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Six Mile Lane, Old Six Mile Lane and Airport Road, Glenugie

Existing stage road safety audit

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Report No TRF-PROJ-0024-01 ES RSA GLENUGIE REV 1

Date 19/11/2019

This report has been prepared for Traffix.

CONTENTS

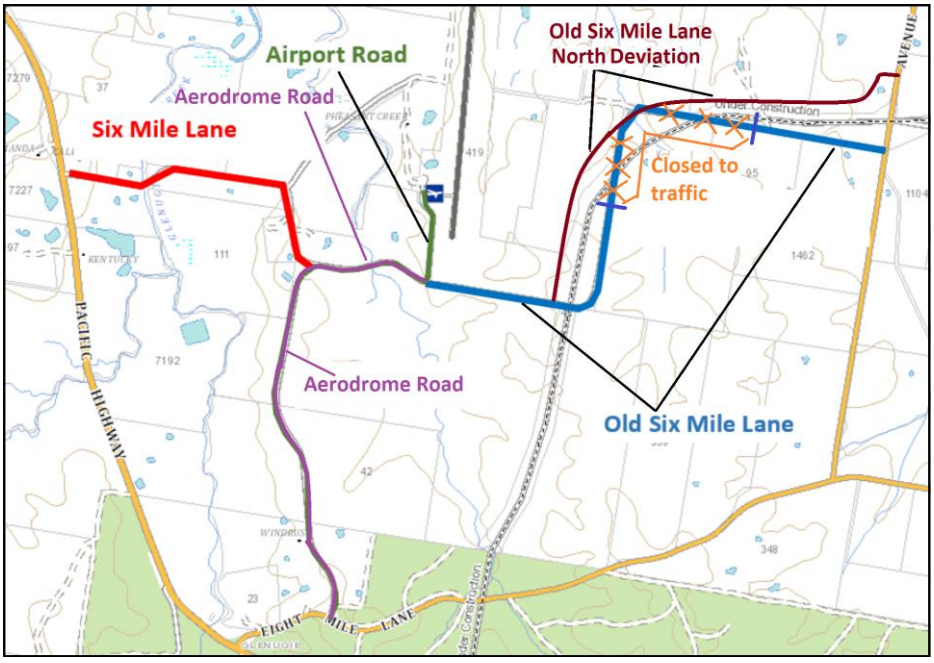
Appendices

1 Introduction

1.1 Project and audit details

Details of the audit have been summarised in Table 1.

Table 1 Details of the road safety audit.

Audited project	Six Mile Lane, Old Six Mile Lane, Old Six Mile Lane North Deviation, Aerodrome Road and Airport Road, Glenugie.
Client/ contact	Kedar Ballurkar Senior Engineer Traffix Ph: (02) 8324 8700 E: kedar.ballurkar@traffix.com.au
Audit type	*Existing stage* road safety audit.
Purpose	An *existing stage* road safety audit was requested of the following roads in Glenugie around the Clarence Valley (Grafton) Airport: ▪ Six Mile Lane, from Pacific Highway to Airport Road. ▪ Old Six Mile Lane, from Airport Road to Avenue Road. ▪ Airport Road, from the Grafton Airport to Eight Mile Lane. It should be noted that the section of this road from Eight Mile Lane to Six Mile Lane, is signposted as *Aerodrome Road*. At the time of the inspections, Old Six Mile Lane was closed to *through* traffic with an alternative route provided to connect this route to Avenue Road. As such, the following road was also included in the audit scope, as this would function as the new *through* route: ▪ Old Six Mile Lane North Deviation, from Old Six Mile Lane to Avenue Road.
Scope of project/ audit	<u>Spatial scope</u> There were slight discrepancies between (i) the roads that were requested to be audited in the brief, and (ii) the actual road layout and the signposted road names as observed on site. As such, the audit team re-defined the scope of this audit to include the roads depicted and listed below:  ***Above:*** *The spatial scope of the audit including roads marked red, purple, green, blue and brown.*

Scope of project/ audit (continued)	From the image above, the spatial scope of the audit was described as follows: ▪ Six Mile Lane, from Pacific Highway to Aerodrome Road – marked in red. ▪ Aerodrome Road, from Eight Mile Lane to Airport Road – marked in purple. ▪ Old Six Mile Lane, from Airport Road to Avenue Road as marked in blue except for the closed portion as marked. The closed portion of the road was due to the new Pacific Motorway corridor. ▪ Old Six Mile Lane North Deviation, from Old Six Mile Lane to Avenue Road. This is mostly a new road with a small portion of the route being a remnant section of the former Old Six Mile Lane route. ▪ Airport Road, from Aerodrome Road-Old Six Mile Lane to the Clarence Valley Airport. This is inclusive of the intersections at each end of these sections. <u>Temporal scope</u> The condition/ "version" of the road subject to this audit, was as inspected at the time and date of the day time and night time inspections. These were: ▪ 1600-1800h on 15/11/2019 (day time inspection). ▪ 2000-2100h on 15/11/2019 (night time inspection).
Audit team details	Damien Chee, DC Traffic Engineering, Level 3 and lead auditor – RSA-02-0094. Linda Chee, DC Traffic Engineering, Level 2 road safety auditor - RSA-02-1069.
Audit methodology	The audit was undertaken using the following methodology: ▪ A day time inspection of the site was carried out between 1600-1800h on 15/11/2019. ▪ A night time inspection was carried out between 2000-2100h on 15/11/2019. ▪ Six Mile Lane, Aerodrome Road, Airport Road and Old Mile Lane North Deviation were all assessed in the context of being publicly accessible roads either for *through* travel, or to access the Clarence Valley Airport. ▪ The section of Old Six Mile Lane between Airport Road and Old Six Mile Lane North Deviation was also assessed in the context of being a publicly accessible road for *through* travel. ▪ The remnant and discontinuous sections of Old Six Mile Lane were assessed in the context of being local access, low-volume roads only. Since this road has been severed by the Pacific Motorway, and is no longer continuous for *through* travel, its function has been reduced accordingly. Furthermore, the expected/ demanded safety amenity along these *no through roads* is also considerably less compared with the alternative *through* route of Old Six Mile Lane North Deviation. ▪ The road safety audit findings have been documented in this report in accordance with the NSW Centre for Road Safety's *Guidelines for Road Safety Audit Practices* (2011). ▪ This report includes completed *checklist 6 –existing stage audit* as sourced from the Austroads *Guide to Road Safety Part 6: Road Safety Audit*.
Material supplied	None.
Meeting and assessment details	Day time inspection carried out between 1600-1800h on 15/11/2019. Night time inspection carried out between 2000-2100h on 15/11/2019.

1.2 Responding to the audit report

Road safety audits provide the opportunity to highlight potential road safety problems and have them formally considered by the project manager in conjunction with all other project considerations.

The responsibility for the project rests with the project manager, not with the auditor. The project manager is under no obligation to accept the audit findings. Also, it is not the role of the auditor to agree to, or approve the project manager's responses to the audit.

1.3 Previous audits

There were no previous road safety audit reports issued to the audit team of direct relevance to this road.

2 Safety audit findings

The road safety audit findings are presented in Tables 2 to 7. The spatial coverage of each table is described in the title.

Table 2 Road safety audit findings – Airport Road from Aerodrome Road-Old Six Mile Lane to the Clarence Valley Airport.

