Appendix B – Traffic and Benefit Cost Analysis (BCA)

1. Summary of Key Traffic Findings – to aid response to submissions

In answering questions in relation to the NNLR (response to submissions report as detailed above, and also response to queries by DoPI) the information below has been compiled to assist the reader to better understand some of the key findings of the traffic study, particularly on some of the key issues raised in the submissions and queries from DoP.

The information below will also inform the reader of the correct interpretation of the modelling results which is useful (for example to demonstrate that it is not necessary to model all three base options with MVRDLK and RCR - to do so would add un necessary cost).

The working party (Council, RTA (now the Roads and Maritime Services – RMS), and AECOM) originally agreed that the modelling works undertaken were sufficient and that no additional analysis was necessary (that is there is sufficient information in the AECOM report to be able to interpret the likely results of modelling other options with MVRDLK and RCR), as described below.

It is intended that the results below (extracted directly and/or calculated from data within the AECOM report) can simplify the outcomes of the traffic modelling on key parameters useful for direct comparison between the options;

2. Summary of Traffic Impacts (impacts of NNLR on the Highway)

In terms of assessing the impact of the NNLR options on the Princes Highway, the two most critical intersections which are focus of the evaluation are the combined intersections of Princes Highway with Illaroo Road and Bolong Road on the northern side of the Shoalhaven River, and the intersection of Princes Highway / Moss Vale Road. These were the intersections most sensitive in the traffic modelling analysis.

Both of these locations have capacity constraints and are sensitive to even small increases / decreases in traffic. With the level of congestion observed in the modelling even small reductions in traffic at these locations returned considerable improvement (reduction in delays).

Based on the findings summarised below it can be seen that the NNLR improves overall Highway performance (Options 1 and 2) with significant improvements at the bridges and acceptable impacts at Moss Vale Road.

Option 3 results in lower improvements at the bridges but adverse impacts at Moss Vale Road.

3. Impact of NNLR on Intersections Princes Highway / Bolong and Princes Highway / Illaroo

Assessment of Impact Intersections northern side of Shoalhaven River				
Option	**Highway/Bolong**	**Highway/Illaroo**	**Combined Hwy Bolong/Illaroo**	**Comments**
Do Nothing	**AM** 3922 veh, 43.4 secs AvgD (LOS D)= 170,214.8 secs **PM** 4482 veh, 39.9 secs AvgD (LOS C) = 178,831.8 secs **Combined Peak** 8404 veh, 349,046.6 secs	**AM** 5177 veh, 105.3 secs AvgD (LOS F) = 545,138.1 secs **PM** 5784 veh, 93.1 secs AvgD (LOS F) = 538,490.4 secs **Combined Peak** 10961 veh, 1,083,628.5 secs	**Combined Peak Combined Intersections** 19365 veh, 1,432,675.1 secs	
Option 1 (Central)	**AM** 3751 veh, 42.5 secs AvgD (LOS D) = 159,417.5 secs **PM** 4316 veh, 60.0 secs AvgD (LOS E) = 258,960 secs **Combined Peak** 8067 veh, 418,377.5 secs	**AM** 4981 veh, 70.3 secs AvgD (LOS E) = 350,164.3 secs **PM** 5635 veh, 71.3 secs AvgD (LOS F) = 401,775.5 secs **Combined Peak** 10616 veh, 751,939.8 secs	**Combined Peak Combined Intersections** 18683 veh, 1,170,317.3 secs	18.31% Less overall average delay in peak periods (compared with Do Nothing)

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Assessment of Impact Intersections northern side of Shoalhaven River				
Option	**Highway/Bolong**	**Highway/Illaroo**	**Combined Hwy Bolong/Illaroo**	**Comments**
Option 2 (Southern)	**AM** 3636 veh, 48.5 secs AvgD (LOS D) = 176,346 secs **PM** 4307 veh, 54.1secs AvgD (LOS D) = 233,008.7 secs **Combined Peak** 7943 veh, 409,354.7 secs	**AM** 4853 veh, 69.7 secs AvgD (LOS E) = 338,254.1 secs **PM** 5687 veh, 65.4 secs AvgD (LOS E) = 371,929.8 secs **Combined Peak** 10540 veh, 710,183.9 secs	**Combined Peak Combined Intersections** 18483 veh, 1,119,538.6 secs	21.86% Less overall average delay in peak periods (compared with Do Nothing)
Option 3 (Northern)	**AM** 3811 veh, 57.2 secs AvgD (LOS E) = 217,989.2 secs **PM** 4280 veh, 53.0 secs AvgD (LOS D) = 226,840 secs **Combined Peak** 8091 veh, 444,829.2 secs	**AM** 5009 veh, 72.1 secs AvgD (LOS F) = 361,148.9 secs **PM** 5547 veh, 76.4 secs AvgD (LOS F) = 423,790.8 secs **Combined Peak** 10556 veh, 784,939.7 secs	**Combined Peak Combined Intersections** 18647 veh, 1,229,768.9 secs	14.16% Less overall average delay in peak periods (compared with Do Nothing)

