

PREDL SYSTEMS
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Project: Load testing on PVC manhole (as named by client) -Reference standard- ASTM D3753-12, Clause 6.4.1

1.0 INTRODUCTION

As requested, Metro Testing Laboratories (Burnaby), a division of CCMET Inc. (Metro) visited PREDL Systems (Yard) to perform load testing on the PVC manhole on 17 May 2018. Metro referred to clause 6.4.1 of ASTM D3753-12 standard to conduct the testing. There were several meetings in past between Metro and PREDL Systems since December 2017 to plan, design, and arrange for the load testing

Client confirmed that this PVC manhole used for testing is manufactured with the similar consistency as the actual service manholes. It was concentric type of manhole (as shown in figure.1).

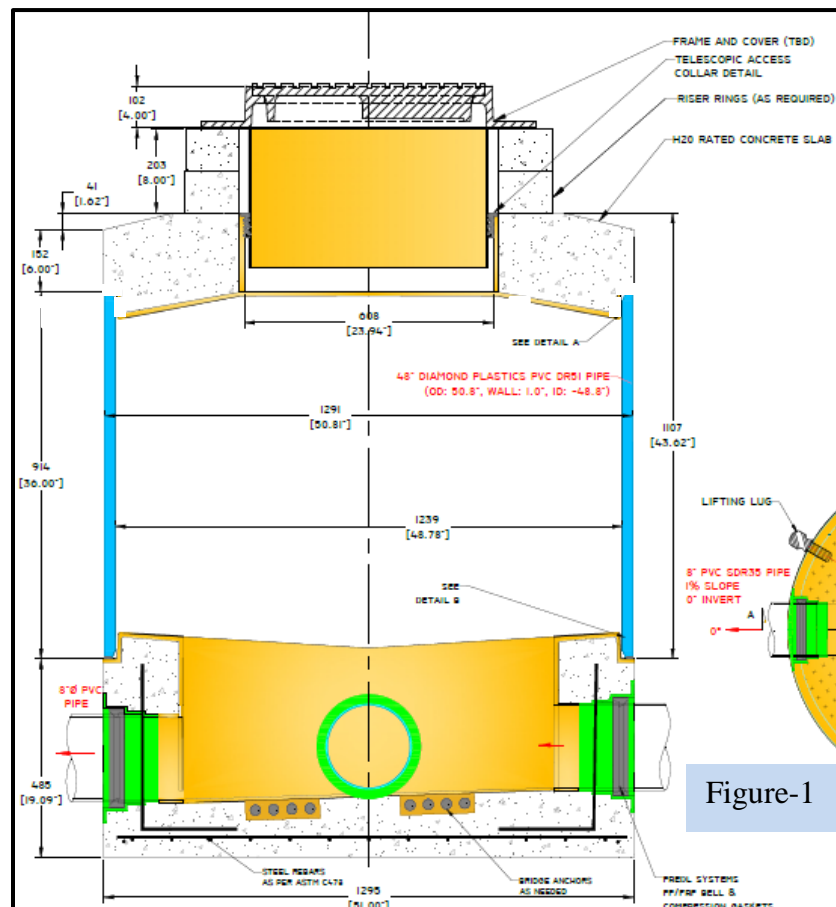


Figure-1

2.0 TESTING PROCEDURE AND RESULTS

ASTM D3753-12 clause 6.4.1 states that:

“The complete manhole shall have a minimum dynamic-load rating of 16,000 lbf. To establish this rating, the complete manhole shall not leak, crack, or suffer any damage when tested to 40,000lbf (~178kN) and shall not deflect vertically downward more than 0.25 in. (6.35 mm) at the point of load application when loaded to 24,000 lbf (~107kN).”

