

APPENDIX B

CORING INVESTIGATION

July 20, 2018

PML Ref.: 18HM069
Report: 1

Mr. Ryan Schertzing
Fisheries and Oceans Canada
867 Lakeshore Road
Burlington, Ontario
L7S 1A1

Dear Mr. Schertzing

**Concrete Coring of Existing Pier Decks
East and West Piers of Port Dalhousie Harbour
Port Dalhousie, Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the results of the investigation recently completed in connection with this project. Authorization to proceed with this assignment was provided by Cameron DiPietro via email dated July 12, 2018.

The purpose of the investigation was to advance ten core holes through the existing pier decks to determine the total depth of concrete and void depth below the concrete at each location. All ten cores were brought back to our laboratory for logging and selective compressive strength testing.

It is our understanding that these measurements will be utilized to quantify the existing concrete for tendering purposes.

We trust the information presented in this report is sufficient for your present purposes. If you have any questions, please do not hesitate to contact our office.

Sincerely

Peto MacCallum Ltd.



Andrew Dale, BEng.
Project Supervisor
Inspection and Testing Services
AD/SA:ad



Scott Jeffrey, P.Eng, QP_{ESA}, LEED_{GA}
Senior Engineer
Geotechnical and GeoEnvironmental Services

Enclosures:

Photos of Concrete Cores
Log of Core Holes
Drawing 1 - Core Hole Location Plan
Laboratory Test Results

Distribution:

1 cc: Fisheries and Oceans (+email)



Investigation Procedures

The field work was carried out on July 18, 2018 and consisted of ten core holes advanced within the existing East and West pier decks of Port Dalhousie Harbour.

The number of core holes and core hole locations were selected by Fisheries and Oceans Canada. A reference chainage was provided for each core location and located in the field utilizing a measuring wheel. Core locations are shown on the attached drawing, Appendix C.

The core holes were advanced with a concrete coring machine supplied and operated by a specialist coring contractor. The field work was supervised by a member of PML's engineering staff. All cores were logged in the field, summarizing the thickness of the different layers of concrete encountered in each core hole.

Summarized Subsurface Conditions

Reference is made to the appended Log of Corehole sheets for details of the subsurface conditions.

The pier decks generally consisted of one or two overlays of concrete underlain by an "older" concrete layer. An "older" concrete layer was not encountered at core hole locations 4, 5 and 6, which has concrete of similar characteristics throughout the full depth of the core hole.

Ground penetrating radar scanning was conducted by our specialist contractor at each core hole location in order to determine the location of rebar, prior to coring. Both longitudinal and transverse bars were noted with spacing between 100 and 150mm centre to centre. 15M rebar was encountered in core holes 3, 7 and 8; additionally, 10M rebar was encountered in core hole 10.



The total depth of concrete and measured void below the concrete at the locations cored are provided in the following table:

Table 1

Total Depth of Concrete and Measured Void Below Concrete

Location	Pier	Chainage	Total Depth of Concrete (mm)	Depth to Gravel (mm)	Void Below Concrete (mm)
1	West	0+150	690	690	0
2	West	0+300	640	640	0
3	West	0+500	480	480	0
4	West	0+600	130	130	0
5	West	0+800	160	160	0
6	Southwest	0+050	600	600 ¹	0
7	East	0+250	700	700	0
8	East	0+350	450	450	0
9	East	0+450	510	510	0
10	East	0+550	520	520	0

Notes:

1. Corehole terminated on hollow plastic object



Laboratory Testing

Reference is made to the appended Laboratory Test Results.

Compressive strength testing was conducted on the top overlay layer of concrete for each core hole location, as requested by Fisheries and Oceans Canada. The results are shown in Table 2 below:

Table 2

Compressive Strength of Top Overlay Layer

Location	Pier	Chainage	Overlay Layer Thickness (mm)	Compressive Strength (mPa)
1	West	0+150	230	62.7
2	West	0+300	140	68.9
3	West	0+500	280	52.8
4	West	0+600	130	62.6
5	West	0+800	160	64.2
6	Southwest	0+050	215	50.7
7	East	0+250	460	57.3
8	East	0+350	295	48.8
9	East	0+450	260	72.5
10	East	0+550	200	62.8



Appendix A

Photos of Concrete Cores

CORE PHOTOS OMITTED



Appendix B

Log of Coreholes

LOG OF COREHOLE NO. 1

PROJECT Port Dalhousie Concrete Cores
LOCATION East and West Piers
BORING METHOD Coring