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Assessment of Impact Intersections northern side of Shoalhaven River				
Option	**Highway/Bolong**	**Highway/Illaroo**	**Combined Hwy Bolong/Illaroo**	**Comments**
Option 1 + MVRDLK	**AM** 3766 veh, 39.0 secs AvgD (LOS C) = 146,874 secs **PM** 4386 veh, 57.6 secs AvgD (LOS E) = 252,633.6 secs **Combined Peak** 8152 veh, 399,507.6 secs	**AM** 4892 veh, 68.2 secs AvgD (LOS F) = 333,634.4 secs **PM** 5630 veh, 64.3 secs AvgD (LOS E) = 362,009 secs **Combined Peak** 10522 veh, 695,643.4 secs	**Combined Peak Combined Intersections** 18674 veh, 1,095,151secs	6.42% Less overall average delay in peak periods (compared with Option1) 23.56% Less overall delay (compared with Do Nothing)
Option 3 + MVRDLK	**AM** 3793 veh, 56.3 secs AvgD (LOS D) = 213,545.9 secs **PM** 4505 veh, 64.7 secs AvgD (LOS E) = 291,473.5 secs **Combined Peak** 8298 veh, 505,019.4 secs	**AM** 4903 veh, 69.6 secs AvgD (LOS E) = 341,248.8 secs **PM** 5670 veh, 79.6 secs AvgD (LOS F) = 451,332 secs **Combined Peak** 10573 veh, 792,580.8 secs	**Combined Peak Combined Intersections** 18871 veh, 1,297,600.2 secs	18.49% Greater overall average delay in peak periods (compared with Option1 + MVRDLK) 5.52% Greater overall delay (compared with Option 3) 9.43% Less overall delay (compared with Do Nothing)

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Key assessment findings (relating to impacts of the NNLR on the Highway between Bolong Road and Illaroo Road):

- The results indicate that the NNLR in isolation would have considerable benefits to the Highway by removing traffic from the critical part of the network (Highway between Bolong and Illaroo)
- All 3 base options reduce traffic and overall average delays in the critical zone on the Highway (Bolong Road to Illaroo Road), which has a positive impact on the Highway
- Option 2 results in greatest reduction in traffic and overall average delay through the intersections of Bolong and Illaroo, closely followed by Option 1.
- Option 3 showed least reduction in traffic and overall average delay through the intersections of Bolong and Illaroo Road.
- Despite these results, the Paramics model showed a queue on the Highway north of Bolong Road (transfer of queue from Illaroo Road), this was primarily because the model parameters were not adjusted to optimise flows based on the changed traffic patterns. This was a decision of the working party to avoid any criticism that results of the modelling were tweaked in any way. In reality however traffic signals would be adjusted by the RMS to optimise traffic flows and considerable reduction in delays would be expected from the modelled reduction in traffic.
- When the MVRDLK was modelled with Option 1; further reductions in traffic and overall delay were observed on the Highway (between Bolong and Illaroo) without any other adjustments in the model.
- However when the MVRDLK was modelled with Option 3; an increase in overall delays was observed on the Highway (between Bolong and Illaroo), the only logical explanation is this is likely to have resulted from increased right turn traffic from the Highway into Bolong Road (an increase in traffic accessing Bomaderry via Bolong Road due to increased delays at Highway /Cambewarra Road intersection)
- Based on the outcome of the analysis the RMS has provided its support of the NNLR project (Option 1) in recognition of the benefits of the project to the Highway and the higher BCR associated with Option 1 (whilst Option 2 has greater traffic benefits on the northern side of the river, the considerably higher cost associated with Option 2 reduces its BCR).
- Because of the base model results that showed a queue on the Highway north of Bolong Road (transfer of queue from Illaroo Road), rather than tweak the signal parameters to

address the issue (as would occur in reality), the working party agreed to consider a suit of low cost options on the Highway to determine whether this would be sufficient to address the queuing problem (primarily this was only to respond to any concerns about the base modelling results). The RCR option did address the queuing problem, which in the modelling returned conditions to pre link road conditions at Highway / Bolong Road.

