MEMORANDUM

Our File	:	Enquiries	: Eric Cheung
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To : **DAVID WILSON**

Subject : **Pier Effects East Perth To Burswood Footbridge Over Swan River**

1. INTRODUCTION

Main Roads WA's Infrastructure Delivery Directorate (IDD) has requested Waterways Section to analyse the effect of piers (from a proposed footbridge) in the Swan River across the river from East Perth to Burswood.

2. ANALYSIS INFORMATION

The same HEC-RAS model used to analyse the effects of a temporary causeway for the construction of this footbridge was adopted for this analysis.

Input details for modelling of the footbridge were taken from the drawing "Transport Infrastructure, Concept Design, Swan River Footbridge – Plan and Profile" (P11250-076 SK-C-0105). A deck thickness of 2.5m, deck width of 10.42m and deck level of 4.0m AHD (by approximation at the west abutment) was adopted.

Pier width and locations were nominated by David Wilson. The pier widths were assumed to be 5m. 7, 6 and 5 pier scenarios were investigated and pier locations were approximately equally spaced either side of the navigational channel.

It was found that the Swan River channel in drawing SK-C-0105 was different to the channel supplied by Department of Water (DoW). Brad Sherlock (BG&E) confirmed that drawing SK-C-0105 was only a draft. Due to this, the channel supplied by DoW was adopted.

The channel from drawing SK-C-0105 was narrower than that from DoW, hence it was centred over the channel supplied by DoW to determine new station locations for input into the HEC-RAS model.

3. RESULTS

Pre footbridge and 7, 6 and 5 Pier scenarios were analysed. HEC-RAS was used to determine water levels and velocities for the 10, 25, 50 and 100 year ARI flood events. There was little difference in the results between the pre footbridge and post footbridge scenarios. The 6 Pier scenario had slightly higher flood water levels than the other two scenarios and is shown in Table 1. Results of the other scenarios can be found in the attachment to this memo.

Table 1: Flood Water Levels Pre and Post Footbridge Construction for the 6 Pier Scenario

Cross Section	Water Levels (m AHD)			
1838	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.77	1.38	1.57	1.80
Post Footbridge	0.77	1.38	1.58	1.82
Difference	*0*	*0*	*+0.01*	*+0.02*
1538	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.75	1.36	1.54	1.76
Post Footbridge	0.75	1.36	1.55	1.78
Difference	*0*	*0*	*+0.01*	*+0.02*
1482	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.75	1.35	1.53	1.75
Post Footbridge	0.75	1.35	1.54	1.76
Difference	*0*	*0*	*+0.01*	*+0.01*
1412	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.75	1.35	1.53	1.75
Post Footbridge	0.75	1.35	1.54	1.76
Difference	*0*	*0*	*+0.01*	*+0.01*
1400 Post Footbridge	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Upstream	0.74	1.34	1.53	1.74
Downstream	0.74	1.34	1.52	1.73
1388	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.74	1.35	1.53	1.74
Post Footbridge	0.74	1.35	1.53	1.74
Difference	*0*	*0*	*0*	*0*
1190	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.74	1.34	1.53	1.74
Post Footbridge	0.74	1.34	1.53	1.74
Difference	*0*	*0*	*0*	*0*
932	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.74	1.34	1.52	1.73
Post Footbridge	0.74	1.34	1.52	1.73
Difference	*0*	*0*	*0*	*0*
635	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.74	1.34	1.52	1.73
Post Footbridge	0.74	1.34	1.52	1.73
Difference	*0*	*0*	*0*	*0*

The results indicate that water levels upstream of the proposed footbridge are only slightly higher post footbridge for the 50 and 100 year ARI flood events, ranging between 10mm and 20mm. There was no water level difference for the 10 and 25 year ARI flood events. The nature of the water levels from Cross Section 1482 to 1838 suggests that the backwater effects will extend slightly further upstream if the model permitted.

The water levels downstream of the footbridge remain the same, as these are not affected by upstream water conditions.

Velocities at the bridge location are barely affected as shown in Table 2.

Table 2: Channel Velocities Pre and Post Footbridge Construction for the 6 Pier Scenario

Cross Section	Channel Velocities (m/s)			
1412	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.63	0.82	1.02	1.24
Post Footbridge	0.63	0.82	1.02	1.23
Difference in Velocity	*0*	*0*	*0*	*-0.01*

4. CONCLUSION

This analysis shows that construction of the footbridge on the Swan River will have minor effects on water levels and velocities. It is likely that this minor effect will extend slightly further upstream if the model permitted. The effect is minor regardless of whether 7, 6 or 5 piers were used for the footbridge. The effects on the natural Swan River flow regime are minor enough for it to be considered insignificant.

The results of this analysis can be used as a guide to the planning decision process. However in order to develop on this proposal and determine its full implications, more detailed hydraulic analysis should be undertaken to include factors such as tidal influences and feasibility studies to all the other issues described earlier in this section.

Eric Cheung
Waterways Engineer (Acting)
10/06/2013

ATTACHMENTS

Cross Section	Water Levels (m AHD)			
1838	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.77	1.38	1.57	1.80
7 Piers	0.77	1.38	1.58	1.82
6 Piers	0.77	1.38	1.58	1.82
5 Piers	0.77	1.38	1.58	1.82
1538	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.75	1.36	1.54	1.76
7 Piers	0.75	1.36	1.55	1.78
6 Piers	0.75	1.36	1.55	1.78
5 Piers	0.75	1.36	1.55	1.77
1482	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.75	1.35	1.53	1.75
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1412	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.75	1.35	1.53	1.75
7 Piers	0.75	1.35	1.54	1.76
6 Piers	0.75	1.35	1.54	1.76
5 Piers	0.75	1.35	1.54	1.76
1400 (Bridge) Upstream	**10 Year**	**25 Year**	**50 Year**	**100 Year**
7 Piers	0.74	1.34	1.53	1.73
6 Piers	0.74	1.34	1.53	1.74
5 Piers	0.74	1.34	1.53	1.74
1400 (Bridge) Downstream	**10 Year**	**25 Year**	**50 Year**	**100 Year**
7 Piers	0.74	1.34	1.52	1.73
6 Piers	0.74	1.34	1.52	1.73
5 Piers	0.74	1.34	1.52	1.73
1388	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.74	1.35	1.53	1.74
7 Piers	0.74	1.35	1.53	1.74
6 Piers	0.74	1.35	1.53	1.74
5 Piers	0.74	1.35	1.53	1.74
1190	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.74	1.34	1.53	1.74
7 Piers	0.74	1.34	1.53	1.74
6 Piers	0.74	1.34	1.53	1.74
5 Piers	0.74	1.34	1.53	1.74
932	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.74	1.34	1.52	1.73
7 Piers	0.74	1.34	1.52	1.73
6 Piers	0.74	1.34	1.52	1.73
5 Piers	0.74	1.34	1.52	1.73
635	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.74	1.34	1.52	1.73
7 Piers	0.74	1.34	1.52	1.73
6 Piers	0.74	1.34	1.52	1.73
5 Piers	0.74	1.34	1.52	1.73

Indicates a change in water level from Pre Footbridge

Cross Section	Channel Velocities (m/s)			
1412	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Pre Footbridge	0.63	0.82	1.02	1.24
7 Piers	0.63	0.82	1.02	1.23
6 Piers	0.63	0.82	1.02	1.23
5 Piers	0.63	0.82	1.02	1.23

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6 Piers	0.64	0.82	1.02	1.24
5 Piers	0.64	0.82	1.02	1.24

Indicates a change in velocity from Pre Footbridge