Following is the test procedure:

- Metro applied the loads using the prefabricated steel bridges. The test load was applied eccentrically (See figure.2)

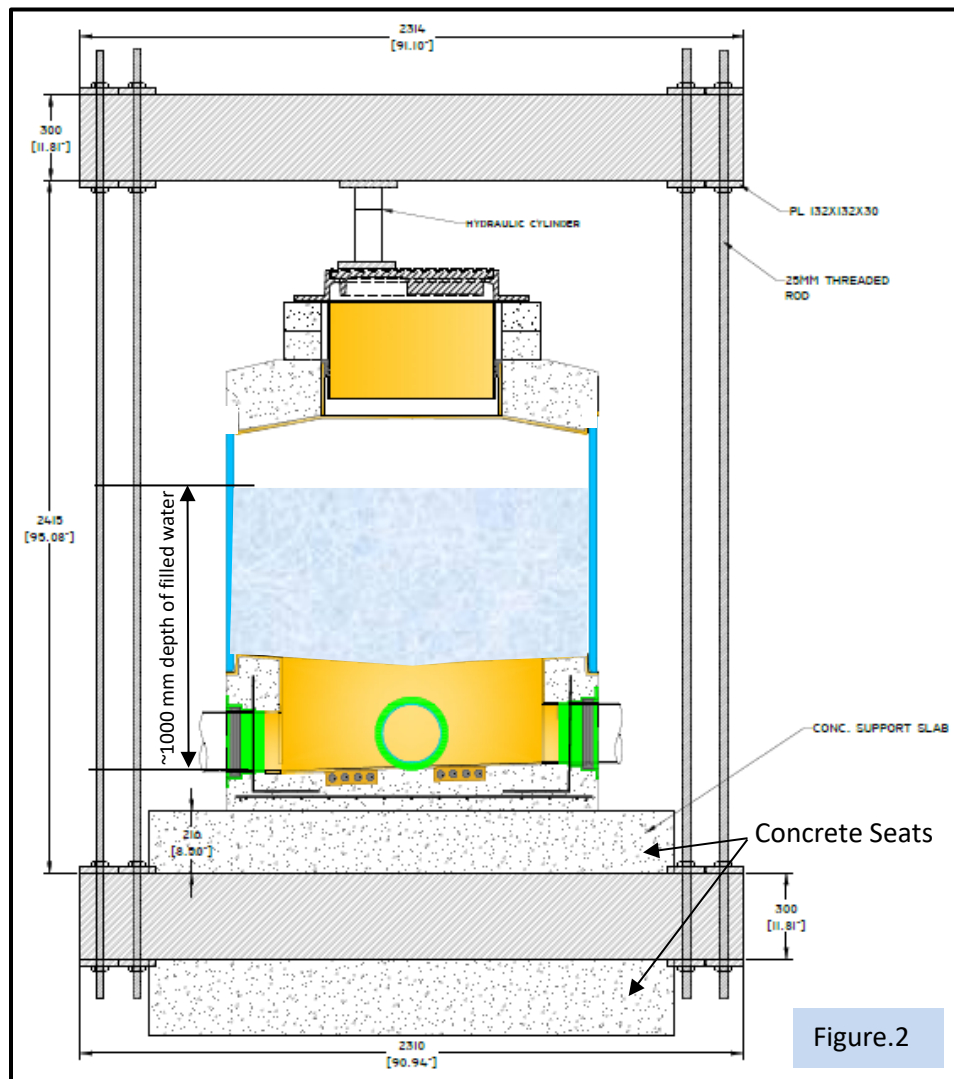


Figure.2

- Metro marked the locations of any existing minor cracks and any flaw which may mislead the tester during the load application.
- Manhole was filled with water up to an approximate depth of 1000mm during entire duration of testing.
- A digital indicator was installed in vertical direction (as per clause 6.4.1 of ASTM D3753-12) to measure deflection. Vertical digital indicator was installed in vicinity to the point of load application.
- Two additional gauges (not required as per ASTM D3753-12) i.e. one digital indicator (named as west side in table-1) and one dial gauge (named as east side in table -1) were installed in horizontally opposite directions to each other approximately at the center of manhole. These gauges were installed to measure the horizontal deflections.
- Gauges were installed on separate standalone arms which were bolted in concrete floor.
- Metro used 30 Ton Ram and 10,000 PSI gauge to perform testing. Calibration sheet is attached in appendix.
- As per clause 8.4.1.1 of ASTM D3753-12, Loading was applied in increments of 2000 lbf intervals. Metro inspected of manhole after every applied increment.
- As per ASTM D3753-12, testing was conducted up to 40,000 lbf (~178kN) and deflection was measured at various load intervals (see table-1).
- Specified load of 40,000 lbf (~178kN) was maintained for 15 minutes.
- Residual deflection was measured after gradual release of load.