Ref	Location	Road safety audit finding – Airport Road	Priority
2-1a	Airport Road, between Old Six Mile Lane and the Clarence Valley Airport – General comment on pavement width and condition.	In general, Airport Road has an approximate sealed width of 5m. This is narrow for two-way travel and as the principle access road to the Clarence Valley Airport. The narrow sealed width generally increases the risk of *head-on* crashes between northbound and southbound vehicles. There may also be more likelihood of wheel tracking over the edges of seal and onto the soft verge areas. This could increase the risk of *loss of control* crashes. Further to the narrow sealed width, there were numerous pavement failures including potholes and associated patchwork, cracked/ jagged edges and tacked on repair work. The poor edge conditions may increase the risk of *loss of control* crashes in two ways. Firstly, by offering insufficient sealed shoulder for recovery/ corrective steering or deceleration of errant vehicles. Secondly, any attempt to recover and steer back into the trafficable portion of the road could lead to tyre scrubbing on the prominent vertical lips at the edge of pavement. Frequent wheel tracking is also suspected as the cause of pavement edge and width deterioration. That is, wheel tracking on the edges leads to damage, which makes the sealed width narrower and hence increases the likelihood of future wheel tracking over the newly formed edges. The subsequent wheel tracking over the edges leads to further damage and the process repeats itself. Table 4.5 of the Austroads *Guide to Road Design Part 3* indicates that the minimum sealed width for a two-lane-two-way rural road (assuming that the traffic volume does not exceed 500 vehicles/day) is 7.2m. This is based on 2 x 3.1m lanes and 0.5m sealed shoulders either side. A 7.2m sealed width would vastly improve safety conditions on Airport Road.  ***Left:*** *Looking southbound along Airport Road showing the limited width of seal and the poor edge conditions. Note also the potholes and associated patchwork.* ***Right:*** *Looking northbound at an example of a degraded edge. The repair effort included a tacked on strip of asphalt with limited work to the sub-base. The tacked on portion appears to be on top of granular, unbound material with little structural capacity. Hence it is susceptible to ongoing damage.*	High

Ref	Location	Road safety audit finding – Airport Road	Priority
2-1b	Airport Road, between Old Six Mile Lane and the Clarence Valley Airport – Pavement width and condition with an emphasis on the reverse curves near the airport car park.	Further to item 2-1a, the narrow sealed width of Airport Road continues northward to the airport car park. At the northern end, there is a pair of left-right reverse curves which makes the narrow width of seal even more critical. There is virtually no shoulder width provided (sealed or unsealed), and the verge hinges into a steep embankment and drop off either side of the road. As such, any errant vehicle movements may lead to *run off road* events where there is little recovery area (in the form of a sealed shoulder) and a steep embankment with rollover crash potential. The curvilinear alignment increases the likelihood of *run off road* crashes. In addition to increasing the width of seal as suggested in item 2-1a, the curves could be better delineated with edge and centrelines (once the pavement width becomes wide enough to accommodate two opposing lanes and the sealed shoulder becomes wide enough to accommodate an edgeline), and chevron alignment markers (CAMs). At present, there are black and white shift markers in the northbound direction. However, these are not the conventional signs for curve delineation.    ***Top left:*** *A view in the southbound direction of Airport Road showing the narrow sealed width of the road, the lack of sealed shoulders and the steep embankment on the western side.* ***Top right:*** *A ditch/ gully in the western verge on the southern curve in the reverse curve pairing.* ***Bottom (left):*** *Looking northbound towards the first curve where black and width shift markers have been used in lieu of the more conventional black and yellow chevron alignment markers (CAMs).*	High

Ref	Location	Road safety audit finding – Airport Road	Priority
2-2	Airport Road/ Aerodrome Road/ Old Six Mile Lane intersection – *Minimum gap sight distance* (MGSD) from Airport Road to Old Six Mile Lane.	The Airport Road/ Aerodrome Road/ Old Six Mile Lane intersection is a T intersection configuration with Old Six Mile Lane-Aerodrome Road as the eastern and western continuous route (respectively), and Airport Road as the northern and terminating leg to the intersection. Furthermore, as the terminating leg, Airport Road is controlled by a STOP sign. There is limited *minimum gap sight distance* (MGSD) from Airport Road to the east due to a crest vertical curve on Old Six Mile Lane. The MGSD was estimated on site as 60-70m which corresponds to a 2.5 second gap at the rural default speed limit of 100km/h. As such, if an eastbound vehicle was travelling at 100km/h, the outbound driver on Airport Drive may have insufficient sight distance to judge safe gaps to turn right into. The saving grace is that to the east of Airport Road, Old Six Mile Lane contains an unsealed section of road where it is difficult to achieve and sustain a travel speed of 100km/h. However, if this is sealed in future (which is a significant safety benefit in its own right), the limited MGSD may become a more prominent issue.   ***Left:*** *Looking east from Airport Road to Old Six Mile Lane. The crest vertical curve limits the MGSD sight line to approximately 60-70m.* ***Right:*** *The corresponding view from Old Six Mile Lane westbound towards Airport Road. Note the extremely limited visibility to the vehicle approaching the intersection from Airport Road (as marked by the yellow arrow).*	High

Ref	Location	Road safety audit finding – Airport Road	Priority
2-3	Airport Road, general speed management issues.	Airport Road is a designated 40km/h speed environment. Whilst this lowered speed limit mitigates many of the issues identified along this route, the audit team notes the following issues: ▪ There is only one R4-1 SPEED LIMIT sign provided on this road, which is for the northbound travel direction. This sign is located approximately 100m north of Aerodrome Road-Old Six Mile Lane. As such, legally, the 40km/h limit only commences from this sign to the north. The speed limit for the section between this sign and Aerodrome Road-Old Six Mile Lane is not defined or signposted. As such, it would default to a 100km/h speed limit for rural areas. This is (i) a dramatic change in speed environments given that the geometric, width, pavement and clear zone conditions remain the same and (ii) it allows drivers to travel up to 100km/h for a very short section of road between a T intersection, and the desired low-speed environment immediately south of the airport. It may be more appropriate to relocate this speed limit sign closer to the T intersection so that a constant 40km/h speed environment is in place for the entire road. ▪ There is no corresponding R4-1 SPEED LIMIT sign at the northern end of the road for drivers departing from the airport. Many of these drivers would be visitors and may not be aware of the prevailing speed limit. With no regulatory speed limit sign in place for outbound traffic from the airport, many of these drivers would default to the rural speed limit of 100km/h. A 40km/h speed limit sign should be provided at the northern end and should face north (for southbound/ outbound drivers from the airport). Accompanying pavement numerals should be provided in the same manner as speed zone changes. Also, typically, for the start of a speed zone, the speed limit signs are paired with one side either side of the road.  ***Above:*** *Looking northbound along Airport Road towards the 40km/h speed limit sign, which is approximately 100m north of the Aerodrome Road-Old Six Mile Lane intersection.*	Medium

Ref	Location	Road safety audit finding – Airport Road	Priority
2-4	Airport Road, between Old Six Mile Lane and the Clarence Valley Airport – Clear zone condition.	Further to items 2-1a and 2-1b, the clear zone conditions along Airport Road are generally poor with steep embankments and drop offs. At the southern end of the road, there are also two letter-box drains (see below) which could pose as wheel-strike/ wheel-snag hazards. The audit team acknowledges that Airport Road is signposted as a 40km/h speed environment and generally clear zone crash hazards would be less critical compared with higher-speed environment. As such, these clear zone conditions are highlighted more to emphasise the other improvement works suggested for Airport Road, such as (i) widening the pavement seal on this road and (ii) clarifying the speed limit that applies along this road.  ***Above:*** *Looking southbound along Airport Road towards its intersection with Aerodrome Road-Old Six Mile Road. The two letter-box drains are highlighted by yellow stars.*	Low

Table 3 Road safety audit findings – Aerodrome Road-Six Mile Lane, from Airport Road to Pacific Highway

Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-1a	Aerodrome Road - General linemarking and lane delineation issues.	In general, the section of Aerodrome Road between Airport Road and Six Mile Lane lacks on-road delineation in the form of edgelines and centrelines. These would greatly enhance the delineation of the route, and the alignment and spatial positions of the opposing lanes. Such delineation would improve driver guidance along the route and allow them to maintain a consistent trajectory and offset from the verge, as well as from opposing traffic. It may also improve driver's awareness and interpretation of the road alignment at the horizontal curves, which is discussed in items 3-3a to 3-3e. The audit team noted that this section of Aerodrome Road has an approximate sealed width of 6-7m. This should be adequate to accommodate a centreline at the very least. Ie. edgelines could be precluded if there was insufficient sealed shoulder to buffer the edgeline from the edge of pavement seal. Also, the lane widths between the edge and centrelines should be at least 3.0m (see Section 4.2.2.1 of AS1742.2).  ***Above:*** *Looking westbound along Aerodrome Road, approximately 0.7km west of Airport Road. Note the lack of linemarking and the opportunity to enhance route guidance and delineation with centrelines and possibly edgelines.*	High

Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-1b	Six Mile Lane - General linemarking and lane delineation issues.	In general, the section of Six Mile Lane between Aerodrome Road and Pacific Highway lacks on-road delineation in the form of edgelines and centrelines. These would greatly enhance the delineation of the route, and the alignment and spatial positions of the opposing lanes. Such delineation would improve driver guidance along the route and allow them to maintain a consistent trajectory and offset from the verge, as well as from opposing traffic. It may also improve driver's awareness and interpretation of the road alignment at the horizontal curves, which was discussed in items 3-3a to 3-3e. The audit team noted that this section of Aerodrome Road has a approximate sealed width of 5-6m. This should be adequate to accommodate a centreline at the very least. Ie. edgelines could be precluded if there was insufficient sealed shoulder to buffer the edgeline from the edge of pavement seal. Section 4.2.2 of AS1742.2 stipulates that a centreline can be provided as long as the sealed width is greater than 5.5m.  ***Above:*** *Looking westbound along Six Mile Lane showing the lack of linemarking and the associated risk of head-on crash conflicts.*	High

Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-2	Pacific Highway/ Six Mile Lane intersection.	The Pacific Highway/ Six Mile Lane intersection is a T intersection configuration with Pacific Highway as the north-south major route and Six Mile Lane as the eastern and terminating leg. The intersection is configured as a basic right-turn (BAR) configuration where a single northbound lane is provided, with a wide shoulder. The wide shoulder is presumably used by trailing northbound traffic to pass around any slowed or stopped vehicles waiting to turn right into Six Mile Lane. Although the shoulder is wide and this intersection generally has a layout far more enhanced than a typical BAR treatment, this is still considered a very basic treatment and still allows the potentially high-speed *rear-end* crash conflict between stopped/ slowed right-turning vehicles, and trailing northbound vehicles. Trailing drivers may fail to acknowledge that drivers in the road ahead are slowing down. This is particularly if the driver drifts excessively before applying the brakes (and hence activating the brake lights). Also, if the brake lights fail, the trailing driver may not be able to determine whether the vehicle in the road ahead is moving or stationary. Even if they are aware the vehicle is moving, they may not be able to determine how fast the vehicle is moving. In these respects, a BAR treatment can never match the road safety amenity of a fully channelised right-turn lane with adequate deceleration and storage length (CHR treatment). The audit team notes that there has been a build-up of tyre marks on the western edgeline due to frequent wheel tracking by vehicles passing around the stopped right-turner. Over time this edgeline will fade/ wear quicker than normal. Consideration should be given to converting this intersection to a channelised right-turn (CHR) configuration. This is justifiable due to the following: ▪ This section of the Pacific Highway is a high-speed and high-volume route and part of the national highway network (at present). ▪ Further to the above, the Pacific Highway would be a freight corridor and would have a considerable volume of trucks. ▪ Six Mile Lane is probably the most critical access road to the Clarence Valley Airport and would presumably attract a considerable volume of northbound right-turners.  ***Above:*** *Looking northbound on Pacific Highway showing the BAR-configured T intersection with Six Mile Lane.*	High

Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-3a	General – Curve delineation on Aerodrome Road and Six Mile Lane from Airport Drive to Pacific Highway. Site 1 – Aerodrome Road, 0.1-0.3km west of Airport Road (2.7-2.9km east of Pacific Highway).	In general, many of the horizontal curves along Aerodrome Road-Six Mile Lane from Airport Road to Pacific Highway lack delineation devices which would otherwise augment the alignment of the road and guide road users accordingly. In most cases, the identified curves contained W1-3 CURVE + W8-2 ADVISORY SPEED signage combinations. The advisory speeds were significantly less than the default (and unsignposted) speed limit of 100km/h, but yet did not contain D4-6 CHEVRON ALIGNMENT MARKERS (CAMs) around the outside of the curve. The D4-6 "arrow-boards" are beneficial in two ways – firstly by advising drivers which way the road curves, and secondly the spacing between each sign gives the driver an indication of the relative curvature of the road (ie. the rate at which the road is curving away). These signs are retroreflective and also offer enhanced night-time delineation. Example sites are depicted below and in items 3-3b to 3-3e. In each case, the left-hand photo is a view in the westbound direction during day light conditions and the right-hand photo is a view in the eastbound direction during night time conditions. Descriptions of the road safety concerns are provided in the captions. It should be noted that Figure 4.6 of AS1742.2 stipulates that for a 100km/h speed zone, if the advisory speed is less than 75km/h, then D4-6 CAMs should be provided on the outside of the curve.   ***Left:*** *Looking westbound on Aerodrome Road at the 65km/h curve between 0.1-0.3km west of Airport Drive (2.7-2.9km east of Pacific Highway). The road is signposted as a left-hand curve (in the westbound direction). There are no D4-6 CAMs (black and yellow arrow boards).* ***Right:*** *Looking eastbound towards the same curve at night time (standard headlight beam). The W1-3 + W8-2 signage combination is retroreflective and provides good advanced warning of the curve at night time. However, there are no D4-6 CAMs on the outside of the curve so the driver has little awareness as to when the road commences curving and the rate of curvature.*	Medium

Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-3b	General – Curve delineation on Aerodrome Road and Six Mile Lane from Airport Drive to Pacific Highway. Site 2 – Six Mile Lane, 0.8-1.0km west of Airport Road (2.0-2.2km east of Pacific Highway).	Continued from item 3-3a…   ***Left:*** *Looking westbound on Aerodrome Road-Six Mile Lane at the 65km/h curve between 0.8-1.0km west of Airport Drive (2.0-2.2km east of Pacific Highway). The road is signposted as a right-hand curve (in the westbound direction). The W8-2 ADVISORY SPEED base plate is partially obscured by tree foliage. There are no D4-6 CAMs (black and yellow arrow boards) on the outside of the curve. The southern leg of Aerodrome Road is visible on the left-hand side of the photo.* ***Right:*** *Looking eastbound towards the same curve at night time (standard headlight beam). The W1-3 + W8-2 signage combination is retroreflective and provides good advanced warning of the curve at night time. However, there are no D4-6 CAMs on the outside of the curve so the driver has little awareness as to when the road commences curving and the rate of curvature.*	Medium
3-3c	General – Curve delineation on Aerodrome Road and Six Mile Lane from Airport Drive to Pacific Highway. Site 3 – Six Mile Lane, 1.4-1.5km west of Airport Road (1.5-1.6km east of Pacific Highway).	Continued from items 3-3a and 3-3b…   ***Left:*** *Looking westbound on Six Mile Lane at the 55km/h curve between 1.4-1.5km west of Airport Drive (1.5-1.6km east of Pacific Highway). The road is signposted as a left-hand curve (in the westbound direction). A W2-9 CURVED ROAD SIDE JUNCTION sign is used in lieu of a W1-3 CURVE sign. This is acceptable since the side road (Carioca Lane) is positioned midway along the curve. There are no D4-6 CAMs (black and yellow arrow boards) on the outside of the curve.* ***Right:*** *Looking eastbound towards the same curve at night time (under high beam). The W2-9 + W8-2 signage combination is retroreflective and provides good advanced warning of the curve at night time. However, there are no D4-6 CAMs on the outside of the curve so the driver has little awareness as to when the road commences curving and the rate of curvature. The road also has a crest vertical curve at this location which limits the driver's visibility to the guideposts.*	Medium

Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-3d	General – Curve delineation on Aerodrome Road and Six Mile Lane from Airport Drive to Pacific Highway. Site 4 – Six Mile Lane, 2.1-2.3km west of Airport Road (0.7-0.9km east of Pacific Highway).	Continued from items 3-3a to 3-3c…   ***Left:*** *Looking westbound on Six Mile Lane at the 65km/h curve between 2.1-2.3km west of Airport Drive (0.7-0.9km east of Pacific Highway). The road is signposted as a left-hand curve (in the westbound direction). There are no D4-6 CAMs (black and yellow arrow boards) on the outside of the curve.* ***Right:*** *Looking eastbound towards the same curve at night time (under high beam). The W1-3 + W8-2 signage combination is retroreflective and provides good advanced warning of the curve at night time. However, there are no D4-6 CAMs on the outside of the curve so the driver has little awareness as to when the road commences curving and the rate of curvature.*	Medium
3-3e	General – Curve delineation on Aerodrome Road and Six Mile Lane from Airport Drive to Pacific Highway. Site 5 – Six Mile Lane, 2.4-2.5km west of Airport Road (0.5-0.6km east of Pacific Highway), at Glenugie Creek.	Continued from items 3-3a to 3-3d…   ***Left:*** *Looking westbound on Six Mile Lane at the 55km/h curve between 2.4-2.5km west of Airport Drive (0.5-0.6km east of Pacific Highway). The road is signposted as a right-hand curve (in the westbound direction). There are no D4-6 CAMs (black and yellow arrow boards) on the outside of the curve.* ***Right:*** *Looking eastbound towards the same curve at night time (under high beam). The W1-3 + W8-2 signage combination is retroreflective and provides good advanced warning of the curve at night time. However, there are no D4-6 CAMs on the outside of the curve so the driver has little awareness as to when the road commences curving and the rate of curvature.*	Medium

Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-4	Aerodrome Road and Six Mile Lane, between Airport Road and Pacific Highway - General route delineation issues.	Further to items 3-1a and 3-1b, there were many damaged guideposts along these two routes. This also compromised the delineation of the route. Damaged or missing guideposts also create a misleading impression on road alignment. Typically, at any point in space (particularly at night time), the driver should be able to see three of four sets of guideposts. Furthermore, the left-hand guideposts would conventionally contain red reflectors and the right-hand guideposts would contain white reflectors. This helps the driver to interpret the route alignment and the trafficable portion of roadway (ie. between the red and white reflectors). When guideposts are missing or damaged, this creates gaps in the line of guideposts. The driver may need to rely on guess work to “fill in the blanks”.  ***Above:*** *An example of damaged guideposts on Six Mile Lane near Glenugie Creek.*	Medium

Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-5	Westbound travel direction on Six Mile Lane in approach to Pacific Highway.	Six Mile Lane is the eastern and terminating leg it is T intersection with Pacific Highway. There are several aspects that reduce the visual prominence of the intersection and the advanced awareness of the driver. The left-hand image shows that a black and white INTERSECTION SIGHT BOARD has been provided, and is located on the western side of the Pacific Highway facing the outbound traffic from Six Mile Lane. However, as shown, this sight board is very low and lacks visual prominence. As the Pacific Highway has a crowned cross fall, the sign is not completely visible over this vertical profile (which has a similar sight-limiting impact as a crest vertical curve). The entire sight board should be raised to become more visible and prominent to the approaching road user. A W2-3 T INTERSECTION AHEAD sign has also been provided for the westbound/ outbound traffic on Six Mile Lane. However, this sign is placed too close to the actual intersection that it fails to give any effective advanced warning of the intersection. That is, by the time the sign is visible to the driver, the driver would already be able to see the T intersection. This sign could be relocated further upstream, particularly since Six Mile Lane operates to the rural default speed limit of 100km/h and all westbound/ outbound vehicles would need to slow down considerably in approach to the intersection regardless of their intended travel direction. A W2-212 sign could also be considered to improve the prominence of this warning advice. This would be justifiable since Aerodrome Road is a major access/ egress road to/ from Clarence Valley Airport and this is its interface with the Pacific Highway, as a high-speed and high-volume route.   ***Left:*** *Looking westbound along Six Mile Lane with a view of the T intersection (with Pacific Highway) in the distance. Note the relative mounting height of the black and white INTERSECTION SIGHT BOARD. The W2-3 T INTERSECTION AHEAD sign is barely visible at this point.* ***Right:*** *A view of the two signs at a point much closer to the intersection. The SIGHT BOARD (circled in red) is still mounted low relative to the outbound driver.*	Medium

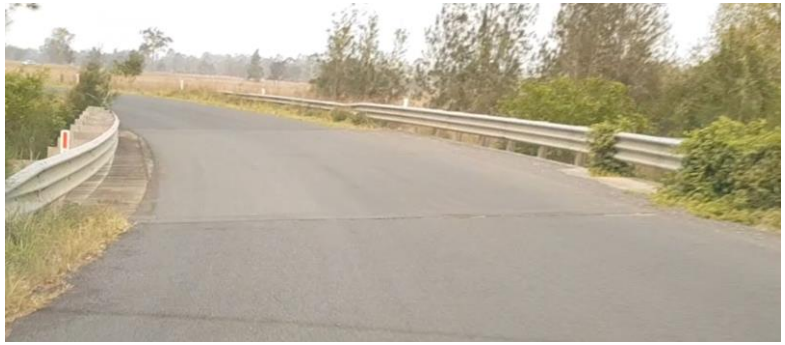
Ref	Location	Road safety audit finding – Aerodrome Road-Six Mile Lane	Priority
3-6	Aerodrome Road and Six Mile Lane – Abrupt level differences at the creek bridges.	There are creek crossings on (i) Aerodrome Road, 0.4km west of Airport Road (2.6km east of Pacific Highway), and (ii) Six Mile Lane, at Glenugie Creek (0.4km east of Pacific Highway). These appear to be box culverts with an asphalt overlay. The sealed sections of Aerodrome Road-Six Mile Lane either side of the creek crossings are bound, flexible pavements. At each location, there is a pronounced vertical discrepancy between the bound, flexible pavement either side of the creek crossing, and the more rigid asphalt layer on top of the culvert. The pronounced lips have the following potential road safety risks: ▪ Poor ride quality with a discernible bump when moving onto and off the top of the culvert. ▪ Destabilisation of the vehicle with associated *loss of control* crash risks, especially for motorcycles. ▪ Possible damage to the tyres, wheels and axles of the vehicle. ▪ Progressive degradation of the asphalt overlay on the top of the culvert as well as to the flexible and bound pavements either side of the crossing. There does not appear to be any gradual transition between the flexible pavements either side of the creek crossings and the more rigid asphalt overlay over the culverts.   ***Left:*** *Looking westbound along Aerodrome Road at the creek crossing, 0.4km west of Airport Road. This photo shows the eastern "abutment" where the flexible, bound pavement transitions abruptly to the more rigid asphalt layer on top of the culvert.* ***Right:*** *Looking eastbound along Six Mile Lane towards the Glenugie Creek crossing. The "crack line" running transversely across the road is the road-culvert interface.*	Low

Table 4 Road safety audit findings – Old Six Mile Lane, Airport Road to Old Six Mile Lane North Deviation

Ref	Location	Road safety audit finding – Old Six Mile Lane	Priority
4-1a	Old Six Mile Lane, 0.1-0.9km east of Airport Road.	Generally, the unsealed section of Old Six Mile Lane between 0.1-0.9km east of Airport Road is a "missing link" and the most critical road safety deficiency along this road. The unseal surface has much poorer skid resistance being made up of loose and unbound material. The surface is also rough and extremely corrugated and results in a very poor ride quality. The audit team were unable to sustain a speed any higher than 40km/h due to the discomfort. Whilst the forced low-speeds would have road safety merit in their own right, there are still residual road safety risks such as: ▪ The road is generally unfit for high-speed travel. The rough surface and ride quality would increase the risk of *loss of control* crash events, and tyre/ wheel/ axle damage. ▪ The transition points from the sealed sections either side present abrupt changes in road safety conditions. In particular, the unsealed section commences downstream from a sight-limited crest vertical curve at its western end (see images below). ▪ There are also prominent vertical lips between the unsealed sections of the road and the adjacent paved sections. This could also impart high forces on the tyre/ wheel. ▪ There are many non-frangible clear zone hazards such as trees, and also steep side slopes and culvert openings which may result in rollover events. This unsealed section presents an extreme-change in road safety and driving conditions and converting this to a sealed road should be the first priority. Furthermore, whilst there are road safety concerns on adjacent paved sections, there is little justification in enhancing these sections if the unsealed section remains as it is. Any improvements to the paved sections would further exacerbate the discrepancy in road safety conditions between the sealed and unsealed sections of the route.  ***Top:*** *Looking eastbound along Old Six Mile Lane from its intersection with Airport Road. The Road is initially sealed up to and beyond the crest vertical curve.*  ***Bottom:*** *Beyond the crest vertical curve, the road transitions abruptly to an unsealed road with no warning to the driver. The unsealed section is approximately 800m long and consists of unbound granular material. The skid resistance and ride quality are poor.*	High

Ref	Location	Road safety audit finding – Old Six Mile Lane	Priority
4-1b	Old Six Mile Lane, 0.1-0.9km east of Airport Road.	Continued from item 4-1a… Further to item 4-1a, there are generally no warning or advisory signs provided in approach to or throughout the unsealed section. This includes advanced warning of the upcoming unsealed section (eg. warning of the gravel and slippery surface). There is very little advice provided with respects to speed zones. In the absence of such advice, many drivers would consider that the rural default speed limit of 100km/h would apply, which is generally inappropriate. As discussed in item 4-1a, the audit team were unable to sustain a speed higher than 40km/h along this road due to the uncomfortable and bumpy ride. At the eastern end, a signage assembly is provided as shown below. This consists of an END 60 + REDUCE SPEED TO CONDITIONS message. This attempts to put the onus back on the driver to select an appropriate speed. However, this would give rise to high speed-differential. Some drivers/ vehicles would be able to negotiate this section at a relatively high speed (eg. 65-70km/h) whilst others may prefer a much lower speed (eg. 25-30km/h). These two speed preferences already present a speed differential of 40km/h. Operating speed is a key consideration in the function and performance of a road and measures should be taken to create a consistent, legible and self-enforcing set of conditions for all road users. Hence, as stated in item 4-1a, consideration should be given to sealing this section as a priority in the short-term.  ***Above:*** *Looking westbound along Old Six Mile Lane with a view of the END 60 + REDUCE SPEED TO CONDITIONS signage combination.*	High

Table 5 Road safety audit findings – Old Six Mile Lane North Deviation, from Old Six Mile Lane to Avenue Road.

