Kin Kin Road (141)

Kin Kin Road (141) Engineering Review

November 2022

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Executive summary

The *Kin Kin Road (141) Engineering Review* presents the findings of assessments and investigations undertaken into the condition and management of the section of Kin Kin Road that falls under the responsibility of the Department of Transport and Main Roads' (TMR) North Coast Region (NCR).

TMR has undertaken these assessments and investigations in exercising its duty of care in the operational management of Kin Kin Road, and in response to safety concerns raised by the community regarding the increased volumes of heavy vehicle traffic on the road.

Kin Kin Road

Kin Kin Road is part of the state-controlled road network and functions as a rural arterial/distributor road connecting rural communities and centres in the Noosa and Cooloola hinterland, east of the Bruce Highway, including the larger population centres of Gympie and Cooroy. Communities located on Kin Kin Road include Pomona and Pinbarren.

In addition to servicing the local agricultural and tourism industries, the road is a popular route for recreational bike riders, horse riders, and motorcyclists. The road also serves a significant commercial function, with the biggest generator of commercial traffic being the local quarry at Kin Kin, currently operated by Cordwells Resources, located off Sheppersons Lane (a local government-controlled road), north of Kin Kin township.

The section of Kin Kin Road considered in the report extends from the Gympie Regional/Noosa Shire Council boundary, approximately nine kilometres north of Kin Kin township, to the road's southern end at the intersection with Cooroy Connection Road. This covers a total distance of 28.87 kilometres. The road is generally an undivided two-lane, two-way sealed roadway. North of the Kin Kin Range, the alignment is winding on a rolling terrain. The road traverses the range from Chainage 39.75km to 42.43km which is characterised by a section of steep and winding alignment. South of the range, the alignment becomes more curvilinear on undulating terrain.

Report considerations

This report examines current road attributes including road use, geometry, road surface and pavement condition, and condition/suitability of road infrastructure (bridges). A comprehensive study of crash history was also undertaken to identify any common crash trends or locations. Kin Kin Road's crash history was also compared to other similar rural roads within NCR to determine whether the crash numbers and severity of crashes recorded were more of less than these other roads. This report also examined management strategies applied to the road, maintenance and upgrades carried out, as well as planned future works.

Quarry operations and road use

Concerns raised by Noosa Shire Council (NSC) and the local community in relation to quarry operations at Kin Kin form part of the basis for this report. The quarry was first approved by NSC in 1987, with the current approval valid until 12 May 2033.

The operation of the quarry has been subject to protracted actions in the Planning and Environment Court, firstly brought about in October 2010 by Kin Kin Community Group Incorporated and more recently by NSC against the quarry's owners and operator, Cordwell Resources, regarding a number of alleged breaches by them, including such matters in relation to the Quarry Management Plan, and seeks to address the intensification of use issues. The submissions hearing for these matters concluded on 17 June 2022, with the judge reserving his decision for a later date.

This report examined the use of Kin Kin Road including:

- a study of traffic volumes, composition, growth, and peak hour flows
- the history of speed limit changes, including speed limit reviews and compliance
- traffic generation associated with the quarry at Kin Kin including conditions placed on heavy vehicles as part of the quarry's Traffic Management Plan (TMP).

This report concludes that overall traffic growth has generally been steady over the last 10 to 12 years, but the percentage of heavy vehicles within the traffic stream has grown at a faster rate. It is likely that this additional growth in heavy vehicles can be attributed mainly to the quarry's operations.

The TMP for the quarry at Kin Kin is a condition of the quarry's Development Permit and outlines the management procedures and practices, and special conditions regarding heavy vehicle movements accessing the quarry. This includes load staging/intervals, load protection (tarping), truck roadworthiness, driver behaviour and interaction with school buses. It also identifies liaison with NSC and the community as a key to continual improvement in road safety. The number of quarry trucks recorded on Sheppersons Lane is irregular, averaging around 78 trucks per day in each direction up to the end of 2021. However, community group members have reported counting up to 250 quarry trucks on Kin Kin Road in a single day.

Speed restrictions

Over the last 10 to 12 years, all speed limits have been reviewed and speed limits have changed significantly. Reduced speed limits now apply over most of the length of the road in accordance with changes in the philosophy of, and process for, setting speed limits on Queensland roads. The speed limits currently in place are in accordance with the Manual of Uniform Traffic Control Devices Part 4 (Speed Controls). TMR will continue to monitor the need for further reviews or speed limit changes.

TMR also investigated applying lower speed limits for heavy vehicles only on the Kin Kin Range section but determined this would not be appropriate. Speed surveys undertaken along the route showed there are typically good levels of speed compliance from heavy vehicles, and poorer levels of speed compliance from passenger-type vehicles. In particular, Class 10 heavy vehicles, which would constitute a high proportion of the quarry fleet, showed a very high level of compliance with the posted speed limits.

Road geometry and capability

This report includes a comprehensive review of road geometry including a study of vehicle swept paths. A study was undertaken to determine if heavy vehicles could negotiate the full length of Kin Kin Road within the NCR and stay within their own traffic lane on curves (without crossing into the oncoming lane or running off the sealed pavement).

A further examination was carried out on the Kin Kin Range section to determine if a heavy vehicle (semi-trailer) and a passenger vehicle (car) could safely pass each other on each of the curves. This analysis was undertaken firstly only considering the sealed pavement and then again taking into account the sealed pavement plus the trafficable unsealed shoulder. Assessment of current-day design cross section widths was also undertaken and these standards were compared to existing widths. This report also contains commentary regarding visibility on horizontal curves and compares this to the range of curvature on Kin Kin Road.

While falling short of the current day geometric standard in a number of areas, the road does provide a fairly good level of service. The more constrained sections of the alignment are also the lighter trafficked sections which assists in overall functionality, particularly on the tighter curves. It has been demonstrated that interaction between heavy and passenger vehicles can occur safely and that the lack of crash history involving heavy vehicles is evidence of this. While seal widths are short of current-day standards in many areas, the presence of trafficable, unsealed shoulders assist in the safe functionality of the road. Visibility is restricted in many areas, particularly around curves; however, the roadside environment is consistent throughout which allows the driver to focus on the road

Vehicle crash analysis

A comprehensive review of crash reports (using injury-related crash data from the Queensland Police Service (QPS)) was carried out for the section of Kin Kin Road that falls within TMR North Coast Region from January 2010 to June 2021. This was compared to the number of injury related crashes recorded on this section of road between 2000 and 2010. The road's potential for fatal and severe crashes was also compared to that of other similar sections of road within the NCR. These roads included Woombye – Montville Road, Brisbane – Woodford Road and Eumundi – Kenilworth Road as they are similar rural-type roads with similar alignments, cross sections, and traffic characteristics.

The results of the crash analysis showed that crash rates have not increased in line with traffic/heavy vehicle volumes over the last decade. The predominate type of crashes involve light vehicles and motorcycles, with over half of the recorded crashes being single vehicle crashes. Only one reported crash involved a heavy vehicle, but neither the truck nor the roadway could be considered as having directly contributed to this crash. Many crashes involved some form of violation/driving infringement, impairment, or mechanical issue as a contributing cause.

The data showed the severity of crashes on Kin Kin Road reasonably aligns to what is occurring on average on state-controlled roads within the Noosa Shire Council (NSC) area. The comparison with other similar road sections indicated that Kin Kin Road has less risk of fatal and severe crashes than these roads; Kin Kin Road is not ranked in the top 20 in terms of risk of fatal or serious injury crashes within the NCR. A literature review was also carried out to determine if characteristics of Kin Kin Road would be more likely to increase the risk of heavy vehicle crashes. Kin Kin Road has some sections of limited pavement widths, curves with tight radius, and very narrow shoulders which were identified as risk factors; however, this did not corelate to actual recorded crashes.

Structures review and capability

Four of the five single-lane timber bridges along the route were reviewed by the structures team in TMR's Engineering and Technology Branch to determine if their structural capacity was adequate for the loads they are currently carrying. Six Mile Creek Bridge was not included in this review as construction has commenced on its replacement. The review was carried out based on the most recent inspections undertaken. For each of the bridges reviewed, it was found that the capacity was satisfactory for present use and the bridges are capable of carrying a 42.5 tonne semi-trailer or 50.5 tonne truck and dog trailer combinations. The review recommended that management of the bridges continue as business as usual, with continued routine/scheduled inspections and any recommended repairs carried out as required.

Maintenance and improvement projects

This report found that Kin Kin Road is subject to regular rehabilitation and maintenance works. In the 2020–2021 financial year, TMR invested more than $1.2 million into routine maintenance activities on Kin Kin Road, reflecting its commitment to maintain the road in a safe and serviceable condition, and demonstrating TMR's increased efforts to meet community expectations.

In regard to the pavement condition of Kin Kin Road, TMR collects pavement condition data on an annual or biannual basis on state-controlled roads to be used among other inputs to determine the need for maintenance interventions. Different roads within the network have different intervention levels, with motorways and highways demanding the earliest intervention due to higher traffic volumes and rural roads, such as Kin Kin Road, being prioritised below them. Once the intervention level has been reached for any particular road, actual intervention needs to be determined with regard to competing priorities on the network. Routine maintenance is carried out to ensure the level of service of roads, such as Kin Kin Road, is maintained to a safe standard for motorists and other road users.

TMR is committed to assessing the need for further improvements on Kin Kin Road, along with the needs of all state-controlled roads across Queensland, to determine future priorities for upgrades, safety improvements, road resurfacing, and rehabilitation. In 2018, $1 million was spent on upgrading signage and delineation, including improvements to line marking and removal of roadside hazards. In the 2020–2021 financial year, targeted vegetation clearing work was undertaken as part of routine maintenance from north of Kin Kin township to the Kin Kin Range. The range section has been a major priority for upgrade, with a pavement widening upgrade undertaken in 2012 over the top of the range. Construction is currently underway on a $6 million upgrade project on the northern approach to the range, and funding has been allocated to upgrade a further two sections on approach to the range (one north and one south of the range). Construction to replace the existing single-lane timber bridge over Six Mile Creek has also commenced.

Heavy vehicle movements

This report also examined TMR's commitment to manage heavy vehicles on the state-controlled road network. TMR acknowledges the concerns raised by the local community about increased heavy vehicle movements on Kin Kin Road and understands it is a challenging issue for all involved.

It should be noted, the heavy vehicles currently using Kin Kin Road are classed as general access vehicles which do not require any special permit or permission to move on any state-controlled road in Queensland. It was found that although TMR has the ability under section 46 of the *Transport Infrastructure Act 1994* (TIA) to impose temporary restrictions on the use of state-controlled roads to prevent damage or to ensure the safety of road users, these powers are typically only exercised after such things as flooding or other extreme weather events to preserve infrastructure and allow the road to dry out enough for remedial repairs to be undertaken. Restrictions under the TIA have been implemented three times in 2022 due to the impact of weather events on Kin Kin Road.

While section 46 allows temporary restrictions to be placed on particular classes of vehicles or vehicles above a certain weight limit, TMR cannot apply restrictions to one business only (such as quarry trucks). Any restriction applied would need to apply to all vehicles of that class or weight, which would have a broader impact on the whole community. This report also concluded that there are no alternative state-controlled roads in the area to accommodate such road users, so applying these restrictions is not a practical or justified option.

As stated above, the quarry at Kin Kin operates under a local government development approval. TMR has no authority to close or relocate this business, or to permanently stop general access vehicles (including truck and dog trailer combinations used to access the quarry) from travelling on state-controlled roads in the Noosa hinterland. Management of issues around the quarry’s operations, including the volume of heavy vehicles to and from the quarry and haulage routes, are matters for the Noosa Shire Council (NSC) and the operator of the quarry.

This report also found that TMR further acknowledged the community's concerns regarding interaction with heavy vehicles on Kin Kin Road, by committing to install special warning signs along the route. These signs will replace the existing special warning signs on approach to the Kin Kin Range and will also be placed at strategic locations along the road to warn users of potential encounters with large vehicles in areas where narrow shoulders exist. Recently, TMR also made it a requirement that any contractor carrying out work for TMR projects must undertake a haul route assessment for major material movements along roads carrying less than 10,000 vehicles per day. The assessment must consider things such as the safety of other road users, impacts on local residents, and additional infrastructure maintenance implications.

TMR acknowledges, and has identified in this report, that in several areas the road falls below the ideal current-day standard for a newly constructed roadway. The existing road does, however, demonstrate a reasonable level of service in terms of safety, ability for vehicles to interact, and to carry the current volume and composition of traffic. The combination of challenging alignment, narrow cross section, and relatively high percentage of heavy vehicles does represent a risk to the travelling public, but this risk has been substantially reduced by the mitigation measures put in place over the past several years as detailed throughout this report.

While the public's focus is on safety surrounding the increased numbers of, and interaction with, heavy vehicles, the various assessments and investigations undertaken have shown this does not manifest itself into a demonstrated road safety problem. Traffic crash reports do not identify heavy vehicles as being a contributing factor in any crashes between January 2010 to June 2021. The quarry at Kin Kin does have a Traffic Management Plan (TMP) in place, with the objective of addressing some of the issues relating to heavy vehicle interaction on Kin Kin Road and other roads on which quarry vehicles travel. The TMP is part of the quarry's Development Permit issued by the Department of Environment and Science which is also responsible for ensuring compliance. TMR does not monitor the quarry's compliance with the TMP or have any authority in regard to its enforcement.

The crash data presented in this report indicates that higher risk factors to the safety of the travelling public on the Kin Kin Road include driver inattention, non-compliance with the road rules, and driver impairment, with these three factors contributing heavily to the number of reported injury-related crashes (using data from the Queensland Police Service (QPS)).

Report conclusions

This report concludes that even though Kin Kin Road does not show an adverse crash history and displays a reasonable level of service in terms of safety, ability for vehicles to interact with each other, and ability to carry the current traffic volumes and composition, TMR will actively monitor its performance and make improvements. TMR will continue to plan and consider future projects to upgrade Kin Kin Road where and when possible, balanced with statewide needs on the wider road network and available funding.

Apart from the projects mentioned in this report, no additional sections of the road have been identified that warrant immediate intervention at this time. TMR will continue to work with its maintenance contractor in responding to the maintenance needs of Kin Kin Road in a timely manner, and in line with the prescribed maintenance intervention levels. TMR will also monitor the need for further reviews or speed limit changes as needed. TMR will also continue to work with Noosa Shire Council, the Queensland Police Service (QPS), Members of Parliament, and other key stakeholders regarding community concerns and coordinated approaches for the management of Kin Kin Road.

This report has been developed by staff from TMR North Coast Region, with input from other specialist areas within TMR, such as the Engineering and Technology Branch. The authors of the report have used all available information at their disposal to produce a report that is factual and up to date at the time of compilation.

The report has also been independently reviewed by Professor Rod Troutbeck, an Adjunct Professor at QUT Centre for Accident Research and Road Safety (CARRS-Q) and Director of Troutbeck & Associates. Professor Troutbeck has more than 35 years' experience in traffic and transport engineering and provides expert advice on operational performance of roads and independent assessment of the engineering procedures of TMR.

Professor Troutbeck was engaged to perform an independent review on the soundness of the assessment TMR has undertaken. Please see Annexure G for Professor Troutbeck's Independent review of the TMR Engineering Review of Kin Kin Road.

1. Introduction

This report documents the outcomes of various assessments and investigations into the condition and management of Kin Kin Road within the Department of Transport and Main Roads' (TMR) North Coast Region (NCR). It examines the options for managing the road to an acceptable level of risk within budgetary constraints, and in consideration of the needs of the overall state-controlled road network.

As part of this review, TMR has taken into consideration road use, existing road geometry, road surface and pavement condition, assessment of existing timber bridges, and crash history. The report also looks at recent and proposed infrastructure projects carried out on this section of Kin Kin Road, heavy vehicle management, and examines other reports and literature relevant to the road. TMR has undertaken these assessments and investigations in exercising its duty of care in the operational management of Kin Kin Road.

Kin Kin Road is part of the state-controlled road network managed by TMR. The road commences at its intersection with Tin Can Bay Road in the north and continues to its intersection with Cooroy Connection Road (Elm Street) in the south. Rural hinterland communities located along the road include Kin Kin, Pomona and Pinbarren. From a state-controlled road gazettal purpose, the road starts at Chainage 0km (at the intersection with Tin Can Bay Road) and ends at Chainage 54.65km (at the intersection with Cooroy Connection Road). The Gympie Regional Council (GRC)/Noosa Shire Council (NSC) boundary is located at Chainage 25.78km, approximately nine kilometres north of Kin Kin township. The section of Kin Kin Road considered in the report, extends from the GRC/NSC boundary to the road's southern end at the intersection with Cooroy Connection Road. This represents a total distance of 28.87 kilometres.

The road is generally an undivided two-lane, two-way sealed roadway with a winding alignment on a rolling to undulating terrain, in most sections. The road traverses the Kin Kin Range from Chainage 39.75km to 42.43km which is characterised by a section of steep and winding alignment. Nunan Range lies just to the north of the Gympie Regional Council (GRC)/Noosa Shire Council (NSC). This section of road remains unsealed, however, only the first 540 metres of the unsealed roadway on the northbound approach to the range lies within NCR's area of responsibility. Five single-lane timber bridges are located along the road within the section managed by NCR.

As with many state-controlled roads, TMR acknowledges the road does not meet all current engineering standards. It was constructed to standards and within limitations at the time of construction, with progressive improvements undertaken over time.

Kin Kin Road is the gazetted name for the entire length of the state-controlled road. However, the section contained within the Noosa Shire is also known by the following local road names:

- Gympie – Kin Kin Road (extending north of Kin Kin)
- Pomona – Kin Kin Road (between Kin Kin and Louis Bazzo Drive)
- Pound Road (between Louis Bazzo Drive and Pomona)
- Factory Street and Hill Street (within Pomona township)
- Yurol Forest Drive (between Summit Road and Elm Street).

These assessments and investigations into the condition and management of Kin Kin Road are also in response to concerns raised in relation to operations of the quarry at Kin Kin and, in particular, concerns raised by NSC and the local community regarding the number and safe operation of heavy vehicles as a result of the quarry's activities. The quarry was first approved by council in 1987, with the current approval valid until 12 May 2033. This approval is a matter for NSC and the operator of the quarry; TMR is not a party to this approval.

The operation of the quarry has been subject to protracted actions in the Planning and Environment Court. Firstly, in October 2010, brought about by Kin Kin Community Group Incorporated challenging issues surrounding the original town planning consent approval and changes allowed to that approval by the Local Government Court, all of which were dismissed.

More recently, NSC has brought action against the quarry's owners and operator for a number of alleged breaches of the Quarry Management Plan (QMP) which, as a condition of the Development Approval, the quarry is to be operated generally in accordance with. NSC has submitted that there are four areas in which the quarry operations are allegedly not generally in accordance with the QMP: (i) Quarry trucks on Kin Kin Road during school bus hours; (ii) Quarry trucks outside of operating hours; (iii) Quarry trucks travelling in convoy; (iv) Quarry trucks hauling uncovered load. It was also alleged by NSC that the impact of the quarry's intensification of work constitutes a material change of use. The submissions hearing for these matters concluded on 17 June 2022 with the judge reserving his decision to a later date.

Both NSC and the State Member of Parliament for Noosa have been advocating for some time for Kin Kin Road to be upgraded, citing the quarry’s operations are significantly impacting on other road users and residents along the route. NSC has previously formally written to TMR calling for the department to investigate what works can be done to improve safety on Kin Kin Road.

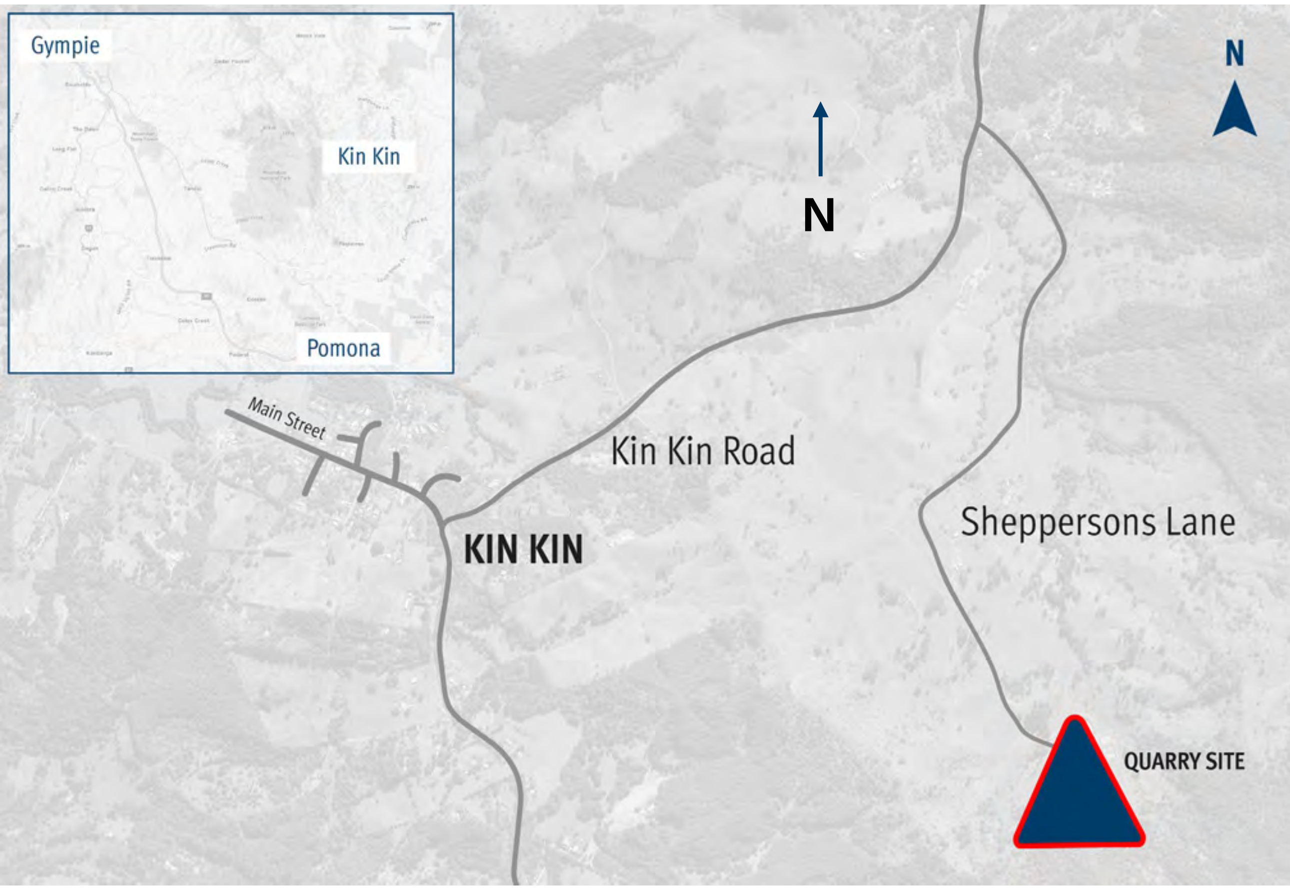
2. Road use

Kin Kin Road functions as a rural arterial/distributor road connecting rural communities and centres in the Noosa and Cooloola hinterland, east of the Bruce Highway, with larger population centres of Gympie, Cooroy, Tin Can Bay, and other hinterland areas in the Noosa Shire Council (NSC) and Gympie Regional Council (GRC) local government areas.

In addition to servicing the local agricultural and tourist industries, the road is a popular route for recreational motorcyclists, particularly on weekends. Recreational bicycle riders also frequent the route and there is an annual bicycle riding event, the Noosa Classic, held along part of Kin Kin Road. The area is also popular for horse riding, being in a rural area in proximity to the Noosa Trail.

The road also serves a significant commercial function, providing access to the quarry at Kin Kin. The quarry is located off Sheppersons Lane (a local government-controlled road), which intersects with Kin Kin Road approximately 2.6 kilometres north-east of Kin Kin township. The location of this facility is shown in Figure1 on page 8.

Figure 1: Location of the quarry at Kin Kin



Source: TMR

The entire road is identified as a school bus route, with a number of services operating along the route. Road signs are displayed on both sides of the Kin Kin Range warning of school buses operating during the hours of 6.30–8.00am and 3.30–4.45pm. There is some pedestrian activity associated with the school bus services, with school children using the road edge or narrow verges to access bus stops from their places of residence.

2.1 Traffic volumes and growth

TMR routinely collects traffic data along the state-controlled road network to determine the Annual Average Daily Traffic volume (AADT), vehicle composition and traffic growth. AADT is the number of vehicles passing a point on a road in a 24-hour period, averaged over a calendar year. Vehicle composition is typically categorised between 'light' and 'heavy' vehicles, with light vehicles consisting mainly of passenger-type vehicles such as cars and utilities, including vehicles towing trailers/caravans. Heavy vehicles include trucks and buses with a vehicle mass greater than 4.5 tonnes. These vehicles may comprise single unit trucks, truck and dog trailer combinations, semi-trailers, and multi-combination type vehicles such as B-Doubles, where applicable. Traffic growth is a percentage of growth in traffic averaged over a five-year period.

The purpose of collecting traffic data is to provide input into road planning and design activities and the operations of the road network. The data does not provide information about daily or seasonal variations in traffic characteristics that may occur on a road segment. The heavy vehicle information collected cannot distinguish between quarry-generated traffic and other large commercial vehicles such as general freight, timber, or livestock haulage trucks.

Kin Kin Road is gazetted as a general access vehicle route, allowing general access to rigid trucks, rigid truck and trailer combinations, semi-trailers, and short B-Double combinations up to 19 metres in length, 2.5 metres in width, and with a gross mass not exceeding 42.5 tonnes. General access vehicles (including truck and dog trailer combinations typically used for haulage out of the quarry at Kin Kin) can use public roads without restriction, or the need for a permit, unless the road is sign-posted otherwise. TMR has not approved any vehicles above general access vehicles to operate on Kin Kin Road.

With reference to Table 1, south of Kin Kin, the 2021 AADT ranges between 1072 vehicles per day (vpd) north of the Kin Kin Range, to 4903 vpd near Summit Road at Pomona. The Annual Average Daily Truck Traffic (AADTT) ranges between 381 and 431 heavy vehicles per day, which also increases in a southerly direction to Summit Road. Heading south, the percentage of heavy vehicles decreases as the AADT increases. A reduction in both AADT and AADTT is observed beyond Summit Road. Full details of the traffic count summarised in Table 1 are contained in Annexure A – Traffic count data.

Table 1: Traffic data for Kin Kin Road

Kin Kin Road Segment description	Data collection year	Annual Average Daily Traffic (AADT)	Percentage heavy vehicles	Annual Average Daily Truck Traffic (AADTT)	5-year AADT growth
Kin Kin Road to Greenridge-Pinbarren Road	2021	1072	16%	172	5.86%
Greenridge-Pinbarren Road to Louis Bazzo Drive	2021	4394	8.67%	381	0.87%
Louis Bazzo Drive to Summit Road	2021	4903	8.80%	431	1.81%
Summit Road to Elm Street	2021	3957	9.28%	367	-1.45%

Source: TMR traffic count data.

The AADT data for Kin Kin Road has similar characteristics as similar rural road segments in the North Coast Region as shown in Table .

Table 2: Traffic data for similar rural roads

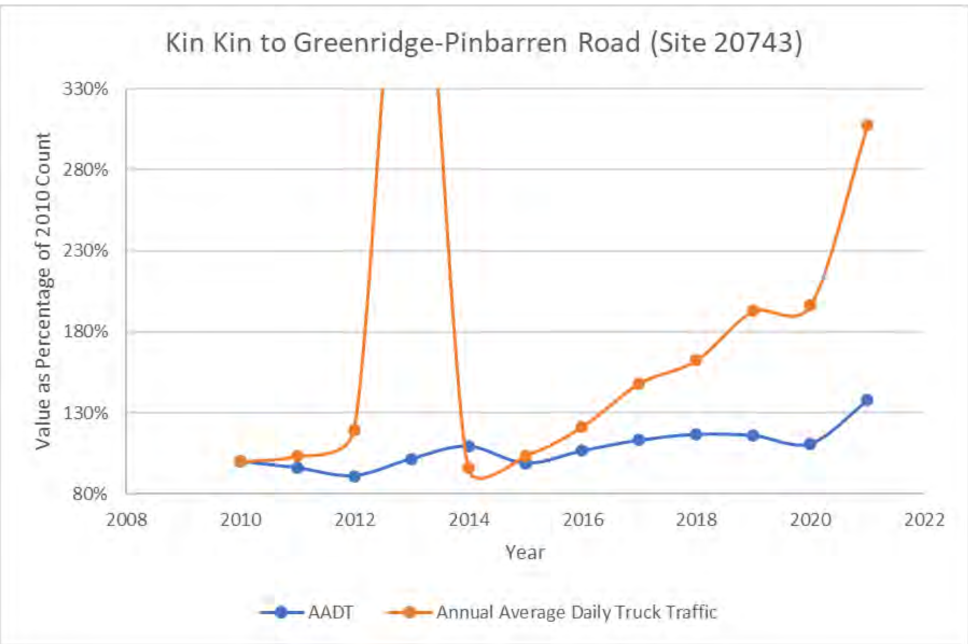
Road (Segment description, Chainage)	Data collection year	Annual Average Daily Traffic (AADT)	Percentage heavy vehicles	Annual Average Daily Truck Traffic (AADTT)	5-year AADT growth
Eumundi – Kenilworth Road (Eerwah Vale to Belli Ch. 7.08 – 12.4km)	2020	2761	17.24%	476	5.18%
Maleny – Kenilworth Road (Conondale to Cambroon Ch. 17.49 – 33.17km)	2020	984	9.70%	95	7.95%
Kilcoy – Beerwah Road (Woodford to Booroobin Ch. 0 – 13.51km)	2020	3548	11.42%	405	0%
Esk – Hampton Road (Esk to Ravensbourne Ch. 0 – 27.62km)	2020	1223	13.62%	167	0%

Source: TMR traffic count data.

AADT and AADTT growth per year on Kin Kin Road varies significantly on some road segments. Figure 2 to Figure 5, provide a graphical comparison between the AADT and the AADTT growth observed since 2010. For the road sections north of Summit Road, a trend can be observed where the AADTT has grown at a more rapid rate than the AADT since 2014. The highest growth has been observed on the road segment between Kin Kin and Greenridge-Pinbarren Road.

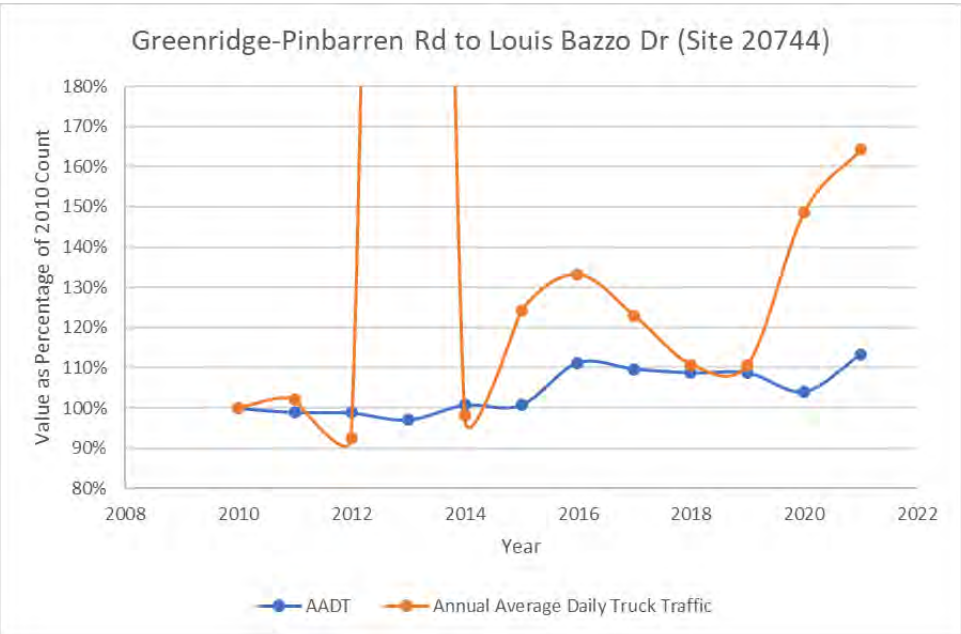
In 2013, a spike in the AADTT was observed. Because this increase coincides with the first stage of the Bruce Highway Cooroy to Curra Upgrade Project and was not observed in future years, it is safe to assume it was due to a short-term seasonal variation during the period when the traffic counts were taken.