BORING DATE July 19, 2018

PML REF. 18HM069
ENGINEER S. Jeffrey
TECHNICIAN A. Dale

SOIL PROFILE		STRAT PLOT	SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT kN/m ³	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION		NUMBER	TYPE	"N" VALUES		+ FIELD VANE	Δ TORVANE	○ Qu	▲ POCKET PENETROMETER					
						50	100	150	200						
0.0	GROUND SURFACE														
	Concrete: 230 mm overlay with 20 mm angular aggregate		1	CC											
0.23	460 mm poor quality with 40 mm rounded aggregate		2	CC											
			3	CC											
			4	CC											
			5	CC											
0.69	CORING TERMINATED AT 0.69 m		6	CC											
NOTES															

LOG OF COREHOLE NO. 2

PROJECT Port Dalhousie Concrete Cores
LOCATION East and West Piers
BORING METHOD Coring

BORING DATE July 19, 2018

PML REF. 18HM069
ENGINEER S. Jeffrey
TECHNICIAN A. Dale

SOIL PROFILE		STRAT PLOT	SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT kN/m ³	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION		NUMBER	TYPE	"N" VALUES		+ FIELD VANE	Δ TORVANE	○ Qu	▲ POCKET PENETROMETER					
						50	100	150	200						
0.0	GROUND SURFACE														
	Concrete: 135 mm overlay with 20 mm angular aggregate		1	CC											
0.14	165 mm overlay with 30 mm rounded aggregate		2	CC											
0.30	245 mm poor quality concrete; 40 to 50 mm rounded stone aggregate		3	CC											
			4	CC											
0.64	CORING TERMINATED AT 0.64 m		5	CC											
NOTES															

LOG OF COREHOLE NO. 3

PROJECT Port Dalhousie Concrete Cores
LOCATION East and West Piers
BORING METHOD Coring

BORING DATE July 19, 2018

PML REF. 18HM069
ENGINEER S. Jeffrey
TECHNICIAN A. Dale

SOIL PROFILE		SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT kN/m ³	GROUND WATER OBSERVATIONS AND REMARKS GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		"N" VALUES	+ FIELD VANE	Δ TORVANE	○ Qu					
						50	100	150	200					
						DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●								
						20	40	60	80					
0.0	GROUND SURFACE													
	Concrete: 275 mm overlay with 20 mm angular aggregate; rebar at 215 mm		1	CC										
0.28	75 mm overlay with 20 mm rounded aggregate; rebar at 320		2	CC										
0.48	130 mm very poor quality with 40 mm rounded aggregate; partial core recovery		3	CC										
	CORING TERMINATED AT 0.48 m													
1.0	NOTES													

LOG OF COREHOLE NO. 4

PROJECT Port Dalhousie Concrete Cores
LOCATION East and West Piers
BORING METHOD Coring

BORING DATE July 19, 2018

PML REF. 18HM069
ENGINEER S. Jeffrey
TECHNICIAN A. Dale

SOIL PROFILE		SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT kN/m ³	GROUND WATER OBSERVATIONS AND REMARKS GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		"N" VALUES	+ FIELD VANE	Δ TORVANE	○ Qu					
						50	100	150	200					
						DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●								
						20	40	60	80					
0.0	GROUND SURFACE													
	Concrete: 130 mm concrete with 20 mm angular aggregate		1	CC										
0.13	CORING TERMINATED AT 0.13 m													
1.0	NOTES													

LOG OF COREHOLE NO. 7

PROJECT Port Dalhousie Concrete Cores
LOCATION East and West Piers
BORING METHOD Coring

BORING DATE July 19, 2018

PML REF. 18HM069
ENGINEER S. Jeffrey
TECHNICIAN A. Dale

SOIL PROFILE		SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT kN/m ³	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		"N" VALUES	+ FIELD VANE	Δ TORVANE	○ Qu					
						50	100	150	200					
						DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●								
						20	40	60	80					
0.0	GROUND SURFACE													
	Concrete: 460 mm overlay with 20 mm angular stone aggregate; core sheared at 315 mm, rebar at 250 mm		1	CC										
			2	CC										
0.46	120 mm overlay with 30 mm rounded aggregate		3	CC										
	120 mm poor quality with 50 mm rounded aggregate; partial core recovery		4	CC										
	CORING TERMINATED AT 0.7 m													
1.0	NOTES													

LOG OF COREHOLE NO. 8

PROJECT Port Dalhousie Concrete Cores
LOCATION East and West Piers
BORING METHOD Coring