Ref	Location	Road safety audit finding – Old Six Mile Lane North Deviation	Priority
5-1	Old Six Mile Lane North Deviation, from 1.1-1.7km north of Old Six Mile Lane.	The unsealed section of Old Six Mile Lane North Deviation between 1.1-1.7km north of Six Mile Lane is the remnant portion of the former Old Six Mile Lane (the portion on the northern side of the Pacific Motorway corridor). As an unsealed section, this is the "missing link" and the most critical road safety deficiency along this road. The unseal surface has much poorer skid resistance being made up of loose and unbound material. The surface is also rough and extremely corrugated and results in a very poor ride quality. The audit team were unable to sustain a speed any higher than 40km/h due to the discomfort. Whilst the forced low-speeds would have road safety merit in their own right, there are still residual road safety risks such as: ▪ The road is generally unfit for high-speed travel. The rough surface and ride quality would increase the risk of *loss of control* crash events, and tyre/ wheel/ axle damage. In particular, the section between 1.4-1.7km north of Six Mile Lane is very rough. ▪ The transition points from the sealed sections either side present abrupt changes in road safety conditions. In particular, the unsealed section commences downstream from a sight-limited horizontal curve at its western end. ▪ There are also prominent vertical lips between the unsealed sections of the road and the adjacent paved sections. This could also impart high forces on the tyre/ wheel. ▪ There are many non-frangible clear zone hazards such as trees, and also steep side slopes and culvert openings which may result in rollover events. Some of these sections are very narrow and unfit for safe, two-way traffic operations. This unsealed section presents an extreme-change in road safety and driving conditions and converting this to a sealed road should be the first priority. Furthermore, whilst there are road safety concerns on adjacent paved sections, there is little justification in enhancing these sections if the unsealed section remains as it is. Any improvements to the paved sections would further exacerbate the discrepancy in road safety conditions between the sealed and unsealed sections of the route.   ***Left:*** *Looking northbound on Old Six Mile Lane North Deviation at the transition from sealed to unsealed sections. The initial unsealed section beyond this interface is somewhat better than the sections further downstream.* ***Right:*** *Midway along the unsealed section, the road formation becomes very narrow and generally unfit for safe, two-way traffic operations. There is an increased risk of head-on crashes and run off road crashes into trees, especially since there is a sight-limiting crest vertical curve present.*	High

Ref	Location	Road safety audit finding – Old Six Mile Lane North Deviation	Priority
5-2	General – Sealed sections of Old Six Mile Lane North Deviation and lack of linemarking.	Old Six Mile Lane North Deviation has a much better alignment and ride quality compared with the other audited roads. It appears to be a future secondary road to the Pacific Motorway with a high-speed alignment intended for trips to local destinations. However, at present, the route has some minor deficiencies including: ▪ Lack of edgelines and centrelines to define traffic lanes and improve spatial clearances between opposing vehicles. Or alternatively, where linemarking has been provided, it has become faded due to dust-masking. ▪ Grass encroachment onto the edge of pavement and shoulders. These items should be addressed as part of the longer-term planning horizon for this road. Similar to Old Six Mile Lane (Table 4), there is little justification in carrying out improvements to the sealed portions of this road, when there is still an unsealed section of the route between 1.1-1.7km north of Old Six Mile Lane. Any improvements to the sealed sections would further exacerbate the discrepancy between the sealed and unsealed sections. It should be noted that the audit team were able to comfortably drive the sealed sections of this route at 90-100km/h compared with the forced low speed of 40km/h or less through the unsealed section.  ***Above:*** *The sealed sections of Old Six Mile Lane North Deviation were of much better geometric and width condition compared with the unsealed sections. However, they generally lacked linemarking and the verge grasses have begun to grow over the pavement edges.*	Medium

Ref	Location	Road safety audit finding – Old Six Mile Lane North Deviation	Priority
5-3	Old Six Mile Lane North Deviation, eastern end near its intersection with Avenue Road.	The eastern end of Old Six Mile Lane North Deviation contains a pair of left-right reverse curves as the road deviates (in the eastbound direction) away from the future Pacific Motorway and the Avenue Road bridge. As seen in the image below, the horizontal curves are used to deviate this road further north where it can intersect with Avenue Road at-grade and not midway along the fill embankment. The curves present an abrupt change in horizontal alignment, particularly when the straighter and more level alignment of this road enables drivers to reach speeds between 80-100km/h (based on comfort and self-enforcing factors rather than speed limit signs, which were absent). Furthermore, there were no warning signs of the sudden change in conditions such as curve warning and advisory speed signs, chevron alignment markers around the curves, warning of the upcoming T intersection with Avenue Road, and linemarking. Fast-approaching motorists may be at risk of *loss of control* crashes if they fail to observe the change in horizontal alignment and the sharpness of this curve. This issue would be most prominent for eastbound drivers as they would be moving from a relatively straight and long section of road when entering the curved section. By contrast, westbound drivers would have entered this curved section directly from an intersection and are less likely to enter or negotiate the curves at a high speed.  ***Above:*** *Looking eastbound along Old Six Mile Lane North Deviation where there is a sudden change in horizontal alignment as the road deviates to the north to intersect with Avenue Road on level-grade.*	Medium

Ref	Location	Road safety audit finding – Old Six Mile Lane North Deviation	Priority
5-4	Westbound travel direction on Old Six Mile Lane North Deviation in approach to the Old Six Mile Lane intersection.	The Old Six Mile Lane/ Old Six Mile Lane North Deviation is a T intersection with Old Six Mile Lane as the east-west major road and Old Six Mile Lane North Deviation as the northern and terminating leg. Old Six Mile Lane North Deviation has a high-speed alignment where the audit team were able to sustain a comfortable speed of 80-100km/h (on the sealed sections). As such, the termination of this road at the Old Six Mile Lane T intersection would be an abrupt change in speed conditions, particularly for southbound drivers (as they would be moving from the high-speed alignment into an intersection). By contrast, eastbound drivers on Old Six Mile Lane, would have just emerged from an unsealed section further west so hence would tend to be speed-limited anyway. Under current conditions, there is a risk of southbound drivers approaching the T intersection at inappropriately high speeds. The intersection lacks visual prominence. In particular, the audit team notes the following: ▪ There are no advanced warning signs such as W2-3 T JUNCTION AHEAD, or REDUCE SPEED signs. ▪ There is one R1-2 GIVE WAY sign but this lacks visual prominence since it is laterally offset from the road alignment and from the driver's focal point to the road ahead. The sign also lacks prominence against the woody visual backdrop. ▪ There is no linemarking in place to act as a visual cue on the change of road conditions, eg. a BB double barrier centreline would give an impression that the road conditions will change. The audit team also notes that the current intersection configuration is not ideal over the longer-term where Old Six Mile Lane North Deviation acts as the *through* route between Pacific Highway and Avenue Road. This is because the dominant traffic movements would be (i) southbound right-turns from Old Six Mile Lane North Deviation, and (ii) the opposing eastbound left-turn movements from Old Six Mile Lane. Over the longer term, the western and northern legs should become the priority legs (even if this requires reconfiguration of the intersection). The "reversed priority" under the current intersection configuration presents safety issues due to the need for the priority traffic movements to slow down, check for gaps, yield to other lower priority movements, and negotiate the high-angled turns of the intersection.  ***Above:*** *Looking southbound along OId Six Mile Lane North Deviation towards its terminal end and intersection with Old Six Mile Lane.*	Medium

Table 6 Road safety audit findings – Old Six Mile Lane, the *no through* sections between Old Six Mile Lane North Deviation and Avenue Road.

