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Memorandum

Date: June 17, 2008
To: Brent Kellet
From: C.C. Macey, P. Eng.
Subject: Bishop Grandin Greenway Asphalt Path – Glen Meadow Street to River Road
Project Number: 0265-389-00 (4)

Distribution: K. Zurek/R.A. Sorokowski/D. Griffin- WWD
 G. Blazek/M.G. McDonald - UMA

We have reviewed construction of the Bishop Grandin Greenway Asphalt Path and construction access over the 600mm Fort Garry – St. Vital (FGSV) Feedermain between Glen Meadow Street and River Road. This review is an extension of a previous report entitled “Pedestrian Path – Bishop Grandin Boulevard between St. Mary’s Road and Glen Meadow Street, Fort Garry – St. Vital Feedermain and Branch II Aqueduct Loading Review”¹. We believe that your design of the pathway and indicated construction access points can safely be used without jeopardizing the regional water supply plant, based on the conditions described in the referenced 2007 report and herein.

Construction Overview

Your project involves construction of a 3.5 m wide asphalt walkway north of Bishop Grandin Boulevard from Glen Meadow to River Road. While the asphalt path has only one permanent crossing of the feedermain, there are up to 5 potential temporary crossings you are looking at to gain access to the walkway area to facilitate construction.

Data Collection and Review

In order to complete the analysis, we reviewed the following information;

- Proposed pathway construction and construction access drawings SE-08-22 to SE-08-25 (attached in Appendix A)
- Original construction record drawings as noted on City of Winnipeg WWD drawings D-854, D-855 and D-859 (attached in Appendix B)
- Original pipe specification sheets from Lock Joint Pipe Company (attached in Appendix C)
- Original laying schedules (attached in Appendix A)
- ASTM Standard A648 Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Pipe
- AWWA Standard A301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type
- Booklet 25 - Design of Lock Joint PCC Pipe, issued January 1963

¹ Pedestrian Path – Bishop Grandin Boulevard Between St. Mary’s Road and Glen Meadow Street, Fort Garry – St. Vital Feedermain and Branch II Aqueduct Loading Review, UMA|AECOM, April 2007.

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As noted above up to five separate construction access points have been identified and 1 section of the pathway will be constructed directly over the 600mm FGSV Feedermain. The existing cover over the 600mm Feedermain ranges from 1.37m (4.5') to 2.74m (9') with the specific height at each potential crossing location summarized in Table 1 below.

Table 1: Cover over Feedermain

Crossing Location	Finished/Existing Cover	Approx. Temporary Construction Cover
Access Road Option 1	1.37 m (4.5 feet)	1.67 m (5.5 feet) ^{Note 1}
Access Road Option 2	1.43 m (4.7 feet)	1.73 m (5.7 feet) ^{Note 1}
Access Road Option 3	1.98 m (6.5 feet)	2.28 m (7.5 feet) ^{Note 2}
Access Road Option 4	2.56 m (8.4 feet)	2.86 m (9.4 feet) ^{Note 2}
Temp Crossing at Glen Meadow	2.16 m (7.1 feet)	2.46 m (8.1 feet) ^{Note 2}
Permanent Pathway Crossing	2.16 m (7.1 feet)	1.86 m (6.1 feet) ^{Note 3}

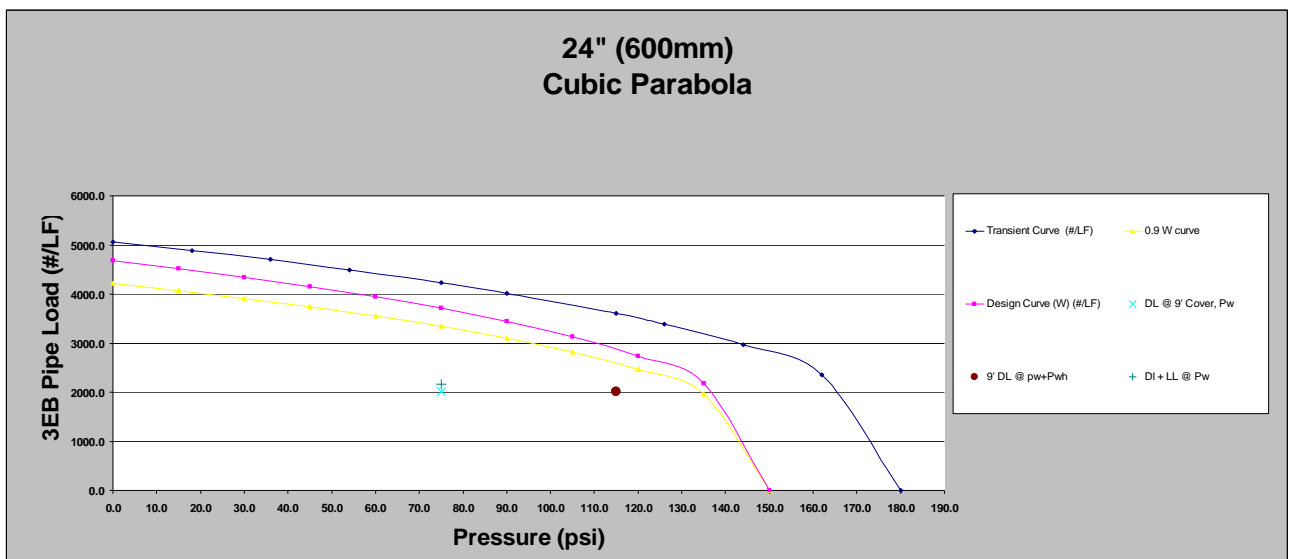
*Note 1: Temporary crossing **should be** constructed by adding 0.3 m of temporary granular to existing grade*
Note 2: Temporary crossing can be constructed either by subcut or by building up over existing grade
Note 3: Permanent crossing assumes a maximum 0.30 m subcut to facilitate construction of walkway