BORING DATE July 19, 2018

PML REF. 18HM069
ENGINEER S. Jeffrey
TECHNICIAN A. Dale

SOIL PROFILE		SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT kN/m ³	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		"N" VALUES	+ FIELD VANE	Δ TORVANE	○ Qu					
						50	100	150	200					
						DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●								
						20	40	60	80					
0.0	GROUND SURFACE													
	Concrete: 295 mm overlay with 20 mm angular aggregate; rebar at 210 mm		1	CC										
0.30	155 mm poor quality with 30 mm rounded aggregate; core in 3 pieces of approximately equal length		2	CC										
0.45	CORING TERMINATED AT 0.45 m													
1.0	NOTES													

LOG OF COREHOLE NO. 9

PROJECT Port Dalhousie Concrete Cores
LOCATION East and West Piers
BORING METHOD Coring

BORING DATE July 19, 2018

PML REF. 18HM069
ENGINEER S. Jeffrey
TECHNICIAN A. Dale

SOIL PROFILE		STRAT PLOT	SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT kN/m ³	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION		NUMBER	TYPE	"N" VALUES		+ FIELD VANE	Δ TORVANE	○ Qu	▲ POCKET PENETROMETER					
						50	100	150	200						
						DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●									
						20	40	60	80						
0.0	GROUND SURFACE														
	Concrete: 260 mm overlay with 20 mm angular aggregate		1	CC											
0.26	250 mm concrete with 20 mm angular aggregate		2	CC											
			3	CC											
			4	CC											
0.51	CORING TERMINATED AT 0.51 m														
NOTES															

LOG OF COREHOLE NO. 10

PROJECT Port Dalhousie Concrete Cores
LOCATION East and West Piers
BORING METHOD Coring

BORING DATE July 19, 2018

PML REF. 18HM069
ENGINEER S. Jeffrey
TECHNICIAN A. Dale

SOIL PROFILE		STRAT PLOT	SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT kN/m ³	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION		NUMBER	TYPE	"N" VALUES		+ FIELD VANE	Δ TORVANE	○ Qu	▲ POCKET PENETROMETER					
						50	100	150	200						
						DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●									
						20	40	60	80						
0.0	GROUND SURFACE														
	Concrete: 200 mm overlay with 20 mm angular aggregate		1	CC											
0.20	60 mm poor quality with 40 mm angular aggregate		2	CC											
	GRAVEL: 40 mm of 20 mm angular gravel		3	CC											
	CONCRETE: 220 mm very poor quality with 40 mm angular aggregate; rebar at 500 mm, core in 3 pieces of approximately equal length		4	CC											
0.52	CORING TERMINATED AT 0.52 m														
NOTES															



Appendix C

Core Hole Locations



DEPARTMENT OF FISHERIES AND OCEANS
 CONCRETE CORING OF EXISTING PIER DECKS
 EAST AND WEST PIER DECKS OF PORT DALHOUSIE HARBOUR
 PORT DALHOUSIE, ONTARIO
 CORE HOLE LOCATIONS





Appendix D

Laboratory Test Results

CONCRETE CORE COMPRESSIVE STRENGTH TEST REPORT

CLIENT Fisheries and Oceans Canada
PROJECT Port Dalhousie Harbour Concrete Cores
LOCATION St. Catharines

OUR PROJECT NO. 18HM069
REPORT NO. 1
ENCLOSURE.

CORE NO./LAB NUMBER	1850948 A	1850948 B	1850948 C
LOCATION	Location 1, West Pier 0+150, top overlay 0-230 mm	Location 2, West Pier 0+300, top overlay 0-140 mm	Location 3, West Pier 0+500, top overlay 0-280 mm
DATE CAST			
DATE EXTRACTED	July 18, 2018	July 18, 2018	July 18, 2018
DATE TESTED	July 31, 2018	July 31, 2018	July 31, 2018
AGE OF SPECIMEN (Days)	-	-	-
PENETRATION (mm)	-	-	-
RECOVERY (mm)	-	-	-
DIAMETER (mm)	94	94	94
GROUND OR CAPPED HEIGHT (mm)	165	112	184
L/D RATIO	1.76	1.19	1.96
UNCORRECTED LOAD (kN)	443.79	521.78	367.53
FRACTURE TYPE (CSA A23.2-9C)	1	1	1
CORRECTION FACTOR	0.981	0.916	0.997
CORRECTED LOAD (kN)	435.4	478	366.4
AREA (mm ²)	6939.8	6939.8	6939.8
NOMINAL SIZE OF AGGREGATE(mm)	19	19	19
DENSITY (kg/m ³)	2350	2362	2331
DENSITY AFTER RE-BAR CORRECTION (kg/m ³)			
COMPRESSIVE STRENGTH (MPa)	62.7	68.9	52.8

REMARKS:

Cores were dry-conditioned prior to testing as per CSA Test Standard A23.2-14C.

