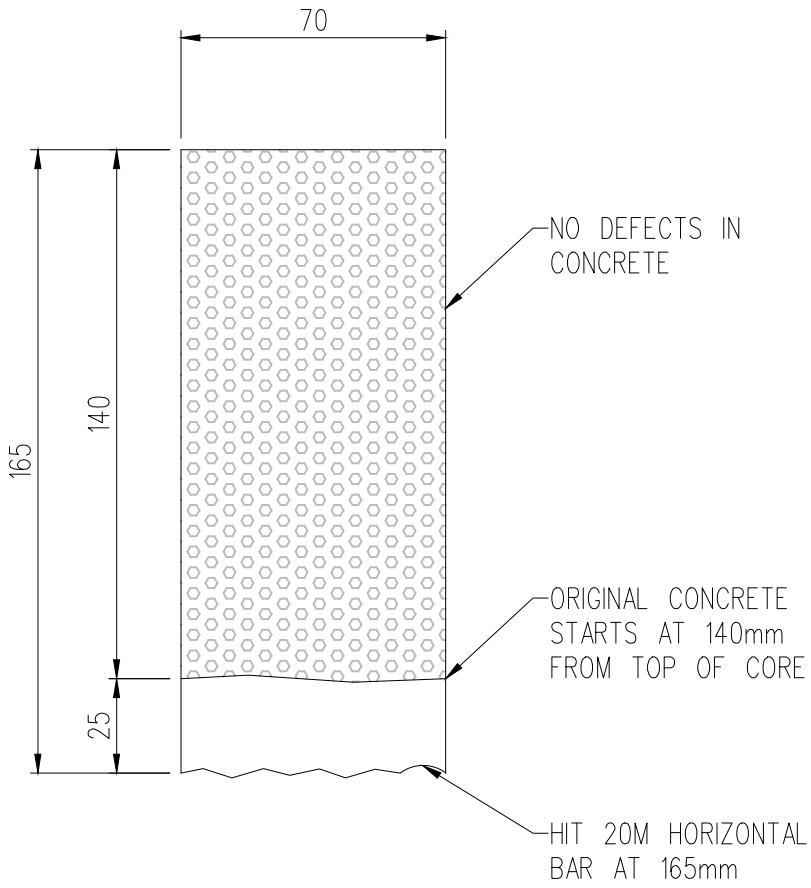


LEGEND

ORIGINAL CONCRETE

ABUTMENT WALL REFACING

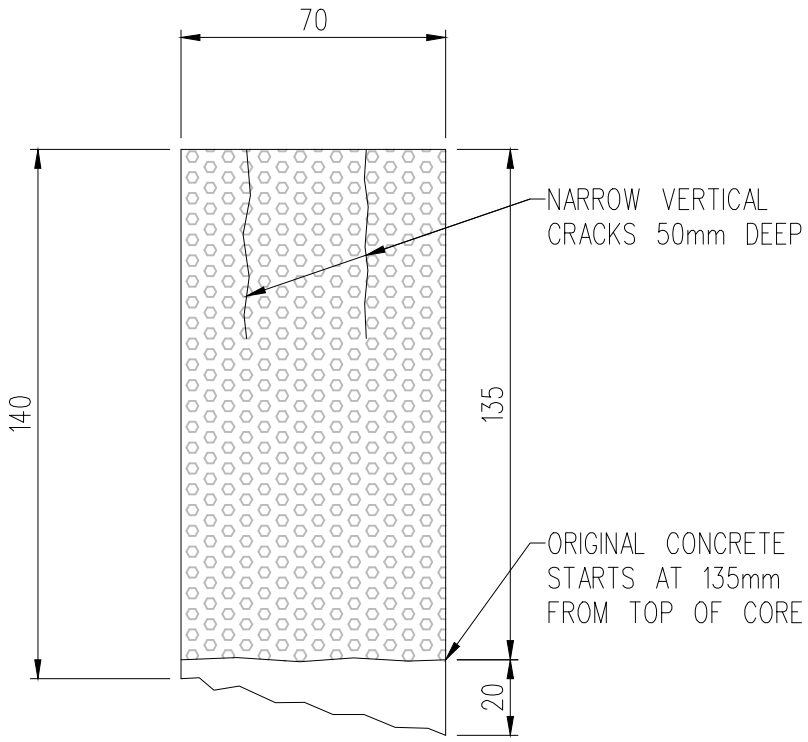
STEEL REINFORCEMENT

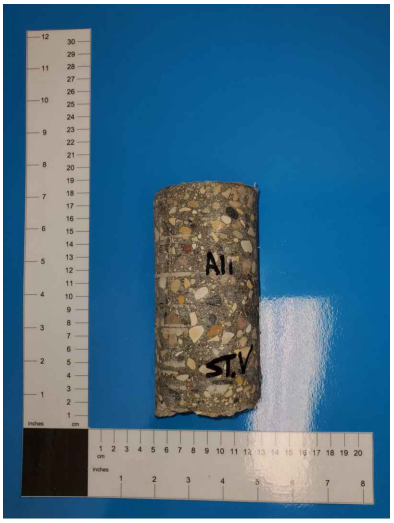


LEGEND

ORIGINAL CONCRETE

ABUTMENT WALL REFACING





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ORIGINAL CONCRETE

ABUTMENT WALL REFACING

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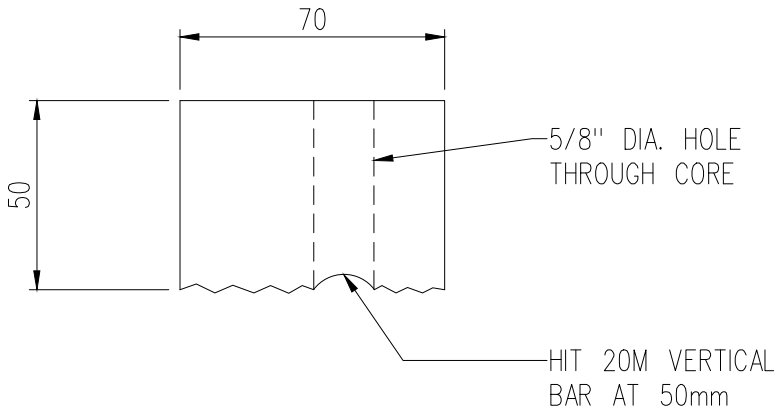

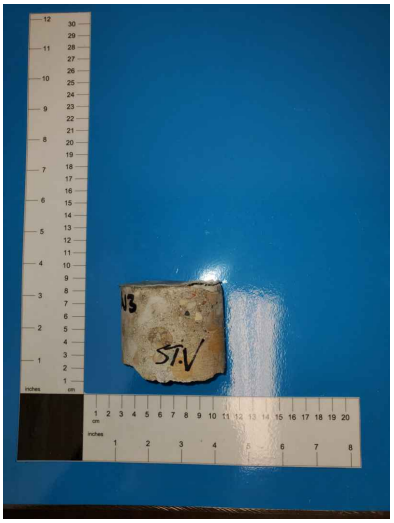

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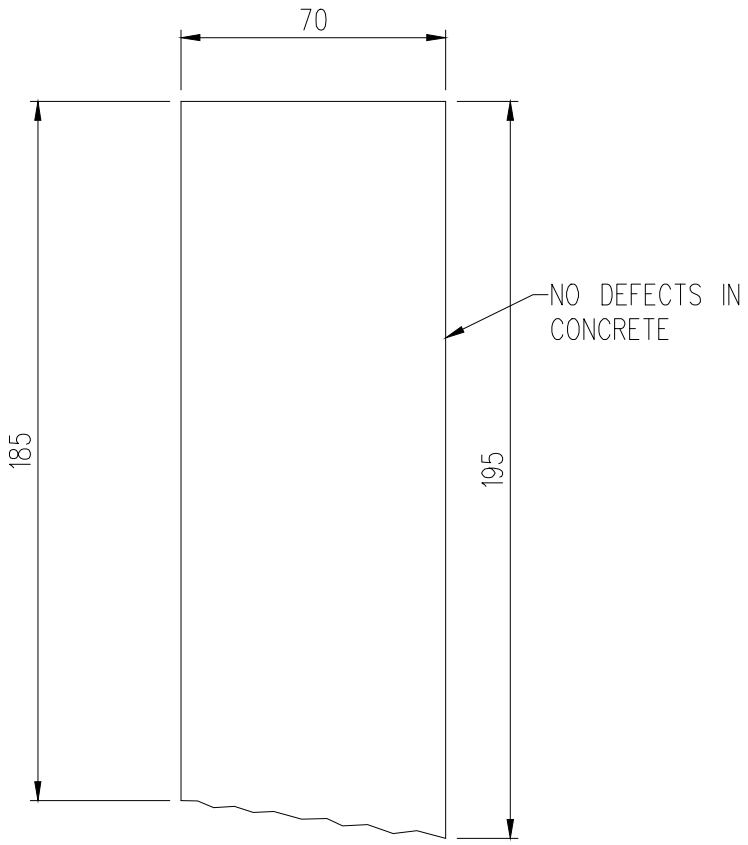

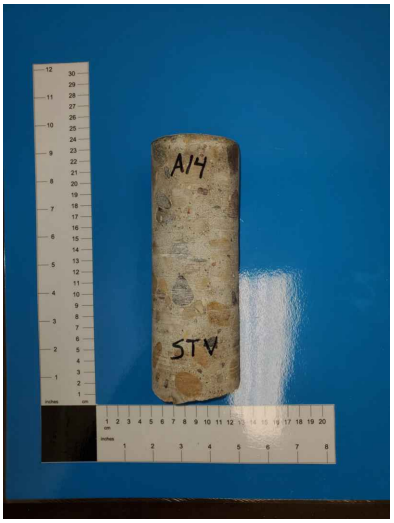

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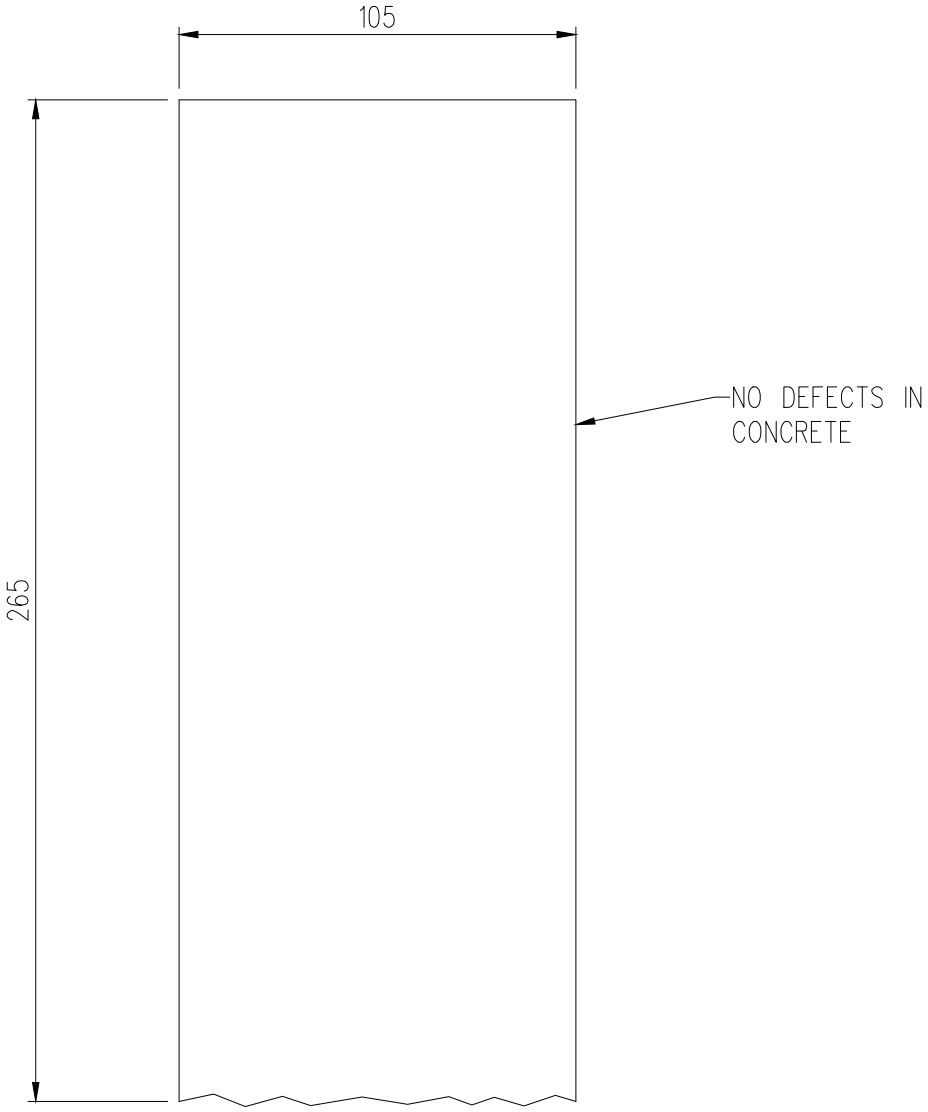

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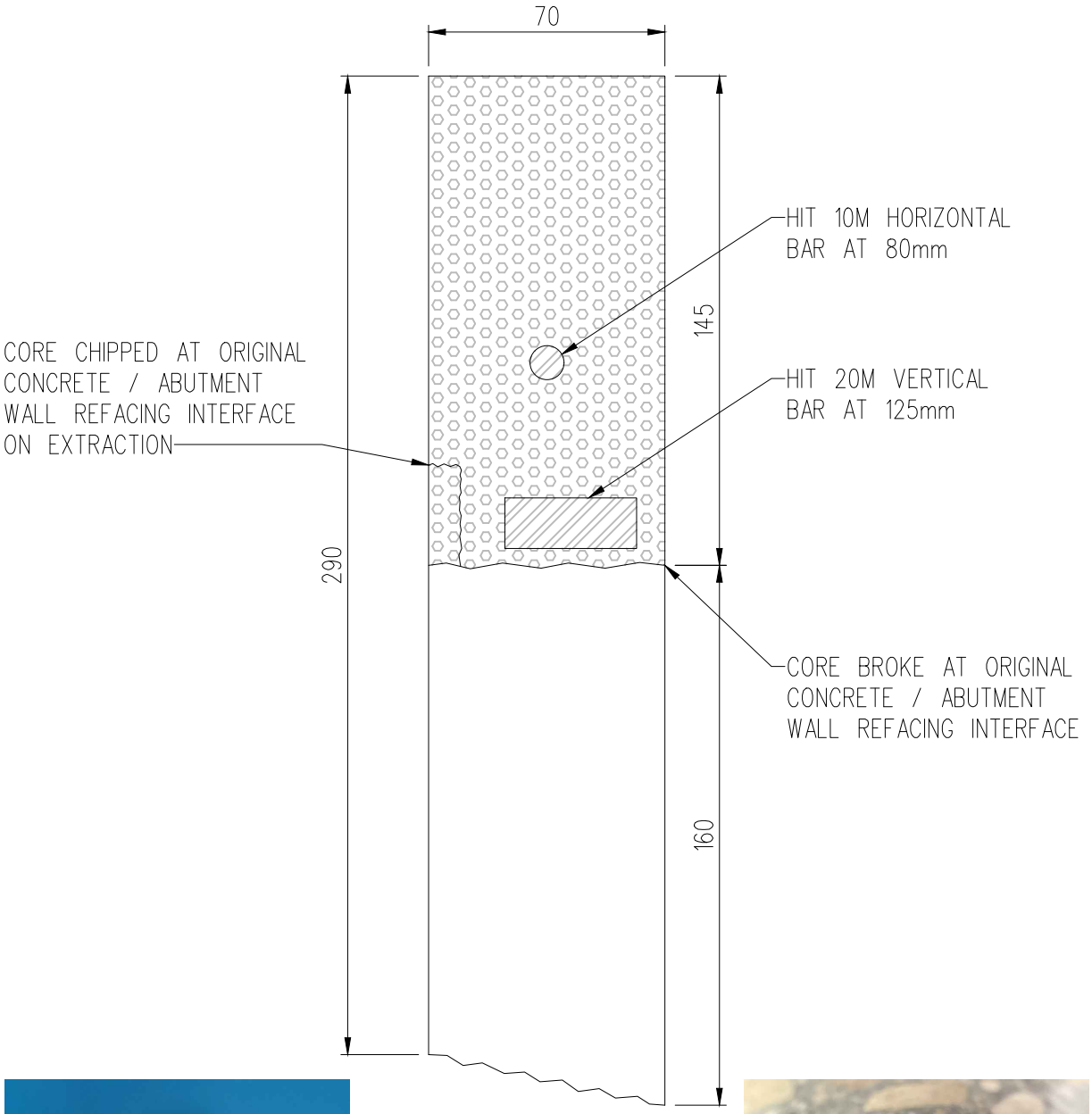

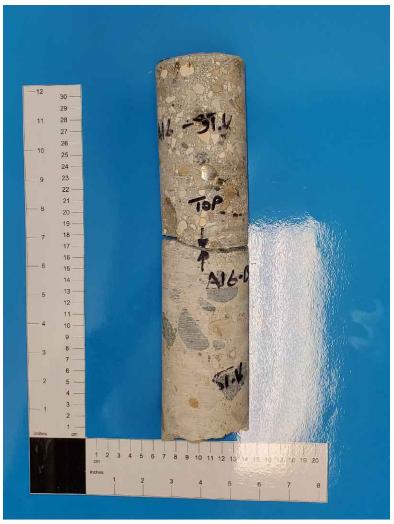

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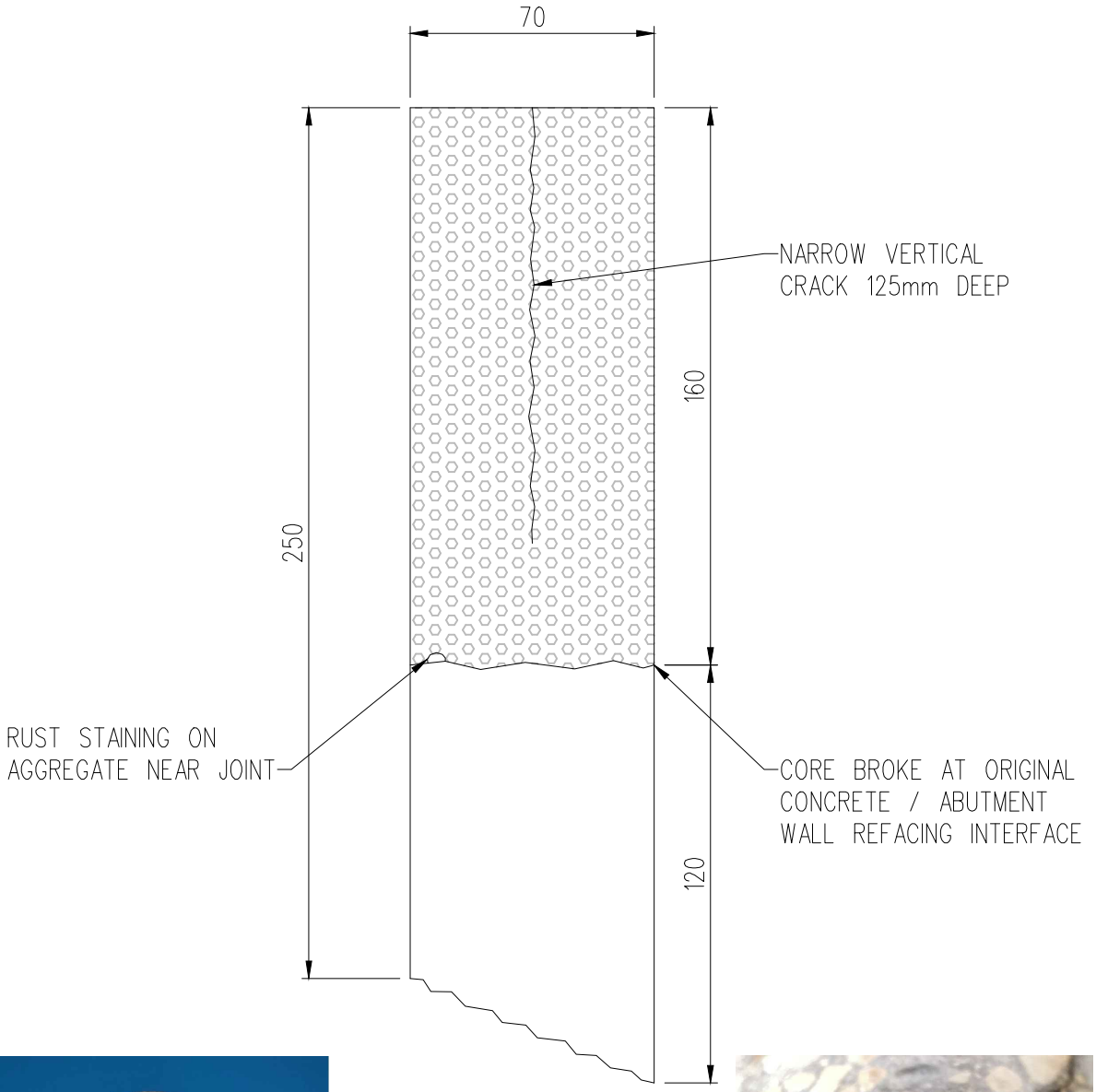
ORIGINAL CONCRETE | ABUTMENT WALL REFACING | STEEL REINFORCEMENT



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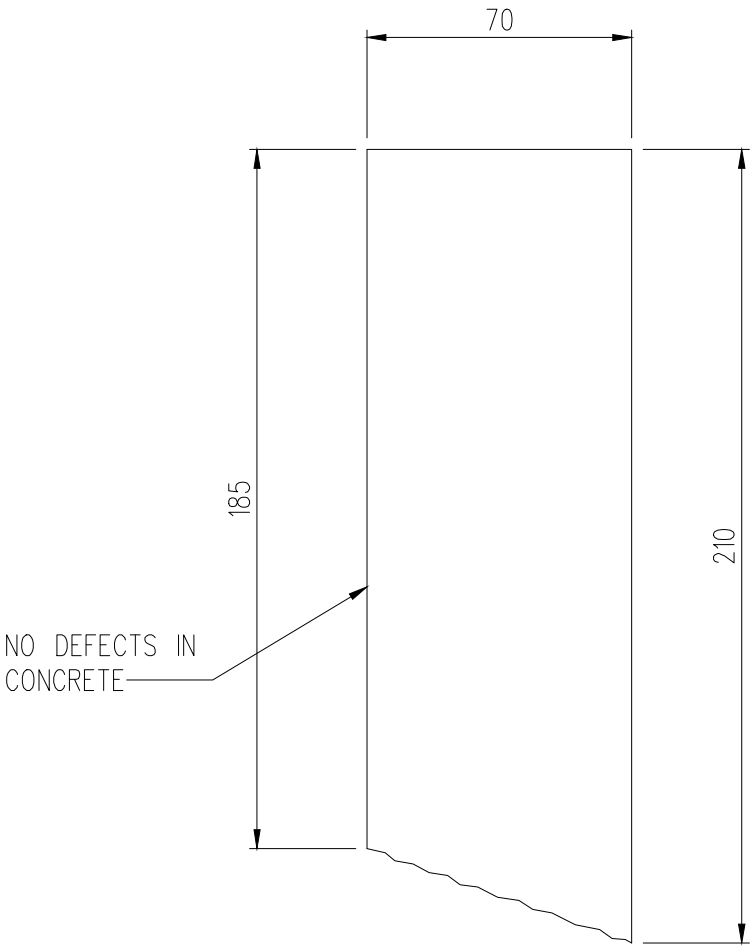

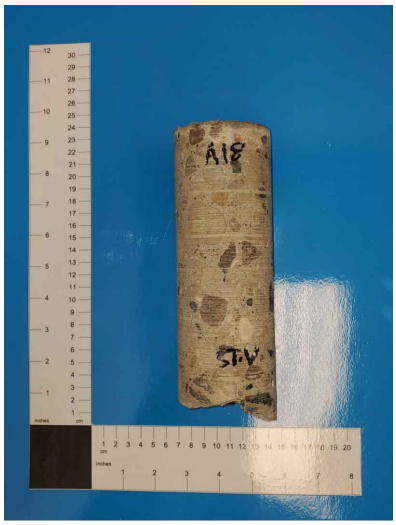

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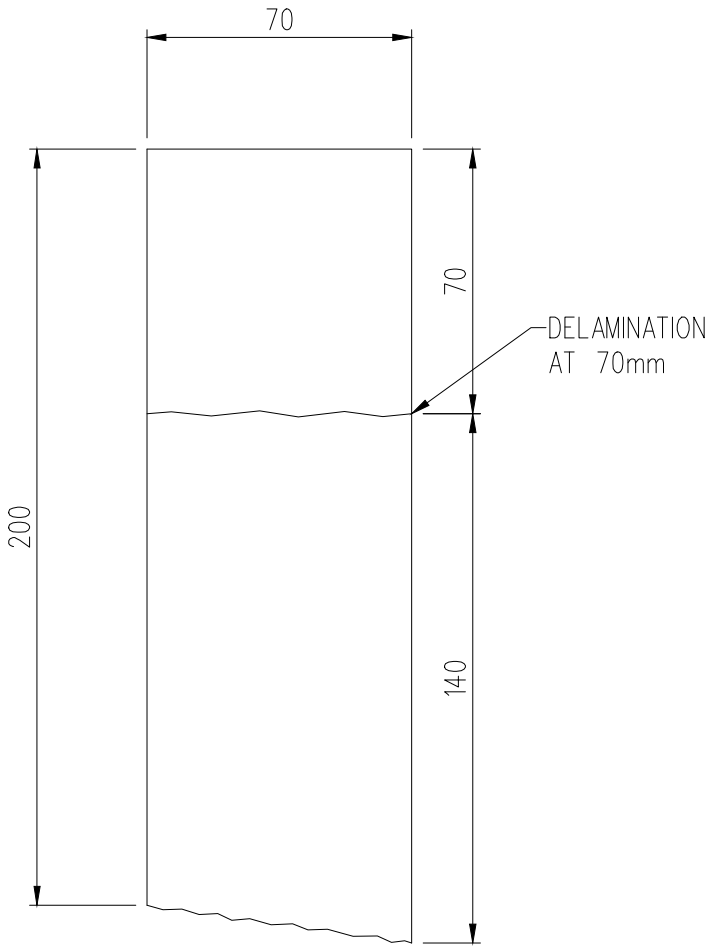

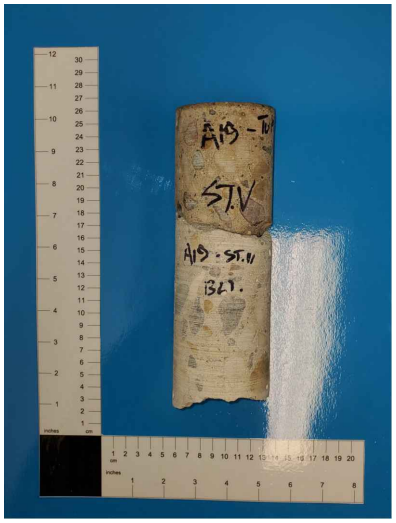

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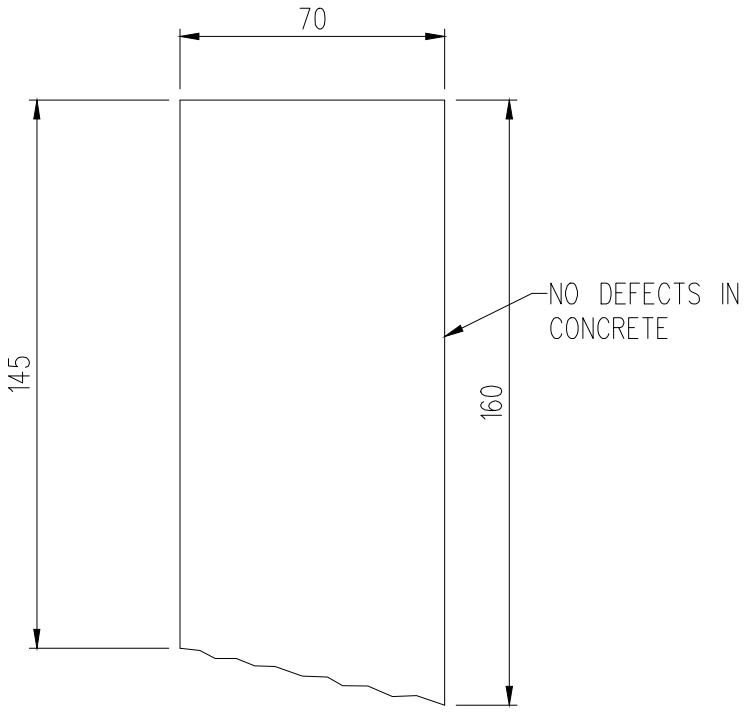

