SUBMISSION ON WINDSOR BRIDGE REPLACEMENT PROJECT

14 DECEMBER 2012

CHRISTOPHER HALLAM & ASSOCIATES PTY LTD

PO BOX 265, KURRAJONG NSW 2758

Telephone: 02 4573 1045

E-mail: chris@christopherhallam.com

1.0 INTRODUCTION

Christopher Hallam & Associates Pty Ltd is a consulting engineering practice, specialising in roads and traffic planning. This practice has operated for 25 years in the Sydney Region. We have undertaken a number of traffic studies for Hawkesbury City Council, with the most recent – and relevant – being *Windsor Town Centre Traffic Study,* June 2011. We have previously provided a submission on the bridge design as part of the RMS consultation process, in our January 2012 report *Windsor Bridge over the Hawkesbury River Submission for Option 1 Revised Design.*

The *Windsor Bridge Replacement Project Environmental Impact Study* (November 2012) has been reviewed. This Submission has been prepared in response to that EIS. It is set out as follows:

- Section 2 reviews – and queries – the justification for the new bridge;
- Section 3 briefly discusses an alternative to the proposal;
- Section 4 recommends a course of action to address strategic road planning objectives, while not precluding an ultimate construction of Option 1;
- Section 5 contains a submission on the design of Option 1, should it be adopted, and
- Section 6 sets out our conclusions.

2.0 THE NEED FOR A NEW BRIDGE

Overview

Two considerations that underpin the proposal for a new bridge are the structural condition of the current bridge and the issues associated with its carriageway width of 6.1m.

We note that the EIS talks of *"elements of the bridge have deteriorated substantially and RMS has assessed that it is not practical to replace or repair these elements".* We are not experienced bridge design engineers and hence cannot provide a professional comment. However we have seen statements made by retired senior RTA/DMR bridge engineers Ray Wedgewood and Brian Pearson that provide a counter view, a view that for a not unreasonable sum of money, repairs can be made. We understand that other submissions will cover this point. If this is a feasible option, it could provide a means of staging decisions on the strategic plan for roads and river crossings in the area, as discussed in Section 4.

We note that there is currently no load limit in place on Windsor Bridge. We conclude from this situation that the bridge is not in immediate danger of failing. From this perspective, there does not appear to be an urgent need to do anything immediately., so time is available to consider the broader issues.

Truck Conflicts

With the bridge carriageway width of 6.1m, this is less than the desirable width for two-way heavy truck movements. However, what has recently changed to require immediate action on a new bridge? Trucks have not become wider. Trucks are limited to 2.5m in body width, with mirrors increasing the clearance width. The worst case is if two large trucks arrive at the same time to travel across the bridge, in opposite directions, and one driver decides to wait for the other truck to pass. From automatic tube traffic counts undertaken under our direction by CFE in November 2012, the current ADT across Windsor Bridge is 19,125 vpd, with 8.17% heavy vehicles (Class 3-10). This is some 1560 trucks per day in either direction. Taking the average hourly flows over seven days and the vehicle classification per hour, the opposing heavy vehicle movements are:

Hour	**Northbound**	**Northbound**	**Southbound**	**Southbound**
	Class 3	**Class 4-10**	**Class 3**	**Class 4-10**
7-8am	26	18	45	23
8-9am	26	22	49	20
9-10am	25	27	37	23
3-4pm	43	20	30	18
4-5pm	45	19	27	14
5-6pm	40	15	15	10

Class 3 "heavy vehicles" are two axle rigid vehicles which are typically small to medium trucks, while Classes 4-10 cover multi-axle rigid trucks and articulated trucks. The latter might be more likely to avoid passing on the bridge. Taking 9-10am as a period with highest heavy vehicle movements, the northbound flow of 27 large trucks/hour would have an average arrival headway of one truck each 133 seconds. The southbound flow of 23 large trucks/hour would have an average arrival headway

of one truck each 157 seconds. Without going into a detailed queuing theory analysis, the numbers suggest that the number of truck conflict situations each hour in the peak periods is not high. With the largest type of truck, B-Doubles (Class 10), of the 19,125 vpd, some 29 movements are by B-Double, based on the counts. These very large trucks make up only a very small proportion of total traffic movements.