Figure 2: AADT and Annual Average Daily Truck Traffic growth (Kin Kin to Greenridge-Pinbarren Road)



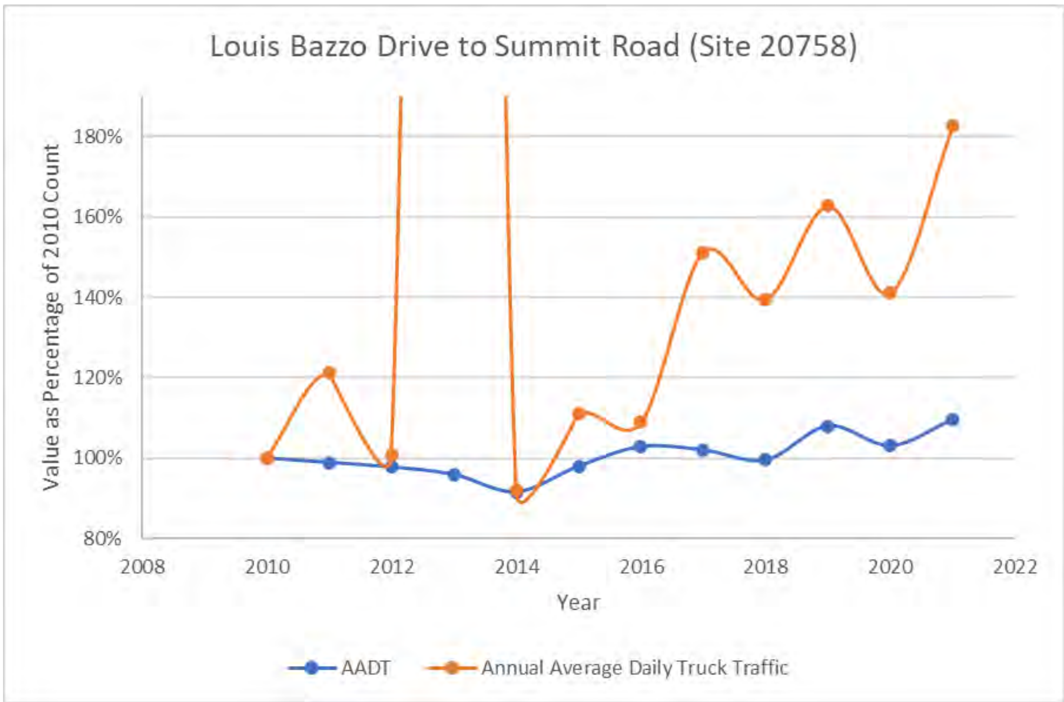
Source: TMR traffic count data.

Figure 3: AADT and Annual Average Daily Truck Traffic growth (Greenridge-Pinbarren Road to Louis Bazzo Drive)



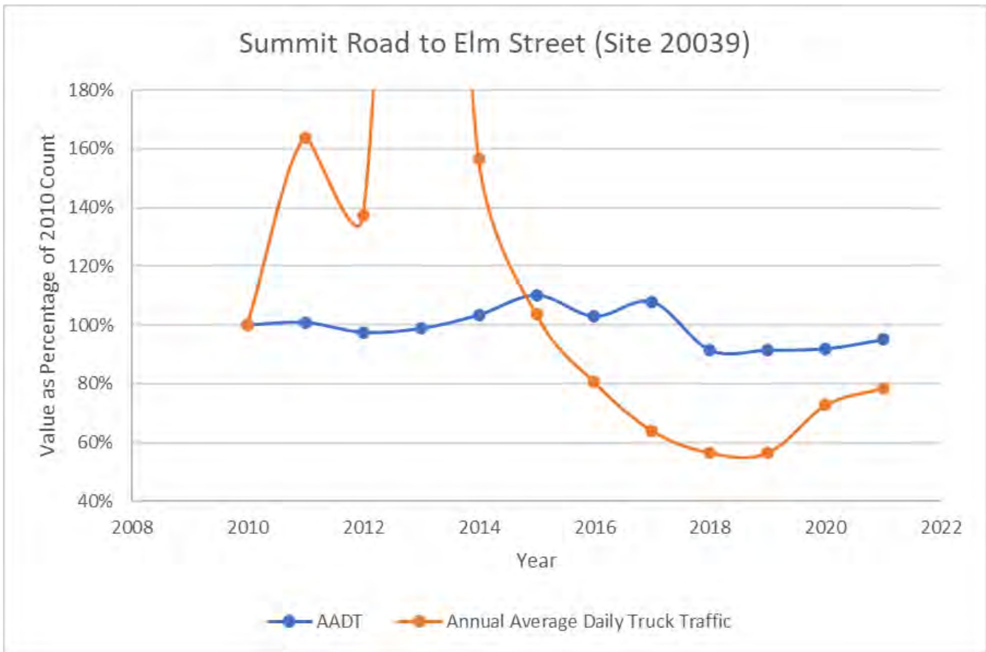
Source: TMR traffic count data.

Figure 4: AADT and Annual Average Daily Truck Traffic growth (Louis Bazzo Drive to Summit Road)



Source: TMR traffic count data.

Figure 5: AADT and Annual Average Daily Truck Traffic growth (Summit Road to Elm Street)

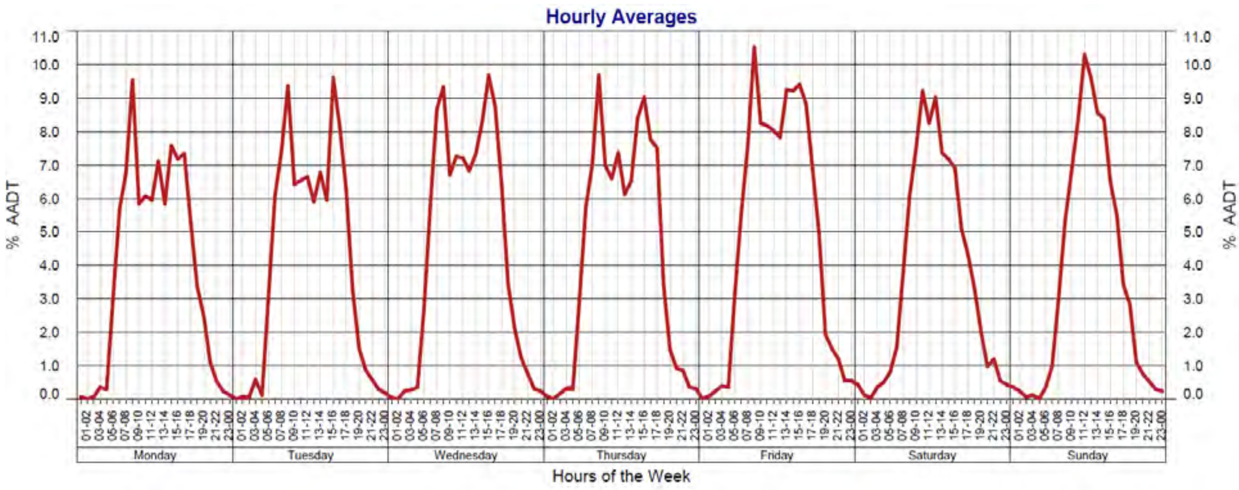


Source: TMR traffic count data.

2.2 Peak traffic flows

While AADT figures show the number of vehicles passing a particular point on a roadway in a 24-hour period, that traffic flow is not uniform throughout the 24 hours. Typically, traffic flow is very light during the late evening to early morning hours and tends to be heaviest between the morning to afternoon period. Consideration of these peak traffic flows is critical when undertaking planning and design activities on the road network. Figure 6 shows the typical weekly flow pattern near Kin Kin township. The graph shows that peak traffic flows along the route occur between the hours of 5am and 6pm on weekdays, with a noticeable spike in traffic flow at 8am and again at 3pm. Peak flow on weekends occurs between the hours of 7am and 5pm, with a single spike in traffic flow during the middle of the day. The traffic flow profile for Kin Kin Road at this location is typical of rural roads, showing two peaks during weekdays and generally a prolonged spike, centring around the middle of the day, over the weekends.

Figure 6: Peak traffic flows along Kin Kin Road



Source: TMR traffic count data.

2.3 Posted speed limits

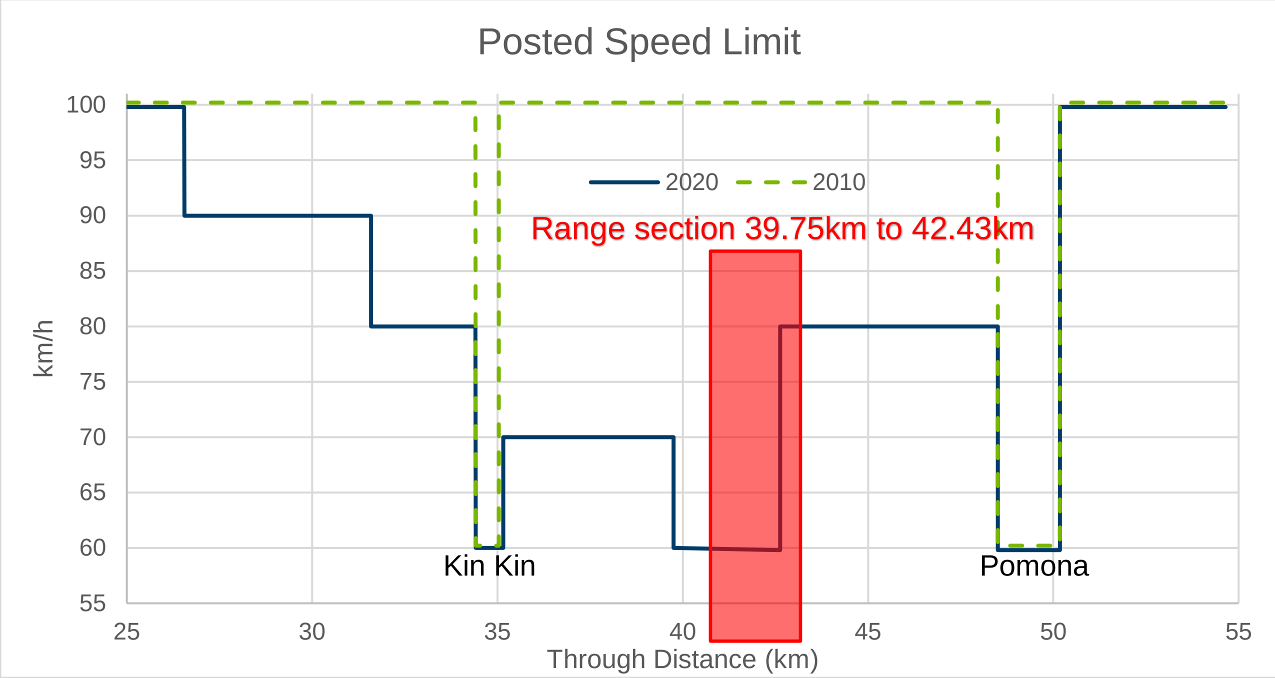
This section provides background to the setting of speed limits, a general discussion of speed limit reviews conducted in recent years on Kin Kin Road, and a detailed assessment of the current 60 km/h speed limit over the approximate three-kilometre section known as the Kin Kin Range.

The setting of speed limits is undertaken in accordance with the process described in Part 4 of the *Manual of Uniform Traffic Control Devices* (MUTCD). The detailed review of speed limits on Kin Kin Road presented in this section of the report, concludes that all current speed limits are appropriate and in accordance with the MUTCD, and that TMR will continue to monitor the need for further reviews or speed limit changes.

Posted speed limits along Kin Kin Road have changed significantly over the last 10 to 12 years, with reduced speed limits implemented over most of the length of the road within TMR North Coast Region (NCR). The speed limit reductions occurred primarily due to changes in the philosophy of, and process for, setting speed limits.

The historic setting of speed limits on low volume rural roads was often to set an open rural limit (100 km/h) with advisory and warning signs to guide motorists through the more challenging road environments. The current process of setting speed limits includes a risk-based approach and is more aligned to setting a regulatory limit that allows a constant travel speed for most of the road segment for which it applies. Figure 7 shows the changes in speed limits along Kin Kin Road within the NCR between 2010–2011 and 2020–2021.

Figure 7: Changes in speed limits along Kin Kin Road within North Coast Region



Source: TMR.

2.3.1 Speed limit review process

Speed limits throughout Queensland are set by TMR and local governments for roads under their jurisdiction. Speed limits are determined in accordance with Part 4 of the MUTCD, which outlines requirements for speed zones and signage.

Speed limits are set following a detailed engineering assessment which considers a range of factors including the function of the road, abutting development, the standard of road construction, prevailing vehicle speeds, and crash history (based on injury-related crash data from the Queensland Police Service (QPS)).

In November 2018, TMR released a new *Queensland Manual of Uniform Traffic Control Devices: Part 4 Speed Controls* (MUTCD Part 4). This was the first major revision of speed limit guidelines in Queensland since 2003. The engineering assessment methodology was revised to incorporate a safety assessment of the road infrastructure. The new risk-based speed limit model is a two-part process.

Risk Assessment Speed Limit

The first part produces a Risk Assessed Speed Limit (RASL). The RASL is calculated from the Road Risk Metric (RRM).

The RRM is calculated from a combination of the Crash Risk Rating (CRR) and the Infrastructure Risk Rating (IRR). The CRR is calculated by the number and type of injury-related crashes over the length of the road segment over the last five years of available crash data, with consideration of the daily traffic volume. The IRR is calculated by input of the road infrastructure variables, including the level of abutting development and the standard of road construction. The output from these calculations is either a Low, Medium or High RRM. The RRM outcome combined with a determination on abutting land use and function of the road allows the speed limit review practitioner to determine a RASL by using either Table 5.1.5 (b), (c) or (d) from the MUTCD Part 4.

Speed Data Speed Limit

The second part of the speed limit review process considers prevailing traffic speed data in determining a Speed Data Speed Limit (SDSL). This data is captured from speed surveys.

The final aspect of the formal speed limit review process is determining a recommended speed limit. The recommended speed limit is an engineering judgment-based process, and typically the lower of the RASL and SDSL.

Speed Management Committee

All speed limit reviews conducted must be submitted to the local Speed Management Committee (SMC) for endorsement. This is intended to ensure that the interests of all road users are considered before a speed zone is established and to ensure that speed zones throughout Queensland are consistent and credible. The role of the SMC is to deliberate thoroughly on all issues in relation to the recommendation of the road authority including, but not necessarily limited to safety, uniformity, consistency and credibility. The SMC must also be satisfied that the Speed Limit Review process was followed in accordance with the MUTCD Part 4.

Speed limit reviews on state and local government roads through the Noosa Shire Council (NSC) area are tabled at the Noosa Shire Council Speed Management Committee. This committee is chaired by council and includes representatives from NSC, TMR and QPS.

Speed limit reviews: Recent history on Kin Kin Road

The segment of Kin Kin Road in Noosa Shire includes sections of road locally known as Yurol Forest Road, Hill Street, Factory Street, Pound Road, Pomona – Kin Kin Road, and Gympie – Kin Kin Road. The full length of Kin Kin Road extends from Tin Can Bay Road in the north to Elm Street to the south. The segment within Noosa Shire begins at Chainage 25.78km and extends to Chainage 54.65km.

In recent years, TMR has undertaken formal or 'desk-top' speed limit reviews over the full length of Kin Kin Road through the Noosa Shire area. Table 3 on page 15 contains a summary, by road segment, of endorsed speed limit reviews and/or conclusions of 'desk-top' reviews.

Table 3: Speed limit reviews carried out along Kin Kin Road

Road name	Chainage	Speed limit history/status
Gympie – Kin Kin Road	25 – 31.59km	This road section had a historic speed limit of 100 km/h. In 2021 the speed limit was reviewed and reduced to 90 km/h.
Gympie – Kin Kin Road	31.59 – 34.41km	This road section had a historic speed limit of 100 km/h. In 2021 the speed limit was reviewed and reduced to 80 km/h.
Gympie – Kin Kin Road	34.41 – 35.15km	This road section is on approach to Kin Kin township and has a 60 km/h speed limit. This is the typical minimum speed limit for a rural collector road. The 60 km/h posted limit is considered suitable, and a formal speed limit review will not likely recommend a lower limit.
Pomona – Kin Kin Road	35.15 – 39.6km	This road section had a historic speed limit of 100 km/h. In 2019 the speed limit was reviewed and reduced to 80 km/h. In 2021 the limit was further reduced to 70 km/h.
Pomona – Kin Kin Road (Range)	39.6 – 42.7km	This section had a historic speed limit of 100 km/h. In 2011 the speed limit was reduced to 60 km/h. (This section is discussed in greater detail below).
Pomona – Kin Kin / Pound Road	42.7 – 48.5km	This road section had a historic speed limit of 90 km/h. In 2019 the speed limit was reviewed and reduced to 80 km/h.
Hill Street / Factory Street	48.5 – 50.2km	This road section has a 60 km/h speed limit and extends through a commercial/industrial precinct and then into a residential environment. A 60 km/h speed limit is the typical minimum speed limit for a traffic carrying road. This is a wide road that can be comfortably travelled at the 60 km/h. A formal speed limit review was being undertaken on this section as at November 2022.
Yurol Forest Road	50.2 – 54.65km	This road section had a historic speed limit of 100 km/h. In 2020 the speed limit was reviewed and maintained at 100 km/h.

Source: TMR.

Speed limit review on the Kin Kin Range: Chainage 39.6 to 42.7km

As discussed above, one of the key aspects of setting speed limits is applying speed limits over homogenous lengths of road that have a similar road construction standard and abutting development. As a result, changes in speed zones typically occur at notable changes in roadside environments and the motorist can appreciate why they must reduce, or can increase, their travel speed. A 60 km/h speed limit exists on the approximate three-kilometre length of the winding range section of Kin Kin Road between Chainage 39.6 to 42.7km. This section represents a distinct driving experience compared to the adjoining 70 km/h speed limited section heading towards Kin Kin township and the 80 km/h speed limited section heading towards Pomona township. The 70 km/h and 80 km/h speed limited sections have longer lengths of straight road and more gentle curves that permit motorists to comfortably travel at these higher limits.

A speed limit review of the 60 km/h posted limit was carried out recently on the Kin Kin Range section. The 60 km/h limit has been in place since 30 June 2011. Prior to that time, a 100 km/h rural road limit applied and was supplemented with appropriate warning signs and advisory speed limits, as had been the practice for many years across the state on isolated stretches of lower geometric standard roads. The injury-related crash data (based on data from QPS) since the introduction of the 60 km/h limit comprises:

- 7 December 2011 – single vehicle loss of control crash
- 7 June 2020 – car vs. motorcycle side swipe crash
- 30 January 2021 – truck vs. motorcycle head-on crash.

(Note: From 2010, QPS stopped investigating and recording non-injury-related crashes. Since 2010, TMR can only access injury-related crash data).

Risk Assessment Speed Limit: Kin Kin Range

The key inputs for the speed limit review were the:

- rural road environment
- trunk collector road
- crash data – based on the last five years of recorded injury-related crashes – two crashes in the last five years:
    - car vs. motorcycle crash, 7 June 2020
    - truck vs. motorcycle crash, 30 January 2021.

The calculation identified this section of road having a 'High' Road Risk Metric (RRM) and the Risk Assessment Speed Limit (RASL) recommended a speed of 80 km/h. Even though the RRM is High, given the road has been identified as a rural trunk collector road, the RASL outcome will never be lower than 80 km/h based on Table 5.1.5(D) of the MUTCD Part 4 (see Figure 8).

Figure 8: Extract of Table 5.1.5(D) from MUTCD Part 4

Table 5.1.5(D) – Risk Assessed Speed Limits: Roads in a rural environment

Road class	Functional description	Road Risk Metric		
		Low	Medium	High
Access / local street	Only for roads that provide direct access to property	80 km/h	70 km/h	60 km/h
Collector road	Used for access to properties and other roads and for local neighbourhood access within the rural residential areas, generally used only by owners of properties along those roads and by other people living within the rural areas	80 km/h	70 km/h	60 km/h
Trunk collector road	Used to travel through an area or as a major connector into an area, significant use by motorists from outside the area	100 km/h	100 km/h	80 km/h
Arterial road	These roads form the principal avenues for communications between major regions including direct connections between cities, between a capital city and adjoining states and their capital cities, between a capital city and key towns and between key towns	100 km/h	100 km/h	90 / 80[1] km/h

Source: MUTCD Part 4 (November 2019); Speed Controls.

Speed Data Speed Limit: Kin Kin Range

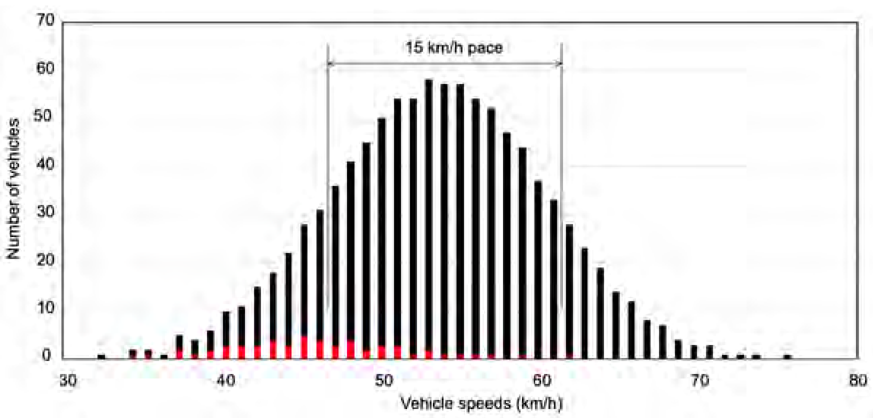
The Speed Data Speed Limit (SDSL) is determined by capturing speed data within the segment, with the speed data to be representative of the prevailing speeds over the length of segment. The mean speed, upper limit of the 15 km/h pace, and percentage within the pace are to be determined.

Key points in regard traffic count data for speed limit reviews:

1. Mean speed is the average speed of all vehicles counted. This is purely the sum of the travel speed by all recorded vehicles divided by the number of recorded vehicles.
2. The '15 km/h pace' is the grouping of vehicles travelling within a 15 km/h band width (for example, 46 km/h to 61 km/h), that contains the largest number of vehicles. The program used to calculate speed data can identify the number of vehicles captured in each 15 km/h pace and identify the '15 km/h pace' with the largest number of vehicles travelling within this band width.
3. The 'upper limit of the 15 km/h pace' is the highest recorded vehicle speed captured in the 15 km/h pace. In the above example, this would be 61 km/h. Figure 9 shows a typical histogram which demonstrates this concept. Please note that the histogram is not based on any count sites on Kin Kin Road but used simply to explain the concept of 'pace'. The histogram also contains the speed of trucks (shown in red) and illustrates how the recorded spread of truck speeds is typically spread towards the lower end of the count data.
4. A valid traffic count requires that greater than 60 per cent of the vehicles captured in the speed survey are travelling within the '15 km/h pace'. A high percentage of vehicles captured within pace is an indicator that the majority of motorists are travelling at similar speeds and therefore there will be fewer instances where motorists will have interactions with excessively slow vehicles or be tailgated by motorists wanting to travel at a higher speed. Conversely, a low percentage of vehicles captured within pace would indicate a very wide spread of speeds travelled by motorists, resulting in regular vehicle interactions.
5. The 'upper limit of pace' should be approximately the same value as the speed limit. Table 5.2.2 of the MUTCD Part 4 (reproduced in Figure 10 on page 18) demonstrates that for each speed zone, the 'upper limit of 15 km/h pace' can be between 4–5 km/h lower and up to 8–9 km/h higher than the posted limit.
6. The data used in determining a speed limit is based on the prevailing speeds travelled by the majority of motorists. It is acknowledged that there is a wide variety of vehicle types and mindsets of drivers on the road network. There will be vehicles and drivers that travel well below and well above the posted speed limit. This is why it is important that the majority of recorded vehicles are within the 15 km/h pace.

The speed distribution obtained from the speed count data is assessed against the criteria in Table 5.2.2 of the MUTCD Part 4 (reproduced in Figure 10 on page 18) to determine whether the data conforms to an acceptable speed distribution for the existing speed limit or may warrant a change.

Figure 9: Histogram demonstrating the concept of 'pace' for speed limit reviews



Source: Professor Rod Troutbeck; 2021.

Figure 10: Extract of Table 5.2.2 from MUTCD Part 4

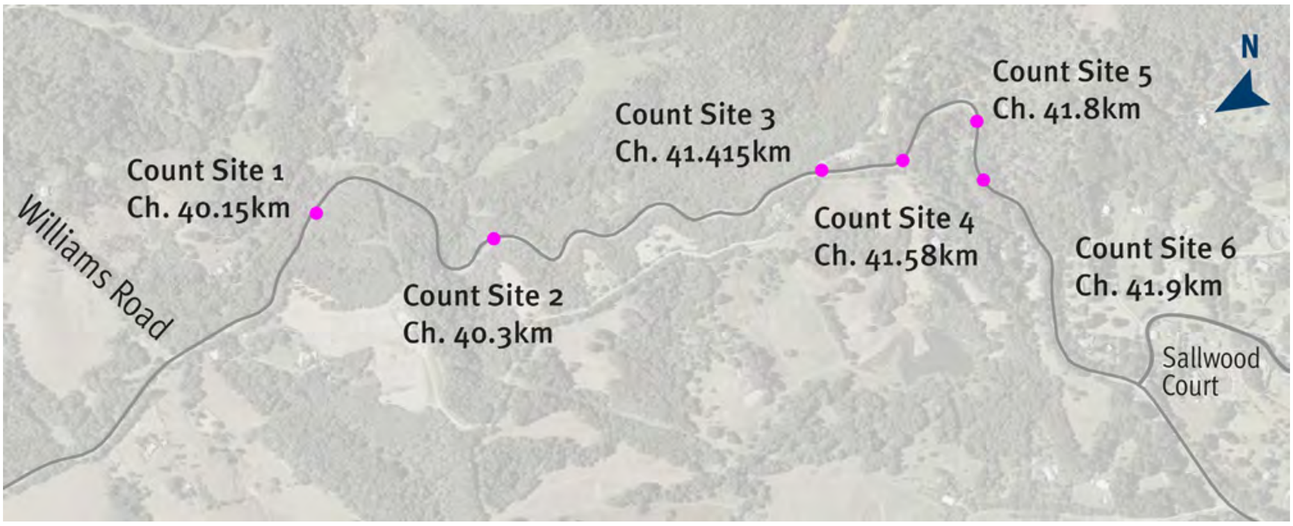
Table 5.2.2 – Speed data test ranges

Criteria	Existing Speed Limit (km/h)							
	40	50	60	70	80	90	100	110
Mean speed	32–43	41–53	49–63	59–72	69–80	79–89	89–97	99–106
Upper limit of 15 km/h pace	36–49	46–59	56–69	66–79	76–89	86–98	96–106	105–114
Percentage within pace	>60	>60	>60	>60	>60	>60	Urban >54 Rural >45	>40

Source: MUTCD Part 4 (November 2019); Speed Controls.

Tube count speed data was obtained at six locations on the Kin Kin Range. The range is a relatively consistent driving experience for motorists, with a constantly winding alignment and short lengths of straight between each curve. The count data is based on locations just prior to curves. The speed data is calculated by the time it takes for the front set of wheels of the vehicle to cross from the first tube to the second tube. The tube counters also count the number of wheel axles to determine speed by vehicle type. Figure 11 indicates the location of the six traffic count sites.

Figure 11: Location of the six traffic count sites on Kin Kin Range



Source: TMR.

It is acknowledged that the measured speed of vehicles captured just prior to a curve will be higher than if measured at the apex of a curve. However, it is not possible to capture the speed of vehicles on the apex or through the curve due to the vehicle striking the tube counters at an angle rather than perpendicular, resulting in inaccurate recording of speeds and classifications of vehicles.

Table 4 on page 19 illustrates the location, mean speed, upper limit of 15 percentile pace and percentage in pace for the six count sites undertaken on the range. The speed data for each count site is a summary of both northbound and southbound traffic and includes all vehicle types.

Table 4: Analysis of speed limit counts on Kin Kin Range

Location	Chainage	Class	Mean Speed	UL 15km/h pace	% in pace
395m South of Williams Rd	40.15	All	55	62	73
550m South of Williams Rd	40.3	All	55	63	74
1010m North of Sallwood Ct	41.415	All	56	63	71
840m North of Sallwood Ct	41.58	All	49	57	78
620m North of Sallwood Ct	41.8	All	52	60	80
520m North Sallwood Ct	41.9	All	50	58	81
All Vehicle Average			53	61	76

Source: TMR.

The count data validates the previous statement that the range is a consistent driving experience as evidenced by:

- only 6 km/h speed difference between the highest and lowest of the calculated 'upper limit of 15 km/h pace
- the mean speed and upper limit of 15 km/h pace data from each count site fits within the accepted data distribution from Table 5.2.2 of MUTCD Part 4 for a posted 60 km/h speed limit
- much greater than 60 per cent of vehicles recorded at each count site travelling within the 15 km/h pace.

Speed limit review conclusion

From the speed limit review process noted above it is concluded that:

The RASL = 80 km/h

The SDSL = 60 km/h.

As previously stated, the recommended speed limit is an engineering judgment-based process, and typically the lower of the RASL and SDSL. In this case, the formal speed limit review process supported maintaining a 60 km/h speed limit.

Special consideration for heavy vehicles

The MUTCD does permit differing posted speed limits for different vehicle classes. This section will explore the option of maintaining a 60 km/h limit but posting a lower limit for heavy vehicles.

The MUTCD provides little guidance on the decision-making process, noting only that it may be a consideration to provide differing speed limits where a reduced speed limit is considered necessary for safety reasons such as limited visibility in advance of a hazard or conflict (see Figure 12 on page 20). The guidance in the MUTCD implies that any consideration for a lower limit for trucks should only be on the basis of a short length or isolated hazard or conflict. Following this guidance, it is considered that applying differential speed limits based on vehicle types alone is not a valid treatment and should not be applied on Kin Kin Road.

Figure 12: Extract from Section 10.1.4 of MUTCD Part 4 – Truck speed limit sign

(c) *Truck Speed Limit (TC2255)*

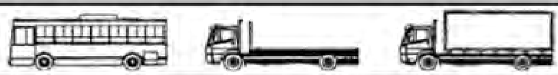
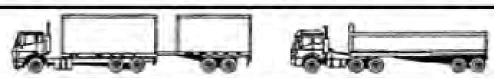
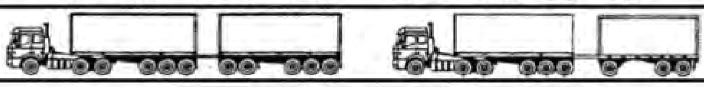
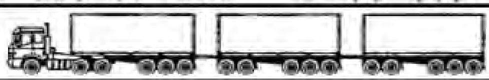
The Truck Speed Limit (TC2255) sign in conjunction with the Speed Restriction (R4-1) sign shall be used to indicate the speed limit that applies to trucks on a section of road. This sign is generally used where a reduced speed limit is considered necessary for safety reasons such as limited visibility in advance of a hazard or conflict. This sign may also be used to regulate the speed of trucks through towns for amenity reasons.

The END (R7-4) sign, Truck Speed Limit (TC2255) and Speed Restriction (R4-1) sign shall be installed at the end of the speed zone where the reduced speed limit for trucks applies.

Source: MUTCD Part 4 (November 2019); Page 43.

The speed surveys are conducted in a way that allows interrogation of data for differing vehicle types. TMR utilises the Austroads vehicle classifications to define these vehicle types. Figure 13 illustrates the Austroads vehicle classes and their groupings used in the analysis and presentation of the speed data for this report.

Figure 13: Austroads vehicle classifications

Vehicle Type		AUSTROADS Classification
Class	**Typical Description**	**Typical Configuration**
	LIGHT VEHICLES	
1	**Short** Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	
2	**Short - Towing** Trailer, Caravan, Boat, etc	
	HEAVY VEHICLES	
3	**Two Axle Truck or Bus**	
4	**Three Axle Truck or Bus**	
5	**Four Axle Truck**	
6	**Three Axle Articulated** Three axle articulated vehicle, or Rigid vehicle and trailer	
7	**Four Axle Articulated** Four axle articulated vehicle, or Rigid vehicle and trailer	
8	**Five Axle Articulated** Five axle articulated vehicle, or Rigid vehicle and trailer	
9	**Six Axle Articulated** Six axle articulated vehicle, or Rigid vehicle and trailer	
10	**B Double** B Double, or Heavy truck and trailer	
11	**Double Road Train** Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	
12	**Triple Road Train** Triple road train, or Heavy truck and three trailers	

Notes:

1. Only vehicles in B-Double configuration (Class 10) up to 19m in length have general access to Kin Kin Road.
2. Class 11 and Class 12 vehicles do not have general access to Kin Kin Road.

Source: Based on Austroads – Guide to Traffic Management Part 3 (2017); Table A 8 (Page 122) and Figure A 12 (Page 123).

Table 5 provides a summary of speed data for all vehicles compared to only Class 7–12* heavy vehicles. Class 7–10 heavy vehicles are the vehicles that would be associated with the haulage from the quarry at Kin Kin. The 'percentage in pace' for the Class 7–12 vehicles is greater than 84 per cent for each of the six count sites, indicating that the vast majority of these vehicles are travelling at similar speeds, and that there must not be a significant disparity in travel speed between empty and loaded vehicles, or when travelling up or down grade.

* Note: All vehicles in this range should be Class 7–10. Class 11–12 vehicles do not have general access to Kin Kin Road.