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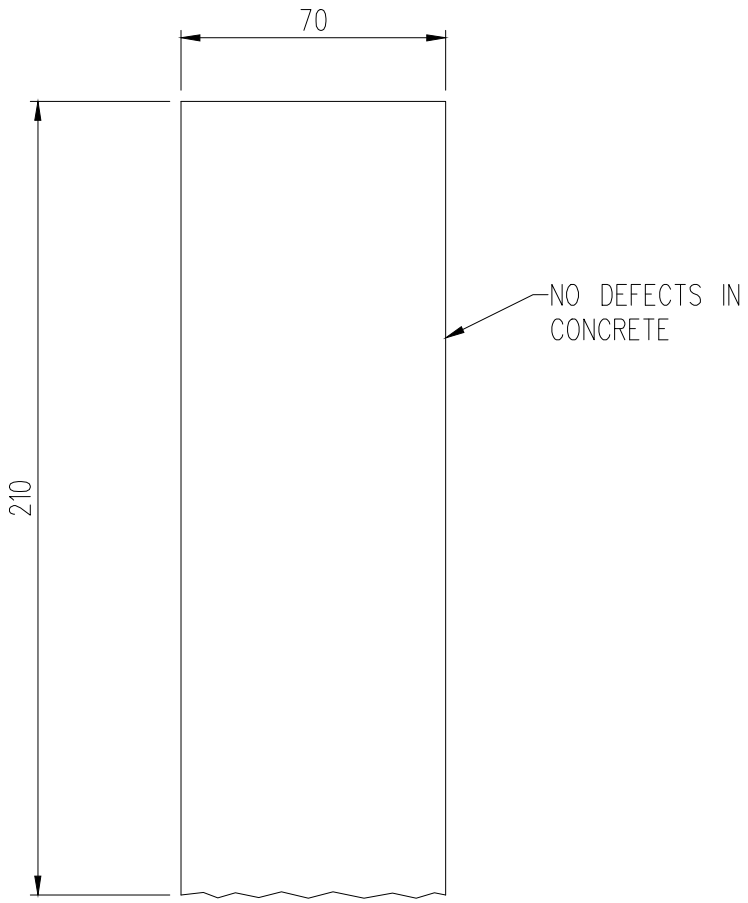

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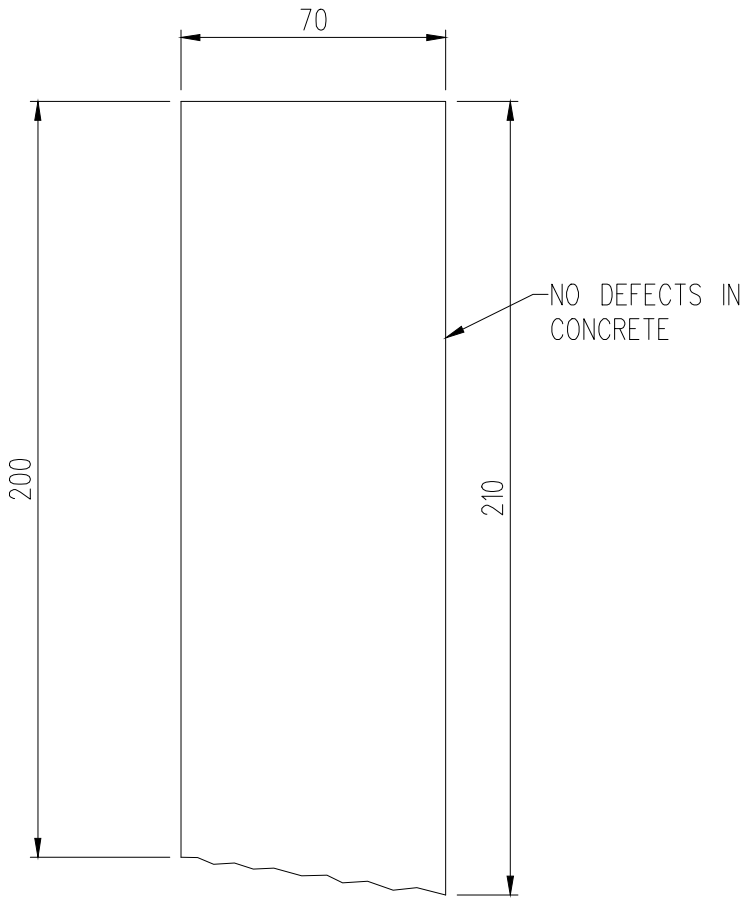

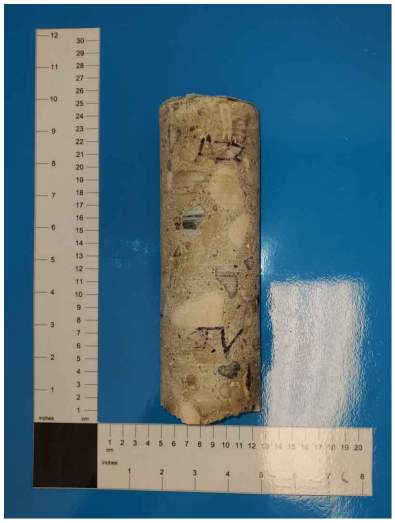

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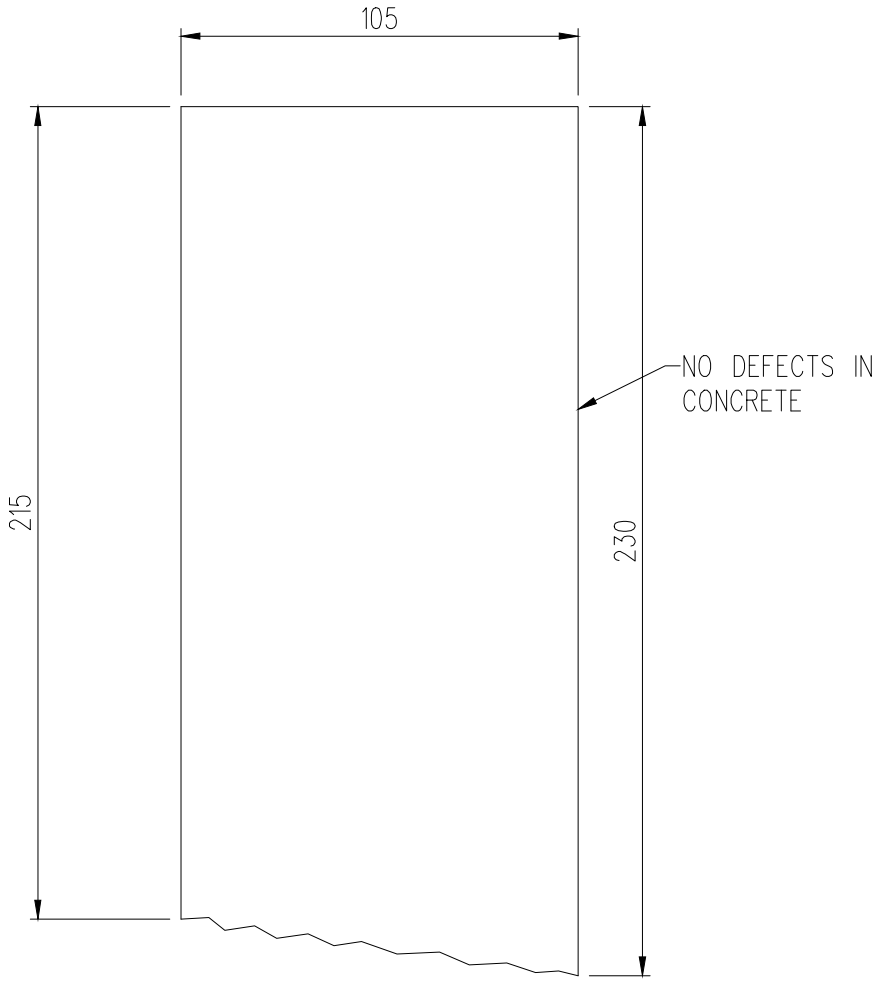
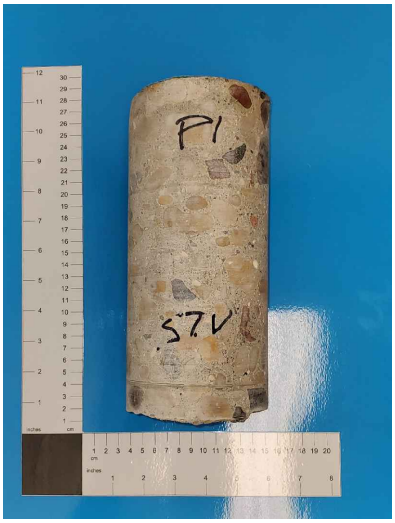
ABUTMENT WALL REFACING





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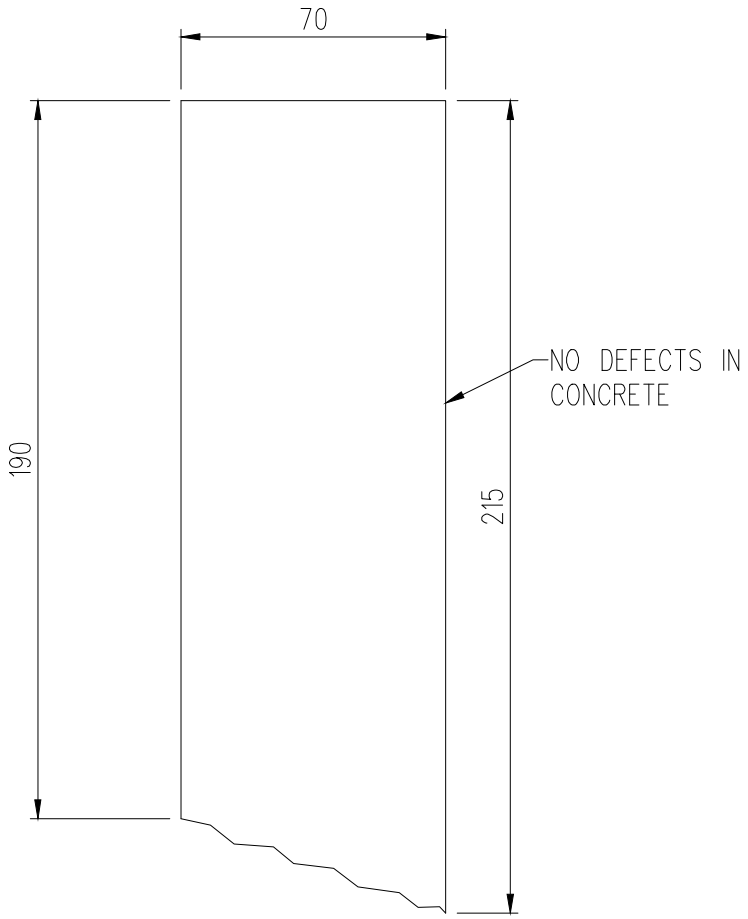
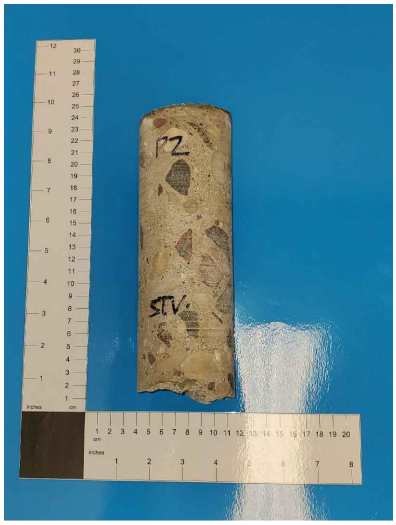
ABUTMENT WALL REFACING





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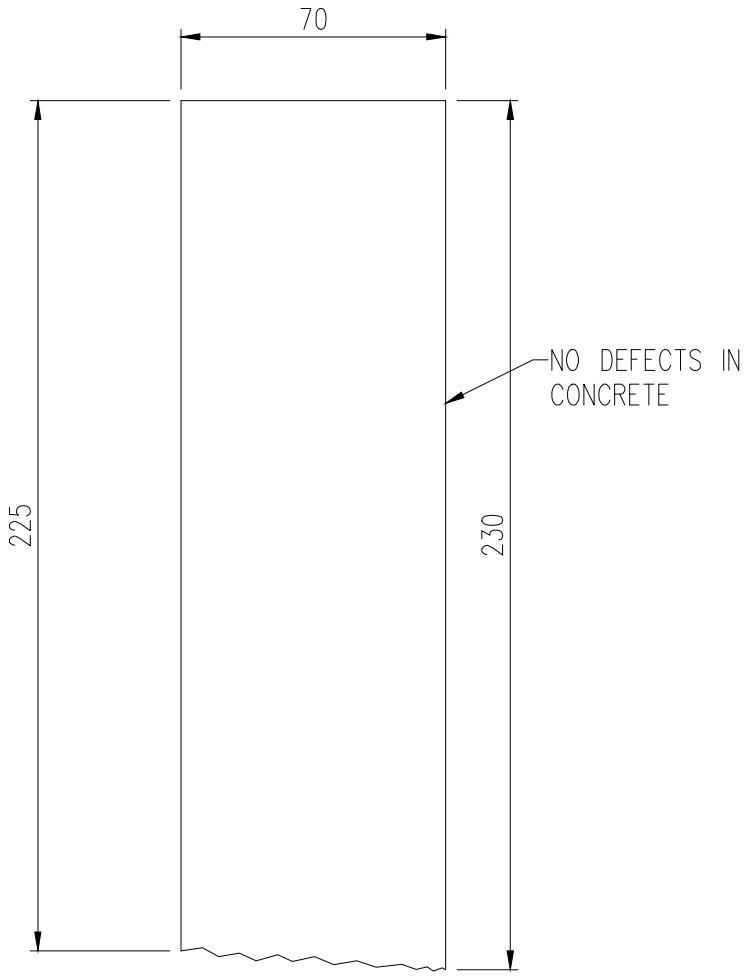

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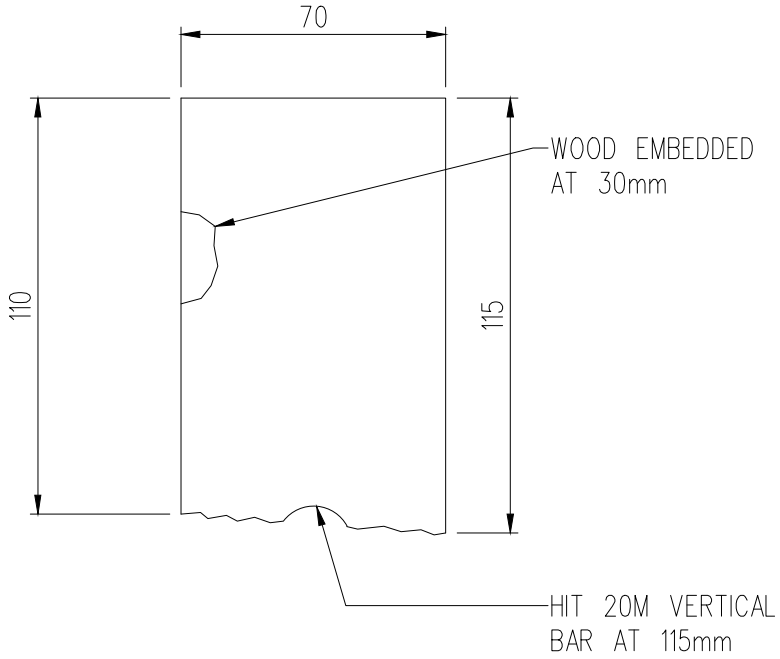

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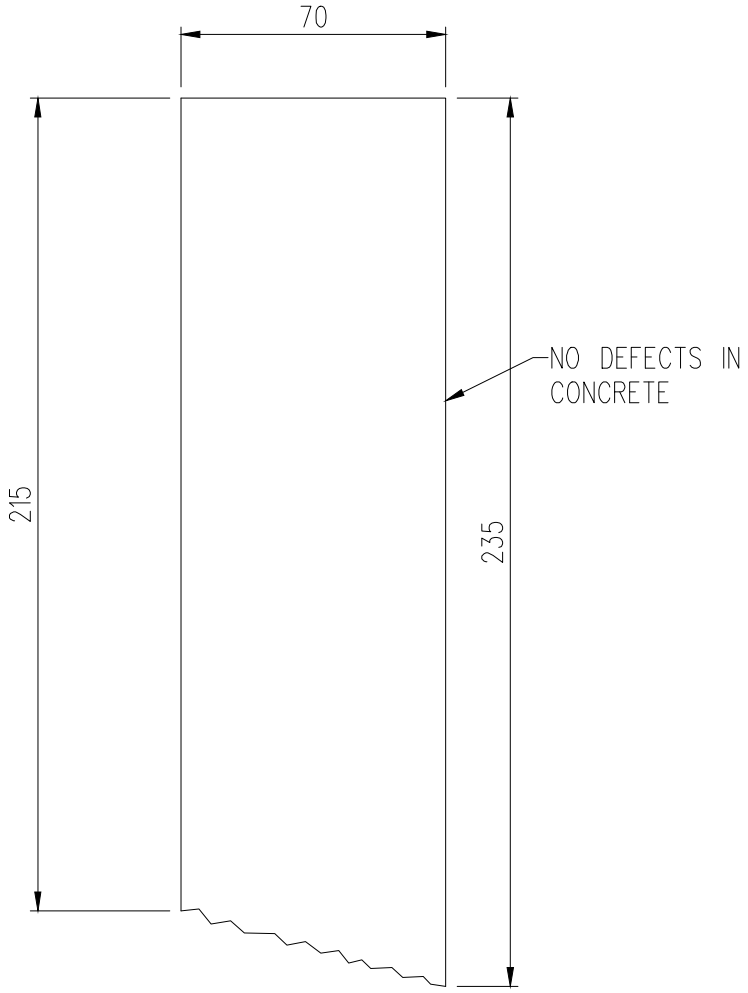

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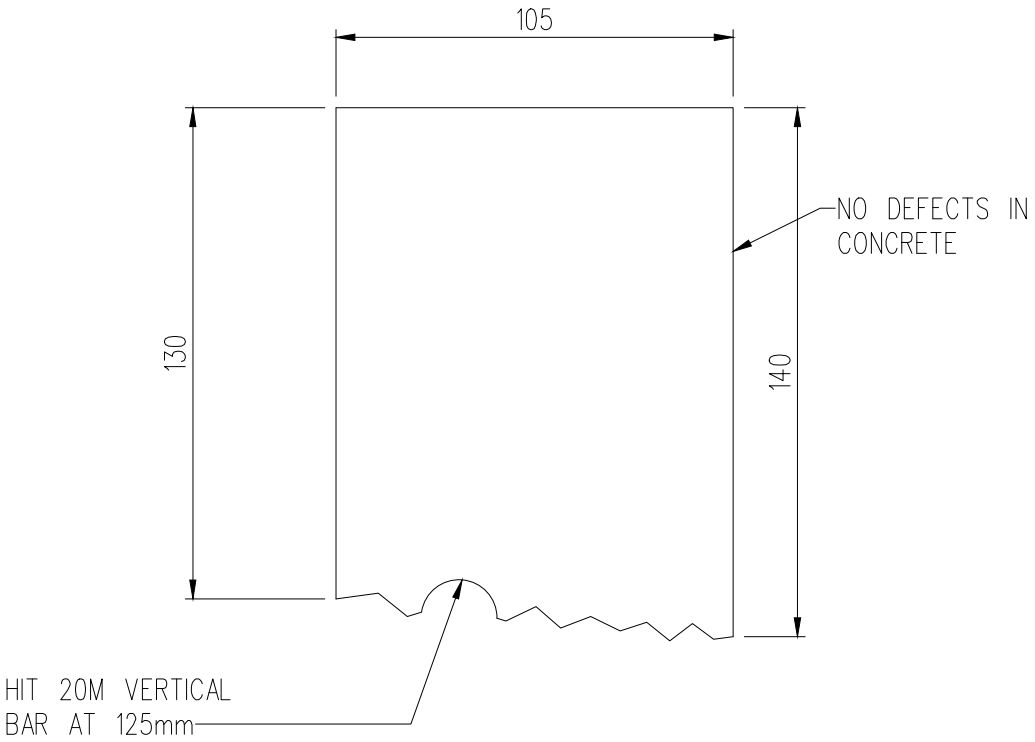

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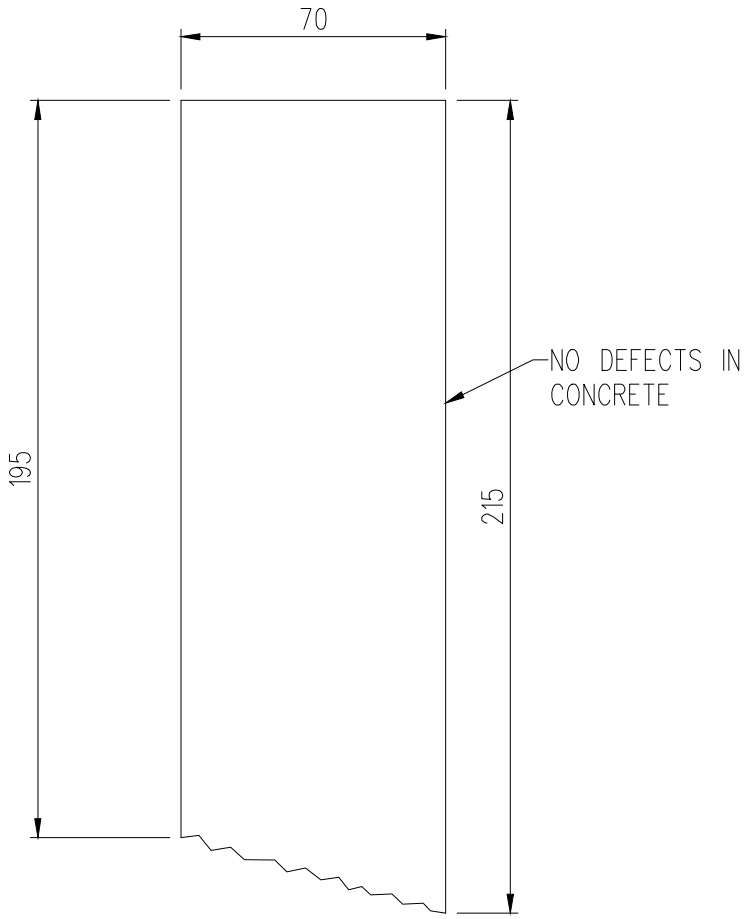

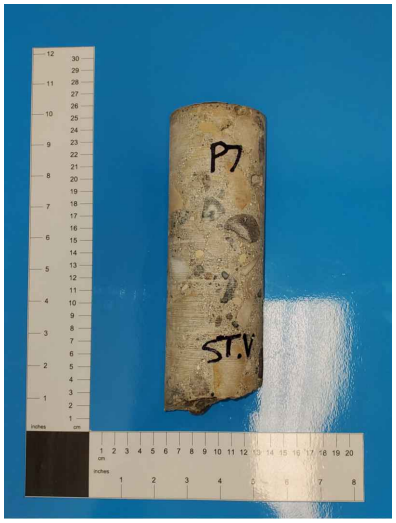

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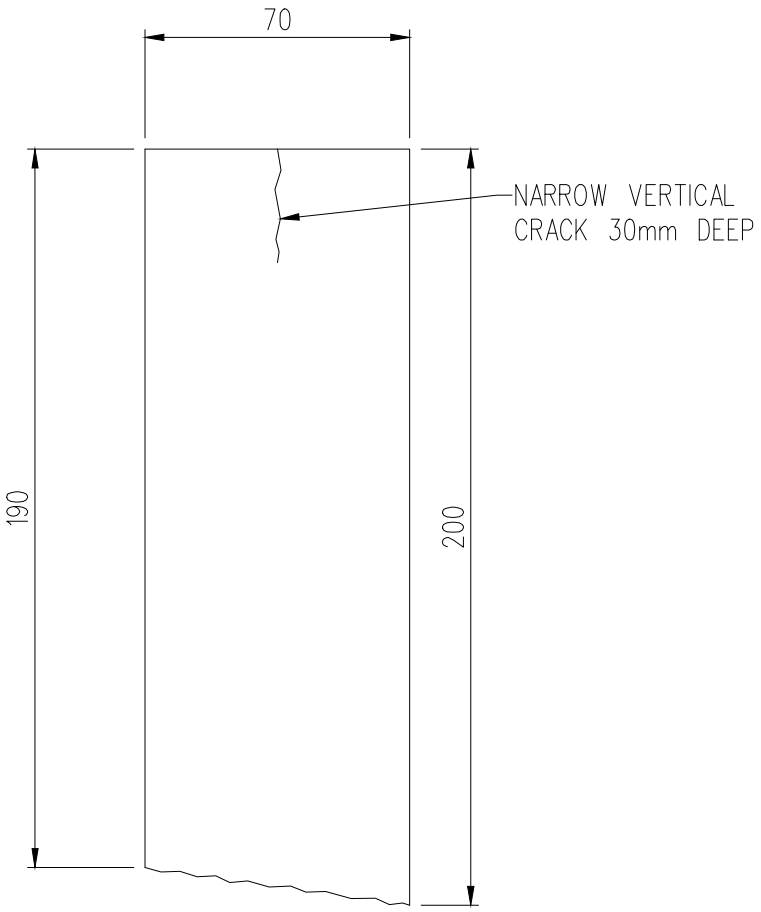

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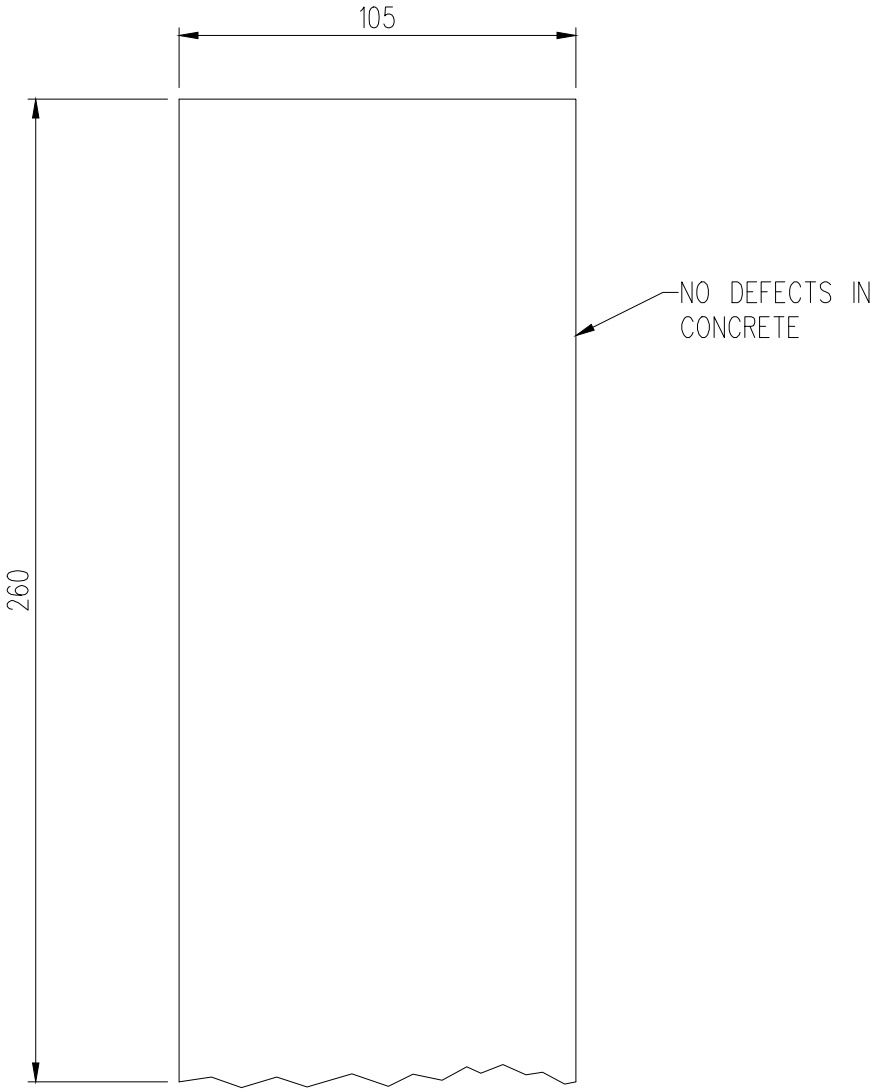