Following table.1 shows the loading and deflection measurements:

No.	Load Applied	kN	Deflection		
	lbf (kgf)		Vertical inches (mm)	West Side inches (mm)	East Side inches (mm)
1	2000 (907)	9	All dial guages were zeroed at 2000 lbf.		
2	4000 (1814)	18	-0.0016 (-0.04)		0
3	6000 (2721)	27			
4	8000 (3629)	36			
5	10000 (4536)	44	-0.017 (-0.45)		0.025 (0.64)
6	12000 (5443)	53			
7	14000 (6350)	62			
8	16000 (7257)	71	-0.047 (-1.21)		-0.013 (-0.33)
9	18000 (8165)	80			
10	20000 (9072)	89	-0.067 (-1.72)	0.0028 (0.07)	-0.017 (-0.43)
11	22000 (9979)	98			
12	24000 (10886)	107	-0.085 (-2.17)	0.006 (0.15)	-0.022 (-0.56)
13	26000 (11793)	116	-0.094 (-2.4)	0.0086 (0.22)	-0.022 (-0.56)
14	28000 (12700)	125			
15	30000 (13608)	133	-0.108 (-2.76)	0.018 (0.46)	-0.024 (-0.61)
16	32000 (14514)	142			
17	34000 (15422)	151			
18	36000 (16329)	160	-0.128 (-3.27)	0.04 (1.04)	-0.028 (-0.71)
19	38000 (17236)	169			
20	40000 (18144)	178	-0.14 (-3.71)	0.053 (1.36)	-0.033 (-0.84)
	After 15 mins of maintaining the specified load of 40000 lbf		-0.15 (-3.83)	0.052 (1.33)	-0.033 (-0.84)
	Residual		-0.015 (-0.39)	0.019 (0.5)	0.037 (0.94)

Table.1

Notes: Metro realised that during testing horizontal west side digital indicator was not in contact with surface until applied load of 18,000 lbf. This digital indicator was adjusted and the readings were recorded from 20,000 lbf loading onwards. However, measurement of horizontal deflections (in this case west & east side gauges) are not a required as per ASTM D3753-12

3.0 OBSERVATIONS AFTER MANHOLE DISMANTLING:

On 08 June 2018, Metro observed the following after dismantling of Manhole components:

- Gaskets were installed at the top and bottom vertical interfaces of PVC pipe and concrete pieces. One layer of the mastic was observed at the bottom horizontal interface of the PVC pipe and concrete base (pressed thickness of the mastic was 1-2 mm).

Client informed Metro that Hamilton Kent, Tylox Type “C” gasket, Model 5796 as an ASTM C443ASTM compliant Manhole Riser gasket, was used.

ConSeal, CS-102 Butyl Rubber Sealant (called mastic in this report) was used in the manhole assembly. As per the materials technical data sheet, the mastic is an ASTM C990-compliant Butyl Mastic Sealant.

4.0 CONCLUSION:

- The recorded vertical deflection at 24000 lbf was 0.085 in. (2.17 mm), which is below than the allowable deflection value of 0.25 in. (6.35 mm) as per clause 6.4.1 of ASTM D3753-12.
- After maintaining the 40,000 lbf load for 15 minutes as per clause 6.4.1 of ASTM D3753-12, Metro did not observe water any leakage, new cracks or damages in the manhole structure.

Metro closely reviewed different parts of the manhole such as the fiber glass collar under the concrete rings to detect any potential damage.

As per test results, Metro hereby confirms that test manhole meets the 16000lbf (~71kN) dynamic load rating as per clause 6.4.1 of ASTM D3753-12.

We trust that this report meets your present requirements; if you have any questions, please feel free to contact us at 604-436-9111.

For Metro Testing Laboratories (Burnaby)
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APPENDIX

- Site Pictures
- Calibration chart





Pic.1: Manhole Test Assembly



Pic.2: Testing in progress



Pic.3: Bridge assembly and standalone arms for Gauges



Pic.4: Filled water up to a depth of ~1000 mm.



Pic.5: Hydraulic ram set up



Pic.6: Local contact marks on the fiber glass collar under the concrete rings, does not indicate any signs of the failure



Pic.7 Local contact marks on the fiber glass collar under the concrete rings, does not indicate any signs of the failure the concrete rings



Pic.8: Inside view of manhole after testing



Pic.9: Gasket on vertical interface of concrete and PVC pipe



Pic.10: Gasket on vertical interface of concrete and PVC pipe and Mastic on Horizontal surface of concrete