- Once the hypothetical test was satisfied (the RCR worked) the working party agreed there was no further analysis required for the completion of the report. This decision was also based on the fact that the reduction of traffic and delays at Bolong Road and Illaroo Road intersections as consequence of the link road would be sufficient (alone) to provide marked improvement to actual flow conditions on the Highway, as a consequence of RMS optimising signal parameters to suit the changed flow patterns that would result from the link road being constructed (as would occur in reality)
- The impacts of the NNLR project on Highway / Cambewarra Road can be seen below;

4. Impact of NNLR on Intersection Princes Highway / Moss Vale Road

Assessment of Impact Intersection of Highway/Moss Vale / Cambewarra Roads		
Option	**Traffic Modelling Data Outputs**	**Comments**
Do Nothing	**AM** 2601 veh, 15.6 secs AvgD (LOS B)= 40575.6 secs **PM** 2761 veh, 13.7 secs AvgD (LOS A) = 37825.7 secs **Combined Peak** 5362 veh, 78401.3 secs	
Option 1 (Central)	**AM** 2690 veh, 16.4 secs AvgD (LOS B) = 44116 secs **PM** 2980 veh, 18.5 secs AvgD (LOS B) = 55130 secs **Combined Peak** 5670 veh, 99246 secs	26.59% Greater overall average delay in peak periods (compared with Do Nothing)
Option 2 (Southern)	**AM** 2659 veh, 16.6 secs AvgD (LOS B) = 44139.4 secs **PM** 2872 veh, 14.2 secs AvgD (LOS D) = 40782.4 secs **Combined Peak** 5531 veh, 84921.8 secs	8.32% Greater overall average delay in peak periods (compared with Do Nothing)

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Assessment of Impact Intersection of Highway/Moss Vale / Cambewarra Roads		
Option	**Traffic Modelling Data Outputs**	**Comments**
Option 3 (Northern)	**AM** 2485 veh, 13.9 secs AvgD (LOS A) = 34541.5 secs **PM** 2857veh, 57.1 secs AvgD (LOS E) = 163134.7 secs **Combined Peak** 5342 veh, 197676.2 secs	152.13% Greater overall average delay in peak periods (compared with Do Nothing)
Option 1 + MVRDLK	**AM** 2795 veh, 16.1 secs AvgD (LOS B) = 44999.5 secs **PM** 3020 veh, 23.0 secs AvgD (LOS B) = 69460 secs **Combined Peak** 5815 veh, 114459.5 secs	15.33% Greater overall average delay in peak periods (compared with Option 1) 45.99% Greater overall average delay (compared with Do Nothing)
Option 3 + MVRDLK	**AM** 2483 veh, 12.9 secs AvgD (LOS A) = 32030.7 secs **PM** 3116 veh, 65.3 secs AvgD (LOS E) = 203474.8 secs **Combined Peak** 5599 veh, 235505.5 secs	105.75% Greater overall average delay in peak periods (compared with Option 1 + MVRDLK) 19.14% Greater overall average delay (compared with Option 3) 200.38% Greater overall average delay (compared with Do Nothing)

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Key assessment findings (relating to impacts of the NNLR on the Highway / Moss Vale Road / Cambewarra Road intersection):