Capacity of Bridge

The capacity of Windsor Bridge is presented as an issue. However road capacity in this location relates more to the capacity of the intersections at each end, at Bridge Street/George Street and Wilberforce Road/Freemans Reach Road. This is acknowledged in the EIS. The former intersection has acceptable capacity. At the latter, northern, intersection, delays occur to traffic turning right out of Freemans Reach Road, reducing the overall level of service of this intersection. The capacity of each of these intersections could be increased independent of what is done with Windsor Bridge. The Bridge Street/George Street roundabout could be replaced by traffic signals, to provide improved pedestrian safety. The priority junction of Wilberforce Road and Freemans Reach Road could be replaced by a roundabout. Again, the capacity of this road corridor is not governed by the capacity of the bridge.

This is partly acknowledged in the EIS (page 32) where it is stated:

> *"Ultimately the operational performance of the bridge is constrained on its entry and exit by the operation of intersections at Bridge Street/George Street and Wilberforce Road/Freemans Reach Road. For this reason, the capacity of the existing bridge cannot be accurately calculated as an isolated element within the overall road network. It is therefore more appropriate to determine the operational performance of the section of road network which incorporates the existing bridge element..."*

In our previous submission of January 2012 *Windsor Bridge over the Hawkesbury River – Submission for Option 1 Revised Design,* we analysed the effect of a reduction in the gradient of the southbound lane from the bridge to the roundabout at Bridge Street/George Street, from the current average gradient of 10.4% to a gradient of 6%, reflecting the option proposed. Our SIDRA analysis of the roundabout showed zero effect, with the AM peak average delay remaining unchanged at 7.9 seconds, and the PM peak average delay remaining unchanged at 9.5 seconds. Windsor Bridge has a carriageway width of 6.1m, so say an average of 3.0m per lane. However any minor friction at the bridge level has minimal impact by the time southbound traffic reaches the roundabout. As a sensitivity test, the southbound approach of Bridge Street directly into the roundabout was reduced from 5.0m to 3.0m and the operation re-assessed. The AM peak average delay marginally increased from 7.9 to 8.0 seconds and the PM peak delay marginally increased from 9.5 to 9.6 seconds. Given the immediate proximity of this assumed width reduction and the relative width reduction, it could be concluded that approach width is not a significant factor, and that increasing the actual lane width on the bridge from 3.0 to 3.5m would have no impact on the roundabout operation. Thus the only impact of this reduced width is the rare occasion when one truck driver might wait for an on-coming truck to pass, plus the fact that the truck speed limit is 40 km/hr. This needs to be seen in the context of the lower than average (for an arterial road) heavy vehicle percentage of 7-8%.

Traffic Accidents

Traffic accidents are a consideration in any road planning. The five year accident history showed no accidents on Windsor Bridge. There have been a number of accidents at the Wilberforce Road/Freemans Reach Road intersection. Again, the construction of a new roundabout here, independent of the bridge, would improve traffic safety and reduce accidents.

Benefit-Cost Ratio

The question of the benefit-cost ratio of the bridge proposal appears to be a movable feast. The August 2011 report *Windsor Bridge over the Hawkesbury River – Traffic modelling and evaluation of options – preliminary report,* quotes a Benefit-Cost ratio of Option 1 of 4.5, assuming a capital cost of $45.4M. However on page 26 of the EIS, for a capital cost of $46.36M, the Benefit-Cost ratio is stated to be 14.6. In the earlier assessment, the benefits were reduced travel costs (travel time and vehicle operating costs). The EIS assessment included "external savings" and "safety benefits". However looking at Table 3.5, these make up less than 1% of the total benefits, and hence do not explain the difference.