Ref	Location	Road safety audit finding – Old Six Mile Lane *no through* sections.	Priority
6-1	Old Six Mile Lane, from Old Six Mile Lane North Deviation to its cul-de-sac terminal at "Oxenbridge" (property name).	This 0.9km section of road is the remnant portion of Old Six Mile Lane, which was previously a *through* road with connectivity between Aerodrome Road and Avenue Road. It appears to have been retained only as a local access road to maintain access to land and properties along side it. The road is mostly unsealed, with only a short sealed section at the western end including a bridge over the future Pacific Motorway. Overall, the road is of a poor standard as an unsealed road. There is a high degree of loose and unbound granular material which compromises skid resistance. The clear zone conditions are also poor with little roadside recoverable area. Despite these deficiencies, the audit team acknowledges that this is only a local road, and furthermore, there is no *through* connectivity. It was also assumed that the severed connectivity will remain since part of the former road corridor is now occupied by the Pacific Motorway corridor. In these respects, since the function and expected usage of this road has been significantly downgraded, these geometric, width and surface deficiencies are less critical. That is, if the road is to function as a local road only for the small number of residents, then it is in a reasonable condition and fit for this new purpose. Perhaps the only necessity, is to provide a NO THROUGH ROAD sign, visible to all inbound traffic entering this road from the intersection of Old Six Mile Lane and Old Six Mile Lane North Deviation.  ***Above:*** *Looking westbound along Old Six Mile Lane from its cul-de-sac terminal near "Oxenbridge" (property name).*	To note

Ref	Location	Road safety audit finding – Old Six Mile Lane *no through* sections.	Priority
6-2	Old Six Mile Lane, from Avenue Road to its cul-de-sac terminal 1.0km to the west of Avenue Road.	This 1.0km section of road is the remnant portion of Old Six Mile Lane, which was previously a *through* road with connectivity between Aerodrome Road and Avenue Road. It appears to have been retained only as a local access road to maintain access to land and properties along side it. The road is unsealed for its entire length. Overall, the road is of a poor standard as an unsealed road. There is a high degree of loose and unbound granular material which compromises skid resistance. The clear zone conditions are also poor with little roadside recoverable area. Despite these deficiencies, the audit team acknowledges that this is only a local road, and furthermore, there is no *through* connectivity. It was also assumed that the severed connectivity will remain since part of the former road corridor is now occupied by the Pacific Motorway corridor. In these respects, since the function and expected usage of this road has been significantly downgraded, these geometric, width and surface deficiencies are less critical. That is, if the road is to function as a local road only for the small number of residents, then it is in a reasonable condition and fit for this new purpose. Unlike the western *no through road*, this eastern section is already furnished with a NO THROUGH ROAD sign at its intersection with Avenue Road.  ***Above:*** *Looking westbound into the eastern no through section of Old Six Mile Lane.*	To note

Table 7 Road safety audit findings – Aerodrome Road from Six Mile Lane to Eight Mile Lane.

Ref	Location	Road safety audit finding – Aerodrome Road from Six Mile Lane to Eight Mile Lane.	Priority
7-1	Aerodrome Road, from Six Mile Lane to Eight Mile Lane.	Overall, this road has a poorer layout compared with Six Mile Lane and Old Six Mile Lane North Deviation. This includes: ▪ Narrow sealed width with limited passing clearance between opposing vehicles, and little recovery area in the form of sealed shoulders. This has associated risks of *head-on* and *run off road* crashes. ▪ Further to the above, there are poor edge conditions including jagged edges, and grass encroachment onto the roadway. The jagged edges are structurally weak and susceptible to progressive damage due to wheel loading and possible under-mining of the sub-base with water ingress and root growth. ▪ Rough pavement consisting of potholes and associated patchwork, and transverse corrugations which result in a poor ride quality, and which may destabilise vehicles including motorcyclists. ▪ Clusters of non-frangible trees, fence posts and longitudinal culverts on each side of the road with limited clear zone, run out and recovery space in the event of a *loss of control* crash. ▪ A high degree of leaf and gravel litter which compromises skid resistance. If this section of Aerodrome Road is to function as a key access route over the long term, consideration should be given to widening its sealed formation. Table 4.5 of the Austroads *Guide to Road Design Part 3* indicates that the minimum sealed width for a two-lane-two-way rural road (assuming that the traffic volume does not exceed 500 vehicles/day) is 7.2m. This is based on 2 x 3.1m lanes and 0.5m sealed shoulders either side. A 7.2m sealed width would vastly improve safety conditions on Aerodrome Road.   ***Above:*** *Examples photos showing the typical appearance of Aerodrome Road between Six Mile Lane and Eight Mile Lane.*	Medium

Ref	Location	Road safety audit finding – Aerodrome Road from Six Mile Lane to Eight Mile Lane.	Priority
7-2	Westbound travel direction on Eight Mile Lane in approach to Aerodrome Road.	The Eight Mile Lane/ Aerodrome Road intersection is a T intersection configuration with Eight Mile Lane as the east-west major route and Aerodrome Road as the northern and terminating leg. Under current conditions, there are no passing facilities available for westbound drivers to use when there is a vehicle in the road ahead which has stopped or slowed down to turn right into Aerodrome Road. With the signage assembly currently in place on the southern side of the intersection, the shoulder has been rendered un-useable as a passing facility in the same manner as a basic right-turn (BAR) treatment. Consideration should be given to widening the shoulder and/ or shifting the entire signage assembly further south. This is especially since, from further upstream, the road appears to have a wide verge and shoulder. Furthermore, this verge area appears to be fully traversable. The photos below illustrate this further.   ***Top:*** *Looking westbound on Eight Mile Lane towards the Aerodrome Road side road leg (where the white van is located). The left-hand (southern) verge appears wide and fully traversable. Many drivers may falsely believe that this can be used as a passing facility if they encounter a stopped or slowed vehicle waiting to turn right into Aerodrome Road.* ***Bottom:*** *Further downstream and closer to the intersection, it becomes apparent that the shoulder and verge cannot be used as a passing facility since there is a signage assembly. If this signage assembly was simply shifted to the south and the ground made traversable, this could function as a shoulder and passing facility.*	Medium

3 Concluding statement

DC Traffic Engineering has undertaken an *existing stage* road safety audit of this project in accordance with the methodology outlined in Section 1 of this report.

Issues identified have been noted in this report for the Project Manager to review, assess, and where appropriate, make the necessary recommendations to improve safety.

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DC Traffic Engineering Pty Ltd

Appendix A

Road Safety Audit Checklist

Checklist questions	Comments
6.1 Road alignment and cross section	
1 Visibility ▪ sight distance Is sight distance adequate for the speed of traffic using the route? ▪ Is adequate sight distance provided for intersections and crossings? (eg. pedestrian, cyclist, cattle, railway) ▪ Is adequate sight distance provided at all private driveways and property entrances?	MGSD issues noted at Airport Road/ Old Six Mile Lane intersection. Poor sight benches on Aerodrome Road.
2 Design speed ▪ Is the horizontal and vertical alignment suitable for the (85th percentile) traffic speed? ▪ If not are: o Warning signs installed? Advisory speed signs installed? o Are the posted advisory speeds for curves appropriate?	CAMs needed on horizontal curves on the Six Mile Lane-Aerodrome Road route.
3 Speed limit/speed zoning ▪ Is the speed limit compatible with the function, road geometry, land use and sight distance?	There is a lack of speed advice for the unsealed sections of Old Six Mile Lane and the Old Six Mile Lane North Deviation.
4 Overtaking ▪ Are safe overtaking opportunities provided?	Enhanced passing facility suggested at the Pacific Highway/ Six Mile Lane intersection (CHR treatment). Enhanced passing facility suggested at the Eight Mile Lane/ Aerodrome Road intersection (BAR treatment).
5 Readability by drivers ▪ Is the road free of elements which may cause confusion? For example: o Is alignment of the roadway clearly defined? o Has disused pavement (if any) been removed or treated? o Have old pavement markings been removed properly? o Do tree lines follow the road alignment? o Does the line of street lights or the poles follow the road alignment? ▪ Is the road free of misleading curves or combinations of curves?	Routes would be enhanced with centrelines and (if possible) edgelines.
6 Widths ▪ Are medians and islands of adequate width for the likely users? ▪ Are traffic lane and carriageway widths adequate for the traffic volume and mix? ▪ Are bridge widths adequate?	Narrow sealed widths and lack of sealed shoulders noted.

