

June 14, 2011

File No. 11-0107-01



3rd Floor
865 Waverley Street
Winnipeg,
Manitoba
R3T 5P4
204.896.1209
fax: 204.896.0754
www.ksgsgroup.com

City of Winnipeg
Planning, Property and Development Department
Municipal Accommodations Division
4th Floor – 185 King Street
Winnipeg, Manitoba
R2B 1J1

ATTENTION: Mr. Lou Chubenko

RE: Harbourview Recreation Complex – Courtyard Restoration
• Site Investigation

Dear Mr. Chubenko:

We have completed our site investigation at Harbourview Recreation Complex, courtyard retaining wall, paving and canopy. The terms of reference for the investigation were to:

- Review existing construction drawings.
- Complete a site survey and excavation adjacent to the retaining wall.
- Prepare a report documenting our investigation findings, our condition assessment and our recommendations for remedial work.

1.0 BACKGROUND

The Harbourview Complex was constructed in 1981. The buildings surrounding the courtyard are wood framed supported on concrete structural floor slabs and cast-in-place concrete friction piles. The courtyard between the buildings is surfaced with paving stones and is approximately 535 sq. m in area. The west side of the courtyard borders the retention pond with a concrete retaining wall.

2.0 CONDITION ASSESSMENT

Our condition assessment based on a review of existing drawings, site observations and survey is as follows: (also reference Figures 1 and 2 and Photos 1 to 18 attached).

2.1 CONCRETE RETAINING WALL

Figure 1 is a cross section through the retaining wall (also reference Photos 1 to 5). The counterfort and pile supports are spaced at 3400 mm o.c. The wall has rotated towards the retention pond to varying degrees along the length of the wall. With the assistance of Patio World, an area adjacent to the wall was excavated to

confirm where the rotation is occurring – i.e. has the counterfort separated from the footing; the footing separated from the top of the pile; or has the pile heaved from frost jacking and/or an upward pull on the pile. A portion of the counterfort was exposed. Unfortunately, the water level was still too high to expose the top of the pile and all of the information hoped for could not be obtained. The slope of the wall at the location of the excavation was measured to be approximately 1:12 (approximately 125 mm over the height of the wall). The concrete was found to be in good condition and there is no separation between the vertical face of the wall and the counterfort. The frost line is well above the top of the piles and frost jacking of the piles is, therefore, not considered to be the cause of the wall rotation.

The ultimate force required to pull up a 6000 mm long 400 mm diameter pile is estimated to be 65 kips based on an ultimate skin friction value and the yield strength of a 25 M reinforcing bar is approximately 47 kips. Judging from the condition of the concrete, our conclusion is that the separation is most likely occurring between the top of the pile and the underside of the footing and that the wall rotation is caused by soil over the height of the wall expanding with frost and exerting a pressure on the wall much higher than the normal soil design pressure. The movement resulting from this pressure will progressively increase with each annual frost cycle.

2.2 CANOPY COLUMNS

Survey data indicates that the relative difference in the elevation of the underside of the canopy at column support points is as much as 190 mm (Ref. Photos 7 and 8). The differences is attributed to frost jack of the piles which is not unexpected given the wet soil conditions surround the top of the piles. The piles are 400 mm in diameter by 5000 mm long. The required minimum pile length to resist frost jacking is typically considered to be 8500 mm.

2.3 WOOD HANDRAILS, LIGHT POSTS AND CANOPY SUPPORTS

In a number of locations the wood handrails, light posts and canopy supports are in disrepair – Reference Photos 2, 3, 4, 5, 6, 10 and 11.

2.4 PAVING STONES

The paving stone courtyard between the building is approximately 535 sq. m. in area (Reference Figure 1). There is also a large area of paving stones to the east of the courtyard (Ref. Photo 15, 17 and 18). Elevations from site survey data are shown on Figure 1. The paving stones have settled in many areas and are missing in other locations (Ref. Photos 12, 13, and 14). There are two drains in the courtyard as noted on Figure 1. Drainage towards these drains as per the survey data, is poor. Rubber mats have been placed in some locations in which the paving stones are missing (Ref. Photo 16). These conditions have been identified by the City Public Works Department as public safety concerns.