Table 5: Summary of speed data for all vehicles compared to only Class 7–12 heavy vehicles

Location	Chainage	Class	No. Vehicles	Mean Speed	UL 15km/h pace	% in pace	Vehicles in pace	Number of Class 7-12 in pace	% of total vehicles in pace that are Class 7-12	% of Class 7-12 travelling within pace	% of class 7-12 compared to total traffic
395m South of Williams Rd	40.15	All	16280	55	62	73	11824	503	4.3	56	5.5
		7-12	901	47	54	88	791				
550m South of Williams Rd	40.3	All	16250	55	63	74	12005	281	2.3	32	5.4
		7-12	878	46	55	85	748				
1010m North of Sallwood Ct	41.415	All	16434	56	63	71	11682	417	3.6	48	5.3
		7-12	864	47	55	85	732				
840m North of Sallwood Ct	41.58	All	16365	49	57	78	12833	442	3.4	53	5.1
		7-12	830	43	50	84	695				
620m North of Sallwood Ct	41.8	All	16277	52	60	80	13031	424	3.3	58	4.5
		7-12	728	46	54	89	651				
520m North Sallwood Ct	41.9	All	15274	50	58	81	12444	513	4.1	71	4.7
		7-12	721	45	52	93	672				
All Vehicle Average				53	61	76					
Class 7-12 Average				46	53	87					

Source: TMR.

The speed count data shows the Class 7–12 vehicles are generally travelling at approximately 8 km/h slower than 'all vehicles'. The traffic count data for Class 7–12 vehicles indicates that these vehicles are travelling within a speed distribution typical of a 50 km/h speed limit. It is typical that heavy vehicles will travel at a lower prevailing speed than light vehicles. This will be more pronounced on a steep and winding road alignment. It is not normal to post different speed limits for different class vehicle types.

TMR's Safer Roads Infrastructure Business Unit (SRI) within the Engineering and Technology Branch developed the MUTCD Part 4. It is the opinion of senior officers from SRI, that the Kin Kin Range is not a suitable candidate for treatment with differential speed zones for trucks. They felt that this treatment should be reserved for locations with a high crash rate involving heavy vehicles, and/or an extraordinary low road construction standard. SRI further advised that any consideration for a reduction in speed limit should apply to all vehicle classes.

The current 60 km/h speed limit is the typical minimum speed limit for a range section on a major rural road and is well supplemented with a suite of high-standard advisory and warning signs to guide motorists through the curvilinear road alignment. This is the arrangement TMR has deployed throughout the TMR North Coast Region (NCR) on similar winding range roads, adopting a 60 km/h regulatory limit and advisory/warning signs where motorists may need to travel at a reduced limit.

The speed counts taken show that there is good compliance with the existing 60 km/h speed limit. TMR does not believe a different speed zone should apply for trucks on this section of road. To do so would introduce unnecessary confusion and would be difficult to enforce due to the nature of the existing roadside environment. Furthermore, while there is currently an approximate 8 km/h speed differential between light and heavy vehicles, lowering the posted speed for trucks would almost certainly increase this differential resulting in less overall vehicles travelling within the 15 km/h pace. This would increase vehicle interaction and may result in slower vehicles being tailgated by motorists wanting to travel at a higher speed, and potentially lead to driver frustration and risky driver behaviour as drivers of light vehicles try to overtake slower moving heavy vehicles.

Conclusion

The review into the speed limits on Kin Kin Road has found that all current speed limits have been reviewed or considered in recent times and are considered appropriate and in accordance with the MUTCD. TMR has also investigated the possibility of applying lower speed limits for heavy vehicles on the Kin Kin Range section but determined that this would not be appropriate. TMR will continue to monitor the need for further reviews or speed limit changes.

2.4 Speed limit compliance

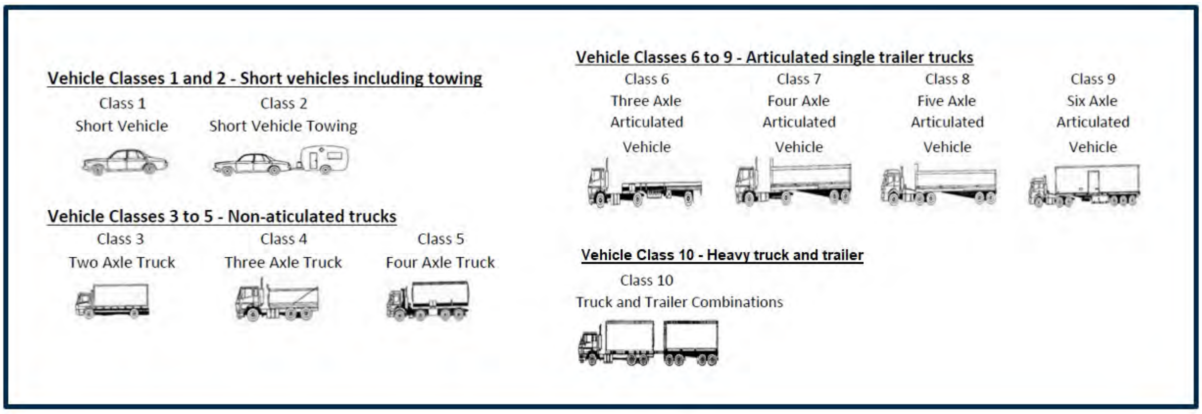
The Noosa hinterland community has raised numerous concerns about trucks speeding on various parts of Kin Kin Road, and in the vicinity of the pedestrian crossing on Pomona Connection Road (Reserve Street, Pomona). In response to those concerns, and to assist TMR's investigations into the operational performance of the route, TMR performed speed surveys at the following locations:

- Kin Kin Road, in the vicinity of Sheppersons Lane
- Kin Kin Road, 450 metres north of Williams Road
- Kin Kin Road, 80 metres south of Turnbull Road, on the section of the Kin Kin Range upgraded in 2012
- Kin Kin Road, 100 metres north of Six Mile Creek northern abutment
- Kin Kin Road, 300 metres south of Boreen Road (Louis Bazzo Drive)
- Pomona Connection Road, 30 metres north of School Road
- Pomona Connection Road, 150 metres south of Barina Court.

The speed surveys were conducted by collecting traffic data from pneumatic tubes installed at each of the locations. Data was initially collected between 16–24 September 2020. During this period, a temporary lower speed limit of 60 km/h was in place over a 12-kilometre section of the road, between Sheppersons Lane to near Binalong Road, as an interim measure while TMR's contractor was repairing sections of damaged pavement. The imposition of this low temporary speed limit may have impacted typical travel speeds under normal prevailing conditions. As such, further speed surveys were conducted at various sites between 20–29 October 2020, after the temporary speed limits were removed.

The speed surveys were conducted in a way that allowed interrogation of data for differing vehicle types. TMR utilises the Austroads vehicle classifications to define these vehicle types. Figure 14 on page 23 illustrates the vehicle classes and their groupings used in the analysis and presentation of the speed data for this report.

Figure 14: Vehicle classes and groupings used for speed data analysis



Source: Based on Austroads – Guide to Traffic Management Part 3 (2017); Table A 8 (Page 122) and Figure A 12 (Page 123).

Tables 6 to 8 (on pages 24 to 26) present the numerical findings of the data captured and analysed during the October 2020 period at three sample sites: 80 metres south of Turnbull Road; 450 metres north of Williams Road; and 30 metres north of School Road (Pomona Connection Road).

Analysis of the speed data shows common themes at all surveyed sites. The results showed that:

- the poorest levels of compliance were demonstrated by Class 1 and Class 2 vehicles
- compliance increased with increasing vehicle classes
- heavy truck and trailer combinations demonstrate the highest level of compliance.

Table 6 displays data captured and analysed at the survey site located on the Kin Kin Range, 80m south of Turnbull Road. The data indicates that no Class 10 truck and trailer combinations were recorded exceeding the 60 km/h speed limit heading south towards Pomona. Heading north towards Kin Kin, the survey recorded five truck and dog trailer combination exceeding the speed limit. Of these five, the highest recorded speed was 61.2 km/h, meaning all five speeding trucks were travelling only marginally above the speed limit. At the same location, the data shows around one quarter of Class 1 and Class 2 vehicles (typically called passenger vehicles) exceeded the speed limit, with 177 (2.5 per cent) of these vehicles travelling between 10 km/h and 20 km/h over the speed limit, and a further 88 (1.2 per cent) vehicles travelling more than 20 km/h above the speed limit.

Table 6: Speed survey data on Kin Kin Road, 80 metres south of Turnbull Road

Vehicle class	1 and 2	3 to 5	6 to 9	10
Vehicle class description	**Short vehicles including towing**	**Non-articulated trucks**	**Articulated single trailer trucks**	**Truck and trailer combinations**
Northbound (toward Kin Kin)				
Posted speed limit (km/h)	60	60	60	60
Number of vehicles recorded	3670	643	166	199
85th percentile (km/h)	63.2	60.5	53.3	55.3
95th percentile (km/h)	68.9	65.8	57.9	58.1
Number exceeding posted speed limit	1024	102	5	5
Percentage exceeding posted speed limit	27.9	15.9	3.0	2.5
Mean exceeding posted speed limit	65.8	64.6	62.4	60.5
Number exceeding by > 10km/h but < 20 km/h	105	9	0	0
Percentage exceeding by > 10km/h but < 20 km/h	2.9	1.4	0.0	0.0
Number exceeding by > 20km/h	46	0	0	0
Percentage exceeding by > 20km/h	1.3	0.0	0.0	0.0
Maximum recorded speed (km/h)	111.7	78.3	64.1	61.2
Southbound (toward Pomona)				
Posted speed limit (km/h)	60	60	60	60
Number of vehicles recorded	3522	414	135	185
85th percentile (km/h)	62.4	59.2	51.2	51.0
95th percentile (km/h)	67.9	64.7	53.9	52.6
Number exceeding posted speed limit	854	58	1	0
Percentage exceeding posted speed limit	24.2	14.0	0.7	0.0
Mean exceeding posted speed limit	65.7	64.7	61.3	0.0
Number exceeding by > 10km/h but <20 km/h	72	6	0	0
Percentage exceeding by > 10km/h but <20 km/h	2.0	1.4	0.0	0.0
Number exceeding by > 20km/h	42	1	0	0
Percentage exceeding by > 20km/h	1.2	0.2	0.0	0.0
Maximum recorded speed (km/h)	115.5	84.5	61.3	55.2

Source: TMR.

Table 7 on page 25 shows data captured and analysed at the survey site located on the section of Kin Kin Road to the north of the Kin Kin Range, 450 metres north of Williams Road. At this location, only a very small number of Class 10 truck and trailer combinations were recorded exceeding the speed limit of 70 km/h, and by an amount of less than 3 km/h. Similar speed profiles were obtained for the Class 6 to 9 articulated single trailer trucks, with only one of these recorded truck types travelling at more than 10 km/h over the speed limit.

Class 1 and Class 2 vehicles show the greatest numbers and percentages of speed limit non-compliance with 147 (4.4 per cent) northbound and 254 (7.5 per cent) southbound travelling between 10 km/h and 20 km/h over the speed limit, and a further 81 (1.2 per cent) vehicles travelling more than 20 km/h above the speed limit (more than 90 km/h).

Table 7: Speed survey data on Kin Kin Road, 450 metres north of Williams Road

Vehicle class	1 and 2	3 to 5	6 to 9	10
Vehicle class description	Short vehicles including towing	Non-articulated trucks	Articulated single trailer trucks	Truck and trailer combinations
Northbound (toward Kin Kin)				
Posted speed limit (km/h)	70	70	70	70
Number of vehicles recorded	3355	473	156	211
85th percentile (km/h)	74.3	68.4	64.2	64.8
95th percentile (km/h)	80.5	76.3	67.6	71.1
Number exceeding posted speed limit	933	61	3	12
Percentage exceeding posted speed limit	27.8	12.9	1.9	5.7
Mean exceeding posted speed limit	76.4	76.1	70.6	72.8
Number exceeding by > 10km/h but < 20 km/h	147	11	0	0
Percentage exceeding by > 10km/h but < 20 km/h	4.4	2.3	0.0	0.0
Number exceeding by > 20km/h	32	1	0	0
Percentage exceeding by > 20km/h	1.0	0.2	0.0	0.0
Maximum recorded speed (km/h)	118.2	93.4	71.6	77.8
Southbound (toward Pomona)				
Posted speed limit (km/h)	70	70	70	70
Number of vehicles recorded	3379	616	158	243
85th percentile (km/h)	77.0	73.4	62.6	62.5
95th percentile (km/h)	82.8	80.5	67.7	66.7
Number exceeding posted speed limit	1323	146	5	4
Percentage exceeding posted speed limit	39.2	23.7	3.2	1.6
Mean exceeding posted speed limit	76.8	76.5	76.9	71.7
Number exceeding by > 10km/h but <20 km/h	254	33	1	0
Percentage exceeding by > 10km/h but <20 km/h	7.5	5.4	0.6	0.0
Number exceeding by > 20km/h	49	3	0	0
Percentage exceeding by > 20km/h	1.5	0.5	0.0	0.0
Maximum recorded speed (km/h)	112.1	93.2	82.5	72.4

Source: TMR.

Speed data captured on Pomona Connection Road (Reserve Street) in Pomona, at a site located 30m north of School Road, is shown in Table 8 on page 26. Data was collected at this site primarily to measure the speed of trucks approaching the nearby zebra crossing near the Memorial Street/Station Street roundabout, following community concerns about the dangerous speeding behaviours of heavy vehicle operators. The speed limit at the survey site is 40 km/h, the reduction in the posted speed limit from 60 km/h to 40 km/h is around 30m to the south of the survey site. The pedestrian crossing is about 200m to the north of the survey site.

The speed profiles for northbound movements (toward Kin Kin Road), in the direction toward the zebra crossing, show relatively low numbers and percentages of Class 10 vehicles exceeding the 40 km/h speed limit, with only eight out of 141 Class 10 vehicles exceeding the limit, and only two of these exceeding it by greater than 10 km/h (travelling above 50 km/h). Almost one quarter of Class 6 to 9 vehicles exceeded the speed limit in this direction, although a very low number were more than 10 km/h over the limit.

Based on the sample data, Class 1 and Class 2 vehicles are five times more likely to be speeding, and three times more likely to exceed the speed limit by more than 10 km/h, than Class 10 vehicles at the site, travelling in the northbound travel direction.

Table 8: Speed survey data on Pomona Connection Road, 30 metres north of School Road

Vehicle class	1 and 2	3 to 5	6 to 9	10
Vehicle class description	**Short vehicles including towing**	**Non-articulated trucks**	**Articulated single trailer trucks**	**Truck and trailer combinations**
Northbound (toward Factory Street)				
Posted speed limit (km/h)	40	40	40	40
Number of vehicles recorded	11327	831	118	141
85th percentile (km/h)	44.3	41.4	43.0	37.0
95th percentile (km/h)	49.7	47.4	46.8	40.5
Number exceeding posted speed limit	3446	164	27	8
Percentage exceeding posted speed limit	30.4	19.7	22.9	5.7
Mean exceeding posted speed limit	45.4	44.7	44.0	44.6
Number exceeding by > 10km/h but < 20 km/h	473	18	3	2
Percentage exceeding by > 10km/h but < 20 km/h	4.2	2.2	2.5	1.4
Number exceeding by > 20km/h	36	0	0	0
Percentage exceeding by > 20km/h	0.3	0.0	0.0	0.0
Maximum recorded speed (km/h)	77.9	56.4	51.1	54.8

Source: TMR.

Increasing travel speeds generally leads to longer stopping distances, decreased ability for motorists to take evasive action in an emergency situation and higher crash severities. Whilst TMR does not condone any form of speeding, the speed survey data generally shows very high numbers and proportions of heavy vehicles complying with the posted speed limits when compared to levels of speed compliance recorded for passenger type vehicles.

2.5 Quarry at Kin Kin haulage operations

While TMR traffic counts cannot distinguish between quarry trucks and other heavy vehicles using Kin Kin Road, observation shows that a large percentage of the heavy vehicle traffic can be attributed to operations of the quarry at Kin Kin. The quarry has a Traffic Management Plan (TMP) in place which is part of the overall Quarry Management Plan (QMP). The QMP was prepared as a condition of the Development Permit issued by what is now the Department of Environment and Science. The TMP outlines the management procedures and practices and special conditions regarding heavy vehicle movements into and out of the quarry. Procedures applicable to haulage on the Kin Kin Road include the following:

- Trucks must not depart the quarry at less than five-minute intervals.
- Implementation of the road transport protocol and a 'Driver Code' which includes avoiding cartage during times when the school bus is using the local road system.
- All loads except large rock boulders, will be covered. The quarry will adopt a 'no tarp – no load' policy.

- Vehicles will be fitted with well-maintained engine mufflers.
- Reduced speed and increased care to be taken by drivers 2.5 kilometres south of Kin Kin where the road becomes steep and winding (Kin Kin Range).
- Ongoing liaison with drivers, council and community to identify priorities for continual improvements in road traffic safety for Kin Kin Road.
- Discourage practices such as early arrivals or convoying which can impact on residents and other road users.

In addition to the above procedures, drivers must also adhere to the following conditions:

- Truck drivers are not to overtake other vehicles.
- 'Give Way' signs at single-lane bridges are to be strictly adhered to.
- The quarry will seek to minimise truck movements by rescheduling product deliveries from the site and discourage unnecessary truck movements during the school bus hours of 6.30–8am and 3–4.30pm.
- If the school bus is encountered along the road, then it is a requirement that the school bus must not be overtaken, unless indicated to do so by the bus driver, and it is safe to do so.
- Trucks must not arrive at the quarry site prior to the approved operations and must not leave the site with a full load after the approved operating hours.

It is also understood the trucks' operators are in UHF contact with the school bus driver when using the Kin Kin Range.

The quarry is approved to extract a maximum of 1,000,000 tonnes per annum, with actual extraction volumes largely driven by market needs and material availability.

The quarry is approved to operate between the hours of 6am and 6pm on weekdays, and 7am to 5pm on Saturdays. Considering the hours of operation, and the minimum five-minute interval between truck departures from the quarry, the maximum number of truck departures is 144 on weekdays and 120 on Saturdays, equating to a maximum of 288 and 240 quarry truck movements along Kin Kin Road on these days respectively.

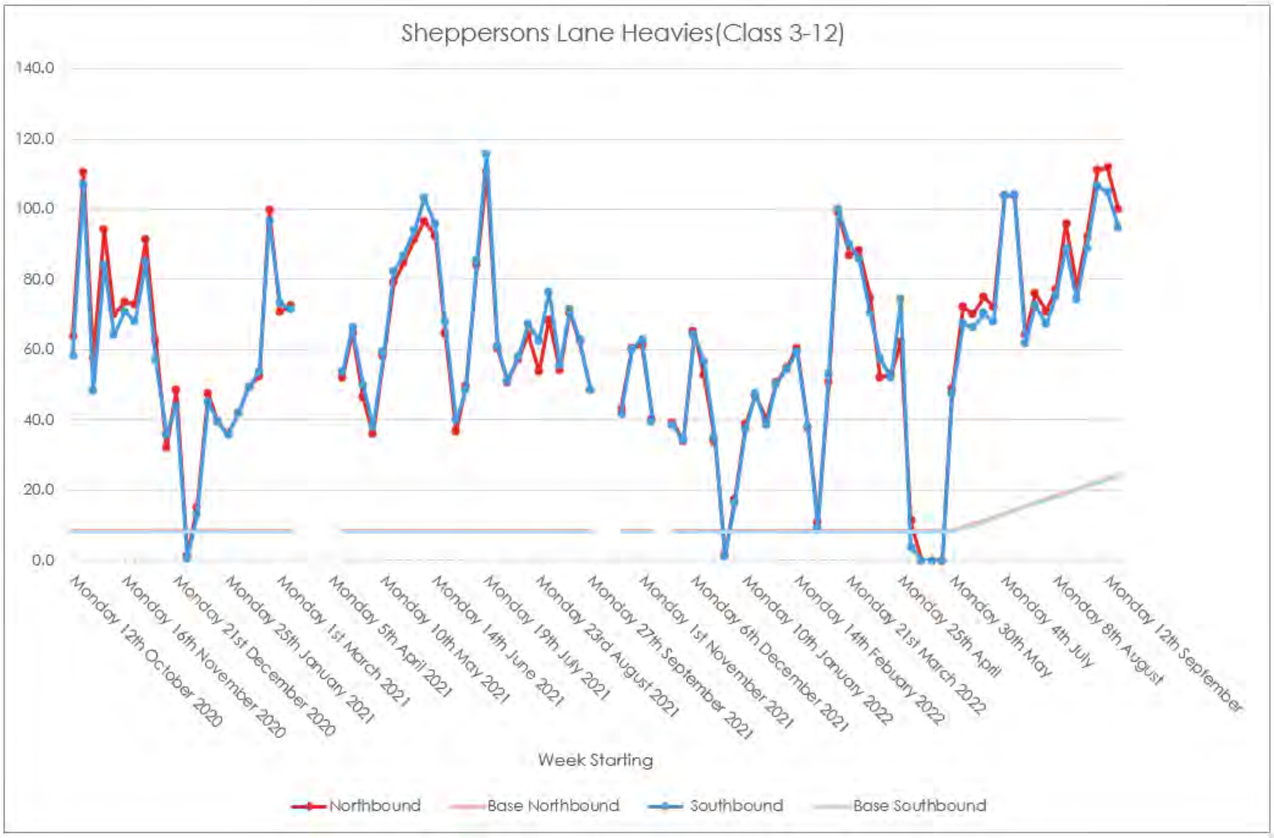
Truck and dog trailer combinations are frequently deployed for haulage of material from the quarry at Kin Kin. Taking into account the general tare weight of these vehicle types, the average payload equates to around 30 tonnes to stay within the gross combination mass limits of 42.5 tonnes.

To hypothesise, if the quarry were to operate 300 days per year (six days per week for 50 weeks of the year), and that all material is carried by truck and dog trailer combinations with an average payload of 30 tonnes, this equates to about 111 trucks departing the quarry each operating day to reach the maximum annual extraction limits. Based on the assumption that the number of trucks entering is equal to the number of trucks exiting the quarry, this equates to 222 movements along Kin Kin Road every operating day.

The Noosa Shire Council Mayor established a 'Roundtable Meeting' which meets regularly to identify issues arising from quarry operations and provides an opportunity for stakeholders to work together to identify potential solutions. Council reported at the meeting held on 1 February 2022 that their count data on Sheppersons Lane showed the actual number of truck movements to and from the quarry per day was erratic and averaged 78 movements per day up to the end of 2021. Therefore, the quarry truck activity experienced during council's monitoring period was well below that required to achieve the annual extraction limit. At the first Roundtable Meeting held in August 2020, community group members reported counting around 250 quarry trucks on Kin Kin Road in a single day. The high rate of truck activity reported at that time is indicative of the daily operational truck activity for the quarry to achieve the maximum annual extraction limit.

Figure 15 provides a graph showing heavy vehicle movements recorded by Noosa Shire Council (NSC) on Sheppersons Lane from October 2020 to September 2022.

Figure 15: Heavy vehicle movements recorded by Noosa Shire Council on Sheppersons Lane



Source: Noosa Shire Council.

2.6 Summary of road use

Kin Kin Road is a rural arterial/distributor road servicing communities in the Noosa and Cooloola hinterland east of the Bruce Highway. In addition to servicing the local agricultural and tourism industries, the road also serves a recreational and commercial function. The biggest generator of commercial traffic is the local quarry at Kin Kin, located off Sheppersons Lane, north of Kin Kin township. The road is gazetted as a general access vehicles route, allowing unrestricted use of the road by rigid trucks, rigid truck and trailer combinations, semi-trailers, and short B-Double combinations, up to 19 metres in length, 2.5 metres in width and with a gross mass not exceeding 42.5 tonnes.

The road has experienced steady traffic growth over the past 10 years and has a low traffic volume over most of the route compared with many other state-controlled roads in the TMR North Coast Region (NCR). Heavy vehicle use has increased in recent years and while the percentage of heavy vehicles is up to 16 per cent in places, this percentage is more a function of the low numbers of passenger vehicles using the road rather than an extraordinarily high number of heavy vehicles. The number and composition of traffic on Kin Kin Road shows similar characteristics to other similar rural road segments in the NCR. Since 2014, trends show that the average annual daily truck traffic has grown at a higher rate than the overall average annual daily traffic including all vehicles. Analysis of traffic flows throughout the day show that the traffic profile for Kin Kin Road is typical of other rural roads, showing peak flows around 8am and 3pm on weekdays, and a single peak around midday on weekends.

Prior to 2010, the road had a posted speed limit of 100 km/h for the whole length, excluding the sections past Kin Kin township and thorough Pomona. The posted speed limits along various sections have changed significantly over the last 10 to 12 years, with reduced speed limits now applied over most of the length of the road. The range section had its speed limit lowered to 60 km/h in 2011.

Speed limits over the entire length of Kin Kin Road in the NCR have been reviewed over the last 10 to 12 years in accordance with changes in the philosophy of and process for setting speed limits on Queensland roads. The speed limits currently in place are considered appropriate in accordance with the MUTCD. TMR has also investigated the possibility of applying lower speed limits for heavy vehicles only, on the Kin Kin Range section, but has determined that this would not be appropriate. TMR has no plans for any further reviews or changes to any speed limits along the route at this time.

TMR has undertaken speed surveys along the route in response to community concerns relating to the perception of trucks speeding on various parts of Kin Kin Road. These surveys showed that there are typically good levels of speed compliance from heavy vehicles, and poorer levels of speed compliance from passenger type vehicles. In particular, Class 10 heavy vehicles, which would constitute a high proportion of the quarry fleet, showed a very high level of compliance with the posted speed limits.

The TMP for the quarry is a condition of the Development Permit issued by the Department of Environment and Science. The TMP outlines the management procedures and practices and special conditions regarding heavy vehicle movements accessing the quarry. The TMP covers load staging/intervals, load protection (tarping), truck roadworthiness and driver behaviour. The plan also addresses heavy vehicle interaction with school buses and identifies liaison with council and the community as key to continual improvement in road safety.

The number of quarry trucks (recorded on Sheppersons Lane) is irregular, averaging around 78 trucks per day in each direction up to the end of 2021. Community group members, however, have reported counting up to 250 quarry trucks on Kin Kin Road in a single day. The quarry is approved to extract a maximum of 1,000,000 tonnes per annum. At this peak output rate, it can be calculated that this would equate to 222 truck and dog trailer combinations along Kin Kin Road per day. The actual extraction volumes, however, are a largely governed by market need and material availability.

3. Road geometry

The section of Kin Kin Road within TMR North Coast Region (NCR) begins on the lower part of Nunan Range (25.78km) which is an unsealed gravel pavement. The two-lane bitumen sealed pavement begins at Chainage 26.32km and the majority of the road north of the Kin Kin Range has a seal width between 6.0 metres and 7.2 metres, with or without marked edge lines and with either grassed or gravel shoulders. A project in 2012 widened a section of the existing pavement within the range section from Chainage 40.36km to 41.78km to an 8.0 metre plus, sealed standard. To the south of the range through to Greenridge-Pinbarren Road (Cooran turnoff, Chainage 45.17km), the sealed pavement widths are similar to those to the north ranging from 6.0 metres to 7.2 metres. From the Cooran turnoff to the end of Kin Kin Road, the seal widths are typically around 9.0 metres. Overall, for the section of Kin Kin Road within the NCR, 38.5 per cent of the total sealed length has a width of 8.0 metres or greater and more than 55 per cent of the sealed pavement has marked edge lines.

From the NCR regional boundary to the Kin Kin Range, the alignment is winding on a rolling terrain, with horizontal curves generally within the range of radii 200–300 metres in the lower country but reducing to radii 50–150 metres nearer to the range. The range section, which spans from Williams Road (Chainage 39.75km) to Sallwood Court (Chainage 42.43km), is mountainous with tight horizontal curves and grades in excess of 15 per cent. The combination of tight horizontal and vertical geometry restricts sight distance at several locations, however, the speed limit on the range section is reduced to 60 km/h with multiple curve warning signs and 30/40/50 km/h advisory speeds. The section is also well delineated with road edge guideposts and chevron alignment markers. Warning signs are also present to advise motorists of trucks and school buses on the route.

The remainder of the section from the Kin Kin Range towards Cooroy traverses more gently undulating terrain. The area closer to the range has horizontal curves predominately in the range of radii 50–150 metres while areas beyond, have curvature in the radii of 150–300 metre range. The section between Boreen Road (Louis Bazzo Drive) and the Cooroy Connection Road has adequate sealed lane and shoulder width with some intersection treatments for turning vehicles.

There are five timber bridges operating under single lane, 'Give Way' operation at Kin Kin Creek No. 1 (Chainage 29.55km), Yellow Gully (Chainage 29.94km), Kin Kin Creek No. 2 (Chainage 34.67km), Kin Kin Creek No. 3 (Chainage 36.89km), and at Six Mile Creek (Chainage 45.85km).

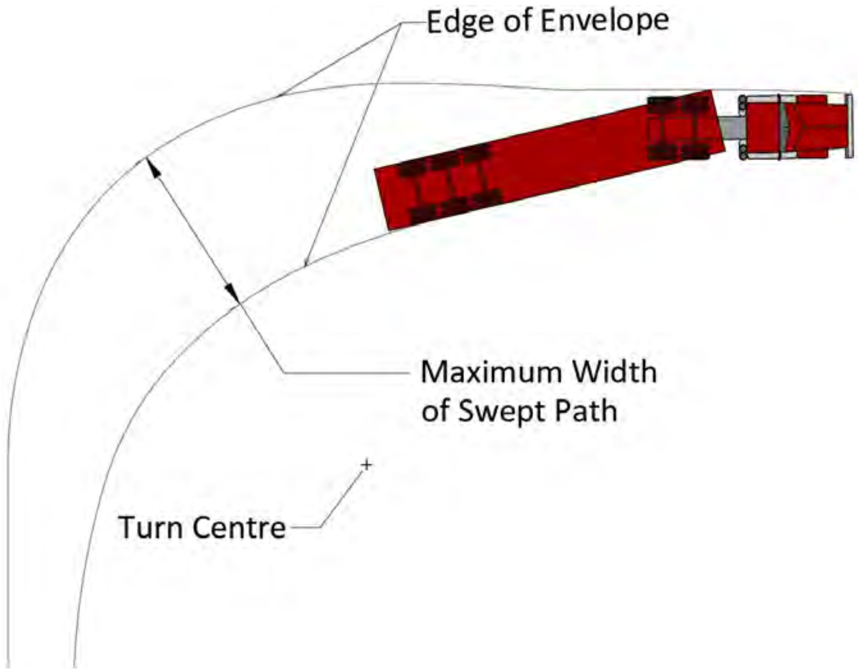
Due to the nature of the terrain, the road width and geometry is constrained in certain areas, particularly over the range section.

3.1 Use of road space

A geometric assessment of the section of Kin Kin Road within the NCR was completed by TMR Technical Services (Design).

'Swept path' is a term that is frequently used when analysing the space that a specific vehicle occupies on the roadway. The definition implies that it is the envelope swept out by the sides of the vehicle body, or any other part of the structure of the vehicle. Refer to Figure 16, for an example of a swept path.

Figure 16 - Example of vehicle swept path



Source: TMR.

Several different assessment criteria were used to analyse the section in terms of overall swept paths and interaction between opposing heavy and passenger vehicles. These include:

- analysis of swept paths to determine whether heavy vehicles can negotiate individual curves along the route without encroaching over the road centreline or the sealed pavement edge (refer to Table 9 on page 32)
- analysis of opposing heavy vehicle versus passenger vehicle swept paths on the Kin Kin Range to determine whether enough width exists for opposing vehicles to pass each other on the curves using only the sealed pavement (refer to Table 10 on page 35), and
- analysis of opposing heavy vehicle versus passenger vehicle swept paths on the Kin Kin Range to determine whether enough width exists for opposing vehicles to pass each other on the curves using the sealed pavement plus any available trafficable unsealed shoulder (refer to Table 11 on page 36).

The Kin Kin Range was assessed separately as this is the most constrained section in terms of horizontal geometry, with many curves of a radius of 60 metres and below. Assessment vehicles included a 19 metre semi-trailer and a three-axle truck with four-axle dog trailer combination. Results summarised in Tables 9, 10 and 11 are based on the swept path of the 19 metre semi-trailer. While the truck and dog combination is the more common vehicle on this road, the 19 metre semi-trailer is the largest vehicle that can operate on the road without a special permit. The semi-trailer has been used for the analysis as it produces a slightly wider swept path than the truck and dog trailer combination. The opposing vehicle used for the assessment is a standard passenger vehicle (car).

The detailed assessment is included in Annexure C – Geometric Assessment.

3.1.1 Heavy vehicle swept path analysis (within own lane)

Table 9 summarises the results of the heavy vehicle swept path analysis undertaken to determine whether a vehicle can negotiate the horizontal alignment while remaining on the sealed pavement and within their own lane of travel.