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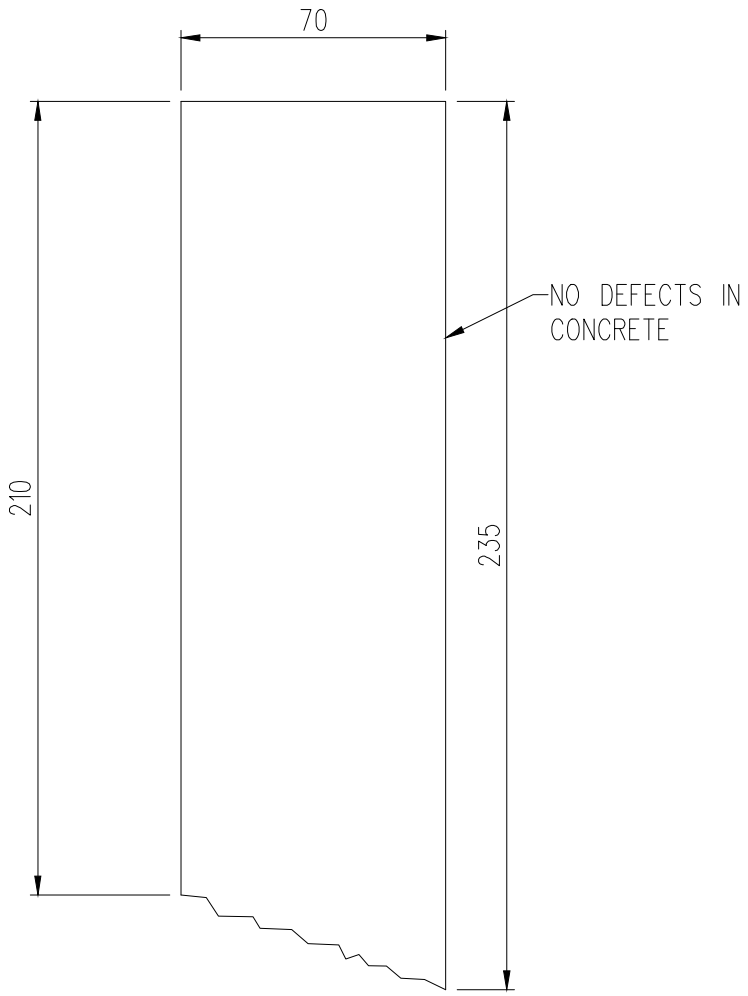

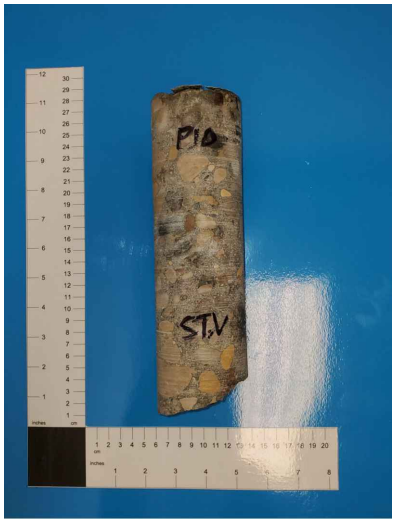

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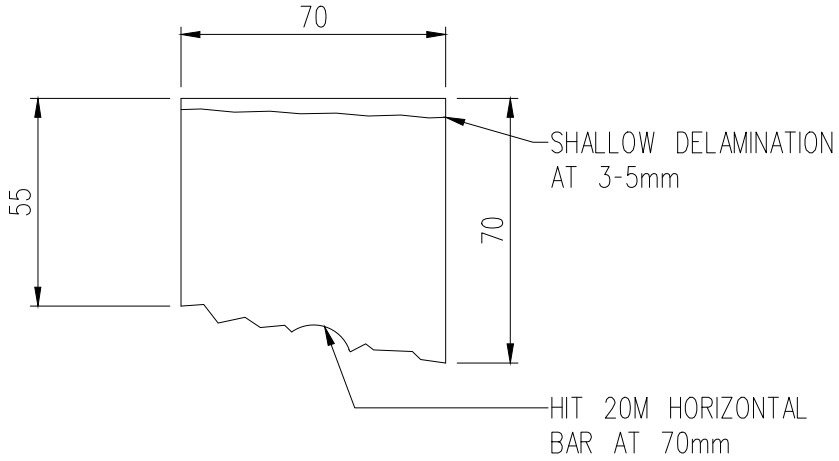

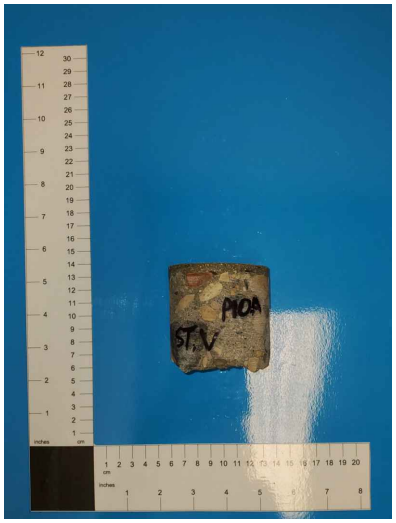

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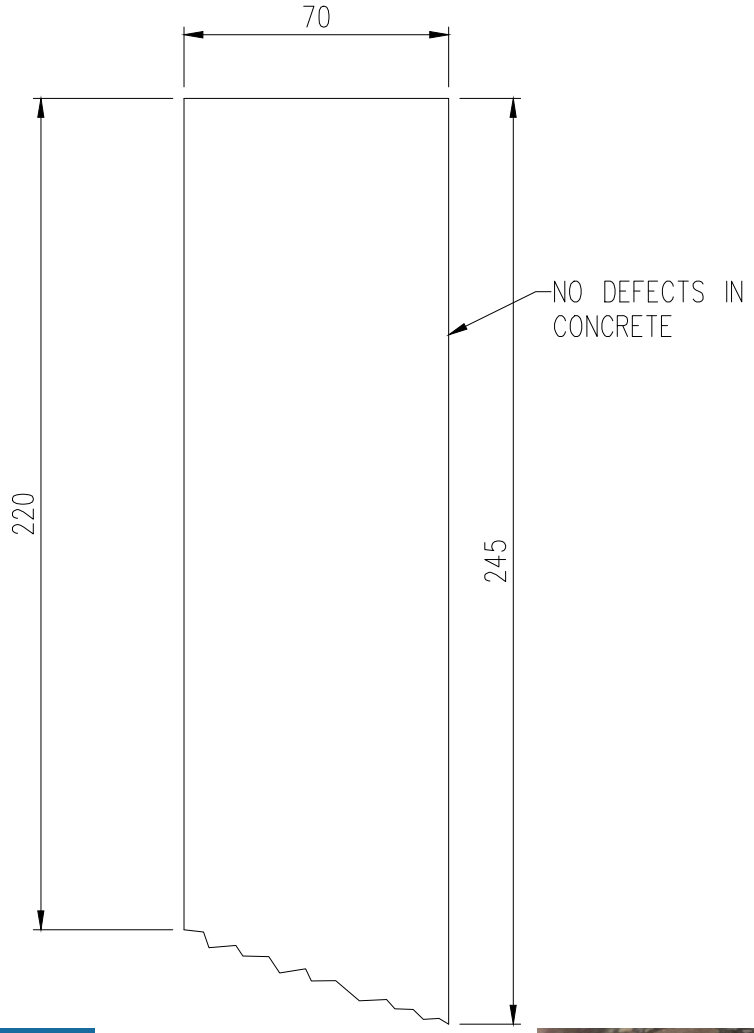

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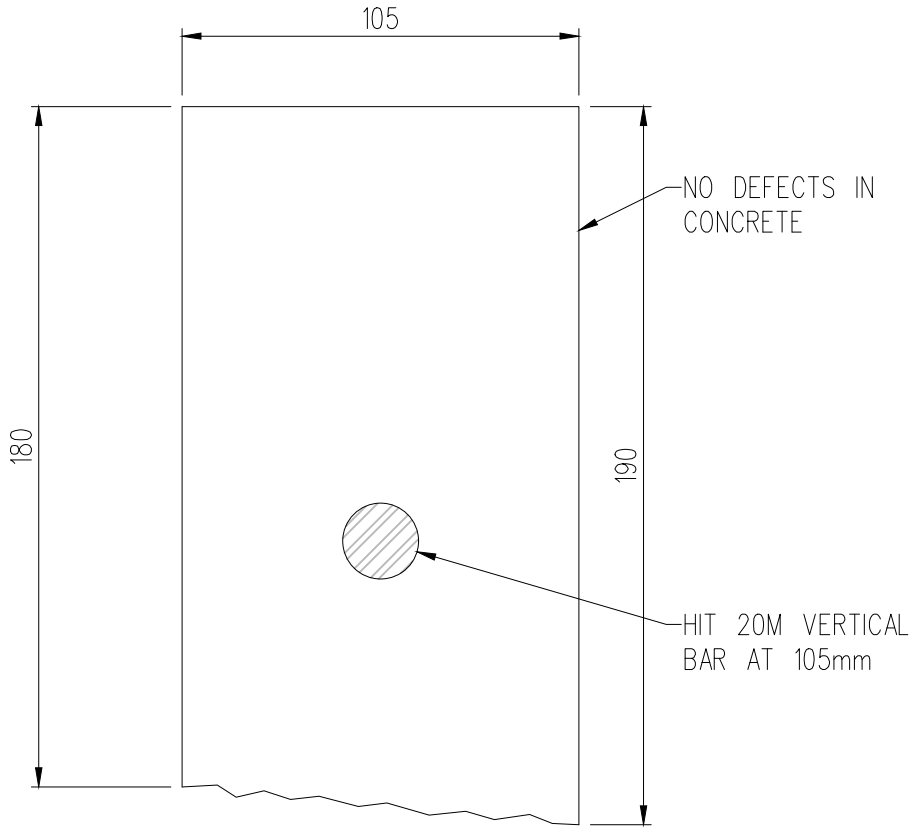

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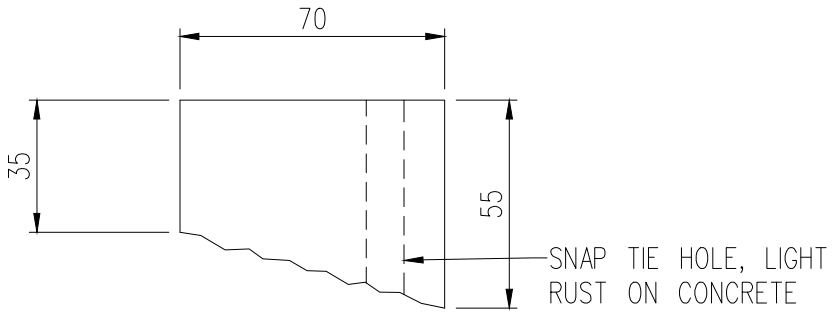
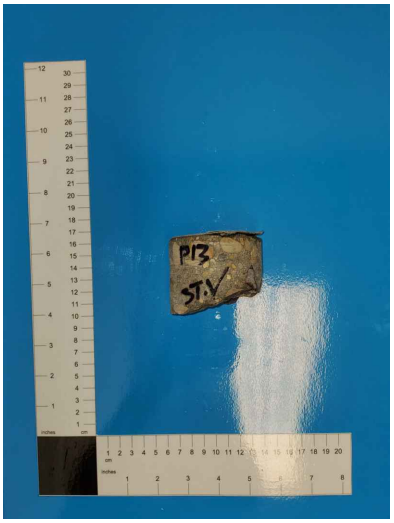
ABUTMENT WALL REFACING

STEEL REINFORCEMENT





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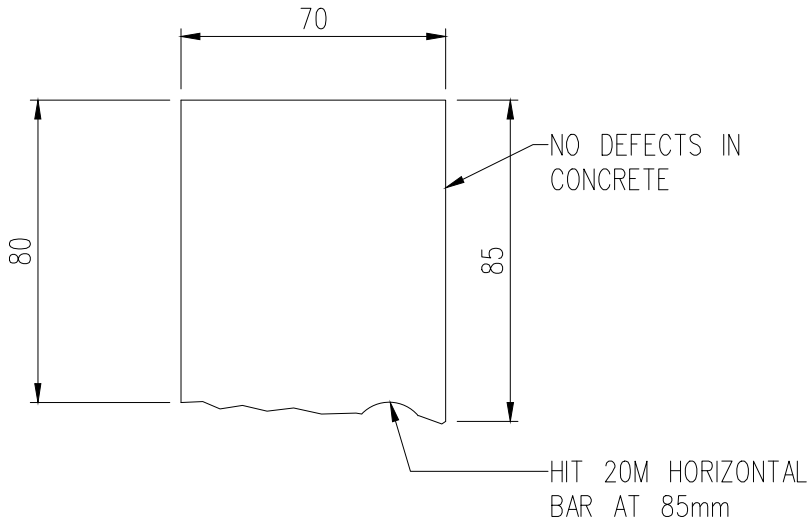

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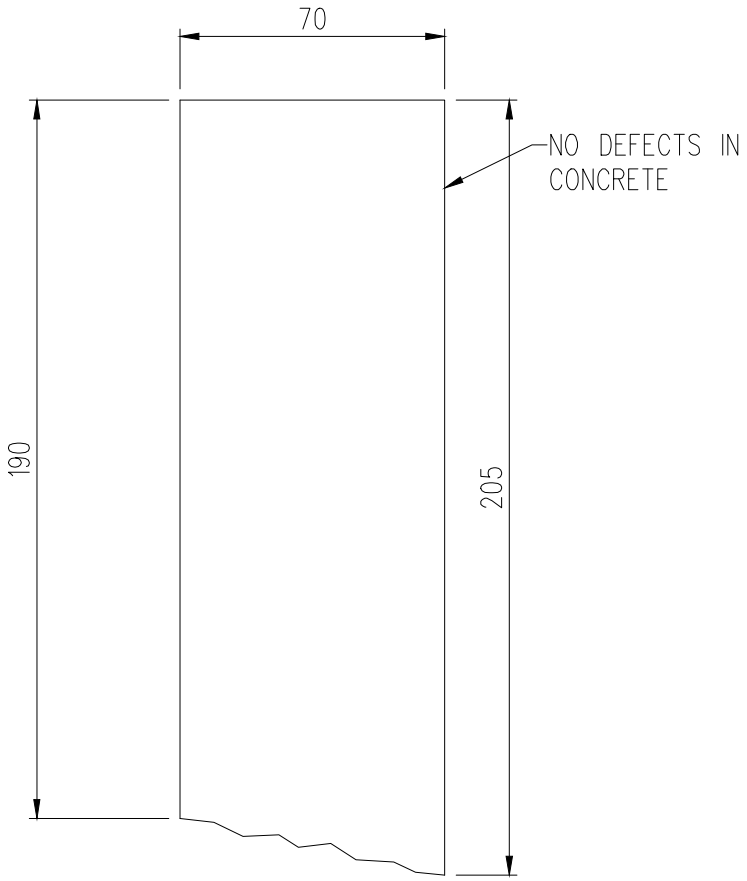

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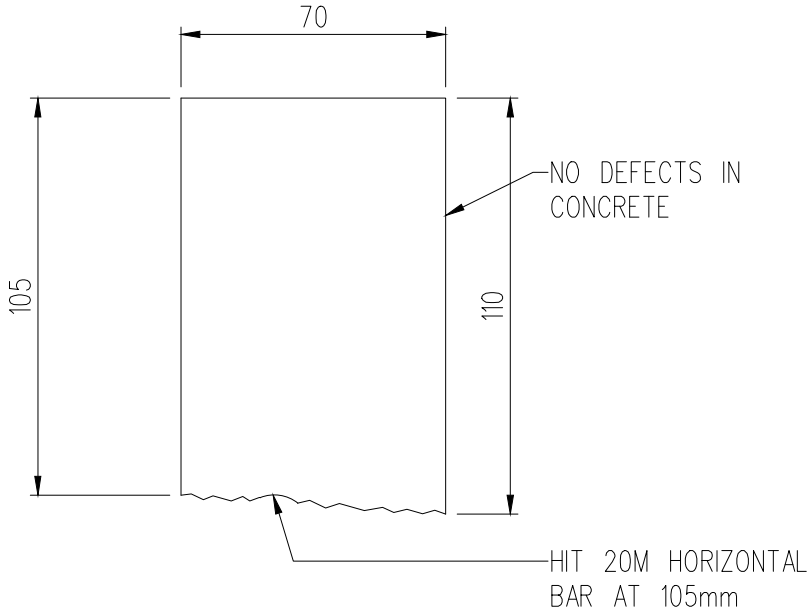

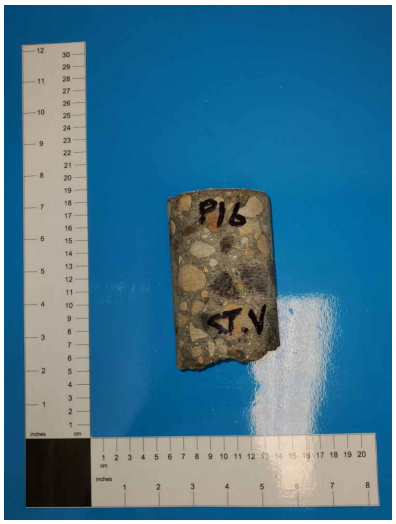

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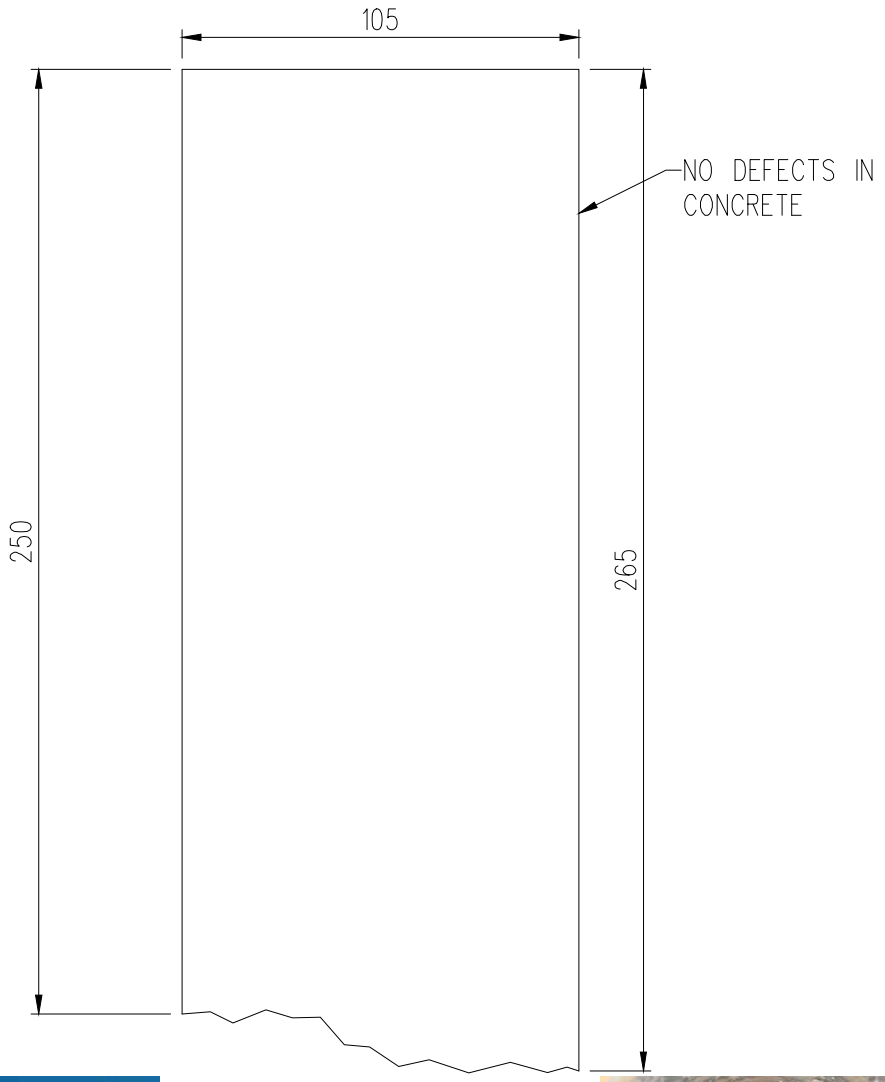

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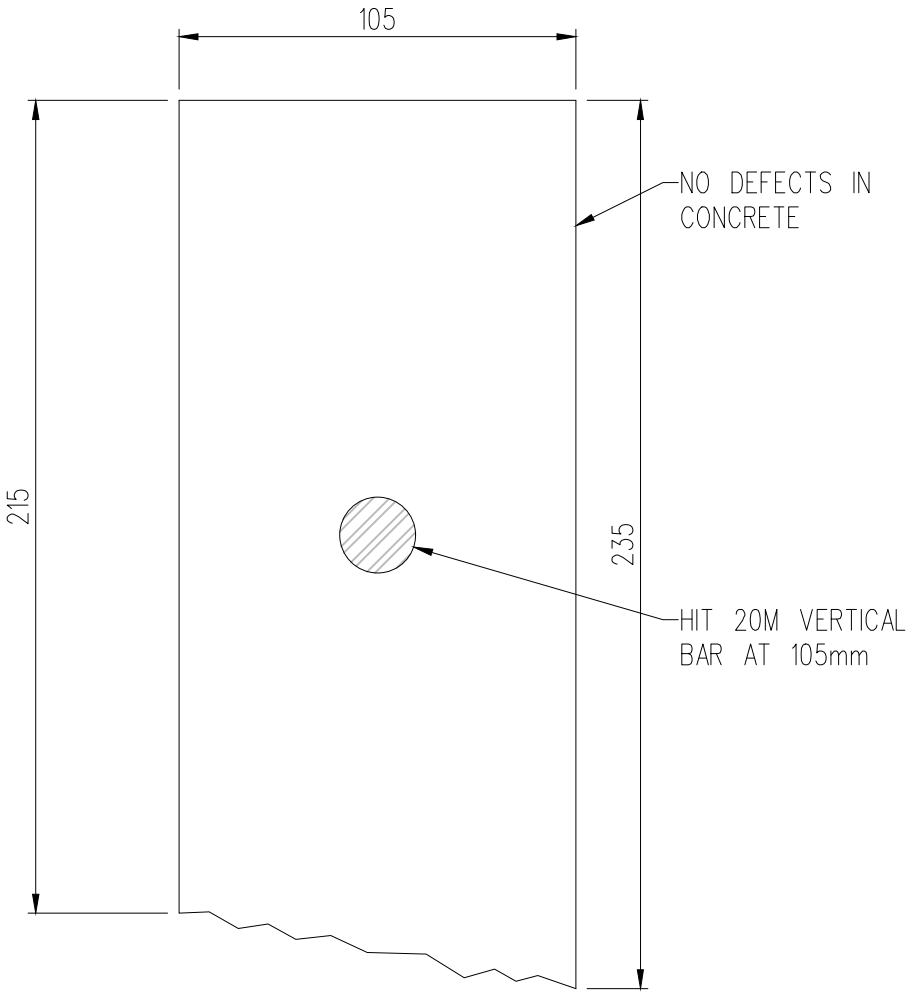

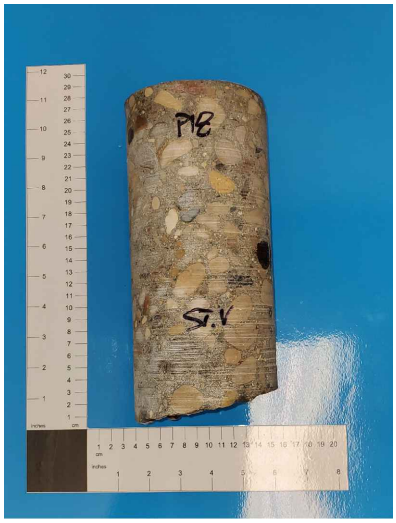

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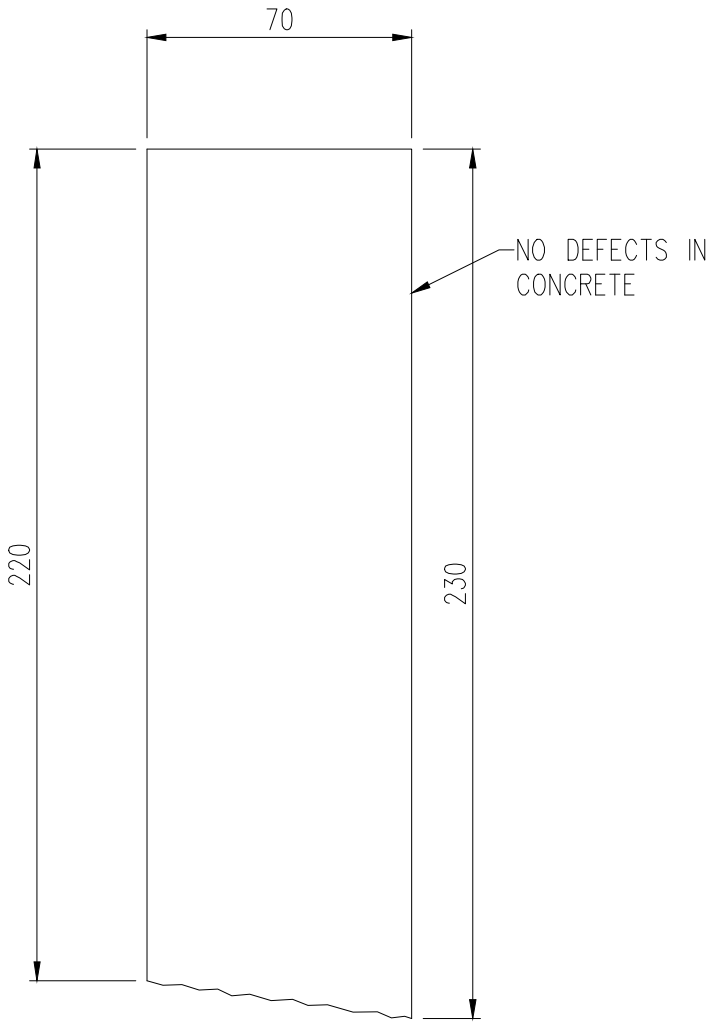
ABUTMENT WALL REFACING

STEEL REINFORCEMENT



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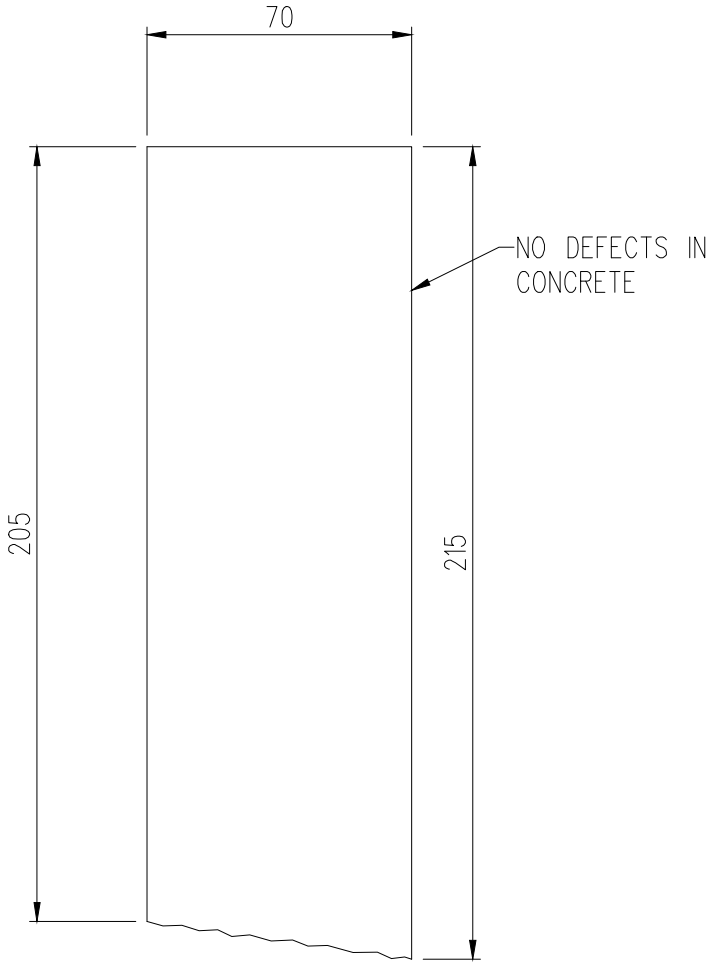