Checklist questions	Comments
7 Shoulders ▪ Are shoulders wide enough to allow drivers to regain control of errant vehicles? ▪ Are shoulders wide enough for broken down or emergency vehicles to stop safely? ▪ Are shoulders sealed? ▪ Are shoulders trafficable for all vehicles and road users? (I.e. are shoulders in good condition) ▪ Is the transition from road to shoulder safe? (no drop-offs)	Lack of sealed shoulders noted across some of the audited roads.
8 Crossfalls ▪ Is appropriate superelevation provided on curves? ▪ Is any adverse crossfall safely managed (for cars, trucks, etc.)? ▪ Do crossfalls (carriageway and shoulder) provide adequate drainage?	Yes.
9 Batter slopes ▪ Are batter slopes traversable by cars and trucks which run off the road?	Some steep embankments exist but generally mitigatable with pavement widening, sealed shoulders and improved on-road delineation (linemarking).
10 Drains ▪ Are roadside drains and culvert end walls traversable?	Letter-box drains noted on Airport Road. Culverts were present as clear zone crash hazards.
6.2 Auxiliary lanes	
1 Tapers ▪ Are starting and finishing tapers located and aligned correctly? ▪ Is there sufficient sight distance to the end of the auxiliary lane?	The Pacific Highway/ Six Mile Lane intersection is only a BAR configuration with no formal passing facility. Passing vehicles are expected to use the wide shoulder and the merge travel paths are not defined.
2 Shoulders ▪ Are appropriate shoulder widths provided at merges? ▪ Have shoulder widths been maintained beside the auxiliary lane?	See above.
3 Signs and markings ▪ Have all signs been installed in accordance with the appropriate guidelines? ▪ Are all signs conspicuous and clear? ▪ Does all linemarking conform to these guidelines (particularly three merge arrows)? ▪ Is there advance warning of approaching auxiliary lanes?	Yes.
4 Turning ▪ Have right turns from the through lane been avoided? ▪ Is there advance warning of turn lanes?	No. See above. The Eight Mile Lane/ Six Mile Lane intersection also lacks passing facilities and there is no sealed shoulder available at the intersection (due to a signage assembly).

Checklist questions	Comments
6.3 Intersections	
1 Location ▪ Are all intersections located safely with respect to the horizontal and vertical alignment? ▪ Where intersections occur at the end of high speed environments (eg. at approaches to towns), are there traffic control devices to alert drivers?	Sight-limiting crest vertical curve noted on Old Six Mile Lane immediately east of Airport Road intersection. This affects MGSD from Airport Road.
2 Visibility ▪ sight distance o Is the presence of each intersection obvious to all road users? o Is the sight distance appropriate for all movements and all users? o Is there stopping sight distance to the rear of any queue or slow moving turning vehicles? o Has the appropriate sight distance been provided for entering and leaving vehicles?	Low mounting height of intersection sight board at Six Mile Lane approach to Pacific Highway.
3 Controls and delineation ▪ Are pavement markings and intersection control signs satisfactory? ▪ Are vehicle paths through intersections delineated satisfactorily? ▪ Are all lanes properly marked (including any arrows)?	Issues noted.
4 Layout ▪ Are all conflict points between vehicles safely managed? ▪ Is the intersection layout obvious to all road users? ▪ Is the alignment of kerbs obvious and appropriate? ▪ Is the alignment of traffic islands obvious and appropriate? ▪ Is the alignment of medians obvious and appropriate? ▪ Can all likely vehicle types be accommodated? ▪ Are merge tapers long enough? ▪ Is the intersection free of capacity problems which may produce safety problems?	Issues raised with passing opportunities.
5 Miscellaneous ▪ Particularly at rural sites, are all intersections free of loose gravel?	Loose gravel spillage noted across the audited roads.
6.4 Signs and lighting	
1 Lighting ▪ Is lighting required and if so, has it been adequately provided? ▪ Is the road free of features which interrupt illumination (eg. trees or overbridges)? ▪ Is the road free of lighting poles which are a fixed roadside hazard? ▪ Are frangible or slip-base poles provided? ▪ Ambient lighting: if it creates special lighting needs, have these been satisfied? ▪ Is the lighting scheme free of confusing or misleading effects on signals or signs? ▪ Is the scheme free of any lighting black patches?	NA.

Checklist questions	Comments
2 General signs issues ▪ Are all necessary regulatory, warning and direction signs in place? Are they conspicuous and clear? ▪ Are the correct signs used for each situation, and is each sign necessary? ▪ Are all signs effective for all likely conditions (eg. day, night, rain, fog, rising or setting sun, oncoming headlights, poor lighting)? ▪ If restrictions apply for any class of vehicle, are drivers adequately advised? ▪ If restrictions apply for any class of vehicle, are drivers advised of alternative routes?	Lack of CAMs noted on low-radii curves on Six Mile Lane and Aerodrome Road. Lack of NO THROUGH ROAD sign for severed remaining portion of Old Six Mile Lane to the east of Old Six Mile Lane North Deviation. Lack of speed limit advice noted.
3 Sign legibility ▪ In daylight and darkness, are signs satisfactory regarding: o visibility: Clarity of message? Readability/legibility at the required distance? ▪ Is sign retroreflectivity or illumination satisfactory? ▪ Are signs able to be seen without being hidden by their background or adjacent distractions? ▪ Is driver confusion due to too many signs avoided?	Yes.
4 Sign supports ▪ Are sign supports out of the clear zone? ▪ If not, are they: o Frangible? o Shielded by barriers (eg. guard fence, crash cushions)?	Signage assembly on southern side of Eight Mile Lane/ Six Mile Lane intersection compromises passing opportunity.
6.5 Markings and delineation	
1 General Issues ▪ Is the line marking and delineation: o Appropriate for the function of the road? o Consistent along the route? o Likely to be effective under all expected conditions? (day, night, wet, dry, fog, rising and setting sun position, oncoming headlights, etc) ▪ Is the pavement free of excessive markings? (eg. unnecessary turn arrows, unnecessary barrier lines, etc.)	Centrelines would generally enhance the delineation and guidance along the route.
2 Centrelines, edgelines, lane lines ▪ Are centrelines, edgelines, and lane lines provided? If not, do drivers have adequate guidance? ▪ Are RRPM's required? ▪ If RRPM's are installed, are they correctly placed, correct colours, in good condition? ▪ Are profiled (audible) edgelines provided where required? ▪ Is the linemarking in good condition? ▪ Is there sufficient contrast between linemarking and pavement colour?	See above.

Checklist questions	Comments
3 Guideposts and reflectors ▪ Are guideposts appropriately installed? ▪ Are delineators clearly visible? ▪ Are the correct colours used for the delineators? ▪ Are the delineators on guard fences, crash barriers and bridge railings consistent with those on guideposts?	Many guideposts missing or damaged.
4 Curve warning and delineation ▪ Are curve warning signs and advisory speed signs installed where required? ▪ Are advisory speed signs consistent along the route? ▪ Are the signs correctly located in relation to the curve? (ie. not too far in advance) ▪ Are the signs large enough? ▪ Are chevron alignment markers (CAMs) installed where required? ▪ Is the positioning of CAMs satisfactory to provide guidance around the curve? ▪ Are the CAMs the correct size? ▪ Are CAMs confined to curves (not used to delineate islands, etc)?	Missing CAMs noted.
6.6 Crash barriers and clear zones	
1 Clear zones ▪ Is the clear zone width traversable (i.e. drivable)? ▪ Is the clear zone width free of rigid fixtures? (if not, can all of these rigid fixtures be removed or shielded?) ▪ Are all power poles, trees, etc., at a safe distance from the traffic paths? ▪ Is the appropriate treatment or shielding provided for any objects within the clear zone?	No.
2 Crash barriers ▪ Are crash barriers installed where necessary? ▪ Are crash barriers installed at all necessary locations in accordance with the relevant guidelines? ▪ Are the barrier systems suitable for the purpose? ▪ Are the crash barriers correctly installed? ▪ Is the length of crash barrier at each installation adequate? ▪ Is guard fence attached correctly to bridge railings? ▪ Is there sufficient width between the barrier and the edge line to contain a broken down vehicle?	Generally, the safety barriers were in reasonable condition. However, there were many exposed hazards. The audit team focussed on pavement and shoulder widening as mitigation measures as a higher priority than hazard protection.
3 End treatments ▪ Are end treatments constructed correctly? ▪ Is there a safe run off area behind breakaway terminals?	Yes.
4 Fences ▪ Are pedestrian fences frangible? ▪ Are vehicles safe from being "speared" by horizontal fence railings located within the clear zone?	Property fence posts are non-frangible.