- The results indicate that the NNLR in isolation would have adverse impacts on the Highway (at the intersection Princes Highway / Cambewarra Road / Moss Vale Road) by introducing new traffic through the intersection (traffic that otherwise currently accesses Bomaderry via Bolong Road, or regional traffic that would use the Highway instead of Bolong Road (sandtrack).
- All 3 base options increase traffic and overall average delays on the Highway (at the intersection Cambewarra Road / Moss Vale Road), which has a negative impact on the Highway, to varying degrees
- Option 2 results in least impact, closely followed by Option 1, although the modelling indicated that both of these options could be accepted (impacts fall within RMS guidelines).
- Option 3 showed the greatest impact and was the only option that led to the current roundabout intersection failing (according to RMS assessment guidelines) and RMS has objected to Option 3 accordingly. One of the contributing factors is likely to have been as result of the increased right turn traffic at the Princes Highway / Cambewarra Road intersection as consequence of Option 3.
- When the MVRDLK was modelled with Option 1; further increases in traffic and overall delay were observed on the Highway at Cambewarra Road / Moss Vale Road intersection, although the way the MVRDLK was modelled perhaps influenced additional traffic along West Cambewarra Road than would occur in reality.
- When the MVRDLK was modelled with Option 3; a more significant increase in overall delays was observed on the Highway at Cambewarra Road / Moss Vale Road intersection. Whilst the way the MVRDLK was modelled perhaps influenced additional traffic along West Cambewarra Road than would occur in reality, the same MVRDLK scenario was modelled for Option 1, and because of the higher sensitivity of the Highway at Cambewarra Road / Moss Vale Road intersection to even small increases in traffic, Option 3 resulted in greater adverse impacts at Highway / Moss Vale Road intersection than was observed with Option 1.
- Based on the outcome of the analysis the RMS has indicated its objection to Option 3.

5. Combined Impacts of NNLR on key Intersections on the Princes Highway

The above results show the individual impacts of the NNLR on individual intersections at key locations on the Highway network.

Key assessment findings (relating to impacts of the NNLR on the Highway:

- The results indicate that the NNLR in isolation would result in benefits to the Highway at Bolong Road and Illaroo Road (no RCR would be required)
- All 3 base options reduce traffic and overall average delays on the Highway (Bolong Road to Illaroo Road), which has a positive impact on the Highway;
- Option 2 results in greatest reduction in traffic and overall average delay through the intersections of Bolong and Illaroo, closely followed by Option 1.
- Option 3 showed least reduction in traffic and overall average delay through the intersections of Bolong and Illaroo Road.
- All 3 base options increase traffic and overall average delays on the Highway (at the intersection Cambewarra Road / Moss Vale Road), which has a negative impact on the Highway, to varying degrees
- Option 2 results in least impact on the Highway (at the intersection Cambewarra Road / Moss Vale Road), closely followed by Option 1, although the modelling indicated that both of these options could be accepted (impacts fall within RMS guidelines).
- Option 3 showed the greatest impact on the Highway (at the intersection Cambewarra Road / Moss Vale Road) and was the only option that led to the current roundabout intersection failing (according to RMS assessment guidelines) and RMS has objected to Option 3 accordingly
- Based on the results Options 1 & 2 could provide acceptable traffic outcome; where as Option 3 does not provide the same degree of benefits to the Highway (immediately north of the Shoalhaven river), and leads to unacceptable impacts at the Highway / Cambewarra Road / Moss Vale Road intersection.
- In the context of impacts / benefits to the Princes Highway alone Option 2 has superior traffic benefits over Option 1 (ability to reduce delays and improve flows on the Highway better than Option 1); however because Option 1 does have considerable benefits and

because of the higher costs associated with Option 2; Option 1 has resulted in the highest BCR calculation.

- The other advantage of Option 1 is that compared with Options 2 & 3 Option 1 is less risk in terms of influencing higher traffic volumes on existing Bomaderry Streets. Option 2 directly aligns with West Bunberra Street and therefore is likely to increase traffic in Bunberra Street. Option 3 directly aligns with Cambewarra Road and therefore is likely to increase traffic in Cambewarra Road. Irrespective of the planning advantages of aligning a new link road with existing collector roads in the network (accessibility and transport advantages), both Options 2 & 3 have schools and other community facilities located on them so increases in traffic along those roads is a sensitive issue. Because Option 1 does not directly connect with an existing collector road it has greater capacity at the Highway to absorb link road traffic (compared with the other options that have greater conflicts at the Highway) and it is unlikely to influence a greater increase in traffic along existing Bomaderry roads solely as a consequence of the new link road.

6. Summary of TRACKS analysis / benefit cost ratios, compared with Paramics (AECOM) results

In terms of assessing the comparative benefits of each option, Council's TRACKS analysis can be compared to the AECOM Paramics analysis.