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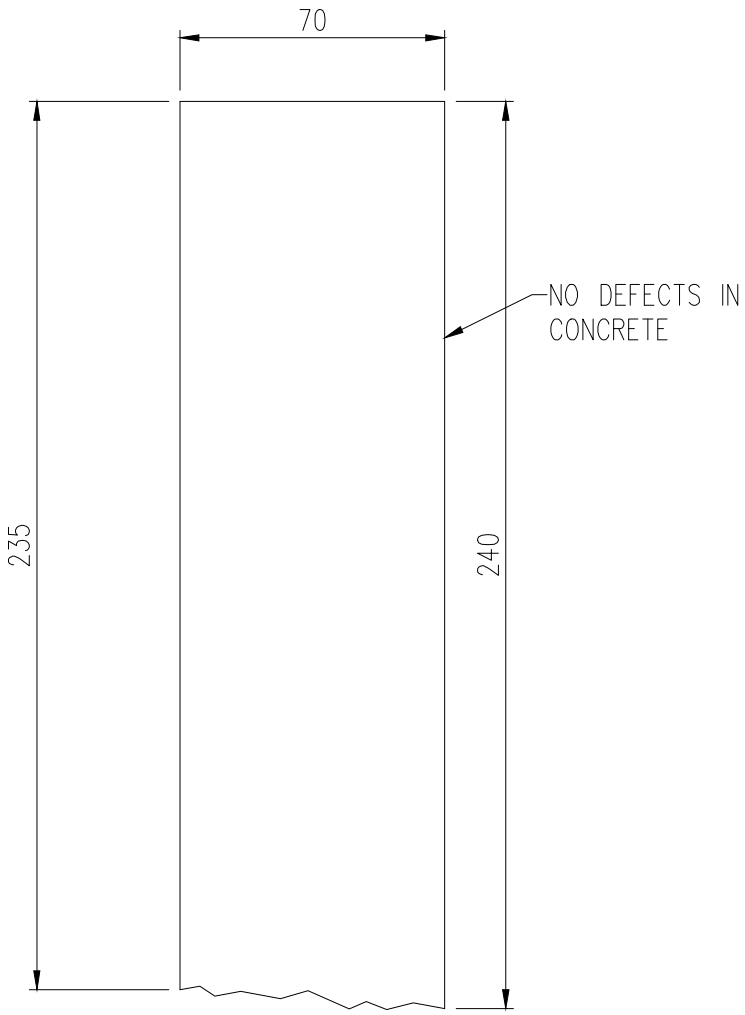

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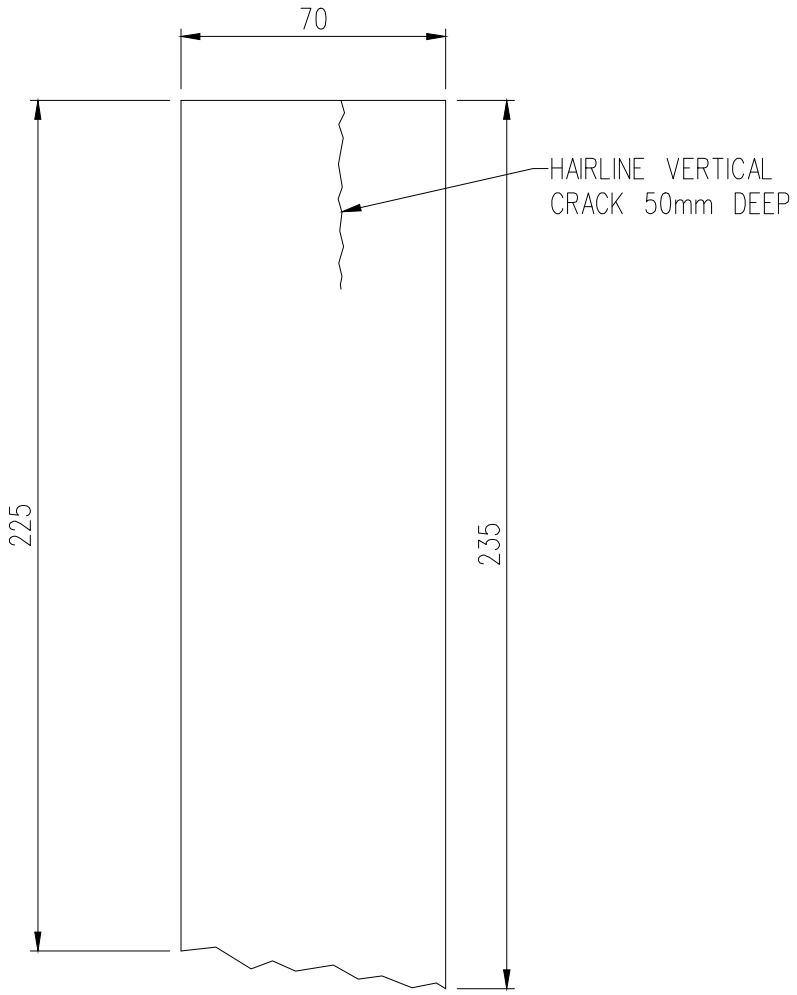

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ORIGINAL CONCRETE

ABUTMENT WALL REFACING

APPENDIX O.4: SUBSTRUCTURE CONDITION ASSESSMENT

CORE LOGS

Core No.	A1				
Location	South Abutment, Gridpoint S4 (0.82 m above, 0.2 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble	10-20		
Thickness of Concrete, mm	220	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-542				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content	4.400	%
			Specific Surface	29.800	mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor	152.000	µm
Remarks (Note 3.)	No defects in concrete.				

Core No.	A2				
Location	South Abutment, Gridpoint O4 (0.55 m above, 0.15 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	235	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-470				
Compressive Strength, MPa	53.1				
		Unit Weight	2364	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A3				
Location	South Abutment, Gridpoint O4 (0.55 m above, 0.1 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	70		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	-470				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defect in concrete. Entrapped air noted on core. Hit vertical 20M bar at depth of 70 mm.				

Core No.	A4				
Location	South Abutment, Gridpoint G4 (1.0 m above, 0.4 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	200		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-304				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content	7.300	%
			Specific Surface	28.700	mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor	96.000	µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A5				
Location	South Abutment, Gridpoint E4 (0.8 m above, 0.05m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	200	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-583				
Compressive Strength, MPa	41.1				
		Unit Weight	2392	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Core No.	A6				
Location	South Abutment, Gridpoint E4, (1.15 m above, 0.4 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	65	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	-345				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Hit 20M vertical bar at 65mm depth.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A7				
Location	South Abutment, Gridpoint E4 (1.05 m above, 0.1 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	120		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-345				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Core No.	A8				
Location	North Abutment, Gridpoint Q2 (0.95 m below, 0.15 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	300		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	LR				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
		Chloride Permeability	Sample depth (mm)	Charge Passed (Coulombs)	Chloride Ion Penetrability Rating
Compressive Strength, MPa			68-118	168	Very Low
			230-280	2063	Moderate
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete, small piece of wood noted at 160 mm depth. Core broke on retrieval at 170 mm depth. Original concrete and abutment wall refacing interface at 140 - 160 mm depth. Hit 15M vertical bar at 125 mm depth, bar in good condition. Hit 15M horizontal bar at 145 mm depth, light corrosion on bar. Chloride ion penetrability trial test at a depth of 68-118 mm was conducted on a section of the concrete overlay, the test at a depth of 230-280 mm was conducted on a section of the concrete substrate.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A9				
Location	North Abutment, Gridpoint O2 (0.5 m below, 0.4 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble	10-20		
Thickness of Concrete, mm	300	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	C		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	LR				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Petrographic examination completed on core, no significant defects noted in core. Core broke at 200 mm on retrieval. Hit 10M horizontal bar at 85 mm depth. Hit 20M horizontal bar at 180 mm, light corrosion noted on bar. Narrow cracking in area above 10M horizontal bar. Original concrete starts at 120 - 140 mm depth.				

Core No.	A10				
Location	North Abutment, Gridpoint G2 (0.8 m below, 0.6 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	165	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	LR				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa	73.5				
		Unit Weight	2358	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Compressive strength testing completed on refacing concrete (compressive strength was higher than original substructure concrete). No defects in concrete. Hit 20M horizontal bar at 165 mm depth, light corrosion noted on bar. Original concrete starts at 140 mm depth.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A11				
Location	North Abutment, Gridpoint G2 (0.85 m below, 0.35 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	140	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	C		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Narrow vertical cracking to 50 mm depth. Original concrete starts at 135 mm depth.				

Core No.	A12				
Location	North Abutment, Gridpoint E2 (0.85 m below, 0.2 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	220	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa	42.9				
		Unit Weight	2391	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A13				
Location	North Abutment, Gridpoint E2 (0.8 m below, 0 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	50	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	LR				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete, 5/8" diameter hole through core. Hit 20M vertical bar at 50 mm depth, light corrosion on rebar noted.				

Core No.	A14				
Location	North Abutment, Gridpoint E2 (1.05 m below, 0.1 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	185	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A15				
Location	North Abutment, Gridpoint C2 (0.85 m below, 0.15 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	265		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content	3.000	%
			Specific Surface	30.700	mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor	103.000	µm
Remarks (Note 3.)	No defects in concrete.				

Core No.	A16				
Location	North Abutment, Gridpoint S2 (1.05 m below, 0 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	290		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	LR				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content	7.8 (refacing) and 4.0 (substrate)	%
			Specific Surface	30.7 (refacing) and 24.8 (substrate)	mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor	103 (refacing) and 229 (substrate)	µm
Remarks (Note 3.)	No defects in concrete, core was chipped and broke at 145 mm during retrieval. Hit 10M horizontal bar at 80 mm depth. Hit 20M vertical bar at 125 mm depth, light corrosion noted on bar. Original concrete starts at 145 mm depth.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A17				
Location	North Abutment, Gridpoint Q2 (0.3 m above, 0.15 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20	0.224	-
Thickness of Concrete, mm	250		30-40	0.130	-
			50-60	0.088	-
Defects in Concrete (Note 1.)	C		70-80	0.062	-
			90-100	0.085	-
			110-120	0.060	-
Condition of Rebar (Note 2.)	N/A		130-140	0.080	-
			150-160	0.128	-
Corrosion Potential (- mV) At Closest Grid Point	N/A		170-180	0.320	-
			190-200	0.206	-
			210-220	0.208	-
			240-250	0.132	-
Compressive Strength, MPa					
Background Chloride Content (Note 4.)	0.008	Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	All test depths exceed Ontario Structure Rehabilitaiton Manual (OSRM) chloride threshold for corrosion initiation of 0.05% chloride content by mass of concrete. Narrow vertical crack 125 mm deep. Core broke at original concrete and abutment wall refacing interface 160 mm deep. Rust staining on aggregate near joint.				

Core No.	A18				
Location	North Abutment, Gridpoint E2 (0.2 m above, 0.2 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20	0.380	-
Thickness of Concrete, mm	185		30-40	0.428	-
			50-60	0.370	-
Defects in Concrete (Note 1.)	None		70-80	0.220	12.450
			90-100	0.188	-
			110-120	0.112	-
Condition of Rebar (Note 2.)	N/A		130-140	0.066	-
			150-160	0.025	-
Corrosion Potential (- mV) At Closest Grid Point	N/A		170-180	0.030	-
Compressive Strength, MPa					
Background Chloride Content (Note 4.)	0.008	Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Test depths from surface to ~150 mm depth from surface exceed OSRM chloride threshold for corrosion initiation of 0.05% chloride content by mass of concrete. No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A19				
Location	North Abutment, Gridpoint C2 (0.15 m above, 0.3 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20	0.597	-
Thickness of Concrete, mm	200	Chloride Content	30-40	0.634	-
			50-60	0.455	-
Defects in Concrete (Note 1.)	D		70-80	0.153	-
			90-100	0.148	-
			110-120	0.144	-
Condition of Rebar (Note 2.)	N/A		130-140	0.085	-
			150-160	0.058	-
Corrosion Potential (- mV) At Closest Grid Point	N/A		170-180	0.037	-
Compressive Strength, MPa					
Background Chloride Content (Note 4.)	0.008	Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Delamination at 70 mm depth. Test depths from surface to ~160-170 mm depth from surface exceed OSRM chloride threshold for corrosion initiation of 0.05% chloride content by mass of concrete.				

Core No.	A20				
Location	South Abutment, Gridpoint G2 (0.4 m below, 0.2 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20	0.323	-
Thickness of Concrete, mm	145	Chloride Content	30-40	0.194	-
			50-60	0.303	-
Defects in Concrete (Note 1.)	None		70-80	0.097	12.52
			90-100	0.050	-
			110-120	0.030	-
Condition of Rebar (Note 2.)	N/A		130-140	0.029	-
Corrosion Potential (- mV) At Closest Grid Point	-304				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)	0.008	Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Test depths from surface to ~80-90 mm depth from surface exceed OSRM chloride threshold for corrosion initiation of 0.05% chloride content by mass of concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	A21				
Location	South Abutment, Gridpoint E2 (0.3 m below, 0.2 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20	0.296	-
Thickness of Concrete, mm	210		30-40	0.344	-
			50-60	0.224	-
Defects in Concrete (Note 1.)	None		70-80	0.155	-
			90-100	0.065	-
			110-120	0.038	-
Condition of Rebar (Note 2.)	N/A		130-140	0.026	-
			150-160	<0.020	-
Corrosion Potential (- mV) At Closest Grid Point	-300		170-180	0.026	-
Compressive Strength, MPa					
Background Chloride Content (Note 4.)	0.008	Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Test depths from surface to ~100-110 mm depth from surface exceed OSRM chloride threshold for corrosion initiation of 0.05% chloride content by mass of concrete.				

Core No.	A22				
Location	South Abutment, Gridpoint C2 (0.2 m below, 0.3 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20	0.375	-
Thickness of Concrete, mm	200		30-40	0.370	-
			50-60	0.263	-
Defects in Concrete (Note 1.)	None		70-80	0.143	-
			90-100	0.084	-
			110-120	0.034	-
Condition of Rebar (Note 2.)	N/A		130-140	0.028	-
			150-160	0.022	-
Corrosion Potential (- mV) At Closest Grid Point	66		170-180	0.028	-
Compressive Strength, MPa					
Background Chloride Content (Note 4.)	0.008	Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Test depths from surface to ~100-110 mm depth from surface exceed OSRM chloride threshold for corrosion initiation of 0.05% chloride content by mass of concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P1				
Location	Pier 8, South Face, Gridpoint S2 (0.6 m below, 0.3 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble	10-20		
Thickness of Concrete, mm	215	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	30				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content	4.3	%
			Specific Surface	23.6	mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor	150.0	µm
Remarks (Note 3.)	No defects in concrete.				

Core No.	P2				
Location	Pier 8, South Face, Gridpoint P2 (0.3 m below, 0 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	190	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-546				
Compressive Strength, MPa	42.0				
		Unit Weight	2370	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P3				
Location	Pier 8, South Face, Gridpoint P2 (0.5 m below, 0 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	90-100	-	12.54
Thickness of Concrete, mm	225				
Defects in Concrete (Note 1.)	None				
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-546				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Core No.	P4				
Location	Pier 8, South Face, Gridpoint G2 (0.6 m below, 0.5 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	110		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	-256				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete, small piece of wood embedded at 30 mm. Hit 20M vertical bar at 115 mm.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P5				
Location	Pier 8, South Face, Gridpoint G2 (0.5 m below, 0.4 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	215	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-256				
Compressive Strength, MPa	57.7				
		Unit Weight	2411	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Core No.	P6				
Location	Pier 8, South Face, Gridpoint C2 (0.8 m below, 0.5 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble	10-20		
Thickness of Concrete, mm	130	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	-698				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content	3.9	%
			Specific Surface	19.0	mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor	207.0	µm
Remarks (Note 3.)	No defects.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P7				
Location	Pier 7, South Face, Gridpoint E2 (0.55 m above, 0.3 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	195	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa	40.4				
		Unit Weight	2392	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete, small bug holes noted.				

Core No.	P8				
Location	Pier 7, South Face, Gridpoint E2 (0.3 m above, 0.3 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	90-100	-	12.54
Thickness of Concrete, mm	190	Chloride Content			
Defects in Concrete (Note 1.)	C				
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Narrow vertical crack 30 mm deep.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P9				
Location	Pier 1, North Face, Gridpoint D2 (0.35 m below, 0.1 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble	10-20		
Thickness of Concrete, mm	260	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-110				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Petrographic examination completed on core, no significant defects noted in core.				

Core No.	P10				
Location	Pier 1, North Face, Gridpoint E2 (0.3 m below, 0 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	210	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-49				
Compressive Strength, MPa	53.4				
		Unit weight (kg/m3)	2391		
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P10A				
Location	Pier 1, North Face, Gridpoint F2 (0.5 m below, 0.4 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	55	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	D		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	-49				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Shallow delamination at 3 - 5 mm deep. Hit 20M horizontal bar at 70 mm.				

Core No.	P11				
Location	Pier 1, North Face, Gridpoint F2 (0.45 m below, 0.2 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	220	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-49				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content	4.1	%
			Specific Surface	22.6	mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor	216.0	µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P12				
Location	Pier 1, North Face, Gridpoint P2 (0.6 m below, 0 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble	10-20		
Thickness of Concrete, mm	180	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	-177				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Hit 20M vertical bar at 105 mm depth.				

Core No.	P13				
Location	Pier 1, North Face, Gridpoint R2 (0.1 m below, 0.18 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	35	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	LR				
Corrosion Potential (- mV) At Closest Grid Point	-166				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Hit snap tie full depth, light rust noted.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P14				
Location	Pier 1, North Face, Gridpoint R2 (0.1 m below, 0.0 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	80	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	-166				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Hit 20M horizontal bar at 85 mm depth.				

Core No.	P15				
Location	Pier 1, North Face, Gridpoint R2 (0.25 m below, 0.15 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	190	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	-166				
Compressive Strength, MPa	43.8				
		Unit Weight	2363	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P16				
Location	Pier 1, North Face, Gridpoint R2 (0.50 m below, 0.15 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	105		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	-166				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Hit 20M vertical rebar at 105 mm depth				

Core No.	P17				
Location	Pier 2, North Face, Gridpoint E2 (0.40 m below, 0.40 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	250		30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
		Chloride Permeability	Sample depth (mm)	Charge Passed (Coulombs)	Chloride Ion Penetrability Rating
Compressive Strength, MPa			23-72	3028	Moderate
			188-237	2843	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P18				
Location	Pier 2, North Face, Gridpoint R2 (0.10 m below, 0.50 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	105	Acid Soluble	10-20		
Thickness of Concrete, mm	215	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	G				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete. Hit 20M vertical bar at 105 mm depth.				

Core No.	P19				
Location	Pier 2, North Face, Gridpoint F2 (0.30 m below, 0.15 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	220	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P20				
Location	Pier 2, North Face, Gridpoint F2 (0.60 m below, 0.15 m W)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	205	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Core No.	P21				
Location	Pier 2, North Face, Gridpoint P2 (0.10 m below, 0.20 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble	10-20		
Thickness of Concrete, mm	235	Chloride Content	30-40		
			50-60		
Defects in Concrete (Note 1.)	None		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	TBD				
Compressive Strength, MPa	40.5				
		Unit Weight	2386	kg / m3	
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	No defects in concrete.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

Core No.	P22				
Location	Pier 2, North Side, Gridpoint P2 (0.40 m below, 0.20 m E)				
Full Depth (Y/N)	N		Sample depth (mm)	% by mass of concrete	pH Level
Diameter, mm	70	Acid Soluble Chloride Content	10-20		
Thickness of Concrete, mm	225		30-40		
			50-60		
Defects in Concrete (Note 1.)	C		80-90		
			100-110		
			140-150		
Condition of Rebar (Note 2.)	N/A				
Corrosion Potential (- mV) At Closest Grid Point	N/A				
Compressive Strength, MPa					
Background Chloride Content (Note 4.)		Air Void Analysis	Air Content		%
			Specific Surface		mm2 / mm3
Testing Laboratory	Stantec		Spacing Factor		µm
Remarks (Note 3.)	Hairline vertical crack 50 mm deep.				

Notes

1. Defects - C = Cracked, D = Delamination, R = Rough, Sc = Scaling
2. Condition of Rebar - LR = Light Rust, SR = Severe Rust, N/A No Rebar Exposed, G = Good
3. Orientation of Rebar - T = Transverse, L = Longitudinal
4. Chloride contents shall be stated as % by Mass of Concrete

APPENDIX O.5: SUBSTRUCTURE CONDITION ASSESSMENT

LABORATORY TEST RESULTS

Stantec Consulting Ltd.
199 Henlow Bay, Winnipeg MB R3Y 1G4

October 18, 2022
File: 123315654

Attention: Mr. Troy Hengen
Morrison Hershfield
Unit 1 – 59 Scurfield Boulevard
Winnipeg, MB R3Y 1V2

Good day Troy,

Reference: St. Vital Bridge Deck Core Testing

On July 15, 2022, thirty-two(32) core samples were submitted to our laboratory for testing. It was reported that the core samples were obtained from piers and abutments of the St. Vital Bridge over the Red River in Winnipeg, Manitoba. The testing performed and the corresponding results for each core sample are identified below.

COMPRESSIVE STRENGTH

Ten (10) core samples were tested for compressive strength in accordance with *CSA A23.2-14C; Obtaining and Testing Drilled Cores for Compressive Strength*. The core samples were conditioned in water at room temperature for 48 hours prior to testing.

The compressive strength results ranged from 40.5 to 73.5 MPa with an average of 48.8 MPa. A summary of the compressive strength test data is provided in **Appendix A, Table 1**.

AIR VOID PARAMETERS IN HARDENED CONCRETE

Nine (9) core samples were tested of air void parameters in accordance with the modified linear point count method outlined in ASTM C457; Test Method for Microscopical Determination of Parameters of the Air Void System in Hardened Concrete.

The total air content of the core samples ranged from 3.0 to 7.8% with an average of 5.0%. The spacing factor ranged from 96 to 229 µm with an average of 169 µm. The test results comply with CSA A23.1-19 specification limits for frost resistant concrete. A summary of the air void parameter test data is provided in **Appendix B, Table 2**.

RAPID CHLORIDE PENETRABILITY

Two (2) core samples were tested for chloride ion penetrability in accordance with CSA A23.2-23C; Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

The total charge passing the two core samples were 168 to 3028 coulombs resulting in a chloride ion penetrability rating of very low and moderate, respectively. The chloride ion penetrability test data is provided in **Appendix C, Table 3a** and **3b**.

Reference: **St. Vital Bridge Deck Core Testing**

WATER-SOLUBLE CHLORIDE ION CONTENT & PH LEVEL

Eight (8) core samples were prepared for chloride ion content determination by trimming 10 mm slices at prescribed depth intervals from the surface of the core sample. Testing of the 10 mm slices was performed by CARO Analytical Services in accordance with *CSA A23.2-4B; Sampling and Determination of Water-Soluble Chloride Ion Content in Hardened Grout or Concrete*.

Additionally, four (4) of the 10 mm slices were also tested to determine the pH level of the concrete. Testing of the 10 mm slices was also performed by CARO Analytical Services in accordance with *Carter 16.2/SM 4500-H+ B; Determination of pH Value in Solids*.

A summary of the chloride ion content and pH level test data is provided in **Appendix D, Table 3**. A copy of CARO's analytical report is also attached.

PETROGRAPHIC EVALUATION

Two (2) core samples (core nos.P9 and A9) were submitted to Golder Associates in Vancouver, British Columbia where they were examined in accordance with *ASTM G856; Standard Practice for Petrographic Examination of Hardened Concrete*. The petrographic evaluation report found in **Appendix E** provides detailed information on the concrete matrix of the core samples.

CLOSING

We trust the information provided herein meets your requirements. Should you have any questions or require clarification of the contents of this report, please do not hesitate to contact the undersigned.

We appreciate the opportunity to assist you with this assignment.

Regards,

Stantec Consulting Ltd.

Jason Thompson C.E.T.
Principal - Manager, Materials Testing Services
Phone: 204 928 4004
Mobile: 204 981 8445
jason.thompson@stantec.com

Attachment: Appendix A – Compressive Strength Test Data
Appendix B – Air Void Parameter Test Data
Appendix C – Rapid Chloride Penetrability Test Data
Appendix D – Water-Soluble Chloride Ion Content & pH Level Test Data
Appendix E – Petrographic Evaluation Report

c. Bill Ebenspanger – Morrison Hershfield

APPENDIX A

Compressive Strength & Unit Weight Test Data

Stantec

Table 1 - Compressive Strength & Unit Weight Test Data

Stantec Sample No.	Client Core Identification	Unit Weight (kg/m³)	Compressive Strength (MPa)
5042	P2	2370	42.0
5044	P5	2411	57.7
5046	P7	2392	40.4
5049	P10	2391	53.4
5051	P15	2363	43.8
5054	P21	2386	40.5
5056	A2	2364	53.1
5058	A5	2392	41.1
5062	A10	2358	73.5
5063	A12	2391	42.9

APPENDIX B

Air Void Parameters Test Data

Stantec

Table 2 - Air Void Parameters Test Data

Stantec Sample No.	Client Core Identification	Total Air Content (%)	Specific Surface (mm^{-1})	Paste Content (%)	Spacing Factor (µm)
5041	P1	4.3	23.6	15.1	150
5045	P6	3.9	19.0	15.2	207
5050	P11	4.1	22.6	23.1	216
5053	P18	6.2	23.0	20.1	140
5055	A1	4.4	29.8	20.7	152
5057	A4	7.3	28.7	20.2	96
5065	A15	3.0	226	19.0	229
5066-A	A16 (overlay)	7.8	30.7	24.8	103
5066-B	A16 (substrate)	4.0	22.6	25.3	229
CSA limits for frost resistant concrete		**3.0 min**	**---**	**---**	**230 max avg.**

APPENDIX C

Rapid Chloride Ion Penetrability Test Data

Stantec

Table 3a - Rapid Chloride Ion Penetrability Test Data

Test Parameters	Trial 1	Trial 2
Type of specimen	Core	Core
Stantec sample no.	5052	5052
Client core identification	P17	P17
Source of specimen related to structure	Pier 2, North Face	Pier 2, North Face
Curing history	Field	Field
Date tested	July 21, 2022	July 21, 2022
Location of specimen within sample	23 to 72 mm from top of core	188 to 237 mm from top of core
Specimen preparation	Germann's Proove'It	Germann's Proove'It
Charge passed in 6 hours (Coulombs)	3028	2843
Average Total Charge Passed (Coulombs)	**2936**	
Chloride Ion Penetrability Rating	**Moderate**	

CSA A23.2-23C – Chloride Penetrability Rating Based on Charge Passed	
Charge Passed (Coulombs)	**Penetrability Rating**
>4000	High
2000 – 4000	Moderate
1000 – 2000	Low
100 – 1000	Very Low
<100	Negligible

Stantec

Table 3b - Rapid Chloride Ion Penetrability Test Data

Test Parameters	Trial 1	Trial 2
Type of specimen	Core	Core
Stantec sample no.	5060	5060
Client core identification	A8	A8
Source of specimen related to structure	North Abutment	North Abutment
Curing history	Field	Field
Date tested	July 23, 2022	July 23, 2022
Location of specimen within sample	68 to 118 mm from top of core	230 to 280 mm from top of core
Specimen preparation	Germann's Proove'It	Germann's Proove'It
Charge passed in 6 hours (Coulombs)	**168**	**2063**
Chloride Ion Penetrability Rating	**Very Low**	**Moderate**

CSA A23.2-23C – Chloride Penetrability Rating Based on Charge Passed	
Charge Passed (Coulombs)	**Penetrability Rating**
>4000	High
2000 – 4000	Moderate
1000 – 2000	Low
100 – 1000	Very Low
<100	Negligible

Notes:

1. Trial 1 was conducted on a section of the concrete overlay
2. Trial 2 was conducted on a section of the concrete substrate.