3.0 RECOMMENDATIONS

Based on our review of construction drawings, our site investigation, and client review comments, our recommendations for remedial work are as follows:

3.1 CONCRETE RETAINING WALL

Three potential options to upgrade the retaining wall are:

1. **Remedial Repair** – This option will minimize future wall movement but will not straighten the wall. Remedial work will consist of excavating behind the wall, placing a compressible low density Styrofoam on the inside vertical face of the wall and backfilling with a free draining granular fill. This work could be completed in conjunction with improvements to the paving. Overtime, with compression of the styrofoam, the benefits of this repair will be minimized. The estimated cost of this option is \$20,000.00
2. **Replacement** – The wall is constructed independent of the buildings at each end and can be removed and replaced without compromising these structures. The wall can be replaced with a new concrete wall with modifications to prevent frost movement. A concrete wall replacement is complicated by the need to draw down the retention pond or provide a cofferdam during construction. An earth berm is considered to be the most cost effective cofferdam option. A second wall option is a driven steel sheet pile wall or a wall constructed with driven steel soldier piles and lagging. The lagging could be pressure treated wood, concrete panels or composite material panels. This wall option will not require a cofferdam. The estimate cost of this is \$100,000.00 to \$150,000.00.
3. **Wall Removal and Embankment** – The existing wall provides a separation and transition to the dock structures. The dock structures have limited functional value and are an on-going maintenance expense. Plans are in place to remove the docks. With the docks removed an alternate to a retaining wall is an embankment to provide a transition and separation between the paved area and the waters edge. This option will not require a handrail and will require minimal maintenance overtime. The estimate cost of this option is \$70,000.00.

3.2 CANOPY COLUMNS

We recommend that the top 1400 mm of the piles supporting the canopy posts be exposed and be wrapped with a double layer of 20 mill polyethylene with grease between the layers. This work could also be completed when upgrading the paving. Consideration should also be given to replacing the concrete pile caps at the base of the columns (Ref. Photo 11).

3.3 WOOD HANDRAILS, LIGHT POSTS AND CANOPY POSTS

We recommend replacing the handrail and light posts along the retaining wall and replacing the canopy posts which are in disrepair. The canopy posts which have experienced significant frost jacking should be shortened to level the canopy. As noted above a handrail will not be required with the embankment option. Short term remedial work should be provided to address safety concerns if the handrail is not replaced at this time. Providing a mesh similar that existing in other locations is an option for short term repair.

3.4 PAVING STONES

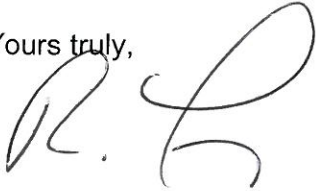
Within the courtyard area we recommend that the existing paving stones and granular base be removed and replaced. The new base should be a combination of granular and crushed stone with a minimum total thickness of 450 mm. As there is limited gradient for proper surface drainage, consideration should be given to a permeable paving system which provides for subsurface drainage. The cost of replacing the paving stones and base is estimated to be

Mr. Chubenko
Page 4

\$130 per sq. m. The total estimated cost for the courtyard repaving is \$70,000.00. If the paved area to the east of the courtyard is replaced, the cost would be over twice this amount.

We trust that the above report fulfills the requirements of the Terms of Reference. Please call to discuss any further clarification which may be required.

Yours truly,

A handwritten signature in black ink, appearing to read 'R. Long', with a large, stylized flourish extending from the end of the name.