Please note that any temporary crossings planned access Road Options 1 or 2 should be constructed by building up from existing grade as opposed to subcutting at these locations. All other temporary crossing locations can be either subcut or built up from existing grade to enable construction of a temporary access point to facilitate the walkway construction.

Loading Analysis Procedure

We have analyzed this section of the 600mm FGSV Feedermain using the same assumptions stated in the 2007 report as the pipes were installed under the same contract and are the same class of pipe. The cubic parabola design curves and points associated with the applied loadings at 2.74 m (9 feet of cover) are presented in Figure 1 below.

Figure 1: Cubic Parabola Design Curves – FGSV AWWA C301 24” (600mm) Approx. Class 15 Pipe



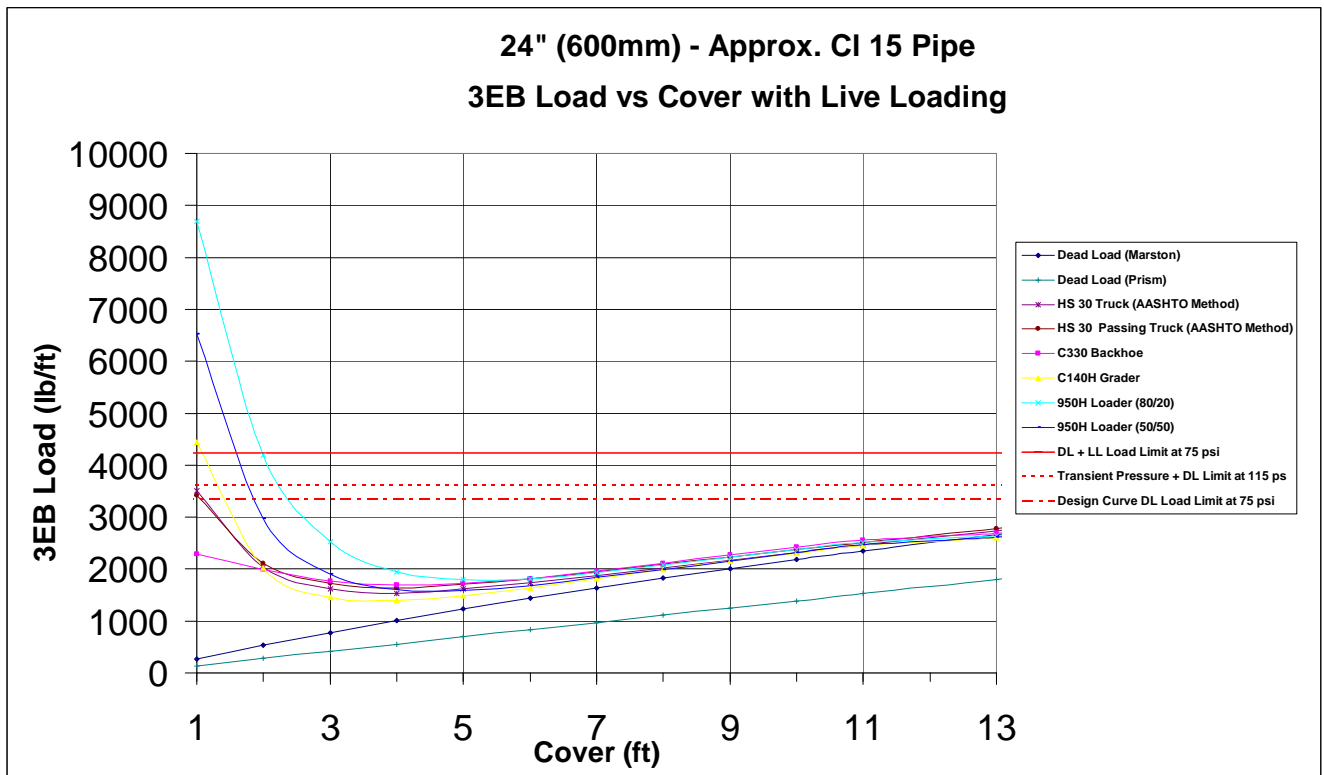
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The figure illustrates that all of the final control design points are all within the allowable limits of the pipe.

