

15 Multi criteria consideration of options

Table 30 provides an initial consideration of the options against the evaluation criteria.

Table 30 - Option Assessment Criteria

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Safety	Improves road safety for all road users along the corridor	A qualitative comparison of the overall improvement to safety for each option. Key factors to consider are: <ul style="list-style-type: none"> divided carriageways for 80km/h zones, protected turn bays, signal control with pedestrian crossing facilities at intersections, safety barriers, off road shared paths. A higher performing option would be one that provides the greatest improvement to safety. 	Provides traffic signal control at intersections in Richmond and North Richmond with dedicated right turn bays and pedestrian crossing facilities. Provides a separated dual carriageway between Chapel Street and the Bridge in the 80km/h zone. Provides 3 metre wide off road shared user path between Richmond and North Richmond. This option does require the set up of a contra flow management system in the peak direction (Mon-Fri) which introduces an operational risk to safety for the operator of the system.	Provides traffic signal control at intersections in Richmond and North Richmond with dedicated right turn bays and pedestrian crossing facilities. Provides a separated dual carriageway between Chapel Street and the Bridge in the 80km/h zone. Provides 3 metre wide off road shared user path between Richmond and North Richmond. A dedicated right turn bay for eastbound traffic on Kurrarjong Road /to access Old Kurrarjong Road / Yarramundi Lane will also be provided.	Same as Option B.	Same as Option B. Some movements at Old Kurrarjong Road/Yarramundi Lane are banned (and not possible due to the level difference between the carriageways). This improves safety at this intersection through the removal of these turning movements against the traffic flow along the main corridor. Where right turns onto or off Kurrarjong Road are provided, dedicated lanes will be provided.
	Improves safety along and across the corridor for vulnerable road users (pedestrians and cyclists)	Provision of off road shared path facilities and safer crossing locations (mid block and with signal control at intersections). A higher performing option would be one that provides the greatest improvement to safety.	The same for all Options. Provides a 3 metre wide off road shared use path for pedestrians and cyclists from Richmond to North Richmond. Intersections in Richmond and North Richmond (except for West Market Street and Old Kurrarjong Road/Yarramundi Lane) will be signalised and will have signalised crossing facilities incorporated for pedestrians.	Same as Option A	Same as Option A	Same as Option A

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Road capacity	Reduces congestion along the corridor, particularly in AM and PM peak periods	A qualitative assessment of the improvement to congestion provided by the option when compared against a 'Do nothing' scenario. A higher performing option would be one that provides the best possible reduction in traffic congestion.	Provides a contra-flow traffic management arrangement in the AM and PM peaks to provide for two lanes in the peak direction across the Bridge.	Provides for two lanes in each direction at all times along the corridor and across the Bridge. Does not require a contra flow system in the peak direction across the Bridge.	Same as Option B	Same as Option B
	Improves the travel time along the corridor	A qualitative assessment of the improvement to travel time provided by the option when compared against a 'Do nothing' scenario. A higher performing option would be one that provides the best possible improvement to travel time.	Will improve travel time in the peak direction across the Bridge due to the contra flow arrangement. However, the set-up of the contra flow system will have travel time impacts along the corridor prior to and following the peak periods due to the set-up process.	Travel time will be improved at all times as there is no need for a contra flow system to be implemented for peak hour periods due to the two lanes in each direction provided across the bridge.	Same as Option B	Same as Option B
	Improves access (and safety) onto and off the corridor	Mimimising the restriction of turning movements onto and off the corridor and providing safer facilities (TCS or sheltered turning bays). A higher performing option would be one that provides the greatest improvement to safety. A dedicated right turn bay for eastbound traffic on Kurrajong Road to access Old Kurrajong Road / Yarramundi lane will also be provided.	Provides for traffic signal control at key intersections in Richmond and North Richmond (existing and new) with dedicated right turn bays. A dedicated right turn bay for east bound traffic on Kurrajong Road to access Old Kurrajong Road / Yarramundi lane will also be provided.	Same as Option A	Same as Option A	Provides for traffic signal control at key intersections in Richmond and North Richmond (existing and new) with dedicated right turn bays. However, some turning movements are not possible at Old Kurrajong Road/ Yarramundi Lane due to the height difference between the carriageways with access typically being left in/left out. The right turn into Old Kurrajong Road/Yarramundi Lane in the eastbound direction and the right turn out of Old Kurrajong Road / Yurramundi Lane eastbound into Kurrajong Road will remain.