APPENDIX D

Water-Soluble Chloride Ion Content & pH Level Test Data

Stantec

Table 4 - Acid-Soluble Chloride Ion Content & pH Level Test Data

Stantec Sample No.	Client Core Identification	Sample Depth (mm)	Acid-Soluble Chloride Content (% by mass of concrete)	pH Level
5043	P3	90 to 100	---	12.54
5047	P8	90 to 100	---	12.54
5067	A17	10 to 20	0.224	---
		30 to 40	0.130	---
		50 to 60	0.088	---
		70 to 80	0.062	---
		90 to 100	0.085	---
		110 to 120	0.060	---
		130 to 140	0.080	---
		150 to 160	0.128	---
		170 to 180	0.320	---
		190 to 200	0.206	---
		210 to 220	0.208	---
		240 to 250	0.132	---
5068	A18	10 to 20	0.380	---
		30 to 40	0.428	---
		50 to 60	0.370	---
		70 to 80	0.220	12.45
		90 to 100	0.188	---
		110 to 120	0.112	---
		130 to 140	0.066	---
		150 to 160	**0.025**	---
		170 to 180	0.030	---
5069	A19	10 to 20	0.597	---
		30 to 40	0.634	---
		50 to 60	0.455	---
		70 to 80	0.153	---
		90 to 100	0.148	---
		110 to 120	0.144	---
		130 to 140	0.085	---
		150 to 160	0.058	---
		170 to 180	0.037	---

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Stantec Sample No.	Client Core Identification	Sample Depth (mm)	Acid-Soluble Chloride Content (% by mass of concrete)	pH Level
5070	A20	10 to 20	0.323	---
		30 to 40	0.194	---
		50 to 60	0.303	---
		70 to 80	0.097	12.52
		90 to 100	0.050	---
		110 to 120	0.030	---
		130 to 140	0.029	---
5071	A21	10 to 20	0.296	---
		30 to 40	0.344	---
		50 to 60	0.224	---
		70 to 80	0.155	---
		90 to 100	0.065	---
		110 to 120	0.038	---
		130 to 140	0.026	---
		150 to 160	**<0.020**	---
		170 to 180	0.026	---
5072	A22	10 to 20	0.375	---
		30 to 40	0.370	---
		50 to 60	0.263	---
		70 to 80	0.143	---
		90 to 100	0.084	---
		110 to 120	0.034	---
		130 to 140	0.028	---
		150 to 160	**0.022**	---
		170 to 180	0.028	---

Notes:

1. The chloride threshold necessary to permit corrosion in the reinforcing steel with the presence of oxygen and water must be greater than 0.025% by mass of concrete (in accordance with OSRM manual, April 2007)
2. All results noted in the Table above exceeded this threshold, with the exception of the 3 highlighted results in Green font.

CERTIFICATE OF ANALYSIS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg) 199 Henlow Bay Winnipeg, MB R3Y 1G4		
ATTENTION	Jason Thompson, C.E.T	**WORK ORDER**	22G3842
PO NUMBER		**RECEIVED / TEMP**	2022-07-27 15:40 / 29.0°C
PROJECT	123315654	**REPORTED**	2022-08-08 12:14
PROJECT INFO		**COC NUMBER**	No #

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at nyipp@caro.ca

Authorized By:

Nicole Yipp
Client Service Team Lead

TEST RESULTS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

Analyte	Result	RL	Units	Analyzed	Qualifier
5067 10 - 20 mm (22G3842-01) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.224**	0.020	%	2022-08-02	
5067 30 - 40 mm (22G3842-02) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.130**	0.020	%	2022-08-02	
5067 50 - 60 mm (22G3842-03) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.088**	0.020	%	2022-08-02	
5067 70 - 80 mm (22G3842-04) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.062**	0.020	%	2022-08-02	
5067 90 - 100 mm (22G3842-05) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.085**	0.020	%	2022-08-02	
5067 110 - 120 mm (22G3842-06) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.060**	0.020	%	2022-08-02	
5067 130 - 140 mm (22G3842-07) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.080**	0.020	%	2022-08-02	
5067 150 - 160 mm (22G3842-08) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.128**	0.020	%	2022-08-02	
5067 170 - 180 mm (22G3842-09) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.320**	0.020	%	2022-08-02	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

Analyte	Result	RL	Units	Analyzed	Qualifier
5067 190 - 200 mm (22G3842-10) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.206**	0.020	%	2022-08-02	
5067 210 - 220 mm (22G3842-11) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.208**	0.020	%	2022-08-02	
5067 240 - 250 mm (22G3842-12) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.132**	0.020	%	2022-08-02	
5068 10 - 20 mm (22G3842-13) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.380**	0.020	%	2022-08-02	
5068 30 - 40 mm (22G3842-14) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.428**	0.020	%	2022-08-02	
5068 50 - 60 mm (22G3842-15) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.370**	0.020	%	2022-08-02	
5068 70 - 80 mm (22G3842-16) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
pH	**12.45**	0.10	pH units	2022-08-04	
Chloride, Acid-Soluble	**0.220**	0.020	%	2022-08-02	
5068 90 - 100 mm (22G3842-17) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.188**	0.020	%	2022-08-02	
5068 110- 120 mm (22G3842-18) | Matrix: Solid | Sampled: 2022-07-27					

TEST RESULTS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

Analyte	Result	RL	Units	Analyzed	Qualifier
5068 110- 120 mm (22G3842-18) | Matrix: Solid | Sampled: 2022-07-27, Continued					
General Parameters					
Chloride, Acid-Soluble	**0.112**	0.020	%	2022-08-02	
5068 130- 140 mm (22G3842-19) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.066**	0.020	%	2022-08-04	
5068 150- 160 mm (22G3842-20) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.025**	0.020	%	2022-08-04	
5068 170- 180 mm (22G3842-21) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.030**	0.020	%	2022-08-04	
5069 10- 20 mm (22G3842-22) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.597**	0.020	%	2022-08-04	
5069 30- 40 mm (22G3842-23) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.634**	0.020	%	2022-08-04	
5069 50- 60 mm (22G3842-24) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.455**	0.020	%	2022-08-04	
5069 70- 80 mm (22G3842-25) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.153**	0.020	%	2022-08-04	
5069 90- 100 mm (22G3842-26) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.148**	0.020	%	2022-08-04	

TEST RESULTS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

Analyte	Result	RL	Units	Analyzed	Qualifier
5069 110- 120 mm (22G3842-27) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.144**	0.020	%	2022-08-04	
5069 130- 140 mm (22G3842-28) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.085**	0.020	%	2022-08-04	
5069 150- 160 mm (22G3842-29) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.058**	0.020	%	2022-08-04	
5069 170- 180 mm (22G3842-30) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.037**	0.020	%	2022-08-04	
5070 10- 20 mm (22G3842-31) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.323**	0.020	%	2022-08-04	
5070 30- 40 mm (22G3842-32) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.194**	0.020	%	2022-08-04	
5070 50- 60 mm (22G3842-33) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.303**	0.020	%	2022-08-04	
5070 70- 80 mm (22G3842-34) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
pH	**12.52**	0.10	pH units	2022-08-04	
Chloride, Acid-Soluble	**0.097**	0.020	%	2022-08-04	
5070 90- 100 mm (22G3842-35) | Matrix: Solid | Sampled: 2022-07-27					

TEST RESULTS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

Analyte	Result	RL	Units	Analyzed	Qualifier
5070 90- 100 mm (22G3842-35) | Matrix: Solid | Sampled: 2022-07-27, Continued					
General Parameters					
Chloride, Acid-Soluble	**0.050**	0.020	%	2022-08-04	
5070 110- 120 mm (22G3842-36) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.030**	0.020	%	2022-08-04	
5070 130- 140 mm (22G3842-37) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.029**	0.020	%	2022-08-04	
5071 10- 20 mm (22G3842-38) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.296**	0.020	%	2022-08-04	
5071 30- 40 mm (22G3842-39) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.344**	0.020	%	2022-08-04	
5071 50- 60 mm (22G3842-40) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.224**	0.020	%	2022-08-04	
5071 70- 80 mm (22G3842-41) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.155**	0.020	%	2022-08-04	
5071 90- 100 mm (22G3842-42) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.065**	0.020	%	2022-08-04	
5071 110- 120 mm (22G3842-43) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.038**	0.020	%	2022-08-04	

TEST RESULTS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

Analyte	Result	RL	Units	Analyzed	Qualifier
5071 130- 140 mm (22G3842-44) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.026**	0.020	%	2022-08-04	
5071 150- 160 mm (22G3842-45) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	< 0.020	0.020	%	2022-08-04	
5071 170- 180 mm (22G3842-46) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.026**	0.020	%	2022-08-04	
5072 10- 20 mm (22G3842-47) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.375**	0.020	%	2022-08-04	
5072 30- 40 mm (22G3842-48) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.370**	0.020	%	2022-08-04	
5072 50- 60 mm (22G3842-49) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.263**	0.020	%	2022-08-04	
5072 70- 80 mm (22G3842-50) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.143**	0.020	%	2022-08-04	
5072 90- 100 mm (22G3842-51) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.084**	0.020	%	2022-08-04	
5072 110- 120 mm (22G3842-52) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					

TEST RESULTS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

Analyte	Result	RL	Units	Analyzed	Qualifier
5072 110- 120 mm (22G3842-52) | Matrix: Solid | Sampled: 2022-07-27, Continued					
General Parameters, Continued					
Chloride, Acid-Soluble	**0.034**	0.020	%	2022-08-04	
5072 130- 140 mm (22G3842-53) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.028**	0.020	%	2022-08-04	
5072 150- 160 mm (22G3842-54) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.022**	0.020	%	2022-08-04	
5072 170- 180 mm (22G3842-55) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
Chloride, Acid-Soluble	**0.028**	0.020	%	2022-08-04	
5043 90- 100 mm (22G3842-56) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
pH	**12.54**	0.10	pH units	2022-08-04	
5047 90- 100 mm (22G3842-57) | Matrix: Solid | Sampled: 2022-07-27					
General Parameters					
pH	**12.54**	0.10	pH units	2022-08-04	

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

Analysis Description	Method Ref.	Technique	Accredited	Location
Chloride, Acid-Soluble in Solid	ATU TLT-520	HNO3 Extraction / Potentiometric Titration		Richmond
pH in Solid	ASTM D4972-01*	1:1 Soil/Water Slurry / Electrode		Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
%	Percent
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
pH units	pH < 7 = acidic, ph > 7 = basic
ASTM	ASTM International Test Methods

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Stantec Consulting Ltd. (Winnipeg)	**WORK ORDER**	22G3842
PROJECT	123315654	**REPORTED**	2022-08-08 12:14

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B2G3590										
Blank (B2G3590-BLK1)				Prepared: 2022-07-29, Analyzed: 2022-08-02						
Chloride, Acid-Soluble	< 0.020	0.020	%							
Blank (B2G3590-BLK2)				Prepared: 2022-07-29, Analyzed: 2022-08-02						
Chloride, Acid-Soluble	< 0.020	0.020	%							
Blank (B2G3590-BLK3)				Prepared: 2022-07-29, Analyzed: 2022-08-04						
Chloride, Acid-Soluble	< 0.020	0.020	%							
General Parameters, Batch B2H0293										
Duplicate (B2H0293-DUP1)				**Source: 22G3842-16**	Prepared: 2022-08-04, Analyzed: 2022-08-04					
pH	12.50	0.10	pH units		12.45			< 1	20	

APPENDIX E

Petrographic Evaluation Report

PETROGRAPHIC EXAMINATION OF HARDENED CONCRETE

ASTM C856-20

Stantec
199 Henlow Bay
Winnipeg, Manitoba R3Y 1G4

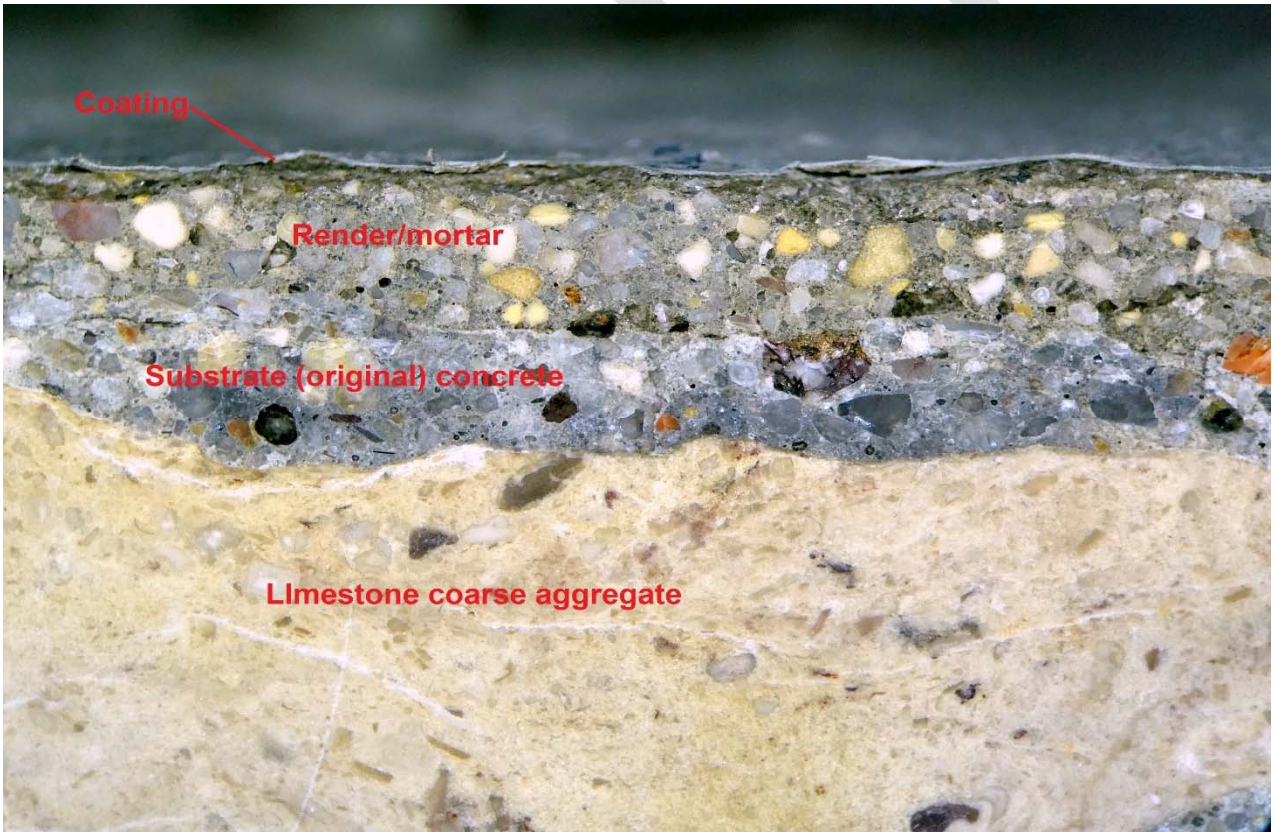
Project number: 20138844.12000
October 16, 2022

Attention: Mr. Kevin Hiraoka, CTech

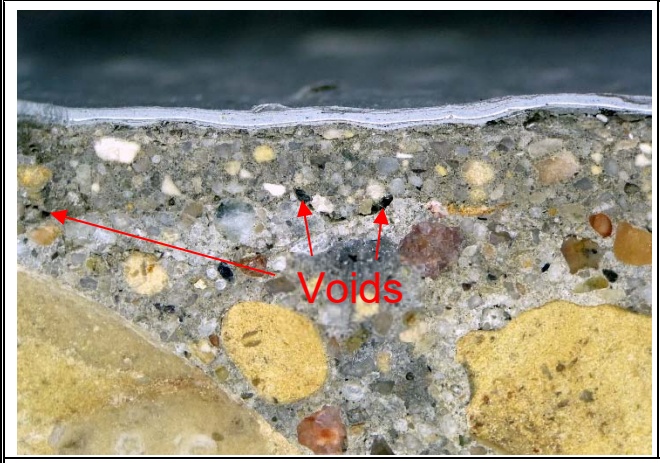
PROJECT:	St. Vital Bridge	Sample	5048

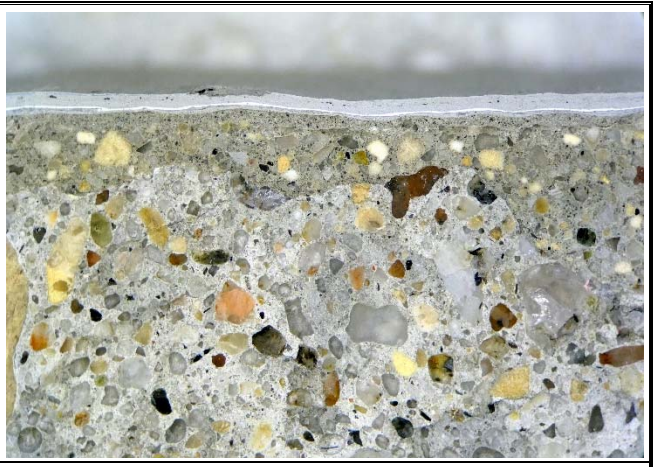
SAMPLE TYPE – GENERAL	The core is 105 mm diameter x 255 mm long. No reinforcing steel was observed.
Aggregate maximum size	30 mm
Aggregate grading	Satisfactory
Concrete consolidation	Concrete is generally dense.
Cement paste	The paste is light cream/beige and moderately hard to firm
Coarse Aggregate	The coarse aggregate is composed of a fluvial (rounded) gravel of multiple lithologies, including limestone, dolomite, granite, gneiss and quartzite.
Fine Aggregate	Fine aggregate is a natural sand made of carbonates, granite, gneiss, quartzite, quartz, feldspar, biotite, garnet and other minerals.
Description	The concrete is well consolidated and generally exhibits good contact between paste and aggregate. Slight cracking observed under magnification at outer face beneath paint coating. In thin-section, these cracks are observed both parallel to surface as well as perpendicular to the surface. Minor carbonated paste is observed in association with micro-cracking, and appears to be limited to the outer 1-2 cm of the sample.
Defects	Very minor parallel-to-surface cracks are observed at outer face, to a depth of 2 cm.

1.View of the sample prior to preparation.	



Profile view at the top/outer surface of the sample coating and render applied at surface. 10x magnification, field of view is about 16 mm across.

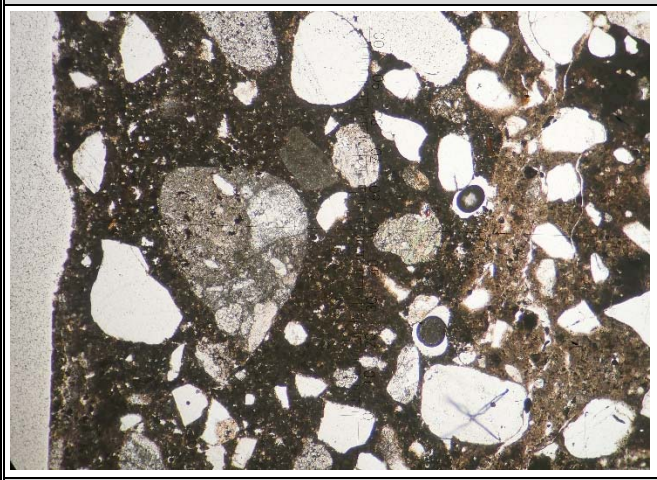


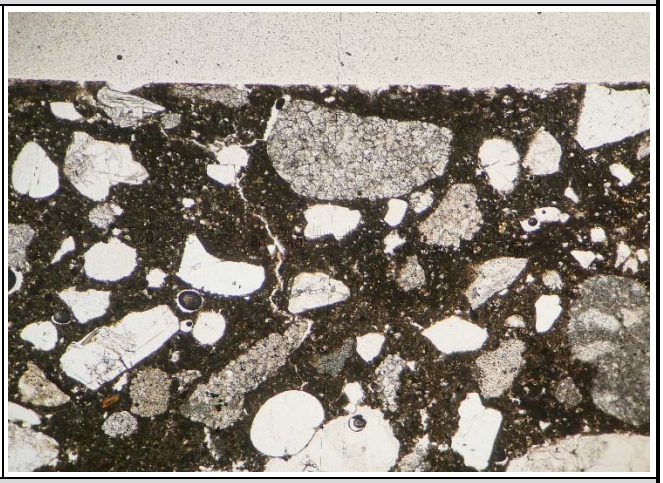


Variable thickness of render is observed. Left image depicts a few voids within and at bottom of render. Magn. 10x, fov = 14 mm

Views at 10x magnification illustrating general condition of paste and aggregates. Field of view is about 13 mm across.

Views at 10x magnification (left) and 30x magnification (right) showing dense paste and good encapsulation of aggregates. Fields of view 13 mm and 2.75 mm across.





Profile views in thin-section (plane polarized light). Left image (top at far left) shows dense paste of render coating over lighter-coloured paste of substrate (lighter brown, cracked). Right image depicts vertical crack passing through render. Both images at 50x magnification, fov = 3 mm.

SUMMARY	Concrete is dense and well-consolidated mix. Paste encapsulation of fine and coarse aggregates is satisfactory. Cracking is observed only on a micro-scale, and appears limited to the upper 1-2 cm of the core. Slightly carbonated/less dense patches of paste observed in upper 1-2 cm.

Petrographer: _____ DATE: October 16, 2022
F. Shrimer, P. Geo.

PETROGRAPHIC EXAMINATION OF HARDENED CONCRETE

ASTM C856-20

Stantec
199 Henlow Bay
Winnipeg, Manitoba R3Y 1G4

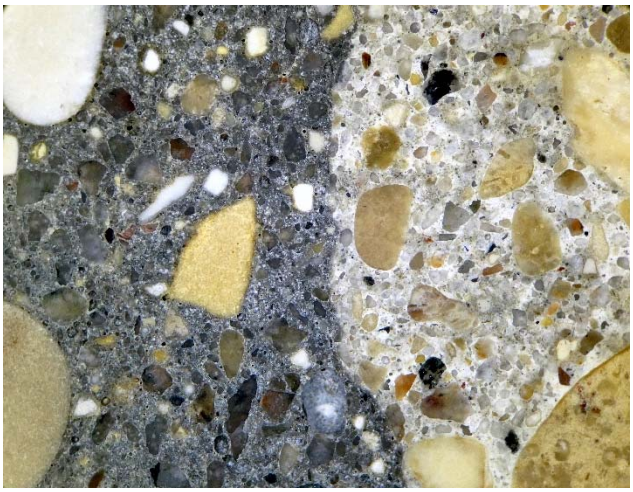
Project number: 20138844.12000
October 16, 2022

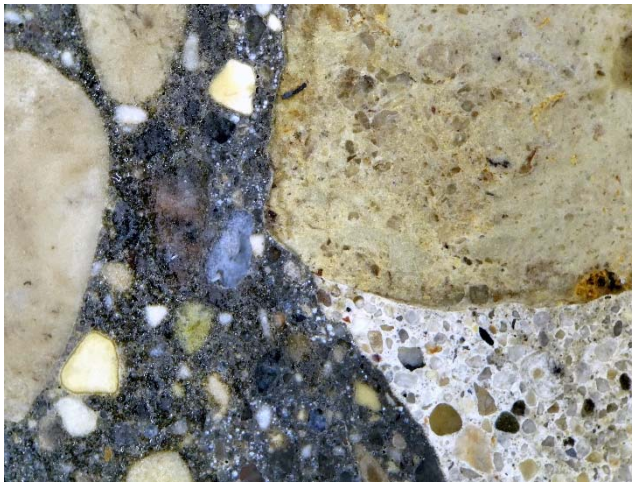
Attention: Mr. Kevin Hiraoka, CTech

PROJECT:	St. Vital Bridge	Sample	5061

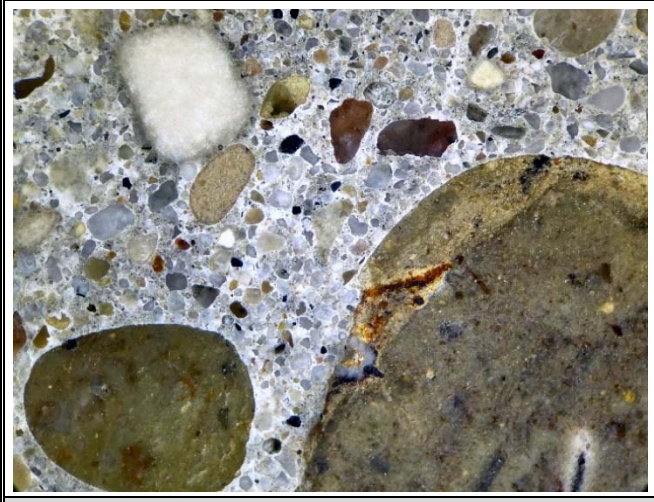
SAMPLE TYPE – GENERAL	Drilled core 105 mm diameter by 255 mm long, consisting of dark grey overlay concrete about 125/140 mm thickness over light-coloured-paste substrate concrete. Uncorroded reinforcing steel bar 19 mm diameter under 40-50 mm cover within the substrate concrete.
Aggregate maximum size	20 mm in substrate; 10 mm in overlay.
Aggregate grading	Satisfactory in both mixes.
Concrete consolidation	Concrete is generally dense in both mixes.
Cement paste	The paste is light cream/beige and moderately hard to firm in the substrate concrete and dark grey and hard in the overlay concrete.
Coarse Aggregate	The coarse aggregates are dominantly carbonates (dolomite and limestone) with minor granitic and gneissic rocks.
Fine Aggregate	Fine aggregate is a natural carbonates, gneiss, quartzite, quartz, feldspar, biotite, garnet and other minerals.
Description	The concrete is well consolidated and generally exhibits good contact between paste and aggregate. .
Defects	

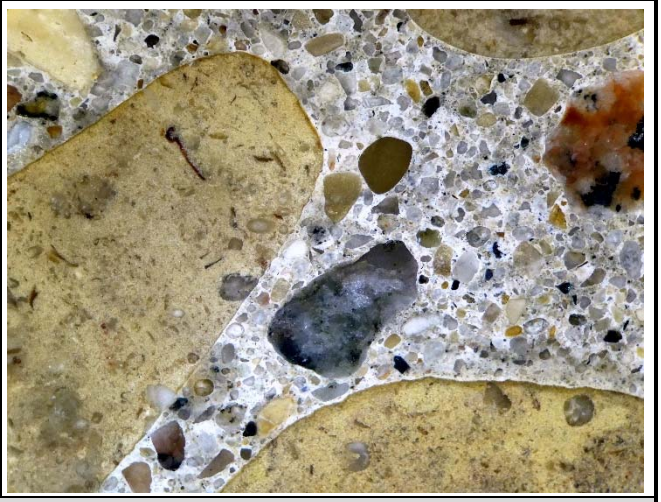
Dark grey paste and small-size aggregate characterize the overlay concrete; the lighter beige paste and larger-size aggregate typify the substrate concrete. Crack at the rebar.