We also reviewed various applied live loads at a range of heights of cover. The results are plotted in Figure 2 below versus the limit states for the pipe with applied loads ranging from the dead load at normal operating internal pressure, the dead + live load at normal operating internal pressure, and the dead load at normal operating internal pressure plus internal transient event pressure. As evident below, while there is a great deal of apparent structural capacity of the pipe we are assuming the pipe to be in good physical condition and the applied loads increase dramatically at heights of cover of less than 3 feet.

Based on other excavations of this particular pipe, it is a reasonable assumption to assume it is still in good physical condition, although it is still prudent to proceed working over it with an abundance of caution. The increase in applied loads at very low heights is the primary reason that we are very concerned about potential rutting in instances where exposed subgrade gets wet or if temporary crossings are not maintained on a regular basis.

Figure 2: Applied Loads vs. Height of Cover



Construction Limitations and Recommendations

Based on the analysis completed, the proposed transit roadway can safely be constructed, based on the live loads and earth covers noted above and subject to the following implementation recommendations. A suggested insert for the Technical Specifications is enclosed as Appendix C. Implementation recommendations are summarized as follows:

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1) Planning and General Execution

- i. No work shall commence at the site until a Construction Method Statement (as defined in Appendix C) is in place and the feedermain location has been clearly delineated in the field including verification that its datum relative to the proposed pavement are adequately defined.
- ii. Work shall only be carried out with equipment that has been reviewed and quantified in terms of its loading implications as noted in Recommendation 5 below.
- iii. Restrict transverse crossings of the Feedermain to designated crossing locations (as noted on the Construction Drawings or approved Construction Method Statement and limit equipment crossing the pipes to these locations. Temporary crossings shall employ a sufficient layer of granular material to limit rutting and reduce equipment speeds to levels that minimize the effect of impact loading.
- iv. Temporary crossings shall be monitored and maintained on a regular basis to ensure excessive rutting is not occurring and that a sufficient granular surface access path is in place.
- v. Work only with equipment and in the manner stipulated in the accepted Construction Method Statement and the supplemental requirements noted herein for construction work activities either longitudinally or transverse to the alignment of the Feedermain.
- vi. Subgrade, subbase and base construction shall be kept in a rut free condition at all times. Construction equipment is prohibited from crossing pipelines if the grade is insufficient to support the equipment without rutting.
- vii. Granular material, construction material, soil or other material shall not be stockpiled on the Feedermain within 5 metres of the centerline of the pipes.
- viii. Where work is in proximity to the pipes (any work within a 5 m offset is defined as work within the proximity to the Feedermain), utilize construction practices and procedures that do not impart excessive vibration loads on the pipes or that would cause settlement of the subgrade below the pipes.

2) Excavation

- i. Excavation of the pathway over the feedermain requires the equipment offset from the pipe a minimum of 3.0 m from the centerline of the pipes, to carry out excavation. While the equipment may cross the pipes at designated crossing locations, do not operate equipment directly over the Feedermain at heights of cover of less than 2.0 m.

3) Base Course Construction

- i. Subbase or base course materials shall not be dumped directly on the pipelines but shall be carefully bladed in-place.
- ii. Subbase compaction within 3.0 metres of the centreline of the Feedermain shall be either carried out by static methods without vibration or with smaller approved equipment such as hand held plate packers or smaller roller equipment.
- iii. Careful selection of granular material gradation requirements as well will minimize the level of on-site densification that is required. Well graded manufactured materials (e.g. a crushed

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limestone) with less than 5% fines typically require very little on site compactive effort after placement to achieve specified densities.

- 4) Any changes in pathway design or in grades over the Feedermain must be reported for further review.
- 5) All proposed construction equipment must be submitted to UMA for review prior to construction. The submissions need to include sufficient data on operational weights, dimensions, and payloads to facilitate assessment that the proposed construction equipment is not in excess of the typical construction loading that this assessment was based on.
- 6) The contractor and all site supervisory personnel and equipment operators have to be formally briefed to ensure that they are fully cognizant of the associated restrictions, constraints, and risks associated with working adjacent to and over these pipes. New personnel introduced after commencement of the project need to be formally orientated as to the significance and constraints associated with working over the FGSV Feedermain.

We trust this information meets your requirements on this matter. Should you have any queries or require further information or clarification please do not hesitate to contact either the writer or Marv McDonald, C.E.T. of this office.

Sincerely,

UMA Engineering Ltd.



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 National Technical Specialist
 Community Infrastructure
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