The *EIS Traffic and transport working paper* sets out in Sections 5.3.1-5.3.2 their analysis of traffic delays and travel times. Comparing network performance indicators in Table 3.10 with Table5.1 of this *Working paper,* the Year 2016 AM peak average speed would increase from 45 km/hr to 54 km/hr with Option 1, while in the PM peak the average speed would increase from 44 km/hr to 49 km/hr. With an adopted design speed of 50 km/hr, the option appears to speed traffic through Thompson Square relatively quickly. In the AM peak hour the Current (2011) average delays to Bridge Street traffic through the Macquarie Street intersection are 35 seconds/vehicle northbound and 11 seconds per vehicle southbound. These would marginally increase for year 2016, where at the Bridge Street/George Street intersection the northbound delays will be 5 seconds and the southbound delays will be 15 seconds. At these two intersections the total northbound intersection delay is 40 seconds, with southbound delays totalling 26 seconds. PM peak hour flows show similar delay levels. The improvements in average travel speeds do appear quite ambitious.

The intersection analysis of the future situation – with Option 1 bridge and associated intersection works completed – makes no mention of the Bridge Street/Macquarie Street intersection. Presumably it remains unchanged. However in the analysis of the Bridge Street/George Street new traffic signals, it is not clear if traffic signal co-ordination has been included in the analysis, in traffic signal network modelling. At this intersection, the current operation as a roundabout is set out in the analysis results set out in the Annexure to the *Working Paper,* where the average AM peak hour delay is given as 8.4 seconds, and the average PM peak hour delay is given as 14.9 seconds. The Option 1 works include the addition of traffic signals at this intersection. Tables 5.3 and 5.4 give the resulting average Year 2016 (one lane approaches) delays as 15 seconds in the AM and 29 seconds in the PM, compared with the Year 2011 Current figures of 8 and 15 seconds respectively. This being the case, where are the travel time benefits coming from?

Returning to the economic analysis results set out in Table 3.5 of the EIS, almost all of the Benefits would also accrue if the ancillary intersection works at Bridge Street/George Street and Bridge Street/Freemans Reach Road/Wilberforce Road were constructed <u>without the new bridge.</u> The resulting Benefit-Cost ratio would be very substantial. Without a cost breakdown of the elements of

the project, the actual figure is hard to calculate. Money could also be put aside for repairs to the existing Windsor Bridge, and the Benefit-Cost ratio would still be significantly higher than any figure for Option 1.

Conclusion

In conclusion, while there would be benefits in improving/replacing Windsor Bridge, there is not a clear cut need to undertake this work immediately. Further options and alternatives need to be explored. The construction of the intersection improvements at the Bridge Street/George Street and Bridge Street/Freemans Reach Road/Wilberforce Road intersections would produce most of the traffic benefits of Option 1, at a substantially lower cost.

3.0 ALTERNATIVES TO THE PROPOSAL

Overview

Previous studies of Windsor Bridge considered nine options, with Option 1 being the preferred option. The choice of a preferred option depends on the weighting given to the various identified impacts. While we are traffic and transport consultants, and not heritage consultants, it is clear that heritage issues associated with Thompson Square and the early history of Windsor are extremely important, and that very high weighting should be given to these issues. The roads authority in the past provided a less than sensitive approach to the bridge over South Creek, next to the historic Toll House. It is hoped that the current roads authority treats heritage issues in such an important location with greater respect.

Rickabys Line Option

While previous studies identified Option 1 as the preferred option, are there any other options that could achieve the road network objectives and at the same time preserve and improve the heritage importance of Thompson Square? The community group CAWB has identified an alternative route option that travels through Macquarie Park, over the River and Rickabys Creek and joins Hawkesbury Valley Way between the Sebel Resort and the RAAF Base. This option is briefly reviewed on page 46 of the EIS. The EIS comments:

> "*While this third Hawkesbury Valley Way option would meet project objectives for heritage and safety, it is anticipated to only partially meet the traffic objectives unless a number of additional significant improvements were made to the surrounding traffic network.*"

This CAWB option was developed as a heavy vehicle bypass of Windsor town centre, and would proceed in association with the retention of the existing Windsor Bridge, with the latter restricted to light traffic only, with a load limit. If remedial works were required, even with this weight restriction, then that would be a cost to the project. As a light traffic route, the accessibility of Windsor town centre is retained for local businesses, and pedestrian and cycle routes are maintained.