Note the comparative rank assessment ranked the options 1-11 from the original eleven options included in the TRACKS assessment. Only the three project options have been shown below;

TRACKS and AECOM Benefit / Cost ratio calculations (and comparative rank)				
Option	**AECOM**	**TRACKS 2006**	**TRACKS 2016**	**TRACKS 2036**
Option 1	2.37 (Rank 1 of 5)	2.376 (Rank 1 of 11)	4.33 (Rank 1 of 11)	23.97 (Rank 1 of 11)
Option 2	1.80 (Rank 3 of 5)	0.911 (Rank 10 of 11)	1.90 (Rank 10 of 11)	13.06 (Rank 9 of 11)
Option 3	-0.45 (Rank 5 of 5)	1.656 (Rank 2 of 11)	3.36 (Rank 2 of 11)	17.30 (Rank 5 of 11)
Option 1 + MVRDLK	2.00 (Rank 2 of 5)	1.04 (Rank 1 of 11)	1.46 (Rank 1 of 11)	8.95 (Rank 1 of 11)
Option 2 + MVRDLK	N/A	0.06 (Rank 10 of 11)	0.25 (Rank 10 of 11)	4.58 (Rank 8 of 11)
Option 3 + MVRDLK	1.77 (Rank 4 of 5)	0.53 (Rank 3 of 11)	0.76 (Rank 4 of 11)	3.47 (Rank 10 of 11)

Notes relating to the above summary:

1. In the TRACKS analysis the original options were all modelled in isolation (all eleven options) and separately all options were modelled with the MVRDLK. This is why Option 1 ranks 1 of 11, and then Option 1 + MVRDLK also ranks 1 of 11 (because that was a separate analysis) i.e. 22 options were modelled, not 11 (i.e. eleven options were all modelled with/without the MVRDLK).

2. In the AECOM BCR analysis any BCR calculation less than 1.0 was assigned a negative value for the purpose of reporting (to indicate the return on investment would be less than the costs outlaid).

Key assessment findings (relating to the AECOM Benefit Cost analysis):

- The results indicate that Option 3 and Option 3 + MVRDLK have the lowest of all the BCR calculations
- The results indicate that Option 1 and Option 1 + MVRDLK have the highest of all the BCR calculations
- Only Option 1 and Option 1 + MVRDLK have a BCR calculation of 2.0 or greater, which is a typical RMS requirement for indicating a projects viability in transport economic terms

Key assessment findings (relating to the TRACKS Benefit Cost analysis):

- The results indicate that as congestion levels grow on the network (from 2006 through to 2036) the role of the NNLR becomes increasingly important as a transport link (see incremental increase in BCR for all options)
- Under all scenarios Option 1 is ranked highest of eleven options (in transport economic terms only) meaning greatest transport benefits for the costs outlaid
- Over time Option 3 drops in rank. This reflects the problems on the network at the intersection of Highway / Cambewarra Road, made worse as traffic volumes increase, which offsets any benefits of Option 3.
- Irrespective of base year Option 3 drops in rank when modelled in conjunction with the MVRDLK. Because of the close proximity of Option 3 and MVRDLK this indicates that both roads are not required.
- It was because of the results of the TRACKS analysis that AECOM were asked to also consider the base options in isolation but also when modelled in conjunction with the MVRDLK, although the results of the AECOM assessment indicate that perhaps the way the Paramics model was set up to reflect the MVRDLK did not allow a proper network evaluation of the impacts of the MVRDLK.
- In the Paramics model the MVRDLK was coded immediately to the north of the Option 3 link (where would connect in reality) however that location could influence additional traffic

along the Option 3 link that would not occur in reality. This would lead to skewed results in relation to the assessment of (in particular) Option 3 + MVRDLK.

- Accordingly in considering the impacts of the MVRDLK, one should also consider the results of the broader TRACKS analysis which include a broader area of network (the entire Nowra / Bomaderry area) and more detailed coding of network (all roads other than quiet residential access streets are included). The TRACKS analysis includes 24 hour average weekday traffic flows, as opposed to detailed peak period traffic flows as represented in the AECOM Paramics analysis. This means the AECOM Paramics analysis provides a better reflection of peak period traffic conflicts to aid queue evaluation and delay calculations, where as the TRACKS model provides a better representation of overall daily traffic demands. The outputs of both models are useful in providing an understanding of the relative benefits and impacts of each option.