Robert J. Long, P.Eng.
Senior Structural Engineer

RJL/jr/sp



Photo 1



Photo 2

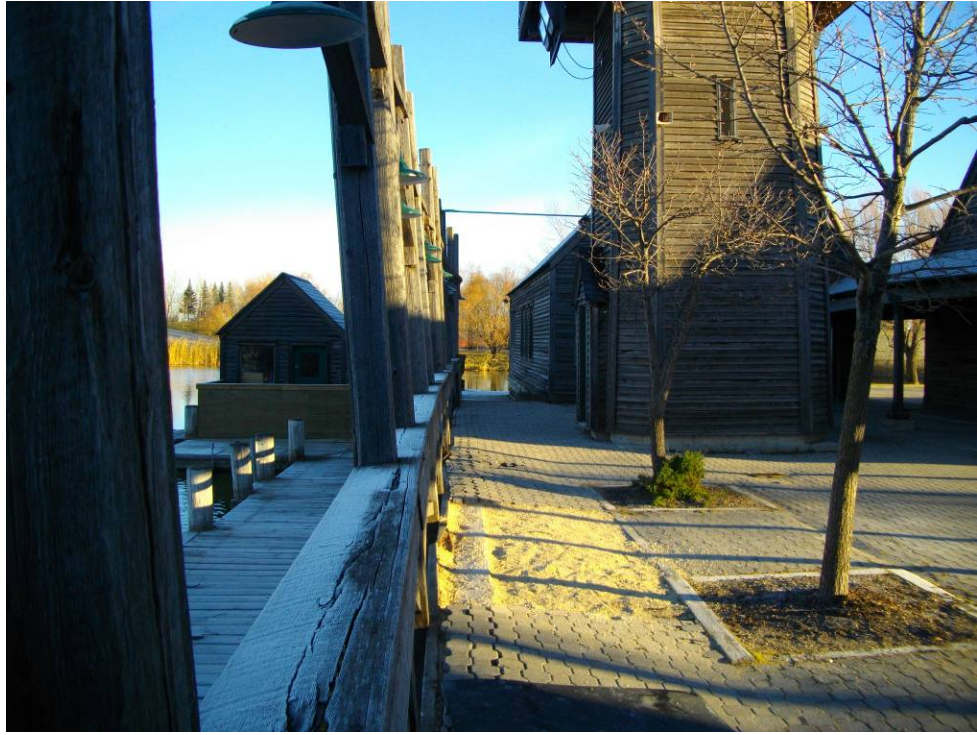


Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8



Photo 9



Photo 10



Photo 11



Photo 12