REVIEWED BY : Amjad Khan, B.Eng.

CONCRETE CORE COMPRESSIVE STRENGTH TEST REPORT

CORE NO./LAB NUMBER	1850948-D	1850948-E	1850948-F
LOCATION	Location 4, West Pier 0+600, top overlay 0-130 mm	Location 5, West Pier 0+800, top overlay 0-160 mm	Location 6, Southwest Pier 0+050, top overlay 0- 215 mm
DATE CAST			
DATE EXTRACTED	July 18, 2018	July 18, 2018	July 18, 2018
DATE TESTED	July 31, 2018	July 31, 2018	July 31, 2018
AGE OF SPECIMEN (Days)	-	-	-
PENETRATION (mm)	-	-	-
RECOVERY (mm)	-	-	-
DIAMETER (mm)	94	94	94
GROUND OR CAPPED HEIGHT (mm)	112	143	181
L/D RATIO	1.19	1.52	1.93
UNCORRECTED LOAD (kN)	474.47	462.77	354.1
FRACTURE TYPE (CSA A23.2-9C)	1	1	1
CORRECTION FACTOR	0.916	0.962	0.994
CORRECTED LOAD (kN)	434.6	445.2	352
AREA (mm ²)	6939.8	6939.8	6939.8
NOMINAL SIZE OF AGGREGATE(mm)	19	19	19
DENSITY (kg/m ³)	2336	2368	2255
DENSITY AFTER RE-BAR CORRECTION (kg/m ³)			
COMPRESSIVE STRENGTH (MPa)	62.6	64.2	50.7

CONCRETE CORE COMPRESSIVE STRENGTH TEST REPORT

CORE NO./LAB NUMBER	1850948-G	1850948-H	1850948-I
LOCATION	Location 7, East Pier 0+250, top overlay 0-460 mm	Location 8, East Pier 0+350, top overlay 0-460 mm	Location 9, East Pier 0+450, top overlay 0-260 mm
DATE CAST			
DATE EXTRACTED	July 18, 2018	July 18, 2018	July 18, 2018
DATE TESTED	July 31, 2018	July 31, 2018	July 31, 2018
AGE OF SPECIMEN (Days)	-	-	-
PENETRATION (mm)	-	-	-
RECOVERY (mm)	-	-	-
DIAMETER (mm)	94	94	94
GROUND OR CAPPED HEIGHT (mm)	185	185	103
L/D RATIO	1.97	1.97	1.1
UNCORRECTED LOAD (kN)	398.64	339.31	562.46
FRACTURE TYPE (CSA A23.2-9C)	1	1	1
CORRECTION FACTOR	0.998	0.998	0.894
CORRECTED LOAD (kN)	397.8	338.6	502.8
AREA (mm ²)	6939.8	6939.8	6939.8
NOMINAL SIZE OF AGGREGATE(mm)	19	19	19
DENSITY (kg/m ³)	2327	2249	2346
DENSITY AFTER RE-BAR CORRECTION (kg/m ³)			
COMPRESSIVE STRENGTH (MPa)	57.3	48.8	72.5

CONCRETE CORE COMPRESSIVE STRENGTH TEST REPORT

CORE NO./LAB NUMBER	1850948-J	
LOCATION	Location 10, East Pier 0+550, top overlay 0-200 mm	
DATE CAST		
DATE EXTRACTED	July 18, 2018	
DATE TESTED	July 31, 2018	
AGE OF SPECIMEN (Days)	-	
PENETRATION (mm)	-	
RECOVERY (mm)	-	
DIAMETER (mm)	94	
GROUND OR CAPPED HEIGHT (mm)	173	
L/D RATIO	1.84	
UNCORRECTED LOAD (kN)	441.72	
FRACTURE TYPE (CSA A23.2-9C)	1	
CORRECTION FACTOR	0.987	
CORRECTED LOAD (kN)	436	
AREA (mm ²)	6939.8	
NOMINAL SIZE OF AGGREGATE(mm)	19	
DENSITY (kg/m ³)	2305	
DENSITY AFTER RE-BAR CORRECTION (kg/m ³)		
COMPRESSIVE STRENGTH (MPa)	62.8	