The logic of this bypass route is that it connects directly to Hawkesbury Valley Way, which continues across South Creek as a flood free route, to Windsor Road. It also connects to Macquarie Street (West), for access to South Windsor and Penrith via The Northern Road. The other consideration is that less than half of the traffic using Windsor Bridge has an origin or destination on Windsor Road (McGraths Hill). From traffic counts we have undertaken in Windsor for Council, in the morning peak hour (February 2011), some 40-41% of bridge traffic comes from or goes to Windsor Road. In the afternoon peak hour the figures are 35% southbound and 41% northbound. Thus a Bypass from Wilberforce Road across to Hawkesbury Valley Way does not necessarily represent additional travel distance for all vehicles. With the existing bridge repaired but restricted to light traffic, the additional travel distances of the 35-40% of heavy traffic with Windsor Road origins/destinations - with this traffic only making up 7-8% of total Windsor Bridge traffic – is not a significant disbenefit.

Benefits of Rickabys Line Option

The primary benefit is the reduced traffic impact on Thompson Square, which is very important from a heritage perspective. Other benefits would be:

- Regional traffic is directed onto Hawkesbury Valley Way and hence onto the flood free route across South Creek, or to Macquarie Street West.
- An additional bridge over the Hawkesbury River would be provided.
- The reduction in traffic using Windsor Bridge would reduce traffic delays through the Bridge Street/George Street and Bridge Street/Macquarie Street intersections. The latter intersection was identified in the EIS an intersection of concern.
- Reduced traffic along Macquarie Street would reduce traffic delays along its intersections and reduce traffic noise.
- The EIS identified traffic noise concerns at some properties fronting Thompson Square. The removal of heavy traffic would provide significant reductions in traffic noise. While the EIS was deficient in not addressing traffic noise at all properties on Thompson Square, ignoring non-residential properties, impacts at commercial buildings are also relevant, particularly "commercial" buildings with residential uses. With residential properties R1-R4 on Figure 7.30 of the EIS, the removal of heavy vehicles might achieve compliance with the Road Noise Policy criteria.
- The Rickabys Line would provide improved access to recreational areas between Wilberforce Road and Hawkesbury Valley Way.
- Should the RAAF Base be redeveloped for civil aviation, road traffic would significantly increase. The new route would provide additional road network capacity where it was needed.

Road Network Connections to Rickabys Line Option

At the eastern end, a form of roundabout would provide an appropriate connection, with the four roundabout arms comprising the Bridge approach, Wilberforce Road, Freemans Reach Road and Rickabys Line. The layout would be different from the Option 1 roundabout layout, but there is sufficient land to allow a satisfactory design to be achieved.

At the western end, the route would intersect with Hawkesbury Valley Way. This could either be a roundabout or a traffic signal controlled intersection. The latter could more easily fit into the road reserve. Such a junction has been modelled, based on current traffic distributions found in surveys undertaken as part of the *"Windsor Town Centre Traffic Study",* (June 2011) by Christopher Hallam & Associates Pty Ltd, plus a sensitivity factor. The SIDRA modelling found a morning peak hour level of service of A and an afternoon peak hour level of service of B, for current traffic levels. These results suggest spare capacity for traffic growth.