Category	Description	Option A	Option B	Option C	Option D
<p>Visual and physical impact on landscape character of proposal (bridge, approaches, upgrades)</p> <p>Visual and landscape</p>	<p>This measure aims to provide an indication of the visual impact of the proposed bridge options when compared to the current situation. Higher performing options would provide a design that either maintains a view downstream of the river (from the existing bridge) or provides a bridge structure that minimises any disruption of this view. A higher performing option is one that would have the least visual impact on the built and natural attributes of the corridor.</p>	<p>Existing heritage bridge elevation is lost behind the new structure. RMS compliant safety barriers and handrails are not visually sensitive to the heritage elevation. Water Main is relocated to the outside of the new bridge in a visually prominent position. Increased width in asphalt surface. Overall rating of visual impact is High (from upstream or downstream) and Moderate (from the existing bridge)</p>	<p>Downstream views from the existing bridge changed. Structure potentially blocks views due to elevation difference between existing and new. Visual clutter of additional bridge on the River. New cuttings on approaches removes screening vegetation. Height difference blocks downstream views from existing bridge. Overall rating of visual impact is Moderate-High (from upstream or downstream) and Moderate-High (from the existing bridge)</p>	<p>Visual clutter of additional bridge on the River. Visual height difference exaggerated on the western approach due to bridge separation of only 25-50 metres with a vertical difference of 8.1 metres. Height differences and tight road intersections on western approach visually undesirable and awkward (potential need for retaining walls). Visual impact is increased on approaches due to removal of existing cultural/riparian vegetation and cut and fill requirements. North Richmond Approach: moderate cut embankment to industrial site; split level arrangement of east and westbound traffic to access both bridges; impacts on Hanna Park cultural plantings and current park design/layout. Richmond Approach: large fill operations into open pasture with long distance view from the north; Potential for new structures to be visually prominent when viewed from Hanna Park and existing elevated residential areas just to the north that currently overlook the park and floodplain. Downstream views from existing bridge blocked. Overall rating of visual impact is High (from upstream or downstream) and Moderate-High (from the existing bridge)</p>	<p>Same issues apply as Option C with only a small increase to impacts associated with an increased vertical separation of 5.5 metres bridge height difference and potentially longer bridge and increased cut and fill requirements depending on further detailed design of approaches. Overall rating of visual impact is High (from upstream or downstream) and Moderate-High (from the existing bridge)</p>

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Noise	Extent (percentage of grade) and length (km) of steep grades (i.e. In excess of 3%)	There is a correlation between this criterion and the occurrence of (Lmax) noise levels due to truck noise compression braking associated with steeper grades. A higher performing option would have a shorter overall length of steep grades.	c. 38 metres	c. 38 metres	c. 34 metres	c. 38 metres
	Noise impacts on community facilities	These include schools, places of worship etc. A higher performing option would impact less on community facilities.	The Option B is along the existing Bridge and the existing corridor between Richmond and North Richmond. There will be no additional noise impacts from this option.	The Option B is adjacent to the existing Bridge and along the existing corridor between Richmond and North Richmond. There will be no additional noise impacts from this option.	Option C requires a new bridge 25-50 metres downstream of the existing bridge. The alignment either side of the bridge is in the majority along the existing corridor between the Richmond and North Richmond. Locations of variance to the alignment are along the flood plain where there are no residential, business, educational or commercial premises and the land is of a rural/agricultural nature.	Option D requires a new bridge 25-50 metres downstream of the existing bridge. The alignment either side of the bridge is in the majority along the existing corridor between the Richmond and North Richmond. Locations of variance to the alignment are along the flood plain where there are no residential, business, educational or commercial premises and the land is of a rural/agricultural nature.