Table 9: Assessment of heavy vehicles ability to negotiate curves

Road section (Chainage)	Existing lane width	Existing total seal width	Swept path analysis outcome
29.3 – 37.8km and 42.4 - 54.42km	3.5m (avg.)	7m to 9m	Of the 60 curves assessed on these two sections for a 19m semi-trailer's ability to negotiate curves while staying in their own lane of travel, there where: • 21 that trucks could negotiate with full 0.5m clearance • 32 that they could negotiate but without the full 0.5m • 7 where they could not stay in their own lane.
37.8 – 42.4km (Kin Kin Range +2km on north approach)	3.0m (avg.)	6m to 8m	Of the 35 curves assessed on this section: • 1 that trucks could negotiate with full 0.5m clearance • 15 that they could negotiate but without the full 0.5m • 19 where they could not stay in their own lane.
Notes: **To negotiate with full 0.5 metre clearance** means that a 19 metre semi-trailer can negotiate the curve without encroaching over the road centreline or sealed shoulder, while also allowing for a 0.5 metre clearance envelope each side of the vehicle. **To negotiate but without the full 0.5 metre** means that a 19 metre semi-trailer can negotiate the curve without encroaching over the road centreline or sealed shoulder but does not maintain all or any of the 0.5 metre clearance envelopes. **Where they could not stay in their own lane** means that not only are no clearance envelopes maintained, but the 19 metre semi-trailer cannot negotiate the movement without physically running off the sealed pavement, running into an oncoming lane or coming into contact with a fixed object such as kerb, culvert or sign.			

Source: TMR.

A total of 47 curves were identified that heavy vehicles could negotiate, but without the desired 0.5 metre clearance envelope. This indicates that the physical swept path (body) of the heavy vehicle is fully contained within the available sealed pavement width, and within its own lane of travel, but it has less than the desirable 0.5 metre vehicle body clearance to the edge of seal/kerbs or to the road centreline. This 0.5 metre clearance is a desirable offset for design purposes. The absence of this clearance reduces safety and margin for error, especially when passing oncoming traffic.

For the 26 curves identified where the heavy vehicle could not stay within its own lane, the vehicle cannot physically negotiate the curve without crossing into the oncoming lane or tracking tyres over the edge of the sealed pavement. It should be noted, however, this is mitigated by the presence of some width of unsealed, trafficable shoulder beyond the sealed pavement edge for most of the length. Figure 17 on page 33 shows a typical situation on the road where it is evident that vehicles utilise the unsealed shoulder for additional lane width. While the practice is not desirable and can lead to increased maintenance requirements to attend to pavement and shoulder damage, it is very common and expected on this type of rural.

The full detailed assessment of this swept path analysis can be found in Annexure C: Geometric Assessment > Geometric Swept Path Assessment: *Kin Kin Rd – 19m Semi-trailer & Truck and Dog Swept Path Analysis.*

The location of individual curves where 19 metre semi-trailers cannot negotiate the curve while staying within their own lane is shown in Annexure C: Geometric Assessment > Location of curves where 19m semi-trailers cannot stay within their own lane.

Figure 17 - Photo showing that vehicles utilise the gravel/unsealed shoulders

Source: TMR.

Outside of the Kin Kin Range section, there are seven curves that were identified where the heavy vehicle could not stay within its own lane– five north and two south of the range. This does not mean that a car travelling in the opposing direction to the heavy vehicle on these curves will suddenly be faced with a truck on the wrong side of the road. As mentioned above, on many of these curves there is additional unsealed shoulder width available for the truck to utilise. Typically, a truck driver will encroach upon the centreline of the road to avoid dropping a tyre off the edge of the sealed surface, if there is nobody coming the other way and visibility is adequate. When a vehicle is approaching from the other direction, or visibility around the curve is limited, the truck driver will typically place the vehicle closer to, or a tyre over the edge of the seal or carriageway.

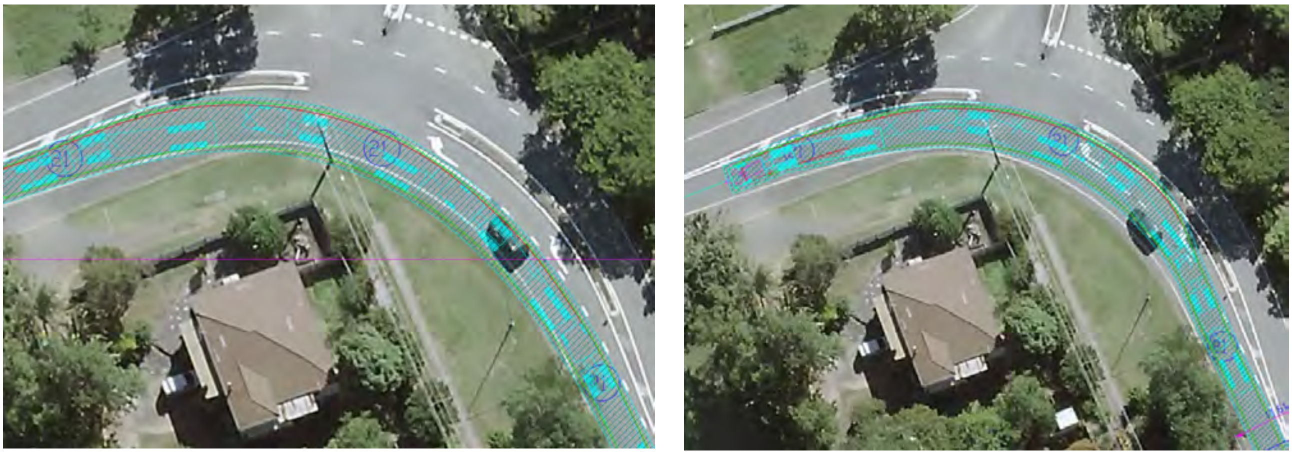
It should also be noted that in order to drive these larger vehicles a special class of driver licence must be attained, which has additional requirements (testing and experience) resulting in more capable heavy vehicle drivers. Heavy vehicle drivers are familiar with these types of situations and are experienced in how their vehicles will handle and track when travelling along roads. It should also be noted that this is a very common occurrence across 1,000s of kilometres of state-controlled road where narrow seals are provided.

Of the five curves to the north of the range, three occur on very low speed sections of the road. The first (Chainage 29.68km) is on the very tight approach/departure curve to the single lane Kin Kin Creek No. 1 bridge. This curve also has some additional width due to the proximity of Wahpunga Lane intersection.

Similarly, the two curves at Chainage 36.9km and 37km are the very tight approach/departure curves to the single-lane Kin Kin Creek No. 3 bridge. On the remaining two curves, heavy vehicles only marginally fail to negotiate the curve while staying within their own lane. The first curve however has ample available unsealed shoulder width, while for the other, the vehicle can stay within its own lane when the simulation speed of the truck is set at 50 km/h (instead of the posted speed of 70 km/h). This corresponds to the posted advisory speed from the southern approach. The presence of tight curves on approaches to bridges helps reduce travel speeds, supporting a safer operation of the 'Give Way' conditions at these bridges.

The two curves on the southern side of the range are both located within Pomona and occur at intersections. The first is at the intersection with Subway Avenue, while the other is at the intersection with Summit Road. The pictures in Figure 18 show the curve at Summit Road. It can be seen that while the heavy vehicle cannot negotiate this curve within its own lane, by partially utilising the right turn lane into Summit Road, the truck easily performs the manoeuvre while staying on the sealed pavement and without affecting oncoming traffic. A similar situation can occur on the other curve at Subway Avenue where the heavy vehicle can utilise intersection widening adjacent to the lane to safely negotiate the curve without crossing the road centreline. It is very common across the road network for heavy vehicles to sometimes encroach on parallel lanes when undertaking turning manoeuvres which is part of the Queensland driver licensing training and education system.

Figure 18 - Summit Road curve, Pomona, showing that larger vehicles need to use adjacent turn lane



Source: TMR.

On the Kin Kin Range, a much larger number of the curves do not allow heavy vehicles to negotiate the curve while staying in their own lane. This is to be expected and is a reflection of the tight curvature associated with range sections on many similar low volume rural roads around Queensland. The existing alignment of the road on the Kin Kin Range was constructed in the mid to late 1920s. The range section has been progressively upgraded in terms of width and surfacing over the ensuing years, but the alignment has essentially remained the same. It should be noted that until the most recent upgrade in 2012, the range section did not have a marked centreline. The 2012 project specified that the centreline should be spotted and marked down the "centre of the sealed pavement", it is not based on actual swept path widths required for heavy vehicles. There is insufficient sealed pavement width available on *some* curves to fully contain the swept path of a heavy vehicle in half the sealed width. However, there is potentially enough width available on some curves to accommodate the heavy vehicle swept path if the marked dividing line was offset slightly to the outside of the curve.

For this reason, further analysis has been undertaken to determine the actual capability of the alignment by essentially ignoring the marked centreline and focusing solely on available pavement width and opposing swept paths. The analysis is presented in the following sections.

3.1.2 Opposing heavy vehicle vs passenger vehicle swept path analysis (sealed pavement)

Analysis was carried out to determine whether enough sealed width exists for opposing heavy vehicles and passenger vehicles (cars) to safely pass each other on the curves, while remaining on the sealed pavement. For the purposes of this analysis, the presence and location of the marked centreline has been ignored. The analysis has only been carried out over Chainages 37.8km to 42.4km, which covers the Kin Kin Range section plus two kilometres on the northern approach, as this area represents the section of the road with the tightest curvature.

When analysing vehicle swept paths, along with the physical width of the path, it is desirable to provide a clearance/safety envelope on both sides of the vehicle path. Typically, a width of 0.5 metres is used, which allows for clearance to the seal edge on the passenger's side of the vehicle, and clearance between the two passing vehicles on the driver's side. Similar clearances are applied to the vehicle travelling in the opposite direction, therefore establishing a total physical clearance between vehicles of 1.0 metre.

With reference to Table 10 two separate analyses are conducted. The first column of results analysed the curves assuming the clearance envelope is always maintained on both sides of the heavy vehicle. The second column of results assume the clearance envelope is only maintained on the driver's side of the heavy vehicle. The clearance envelopes on the passenger vehicle vary as described in the definitions below:

- **Pass with full clearance envelopes** indicates a curve where the two vehicles can pass each other, while maintaining the clearance envelopes to the heavy vehicle as defined above for each column, as well as maintaining full clearance envelopes of 0.5 metres on both sides of the passenger vehicle. Effectively this means that the two vehicles can pass on the sealed pavement with 1.0 metre of separation between them.
- **Pass without full clearance envelopes** indicates a curve where the two vehicles can pass each other while staying on the sealed pavement, maintaining at least 0.5 metre between them, but not maintaining all (or any) of the 0.5 metre envelopes on the outside of the vehicles to the edge of the sealed pavement.
- **Cannot pass on sealed pavement** indicates a curve where the two vehicles *cannot* pass each other while staying on the sealed pavement and maintaining 0.5 metre between them. These vehicles may still be able to pass by moving off the sealed pavement and using the unsealed shoulder or they may not be able to pass at all (see analysis in Section 3.1.3).

Table 10: Opposing heavy vehicles vs passenger vehicle swept path analysis (sealed pavement)

Assessment result	Full clearance envelope for both sides of heavy vehicle	Clearance envelope for inside of heavy vehicle only
Pass with full clearance envelopes	8	17
Pass without full clearance envelopes	17	11
Cannot pass on sealed pavement	10	7
Total number of curves	35	35

Source: TMR.

The assessed swept paths allow for a 19 metre semi-trailer to cross the marked centreline to avoid tracking off the sealed surface. It is acknowledged that this ignores the normal road rules pertaining to barrier line marking, however the object of the analysis was to determine the capability for vehicle interaction taking into account the total seal width only.

A width of 2.0 metres has been allowed for a passenger vehicle (Austroads Design Passenger Vehicle = 1.94 metres). No additional path width has been allowed around curves for the passenger vehicle.

Existing road widths for the assessment has been determined using a combination of ChartView (a road inventory charting package), Digital Video Road (DVR), and AutoCad, due to aerial imagery of the road being restricted by trees (and therefore being inaccurate for measuring on its own).

Trucks were simulated heading north, with cars simulated heading south. The reverse was not considered at this time. This would produce slightly different results, but it is expected the differences would be relatively minor.

Assessment vehicles included a 19 metre semi-trailer and a three-axle truck with four-axle dog trailer combination (truck and dog). It was found the 19 metre semi-trailer required slightly more lateral width for the swept paths, but the difference in results was not significant. The results of this assessment are based on the 19 metre semi-trailer swept.

Table 10 on page 35 shows that as the clearance envelope requirements are relaxed, more curves show the ability to allow vehicles to pass until only seven curves on this section do not allow vehicles to pass without at one or both of the vehicles having to leave the sealed pavement. It should also be noted, however, that of these seven curves, five are currently being upgraded as part of the $6 million widening upgrade project as discussed in Clause 8.3 of this report. The resultant upgrade will widen and seal these curves to fully accommodate the swept path of heavy vehicles. This upgrade is currently scheduled for completion in early to mid-2023.

The full detailed assessment of this swept path analysis can be found in Annexure C – Geometric Assessment > Geometric Swept Path Assessment: *Kin Kin Rd – Range Section, Assessment of FULL SEALED width available for cars to pass on-coming heavy vehicles.*

3.1.3 Opposing heavy vehicle vs passenger vehicle swept path analysis (sealed pavement + unsealed shoulder)

While the above analysis considers only the sealed pavement width, it is recognised that beyond the sealed pavement there are varying widths of unsealed shoulders available for vehicles to utilise. Therefore, a similar analysis was carried out to determine whether enough total road width (sealed and unsealed) exists for opposing heavy vehicles and passenger vehicles (cars) to safely pass each other on the curves. The analysis recognises typical driver behaviour on narrow rural roads (and observed driver behaviour on Kin Kin Road), where it is generally expected that the unsealed shoulder will form part of the running surface when necessary.

All other criteria for the analysis below remain the same as that used for the analysis in Section 3.1.2, except that instead of being limited to staying on the sealed pavement the analysis now takes into account the sealed pavement and trafficable unsealed shoulder.

Table 11: Opposing heavy vehicle vs passenger vehicle swept path analysis (sealed + unsealed shoulder)

Assessment result	Full clearance envelope for both sides of heavy vehicle	Clearance envelope for inside of heavy vehicle only
Pass with full clearance envelopes	22	31
Pass without full clearance envelopes	11	3
Cannot pass on trafficable pavement	2	1
Total number of curves	35	35

Source: TMR.

Comparison between Table 10 and Table 11 shows the number of curves which don't allow vehicles to pass reduces from 10, when taking only the sealed pavement into account, to just two when the unsealed part of the shoulder is considered (and full clearance envelopes are maintained on both sides of the heavy vehicle).

This further reduces to just one when the clearance envelopes are relaxed. Both of these curves however, form part of the current $6 million widening upgrade project on an 800-metre section of the Kin Kin Range.

The full detailed assessment of this swept path analysis can be found in Annexure C: Geometric Assessment > Geometric Swept Path Assessment: *Kin Kin Rd – Range Section, Assessment of FULL SEALED + UNSEALED SHOULDER width available for cars to pass on-coming heavy vehicles.*

3.1.4 Summary of Vehicle Swept Path Analysis

The section of Kin Kin Road within the North Coast Region (NCR) was assessed to determine if heavy vehicles were able to negotiate the curves while staying within their own lane and remaining on the sealed pavement. Outside of the Kin Kin Range section, only seven of the curves failed to achieve this functionality. But when taking all factors into account, including extra width due to intersections at the curves and/or additional unsealed shoulder width, it can be shown that even these curves are quite functional. This is evidenced by the fact that examination of crash records from 2010 to June 2021 (based on injury-related data from QPS), show no reported crashes involving heavy vehicles on the sections either side of the Kin Kin Range. It is noted that the crash database is continually updated, but details of crashes that might have occurred in the most recent months may not be available. Similarly, crashes that have occurred within the last 12 months may still be under investigation and these details could change. Therefore, for the purposes of this report, only crashes recorded up to June 2021 have been analysed.

As expected, due to the tight curving alignment, a higher percentage of curves on the Kin Kin Range section fail in terms of heavy vehicles being able to stay on the sealed pavement while also remining on their own side of the centre dividing line, with a total of 19 curves on this winding section of road failing to provide this capacity. Further analysis was carried out on these curves to determine what actual functionality exists for heavy vehicles to safely manoeuvre and interact with passenger vehicles on these curves. The analysis revealed that, when taking the full sealed width of pavement into account, only seven of these curves failed to provide the functionality for the two vehicles to pass (at the critical mid-point of the curve) without at least one having to drop a tyre off the sealed roadway. This further reduces to just one curve when the available unsealed shoulder is taken into account in the analysis.

Five of these seven curves are currently being upgraded in a $6 million widening upgrade project. Following this, only two curves will remain on the range section where a heavy vehicle and passenger vehicle cannot pass on the tightest part of the curve without at least one vehicle using the unsealed shoulder. However, by using this trafficable shoulder, both vehicles are able to safely pass on these two curves.

3.2 Assessment of Current Standards

Typically, the standards adopted for any road project will depend on a variety of aspects such as the function of the road, traffic volumes and composition, the number and types of heavy vehicles, environmental factors and budgetary constraints. For any proposed project, the Road Design Class defines the type of geometric parameters that need to be considered. These considerations vary from assessing all geometric parameters for a project involving major modification to an existing road, to consideration of only elements with an adverse crash history, or where roadside barriers are being retrofitted on maintenance projects.

It should be noted that although information from the current standards is referenced here, the current standards do not necessarily apply to an existing road, particularly one that was built such a long time ago when older, superseded standards would have been used. If the road was to be upgraded, it is likely that a combination of Design Exceptions and Extended Design Domain (both of which use values that lie outside of current-day normal design domain standards) would be utilised to design a realistic, constructable and feasible project. If these values were not used, it is highly likely that the resultant project would not be able to compete against other projects on the road network, as the costs would be prohibitive for limited additional gain.

Table 12 on page 39 provides a comparison between the various cross-sectional standards that *could* be applied to this section of Kin Kin Road. The road has been broken up into sections based firstly on traffic volumes (AADT) and then on existing pavement widths. Three distinct sections were identified based on traffic volumes:

(i) Shire boundary to Kin Kin township ≈ 300 vehicles per day (vpd)

(ii) Kin Kin township to Greenridge-Pinbarren Road ≈ 1000 vpd

(iii) Greenridge-Pinbarren Road to Cooroy Connection Road > 4000 vpd

The section between Greenridge-Pinbarren Road and Cooroy Connection Road is further broken down into three parts based on existing pavement widths: Greenridge-Pinbarren Road to Boreen Road; Boreen Road to Summit Road (Pomona township); and Summit Road to Cooroy Connection Road.

For each of the sections identified above, the following standards for cross section widths have been analysed and compared to actual cross section widths, with the results shown in Table 12 on page 39:

- *Austroads Guide to Road Design Part 3* (AGRD03 – Feb 2021): Geometric Design, Table 4.5 – Single carriageway rural road widths (m)
- *Road Planning and Design Manual Edition 2: Volume 3 – Supplement to AGRD03* (RPDM03 – Jun 2022), Table 4.2.6(b) – Minimum single carriageway rural road widths (m) – normal design domain *and* Table G.4.1(b) – Normal design domain cross section for a WCLT – two lane, two-way roads
- *Road Planning and Design Manual Edition 2: Volume 3 – Supplement to AGRD03* (RPDM03 – 2022), Table A.2.2 – Minimum single carriageway rural road widths (m) – extended design domain *and* Table G.4.1(c) – Extended design domain cross section for a WCLT – two lane, two-way roads.

(It should be noted that the standards defined in AGRD03 – Feb 2021 are provided for information only. In accordance with Clause 4.2.6 of RPDM03 – Jun 2022, Table 4.5 of AGRD03 – Feb 2021 is replaced by Table 4.2.6(b) of RPDM03 – Jun 2022.)

Table 12: Comparison of standard cross section widths to actual widths

Road section	AADT	Required lane width	Existing min. lane width	Required shoulder width (Fully sealed unless noted otherwise)	Existing sealed shoulder width	Required total width	Existing total seal width
1	307	**Shire boundary (Ch. 23.91km) to Kin Kin township (Ch. 34.73km)**					
AGRD03 – Feb 2021	150-500	2 x 3.1m	2 x 3m	2 x 1.5m [1]	2 x 0.3m nom.	9.2m	6.6m nom.
RPDM03 – Jun 2022 (NDD)	250-400	2x 3.25m		2 x 1.0		8.5m	
RPDM03 - Jun 2022 (EDD)	250-400	2 x 3.0m		2 x 1.0		8.0m	
2 (contains range section)	**1072**	**Kin Kin township (Ch. 34.73km) to Greenridge-Pinbarren Road (Ch. 45.17km)**					
AGRD03 – Feb 2021	1000-3000	2 x 3.5m	2 x 3.0m	2 x 2.0m [2]	0.5m to 1.5m	11.0m	Typically 6.0m to 7.0m
RPDM03 – Jun 2022 (NDD)	1000-2000	2 x 3.5m		2 x 1.5		10.0m	
RPDM03 - Jun 2022 (EDD)	1000-2000	2 x 3.5m		2 x 1.25m		9.5m	
3	4394	**Greenridge-Pinbarren Road (Ch.45.17km) to Boreen Road (Louis Bazzo Drive) (Ch.46.98km)**					
AGRD03 – Feb 2021	>3000	2 x 3.5m	2 x 3.0m	2 x 2.5m [3]	2 x 1.5m	12.0m	9.0m
RPDM03 – Jun 2022 (NDD)	>4000	2 x 3.25m + 0.8m WCLT		2 x 2.0m		11.3m	
RPDM03 - Jun 2022 (EDD)	>4000	2 x 3.25m + 0.8m WCLT		2 x 1.5m		10.3m	
4	4903	**Boreen Road (Ch. 46.98km) to Summit Road (Pomona township) (Ch. 49.70km)**					
AGRD03 – Feb 2021	>3000	2 x 3.5m	2 x 3.0m to 2 x 3.5m	2 x 2.5m [3]	2 x 1.5m	12.0m	9.0m
RPDM03 – Jun 2022 (NDD)	>4000	2 x 3.25m + 0.8m WCLT		2 x 2.0m		11.3m	
RPDM03 - Jun 2022 (EDD)	>4000	2 x 3.25m + 0.8m WCLT		2 x 1.5m		10.3m	
5	3957	**Summit Road (Ch. 49.70km) to Cooroy Connection Road (Ch. 54.65km)**					
AGRD03 – Feb 2021	>3000	2 x 3.5m	2 x 3.5m	2 x 2.5m [3]	1.0m to 1.5m	12.0m	9.0m to 10.0m
RPDM03 – Jun 2022 (NDD)	2000-4000	2 x 3.5m		2 x 2.0m		11.0m	
RPDM03 - Jun 2022 (EDD)	2000-4000	2 x 3.5m		2 x 1.5m		10.0m	

[1] 0.5m minimum seal (each shoulder)

[2] 1.0m minimum seal (each shoulder)

[3] 1.5m minimum seal (each shoulder)

Source: TMR.

The Kin Kin Range section extends from Chainage 39.75km to 42.43km. Table 12 above shows that for the majority of the road the sealed widths are somewhat deficient from the current-day standards, as the current standard does not consider the width of unsealed shoulders. Sections 1 and 2 (in Table 12) have sealed widths between 6–7 metres, and depart furthest from the standards, though the traffic volumes are considerably lower. As lane and seal widths are generally less than indicated by the standards, it is likely that larger vehicles will need to cross outside of the lanes and likely beyond the sealed shoulders in areas of constrained sealed width.

3.3 Visibility assessment

A detailed assessment of available sight distances along the route has not been carried out. It is generally accepted that sight distances will fall short of the desirable standards on much of the section due to the challenging terrain, horizontal curvature, and roadside environment. Instead, consideration was made to *Austroads Guide to Road Design Part 3 – Geometric Design (AGRD03)*, minimum curve radii for a given operating speed and superelevation can be calculated by the formula R = V2 / 127 (e+f). For superelevation values of three per cent and six per cent, the minimum curve radius values are given in Table 13.

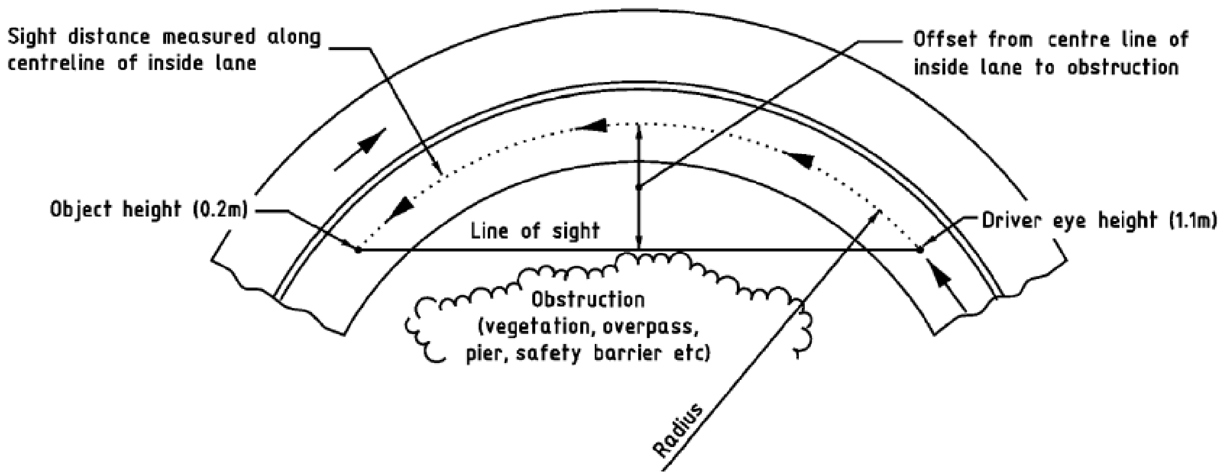
Table 13: Minimum curve radii based on operating speed and crossfall

Operating speed	Radius (3% super)	Radius (6% super)
60–70km/h	100–175m	94–154m
80–90km/h	265–399m	229–336m
100–110km/h	525–635m	437–529m
Based on desirable factor of side friction.		

Source: TMR.

Clause 5.4 of AGRD03 also states the minimum values of horizontal curves *do not necessarily meet the sight distance requirements of drivers if there are obstructions on the inside of the curve*. Where a lateral obstruction off the pavement such cut slopes or natural growth of vegetation exits, visibility and hence stopping sight distance will be compromised.

Figure 19: Extract from AGRD03 (Figure 5.4 Line of sight on horizontal curves)



Source: Austroads Guide to Road Design Part 3 – Geometric Design (2021); Page 140.

For this section of Kin Kin Road, not only do curve radii fall consistently below the values given in Table 13 for the given operating speed, but the terrain and roadside environment dictate that the line of sight, as shown on the diagram, is severely restricted. Even when taking into account the recently reduced posted speed limits and the advisory curve warning speeds, many of the existing curves fall short of ideal visibility standards. However, it should be noted that these current-day standards have evolved over many decades and aim for the design of new roads to optimise the cognitive load and attentiveness required of a driver. The roadside environment, however, is consistent throughout. The presence of lush vegetation close to the roadway, in conjunction with the winding alignment, dictates that drivers maintain a heightened sense of awareness, particularly on the more constrained sections. This is further evidenced by the crash history discussed earlier. Encounters with wildlife are also a regular and expected hazard which also increases the need for driver alertness.

The photos in Figure 20 show average radius curves on three sections of Kin Kin Road: north of the range; on the Kin Kin Range; and south of the range respectively. Each of these curves are typical of curves on their sections and show the limited sight distance due to terrain and vegetation on the inside of curves.

Figure 20: Photos of mid-range curves on Kin Kin Road

Source: TMR.

Analysis of available crash data from QPS showed there was only one reported injury-related crash on the road (at Chainage 47.068km) that suggested limited sight distance as a possible contributing factor. This was a rear end crash into a vehicle waiting to turn right into a private entrance. It was claimed that the crest vertical curve on the approach to the entrance may have contributed to the crash. This is, however, inconsistent with the technical assessment which finds adequate stopping sight distance for a design speed in excess of 100 km/h at this location (the posted speed limit is now 70 km/h). Several other crashes involved hitting animals on the road, but it would appear from the textual description of these crashes that limited visibility was unlikely to have played any role in these incidences. Refer to Section 4.1: Crash history of this report and Annexure D – Road crash data for further information.

3.4 Summary of road geometry

All but a very small length of Kin Kin Road within the North Coast Region (NCR) consists of a two-lane bitumen sealed pavement. North of the Kin Kin Range, and for several kilometres south of the range, seal widths are between 6.0 metres and 7.2 metres with grassed or gravel shoulders. From the Cooran turnoff to the end of Kin Kin Road, seal widths are typically around 9 metres with sealed shoulders. The Kin Kin Range section is sealed to an 8 metre-plus standard and is on a steep, winding alignment. The alignment north of the range is generally winding on a rolling terrain, while south of the range it becomes more curvilinear on undulating terrain.

While falling short of the current day geometric standard in a number of areas, this section of Kin Kin Road does provide a fairly good level of service and capability. The sections with more limited sight distance are also the lighter trafficked sections which assists in overall functionality, particularly on the tighter curves. It has been demonstrated that interaction between heavy and passenger vehicles can occur safely and that the lack of crash history involving heavy vehicles is evidence of this. While seal widths are short of current-day standards, the presence of trafficable, unsealed shoulders assists in the safe functionality of the road.

Visibility is restricted in many areas, particularly around curves. However, the roadside environment is consistent throughout, so even when drivers are confronted with areas of reduced sight distance it is not unexpected and contributes to a heightened state of alertness while driving the road.

4. Crash review

In the process of managing the road network, TMR regularly reviews crashes that occur on state-controlled roads. Along with being reactive in terms of addressing the cause of crashes that have occurred, analysis of crash data also plays a proactive role in determining emerging trends in road incidents and identifying areas that require action, with the aim of addressing the issues before a serious crash occurs. Analysis of historical crash data is a vital tool in the planning and design of upgrades along the state-controlled road network and can often alert the designer to issues on the road that may not be immediately apparent.

4.1 Crash history

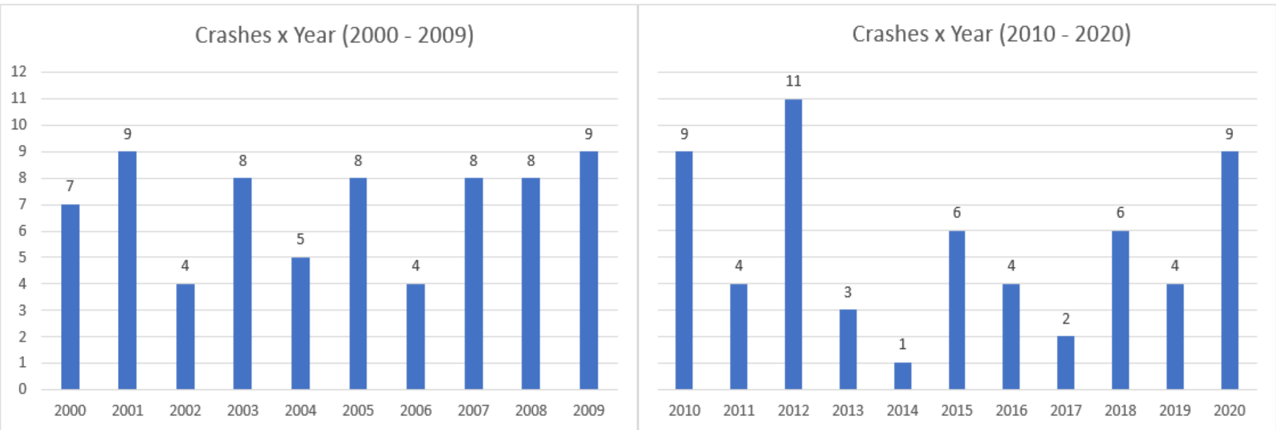
TMR has access to the crash data of all minor injury and more serious crashes that have been investigated and reported by the Queensland Police Service (QPS). The database is continually updated, but details of crashes that may have occurred in the most recent months may not be available. Similarly, crashes that have occurred within the last 12 months may still be under investigation and these details could change. Therefore, for the purposes of this report, only crashes recorded up to June 2021 have been analysed.

Road crashes are categorised in terms of severity into: fatalities; hospitalisations; medical treatment (attended by ambulance but not requiring hospitalisation); and minor injuries (minor cuts or abrasions not requiring professional medical assistance). Prior to 2010, the QPS also reported 'property damage only' crashes (where a crash had occurred, but nobody was physically injured). A total of 60 crashes resulting in minor injury or worse were recorded in the Road Crash 2 database between the Gympie Regional Council and Noosa Shire Council (NSC) boundary (Chainage 25.78km) and the end of Kin Kin Road (Chainage 54.65km) between 1 January 2010 and June 2021.

4.1.1 Number and severity of crashes

The graph in Figure 21 shows the number of crashes over the same section of Kin Kin Road in the years 2000 to 2009 and the years 2010 to 2020 (2021 has omitted due to full year results not being available). In the 10-year period of 2000–2009 a total of 70 injury-sustaining crashes were recorded in the Road Crash 2 database, while 59 occurred in the following 11-year period. This equates to an 18 per cent reduction in the number of crashes that occurred over the later period (graph on the right) when compared to the 10 years prior. This is also in the context of increased traffic volumes between these time periods.

Figure 21: Chart showing number of crashes between 2000–2009 and 2010–2020



Source: TMR.

Posted speed limits on various parts of the road have been progressively reduced since 2010, with most of these reductions being made in the last few years. This, along with upgrading of the range section to a fully sealed standard, together with clearing and delineation works, have been carried out to improve road safety on the section.