The intersection of Hawkesbury Valley Way and Macquarie Street is and will remain the busiest intersection in Windsor. It currently operates close to capacity in peak periods. The Line option will channel additional southbound and northbound traffic along Hawkesbury Valley Way, being traffic that currently uses Bridge Street and thence Windsor Road. Traffic from Windsor Bridge with destinations towards South Windsor and Penrith will have their routes altered, from travelling straight through along each direction of Macquarie Street, to either a left turn from Macquarie

Street West or a right turn into Macquarie Street West. The proportions of traffic between Windsor Bridge and Windsor Road, and Macquarie Street have again been derived from the traffic surveys undertaken for the *"Windsor Town Centre Traffic Study".*

This intersection of Hawkesbury Valley Way and Macquarie Street has been modelled using the SIDRA program. As with any intersection close to capacity, the results are sensitive to how the traffic signals operate. For the 8.00-9.00am peak hour, with a fixed signal cycle time, the impact of the Line is to improve the level of service and reduce delays. Under vehicle-actuated control, the modelled delays are higher, but the impact of the Line still improves the level of service and reduces delays. The 4.00-5.00pm peak hour sees higher traffic flows. Under vehicle-actuated control , the operation remains little different with the traffic redistribution. A 3% increase in average intersection delay is indicated, although the degree of saturation of the intersection reduces. Looking at both peak periods, the impact of Rickabys Line on this intersection is neutral.

4.0 RECOMMENDED ACTION

Taking into account that there is not an immediate urgent need to replace Windsor Bridge, we suggest the following course of action:

1. Undertake structural repairs to Windsor Bridge as per the recommendations of the retired RTA/DMR senior bridge engineers, Ray Wedgwood and Brian Pearson.
2. Undertake a strategic study of all possible crossings over the Hawkesbury River between the Grose River junction and Windsor, taking into account future land use planning, flood free routes (eg Hawkesbury Valley Way) and constraints and opportunities.
3. If the Rickabys Line option is the preferred option then refine and construct this option. If the current Option 1 is the preferred option, retain the repaired Windsor Bridge, for pedestrians and cyclists, but no vehicular traffic, and develop the Option 1 bridge design, but with the deletion of the 3m wide pedestrian/cycleway, given that this will be provided on the existing Windsor Bridge.

5.0 OPTION 1 DESIGN

If the current Option 1 is to be constructed, it will be critical in the design, to reduce the heritage impact, visual impact and noise impact, to adopt the cross-section set out on Figure 4.2 of the EIS, for the 50 km/hr design speed, with Extended Design Domain elements, and with a height clearance to The Terrace extension of 3.6m. Any review of the differences in impacts between the two designs can easily be seen in this Figure 4.2, with the level of the 60km/hr alignment substantially above the ground level of buildings on both sides of Thompson Square.

We note the comment on page 243 of the EIS:

> *"The operation of Windsor Wharf would not be affected by the project. Access to Windsor Wharf would change and would be via The Terrace under the new bridge rather than Old Bridge Street which is the current situation. The new bridge would have a minimum clearance of 3.6 metres over the Terrace which would allow cars, Council garbage trucks, emergency services vehicles and small coaches direct access to the wharf. Large coaches over 3.6 metres in height would be required to park on the western side of the project. There is coach parking on Thompson Square road and Baker Street – which are relatively close to the wharf.*
>
> *In response to Hawkesbury City Council's concerns about large coach access to Windsor Wharf RMS will investigate the possibility of increasing the clearance of the new bridge over The Terrace to allow large coach access during detailed design. Investigations would consider limiting impacts on heritage views and vistas."*

Section 4.3.1 on page 50 of the EIS states in part:

> *"Further reductions in the height of the new bridge and approach road were investigated but were not considered to be feasible, as there needs to be about 3.6 metres of under bridge clearance on the southern side to allow small coaches, service vehicles and emergency vehicles to access Windsor Wharf. While The Terrace could be lowered to achieve the required clearance under the replacement bridge this was considered undesirable due to the potential disturbance of terrestrial and maritime archaeological sites and a steeper access road [to] the wharf car park."*