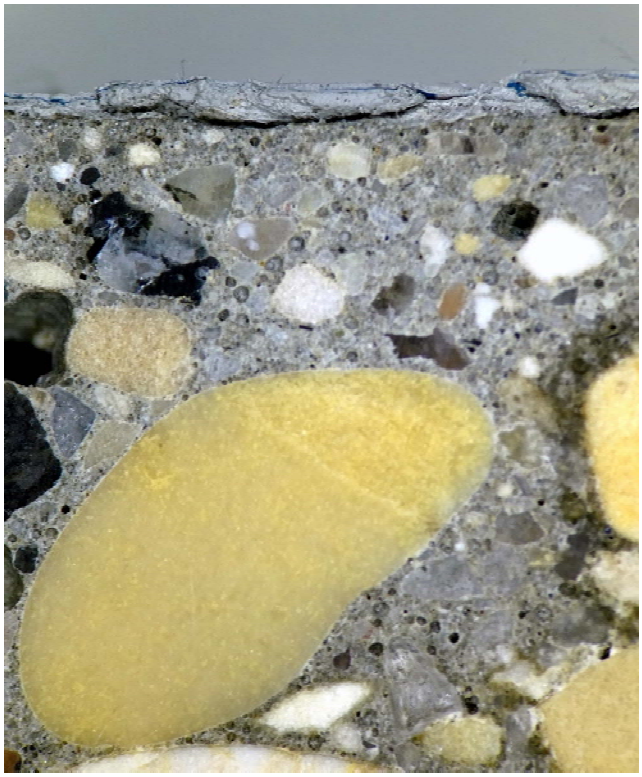


Interface of topping and substrate mixes in both images. Left image at 10x magnification, field of view about 13 mm across, while the right image is at 20x magnification with a field of view of about 8 mm.



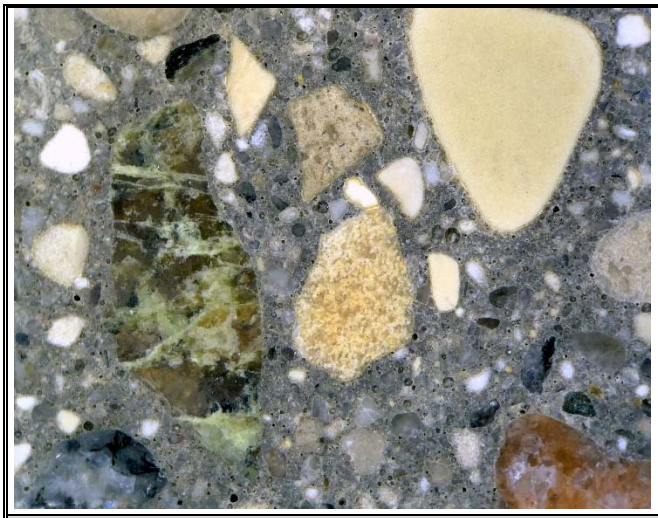


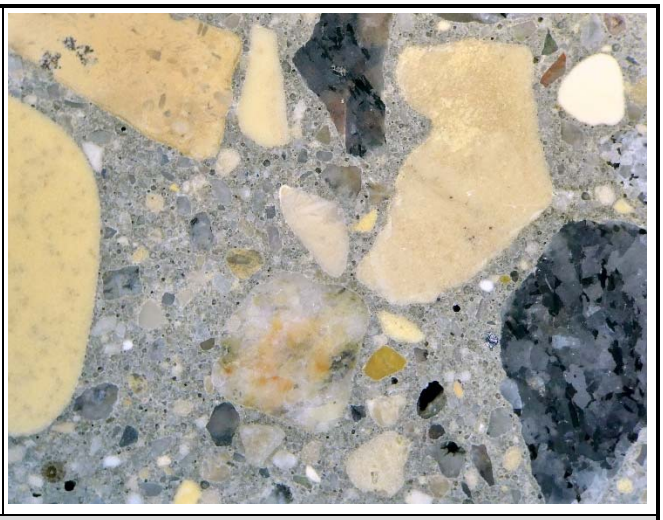
Views at 10x magnification showing typical views of the substrate concrete. Limestone gravel aggregates dominate, with a small amount of granitic and gneissic rock. Mag. 10x, fields of view about 13 mm across.



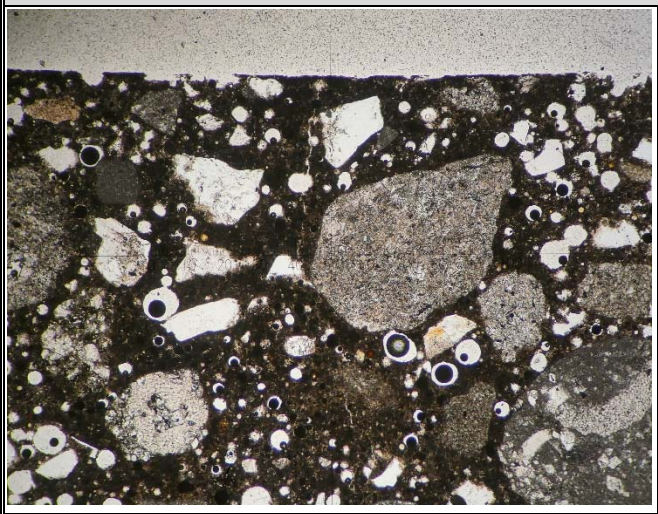
View at 20x magnification of overlay concrete showing dense paste and good encapsulation of aggregate. FOV about 7.5 mm across.

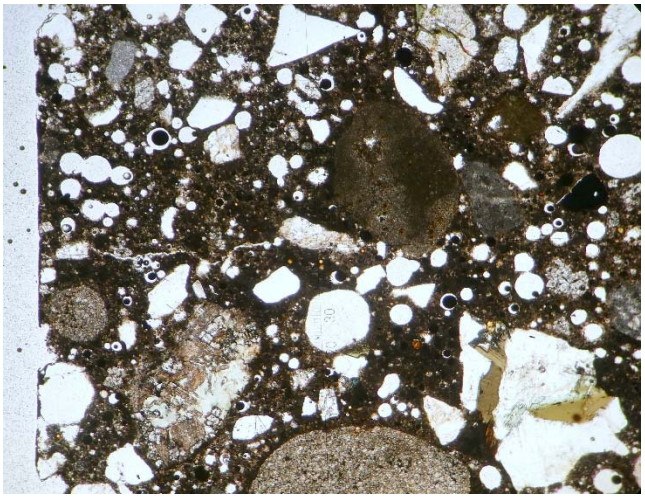
View at 80x magnification showing air voids and fly ash spheres. FOV 2 mm.



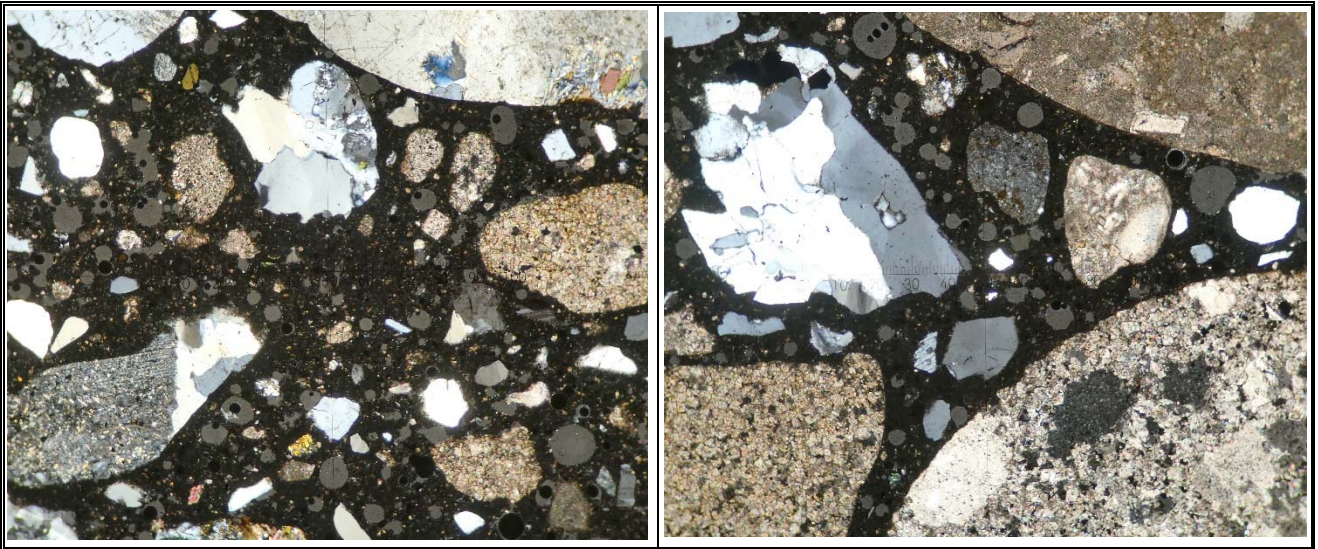


Overlay mix is characterized by dark grey paste. Encapsulation of aggregates is excellent. Magn. 10x.





Thin-section views, seen in plane polarized light, at the top surface of the core illustrating microcracks in the paste. The views are about 3 mm in length, magnification 50x.



Thin-section views, seen in cross-polarized light, illustrating dense paste and an array of rock and mineral types comprising the aggregates. Magn. 50x, fields of view about 3 mm across.

SUMMARY	Good aggregate / paste interface; dense concrete. Minor micro-cracking observed near core surface.

Petrographer: _____ DATE: October 16, 2022
F. Shrimer, P. Geo.

APPENDIX O.6: SUBSTRUCTURE CONDITION ASSESSMENT

RAPID CHLORIDE TEST RESULTS

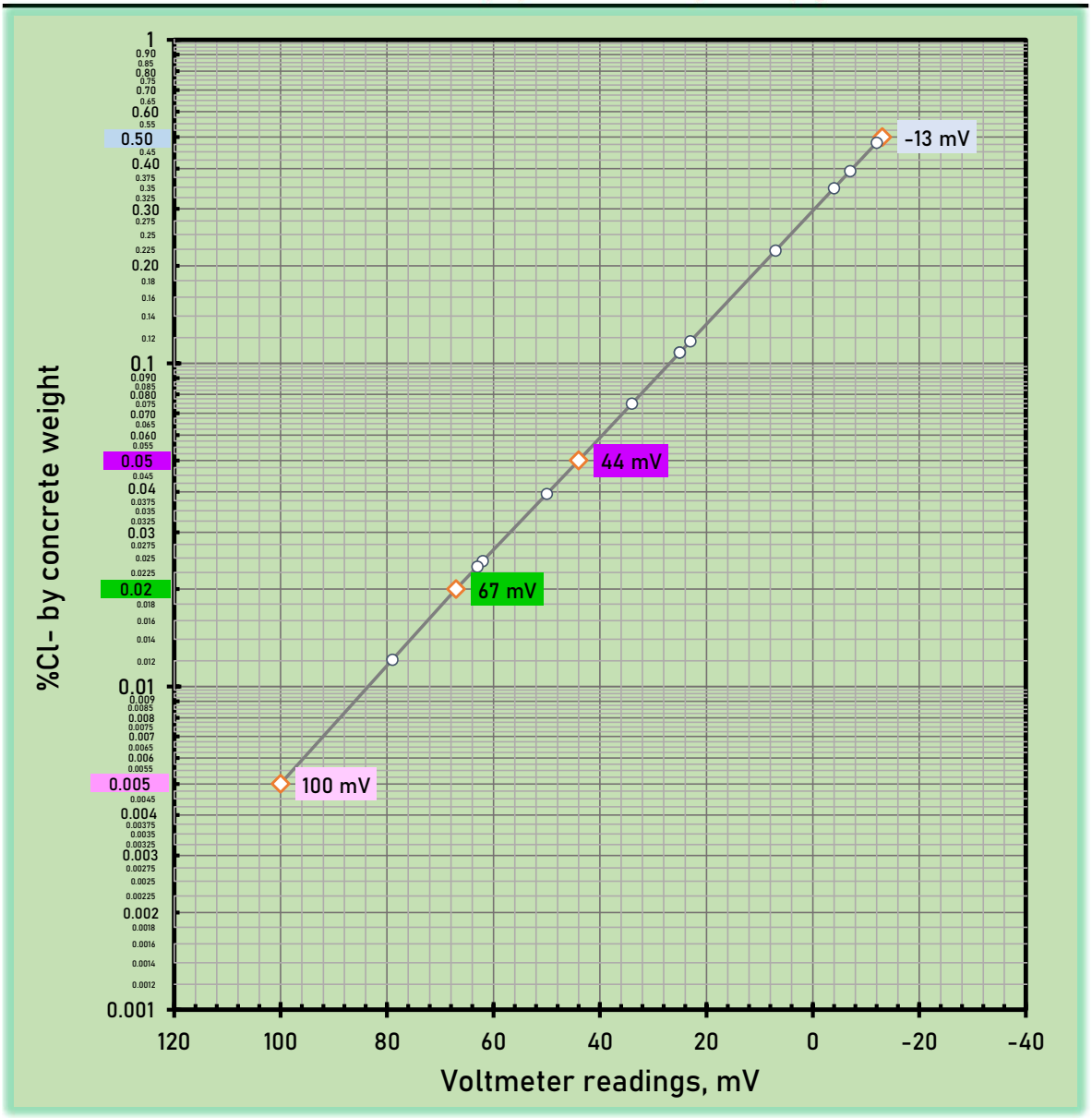
Measurement of the acid soluble chloride content of HARDENED CONCRETE by the RCT method

1.5 gram of concrete dust dissolved in a RCT-1023 vial with 10 ml of extraction liquid

Report #:		Structure:		Project:	**St. Vital Bridge Substructure**
Date:	**8/26/2022**	Electrode #:		Person:	**ALP**
Testing Lab:	**MH**	Phone:		Fax:	
Address:					

Enter the calibration values for the electrode in this table:				
Liquid:	Clear	Purple	Green	Pink
% Cl^- :	0.005	0.020	0.050	0.500
mV :	100	67	44	-13

* The chart below will update automatically when values are captured in the enclosed tables. *
** This chart and tables are prepared for 240 samples on 6 pages. **



Enter Sample no.	Enter mV readings	% Cl^- by concrete weight	Remarks
RCT 1-1	-7	0.392	South Abutment Ballast Wall, NB Lanes, East Bay
RCT 1-2	23	0.117	
RCT 1-3	62	0.024	
RCT 1-4	79	0.012	
RCT 2-1	25	0.108	South Abutment Wall, NB Lanes, East Bay
RCT 2-2	-4	0.348	
RCT 2-3	25	0.108	
RCT 2-4	50	0.039	
RCT 3-1	-12	0.480	South Abutment Ballast Wall, NB Lanes, Middle Bay
RCT 3-2	7	0.223	
RCT 3-3	34	0.075	
RCT 3-4	63	0.023	

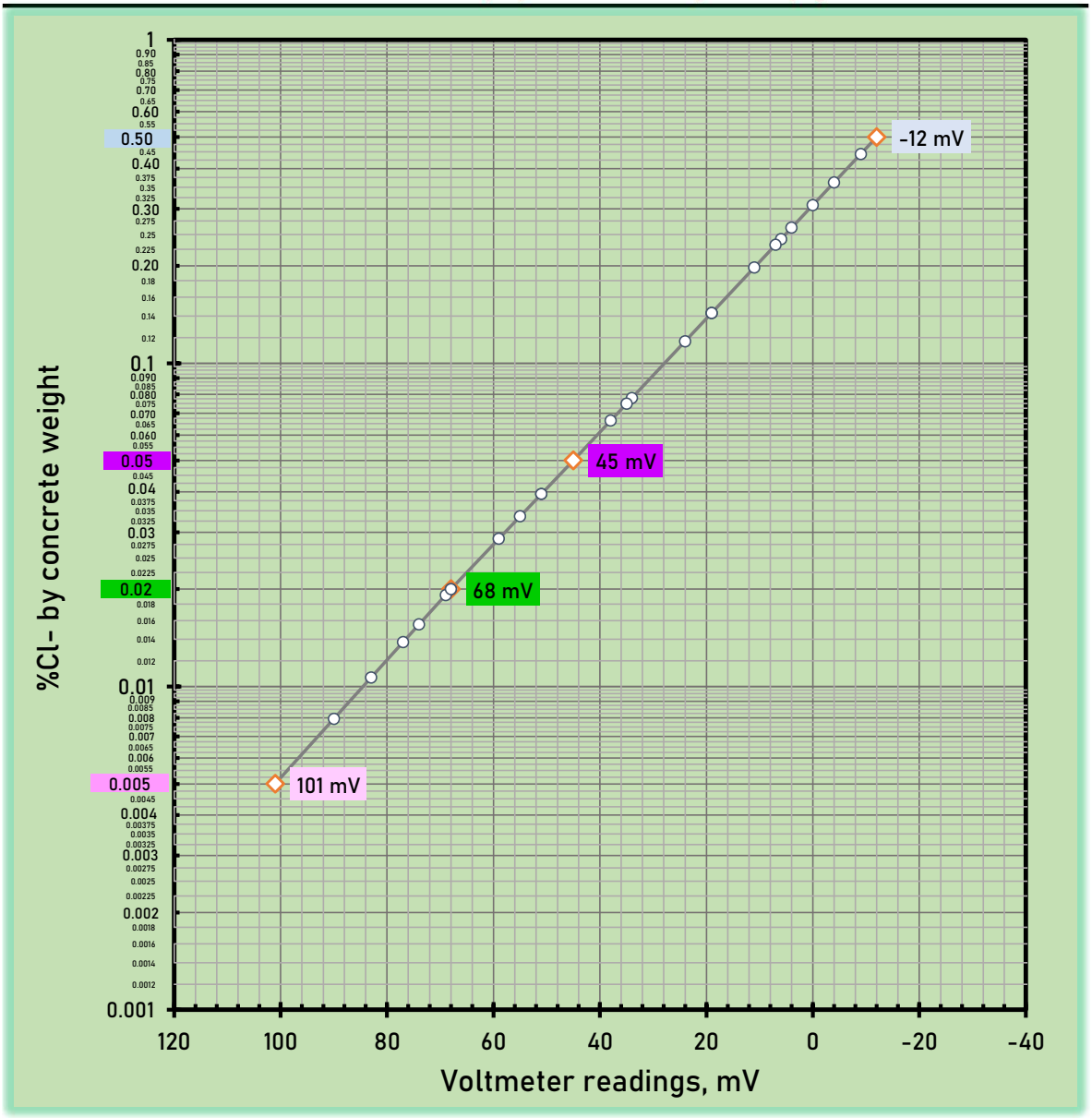
Measurement of the acid soluble chloride content of HARDENED CONCRETE by the RCT method

1.5 gram of concrete dust dissolved in a RCT-1023 vial with 10 ml of extraction liquid

Report #:		Structure:		Project:	**St. Vital Bridge Substructure**
Date:	**8/30/2022**	Electrode #:		Person:	**ALP**
Testing Lab:	**MH**	Phone:		Fax:	
Address:					

Enter the calibration values for the electrode in this table:				
Liquid:	Clear	Purple	Green	Pink
% Cl^- :	0.005	0.020	0.050	0.500
mV :	101	68	45	-12

* The chart below will update automatically when values are captured in the enclosed tables. *
** This chart and tables are prepared for 240 samples on 6 pages. **



Enter Sample no.	Enter mV readings	% Cl⁻ by concrete weight	Remarks
RCT 4-1	-9	0.443	South Abutment Wall, NB Lanes, Middle Bay
RCT 4-2	0	0.308	
RCT 4-3	38	0.066	
RCT 4-4	55	0.034	
RCT 5-1	-4	0.362	South Abutment Ballast Wall, NB Lanes, West Bay
RCT 5-2	19	0.143	
RCT 5-3	68	0.020	
RCT 5-4	90	0.008	
RCT 6-1	34	0.078	South Abutment Wall, NB Lanes, West Bay
RCT 6-2	6	0.242	
RCT 6-3	35	0.075	
RCT 6-4	59	0.029	
RCT 7-1	19	0.143	South Abutment Ballast Wall, SB Lanes, East Bay
RCT 7-2	24	0.117	
RCT 7-3	69	0.019	
RCT 7-4	74	0.016	
RCT 8-1	7	0.232	South Abutment Wall, SB Lanes, East Bay
RCT 8-2	4	0.262	
RCT 8-3	51	0.039	
RCT 8-4	68	0.020	
RCT 9-1	11	0.197	South Abutment Ballast Wall, SB Lanes, Middle Bay
RCT 9-2	51	0.039	
RCT 9-3	77	0.014	
RCT 9-4	83	0.011	

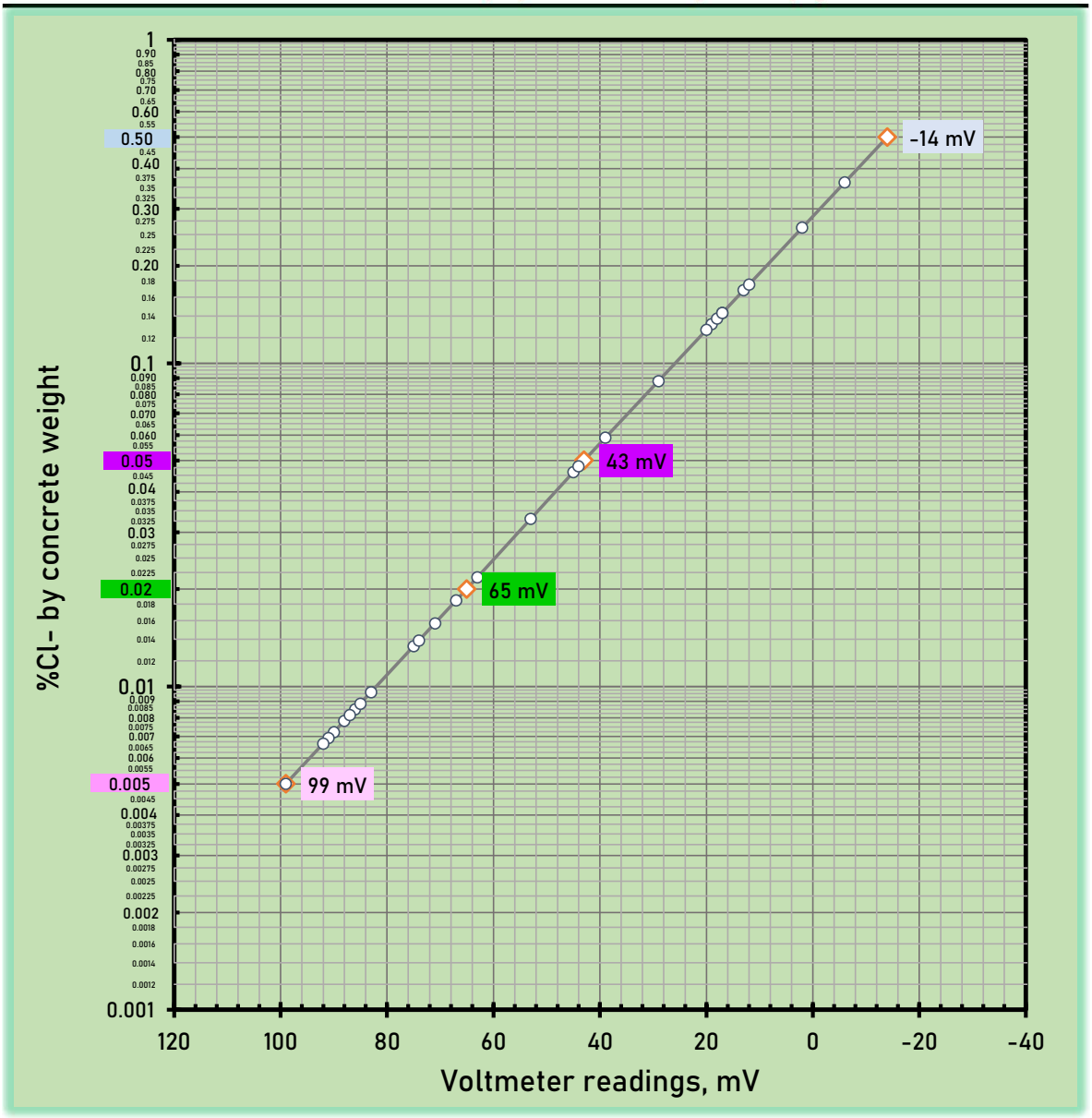
Measurement of the acid soluble chloride content of HARDENED CONCRETE by the RCT method

1.5 gram of concrete dust dissolved in a RCT-1023 vial with 10 ml of extraction liquid

Report #:		Structure:		Project:	**St. Vital Bridge Substructure**
Date:	**8/31/2022**	Electrode #:		Person:	**ALP**
Testing Lab:	**MH**	Phone:		Fax:	
Address:					

Enter the calibration values for the electrode in this table:				
Liquid:	Clear	Purple	Green	Pink
% Cl^- :	0.005	0.020	0.050	0.500
mV :	99	65	43	-14

* The chart below will update automatically when values are captured in the enclosed tables. *
** This chart and tables are prepared for 240 samples on 6 pages. **



Enter Sample no.	Enter mV readings	% Cl^- by concrete weight	Remarks
RCT 11-1	-6	0.362	South Abutment Ballast Wall, SB Lanes, West Bay
RCT 11-2	45	0.046	
RCT 11-3	86	0.008	
RCT 11-4	90	0.007	
RCT 13-1	2	0.262	North Abutment Ballast Wall, NB Lanes, East Bay
RCT 13-2	19	0.132	
RCT 13-3	17	0.143	
RCT 13-4	44	0.048	
RCT 15-1	18	0.137	North Abutment Ballast Wall, NB Lanes, Middle Bay
RCT 15-2	71	0.016	
RCT 15-3	88	0.008	
RCT 15-4	91	0.007	
RCT 17-1	75	0.013	North Abutment Ballast Wall, NB Lanes, West Bay
RCT 17-2	99	0.005	
RCT 17-3	85	0.009	
RCT 17-4	87	0.008	
RCT 19-1	13	0.168	North Abutment Ballast Wall, SB Lanes, East Bay
RCT 19-2	12	0.175	
RCT 19-3	63	0.022	
RCT 19-4	74	0.014	
RCT 21-1	17	0.143	North Abutment Ballast Wall, SB Lanes, Middle Bay
RCT 21-2	20	0.127	
RCT 21-3	83	0.010	
RCT 21-4	92	0.007	
RCT 23-1	29	0.088	North Abutment Ballast Wall, SB Lanes, West Bay
RCT 23-2	39	0.059	
RCT 23-3	53	0.033	
RCT 23-4	67	0.018	

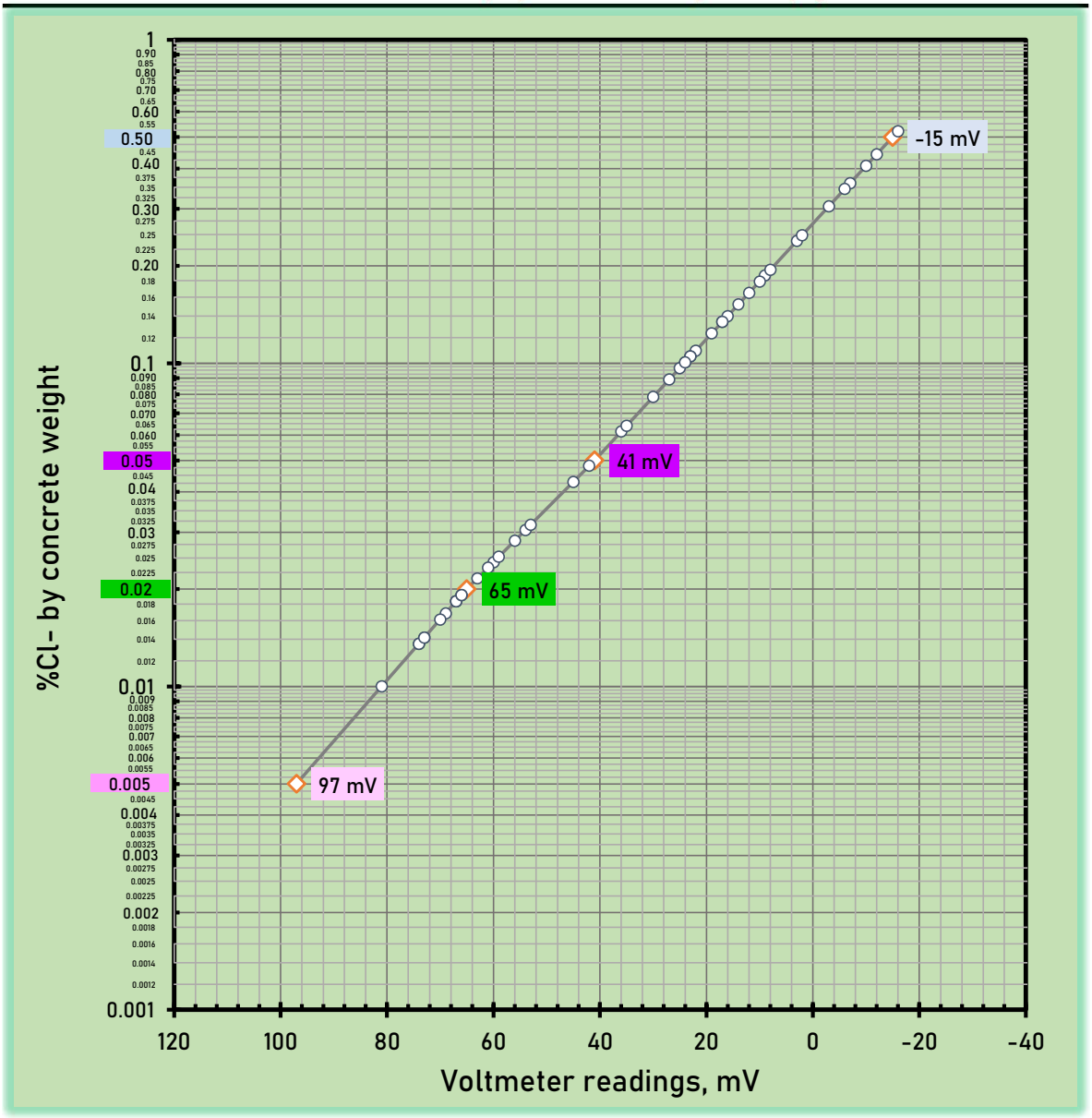
Measurement of the acid soluble chloride content of HARDENED CONCRETE by the RCT method