Photo 13



Photo 14



Photo 15



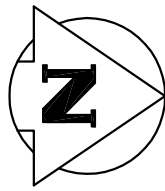
Photo 16



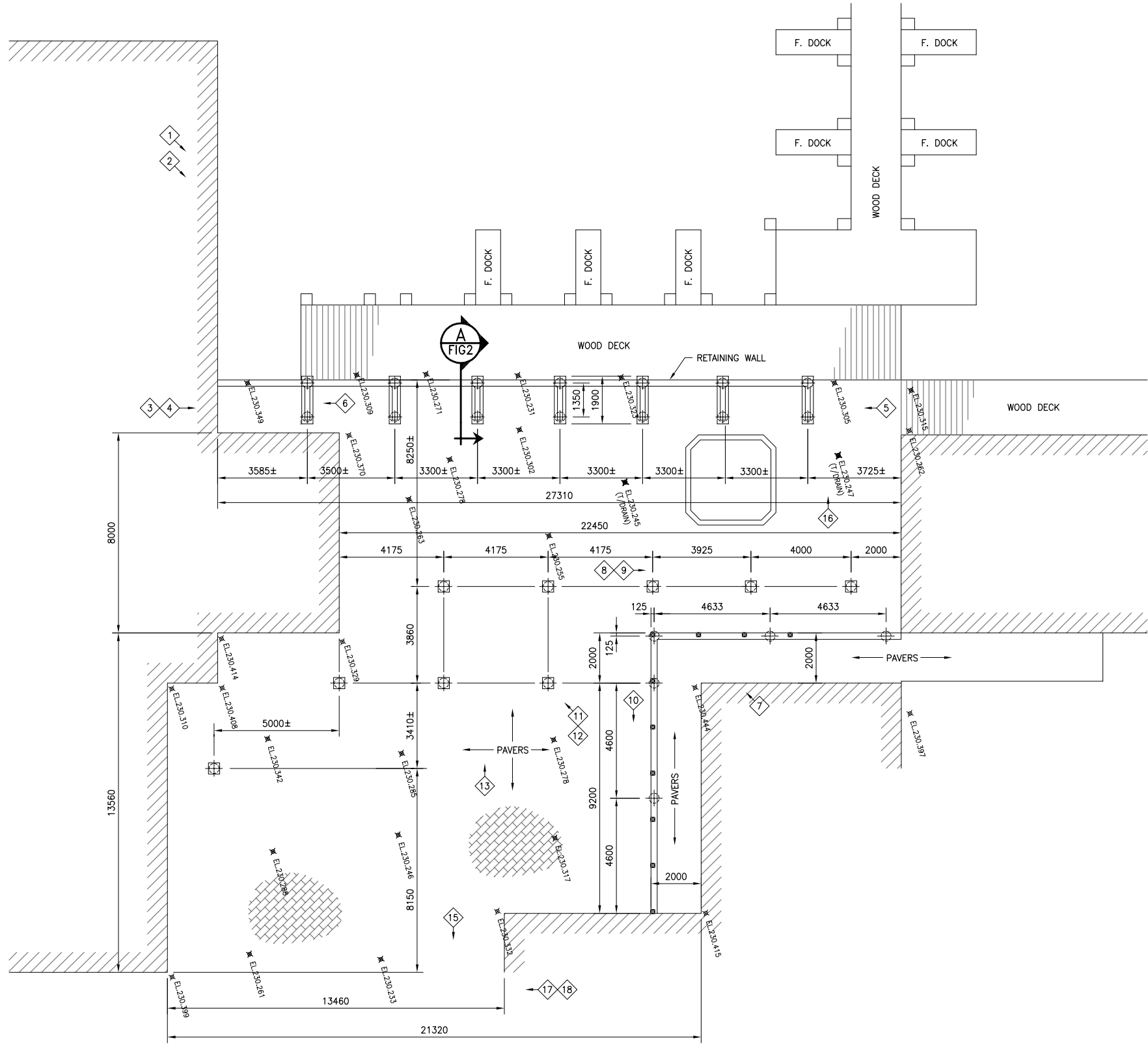
Photo 17



Photo 18



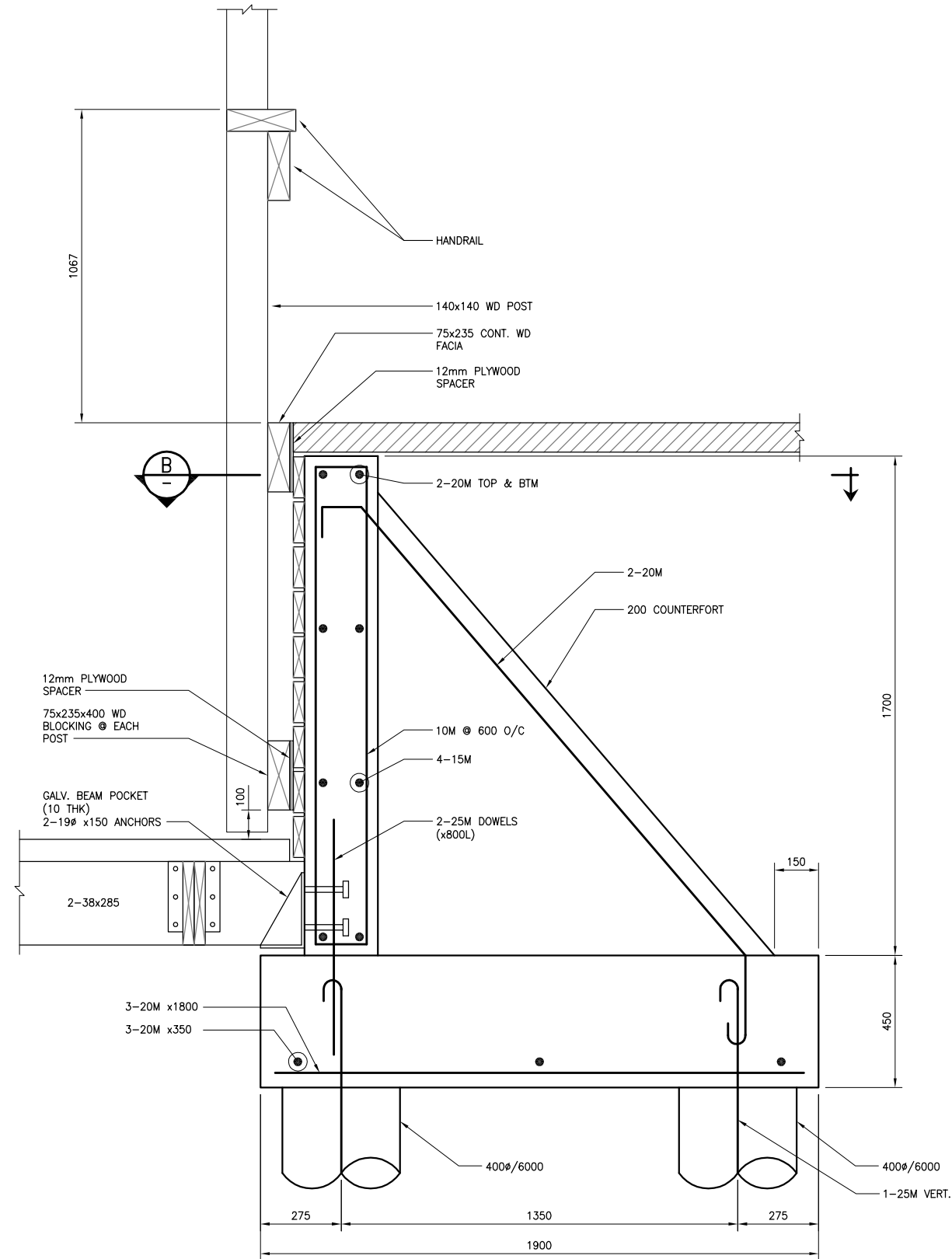
LEGEND:
1 PHOTOGRAPH NUMBER AND PERSPECTIVE