7. Summary of (AECOM) modelled VKT and VHT results

VKT and VHT are important network parameters that indicate the relative performance of an option. It is a State policy objective to encourage networks that minimise VKT and VHT which has the benefit of improved travel efficiency, reduced travel costs, and reduced overall emissions (social, economic, and environmental advantages).

The results of the AECOM modelled VKT and VHT outputs are summarised below:

Option	**Modelled VKT**	**Modelled VHT**
Option 1	36524 (Rank 4 of 5)	1483 (Rank 4 of 5)
Option 2	36318 (Rank 3 of 5)	1465 (Rank 3 of 5)
Option 3	36648 (Rank 5 of 5)	1619 (Rank 5 of 5)
Option 1 + MVRDLK	36124 (Rank 1 of 5)	1382 (Rank 1 of 5)
Option 2 + MVRDLK	N/A	N/A
Option 3 + MVRDLK	36280 (Rank 2 of 5)	1404 (Rank 2 of 5)
*Do Nothing	36202 (if ranked would be 2nd, behind Option 1 + MVRDLK)	1612 (if ranked would be 2nd last ,just in front of Option 3)

Key assessment findings (relating to the AECOM Benefit Cost analysis):

- The results indicate that the do nothing option is not acceptable in terms of network VHT. This indicates considerable reductions in delay across the broader network can be achieved with all link road options (1&2), however not with Option 3 which is worse than the Do Nothing option (Option 3 has highest VHT).
- The results indicate that (apart from the base do nothing option) both VKT and VHT results produce exactly the same ranking of projects

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- The results of modelling of base options in isolation indicate that VKT and VHT both increase in value the further north the link road is
- The results of modelling of the MVRDLK (Options 1 & 3) indicate that VKT and VHT reduce with the introduction of the MVRDLK (options that include the MVRDLK are the highest ranked options in terms of least VKT and VHT) and the results are proportional to the base option results (option 1 + MVRDLK) has less VKT and VHT than (option 3 + MVRDLK) etc
- This indicates that if Option 2 were modelled with the MVRDLK, consistent with the base options modelled in isolation; Option 2 + MVRDLK is likely to result in the lowest of VKT and VHT values of all the options (being the southern most of all options).
- This also indicates that if MVRDLK were modelled in isolation is likely to result in the highest of VKT and VHT values (being the northern most of all of the link road options).
- However the results of the base options (with MVRDLK) indicate the distinct advantages of building the MVRDLK (in addition to the link road) to optimise network performance by optimising network accessibility, however it would not return the same level of performance if built isolation.
- Option 2 results in lowest values of VKT and VHT, closely followed by Option 1.
- Option 3 results in the highest values of VKT and VHT, and therefore is least capable of all options in complying with the State Government Integrated land use and transport objectives of minimising network values of VKT and VHT.
- Because Option 3 results in the highest values of VKT and VHT, it therefore has the greatest indirect social, economic, and environmental impacts of all of the options (highest overall network delays, highest overall network operating costs, and highest overall emissions) of all of the options modelled.
- Option 2 results in the lowest values of VKT and VHT, it therefore has the least indirect social, economic, and environmental impacts of all of the options (lowest overall network delays, lowest overall network operating costs, and lowest overall emissions) of all of the options modelled, closely followed by Option1.

8. Summary of Modelled Traffic Diversion results

The AECOM and TRACKS models estimate the extent to which traffic diversions would occur as consequence of each of the link road options.

The results of the AECOM modelled traffic diversions (peak period flows) are summarised below;

Option	AM Peak	PM Peak
*Do Nothing	1779 vehicles on Illaroo Road (west of Highway)	1894 vehicles on Illaroo Road (west of Highway)
Option 1	536 vehicles (30% of Illaroo Road flows), 19% greater diversion than Option 3	499 vehicles (26% of Illaroo Road flows), 13% greater diversion than Option 3
Option 2	480 vehicles (27% of Illaroo Road flows)	460 vehicles (24% of Illaroo Road flows)
Option 3	450 vehicles (25% of Illaroo Road flows)	442 vehicles (23% of Illaroo Road flows)

The results of the TRACKS modelled traffic diversions (average weekday flows) are summarised below;