1.5 gram of concrete dust dissolved in a RCT-1023 vial with 10 ml of extraction liquid

Report #:		Structure:		Project:	**St. Vital Bridge Substructure**
Date:	**9/1/2022**	Electrode #:		Person:	**ALP**
Testing Lab:	**MH**	Phone:		Fax:	
Address:					

Enter the calibration values for the electrode in this table:				
Liquid:	Clear	Purple	Green	Pink
% Cl^- :	0.005	0.020	0.050	0.500
mV :	97	65	41	-15

* The chart below will update automatically when values are captured in the enclosed tables. *
** This chart and tables are prepared for 240 samples on 6 pages. **



Enter Sample no.	Enter mV readings	% Cl^- by concrete weight	Remarks
RCT 10-1	-3	0.305	South Abutment Wall, SB Lanes, Middle Bay
RCT 10-2	9	0.186	
RCT 10-3	42	0.048	
RCT 10-4	67	0.018	
RCT 12-1	-7	0.360	South Abutment Wall, SB Lanes, West Bay
RCT 12-2	14	0.152	
RCT 12-3	24	0.101	
RCT 12-4	54	0.030	
RCT 14-1	25	0.097	North Abutment Wall, NB Lanes, East Bay
RCT 14-2	60	0.024	
RCT 14-3	74	0.014	
RCT 14-4	17	0.134	
RCT 14-5	19	0.124	
RCT 16-1	22	0.109	North Abutment Wall, NB Lanes, Middle Bay
RCT 16-2	73	0.014	
RCT 16-3	67	0.018	
RCT 16-4	23	0.105	
RCT 16-5	12	0.165	
RCT 18-1	63	0.022	North Abutment Wall, NB Lanes, West Bay
RCT 18-2	69	0.017	
RCT 18-3	81	0.010	
RCT 18-4	23	0.105	
RCT 18-5	16	0.140	
RCT 20-1	-10	0.407	North Abutment Wall, SB Lanes, East Bay
RCT 20-2	61	0.023	
RCT 20-3	74	0.014	
RCT 20-4	24	0.101	
RCT 20-5	27	0.089	
RCT 22-1	-12	0.442	North Abutment Wall, SB Lanes, Middle Bay
RCT 22-2	3	0.239	
RCT 22-3	36	0.061	
RCT 22-4	56	0.028	
RCT 22-5	73	0.014	
RCT 24-1	-6	0.345	North Abutment Wall, SB Lanes, West Bay
RCT 24-2	-16	0.521	
RCT 24-3	8	0.194	
RCT 24-4	30	0.079	
RCT 24-5	45	0.043	
RCT 25-1	35	0.064	North Abutment, Top of Bearing Seat B/W Structures
RCT 25-2	10	0.179	
RCT 25-3	53	0.032	
RCT 25-4	67	0.018	
RCT 25-5	66	0.019	
RCT 26-1	2	0.249	North Abutment, Top of Bearing Seat B/W Structures
RCT 26-2	17	0.134	
RCT 26-3	59	0.025	
RCT 26-4	66	0.019	
RCT 26-5	70	0.016	

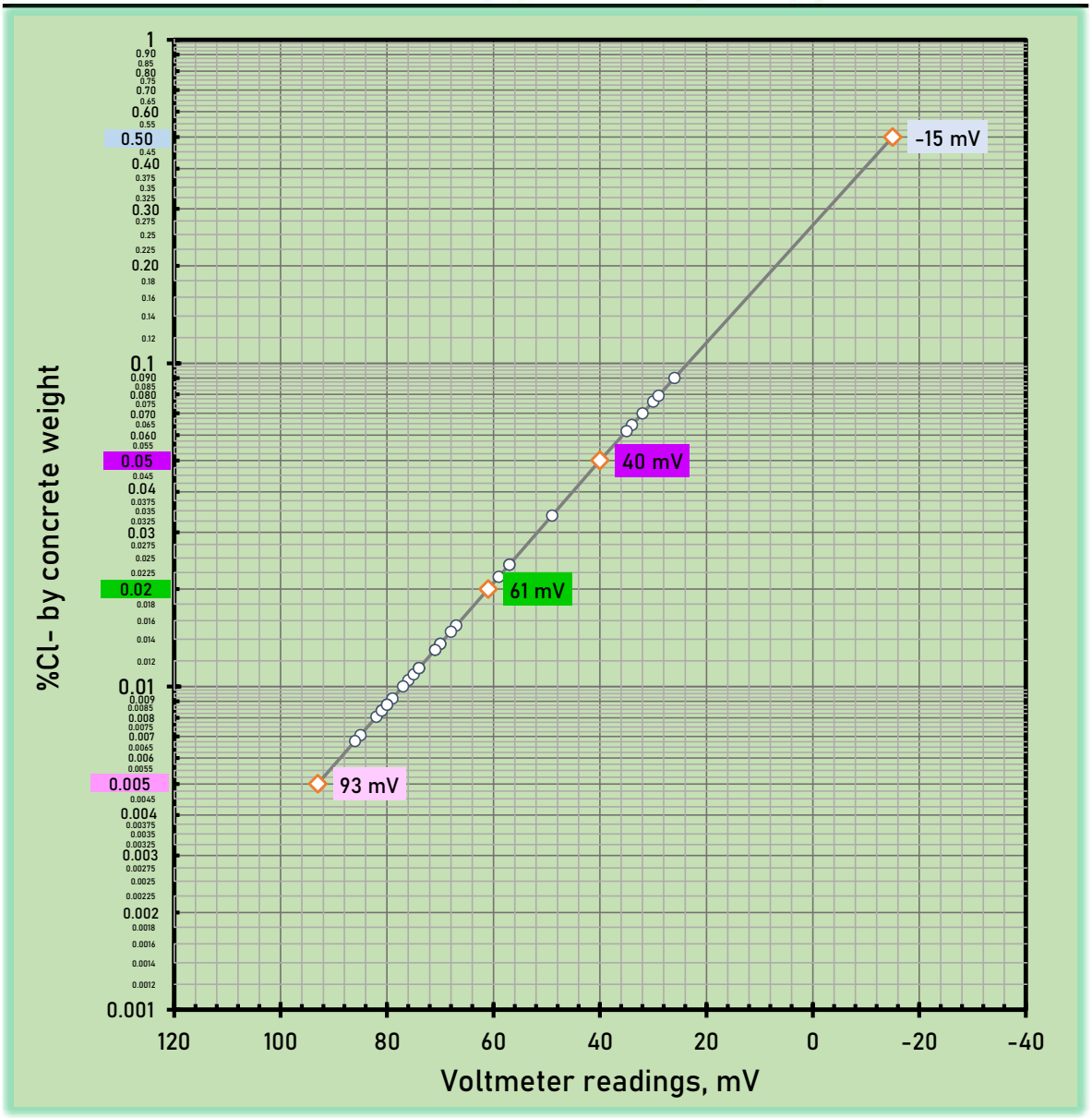
Measurement of the acid soluble chloride content of HARDENED CONCRETE by the RCT method

1.5 gram of concrete dust dissolved in a RCT-1023 vial with 10 ml of extraction liquid

Report #:		Structure:		Project:	**St. Vital Bridge Substructure**
Date:	**9/2/2022**	Electrode #:		Person:	**ALP**
Testing Lab:	**MH**	Phone:		Fax:	
Address:					

Enter the calibration values for the electrode in this table:				
Liquid:	Clear	Purple	Green	Pink
% Cl^- :	0.005	0.020	0.050	0.500
mV :	93	61	40	-15

* The chart below will update automatically when values are captured in the enclosed tables. *
** This chart and tables are prepared for 240 samples on 6 pages. **



Enter Sample no.	Enter mV readings	% Cl^- by concrete weight	Remarks
RCT 27-1	49	0.034	Pier 1, North Face, NB Lanes
RCT 27-2	70	0.014	
RCT 27-3	81	0.008	
RCT 27-4	85	0.007	
RCT 27-5	76	0.010	
RCT 28-1	30	0.076	Pier 1, North Face, NB Lanes
RCT 28-2	57	0.024	
RCT 28-3	71	0.013	
RCT 28-4	67	0.015	
RCT 28-5	79	0.009	
RCT 29-1	34	0.064	Pier 1, North Face, NB Lanes
RCT 29-2	57	0.024	
RCT 29-3	75	0.011	
RCT 29-4	82	0.008	
RCT 30-1	29	0.079	Pier 1, North Face, SB Lanes
RCT 30-2	59	0.022	
RCT 30-3	77	0.010	
RCT 30-4	86	0.007	
RCT 30-5	80	0.009	
RCT 31-1	26	0.090	Pier 1, North Face, SB Lanes
RCT 31-2	35	0.062	
RCT 31-3	70	0.014	
RCT 31-4	81	0.008	
RCT 31-5	68	0.015	
RCT 32-1	32	0.070	Pier 1, North Face, SB Lanes
RCT 32-2	74	0.011	
RCT 32-3	80	0.009	
RCT 32-4	74	0.011	
RCT 32-5	71	0.013	

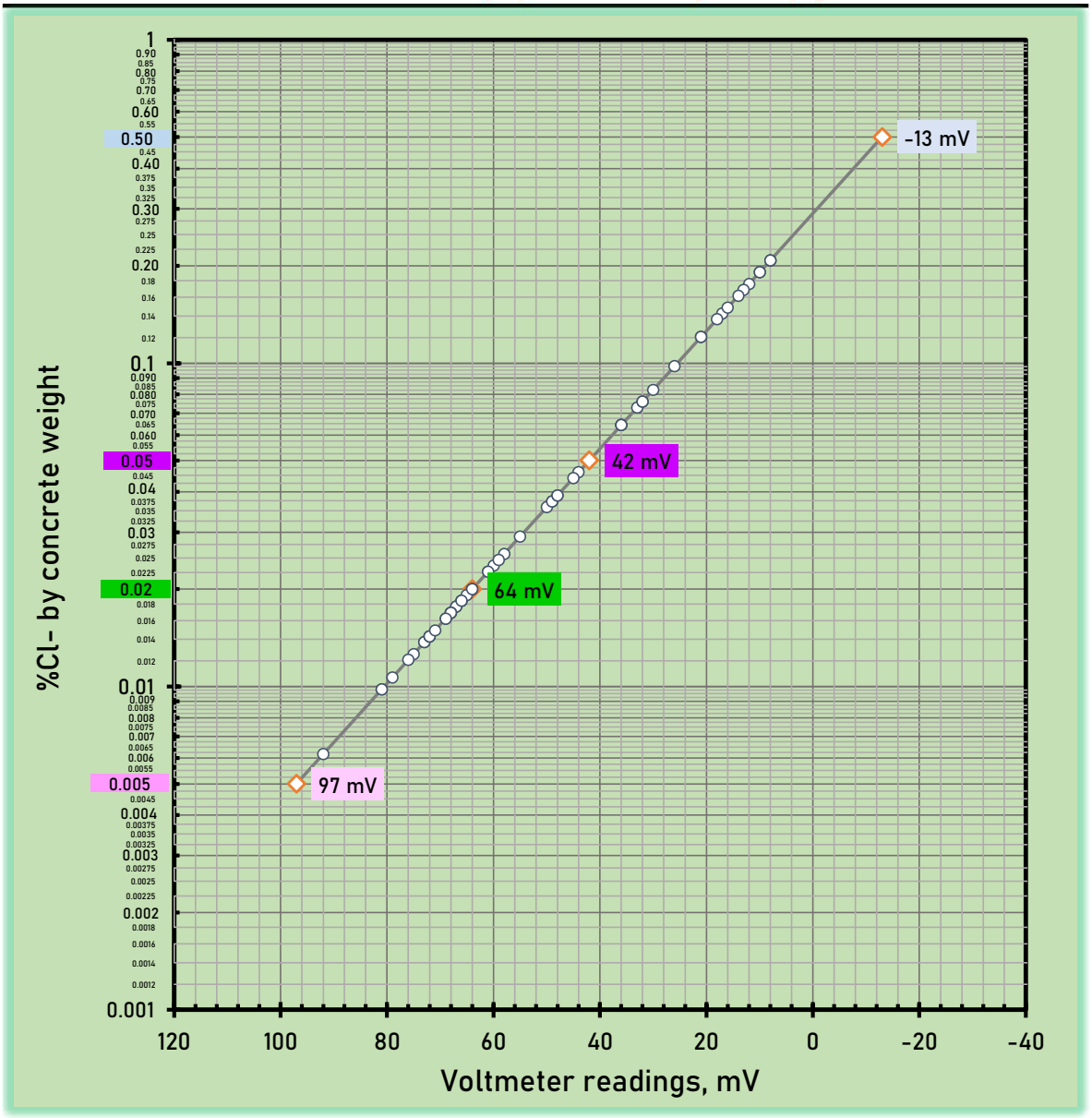
Measurement of the acid soluble chloride content of HARDENED CONCRETE by the RCT method

1.5 gram of concrete dust dissolved in a RCT-1023 vial with 10 ml of extraction liquid

Report #:		Structure:		Project:	**St. Vital Bridge Substructure**
Date:	**9/9/2022**	Electrode #:		Person:	**ALP**
Testing Lab:	**MH**	Phone:		Fax:	
Address:					

Enter the calibration values for the electrode in this table:				
Liquid:	Clear	Purple	Green	Pink
% Cl^- :	0.005	0.020	0.050	0.500
mV :	97	64	42	-13

* The chart below will update automatically when values are captured in the enclosed tables. *
** This chart and tables are prepared for 240 samples on 6 pages. **



Enter Sample no.	Enter mV readings	% Cl^- by concrete weight	Remarks
RCT 29-5	81	0.010	Pier 1, North Face, NB Lanes
RCT 33-1	8	0.208	Pier 8, South Face, NB Lanes
RCT 33-2	21	0.120	
RCT 33-3	44	0.046	
RCT 33-4	61	0.023	
RCT 33-5	75	0.013	
RCT 34-1	17	0.142	Pier 8, South Face, NB Lanes
RCT 34-2	18	0.137	
RCT 34-3	49	0.037	
RCT 34-4	67	0.018	
RCT 34-5	76	0.012	
RCT 35-1	16	0.148	Pier 8, South Face, NB Lanes
RCT 35-2	30	0.083	
RCT 35-3	81	0.010	
RCT 35-4	73	0.014	
RCT 35-5	73	0.014	
RCT 36-1	36	0.064	Pier 8, South Face, SB Lanes
RCT 36-2	58	0.026	
RCT 36-3	64	0.020	
RCT 36-4	68	0.017	
RCT 36-5	92	0.006	
RCT 37-1	33	0.073	Pier 8, South Face, SB Lanes
RCT 37-2	64	0.020	
RCT 37-3	79	0.011	
RCT 37-4	72	0.014	
RCT 37-5	66	0.018	
RCT 38-1	10	0.191	Pier 8, South Face, SB Lanes
RCT 38-2	45	0.044	
RCT 38-3	66	0.018	
RCT 38-4	67	0.018	
RCT 38-5	72	0.014	
RCT 39-1	21	0.120	Pier 5, North Face, B/W Structures
RCT 39-2	50	0.036	
RCT 39-3	55	0.029	
RCT 39-4	64	0.020	
RCT 39-5	68	0.017	
RCT 40-1	12	0.176	Pier 4, South Face, B/W Structures
RCT 40-2	13	0.168	
RCT 40-3	60	0.024	
RCT 40-4	72	0.014	
RCT 40-5	69	0.016	
RCT 41-1	8	0.208	Pier 4, South Face, B/W Structures
RCT 41-2	10	0.191	
RCT 41-3	32	0.076	
RCT 41-4	61	0.023	
RCT 41-5	59	0.025	
RCT 42-1	14	0.161	Pier 4, South Face, B/W Structures
RCT 42-2	49	0.037	

Enter Sample no.	Enter mV readings	% Cl by concrete weight	Remarks
RCT 42-3	65	0.019	
RCT 42-4	36	0.064	
RCT 42-5	71	0.015	
RCT 43-1	26	0.098	Pier 5, North Face, B/W Structures
RCT 43-2	32	0.076	
RCT 43-3	64	0.020	
RCT 43-4	68	0.017	
RCT 43-5	68	0.017	
RCT 44-1	48	0.039	Pier 5, North Face, B/W Structures
RCT 44-2	36	0.064	
RCT 44-3	48	0.039	
RCT 44-4	69	0.016	
RCT 44-5	66	0.018	

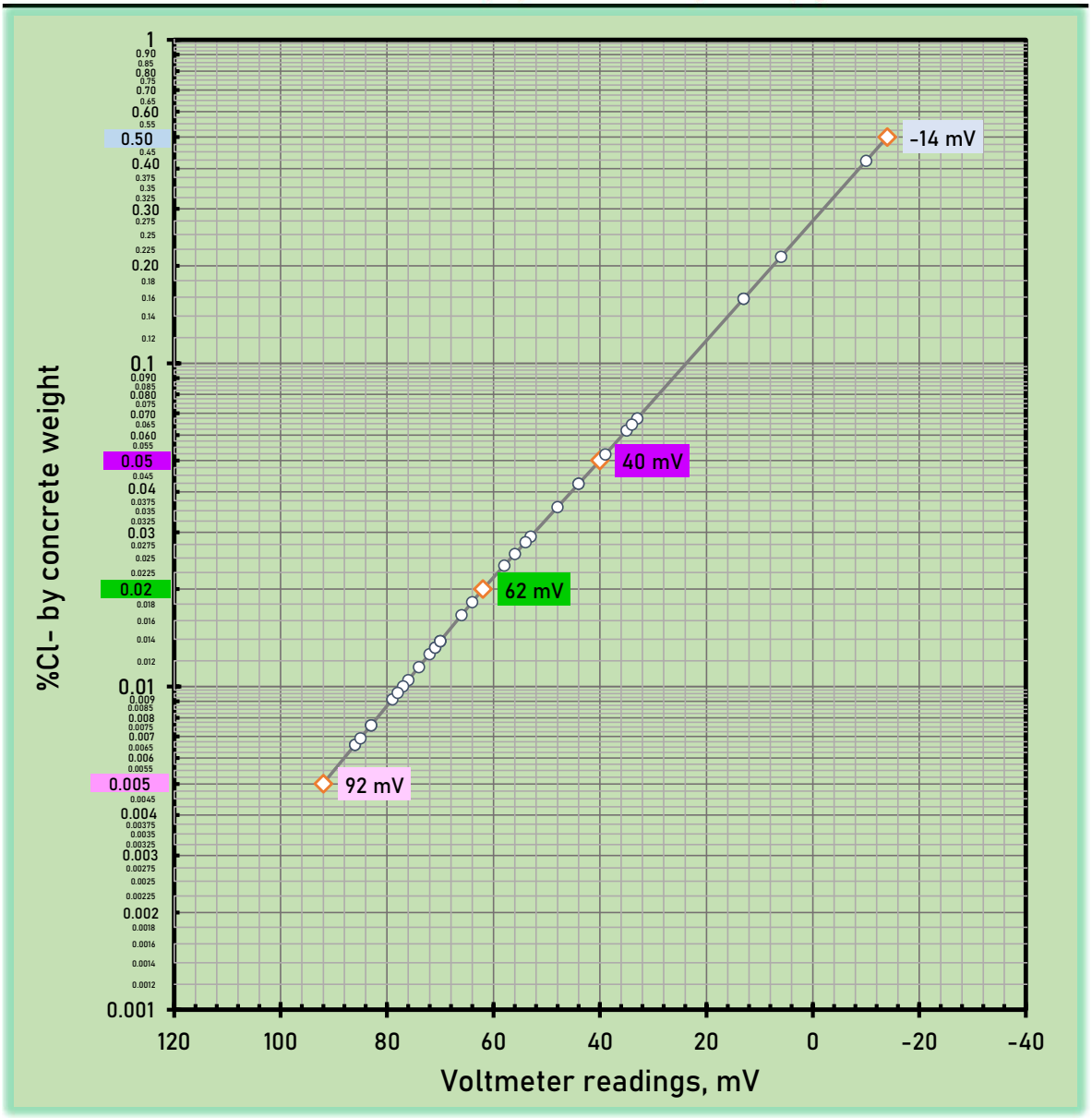
Measurement of the acid soluble chloride content of HARDENED CONCRETE by the RCT method

1.5 gram of concrete dust dissolved in a RCT-1023 vial with 10 ml of extraction liquid

Report #:		Structure:		Project:	**St. Vital Bridge Substructure**
Date:	**9/29/2022**	Electrode #:		Person:	**ALP**
Testing Lab:	**MH**	Phone:		Fax:	
Address:					

Enter the calibration values for the electrode in this table:				
Liquid:	Clear	Purple	Green	Pink
% Cl^- :	0.005	0.020	0.050	0.500
mV :	92	62	40	-14

* The chart below will update automatically when values are captured in the enclosed tables. *
** This chart and tables are prepared for 240 samples on 6 pages. **



Enter Sample no.	Enter mV readings	% Cl^- by concrete weight	Remarks
RCT46-2	74	0.011	South Abutment, B/W Columns 6 & 7
RCT46-3	76	0.010	
RCT46-4	72	0.013	
RCT50-2	53	0.029	South Abutment, Column 10, North Face
RCT50-3	56	0.026	
RCT50-4	39	0.052	
RCT52-2	79	0.009	South Abutment, Column 7, West Face
RCT52-3	77	0.010	
RCT52-4	70	0.014	
RCT54-2	71	0.013	South Abutment, Column 3, North Face
RCT54-3	71	0.013	
RCT54-4	64	0.018	
RCT55-2	33	0.067	South Abutment, Column 2, West Face, Top of Column
RCT55-3	70	0.014	
RCT55-4	44	0.042	
RCT61-2	13	0.158	South Abutment, Column 2, West Face, Bottom of Column
RCT61-3	48	0.036	
RCT61-4	70	0.014	
RCT62-2	54	0.028	North Abutment, Column 2, North Face
RCT62-3	35	0.062	
RCT62-4	34	0.065	
RCT64-2	86	0.007	North Abutment, Column 3, West Face
RCT64-3	86	0.007	
RCT64-4	83	0.008	
RCT66-2	58	0.024	North Abutment, B/W Columns 4 & 5
RCT66-3	66	0.017	
RCT66-4	78	0.010	
RCT69-2	85	0.007	North Abutment, Column 8, West Face
RCT69-3	83	0.008	
RCT69-4	44	0.042	
RCT71-2	-10	0.422	North Abutment, Column 9, East Face
RCT71-3	6	0.213	
RCT71-4	13	0.158	

APPENDIX O.7: SUBSTRUCTURE CONDITION ASSESSMENT

CORROSION POTENTIAL SURVEY RESULTS

CORROSION POTENTIAL TEST

Report Prepared at September 28,2022 10:31 AM

DESCRIPTION

Project Name:	St Vital South Abutment
Date Created:	September 26,2022 2:50 PM
Corrosion Potential Unit	mV/CSE
Length Unit:	cm
Temperature Unit:	℃
Temperature Correction:	On
Number of Nodes (X):	19
Node Spacing (X):	150
Number of Nodes (Y):	3
Node Spacing (Y):	150

Remarks:

Grid Spacing: 1.5 m x 1.5 m grid.

Corrosion Potential Survey Coordinates

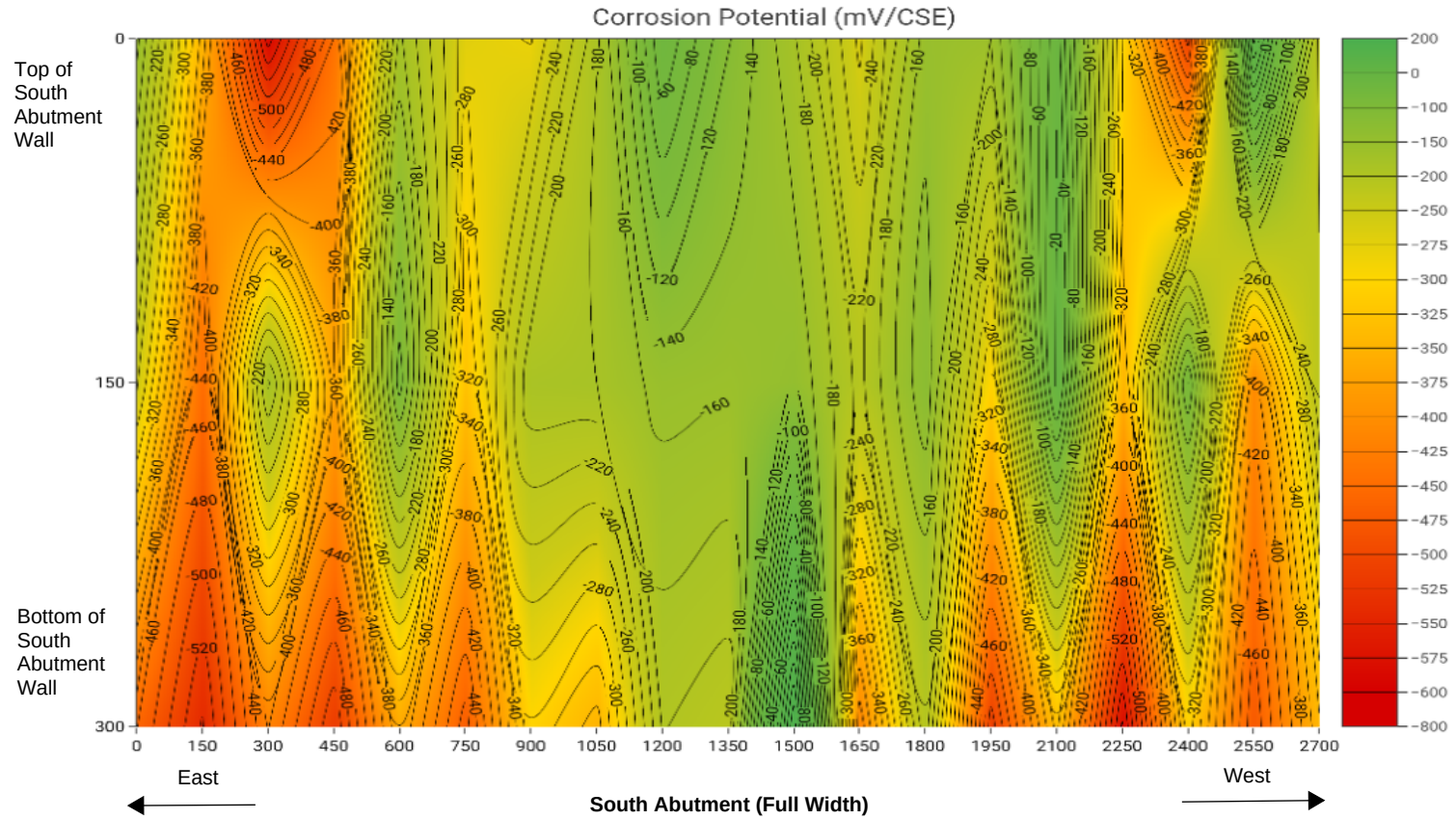
Corrosion potential survey coordinates are given as X and Y coordinates in metres. Y values increase moving from top to bottom on substructure units.