The most significant reduction in crash rates appear to have been achieved through widening of the existing sealed surface on the more heavily trafficked section (Yurol Forest Drive), south of Pomona, from a narrow 6 metre seal to a 9–10 metre standard in 2004.

Severity of injury-sustaining crashes over the 2000–2009 and 2010–2021 periods are shown in Table 14 as a percentage of all crashes over those periods. The last row in the table shows severity of crashes on all state-controlled roads within the NSC area. Kin Kin Road is a small sample of the data reported within the NSC area, showing that it reasonably aligns with what is occurring across the area.

Table 14: Severity of crashes recorded

Year	Location concerned	Fatal	Hospitalised	Medical treatment	Minor injury
2000–09	Kin Kin Road	3%	36%	46%	16%
2010–21	Kin Kin Road	2%	50%	42%	7%
2017–21	State roads within the NSC area	2%	44%	35%	19%

Source: TMR.

4.1.2 Analysis of crashes 2010 – June 2021

A summary listing of all crashes from the Road Crash 2 database between 1 January 2010 and June 2021 is attached in *Annexure D – Road crash data*. The following points have been interpreted from that data:

A total of 60 injury-sustaining crashes were reported:

98 per cent (59 of 60)	Involved only small vehicles (cars/utilities, motorcycles or bicycles).
83 per cent (50 of 60)	Involved only cars or utility vehicles.
73 per cent (44 of 60)	Occurred on sections of roadway that had marked edge lines, full or partially sealed shoulders, was in a kerbed town sections or in an area with intersection widening. Only 15 of the reported crashes occurred on sections of average condition pavement with either gravel or grass shoulders (nine of these 15 had DUI, drug driving, defective vehicle or driving infringement as a contributing factor.
53 per cent (32 of 60)	Were single vehicle accidents.
41.5 per cent (25 of 60)	Were the result of preventable causes such as DUI, drug driving, speed, medical issues, underage driving, fatigue or drivers failing to give way at intersections.
13 per cent (8 of 60)	Involved motorcycles. Of these, six occurred on the winding section on, or near the Kin Kin Range.
1.5 per cent (1 of 60)	Involved a heavy vehicle.

In decreasing order, the type of crashes recorded were:

Hit object	20 crashes as a result of drivers running off the road and hitting a roadside object (predominantly trees). Nine of these crashes had drink/drug driving, fatigue, vehicle defect or inexperience as a contributing factor.
Angle	11 crashes resulted from drivers failing to give way at intersections.
Ran off road	Nine crashes were the result of drivers running off the road and predominately overturning. Eight of these crashes had drink driving, medical issues, driving infringements or animals on the road as a contributing factor (the remaining crash was as a result of water on the road).
Rear end	Seven crashes, mainly involving vehicles waiting to turn right. Only one of these crashes mentioned the road/sight distance as a possible contributing factor.
Sideswipe	Six crashes. Three were a result of vehicles failing to keep left, while two were a result of oil or water on the road. Two of the six crashes occurred on the range section.
Head on	Two crashes. One had drink driving as a contributing factor, while the other was a motorcyclist rounding a sharp curve on the wrong side of the road.
Fell off M-cycle	Two crashes. One on a tight curve at speed, and the other in wet, slippery conditions.
Hit animal	Two crashes, involved hitting animals on the road.
Hit pedestrian	One crash.

Over the analysis period there was one fatal crash recorded. The crash occurred on a straight section of road. The traffic crash report stated: "Alcohol, speed and manner of driving are thought to be contributing factors." The photograph below was taken at the location five months prior to the crash and shows a typical section of Kin Kin Road with no edge lines and narrow, unsealed shoulders.

Figure 22: Photo showing location of fatality on Kin Kin Road

Source: TMR.

Only one recorded crash, occurring on the 30 January 2021, involved a heavy vehicle of any description. The traffic crash report stated:

> *"Unit 1 was riding from Pomona to Kin Kin over the range. Unit 1 was negotiating a tight left hand turn in which Unit 1 motorcycle was leaning over to its left. A B Double truck was travelling with the trailer on the middle double white line. The rider of Unit 1 has become surprised and has gone from leaning Unit 1 bike over to raising Unit 1 bike straight. Unit 1 has then struck near the rear tyres and the rider has fallen off into a ditch."*

Figure 23 shows the curve where the crash occurred. It is noted that the recorded description specifically states the truck was traveling on the middle double white line – but not over it. The textual description would indicate that the motorcycle rider was solely responsible for the crash. While visibility around the tight radius curve is restricted, there is ample width for a motorcycle to negotiate the curve without being anywhere near the double white lines.

Figure 23: Photo showing location of crash involving a heavy vehicle on Kin Kin Road

Source: TMR.

Note: Since the above crash data analysis was undertaken, an updated search of crash data reveals that only one additional crash has been recorded on the section of road. This crash was a single-vehicle motorcycle crash on a curve north of the Kin Kin Range. The rider failed to negotiate a curve in wet weather, hitting the road and sustaining suspected rib injuries resulting in hospitalisation.

4.2 ANRAM analysis

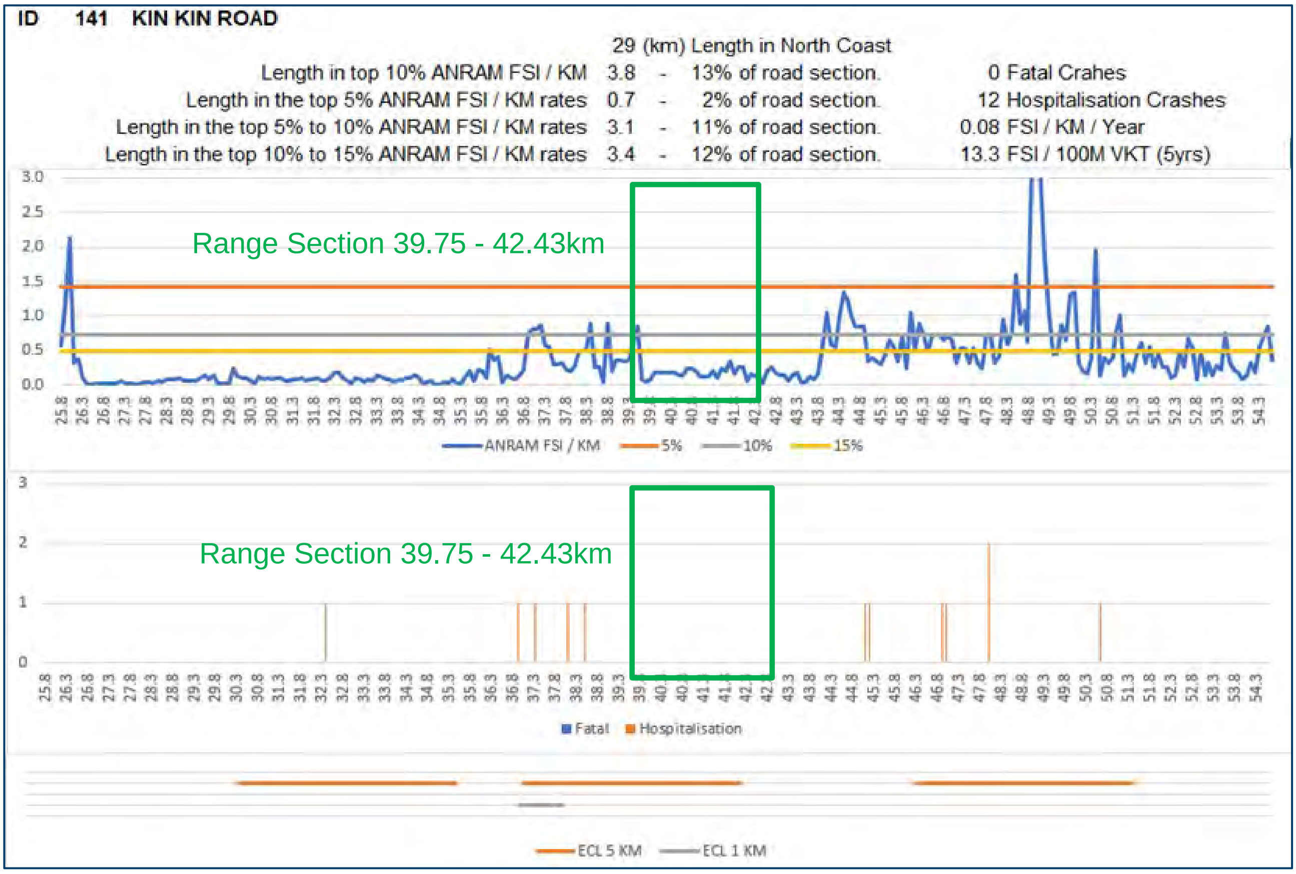
The Australian National Risk Assessment Model (ANRAM) provides a system to implement a nationally consistent risk-based road assessment program to identify road sections with the highest risk of severe crashes.

ANRAM is a nationally agreed approach that has built on existing Australian and international risk-based road safety programs to create a system directly relevant and applicable for Australian state and local road agencies. It is a proactive tool that targets fatal and serious injury (severe) crashes and provides a mechanism for identification, measurement, and reporting of severe crash risk across the Australian road network.

ANRAM uses a risk assessment module to calculate the relative risk of different types of severe crashes based on road features, speed, traffic flow, potentially conflicting vehicle movements and severe crash history for each road section. The traffic inputs into this risk assessment consider only the total traffic volumes and does not take into account heavy vehicle percentages. It is generally utilised to undertake analysis to identify road sections with high fatal and serious injury crashes, the crash types, and the road attributes which contribute to the risk. ANRAM assessment was selected to provide a comparative analysis of the potential crash risk of Kin Kin Road in comparison to other roads within TMR North Coast Region (NCR).

Figure 24 is an image that represents the length of Kin Kin Road with metrics to identify locations of the highest risk occurrence. The upper graph in Figure 24 represents the ANRAM Fatal or Serious Injury (FSI) value at each 100 metre interval (summarised as ANRAM FSI/km for a standard unit rate purpose). This graph includes three thresholds at the Top 5 per cent (red), Top 10 per cent (green) and Top 15 per cent (yellow) levels representing the top of ANRAM FSI/km values of all the state-controlled roads in the NCR by length. The lower graph represents the location of recorded fatal and serious injury crashes over the past five years.

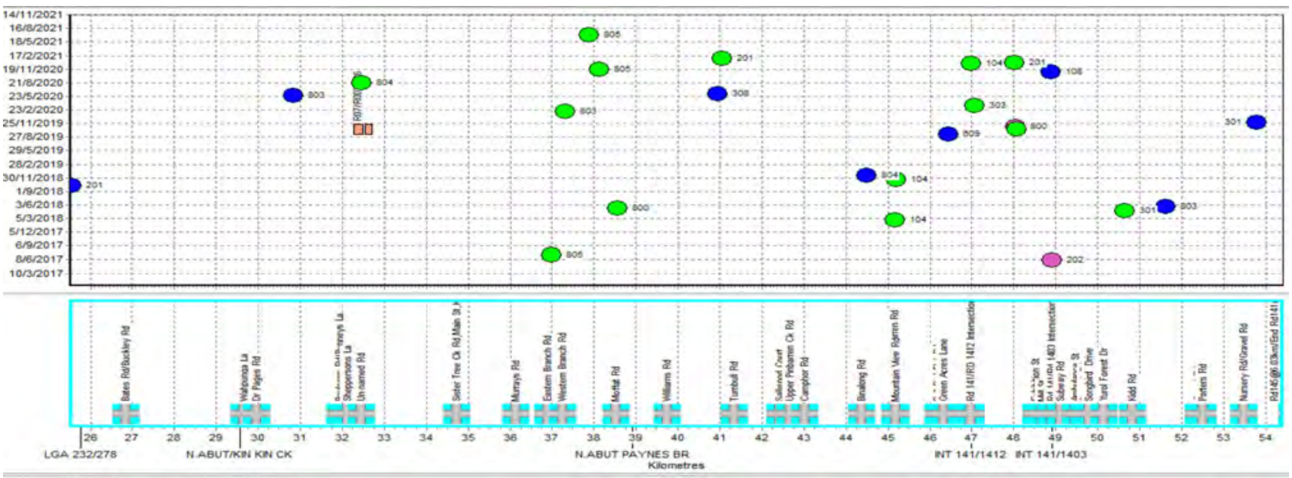
Figure 24: ANRAM chart for Kin Kin Road



Source: TMR.

Figure 25 is a ChartView plot for Kin Kin Road showing the spatial locations of recorded crashes over the last five years, coloured by crash severity and denoted with a three-digit code that indicates the type of crash. The crash severity is fatal (red – none), hospitalisation (green), medical treatment but not admitted to hospital (blue), and minor injury or minor first aid (pink).

Figure 25: ChartView plot for crashes on Kin Kin Road



Source: TMR.

It can be observed from Figure 24 and Figure 25 that:

- From Chainage 26.3km to 43.3km the predicted ANRAM values are generally low.
- Three outliers of the ANRAM values are shown at Chainages 25.8km, 48.8km and 50.3km. These locations do not correspond to the crashes over the last five years, but two of the three areas are located within an Emerging Crash Location (ECL). ECLs are identified through an interpretive modelling system/report that highlights road segments and intersections on the state-controlled road network that may have recently increased in crash risk. The system achieves this by comparing crash data over various time periods (current year vs previous year, current year vs previous five-year average, last three-year average vs previous three-year average) for a number of performance indicators (social crash cost, number of crashes, number of FSI crashes, number of fatalities and percent FSI crashes per total crashes).
- The predicted ANRAM values are, for the most part, below one, with a maximum of about three. A value of three equates to about seven per cent of the NCR network having a poorer safety record.
- Whilst the Kin Kin Range remains an area of high concern for the community, the ANRAM values throughout this section are low.
- The peak ANRAM values coincide with the section of Kin Kin Road known locally as Factory Street in Pomona. This can in part be attributed to the higher traffic volumes, frequency of intersections and driveways, and the presence of pedestrian activity and street lighting poles located close to the edge of the road that would increase crash risk.
- Based on the reported crashes, there is no clear trend of crashes coinciding with the ANRAM predictions.

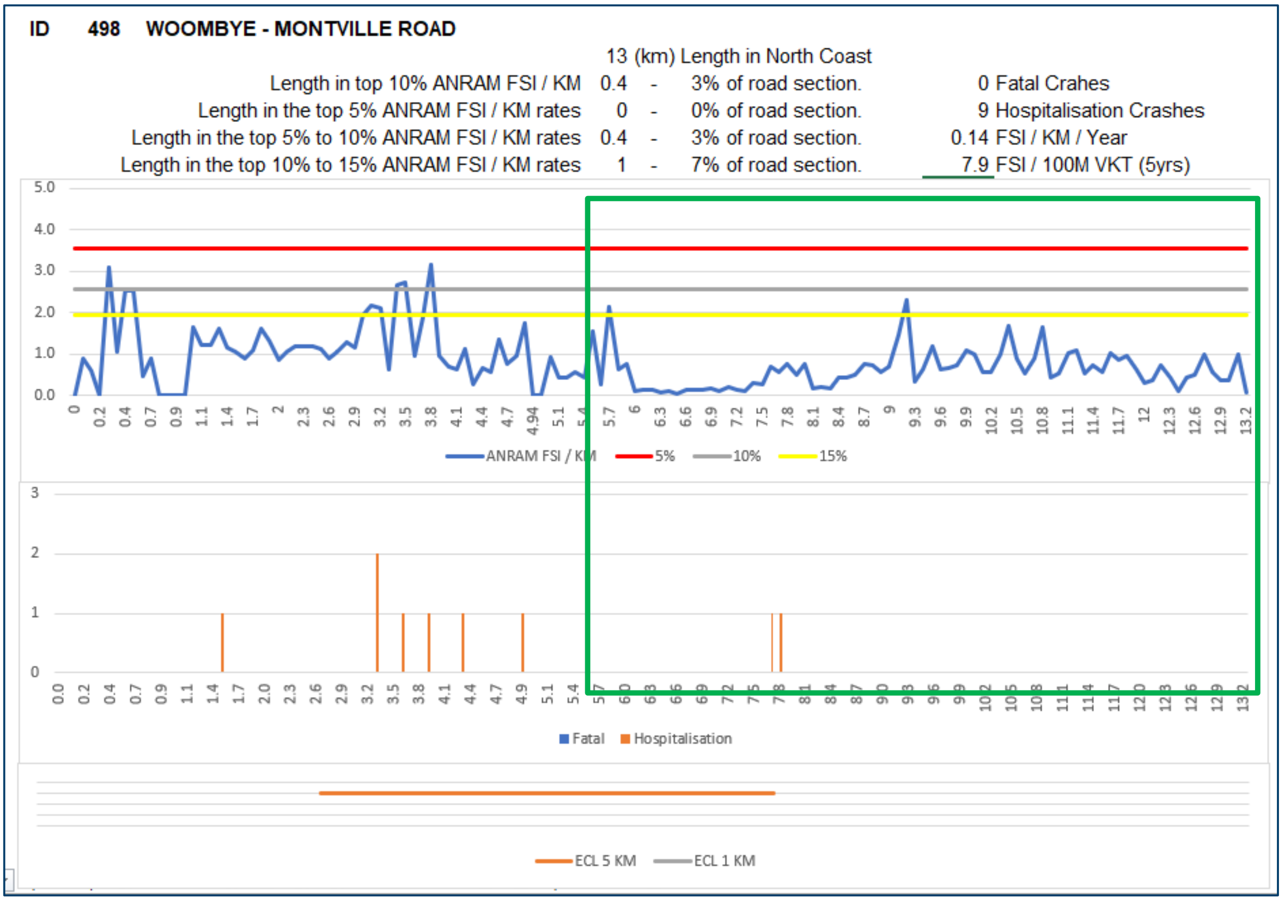
Figures 26 to 28 (pages 51 to 52) show the ANRAM charts for some other roads within the NCR road network: Woombye – Montville Road, Brisbane – Woodford Road and Eumundi – Kenilworth Road for comparison with the ANRAM chart for Kin Kin Road (Figure 24 on page 48). The sections highlighted in green are used for comparison purposes as these sections have a similar geometry and/or mix of traffic. Table 15 shows the AADT and percentage of heavy vehicles for the roads/segments being compared.

Table 15: AADT and percentage of heavy vehicles for ANRAM comparison

Road (Chainage)	Data collection year	Annual Average Daily Traffic (AADT)	Percentage heavy vehicles (%HV)
Kin Kin Road (Ch. 25.78 – 54.65km)	2021	1072–4903	8.7–16.0%
Woombye – Montville Road (Ch. 5.6 – 13.28km)	2021	1143–9806	6.8–12.1%
Brisbane – Woodford Road (Ch. 27.0 – 60.65km)	2021	1189–3826	9.4–13.0%
Eumundi – Kenilworth Road (Ch. 0 – 25km)	2021	1531–3536	15.6–20.7%

Source: TMR.

Figure 26: ANRAM chart for Woombye – Montville Road

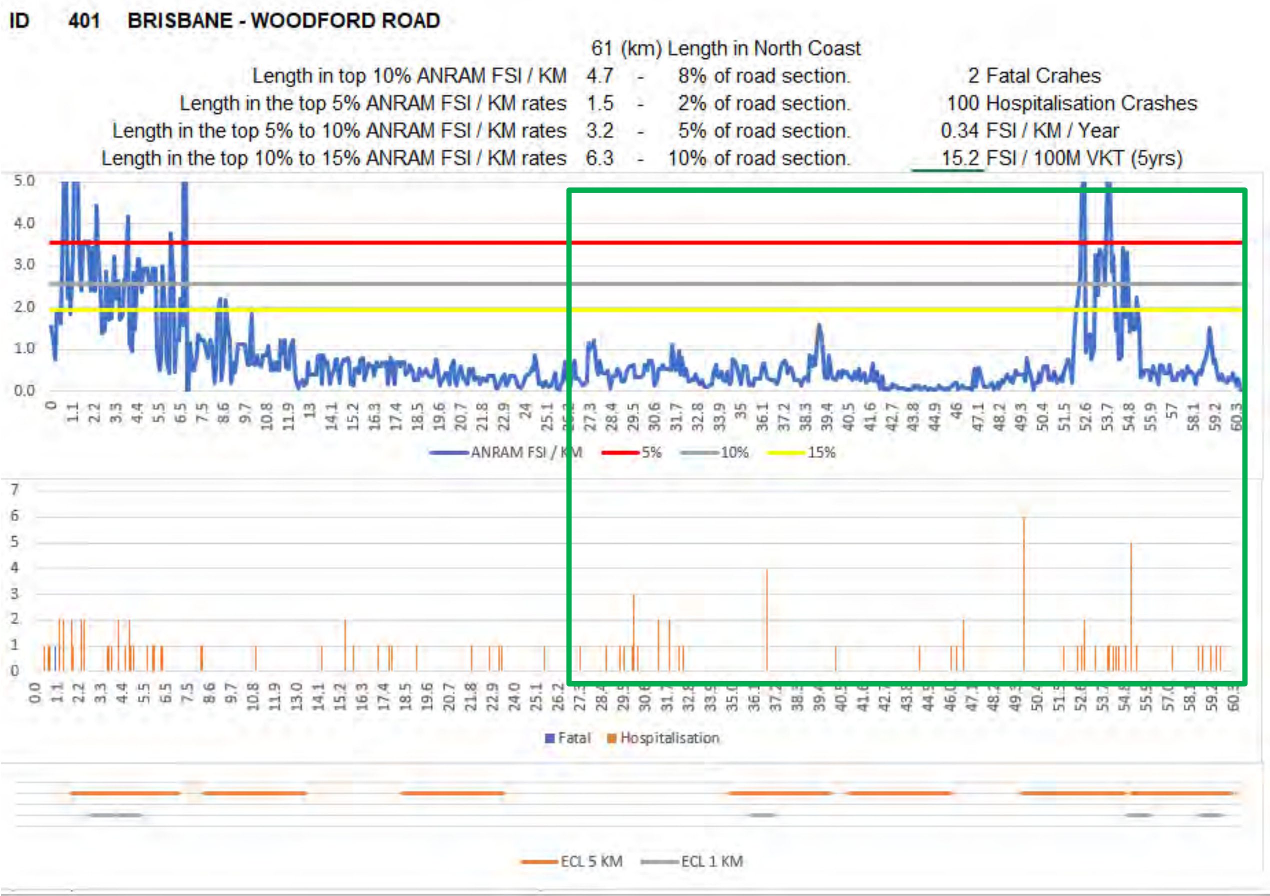


Source: TMR.

It can be observed by comparing to the chart for Kin Kin Road (Figure 24 on page 48) and the highlighted section of the chart for Woombye – Montville Road (Figure 26), that Woombye – Montville Road has:

- generally higher predicted ANRAM values closer to one
- similar or more instances where the predicted ANRAM values extend above one
- a higher rate of crashes/km.

Figure 27: ANRAM chart for Brisbane – Woodford Road

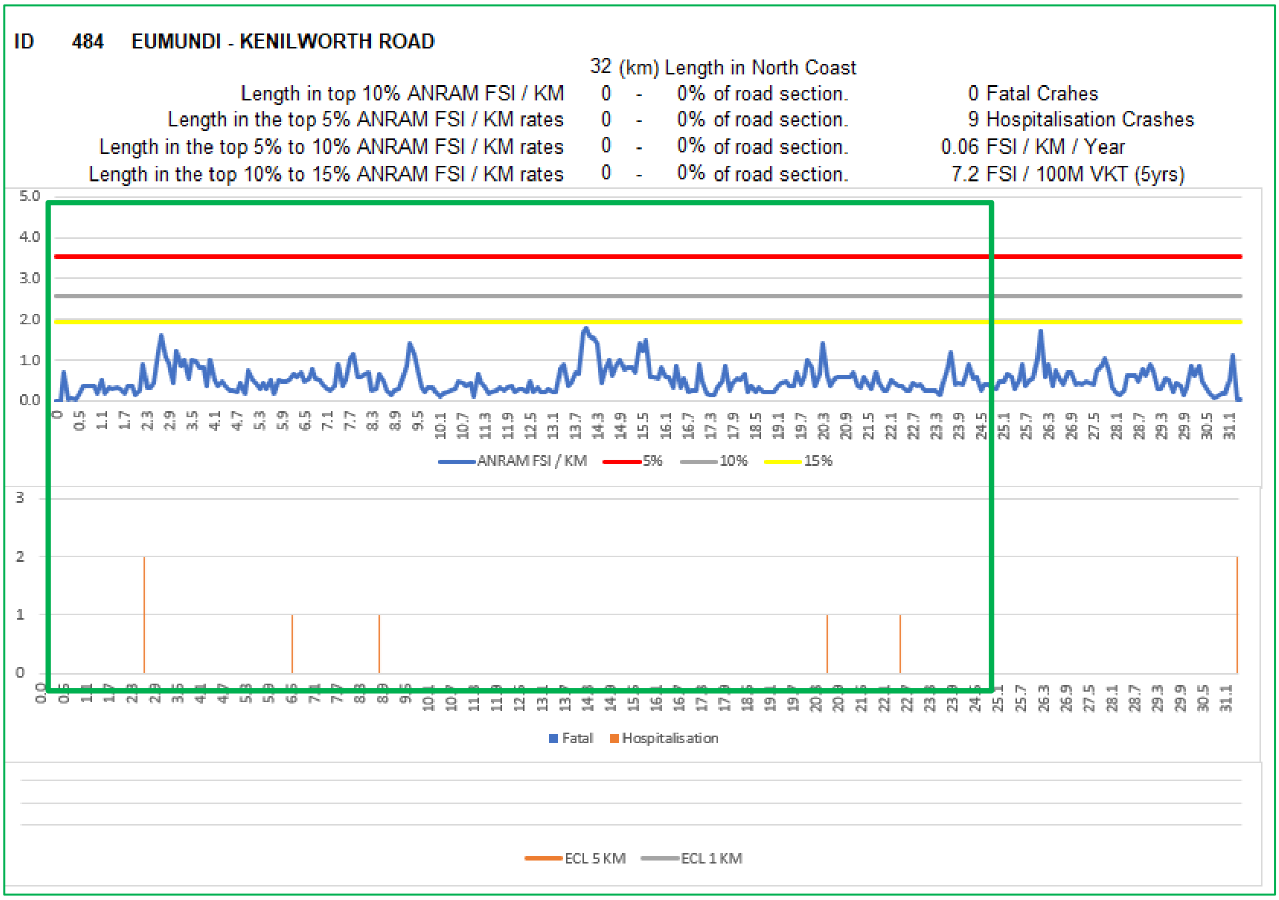


Source: TMR.

It can be observed by comparing to the chart for Kin Kin Road (Figure 24 on page 48) and the highlighted section of the chart for Brisbane – Woodford Road (Figure 27), that Brisbane – Woodford Road has:

- similarly low ANRAM values from Chainage 10.8km to 51.5km
- a higher rate of crashes/km.

Figure 28: ANRAM chart for Eumundi – Kenilworth Road



Source: TMR.

It can be observed by comparing to the chart for Kin Kin Road (Figure 24 on page 48) and the highlighted section of the chart for Eumundi – Kenilworth Road (Figure 28), that Eumundi – Kenilworth Road has:

- ANRAM values similar to the section of Kin Kin Road from Chainage 43.8km to 54.3km
- more instances where the ANRAM values extend above one.

In summary, comparison of the figures above seemingly indicates that Kin Kin Road has a lower risk of predicted serious crashes compared to other roads in the NCR which have similar characteristics. In comparison to the NCR network overall, Kin Kin Road is not ranked in the top 20 roads in terms of risk of fatal or serious injury crashes (30 per cent of network road length has an ANRAM FSI/km score greater than Kin Kin Road).

4.3 Summary of crash review

Road management actions and infrastructure improvements made along this section of Kin Kin Road, including widening of the sealed formation south of Pomona, upgrading pavement (particularly on the range section), vegetation clearing, upgraded roadside delineation and reduced speed limits are likely to all have contributed to ensuring crash rates have not increased in line with traffic/heavy vehicle volumes over the last decade. The predominate crashes involve light vehicles and motorcycles. Only one reported crash involved a heavy vehicle, but neither the truck nor the roadway could be considered as having directly contributed to this crash.

The majority of crashes occurred on what would be described as the 'better sections' of the road, as distinguished by pavement that is in good condition, with marked edge lines and with good, either full or partially sealed shoulders. Of the crashes that did occur on the lesser standard sections of the alignment, many involved some form of violation/driving infringement or mechanical issue as a contributing cause. The data shows the severity of crashes on Kin Kin Road reasonably aligns to what is occurring on average on state-controlled roads within the Noosa Shire Council (NSC) area.

A comparison of ANRAM figures indicate that Kin Kin Road has less risk of fatal and severe crashes than similar sections on road of Woombye – Montville Road, Brisbane – Woodford Road and Eumundi – Kenilworth Road. These particular roads have been compared with Kin Kin Road as they are similar rural-type roads within TMR North Coast Region (NCR) with similar alignments, cross sections and traffic characteristics. Of all state-controlled roads within the NCR, Kin Kin Road is not ranked in the top 20 in terms of risk of fatal or serious injury crashes.

5. Existing timber bridges

Five timber bridges are located along Kin Kin Road within the Noosa Shire boundaries. Due to the width constraints of these structures, they operate as single-lane bridges with 'Give Way' sign control. Concerns have been raised by the community about the adequacy of these bridges to support loads associated with quarry trucks.

Four timber bridges were reviewed by the structures team in TMR's Engineering and Technology Branch, and a summary of the findings are shown in Table 16. Six Mile Creek Bridge was not included in this review as this bridge is funded for replacement and construction commenced in late 2022. The condition state for each structure was reviewed based on the most recent Level 2 inspection at the time the assessment was undertaken. A review of the standard Class B drawings for comparison with existing structural components to establish conformance to Class B sizes was completed to assess the capacity of the bridges.

The assessment also considered the following:

- As of right vehicles have access to Class B Timber Bridges throughout the state and hence access to 42.5 tonne trucks falls within current departmental practice.
- The risk profile has not changed on these bridges as the precedence of 42.5 tonne trucks running over them is established for a number of years.

Table 16: Summary of bridge assessments for Kin Kin Road

Bridge reference	Bridge design class	Capacity	Future condition management
Kin Kin Creek No 1 **(ID. 841)**	T44 (refurbished in 2003)	Satisfactory for present use of a 42.5t semi and 50.5t truck and dog trailer.	Manage as Business As Usual (BAU) with continued routine/scheduled inspections and any recommended repairs. Deficient components identified in the desk top review by Structures be replaced in a timely manner. Bridge Information System (BIS) updated after every inspection/component replacement.
Yellow Gully **(ID. 843)**	B Class (24 ton)	Satisfactory for present use of a 42.5t semi and 50.5t truck and dog trailer.	Manage as BAU with continued routine/scheduled inspections and any recommended repairs. Deficient components identified in the 'desktop' review by structures team to be replaced in a timely manner. BIS updated after every inspection/component replacement.
Kin Kin Creek No 2 (ID. 844)	B Class (24 ton)	Satisfactory for present use of a 42.5t semi and 50.5t truck and dog trailer.	Manage as BAU with continued routine/scheduled inspections and any recommended repairs. Deficient components identified in the 'desktop' review by structures team to be replaced in a timely manner BIS updated after every inspection/component replacement
Kin Kin Creek No 3 (ID. 845)	B Class (24 ton)	Satisfactory for present use of a 42.5t semi and 50.5t truck and dog trailer.	Manage as BAU with continued routine/scheduled inspections and any recommended repairs. Deficient components identified in the 'desktop' review by structures team to be replaced in a timely manner. BIS updated after every inspection/component replacement,

Source: TMR.

The *Design Criteria for Bridges and Other Structures Manual – February 2021* outlines the design standards for bridges in Queensland. In terms of bridge width, Clause 3.5.3 states that, in general, bridges will have the same number of lanes as the adjacent roadway. Figure 29 is an extract from Table 3.5.2(d) of the manual which shows the specified minimum width requirement for bridges based on traffic volumes. Based on current traffic volumes, the existing crossings at Kin Kin Creek No. 1, 2 and 3, along with the Yellow Gully Crossing, would require a minimum bridge width of 8.6 metres, consisting of 2 x 3.5 metre traffic lanes and 2 x 0.8 metre shoulders to comply with current-day guidelines. The other single-lane bridge, over Six Mile Creek, is about to be upgraded to the appropriate standard. The width of the existing bridges is not considered to be an issue that affects the operation of the quarry trucks.

Figure 29: Extract of Table 3.5.2(d) of TMR's Design Criteria for Bridges and Other Structures Manual

Table 3.5.2(d) – Minimum bridge carriageway widths for other roads

Carriageway type	Length (m)	AADT	Shoulder (minimum)	Traffic lane	Traffic lane	Shoulder (minimum)	Minimum bridge carriageway width (concrete deck)	Minimum bridge carriageway width (deck units with cast insitu kerbs)
Two-way, two-lanes	Any	< 1000	0.800–1.050	3.250–3.500	3.250–3.500	0.800–1.050	8.600	8.600
	≤ 20	1000–3000	1.100–1.350	3.250–3.500	3.250–3.500	1.100–1.350	9.200	9.200
		3001–5000	2.000	3.500	3.500	2.000	11.000	11.000
		≥ 5000	2.500	3.500	3.500	2.500	12.000	12.200
	> 20	1000–3000	0.800–1.000	3.250–3.500	3.250–3.500	0.800–1.000	8.600	8.600
		3001–5000	1.100	3.500	3.500	1.100	9.200	9.200
		> 5000	1.200	3.500	3.500	1.200	9.400	9.800

Source: TMR's Design Criteria for Bridges and Other Structures (February 2021); Page 37.