Option	2006	2016	2026
*Do Nothing	21514 vehicles on Illaroo Road (west of Highway)	24752 vehicles on Illaroo Road (west of Highway)	30254 vehicles on Illaroo Road (west of Highway)
Option 1	5144 vehicles (24% of Illaroo Road flows), 34% greater diversion than Option 3	6070 vehicles (25% of Illaroo Road flows), 26% greater diversion than Option 3	9430 vehicles (31% of Illaroo Road flows), 26% greater diversion than Option 3

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Option	2006	2016	2026
Option 2	5001 vehicles (23% of Illaroo Road flows)	5861 vehicles (24% of Illaroo Road flows)	8970 vehicles (30% of Illaroo Road flows)
Option 3	3836 vehicles (18% of Illaroo Road flows)	4820 vehicles (19% of Illaroo Road flows)	7512 vehicles (25% of Illaroo Road flows)

Notes on the above table of data:

1. The AECOM peak flow results (Do Nothing) on Illaroo Road for 2016 are not that much higher than the present day peak period flows. This indicates there is little to no spare capacity to absorb any more traffic from Illaroo Road on to the Highway in the peak periods (this means latent demand held in the model, unable to be released within the peak hour).
2. This also leads to the situation in the model whereby as the respective link roads are tested (creating additional capacity in the network and allowing traffic to divert away from the critical on the Princes Highway between Bolong and Illaroo Roads), a greater number of vehicles is then able to be released within the peak hour.
3. This means it is difficult to compare Illaroo Road flows between options. It is more accurate to assess the modelled link road flows as a percentage of the base model flows on Illaroo Road (Do Nothing), and this is what has been presented in the tables above for ease of comparing the relative levels of diversion able to be achieved with each option.

Key assessment findings:

- In both the AECOM and TRACKS analysis Option 1 results in highest diversions of traffic, this is because the Narang Road roundabout has greater capacity to absorb the additional traffic on to the Highway compared with the proposed traffic signals at Option 2 and the Moss Vale Road/Cambewarra Road roundabout at Option 3.
- Option 3 diverts the least amount of traffic (up to 19% less than Option 1 based on the AECOM Paramics analysis, and up to 34% less than Option 1 based on the TRACKS analysis). This is a significant difference.
- The Narang Road roundabout is only 3 leg roundabout with no other side road conflicts (only conflicts with through traffic on the Highway).

- The Moss Vale Road / Cambewarra Road roundabout is a 4 leg roundabout with considerable additional conflicts (conflicts with existing Moss Vale Road and Cambewarra Road traffic in addition to through traffic on the Highway). This means the Moss Vale Road / Cambewarra Road roundabout has less capacity to absorb the additional link road flows.
- Option 3 resulted in lowest diversions of traffic in both models due to the additional distance from Illaroo Road and inadequate capacity of The Moss Vale Road / Cambewarra Road roundabout to absorb the additional flows.
- In the AECOM results there is greater diversion in the AM peak compared with the PM peak (due to the additional benefits of the left slip lane from the Highway into Illaroo Road of which there is higher demand for that movement in the PM peak).
- Reductions in delay are not proportional to reduction in traffic – in constrained congested network very high reductions in delay can result from small reductions in traffic (reductions in delay at key intersections is presented above for Princes Highway/Illaroo Road, Princes Highway/Bolong Road Road, and Princes Highway Moss Vale/Cambewarra Road). Whilst some may perceive the lower relative diversion to Option 3 insignificant, because of the level of congestion on Illaroo Road and the Highway the delay results are very considerable, and the adverse impacts of Option 3 on the Princes Highway Moss Vale/Cambewarra Road intersection cannot be ignored.
- As the TRACKS analysis is an average weekday analysis (24 hour period) peak hour delays are averaged in the daily model for those periods and as such the impacts of the specific peak period delays are not modelled (in the 24 hour period) to the same degree as the detailed peak hour analysis (AECOM Paramics model).
- As such the results of the TRACKS analysis indicate greater levels of diversion as the network becomes more congested (2006 through to 2036), at 2036 (daily model) similar levels of diversion are observed in the TRACKS model compared with the AECOM Paramics model. This indicates the problems associated with Illaroo Road intersection with the Highway and reflects the increasing importance of providing a link road over time (particularly Option 1 would provide the most significant difference to Illaroo Road and the Princes Highway).