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Local economic	Number of existing businesses to be acquired i.e. those located within the proposed route corridor.	This indicates less economic disruption within the study area. A higher performing option would have a lower number of businesses affected.	0	0	1	1
	Extent (land area) of property and land acquisition	A higher performing option will have less impact and requirement for property acquisition therefore have a lower area of land acquisition. However, residential/business/commercial land will be more valuable than rural/flood plain land. As a result a higher performing option would also have less impact on residential/business/commercial land.	c. 36400 m2	c. 44100 m2	c. 68850 m2	c. 95200 m2
	Area (ha) of high and medium potential for archaeological deposits directly affected	A higher performing option would have a lower area (ha) affected	Option A follows the existing road and Bridge alignment. There is no increase to areas impacted by this option compared to the existing situation.	Option B follows the existing road alignment and the new Bridge alignment is 5 metres downstream of the existing Bridge. The increase to areas impacted by this option is negligible compared to the existing situation.	Option C could potentially have a negative impact on the archaeological remains of the former timber bridge and the railway.	Same as Option C

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Environment and cultural heritage	Number and area (ha) of high and medium value remnant and regenerated vegetation or habitat likely to be affected	This criterion accounts for potential effects to flora and fauna including threatened species and territorial animals. Where riparian flora and fauna has been mapped, this will also be included. A higher performing option would have a lower number and area (ha) impacted.	<p>Potential to impact on identified endangered ecological communities; River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions and, Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.</p> <p>Potential to impact threatened flora or fauna species or their habitat.</p> <p>Potential to impact on hollow bearing trees within riparian forest on the southern bank of the Hawkesbury River, in the vicinity of Richmond Bridge.</p> <p>Potential habitat for the Green and Golden Bell at Pugh's Lagoon.</p> <p>Potential for at least 98 noxious weed species to occur in the study area (12 species have been identified).</p>	Same for all Options	Same for all Options	Same for all Options

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Environment and cultural heritage cont.	Number of high and medium value sites of cultural heritage Aboriginal and non-Aboriginal significance directly affected	The cultural heritage evaluation includes Aboriginal and non-Aboriginal sites. A higher performing option would have a lower number and therefore indicate a lower disturbance of cultural heritage sites.	<p>Non-Aboriginal</p> <p>Option A follows the existing road and Bridge alignment. There is no increase to areas impacted by this option compared to the existing situation.</p>	<p>Non-Aboriginal</p> <p>Option B follows the existing road alignment and the new Bridge alignment is 5 metres downstream of the existing Bridge. The increase to areas impacted by this option is negligible compared to the existing situation.</p>	<p>Non-Aboriginal</p> <p>Options C and D would pass within approximately 25 to 50 metres downstream of the existing bridge. The potential to directly impact the present bridge and archaeological remains of the timber bridges would be reduced on the eastern approach but may still have some impact on archaeological remains associated with the former railway.</p> <p>Options C and D are each likely to have an adverse impact on the visible remains of the former timber bridge and the railway.</p>	<p>Non-Aboriginal</p> <p>Options C and D would pass within approximately 25 to 50 metres downstream of the existing bridge. The potential to directly impact the present bridge and archaeological remains of the timber bridges would be reduced on the eastern approach but may still have some impact on archaeological remains associated with the former railway.</p> <p>Options C and D are each likely to have an adverse impact on the visible remains of the former timber bridge and the railway.</p>
			<p>Aboriginal</p> <p>Option A has less potential to impact on PADs along the Hawkesbury-Nepean River as it follows the existing bridge alignment.</p>	<p>Aboriginal</p> <p>Option B has a greater potential than Option A to impact on PADs along the Hawkesbury-Nepean River as it adopts a new bridge alignment 5 metres downstream of the existing bridge.</p>	<p>Aboriginal</p> <p>Option C has a greater potential than Option A and B to impact on PADs along the Hawkesbury-Nepean River as it adopts a new bridge alignment 25-50 metres downstream of the existing bridge.</p>	<p>Aboriginal</p> <p>Option D – ‘Same as Option C’</p>