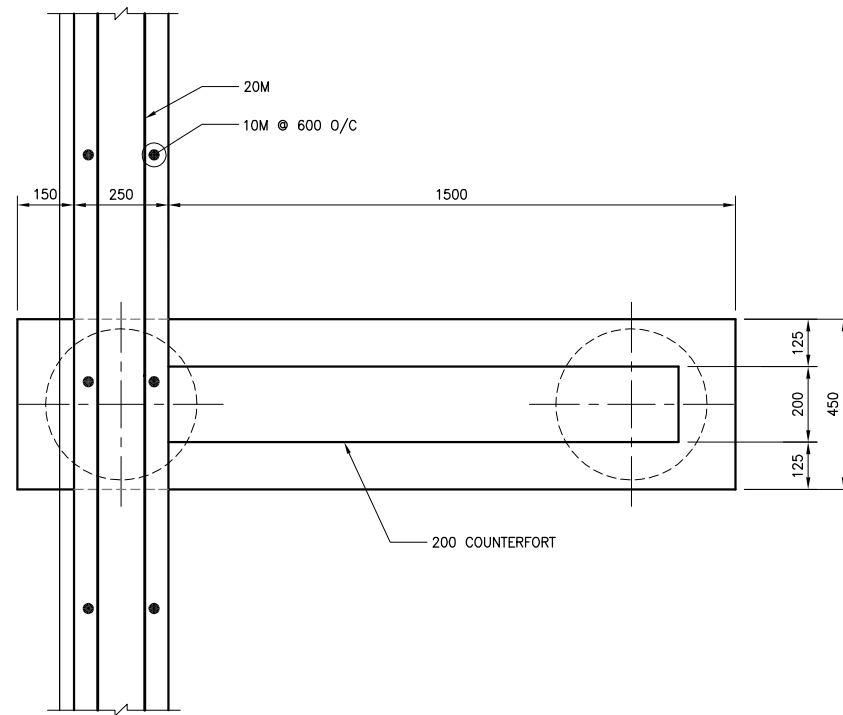
PLAN - DOCK AREA
SCALE: 1:100 (24x36)
1:200 (11x17)

File Name: P:\Projects\2011\11-0107-01\11-0107-01-FIG 1-Rev 0.dwg - Tab: FIG1 Plotted By: MBrischuk 11/06/14 [Tue 1:30pm]
11x17 PLOT SCALE: 1"=2'

0	11/06/14	ISSUED WITH FINAL REPORT
NO.	YY/MM/DD	DESCRIPTION
REVISIONS / ISSUE		
KGS GROUP CONSULTING ENGINEERS		 THE CITY OF WINNIPEG
HARBOUR VIEW RECREATION PROJECT FOUNDATION EVALUATION		
FOUNDATION PLAN		
JUNE 2011	FIGURE 1	REV: 0



A SECTION
SCALE: 1:20mm



B SECTION
SCALE: 1:20mm

0	11/06/14	ISSUED WITH FINAL REPORT
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REVISIONS / ISSUE		
KGS GROUP CONSULTING ENGINEERS		Winnipeg THE CITY OF WINNIPEG
HARBOUR VIEW RECREATION PROJECT FOUNDATION EVALUATION		
DOCK FOUNDATION TYPICAL SECTIONS		
JUNE 2011		FIGURE 2
		REV: 0