6. Other information considered

6.1 Wildlife strikes in crashes

TMR has received reports from community members of wildlife strikes, such as wallabies and kangaroos, on Kin Kin Road.

TMR shares the community's concerns for fauna and driver safety, and implements several measures across state-controlled roads that are designed to mitigate traffic impacts on native fauna.

TMR typically reserves installing wildlife warning signs for endangered or threatened species. Koala warning signs are currently installed on the Yurol Forest Drive section of Kin Kin Road. The installation of further wildlife mitigation controls will be considered along with any future capital expenditure projects on the state-controlled road network.

TMR is aware of virtual fencing trials which are currently underway, or have been conducted, on local roads in the Brisbane City Council, Redland City Council, Logan City Council and Sunshine Coast Council areas. Any outcomes from the council-led trials will be considered during a review of TMR's *Departmental Fauna Sensitive Road Design Manual Volume 2: Preferred Practices* (the manual), which is currently being updated. The Department of Environment and Science and the environmental industry will be consulted as part of the review process.

In view of this, TMR North Coast Region (NCR) will not be installing virtual fencing in the short-term but may consider virtual fencing when there is a more conclusive position on the effectiveness of this technology.

In recent years, TMR lowered the speed limit along significant lengths of Kin Kin Road for the safety of all road users. It is expected that the reduction in speed limits would have also had a positive impact on the number of animal strikes as motorists travelling at lower speeds have more time to react to animals on the road.

6.2 Literature review

Research papers and reports were reviewed to identify if there are characteristics of Kin Kin Road that would be more likely to increase the crash risk. While most reports deal with the effects of heavy vehicles on crash rates more generally, some reports assist with an understanding of the likely effect on crash rates on Kin Kin Road given the existing or proposed traffic operations.

Kin Kin Road has some sections of limited pavement widths, curves with tight radius, and very narrow shoulders. From the literature review, it was concluded that the major factors for heavy vehicle crashes were poorly maintained roads, too narrow roads, and unsealed or only partially sealed shoulders. The risk analysis from Austroads – Road Safety Engineering Risk Assessment Part 1: *Relationship between Crash Risk and the Standards of Geometric Design Elements* indicates that total pavement width is a better measure than using a combination of lane widths and shoulder widths. This assists in justifying the use of wide centreline treatments where the paved width remains the same even though the line marking has seemingly reduced the lane widths. For Kin Kin Road, the literature did not reveal any other insights that were unknown to TMR staff. Refer to Annexure E – Literature Review for further information.

All road design is a compromise between the ideal and what is a reasonable outcome in terms of cost, safety, driver expectation, economic drivers, environmental impacts, and social issues.

Judgements have to be made on the value of improving the standard of a road and the impact this might have on the ability to make improvements elsewhere on the state-controlled road network. These judgements are usually made on the basis of the level of safety of the road in question and the Benefit/Cost

Ratio (BCR) resulting from the proposed improvements. Environmental and social impacts are also major considerations.

6.3 The Holland Report 2010

6.3.1 Introduction and purpose of report

The *Holland Report 2010*, authored by Mr Robert Holland, presents an assessment of traffic-related issues associated with the declarations sought in the Planning and Environment Court in October 2010 by Kin Kin Community Group Incorporated, regarding the quarry proposed by Neilsens Quality Gravels Pty Ltd (Neilsens) at Sheppersons Lane, Kin Kin. It should be noted, however, that the *Holland Report 2010* compares the characteristics of the road to the requirements for a new/greenfield road construction. Kin Kin Road is an existing road where a range of constraints exist, meaning these normal requirements cannot always be applied economically. The report was prepared by Mr Robert Holland to assist the Court at the hearing of the above-mentioned matter. The *Holland Report 2010* is provided for reference in Annexure F – The Holland Report 2010. TMR understands that a new report has been prepared by Mr Stuart Holland, however, the new report from 2021 has not been reviewed as part of this report, as it is subject to the continuing court case between Noosa Shire Council (NSC) and the operators of the quarry at Kin Kin.

6.3.2 Findings of the Holland Report 2010

In the *Holland Report 2010*, Mr Holland formulated the following findings:

- All the access roads which the site might utilise for access are deficient by current standards. They are therefore inherently unsuitable to accommodate the number and type of trucks envisaged in association with the proposed quarry.
- Accordingly, for the scale of development now proposed, the conditions attached to the original town planning approval of the quarry are inadequate.
- If the road system on which the quarry relies for access is retained in its present state, the combination of narrow bridges and carriageways on that network and the imposition of 30–40 loaded quarry trucks per day will exacerbate an existing unsatisfactory situation about the safety of existing road users and will increase road maintenance costs ultimately borne by the general community.
- If a Material Change of Use application were to be made now for the quarry, conditions would need to be formulated effectively restricting quarry trucks to a specific road, (probably Kin Kin Road between the site and the Bruce Highway), with associated upgrading of the existing bridges and carriageway widths on that route.
- It is noted in this respect though that in my view, effective restriction of quarry trucks to a single specified route may well be unrealistic, impractical, or unacceptable, particularly bearing in mind the quarry operators' advice that the majority of customers would send their own trucks.

6.3.3 Review of the Holland Report 2010

The *Holland Report 2010* presents findings of a high-level assessment of the traffic-related issues and adequacy of Kin Kin Road in relation to the proposed quarry operations at the time and the additional traffic generation. The report did not examine the existing geometry of Kin Kin Road but examined the required standards in terms of road and single-lane bridge widths. This report was reviewed by the Geometric Standards area of TMR's Engineering and Technology Branch, and the following points were noted:

- The *Holland Report 2010* identifies that, based on traffic numbers/forecasts and design guidance current at the time, Kin Kin Road south of the quarry site should have a seal width of 9 metres (3.5 metres lanes and 1.0 metre shoulders).

- The report identifies that Kin Kin Road south of the quarry site is grossly sub-standard in relation to a 9-metre seal width and discusses the inherent risks associated with such narrow carriageways, particularly in the context of increasing traffic volumes including heavy vehicles.
- Design guidance has been updated since the time of the *Holland Report 2010*. According to the current version of TMR's *Road Planning and Design Manual*, for rural roads, seal width (lanes and shoulders) if built new should be a minimum of 10.0 metres for the existing traffic volumes south of Kin Kin township based on normal design domain and a minimum of 9.5 metres based on extended design domain as per the *Road Planning and Design Manual 2nd edition* (RPDM03 – 2022). (Refer to Table 12 on page 39 in Section 3.2 of this report for current Standard Cross Section Widths.)
- Seal widths less than those specified for extended design domain in Table 12 (on page 39) would be considered a design exception and should be treated as such. That is, suitable analysis and justification needs to be provided.

The report identifies three bridges on Kin Kin Road south of the quarry site as being significantly deficient in terms of width. Two of these were operating as priority controlled single-lane bridges. The report discusses the inherent risks associated with this, particularly in the context of increasing traffic volumes including heavy vehicles.

Currently all five timber bridges are under single-lane operation with 'Give Way' signs – Kin Kin Creek No. 1, Yellow Gully, Kin Kin Creek No. 2, Kin Kin Creek No. 3, and Six Mile Creek north of Pomona. Six Mile Creek is currently funded for replacement and construction began in late 2022.

Further to TMR's Engineering and Technology Branch's comments on the *Holland Report 2010*, the following comments are also made:

- Clause 3 of the report discusses the absolute minimum intersection layout that would be specified by Main Roads at Sheppersons Lane. The quoted Figure 13.58 from the RPDM is superseded by Figure A 6 of *Austroads Guide to Road Design Part 4* (AGRD04 – Feb 2021): Intersections and Crossings – General, however, the warrant is ostensibly the same. The intersection has never been upgraded to this Basic Right Turn (BAR) standard (see Figure 30 on page 58).

Figure 30: Photo from Kin Kin Road looking southbound towards Sheppersons Lane intersection

Source: TMR.

- The *Holland Report 2010* quotes Austroads guides, however, where the Austroads guides are varied by the *TMR Road Planning and Design Manual*, the TMR guidelines take precedence.
- The report uses subjective statements without justification. For example: “Lead to an exacerbation of existing unsatisfactory conditions.”
- It refers to the standards at the time without considering whether the implications of not meeting any of the specific standards constitutes an acceptable level of risk. Noting that engineering judgement ultimately forms a part of every project to determine the consequences of not meeting the current standards.

6.3.4 Addressing findings

The following are the findings of the *Holland Report 2010*, with TMR's response to each below:

All the access roads which the site might utilise for access are deficient by current standards. They are therefore inherently unsuitable to accommodate the number and type of trucks envisaged in association with the proposed quarry.

> Kin Kin Road may be deficient by current 'greenfield' standards, but it does not have a crash record to indicate concern or the need for significant intervention beyond the recent safety works and maintenance works undertaken.

Accordingly, for the scale of development now proposed, the conditions attached to the original town planning approval of the quarry are inadequate.

> The quarry was approved in 1987 by Noosa Council and has been operational since 1995. TMR was not a referral agency for the original application for the quarry. TMR is limited as to what conditions can be imposed upon an existing approved development application and legally operating business. Imposition of any conditions would need to be justified, reasonable and defendable in a court.

If the road system on which the quarry relies for access is retained in its present state, the combination of narrow bridges and carriageways on that network and the imposition of 30 - 40 loaded quarry trucks per day will exacerbate an existing unsatisfactory situation with regard to the safety of existing road users and will increase road maintenance costs ultimately borne by the general community.

> Increased activity at the quarry has been ongoing for quite a few years now and whilst the community has raised concerns for safety, these do not appear to have translated into recorded crashes. There was only one crash recorded in the 2010 – June 2021 period that involved a heavy vehicle (and even with this crash the heavy vehicle was not at fault).

If a Material Change of Use application were to be made now for the quarry, conditions would need to be formulated effectively restricting quarry trucks to a specific road (probably Kin Kin Road between the site and the Bruce Highway) with associated upgrading of the existing bridges and carriageway widths on that route.

> As previously stated, the quarry was approved in 1987 by Noosa Council and TMR cannot retrospectively apply conditions to that development.

It is noted in this respect though that in my view, effective restriction of quarry trucks to a single specified route may well be unrealistic, impractical or unacceptable, particularly bearing in mind the quarry operators' advice that the majority of customers would send their own trucks.

> This statement is true.

6.4 Summary of other information considered

The Literature Review was undertaken to identify if there are characteristics of Kin Kin Road that would be more likely to increase the crash risk. While most reports dealt with the effect of heavy vehicles on crash rates more generally, some of these reports were able to assist with understanding the likely effect on crash rates on the Kin Kin Road given the existing traffic operations. Kin Kin Road has some sections of limited pavement widths, curves with tight radius and very narrow shoulders. It was concluded from the literature that poorly maintained roads, too narrow roads and unsealed or only partially sealed shoulders were the major factors for truck related crashes. The literature did not reveal any other insights that were not already known to TMR staff.

TMR has the responsibility to apply judgement on the value of improving the standard of a road and the impact this might have on the ability to make improvements elsewhere on the road system. These judgements are usually made on the basis of the level of safety of the road in question and the Benefit/Cost

Ratio (BCR) resulting from the proposed improvements. Environmental and social impacts are also major considerations.

The *Holland Report 2010* was prepared by Mr Robert Holland in 2010 to assist the Planning and Environment Court in matters relating to the quarry at Kin Kin. It presents the findings of a high-level assessment of the traffic-related issues and adequacy of the Kin Kin Road in relation to the proposed quarry operations at the time and the additional traffic generation. The report, however, tends to compare the characteristics of Kin Kin Road to the requirements for new/greenfield road construction rather than an existing road where a range of constraints exist, meaning these normal requirements cannot always be applied economically. The information in the *Holland Report 2010* has been considered and TMR has found that it compares the road characteristics to current new construction standards and then draws conclusions without consideration of whether the shortfalls actually correlate to an unacceptable level of risk.

7. Road surface and pavement condition

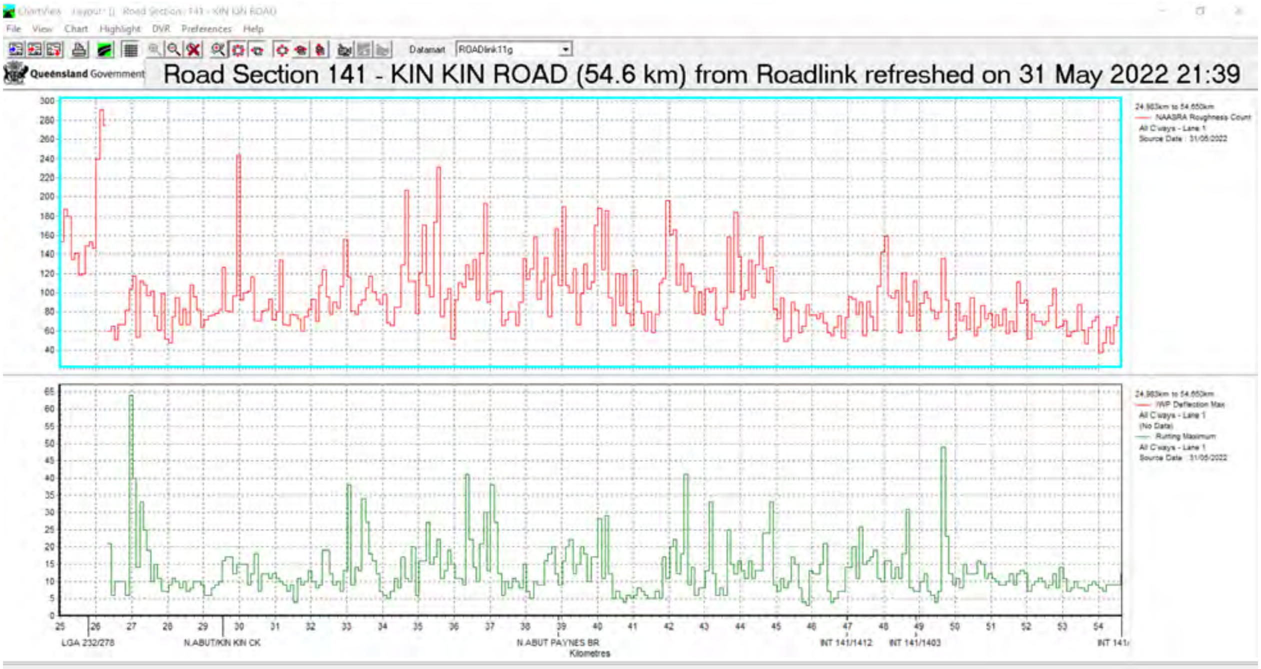
7.1 Pavement conditions

The bitumen sealed width of Kin Kin Road has been progressively widened over the years from a single-lane sealed road to its current configuration of two lanes. Along most of the length, this has occurred typically on poorer quality shoulder material and it can be assumed that this was not originally designed as a pavement structure. It is noted that this was a common occurrence on rural arterial roads within TMR North Coast Region (NCR).

TMR collects pavement condition data at a statewide level on an annual or biannual basis. Road roughness and rutting counts are used among other inputs to determine the need for maintenance intervention on roads. Different roads within the network have different intervention levels, with motorways and highways demanding the earliest intervention due to higher traffic volumes and rural roads, such as Kin Kin Road, being prioritised below them. Once the intervention level has been reached for any particular road, actual intervention needs to be determined with regard to competing priorities on the state-controlled road network.

The latest condition data for Kin Kin Road is shown in Figure 31 (on page 61).

Figure 31: ChartView plot of pavement condition (roughness and rutting) for Kin Kin Road



Source: TMR.

Notwithstanding the pavement condition data, it is recognised that traffic generated by the quarry has had an impact on the performance of the pavement.

A high-level pavement impact assessment was done in 2014 as part of development of the Kin Kin Road Link Strategy. The assessment assumed a terminal roughness of 120 National Association of Australian State Road Authorities (NAASRA) Roughness Measurement (NRM). NRM is a value adopted to represent the pavement roughness at the end of the assumed design period –that is typically when the shape needs to be corrected to improve the ride quality. At the time of the assessment, the predicted remaining life based on these parameters ranged from six to 17.6 years. The analysis showed a significant increase in the Equivalent Standard Axles (ESA) due to the quarry usage in the low (100,000 tonnes per annum over a 20-year period) – high (1,000,000 tonnes per annum over a 20-year period) production scenarios. The predicted increase in ESAs therefore significantly reducing the predicted remaining life. It should be noted that the end of remaining life of a pavement does not mean sudden failure or that the pavement is unsafe. Rather, it indicates that the road would require more routine maintenance or rehabilitation works to provide the same level of service.

7.2 Maintenance

TMR undertakes regular inspection and monitoring of state-controlled roads across TMR North Coast Region (NCR) as part of routine maintenance operations. Any identified safety issues are repaired as quickly as possible to provide a safe environment for motorists and other road users. Additionally, TMR regularly reviews its forward program to identify key priorities and future upgrades on the state-controlled network as part of this review process.

TMR endeavours to perform routine maintenance works such that the maintenance levels of service are not exceeded. The Maintenance Levels of Service sets out Intervention Limits, Notification Levels, and Response Times for various components of road infrastructure.

The level of service is the defined quality for a particular service/activity against which service performance can be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental impact, acceptability, and cost.

To ensure best value for the community is achieved, TMR prioritises maintenance work, with safety issues being the highest priority and regular maintenance activities such as litter removal, mowing and vegetation clearing being given a lower priority. It is recognised that periods of heavy and extended rain mean potholes can form quickly. Potholes are filled at priority locations as soon as it is safe and practical, and further repairs are programmed where needed following the rain event when it is safe and pavement conditions allow.

TMR remains committed to its responsibility to maintain Kin Kin Road as part of the state-controlled road network. In this regard, TMR will continue to undertake maintenance required in line with the use and needs of the road. This is accommodated within the NCR's existing maintenance budget. Like many roads in Southeast Queensland, the extreme rain events in February and May 2022 impacted Kin Kin Road, resulting in road and bridge closures at several locations due to flooding. Maintenance expenditure for 2021–2022 is expected to increase due to remedial works required in response to the extreme rain and flooding events.

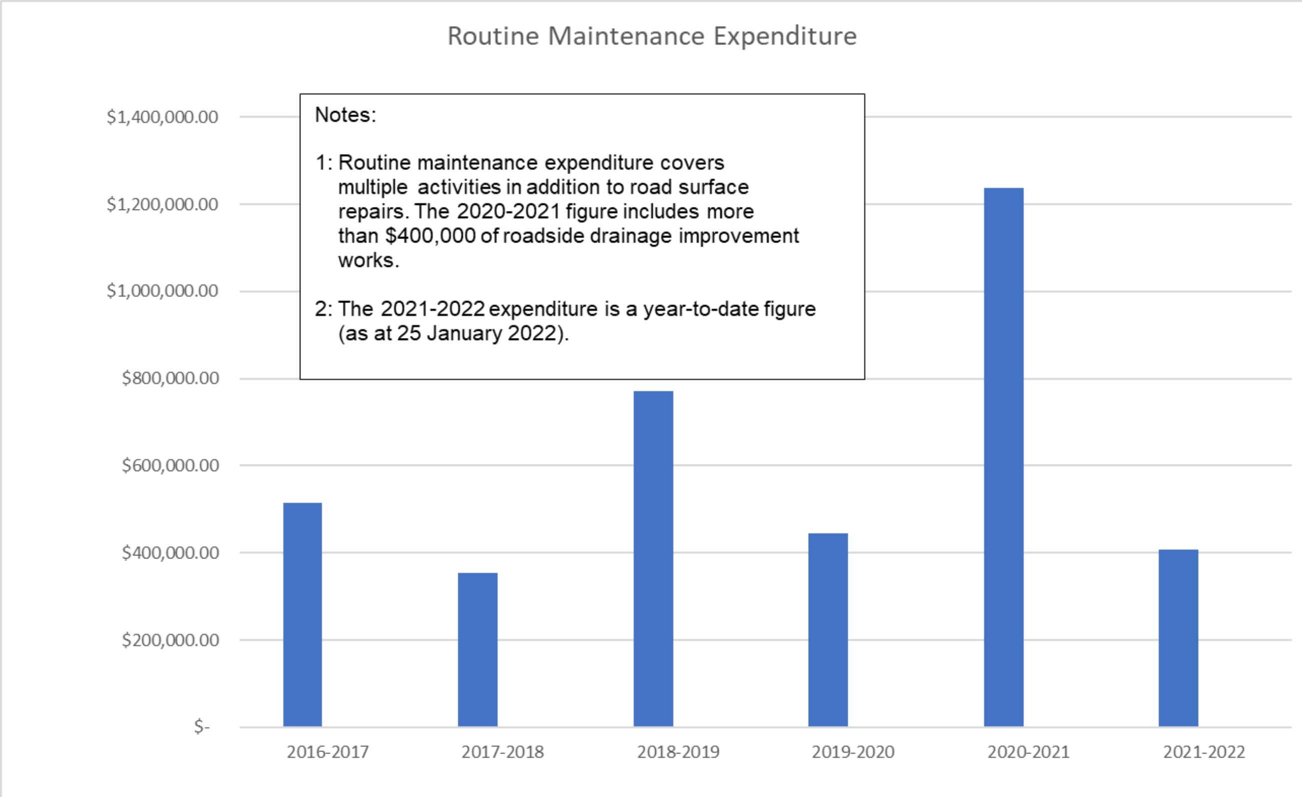
There has been an increasing trend in maintenance expenditure on Kin Kin Road over at least the last five years. Routine maintenance expenditure may be influenced by many factors including traffic conditions, asset characteristics, weather and extreme events, climate and ground conditions, and community sentiment. As well as road surface repairs, routine maintenance includes functions like drainage maintenance and improvements, vegetation maintenance, litter collection, and signage cleaning and replacement. Therefore, the increased maintenance costs cannot exclusively be attributed to the increase in quarry haulage activity.

In the 2020–2021 financial year, TMR invested more than $1.2 million into routine maintenance activities on Kin Kin Road. This reflects TMR's commitment to maintain Kin Kin Road in a safe and serviceable condition and its increased efforts to meet community expectations. In the 2020–2021 financial year, more than $400,000 was spent on a proactive drainage maintenance improvement program of works to help reduce the risk of pavement damage.

Figure 32 (on page 63) shows TMR's data for maintenance expenditure for Kin Kin Road over the last five years. The information contained in the graph must be considered in context of the following notes:

1. The amount shown in 2021–2022 was the year-to-date figure on 25 January 2022.
2. Maintenance expenditure for 2021–2022 will be impacted by the required remedial works in response to large rain events in the first half of 2022.
3. The expenditure for 2020–2021 included more than $400,000 of drainage improvement works.

Figure 32: TMR's maintenance expenditure for Kin Kin Road over the past five years



Source: TMR.

TMR has received enquiries from members of the public requesting for the quarry operator to pay for maintenance on Kin Kin Road. Infrastructure assets on state-controlled roads such as guardrails, traffic lights/signals, pavement and signs are maintained by TMR. Compensation may be sought in instances where infrastructure is damaged as a result of the intentional, reckless or negligent actions of a person. In these situations, the person responsible for the damage is liable to pay the cost of repair, replacement or reconstruction of the property under Section 48 of the *Transport Infrastructure Act 1994*. In most instances, Third Party Property and/or Comprehensive vehicle insurance will cover the costs associated with repairing such damage.

TMR does not seek compensation for routine road maintenance. In some instances, TMR may seek contributions or maintenance agreements from developers for ongoing maintenance of roads. These may be applied as a condition of development and cannot be applied retrospectively. The quarry at Kin Kin operates under a longstanding local government development approval. TMR was not a formal referral agency for the original application for the quarry in the 1980s and has no authority to retrospectively place conditions on the existing approved development application.

8. Infrastructure projects

8.1 Kin Kin Road signs and delineation project

In 2018, a $1 million project was completed on Kin Kin Road funded by the Queensland Government's Targeted Road Safety Program. Safety improvement works on Kin Kin Road through the Pomona, Pinbarren and Kin Kin areas included upgrading road signs, improving guideposts and pavement reflectors, re-establishing or improving line markings where required, and removing roadside hazards at prioritised locations.

8.2 Vegetation management

Vegetation management in the form of routine maintenance activities were undertaken on Kin Kin Road during the 2020–2021 financial year. These activities included regular roadside slashing to a width of approximately 3.5 metre within the road reserve, and herbicide spraying around roadside furniture for the length of the road. Targeted vegetation clearing works were also undertaken between approximately Chainage 29km and 40km including removal or pruning of all roadside vegetation, other than grass, for the purpose of safety or visibility clearing was also carried out. This work included removal of trees too close to the edge of the road and branches likely to fall on the road.

Benefits of these works include:

- improving sight lines along curves, at intersections, bus stops and driveways, enhancing drivers' ability to detect potential conflict and take evasive action
- improving visibility of road signs and delineation devices
- reducing roadside hazards for errant vehicles by enhancing the clear zone
- improving fire breaks
- helping early identification of wildlife near or about to enter road.

8.3 Range upgrading

A geometric deficiency on the range section of Kin Kin Road is the lack of additional width on curves. Typically, pavement is widened on curves to maintain the lateral clearance between vehicles equal to the clearance available on straight sections of road.

In recent years, TMR's routine maintenance expenditure through the range has been very high due to the combination of heavily loaded trucks, inadequate pavement strength, and moisture ingress into the subgrade from unsealed shoulders.

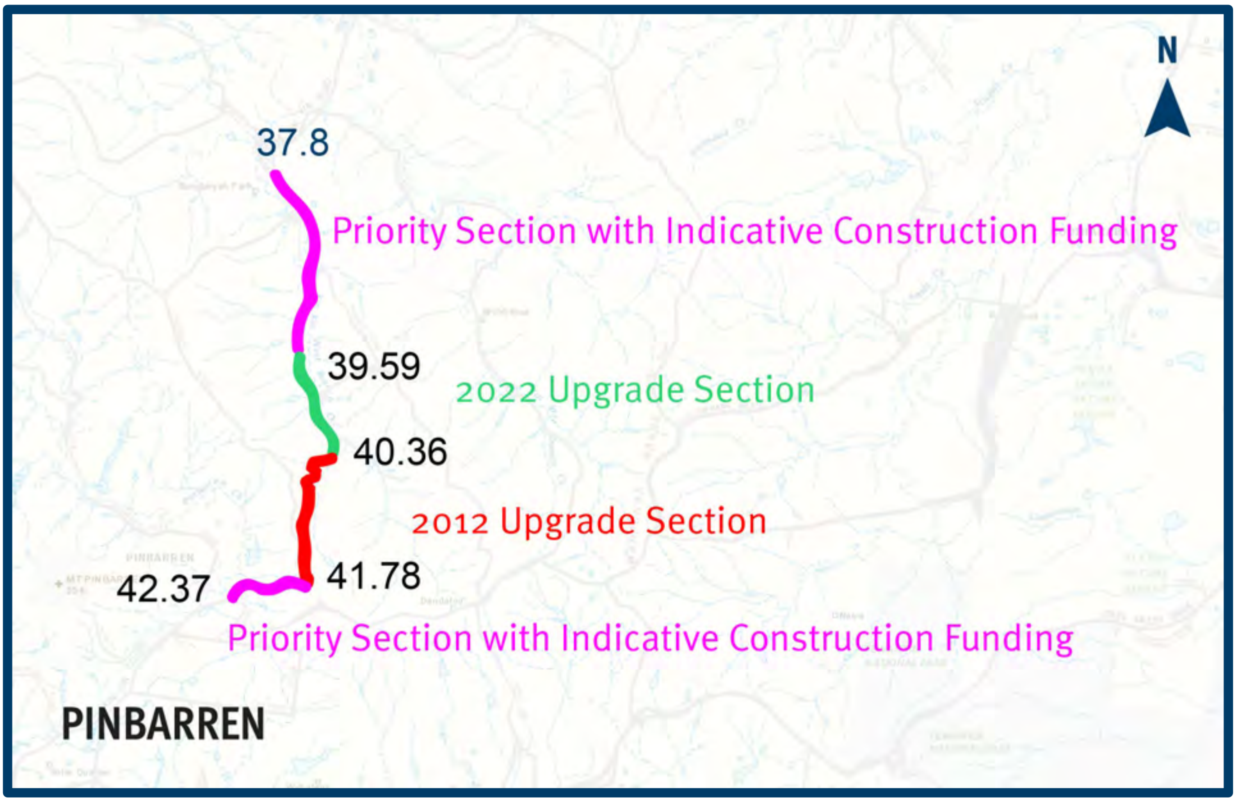
Historically, the low traffic volumes and high treatment costs have been barriers to obtaining funding for upgrades when prioritised with competing needs on the network. In 2012, a TMR project delivered pavement widening on the range between Chainage 40.36km and 41.78km. Increases in demand for material from the quarry in recent years has resulted in intensified community lobbying about the condition of the road, with particular concerns about the safety of the adjacent sections of the range, and where heavy vehicles often need to encroach onto road shoulders and into the opposing traffic lane. Based on safety assessments, TMR identified the Kin Kin Range sections as the priority for upgrading along Kin Kin Road, prompting application for funding to upgrade further sections of the range.

Construction has commenced on a $6 million road widening upgrade project to improve safety on Kin Kin Road on an 800-metre section of the Kin Kin Range. Works will take place on the section from Turnbull Road to just north of Williams Road, adjacent to a section of the road that was widened in 2012. This $6 million project is jointly funded by the Australian and Queensland governments as part of the Targeted Road Safety Program.

In developing the detailed design for the $6 million upgrade project, design investigations revealed that applying the normal design domain standards would create a much larger project footprint, therefore adversely impacting on land requirements from adjacent properties, increased negative impacts on flora and fauna, and significantly increasing project costs. TMR considered and applied justified exceptions to these standards to deliver a fit-for-purpose design solution that achieves the maximum benefit within the available budget. The resultant final design incorporates a 7 metre standard cross section width (3 metre lanes and 0.5 metre shoulders), with full curve widening applied throughout the treatment section to cater for heavy vehicle swept paths. Geometric design experts at TMR thoroughly reviewed and endorsed the use of extended design domain and design exceptions, and the associated justifications for their use, on the project.

With the release of the *Queensland Transport and Roads Investment Program (QTRIP) 2022–23 to 2025–26*, funding has also been allocated to investigate two future widening and strengthening projects located between Western Branch Road and Williams Road, north of the range, and between Turnbull Road and Sallwood Court, south of the range. Funding has been allocated for survey, design and investigation works for the two projects in the 2023–2024 financial year. Figure 33 illustrates the various sections of the Kin Kin Range and their respective funding status.

Figure 33: Map showing completed and planned projects for the range section of Kin Kin Road



Source: TMR.

8.4 Six Mile Creek Bridge

Construction commenced in late 2022 on a project to install a new bridge at Six Mile Creek. The existing bridge is a single-lane timber structure with 'Give Way' control to manage traffic.

The new bridge will be a sturdier, concrete structure and will be up to three metres higher than the existing bridge, noting the bridge height differs at the approaches and as it crosses over Six Mile Creek. The structure has been designed to meet TMR's current design standards. It has a significantly wider bridge deck allowing for two traffic lanes and wider shoulders. It will withstand more significant flood events, reducing the frequency and duration of closures in comparison to the existing timber bridge.

The final design includes:

- a sturdier bridge structure capable of transporting two lanes of traffic (one lane in each direction) removing the need for motorists to stop and give way to opposing traffic on the bridge
- a four-span bridge with improved flood immunity
- dedicated turn lanes into Bellbird Flat Road
- road realignment on sections of Kin Kin Road along the approaches to the bridge
- vegetation clearing to accommodate the new bridge.

The new bridge will include an additional shoulder width (minimum of 2.5 metres) on both sides of the bridge. While this is not a designated shared pathway it will improve accessibility for active transport users like bike riders by providing additional distance from vehicles.

Designated pedestrian access was raised by the community. The detailed design has provided adequate clearance on either side of the bridge to allow for the provision of a pedestrian walkway in the future however, this is subject to funding. Funding for this and network connectivity would compete for priority against other statewide projects.

8.5 Summary of infrastructure projects

As with all roads on the state-controlled road network within TMR North Coast Region, Kin Kin Road is subject to regular rehabilitation and maintenance works. In 2018, $1 million was spent on upgrading signage and delineation, including improvements to line marking and removal of roadside hazards. In the 2020–2021 financial year, targeted vegetation clearing work was undertaken as part of routine maintenance from north of Kin Kin township to the range.

The range section has been a major priority for upgrade with a pavement widening upgrade over the top of the range undertaken in 2012. Construction is currently underway on a $6 million upgrade project on the northern approach to the range, and funding has been allocated for survey, design, and investigation work to upgrade a further two sections on approach to the range (one north and one south of the range).

Construction of the replacement of the existing single-lane timber bridge over Six Mile Creek has commenced. The new bridge will be a higher, wider two-lane structure with wider shoulders and increased flood immunity.

TMR will continue to assess the needs for works on Kin Kin Road, along with the needs of all state-controlled roads across Queensland, to determine future priorities for upgrades, road resurfacing and rehabilitation.