If the ground level of the extended carriageway of The Terrace cannot be lowered, the only way to achieve additional height clearance would be to reduce the depth of the bridge at this location, if the height of the top carriageway is to be retained at the level shown on Figure 4.2 for "50 kmph design with EDD". What would not be acceptable would be to raise the height of the carriageway level shown on this Figure. The comment that "*Investigations would consider limiting impacts on heritage views and access"* is too much of an open-ended approach that could severely compromise the heritage significance of Thompson Square. At the same time, any increase in height of this southern bridge approach would seriously compromise the environmental impact assessment that is set out in this EIS. This clearly applies to heritage views and vistas. It also applies to the acoustic analysis. It is inadequate enough that the noise assessment set out in Table 7.47 of the EIS only considers residential properties. Commercial buildings and open space also need to be considered. A higher

approach level, such as that shown on Figure 4.2, would very significantly affect noise levels at all buildings and locations in the open space of Thompson Square, and render the EIS as an assessment and interpretation document very misleading.

The original proposal had a height clearance of 5.1m, which was promoted as sufficient to allow a tourist coach to pass under the bridge. A key question is, how many large tourist coaches are likely to require access to the wharf? If they do so, where do they park and where do they turn around? There does not appear to be any allowance in the Option 1 plan for coach parking and turning around.

Australian Standard 2890.2-2002 recommends a height clearance of 3.5 m for servicing by the design Small Rigid Vehicle. The only location being serviced is the wharf. With the modest scale of activities occurring at the wharf, there is no strong need for access by maximum height vehicles. AS2890.2-2002 has two levels of servicing, Regular and Occasional. The latter is less than once per day, which would accord with the situation at the wharf, averaged over the week. The EIS acknowledges that the 3.6m clearance would be adequate for Council garbage trucks, emergency services vehicles and small coaches. The frequency of large tourist coaches is low, substantially less than one every day, on average.

As suggested in our submission of January 2012, there is an option of providing large coach parking on the western side of the bridge, where the existing road comes up from the bridge, which would allow coaches to stop and park, and set down passengers who could then walk a very short distance to the wharf. Such a coach parking facility could also serve tourists visiting Thompson Square.

In conclusion, should Option 1 be adopted, it is essential that the bridge and approaches levels shown on Figure 4.2 of the EIS be retained and the height clearance between the underside of the bridge and The Terrace not be increased beyond 3.6 m.

6.0 SUMMARY

1. Windsor Bridge does not currently have a load limit imposed. There is no need for immediate action to construct a new bridge. Trucks have not increased in width in recent years. The percentage of heavy vehicles using the bridge – 7-8% - is relatively modest and less than what is typically found on an arterial road.
2. The current bridge does not substantially reduce the capacity of the route of Bridge Street between Macquarie Street and Wilberforce Road. The capacity of this route is controlled by the capacity of the intersections at each end, and also at the nearby intersection of Bridge Street/Macquarie Street.
3. Virtually all of the claimed benefits for travel time savings and vehicle operating cost savings could be achieved by simply undertaking the intersection upgrading works without the new bridge. Even after allowing for repairs to the existing bridge, the benefit-cost ratio of undertaking the intersection works plus the bridge repair works would be likely to substantially exceed the benefit-cost ratio of Option 1. The claimed benefit-cost ratio of Option 1, of 14.6, appears to be unsubstantiated and significantly more than the BCR of 4.5 stated in the August 2011 assessment of options.
4. The Rickabys Line is a valid alternative bypass of Windsor for heavy vehicles and for light traffic finding it a more convenient route, while retaining the current Windsor Bridge for light traffic only. There would be substantial benefits from this option.
5. As a logical course of action, initial repair works to the existing bridge might be undertaken while a comprehensive regional study of river crossings and road links was undertaken. Should such a study confirm Option 1 as the preferred option, the existing Windsor Bridge could be retained for use by pedestrians and cyclists only and the new bridge built without the need for a 3m wide footpath/cycleway, thus reducing the cost and visual impact.
6. Should Option 1 be ultimately adopted, it is essential that the bridge level shown on Figure 4.2 of the EIS, for a “50 kmph design with EDD” be retained, to keep heritage, visual and noise impacts down. A clearance to The Terrace of 3.6m is perfectly satisfactory for the small number of vehicles requiring access the wharf.