Checklist questions	Comments
5 Visibility of barriers and fences ▪ Is there adequate delineation and visibility of crash barriers and fences at night?	Yes.
6.7 Traffic signals	
1 Operations ▪ Are traffic signals operating correctly? ▪ Are the number, location and type of signal displays appropriate for the traffic mix and traffic environment? ▪ Where necessary, are there provisions for visually impaired pedestrians (eg. audio-tactile push buttons, tactile markings)? ▪ Where necessary, are there provisions for elderly or disabled pedestrians (eg. extended green or clearance phase)? ▪ Is the controller located in a safe position? (i.e. where it is unlikely to be hit, but maintenance access is safe) ▪ Is the condition (especially skid resistance) of the road surface on the approaches satisfactory?	NA.
2 Visibility ▪ Are traffic signals clearly visible to approaching motorists? ▪ Is there adequate stopping sight distance to the ends of possible vehicle queues? ▪ Have any visibility problems that could be caused by the rising or setting sun been addressed? ▪ Are signal displays shielded so that they can be seen only by the motorists for whom they are intended? ▪ Where signal displays are not visible from an adequate distance, are signal warning signs and/or flashing lights installed? ▪ Where signals are mounted high for visibility over crests, is there adequate stopping sight distance to the ends of traffic queues? ▪ Is the primary signal free from obstructions on the nearside footway to approaching drivers? (trees, light poles, signs, bus stops, etc)	NA.
6.8 Pedestrians and cyclists	
1 General issues ▪ Are there appropriate travel paths and crossing points for pedestrians and cyclists? ▪ Are safety fences installed where necessary to guide pedestrians and cyclists to crossings or overpasses? ▪ Are safety barriers installed where necessary to separate vehicle, pedestrian and cyclist flows? ▪ Are pedestrian and bicycle facilities suitable for night use?	Generally, this would be a low-volume pedestrian route.

Checklist questions	Comments
2 Pedestrians ▪ Is there adequate separation distance between vehicular traffic and pedestrians on footways? ▪ Is there an adequate number of pedestrian crossings along the route? ▪ At crossing points is fencing oriented so pedestrians face oncoming traffic? ▪ Is there adequate provision for the elderly, the disabled, children, wheelchairs and baby carriages (eg. holding rails, kerb and median crossings, ramps)? ▪ Are adequate hand rails provided where necessary (eg. on bridges, ramps)? ▪ Is signing about pedestrians near schools adequate and effective? ▪ Is signing about pedestrians near any hospital adequate and effective? ▪ Is the distance from the stop line to a cross walk sufficient for truck drivers to see pedestrians?	Generally, this would be a low-volume pedestrian route.
3 Cyclists ▪ Is the pavement width adequate for the number of cyclists using the route? ▪ Is the bicycle route continuous (i.e. free of squeeze points or gaps)? ▪ Are drainage pit grates 'bicycle safe'?	Cyclists are expected to ride on roads.
4 Public transport ▪ Are bus stops safely located with adequate visibility and clearance to the traffic lane? ▪ Are bus stops in rural areas sign posted in advance? ▪ Are shelters and seats located safely to ensure that sight lines are not impeded? Is clearance to the road adequate? ▪ Is the height and shape of the kerb at bus stops suitable for pedestrians and bus drivers?	Yes.
6.9 Bridges and culverts	
1 Design features ▪ Are bridges and culverts the full formation width? ▪ Are bridge and culvert carriageway widths consistent with approach conditions? ▪ Is the approach alignment compatible with the 85th percentile travel speed? ▪ Have warning signs been erected if either of the above two conditions (I.e. width and speed) are not met?	These present localised squeeze points.
2 Crash barriers ▪ Are there suitable traffic barriers on bridges and culverts and their approaches to shield errant vehicles? ▪ Is the connection between barrier and bridge safe? ▪ Is the bridge free of kerbing which would reduce the effectiveness of barriers or rails?	Yes.
3 Miscellaneous ▪ Are pedestrian facilities on the bridge appropriate and safe? ▪ Is fishing from the bridge prohibited? If not, has provision been made for "safe" fishing? ▪ Does delineation continue over the bridge?	NA.

Checklist questions	Comments
6.10 Pavement	
1 Pavement defects ▪ Is the pavement free of defects (eg. excessive roughness or rutting, potholes, loose material, etc) which could result in safety problems (eg. loss of steering control)? ▪ Is the condition of the pavement edges satisfactory? ▪ Is the transition from pavement to shoulder free of dangerous edge drop offs?	Poor pavement condition noted including: ▪ Potholes and patchwork. ▪ Jagged edges. ▪ Grass encroachment over the edges. ▪ Abrupt level changes at road-culvert crossing interfaces. ▪ Abrupt level changes at unsealed-sealed boundaries.
2 Skid resistance ▪ Does the pavement appear to have adequate skid resistance, particularly on curves, steep grades and approaches to intersections? ▪ Has skid resistance testing been carried out where necessary?	Numerous pavement deficiencies noted.
3 Ponding ▪ Is the pavement free of areas where ponding or sheet flow of water could contribute to safety problems?	Yes.
4 Loose stones/material ▪ Is the pavement free of loose stones and other material?	High degree of gravel spillage noted on the roads and leaf litter is prominent in the verges.
6.11 Parking	
1 General issues ▪ Are the provisions for or restrictions on parking satisfactory in relation to traffic safety? ▪ Is the frequency of the parking turnover compatible with the safety of the route? ▪ Is there sufficient parking for delivery vehicles so that safety problems due to double parking do not occur? ▪ Are parking manoeuvres along the route possible without causing safety problems? (eg. angle parking) ▪ Is the sight distance at intersections and along the route, unaffected by parked vehicles?	NA.
6.12 Provision for heavy vehicles	
1 Design issues ▪ Are overtaking opportunities available for heavy vehicles where volumes are high? ▪ Does the route generally cater for the size of vehicle likely to use it? ▪ Is there adequate manoeuvring room for large vehicles along the route, at intersections, roundabouts, etc.? ▪ Is access to rest areas and truck parking areas adequate for the size of vehicle expected? (Consider acceleration, deceleration, shoulder widths, etc.)	Several roads are narrow.

Checklist questions	Comments
2 Pavement/shoulder quality ▪ Are shoulders sealed at bends to provide additional pavement for long vehicles? ▪ Is the pavement width adequate for heavy vehicles? ▪ In general, is the pavement quality sufficient for the safe travel of heavy and oversized vehicles? ▪ On truck routes, are reflective devices appropriate for truck drivers' eye heights?	Pavement condition in shoulders is generally poor.
6.13 Floodways and causeways	
1 Ponding, flooding ▪ Are all sections of the route free from ponding or flow across the road during wet weather? ▪ If there is ponding or flow across the road during wet weather, is there appropriate signposting? ▪ Are floodways and causeways correctly signposted?	No. Flood markers in place.
2 Safety of devices ▪ Are all culverts or drainage structures located outside the clear roadside recovery area? ▪ If not, are they shielded from the possibility of vehicle collision?	No. Major creek crossings are shielded by safety barriers.
6.14 Miscellaneous	
1 Landscaping ▪ Is landscaping in accordance with guidelines (eg. clearances, sight distance)? ▪ Will existing clearances and sight distances be maintained following future plant growth? ▪ Does the landscaping at roundabouts avoid visibility problems?	Trees and poles in the clear zone.
2 Temporary works ▪ Are all locations free of construction or maintenance equipment that is no longer required? ▪ Are all locations free of signs or temporary traffic control devices that are no longer required?	Yes.
3 Headlight glare ▪ Have any problems that could be caused by headlight glare been addressed (eg. a two-way service road close to main traffic lanes, the use of glare fencing or screening)?	Yes.
4 Roadside activities ▪ Are the road boundaries free of any activities that are likely to distract drivers? ▪ Are all advertising signs installed so that they do not constitute a hazard?	Yes.
5 Errant vehicles ▪ Is the roadside furniture on the verges and footways free of damage from errant vehicles which could indicate a possible problem, hazard or conflict at the site?	Guidepost damage was extensive.

Checklist questions	Comments
6 Other safety issues ▪ Is the embankment stability safe? ▪ Is the route free of unsafe overhanging branches? ▪ Is the route free of visibility obstructions caused by long grass? ▪ Are any high wind areas safely dealt with? ▪ If back to back median kerbing is used is it: o Adequately delineated? o Obvious where it starts? o Obvious at intersections? o Unlikely to be a hazard to pedestrians?	Yes.
7 Rest Areas ▪ Is the location of rest areas and truck parking areas along the route appropriate? ▪ Is there adequate sight distance to the exit and entry points from rest areas and truck parking areas at all times of the day?	NA.
8 Animals ▪ Is the route free from large numbers of animals (eg. cattle, sheep, kangaroos, koalas, wombats, etc.)? ▪ If not, is it protected by animal-proof fencing?	No.