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Engineering and cost	Relative cost of options	Route options costs will represent the likely total project cost for each option, including allowances for design, project development costs incurred by RMS, land acquisition, mitigation measures etc. A higher performing option would have a lower cost.	Base Case	1.1 x Base Case	1.6 x Base Case	2.1 x Base Case
	Constructability	This criteria needs to be assessed qualitatively. It includes aspects of construction techniques including traffic management, movement of construction materials through the study area, ease of bridge construction, noise, dust, environmental management strategies, geological considerations and construction program. A higher performing option would be one that is perceived to be a more constructible design.	The constructability of this option will be more complex compared to the other options. This complexity is created by this option as it is a widening of the existing bridge. It will also be necessary to maintain traffic along the existing bridge during construction.	The constructability of this option will be less complex compared to Option A but more complex than Option C and D. This complexity is created by the construction of the new bridge being in close proximity to the existing bridge.	The constructability of this Option will be less complex compared to Option A and B for the Bridge. This option will however require more fill to raise the carriageway and to install drainage structures (large culverts or plank bridges) across the flood plain to provide 1:5 year ARI flood immunity .	The constructability of this Option will be less complex compared to Option A and B for the Bridge. This option will however require significantly more fill to raise the carriageway and to install drainage structures (large culverts or plank bridges) across the flood plain to provide 1:20 year ARI flood immunity . Due to the higher level of the carriageway across the flood plain, this will require the intersection at Old Kurrajong Road/Yarramundi Lane to be raised and on-load and off-load ramps will be required to provide restricted access. This will also increase the complexity of construction for this option.

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Engineering and cost (cont.)	Level of flood immunity provided for a 1:5yr ARI	Improving the flood immunity and maintaining flood access along the corridor for a 1:5yr ARI flood event. A higher performing option would have a greater length (km) of flood immunity for a 1:5yr ARI flood event.	Nil. This option only provides for the current level of flood immunity which is less than 1:5 year ARI	Nil. This option only provides for the current level of flood immunity which is less than 1:5 year ARI	Full length. This option will provide a level of flood immunity of 1:5 year ARI	Full length. This option will provide a level of flood immunity of 1:20 year ARI
	Level of flood immunity provided for a 1:20yr ARI	Improving the flood immunity and maintaining flood access along the corridor for a 1:20yr ARI flood event. A higher performing option would have a greater length (km) of flood immunity for a 1:20yr ARI flood event.	Nil. This option only provides for the current level of flood immunity which is less than 1:5 year ARI	Nil. This option only provides for the current level of flood immunity which is less than 1:5 year ARI	Nil. This option will provide a level of flood immunity of 1:5 year ARI	Full length. This option will provide a level of flood immunity of 1:20 year ARI
	Maintenance (and ease of maintenance) - Bridge structures	This is a qualitative assessment for each option against the degree and ease of maintenance of bridge structures. A higher performing option would be one that would be easier to maintain.	This option is more difficult to maintain compared to Option B, C and D.	This option is easier to maintain compared to Option A and more difficult to maintain compared to Options C and D.	This Option will be easier to maintain compared to Options A and B. Access for maintenance will be easier as the Bridge is 25-50 metres downstream of the existing Bridge. This will also allow access across the existing Bridge to be maintained whilst the new Bridge is undergoing maintenance.	Same as Option D.

Category	Evaluation criteria	Description	Option A	Option B	Option C	Option D
Engineering and cost (cont.)	Maintenance (and ease of maintenance) - Road carriageway	This is a qualitative assessment for each option against the degree and ease of maintenance of the road carriageway and associated structures. A higher performing option will be one that would be easier to maintain.	The intersections in Richmond and North Richmond are the same for all options. The ease of maintenance for Option A will be similar to the existing alignment with only an increase in carriageway width (2 additional lanes) between Chapel Street and Yarramundi Lane. The introduction of a shared use path for all options will increase the level of maintenance for all options.	Same as Option A.	This will be the same for Option A, however, there will be additional maintenance of drainage structures along the flood plain to allow flood waters to flow across the flood plain and under the carriageway, providing immunity for a 1:5 year ARI event. There will also be additional embankments to maintain compared to Options A & B.	This will be the same for Option A, however, there will be additional maintenance of drainage structures along the flood plain to allow flood waters to flow across the flood plain and under the carriageway, providing immunity for a 1:20 year ARI event. There will also be additional embankments compared to Options A, B and C. Option D will also require long on-load and off-load ramps to provide access (restricted) at Old Kurrajong Road/Yarramundi Lane. This will increase the road pavement area and additional embankments to cater for these ramps.