Key Survey Coordinates
0,0 = Top of south abutment wall at east end (in NBL section)
0,3 = Near bottom of south abutment wall at east end (in NBL section)
27,0 = Top of south abutment wall at west end (in SBL section)
27,3 = Near bottom of south abutment wall at west end (in SBL section)

SUMMARY

Range (mV/CSE)	Area (%)
> -350	31.5
-350 to -200	31.5
> -200	37.0

CORROSION POTENTIAL TEST CONTOUR MAP



Report Generated by Giatec iCOR™

Tabulated file in CSV format is enclosed

CORROSION POTENTIAL TEST RESULTS - RAW DATA

X	Y	Corrosion Potential (mV/CSE)	Temperature (°C)	RH	Duration (sec)	Cover (cm)
0	300	-459	17.0	52%	–	–
0	150	-253	17.0	53%	–	–
150	150	-449	17.0	52%	–	–
150	300	-542	16.5	52%	–	–
0	0	-152	16.5	52%	–	–
150	0	-348	16.5	53%	–	–
300	150	-176	16.5	51%	–	–
300	300	-418	16.5	50%	–	–
450	300	-517	16.0	52%	–	–
450	150	-367	16.0	56%	–	–
600	150	-90	16.0	52%	–	–
600	300	-361	16.0	52%	–	–
750	150	-326	16.0	52%	–	–
750	300	-470	16.0	55%	–	–
900	150	-184	16.0	53%	–	–
900	300	-303	16.0	52%	–	–
1050	150	-180	16.0	52%	–	–
1050	300	-350	16.0	52%	–	–
1200	150	-152	16.0	52%	–	–
1200	300	-198	16.5	53%	–	–
300	0	-589	16.5	54%	–	–
450	0	-439	16.0	57%	–	–
600	0	-175	16.5	55%	–	–
750	0	-271	16.5	55%	–	–
900	0	-281	16.5	52%	–	–
1050	0	-186	16.5	53%	–	–
1500	0	-177	17.0	53%	–	–
1650	0	-265	17.0	53%	–	–
1800	0	-151	17.0	52%	–	–
1650	150	-207	17.0	51%	–	–
1500	150	-142	17.0	51%	–	–
1200	0	-41	17.5	54%	–	–
1350	300	-215	17.5	51%	–	–
1500	300	179	17.5	51%	–	–
1350	0	-117	17.5	53%	–	–
1650	300	-415	17.5	50%	–	–
1800	300	-205	17.5	50%	–	–

CORROSION POTENTIAL TEST RESULTS - RAW DATA

1800	150	-124	17.5	50%	–	–
1950	150	-304	17.0	54%	–	–
1950	300	-512	17.0	55%	–	–
2100	150	-5	17.0	51%	–	–
2100	300	-333	17.0	52%	–	–
2250	150	-345	17.0	55%	–	–
2250	300	-583	16.5	53%	–	–
2400	150	-79	16.5	51%	–	–
2400	300	-308	16.5	51%	–	–
2550	150	-406	16.5	51%	–	–
2550	300	-475	16.5	55%	–	–
2700	150	-214	16.5	52%	–	–
2100	0	-25	16.5	52%	–	–
2250	0	-300	16.5	54%	–	–
2400	0	-508	16.5	52%	–	–
2550	0	66	17.0	52%	–	–
2700	0	-227	17.5	52%	–	–

CORROSION POTENTIAL TEST

Report Prepared at September 28,2022 10:31 AM

DESCRIPTION

Project Name:	St Vital Pier 1 NBL
Date Created:	September 27,2022 3:30 PM
Corrosion Potential Unit	mV/CSE
Length Unit:	cm
Temperature Unit:	℃
Temperature Correction:	On
Number of Nodes (X):	7
Node Spacing (X):	150
Number of Nodes (Y):	3
Node Spacing (Y):	150

Remarks:

Grid Spacing: 1.5 m x 1.5 m grid.

Corrosion Potential Survey Coordinates

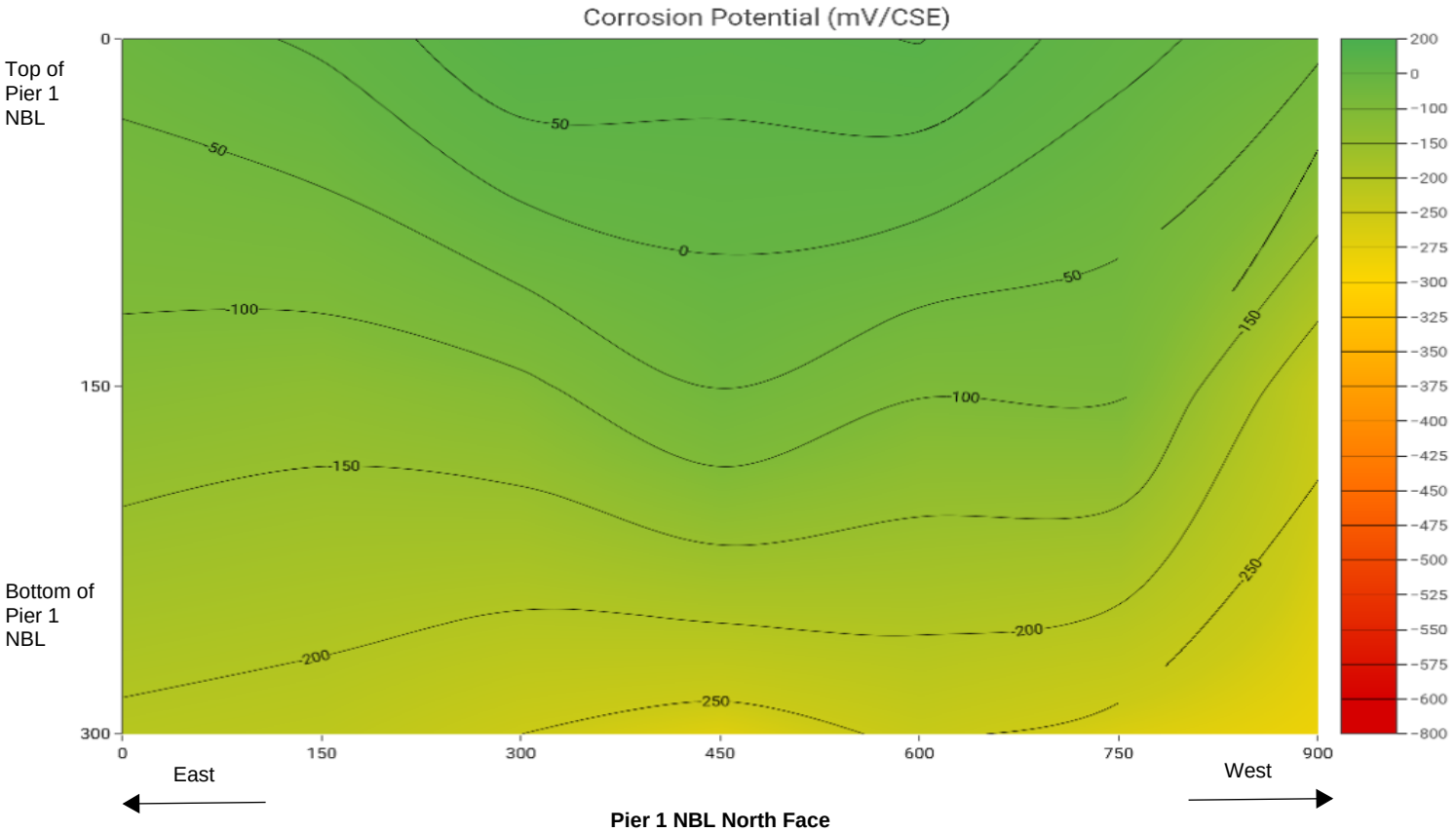
Corrosion potential survey coordinates are given as X and Y coordinates in metres. Y values increase moving from top to bottom on substructure units.

Key Survey Coordinates
0,0 = Top of Pier 1 NBL north face at east end
0,3 = Pier 1 NBL north face near ground line at east end
9,0 = Top of Pier 1 NBL north face at west end
9,3 = Pier 1 NBL north face near ground line at west end

SUMMARY

Range (mV/CSE)	Area (%)
> -350	–
-350 to -200	38.1
> -200	61.9

CORROSION POTENTIAL TEST CONTOUR MAP



Pier 1 NBL North Face
(Churchill Drive Splash Zone)

Report Generated by Giatec iCOR™

Tabulated file in CSV format is enclosed

CORROSION POTENTIAL TEST RESULTS - RAW DATA

X	Y	Corrosion Potential (mV/CSE)	Temperature (°C)	RH	Duration (sec)	Cover (cm)
900	150	-238	14.0	43%	–	–
900	300	-283	14.0	44%	–	–
750	150	-89	14.0	45%	–	–
750	300	-266	14.0	44%	–	–
600	150	-95	14.0	44%	–	–
600	300	-242	14.0	47%	–	–
450	150	-49	14.0	45%	–	–
450	300	-271	14.0	46%	–	–
300	150	-110	14.0	48%	–	–
300	300	-250	14.0	47%	–	–
150	150	-129	14.0	47%	–	–
150	300	-221	13.5	46%	–	–
0	150	-119	13.5	48%	–	–
0	300	-210	13.5	48%	–	–
0	0	-30	13.5	48%	–	–
150	0	8	13.5	47%	–	–
300	0	96	13.5	49%	–	–
450	0	79	13.5	48%	–	–
600	0	102	13.5	47%	–	–
750	0	16	13.5	47%	–	–
900	0	-36	13.5	47%	–	–

CORROSION POTENTIAL TEST

Report Prepared at September 28,2022 10:32 AM

DESCRIPTION

Project Name:	St Vital Pier 1 SBL
Date Created:	September 27,2022 3:39 PM
Corrosion Potential Unit	mV/CSE
Length Unit:	cm
Temperature Unit:	℃
Temperature Correction:	On
Number of Nodes (X):	7
Node Spacing (X):	150
Number of Nodes (Y):	3
Node Spacing (Y):	150

Remarks:

Grid Spacing: 1.5 m x 1.5 m grid.

Corrosion Potential Survey Coordinates

Corrosion potential survey coordinates are given as X and Y coordinates in metres. Y values increase moving from top to bottom on substructure units.

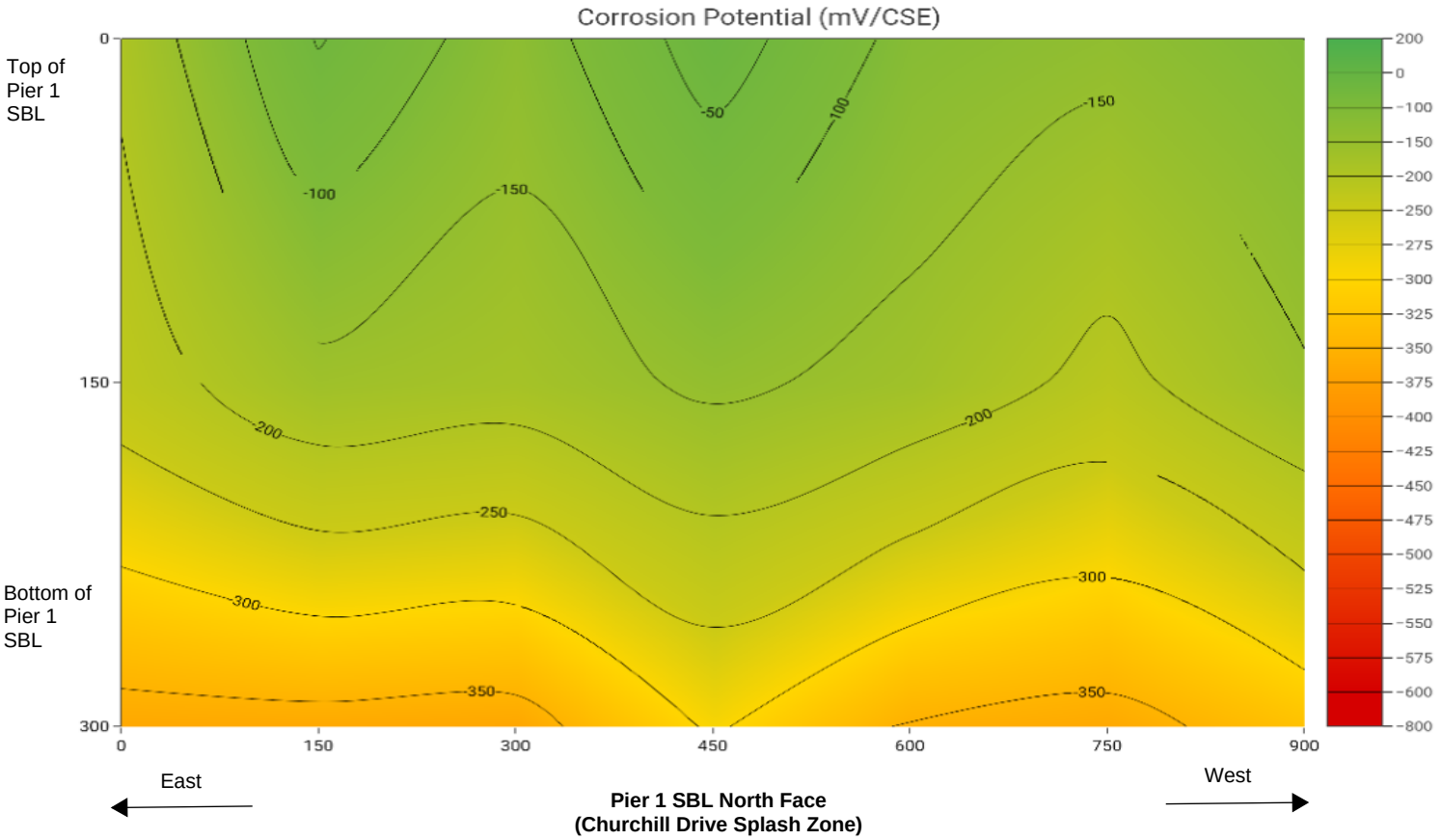
Key Survey Coordinates
0,0 = Top of Pier 1 SBL north face at east end
0,3 = Pier 1 SBL north face near ground line at east end
9,0 = Top of Pier 1 SBL north face at west end

9,3 = Pier 1 SBL north face near ground line at west end

SUMMARY

Range (mV/CSE)	Area (%)
> -350	23.8
-350 to -200	19.0
> -200	57.1

CORROSION POTENTIAL TEST CONTOUR MAP



Report Generated by Giatec iCOR™

Tabulated file in CSV format is enclosed

CORROSION POTENTIAL TEST RESULTS - RAW DATA

X	Y	Corrosion Potential (mV/CSE)	Temperature (°C)	RH	Duration (sec)	Cover (cm)
0	150	-225	13.5	46%	–	–
0	300	-366	13.5	44%	–	–
150	150	-164	13.5	45%	–	–
150	300	-365	13.5	46%	–	–
300	150	-177	13.5	49%	–	–
300	300	-368	13.5	48%	–	–
450	150	-141	13.5	46%	–	–
450	300	-295	13.5	47%	–	–
600	150	-166	13.5	48%	–	–
600	300	-356	13.5	48%	–	–
750	150	-216	13.5	48%	–	–
750	300	-365	13.5	48%	–	–
900	150	-156	13.5	48%	–	–
900	300	-329	13.5	46%	–	–
0	0	-191	13.5	46%	–	–
150	0	-47	13.5	48%	–	–
300	0	-130	13.5	57%	–	–
450	0	-25	13.5	49%	–	–
600	0	-116	13.5	46%	–	–
750	0	-136	13.5	45%	–	–
900	0	-100	14.0	43%	–	–

CORROSION POTENTIAL TEST

Report Prepared at September 28,2022 10:33 AM

DESCRIPTION

Project Name:	St Vital Pier 8 NBL
Date Created:	September 27,2022 5:12 PM
Corrosion Potential Unit	mV/CSE
Length Unit:	cm
Temperature Unit:	℃
Temperature Correction:	On
Number of Nodes (X):	7
Node Spacing (X):	150
Number of Nodes (Y):	3
Node Spacing (Y):	150

Remarks:

Grid Spacing: 1.5 m x 1.5 m grid.

Corrosion Potential Survey Coordinates

Corrosion potential survey coordinates are given as X and Y coordinates in metres. Y values increase moving from top to bottom on substructure units.

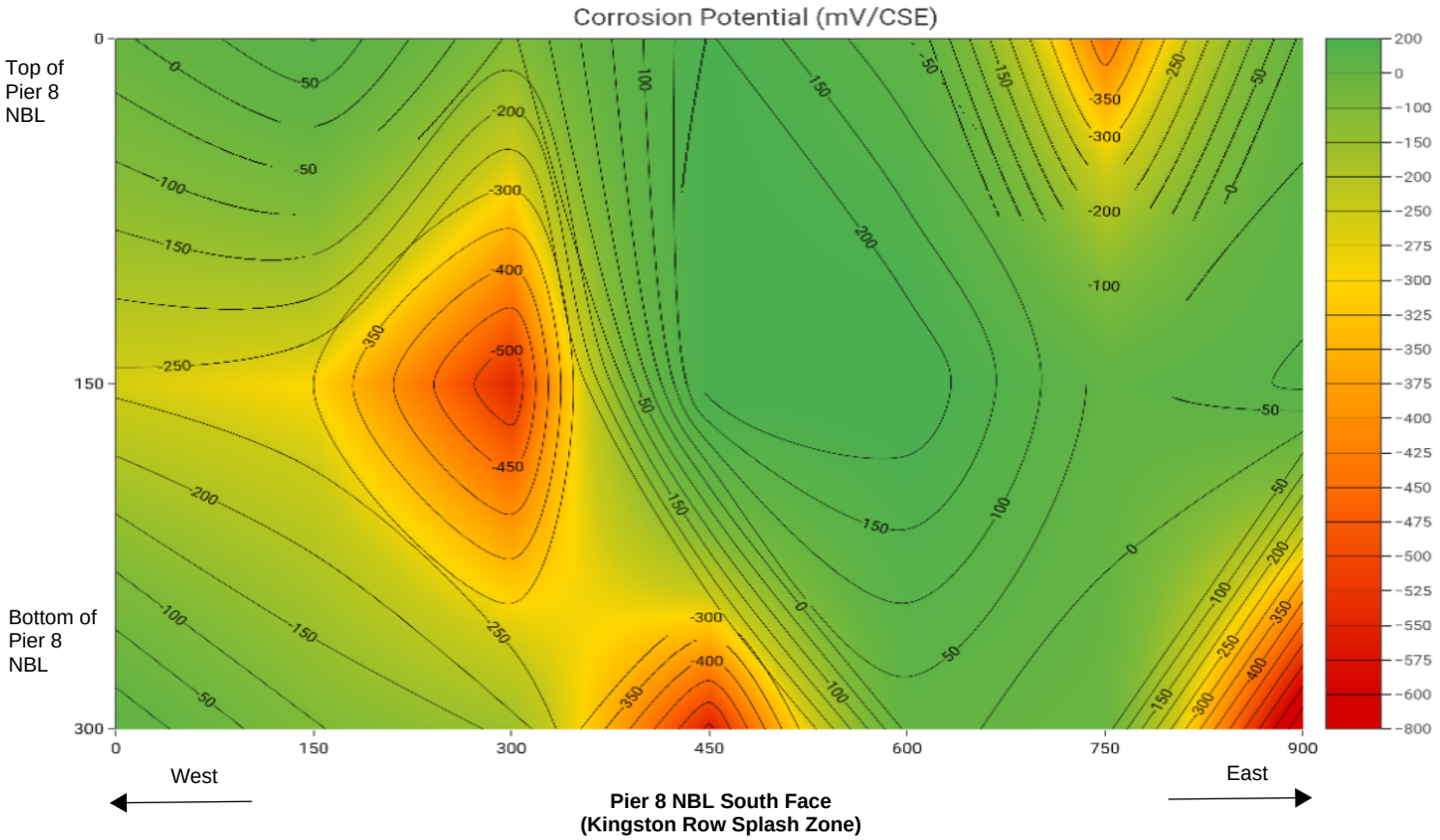
Key Survey Coordinates

0,0 = Top of Pier 8 NBL south face at west end
0,3 = Near bottom of Pier 8 NBL south face at west end
9,0 = Top of Pier 8 NBL south face at east end
9,3 = Near bottom of Pier 8 NBL south face at east end

SUMMARY

Range (mV/CSE)	Area (%)
> -350	19.0
-350 to -200	9.5
> -200	71.4

CORROSION POTENTIAL TEST CONTOUR MAP



Report Generated by Giatec iCOR™

Tabulated file in CSV format is enclosed

CORROSION POTENTIAL TEST RESULTS - RAW DATA

X	Y	Corrosion Potential (mV/CSE)	Temperature (°C)	RH	Duration (sec)	Cover (cm)
0	150	-262	16.0	43%	–	–
0	300	36	16.0	42%	–	–
150	150	-301	16.0	43%	–	–
150	300	-96	16.0	43%	–	–
300	150	-546	16.0	41%	–	–
300	300	-159	16.0	41%	–	–
450	150	239	16.0	42%	–	–
450	300	-561	16.5	42%	–	–
600	150	249	16.5	43%	–	–
750	150	30	16.5	43%	–	–
750	300	-24	16.5	43%	–	–
900	150	113	16.5	43%	–	–
900	300	-698	16.5	42%	–	–
600	300	15	16.5	45%	–	–
0	0	-11	15.5	49%	–	–
150	0	102	15.5	52%	–	–
300	0	-110	15.5	47%	–	–
450	0	205	15.5	46%	–	–
600	0	55	15.5	46%	–	–
750	0	-436	15.5	48%	–	–
900	0	15	15.5	42%	–	–

CORROSION POTENTIAL TEST

Report Prepared at September 28,2022 10:33 AM

DESCRIPTION

Project Name:	St Vital Pier 8 SBL
Date Created:	September 27,2022 5:01 PM
Corrosion Potential Unit	mV/CSE
Length Unit:	cm
Temperature Unit:	℃
Temperature Correction:	On
Number of Nodes (X):	7
Node Spacing (X):	150
Number of Nodes (Y):	3
Node Spacing (Y):	150

Remarks:

Grid Spacing: 1.5 m x 1.5 m grid.

Corrosion Potential Survey Coordinates

Corrosion potential survey coordinates are given as X and Y coordinates in metres. Y values increase moving from top to bottom on substructure units.

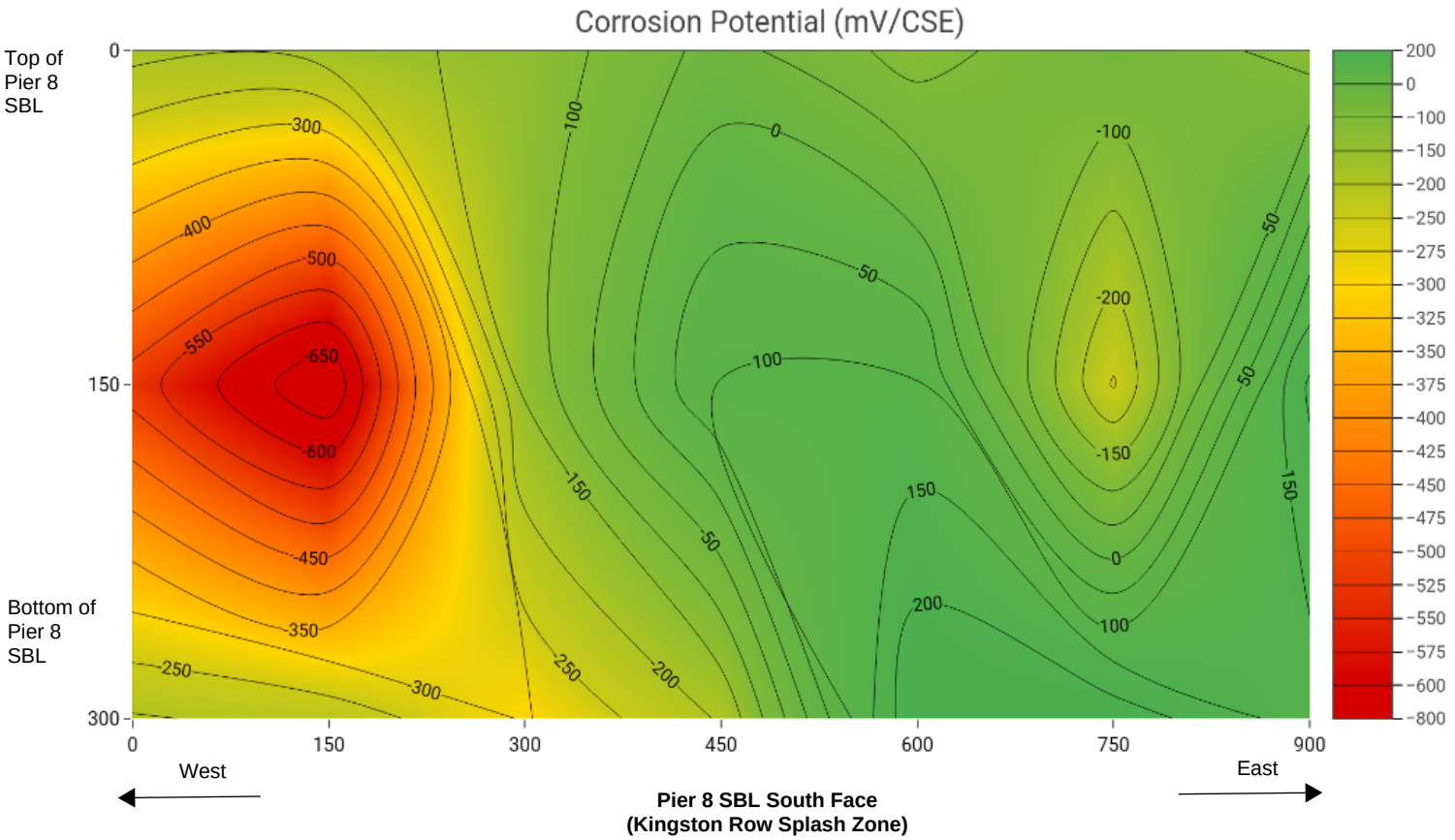
Key Survey Coordinates

0,0 = Top of Pier 8 SBL south face at west end
0,3 = Near bottom of Pier 8 SBL south face at west end
9,0 = Top of Pier 8 SBL south face at east end
9,3 = Near bottom of Pier 8 SBL south face at east end

SUMMARY

Range (mV/CSE)	Area (%)
> -350	9.5
-350 to -200	14.3
> -200	76.2

CORROSION POTENTIAL TEST CONTOUR MAP



Pier 8 SBL South Face
(Kingston Row Splash Zone)

Report Generated by Giatec iCOR™

Tabulated file in CSV format is enclosed

CORROSION POTENTIAL TEST RESULTS - RAW DATA

X	Y	Corrosion Potential (mV/CSE)	Temperature (°C)	RH	Duration (sec)	Cover (cm)
900	150	209	13.5	48%	–	–
900	300	123	13.5	48%	–	–
750	150	-256	13.5	46%	–	–
750	300	233	13.5	46%	–	–
600	150	104	13.5	48%	–	–
600	300	249	14.0	48%	–	–
450	150	106	14.0	51%	–	–
450	300	-195	14.0	49%	–	–
300	150	-138	14.0	51%	–	–
300	300	-304	14.5	53%	–	–
150	150	-698	14.5	52%	–	–
150	300	-218	15.0	52%	–	–
0	150	-525	15.5	50%	–	–
0	300	-195	15.5	50%	–	–
0	0	-184	15.5	47%	–	–
150	0	-171	15.5	50%	–	–
300	0	-133	16.0	49%	–	–
450	0	-31	16.0	46%	–	–
600	0	-121	16.0	47%	–	–
750	0	-53	16.0	44%	–	–
900	0	-124	15.5	43%	–	–