9. Heavy vehicle management

9.1 Heavy vehicle restrictions

TMR acknowledges the concerns the local community have raised about increased heavy vehicle movements on Kin Kin Road, related to the quarry at Kin Kin, and understand this is a challenging issue for everyone involved.

The local community are continuing to advocate to various levels of government to remove or restrict quarry vehicles from using Kin Kin Road and the surrounding local road network. The quarry has been in operation for a number of years and operates under a local government development approval. As such, issues around the quarry's operations, including its suitability for the area, its impacts, the volume of heavy vehicles and haulage routes, are matters for Noosa Shire Council (NSC) and the quarry's operators. TMR does not have the legal ability to stop or unreasonably restrict quarry operations, nor impose restrictions that stop or limit quarry trucks only.

TMR is aware that NSC has made applications in the Planning and Environment Court regarding the quarry. TMR understands that the closing submissions hearing was held on 17 June 2022 and at this stage the judge has reserved his decision. The outcomes are now in the hands of the Court.

Section 46 of the *Transport Infrastructure Act 1994* (TIA) allows temporary restrictions on the use of state-controlled roads to prevent damage to road transport infrastructure or to ensure the safety of road users and other persons. This legislation allows for a state-controlled road to be temporarily closed to all traffic or traffic of a particular class; or that the road may only be used at specified times, or by particular classes of vehicles, or with restricted loads of vehicles.

The TIA does not allow TMR to apply restrictions to quarry trucks only, so any restrictions imposed would have broader impacts on the community, and local business, industry, and agriculture. Kin Kin Road is a public road and is there to accommodate the transportation requirements of all road users and surrounding property owners. Whilst Section 46 of the TIA makes provisions for temporary restrictions, there are no alternative state-controlled roads in the area to accommodate such road user requirements, and applying permanent restrictions is not a practical option.

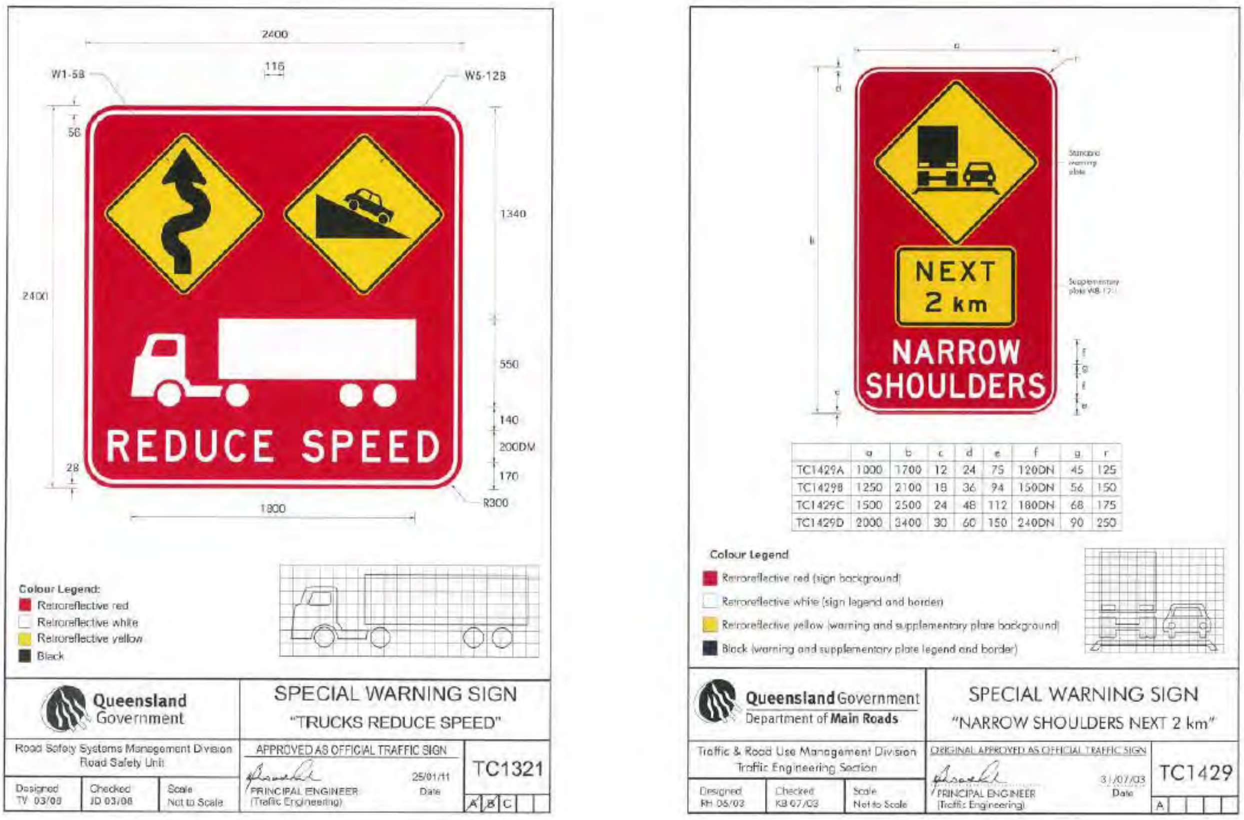
TMR implemented temporary load restrictions on three occasions in 2022 as a result of significant flooding and/or wet weather events. The load restrictions were imposed on parts of Kin Kin Road to prevent damage to road infrastructure, and to allow the road to dry out enough to perform priority repairs. During these load restrictions, TMR received a significant volume of enquiries about the adverse impacts of the load restrictions, and numerous requests for exemptions, highlighting the broader impacts to the community beyond the operations of the quarry.

9.2 Additional warning signs

TMR upgraded road signs along Kin Kin Road in 2018 in accordance with recognised standards and signing practices.

TMR has a suite of additional approved official traffic signs available for use in special circumstances, including the two signs pictured in Figure 34.

Figure 34: Special use warning signs for Kin Kin Road



Source: TMR.

TMR will replace the existing warning signs on the approaches to Kin Kin Range, as pictured in Figure 35, with the 'Trucks reduce speed' special warning sign as depicted in Figure 34 (above) and will also install a series of 'Narrow shoulders next _ km' signs (also depicted in Figure 34 above), at strategic locations along narrow sections of Kin Kin Road to warn motorists of the prevailing conditions and the presence of trucks.

Figure 35: Existing warning signs on approaches to the Kin Kin Range

Source: TMR.

9.3 Supply of materials for TMR infrastructure contracts

To address concerns of increased haulage activities on roads such as Kin Kin Road as a result of TMR projects, TMR has implemented additional contract requirements for the Traffic Management Plans in TMR's

Technical Specification for the Provision for Traffic. The following clauses are now included in the technical specification for Traffic Management Plans.

> ***Supply Chain Haul Route Management***
>
> *The Contractor shall be required to undertake the haul route assessment for the supply chain for major material movements to and from site for the project, including earthworks, pavement materials, asphalt suppliers, pre-cast elements, concrete suppliers and so on. Such assessment shall include at a minimum the impact of additional haul traffic volume on local or low volume road infrastructure (AADT < 10,000). The assessment shall include, but not limiting to the following:*
>
> - *details for the additional haul traffic volume on the local or low volume road infrastructure*
> - *the safety of the other road user groups*
> - *impacts on the residents along the route, such as, noise, dust, vibrations, timing and duration for movements and so on, and*
> - *the additional infrastructure maintenance regime, including structures and pavement.*
>
> *If the haul route assessment identifies any increased risk associated with the infrastructure use, the Contractor shall include a Supply Chain Haul Route management strategy as a part of its Traffic Management Plan. Such strategy shall address risk mitigation measures Contractor is proposing to undertake to maintain the network to the standard without the impacts of the additional haul traffic volumes.*
>
> *Payment for the management, design, construction, operation, maintenance, removal and any other activities required in relation to Supply Chain Haul Route Management are deemed to be included in scheduled Item 20001 Provision for Traffic including all plant, labour and materials.*

It should be noted that these requirements apply only to TMR-engaged contractors constructing TMR works. TMR does not have the ability to apply the same requirements on private or local government works.

10. Conclusions and recommendations

This *Kin Kin Road (141) Engineering Review* presents the findings of assessments and investigations undertaken into the condition and management of the section of Kin Kin Road that falls under the responsibility of TMR's North Coast Region (NCR). TMR has undertaken these assessments and investigations in exercising its duty of care in the operational management of Kin Kin Road, and in response to safety concerns raised by the community regarding the increased volumes of heavy vehicle traffic on the road.

The report examined current road attributes including road use, geometry, road surface and pavement condition, and condition/suitability of road infrastructure (bridges). A comprehensive study of crash history was also undertaken (using crash data from QPS) to identify any common crash trends or locations. The road's crash history was also compared to other similar rural roads within the NCR to determine whether the crash numbers and severity of crashes recorded were more of less than these other roads.

The report also examines management strategies undertaken on the road and looks at maintenance and upgrades carried out as well as detailing planned future works. The information contained within the report is the outcomes of assessments and investigations undertaken to date. While this report identifies width and alignment deficiencies in relation to the current-day standards, this should be viewed together with other data such as the historical operational performance of this road and associated crash history.

Analysis of the road geometry shows that the road does not achieve the highest standards of vehicle manoeuvrability and interaction, as defined by vehicles being able to pass each other on the road while maintaining a desirable 0.5 metre clearance/safety envelope to the edge of the sealed pavement and 1 metre between them. To bring the road up to conform with this standard would be a massive and cost prohibitive project for a road carrying relatively low traffic volumes, particularly over the Kin Kin Range section.

While not meeting this current-day standard at a number of locations, the road does operate to an acceptable level of safety when compared to similar roads in NCR and when consideration is given to clearance being largely achieved between two vehicles (down to 0.5 metre) and with at least one vehicle tracking a wheel off the sealed surface and using the unsealed shoulder.

Several projects that improve some of the geometry on Kin Kin Road are already scheduled to be undertaken or are currently under construction. These projects include the replacement of the Six Mile Creek Bridge and road widening between Williams Road and Turnbull Road. Overall, this section of roadway has also been subject to regular and ongoing minor safety improvements, including speed limit reductions, vegetation clearing, and upgrades to signs and delineation. Several of these risk mitigation measures have only recently been put in place, including reduced speed limits on much of the road. There has been insufficient time to evaluate what impact these measures will have on overall road safety and crash reduction. It is recommended that the impact of these changes be evaluated over time before any further major works are programmed or considered.

It was found that although overall traffic volumes have increased, including an increase in the percentage of heavy vehicles over the last decade, crash rates have not increased. Despite community concerns, there is no evidence of any increase in truck-related crashes, with only one crash occurring between January 2010 and June 2021 involving a heavy vehicle, with the truck driver on that occasion not found to be at fault. Almost all crashes involve light vehicles (cars/utilities, motorcycles or bicycles), with more than half of these being single vehicle crashes. There was also a high prevalence of crashes (41.5 per cent) that could be attributed to some form of impairment (DUI or drug driving), traffic violation (speeding, failing to give way) or were a result of a medical issue of driver fatigue.

10.1 Risk

The geometric review, in combination with the analysis of traffic volumes and compositions, and study of crash history on the section of Kin Kin Road within TMR North Coast Region (NCR) has identified several areas along the existing route which fall below the desired current-day standard for a newly constructed roadway. The existing road does, however, demonstrate a reasonable level of service in terms of safety, ability for vehicles to pass each other and to carry the current volume and composition of traffic. The combination of challenging alignment, narrow cross section, and relatively high percentage of heavy vehicles, like on the many similar roads across Queensland, represents a risk to the travelling public.

This risk, however, has been substantially reduced by the mitigation measures put in place over the last several years. The most significant of these measures has been the reduced speed limit over almost the entire length of the road and most notably on the tighter section of alignment on the northern approach to the Kin Kin Range, where the previous 100 km/h speed limit has been reduced to 70 km/h. It is also believed that other measures, including vegetation clearing and upgrades to signage and delineation, have also reduced the risk of crashes on the section. While it is still too early for the latest changes in the posted speed limits to be reflected in crash data, it is thought that speed changes made prior to these (on and south of the Kin Kin Range), along with clearing and delineation measures, have helped ensure crash rates have not increased over the last 10 years, despite some traffic growth and an increase in the percentage of heavy vehicle.

While the public's focus is on safety due to the increased numbers of, and interaction with, heavy vehicles, the study has demonstrated that the underlying risk is no worse and arguably better than comparable roads. Traffic crash reports fail to identify heavy vehicles being a 'contributing factor' in any crashes between January 2010 to June 2021. The study of the geometric elements does show a reasonable capacity for heavy and light passenger vehicles to co-exist and interact on the road. It is reasonable for the local community to be concerned about the limited width, unforgiving roadside environment and large percentage of heavy vehicles on this road. However, this same concern would seem to be influencing the manner in which people are driving this section of road with a higher sense of attentiveness. This, coupled with the conditions imposed on the operation of the haulage trucks, has resulted in only one crash involving a heavy vehicle over an 11 year period. The presence of five narrow, single-lane bridges also represents a risk in terms of heavy vehicle interaction, however, all bridges have been assessed as being safe to carry the loads that they are currently subject to, and the approach geometry for each bridge ensures a low-speed environment, mitigating that risk. One of these bridges (at Six Mile Creek) is about to be replaced.

The quarry at Kin Kin does have a Traffic Management Plan in place which aims to address some of the issues relating to heavy vehicle interaction on the narrow winding road network. The plan specifically addresses issues of heavy vehicle interaction with the travelling public including measures such as staging of truck departures from the quarry to reduce platooning, reducing speed, and taking increased care on the range and procedures around interaction with school buses. The TMP was a requirement of the quarry's Development Permit issued by the Department of Environment and Science. TMR does not monitor the quarry's compliance with the TMP.

Data would indicate that the higher risk factors to the safety of the travelling public on the Kin Kin Road include light vehicle driver inattention, non-compliance with the road rules, and driver impairment, with these three factors contributing heavily to the number of reported crashes.

10.2 Conclusions

The following conclusions can be gathered from this report:

- Kin Kin Road is a rural arterial/distributor road servicing communities in the Noosa and Cooloola hinterland east of the Bruce Highway. The road services the local agricultural and tourism industries, as well as having a recreational and commercial function. The biggest generator of commercial traffic is the quarry at Kin Kin.
- Traffic volumes range from just more than 1000 vehicles per day (vpd) north of the Kin Kin Range, to 4903 vpd around Pomona. Heavy vehicle percentages range from 8.67 per cent to 16 per cent. Overall traffic growth has generally been steady over the last 10 to 12 years, but the percentage of heavy vehicles within the traffic stream has grown at a faster rate. It is likely that this additional growth in heavy vehicles can be attributed to the quarry operations.
- Posted speed limits have been reviewed or considered over the entire length of Kin Kin Road within TMR North Coast Region (NCR) in recent years. Many speed limits have been reduced as a result, due to changes in philosophy and process for setting speed limits in accordance with Part 4 of the MUTCD. TMR will continue to monitor the need for further reviews or speed limit changes.
- As part of the speed limit reviews mentioned above, the speed limit on the Kin Kin Range was addressed separately. The review determined that the existing speed limit on the range is appropriate, considering the road environment, road function, crash history and current observed speed trends. The MUTCD Part 4 also implies that any consideration for a lower limit for trucks should only be on the basis of a short length or isolated hazard or conflict. In this context, applying a lower speed limit for heavy vehicles on the range section would not meet the criteria.
- As well as reviewing speed limits, TMR has actively monitored actual vehicle speeds in response to community concerns about trucks speeding on parts of the road. At all monitoring sites it was shown that heavy truck and trailer (truck and dog) combinations showed the highest level of compliance with posted speed limits, while the poorest compliance was demonstrated by light passenger vehicles.

- The existing road demonstrates a reasonable level of service in terms of safety, ability for vehicles to interact and to carry the current volume and composition of traffic. The existing timber bridges have been assessed and have been deemed structurally sound to handle the loads they currently carry.
- The road environment on Kin Kin Road (particularly on the range) consists of sections with limited sight distances and pavement width, tight curves, and adjacent steep slopes. Despite these limitations, the terrain and feel of the roadway is consistent throughout and the transition between tighter and more open sections is gradual. This means drivers can appreciate the more challenging conditions and are at a heightened sense of awareness, compared to what they might be on a more open rural road or an unexpected piece of lesser standard geometry.
- Reported traffic crashes on Kin Kin Road from Chainage 25.78km to 54.65km have not increased over the last decade, despite an increase in overall traffic volumes and an increase in percentage of heavy vehicles. Nearly all the crashes involved light vehicles only, with over half the crashes being single vehicle crashes. A truck was involved in only one reported crash between January 2010 and June 2021. Police reports indicated that on this occasion the truck driver was not at fault.
- Kin Kin Road has been analysed as having less safety risk than sections of Woombye – Montville Road, Brisbane – Woodford Road and Eumundi – Kenilworth Road which have similar rural type cross sections and traffic characteristics within the NCR.
- A review of research papers and reports was undertaken to identify if there are characteristics of Kin Kin Road that would be more likely to increase the crash risk. It was found that the major factors for truck crashes on roads in general are poorly maintained roads, too narrow roads, and unsealed or only partially sealed shoulders. While some sections of the Kin Kin Road have some of these characteristics, only one crash involving a truck has been recorded since 2010.
- A review of current-day standards concluded that if the road was to be constructed today, the targeted sealed pavement widths would be significantly wider than those on the existing road (and in particular for the section between the Noosa Shire Council (NSC) boundary and Greenridge-Pinbarren Road). While existing sealed pavement widths do not meet ideal current-day standards, when the sealed and unsealed (trafficable) width is taken into account, the road shows greater capability.
- The *Holland Report 2010* compares the road characteristics of the existing Kin Kin Road to the current-day standards for new/greenfield roads and then draws conclusions without consideration of whether the shortfalls correlate to an unacceptable level of risk. It is not appropriate or feasible to compare the current standards for greenfield site projects (new and without constraints) to the standards which Kin Kin Road was originally constructed.
- TMR undertakes routine maintenance in an endeavour to ensure that the level of service of Kin Kin Road is maintained. In addition, several other projects have been carried out in recent years to address signage, line marking, delineation, and vegetation management. A major upgrade was carried out over the range section in 2012 to widen the pavement over the top of the range. A further project is currently underway to widen pavement on the northern approach to the range, and replacement of the existing single-lane bridge over Six Mile Creek has begun. Funding has also been allocated for survey, design, and investigation for two more sections on approach to the range.
- Legislatively, TMR does have powers to impose restrictions on access to certain types of vehicles. These powers are only used in extreme circumstances, such as post flooding or extreme wet weather to protect the integrity of road infrastructure and ensure the safety of road users. The legislation allows for roads to be temporarily closed to all traffic, closed to a particular class of traffic, or with restricted road limits (typically only for long enough to affect repairs). Any application of these restrictions must apply to all vehicles of a similar class, so could not be applied to quarry trucks only. The quarry has been in operation for many years under an approved Development Permit. TMR does not have the ability to stop or unreasonably restrict their operations.
- To address concerns of increased haulage activities on roads such as Kin Kin Road, TMR has imposed additional requirements on TMR contractors carrying out TMR works to consider the impact

that increased haul activities will have on the road network. Contractors must undertake a haul route assessment for the supply chain for major material movements to and from site for the project. An assessment will be undertaken for any haul routes on road infrastructure with AADT < 10,000. The assessment shall include, but not be limited to: details for the haul traffic volume on these roads; safety of all road user groups; impacts to residents along the route, and additional maintenance regime.

- As part of its Development Permit, the quarry at Kin Kin has a Traffic Management Plan (TMP) in place which outlines the management procedures and practices and special conditions regarding heavy vehicle movements into and out of the quarry and along public roads. Among other things, the TMP covers issues such as staging intervals of loads leaving the quarry, reduced speed and increased care on the range, drivers not overtaking other vehicles, strict adherence to operating hours and protocols around interactions with the school bus.
- In TMR's stewardship role for all of its road infrastructure across Queensland, compromises have to be made between what is desired and what is a practicable outcome in terms of cost, safety, driver expectation, economic drivers, environmental impacts, and social issues. Judgements must be made on the value of improving the standard of a road and the impact this might have on the ability to make improvements elsewhere on the road system. These judgements are usually made based on the level of safety of the road in question and the Benefit Cost Ratio (BCR) resulting from the proposed improvements.

10.3 Recommendations

Even though the road does not show an adverse crash history and displays a reasonable level of service in terms of safety, ability for vehicles to interact with each other and ability to carry the current traffic volumes and composition, TMR actively continues to monitor the performance and make improvements on Kin Kin Road. Pavement condition is routinely monitored, and regular inspections and routine maintenance carried out to identify and repair any safety issues. A road widening project is currently underway between Williams Road and Turnbull Road, and replacement of the Six Mile Creek Bridge has commenced. Funding has also been allocated to investigate two future widening and strengthening projects on two further sections on the Kin Kin Range.

TMR will continue to plan and program future projects to upgrade Kin Kin Road where and when possible, balanced with statewide needs on the wider road network and available funding. Apart from the projects already mentioned in this report, no additional sections of the road have been identified that warrant immediate intervention at this time. TMR North Coast Region (NCR) will also continue to work with its maintenance contractor in responding to the maintenance needs of Kin Kin Road in a timely manner and in line with the prescribed maintenance intervention levels.

TMR will install special use warning signs at strategic locations along Kin Kin Road to reinforce the prevailing roads conditions to road users, and will continue to work with Noosa Shire Council (NSC), the Queensland Police Service (QPS), Members of Parliament, and other key stakeholders regarding community concerns and coordinated approaches for the management of Kin Kin Road.

Annexures

Annexure A – Traffic count data

Annexure B – Speed limit review

Annexure C – Geometric assessment

Annexure D – Road crash data

Annexure E – Literature review

Annexure F – Holland Report 2010

Annexure G – Professor Rod Troutbeck's Independent review of the TMR Engineering Review of Kin Kin Road

Annexure A
Traffic Count Data for 2010, 2016, 2019, 2020

Kin Kin Road (141)

Kin Kin Road (141) Engineering Review

November 2022

Queensland Government

141 Kin Kin Road Road 141

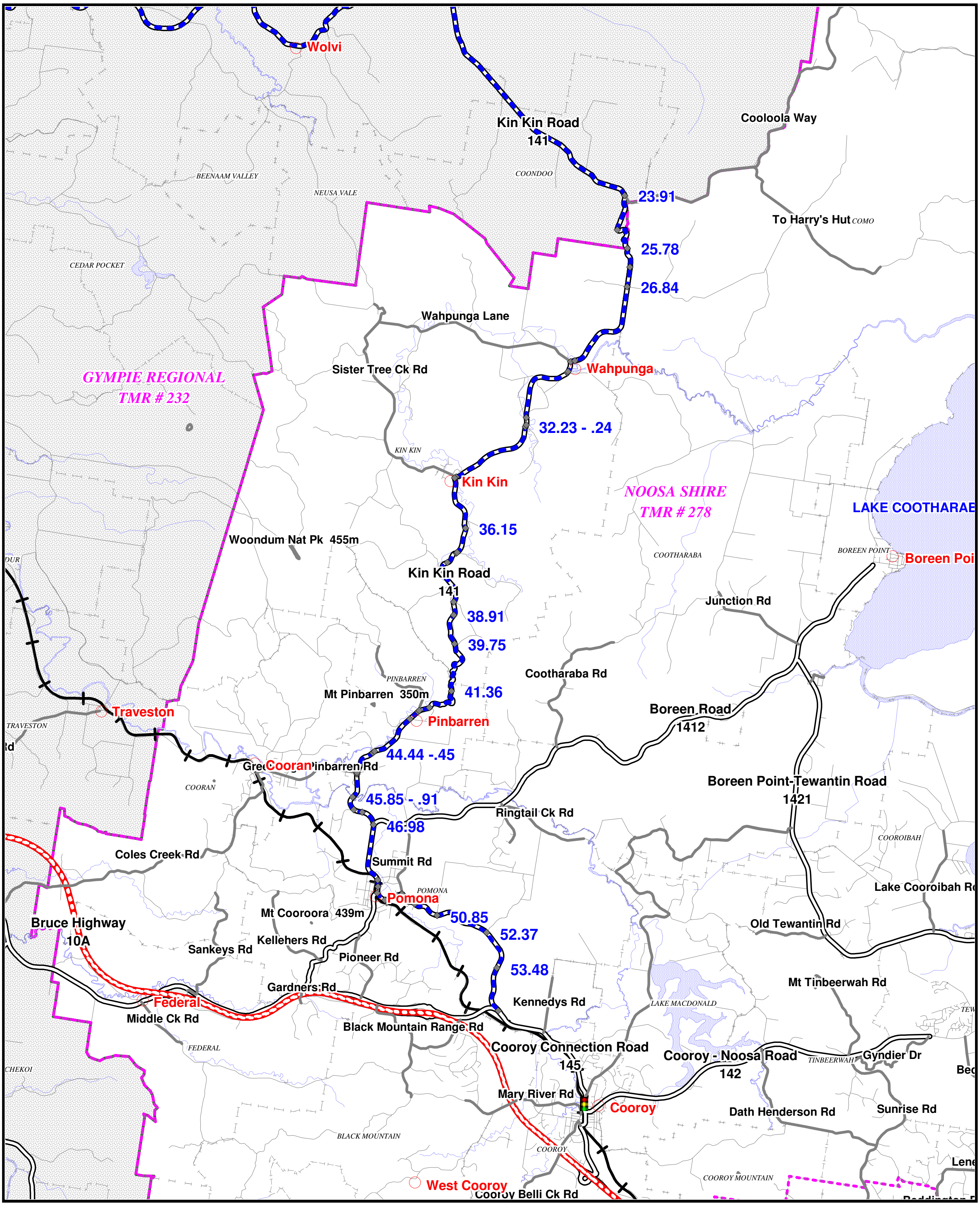
Road 141
Maintenance Network 2
Ch 25.78 - 54.65 km (Sunshine Coast RC)
Work by : Downer EDI Works

Town Name

SUBURB NAME

N W E S

Road Locality Map



NC Traffic and Speed Census 2016

Queensland Government

Kin Kin Road Road 141

Kin Kin Rd

Speed Zone	Speed Sign Dist
	60 39.81
60	39.62
	60 Ah 35.53
100	60 35.16
60	100 34.40
60 Ah	34.20

Description	Chainage	AADT	% HV	% Gth	Intersection Number	Structure ID	RP Number
Williams Rd	39.75				14851		
Culvert	39.20					25311	
Culvert	39.00					11709	
Kin Kin Ck Western Branch, Paynes Bridge	38.91					1235	6
Moffat Rd	38.54				14846		
Culvert	38.22					18555	
Western Branch Rd	37.26				10309		
Eastern Branch Rd	36.90				10302		
Kin Kin Ck No3 One Lane	36.89-.91					845	
Gaz must Give Way	36.87						
Murrays Rd	36.15				10294		
Main St KIN KIN	34.73	829	8	2	10286		
AGaz must Give Way	34.70						
Kin Kin Ck One Lane	34.67-.70					844	
Access Rd	34.60						
Access Rds & Dam on left	32.53						
un-named Access Rd	32.46				14842		
Wahpunga Ck Culvert	32.23-.24					1234	
Sheppersons Lane - Living Valley Springs	32.14				10279		
Paulsens Rd / Bunneys La	31.95				10271		
Dr Pages Rd to Boreen Pt	29.98				10264		
Yellow Gully One Lane	29.94-.96					843	
Gaz must Give Way	29.92						
Park Access	29.78						
Wahpunga Lane - The Gap 13 >>	29.68				10256		
AGaz must Give Way	29.58						
Kin Kin Ck One Lane	29.55-.58					841	5
Culvert	29.07						
Culvert	27.89						
End of long straight							
Bates Rd / Buckley Rd	26.84				10248		
End of Gravel & minor culvert	26.32						
Gympie RC - Sunshine Coast RC Boundary	25.78						4
Dogrell Tree Rd	24.91				10240		
NUNAN Range (after Mary J Nunan, Year 1878)							
McRae Rd to Cooloola Way - Tarangau	23.91	255	15	4	10232		
& Cooloola Way - to Harry's Hut	23.91				10232		

Gaz

All AADT, %HV, %Gth values apply up the page, survey style.

Kin Kin Road Road 141

Kin Kin Rd / Pound Rd / Factory St / Hill St / Yurol Forest Dr

Speed Zone	Speed Sign	Dist	Description	Chainage	AADT	% HV	% Gth	Intersection Number	Structure ID	RP Number
	Gaz		Rd 145 COOROY CONNECTION ROAD	54.65				11564		9A
			Straight to Rd 145 (Sharp right to Rd 141 'T' end)	54.62				15889		
80		54.51								
	100	54.45								
			Access track	54.26						
			Nursery Rd / Gravel Rd	53.48				10407		
			Porters Rd	52.36 (A52.53)				10391		
			Gravel Rd	51.37 (A52.42)				10399		
			Kidd Rd	50.85				14868		
100	80	50.18	Yurol Forest Drive // Service Rd	50.16				10383		
								2471		
80	60	49.84	Songbird Drive	49.81				16025		
			Summit Rd	49.70	4,282	9	1	10376		
			Ambulance St	49.49				10369		
			Cooroora Ck	49.27-.29					847	
60		48.95	To Subway (Railway underpass)	49.12				10362		
			Rd 1403 POMONA CONNECTION Rd (Reserve St)	48.90				1186		8
			Mill St	48.70				10354		
60	90	48.50	Exhibition St (Showgrounds)	48.52				10347		
60Ah		48.15	POMONA							
90		47.10								
			Rd 1412 BOREEN ROAD (Louis Basso Dr)	46.98	4,600	6	2	1221		7
	90	46.80								
			Green Acres Lane	46.35				15768		
			Bellbird Flat Rd	46.20				10339		
			Agaz must Give Way	45.95						
			Six Mile Ck One Lane	45.85-.91					846	
			Mountain View Rd	45.21				10331		
			Green Ridge Pinbarren Rd (COORAN 3 >>)	45.17	4,310	7	3	10323		
			Water Course (minor)	44.44-.45					1236	
			Binalong Rd	44.38				14864		
			Camphor Rd #2	43.66						
			Access Road - Mt Pinbarren	43.26						
			Camphor Rd #1	43.04				14860		
	60Ah	42.91								
			Jack Browne Bdg Culvert	42.72					11705	
			Upper Pinbarren Ck Rd	42.67				10315		
90 (60)		42.62								
	60	42.54								
			Sallwood Crt	42.43				16000		
60	60	41.45								
			Turnbull Rd - Crest of Kin Kin Range	41.36				14856		
60	60	40.32								
			Culvert	40.17					11707	
			Access Rd	40.12						
	End 60	39.81								
			Williams Rd	39.75				14851		
60		39.62								

All AADT, %HV, %Gth values apply up the page, survey style.

Queensland Government

141 **Kin Kin Road** **Road 141**

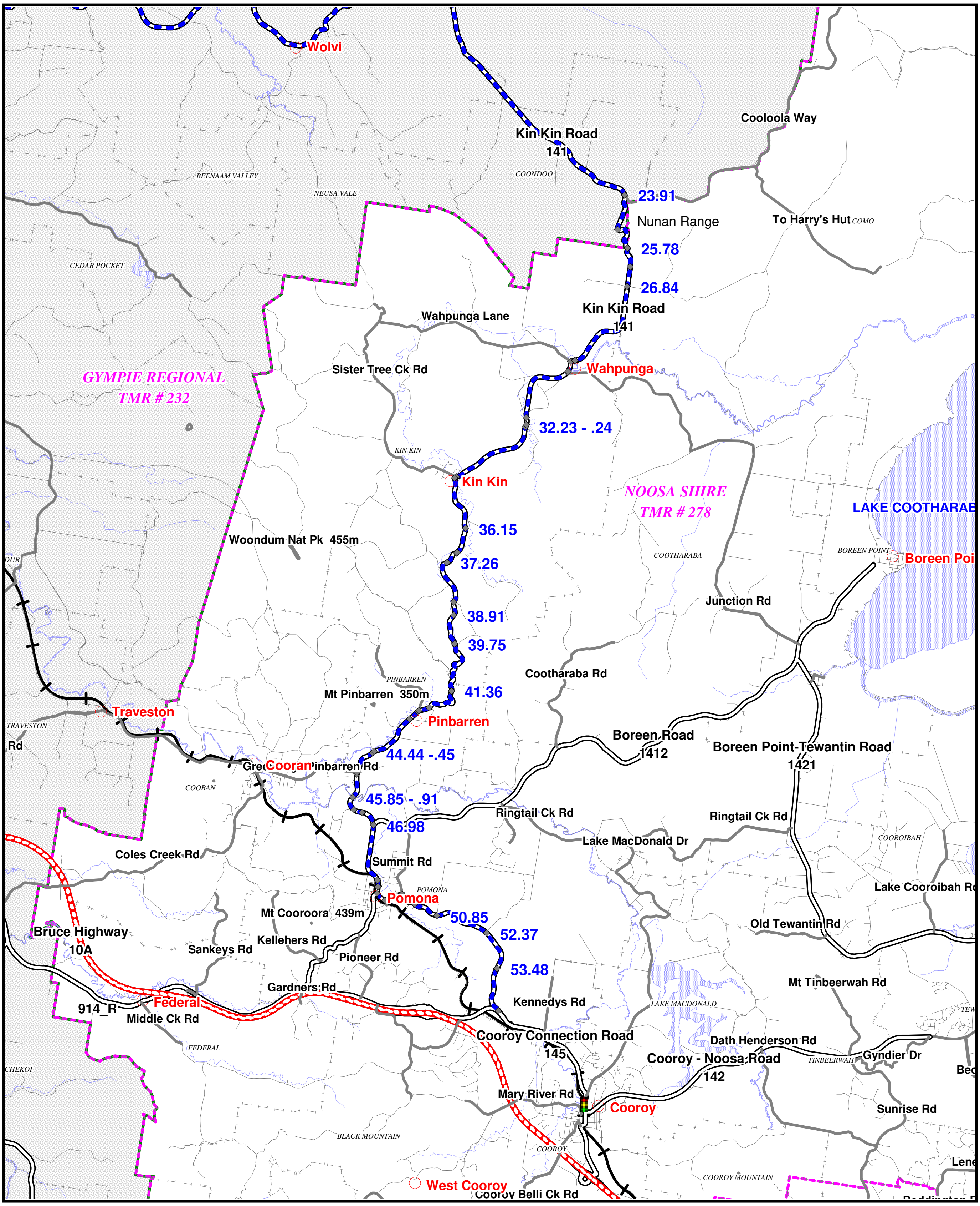
Road 141
Maintenance Network 2
Ch 25.78 - 54.65 km (Sunshine Coast RC)
Work by : Downer EDI Works

Town Name

SUBURB NAME

N W E S

Road Locality Map



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Queensland Government

Kin Kin Road Road 141

Kin Kin Rd / Pound Rd / Factory St / Hill St / Yurol Forest Dr

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100	51.89								
		Gravel Rd	51.37 (A52.42)				10399		
		Kidd Rd	50.85				14868		
100	80 50.18	Yurol Forest Drive // Service Rd	50.16				10383		
80	80						2471		
80	60 49.84	Songbird Drive	49.81				16025		
		Summit Rd	49.70	3,809	7	-3.23 (2018)	10376		
		Ambulance St	49.49				10369		
		Cooroora Ck	49.27-.29					847	
60	60								
60	48.95	To Subway (Railway underpass)	49.12				10362		
		Rd 1403 4POMONA CONNECTION Rd (Reserve St)	48.90				1186		8
		Mill St	48.70				10354		
60	90 48.50	Exhibition St (Showgrounds)	48.52				10347		
90									
60Ah	48.15	POMONA							
90	47.10								
		Rd 1412 BOREEN ROAD (Louis Basso Dr)	46.98	4,434	7.89	0.49	1221		7
	90 46.80								
		Green Acres Lane	46.35				15768		
		Bellbird Flat Rd	46.20				10339		
		Agaz must Give Way	45.95						
		Six Mile Ck One Lane	45.85-.91					846	
90	90	Mountain View Rd	45.21				10331		
		Green Ridge Pinbarren Rd (COORAN 3 >>)	45.17	4,214	6	1.92 (2018)	10323		
		Water Course (minor)	44.44-.45					1236	
		Binalong Rd	44.38				14864		
		Camphor Rd #2	43.66						
		Access Road - Mt Pinbarren	43.26						
		Camphor Rd #1	43.04				14860		
	60Ah 42.91								
		Jack Browne Bdg Culvert	42.72					11705	
		Upper Pinbarren Ck Rd	42.67				10315		
90	42.62								
	60 42.54								
		Sallwood Crt	42.43				16000		
60	60 60 41.45								
60		Turnbull Rd - Crest of Kin Kin Range	41.36				14856		
60	60 40.32								
	60	Culvert	40.17					11707	
		Access Rd	40.12						
60	End 60 39.81								
		Williams Rd	39.75				14851		
60 Gaz	39.62								
		Culvert	39.20						

All AADT, %HV, %Gth values apply up the page, survey style.

Queensland Government

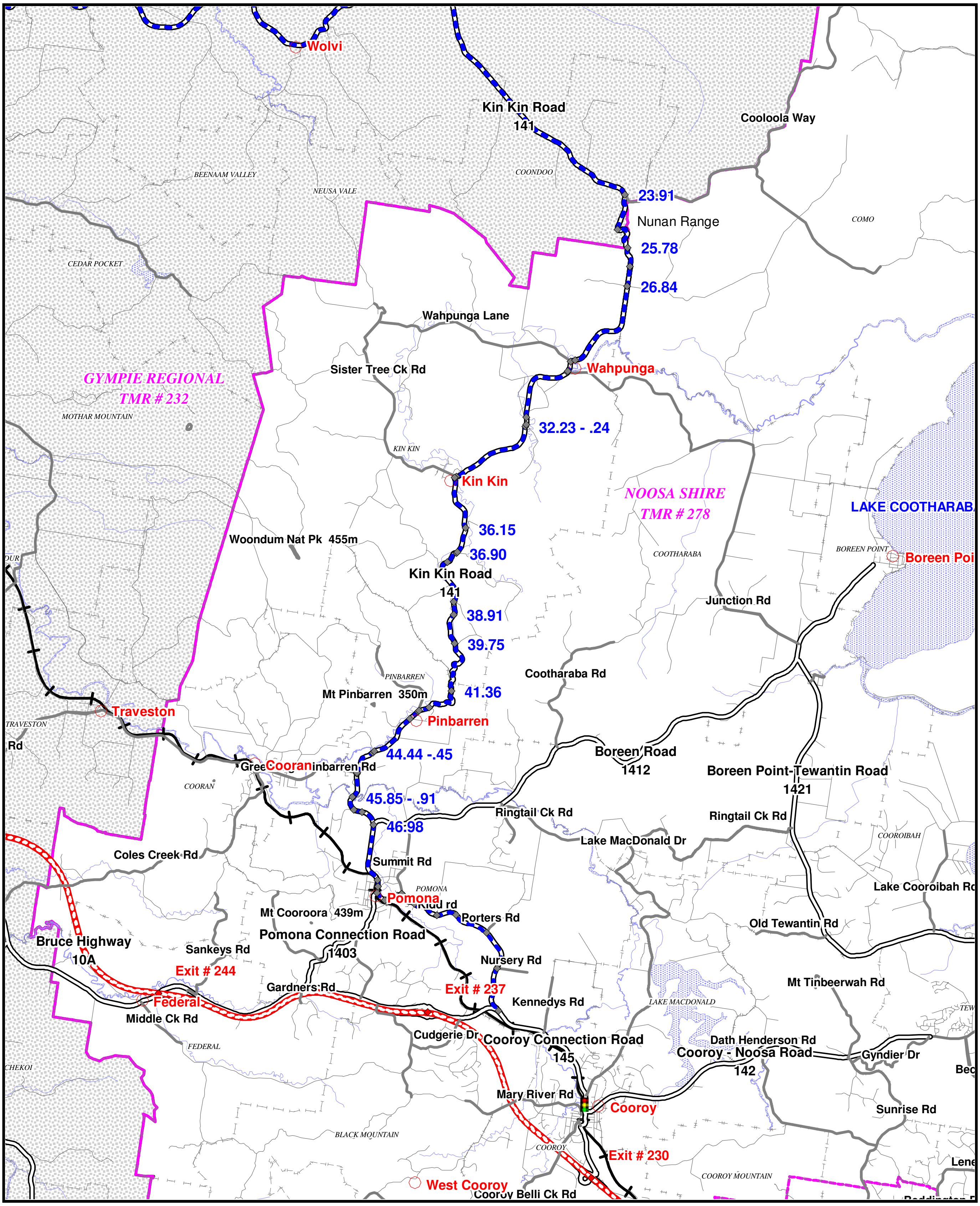
141 Kin Kin Road Road 141

Road 141
Maintenance Network 2
Ch 25.78 - 54.65 km (Sunshine Coast RC)
Work by : Downer EDI Works

Town Name

SUBURB NAME

Road Locality Map



NC Traffic and Speed Census 2020

Queensland Government

Kin Kin Road Road 141

Kin Kin Rd

Speed Zone	Speed Sign	Dist
60	A-Gaz 70	39.84
60		39.67
	70	39.42
60 Ah		39.25
	60 Ah	35.53
70	60	35.16
60	80	34.41
60 Ah		34.20
80	80	
	80	33.09
80		32.37
80	90	31.59
	90	31.34
90	90	29.06
90	End 90	26.70
90		26.40

Description	Chainage	AADT	% HV	% Gth	Intersection Number	Structure ID	RP Number
Culvert	39.86					17612	
Williams Rd	39.75				14851		
Culvert	39.20					25311	
Culvert	39.00					11709	
Kin Kin Ck Western Branch, Paynes Bridge	38.91					1235	6
Moffat Rd	38.54				14846		
Culvert	38.22					18555	
Western Branch Rd	37.26				10309		
Eastern Branch Rd	36.90				10302		
Kin Kin Ck No3 One Lane	36.89-.91					845	
Gaz SB must Give Way	36.87						
Murrays Rd	36.15				10294		
Main St KIN KIN	34.73	864	12.73	0.00 (2020)	10286		
AGaz NB must Give Way	34.70						
Kin Kin Ck One Lane	34.67-.70					844	
Access Rd	34.60						
Access Rds & Dam on left	32.53						
un-named Access Rd	32.46				14842		
Wahpunga Ck Culvert	32.23-.24					1234	
Sheppersons Lane - Living Valley Springs	32.14				10279		
Paulsens Rd / Bunneys La	31.95				10271		
Dr Pages Rd to Boreen Pt	29.98				10264		
Yellow Gully One Lane	29.94-.96					843	
Gaz SB must Give Way	29.92						
Park Access	29.78						
Wahpunga Lane - The Gap 13 >>	29.68				10256		
AGaz must Give Way	29.58						
Kin Kin Ck One Lane	29.55-.58					841	5
Culvert	29.07						
Culvert	27.89						
End of long straight							
Bates Rd / Buckley Rd	26.84				10248		
End of Gravel & minor culvert	26.32						
Gympie RC - Noosa Council Boundary	25.78	307	13.68	2.50 (2020)			4
Dogrell Tree Rd	24.91				10240		
NUNAN Range (after Mary J Nunan, Year 1878)							
McRae Rd to Cooloola Way - Tarangau	23.91	265	13.58	2.71 (2020)	10232		
& Cooloola Way - to Harry's Hut	23.91						

100 100

Gaz

All AADT, %HV, %Gth values apply up the page, survey style.

Queensland Government

Kin Kin Road Road 141

Kin Kin Rd / Pound Rd / Factory St / Hill St / Yurol Forest Dr

Speed Zone	Speed Sign Dist	Description	Chainage	AADT	% HV	% Gth	Intersection Number	Structure ID	RP Number
	Gaz	Rd 145 COOROY CONNECTION ROAD	54.65				11564		9A
		Straight to Rd 145 (Sharp right to Rd 141 'T' end)	54.62				15889		
80	54.51								
	100 54.45								
		Forestry Access track	54.26						
		Nursery Rd / Gravel Rd	54.47 (A53.48)				10407		
		Tracks	52.71						
		Porters Rd	52.36 (A52.53)				10391		
100	51.89								
		Gravel Rd	51.37 (A52.42)				10399		
		Kidd Rd	50.85				14868		
	60 Ahead 50.57								
End 60	60 50.18	Yurol Forest Drive // Service Rd	50.16				10383		
							2471		
		Songbird Drive	49.81				16025		
		Summit Rd	49.70	3,830	8.85	0.55 (2020)	10376		
		Ambulance St	49.49				10369		
		Cooroora Ck	49.27-.29					847	
60	48.95	To Subway (Railway underpass)	49.12				10362		
		Rd 1403 POMONA CONNECTION Rd (Reserve St)	48.90				1186		8
		Mill St	48.70				10354		
		Exhibition St (Showgrounds)	48.52				10347		
60	80 48.50								
60Ah	80 48.15	POMONA							
80	47.12								
		Rd 1412 BOREEN ROAD (Louis Basso Dr)	46.98	4,610	7.20	3.96 (2020)	1221		7
	80 46.80								
		Green Acres Lane	46.35				15768		
		Bellbird Flat Rd	46.20				10339		
		Agaz NB must Give Way	45.95						
		Six Mile Ck One Lane	45.85-.91					846	
80	45.35								
		Mountain View Rd	45.21				10331		
		Green Ridge Pinbarren Rd (COORAN 3 >>)	45.17	4,035	8.48	0.00 (2020)	10323		
	80 45.10								
		Water Course (minor)	44.44-.45					1236	
		Binalong Rd	44.38				14864		
		Camphor Rd #2	43.66						
	80 43.50								
		Access Road - Mt Pinbarren	43.26						
		Camphor Rd #1	43.04				14860		
	60Ah 42.98								
80	42.83	Jack Browne Bdg Culvert	42.72					11705	
		Upper Pinbarren Ck Rd	42.67				10315		
80	42.66								
	60 42.60								
		Sallwood Crt	42.43				16000		
60	60 41.45								
		Turnbull Rd - Crest of Kin Kin Range	41.36				14856		
60	60 40.32								
		Culvert	40.17					11707	
		Access Rd	40.12						
		Culvert	39.86					17612	
	70 39.84								
		Williams Rd	39.75				14851		
60	39.67								
Gaz	70 39.42								

All AADT, %HV, %Gth values apply up the page, survey style.

Queensland Government

Annexure B
Road Speed Data

Kin Kin Road (141)
Kin Kin Road (141) Engineering Review
November 2022

Queensland Government

Pomona Kin Kin Rd - Speed Surveys
0600-1800 Tues 20th July 2021

Annexure B - Kin Kin Road Speed Data (both directions)

Location	Chainage	Class	No. Vehicles	Mean Speed	UL 15km/h pace	% in pace	Vehicles in pace	Number of Class 7-12 in pace	% of total vehicles in pace that are Class 7-12	% of Class 7-12 travelling within pace	% of Class 7-12 compared to total traffic
395m South of Williams Rd	40.15	All	16280	55	62	73	11824	503	4.3%	56%	5.5%
		7-12	901	47	54	88	791				
550m South of Williams Rd	40.3	All	16250	55	63	74	12005	281	2.3%	32%	5.4%
		7-12	878	46	55	85	748				
1010m North of Sallwood Ct	41.415	All	16434	56	63	71	11682	417	3.6%	48%	5.3%
		7-12	864	47	55	85	732				
840m North of Sallwood Ct	41.58	All	16365	49	57	78	12833	442	3.4%	53%	5.1%
		7-12	830	43	50	84	695				
620m North of Sallwood Ct	41.8	All	16277	52	60	80	13031	424	3.3%	58%	4.5%
		7-12	728	46	54	89	651				
520m North Sallwood Ct	41.9	All	15274	50	58	81	12444	513	4.1%	71%	4.7%
		7-12	721	45	52	93	672				
All Vehicle Average				53	61	76					
Class 7-12 Average				46	53	87					

Annexure B - Kin Kin Road Speed Data (northbound)

Location	Chainage	Class	No. Vehicles	Mean Speed	All vehicles 15km/h pace	% of All Vehicles in pace	Total Vehicles in pace	Number of Class 7-8 in pace	% of total vehicles in pace that are Class 7-8	% of Class 7-8 travelling within pace	% of class 7-8 compared to total traffic	Number of Class 9-12 in pace	% of total vehicles in pace that are Class 9-12	% of Class 9-12 travelling within pace	% of class 9-12 compared to total traffic
395m South of Williams Rd	40.15	All	7938	53	46-61	76	6031	12	0.2	50.0	0.3	229	3.8	57	5.1
		7-8	24	46											
		9-12	405	47											
550m South of Williams Rd	40.3	All	7952	55	48-63	75	5962	14	0.2	48.3	0.4	191	3.2	47	5.1
		7-8	29	48											
		9-12	405	47											
1010m North of Sallwood Ct	41.415	All	8207	55	48-63	73	6025	5	0.1	31.3	0.2	198	3.3	48	5.0
		7-8	16	44											
		9-12	411	47											
840m North of Sallwood Ct	41.58	All	8176	51	44-59	79	6476	18	0.3	51.4	0.4	281	4.3	70	4.9
		7-8	35	44											
		9-12	399	45											
620m North of Sallwood Ct	41.8	All	8145	53	45-60	78	6371	11	0.2	40.7	0.3	279	4.4	70	4.9
		7-8	27	45											
		9-12	400	47											
520m North Sallwood Ct	41.9	All	7645	49	42-57	83	6380	26	0.4	65.0	0.5	233	3.7	82	3.7
		7-8	40	43											
		9-12	285	45											

Annexure B - Kin Kin Road Speed Data (southbound)

Location	Chainage	Class	No. Vehicles	Mean Speed	All vehicles 15km/h pace	% of All Vehicles in pace	Total Vehicles in pace	Number of Class 7-8 in pace	% of total vehicles in pace that are Class 7-8	% of Class 7-8 travelling within pace	% of class 7-8 compared to total traffic	Number of Class 9-12 in pace	% of total vehicles in pace that are Class 9-12	% of Class 9-12 travelling within pace	% of class 9-12 compared to total traffic
395m South of Williams Rd	40.15	All	8344	56	49-64	72	5991	20	0.3	55.6	0.4	190	3.2	44	5.2
		7-8	36	49											
		9-12	436	48											
550m South of Williams Rd	40.3	All	8298	55	48-63	73	6043	16	0.3	50.0	0.4	60	1.0	15	5.0
		7-8	32	47											
		9-12	412	45											
1010m North of Sallwood Ct	41.415	All	8227	56	49-64	69	5686	18	0.3	52.9	0.4	162	2.8	40	4.9
		7-8	34	51											
		9-12	403	48											
840m North of Sallwood Ct	41.58	All	8189	47	40-55	84	6863	9	0.1	45.0	0.2	177	2.6	47	4.6
		7-8	20	38											
		9-12	376	40											
620m North of Sallwood Ct	41.8	All	8132	52	44-59	82	6666	29	0.4	76.3	0.5	126	1.9	48	3.2
		7-8	38	47											
		9-12	263	44											
520m North Sallwood Ct	41.9	All	7629	52	44-59	83	6297	35	0.6	63.6	0.7	205	3.3	60	4.5
		7-8	55	46											
		9-12	341	45											

Annexure C

Geometric Swept Path Assessment

Kin Kin Road (141)

Kin Kin Road (141) Engineering Review

November 2022

Queensland Government

Kin Kin Rd - 19m Semi-trailer and Truck and Dog Swept Path Assessment

(white)	**Yes - Meets Standard**
(orange)	**Technically Non-compliant.** Swept path is achievable but does not meet 0.5m offset to edge of pavement and 1.0m to oncoming vehicle required by Austroads, meaning there is very-little to no margin for error.
(red)	**Non-Compliant.** Does not meet standards and a car must manoeuvre off the edge of the sealed lane to avoid hitting an oncoming truck.

95 total CURVES assessed — *S = Straight - not assessed*

Corner	CH Start (Direction of Gazettal)	Curve Radius	Left or Right (in direction of Gazettal)	Previous Posted Speed	New Posted Speed (See General Note 4.)	Previous Advisory Speed	Max Achievable Speed (Truck and Dog/19m Semi)	Speed Analysis: New Proposed / Current Posted Speed Adequate for curve size?	Speed Analysis: Advisory Speed Adequate for curve size?	Road Width Analysis: Road Sealed width adequate as per AustRoads Heavy Vehicle Guidelines? (See General Note 1 & 2.)	Road Width Analysis: Curve Widening Required As Per Austroads guidelines	Road Width Analysis: Curve Widening Achieved? (See General Note 3.)	Swept Path Analysis: Swept Path Adequate?	At Speed condition:	Will lowering the advisory speed make the swept path compliant for the assessed vehicles? (See General Note 5.)	Comments
Side Road Name	(km)	(m)	(L or R)	(km/h)	(km/h)	km/h	(km/h)	(Y/N)	(Y/N)	(Y/N)	(m)	(Y/TN/N)	(Y/TN/N)	(km/h)	(Y/N)	
START OF SEALED ROAD	26.300	*Straight*														
	28.049	245	R	100	90	80	80	No	Yes	No	0.3	No	TN	At Advisory Speed	No	Sub-standard sealed road width for heavy vehicles. Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	28.468	305	L	100	90	80	80	No	Yes	No	0.2	No	TN	""	No	""
	29.337	300	R	100	90	80	80	No	Yes	No	0.2	No	TN	""	No	""
Bridge - Kin Kin Ck No. 1	29.497	*S*														
Wahpunga lane (CH 29.68)	29.657	80	L	100	90	50	50	No	Yes	No	0.6	No	No	At and Below Advisory Speed	No	Southbound semi tracks off pavement. Lane widths inadequate. Insufficient clearnace to vehicle waiting at Giveway line at Chainage 29.587.
	29.817	280	R	100	90	50	70	No	Yes	No	0.2	No	TN	""	No	Sub-standard sealed road width for heavy vehicles. Does not meet 0.5m clearance requirements to CL or Edge of Pavement
Bridge - Yellow Gully. One lane	29.917	*S*														
Dr Pages Road (CH 29.98)	29.997	130	R	100	90	60	55	No	No	No	0.55	No	TN	As Above	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	30.256	300	R	100	90	80	80	No	Yes	No	0.2	No	TN	""	No	""
	30.776	250	L	100	90	80	80	No	Yes	No	0.3	No	TN	""	No	""
	30.936	300	L	100	90	80	85	No	Yes	No	0.2	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement. Curve located on vertical crest.
	31.925	300	L	100	80	90	80	Yes	No	No	0.2	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	32.034	320	R	100	80		80	Yes	Yes	No	0.2	No	TN	""	No	""
	32.124	250	L	100	80	80	80	Yes	Yes	No	0.3	No	TN	""	No	""
Sheppersons Lane (Quarry)	32.140	*S*														
	32.514	360	R	100	80	90	80	Yes	No	No	0.1	No	TN	""	No	""
	32.844	380	R	100	80	90	80	Yes	No	No	0.1	No	TN	""	No	""
	33.982	700	R	100	80	90	90	Yes	Yes	No		No	TN	""	No	""
	34.412	600	L	60	60		60	Yes	Yes	No	0.1	No	TN	""	No	""
	34.562	300	R	60	60		60	Yes	Yes	No	0.2	No	TN	""	No	""
Narrow bridge	34.662	*S*														Insufficient clearnace to vehicle waiting at Giveway line at Chainage 29.587.
Main Street Kin Kin	34.722	45	L	60	60	40	41	No	Yes	No	1.0+ wide painted median provided	TN	TN	""	No	minimum radius of 50 for trucks not met. Total lane an dshoulwidths provided are 4.5 & 5.0m
	35.381	150	L	100	70	70	60	No	No	No	0.45	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	35.791	250	R	100	70	80	70	Yes	No	No	0.3	No	TN	""	No	Northbound lane achieves 3.5m width, southbound 2.9m. Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	36.100	115	L	100	70	50	55	No	Yes	No	0.65	No	TN	""	No	Reverse curve located on uphill grade (southbound)
Murrays Road (CH 36.15)	36.200	100	R	100	70	60	55	No	No	No	0.7	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement. HOV crosses centerline departure of second curve.
	36.750	300	R	100	70		70	Yes	Yes	No	0.2	No	TN	""	No	
Kin Kin Creek Bridge No. 3	36.879	*S*														Insufficient clearnace to vehicle waiting to giveway at Chainage 36.906.
Eastern Branch Rd (CH 36.90)	36.919	65	R	100	70	40	40	No	Yes	No	1+	No	No	""	No	Reverse curve located on uphill grade (southbound). Northbound semi tracks off pavement.
	36.979	75	L	100	70	40	50	No	Yes	No	1	No	No	""	No	southbound semi tracks off pavement. Lane widths inadequate.
	37.219	110	R	100	70	60	55	No	No	No	0.65	No	No	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
Western Branch Rd	37.289	*S*														
	37.409	105	L	100	70	50	55	No	Yes	No	0.7	No	No	""	No	Northbound Semi tracks over centrline. Southbound semi tracks off pavement. Lane widths inadequate.
START OF RANGE	**37.800**	*S*														
"Road Narrows"	37.888	*S*														
I	38.168	200	R	100	70	70	80	Yes	Yes	No	0.3	No	No	At and Below	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
I	38.428	125	R	100	70	70	64	No	No	TN	0.6	No	TN	Achievable Speed	No	""
I	38.558	95	L	100	70	60	70	Yes	Yes	No	0.55	No	No	""	No	""
I	38.828	100	R	100	70	60	55	No	No	No	0.75	No	TN	""	No	""
I	39.117	140	L	100	70	60	60	No	Yes	No	0.7	No	TN	""	No	""
I	39.397	120	R	100	70	60	65	No	Yes	No	0.5	No	TN	""	No	
I	39.447	100	L	100	70	60	60	No	Yes	No	0.6	No	No	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
I	39.687	175	R	60	70	60	75	Yes	Yes	No	0.4	No	TN	""	No	""
Williams Rd (CH 39.727)	39.727	*S*														
I	39.926	55	L	60	80	50	45	No	No	No	1+	No	No	""	No	Wheel path of 19m Semi exceeds sealed width or crosses into oncoming lane
I	39.986	55	R	60	80	50	45	No	No	TN	1+	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
I	40.056	100	L	60	80	40	55	No	Yes	No	0.8	No	TN	""	No	""
I	40.106	60	R	60	80	40	45	No	Yes	No	1+	No	No	""	No	Wheel path of 19m Semi exceeds sealed width or crosses into oncoming lane
I	40.236	50	R	60	80	30	43	No	Yes	No	1+	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
I	40.406	50	R	60	80	30	43	No	Yes	TN	1+	No	TN	""	No	""
I	40.506	40	L	60	80	30	38	No	Yes	No	1+	Yes	TN	""	No	""
I	40.616	50	R	60	80	30	43	No	Yes	No	1+	No	No	""	No	Wheel path of 19m Semi exceeds sealed width or crosses into oncoming lane
I	40.686	60	R	60	80	30	47	No	Yes	No	1+	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
I	40.756	20	L	60	80	30	27	No	No	No	1+	No	No	""	No	Crosses onto inside kerb
I	40.826	30	R	60	80	30	33	No	Yes	No	1+	No	No	""	No	Outside lane crosses into oncoming lane
I	40.895	40	L	60	80	30	38	No	Yes	No	1+	No	No	""	No	""
I	41.005	45	R	60	80	30	41	No	Yes	No	1+	No	No	""	No	""
I	41.085	30	L	60	80	30	33	No	Yes	No	1+	No	No	""	No	Inside lane crosses off pavement
I	41.135	30	R	60	80	30	33	No	Yes	No	1+	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
I	41.195	50	L	60	80	30	43	No	Yes	No	1+	No	TN	""	No	""
I	41.245	50	R	60	80	30	43	No	Yes	No	1+	No	No	""	No	Inside lane crosses off pavement
I	41.335	60	R	60	80	50	45	No	No	No	1+	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
I	41.515	30	L	60	80	30	38	No	Yes	No	1+	No	No	""	No	Inside lane crosses off pavement
I	41.625	50	R	60	80	40	42	No	Yes	No	1+	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
I	41.715	30	R	60	80	40	33	No	No	No	1+	No	No	""	No	Inside lane crosses off pavement
I	41.864	80	L	60	80	40	53	No	Yes	No	0.9	No	No	""	No	""

Queensland Government

Kin Kin Rd - 19m Semi-trailer and Truck and Dog Swept Path Assessment

(white)	**Yes - Meets Standard**
(orange)	**Technically Non-compliant.** Swept path is achievable but does not meet 0.5m offset to edge of pavement and 1.0m to oncoming vehicle required by Austroads, meaning there is very-little to no margin for error.
(red)	**Non-Compliance.** Does not meet standards and a car must manoeuvre off the edge of the sealed lane to avoid hitting an oncoming truck.

95 total CURVES assessed — *S = Straight - not assessed*

Corner	CH Start (Direction of Gazettal)	Curve Radius	Left or Right (in direction of Gazettal)	Previous Posted Speed	New Posted Speed (See General Note 4.)	Previous Advisory Speed	Max Achievable Speed (Truck and Dog/19m Semi)	Speed Analysis: New Proposed / Current Posted Speed Adequate for curve size?	Speed Analysis: Advisory Speed Adequate for curve size?	Road Width Analysis: Road Sealed width adequate as per AustRoads Heavy Vehicle Guidelines? (See General Note 1 & 2.)	Road Width Analysis: Curve Widening Required As Per Austroads guidelines	Road Width Analysis: Curve Widening Achieved? (See General Note 3.)	Swept Path Analysis: Swept Path Adequate?	Swept Path Analysis: At Speed condition:	Swept Path Analysis: Will lowering the advisory speed make the swept path compliant for the assessed vehicles? (See General Note 5.)	Comments
Side Road Name	(km)	(m)	(L or R)	(km/h)	(km/h)	km/h	(km/h)	(Y/N)	(Y/N)	(Y/N)	(m)	(Y/TN/N)	(Y/TN/N)	(km/h)	(Y/N)	
I	41.954	60	R	60	80	40	46	No	Yes	No	1+	No	No	""	No	""
I	42.034	60	L	60	80	50	47	No	No	No	1+	No	No	""	No	""
I	42.074	45	R	60	80	50	41	No	No	No	1+	No	No	""	No	""
V	42.264	80	L	60	80	50	41	No	No	No	0.9	No	No	""	No	""
Sallwood Court (End of Kin Kin Range)	42.424	120	R	60	80	50	53	No	Yes	No	0.5	No	Yes	""	No	Widening for intersection makes this curve compliant
	42.704	200	L	90	80	70	80	Yes	Yes	No	0.3	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	43.453	200	L	90	80	70	70	No	Yes	No	0.3	No	TN	""	No	Lane widths below 3.0m. Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	43.653	170	R	90	80	70	65	No	No	No	0.4	No	TN	""	No	Lane widths below 3.0m. Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	44.112	200	R	90	80	70	70	No	Yes	No	0.3	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
Binalong Road	44.372	250	L	90	80	70	70	No	Yes	No	0.3	No	TN	""	No	""
	44.572	150	R	90	80	70	60	No	No	No	0.45	No	TN	""	Yes	""
	44.751	180	L	90	80	70	65	No	No	No	0.4	No	TN	""	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
	44.961	300	R	90	80	70	70	No	Yes	No	0.2	No	TN	""	No	""
Green Ridge Pinbarren Rd (CH 45.17)			L													
Mountain View Rd (CH 45.21)	45.161	300		90	80	70	80	Yes	Yes	Yes	0.2	Yes	Yes	Posted	No	Widening for intersection makes this curve compliant
	45.681	170	R	90	80	70	65	No	No	No	0.4	No	TN	Advisory	No	Does not meet 0.5m clearance requirements to CL or Edge of Pavement
Six Mile Ck One-lane Bridge	45.85-91	*S*														
	46.060	150	L	90	80	60	60	No	Yes	Yes	0.45	No	Yes	""	No	Tracks over edge line, however maintains 0.5m clearance to sealed edge and centreline on both sides.
Green Acres Lane	46.350	250	L	90	80	70	80	Yes	Yes	Yes	0.3	No	Yes	Posted	No	Extra lane width for Green Acres Lane intersection
Boreen Rd/Kin Kin Rd (CH 46.98)	46.669	350	R	90	80	70	80	Yes	Yes	Yes	0.2	No	Yes	Posted	No	Lanes widened for intersection
	48.188	200	L	90	80	70	60	No	No	Yes	0.3	No	Yes	""	No	Has appropriate 9m formation. Appears to have negligible curve widening. Turn path stil compliant.
Exhibition Street (CH 48.52)	48.468	310	R	90/60	80	60	80	Yes	Yes	Yes	0.2	No	Yes	""	No	""
Pomona Connection Rd (1403)	48.900	110	L	60	60		60	Yes	Yes	Yes		No	TN		No	Width of lane not adequate to maintain 0.5m either side to right turn lane and fully mountable concrete drain.
Subway Avenue (CH 49.12)	49.177	40	L	60	60	40	35	No	No	TN	1+	No	No	""	No	Only just enough room to fit 19m Semi through the corner. There is no space to oncoming vehicles or the edge of sealed width on the inside of the corner.
Summit Road (CH 49.70)	49.676	40	R	60	60	30	30	No	Yes	No	1+	No	No	""	No	Exit of the corner has a safety envelope but marginally less than the required 0.5m. To avoid encroachment of the island on the inside of the turn, a 19m Semi must straddle the continuity line on the outside of the corner.
	49.886	150	L	60	60		60	Yes	Yes	Yes	0.45	Yes	Yes	Advisory	No	Curve widening limited for large vehicles, however 0.5m safety envelope is maintained.
	50.096	150	R	60	60		60	Yes	Yes	Yes	0.45	Yes	Yes	""	No	""
	50.256	150	L	100	100	70	60	No	No	Yes	0.45	Yes	Yes	""	No	"" Low speed achievable relative to 100km/h speed limit.
	50.456	160	R	100	100	70	70	No	Yes	Yes	0.4	Yes	Yes	""	No	Curve adequate for 19m Semi at advisory speeds.
	50.655	200	L	100	100	70	70	No	Yes	Yes	0.3	Yes	Yes	""	No	""
Kid Rd (CH 50.85)	50.885	220	L	100	100	70	80	No	Yes	Yes	0.3	No	Yes	Advisory	No	Curve widening limited for large vehicles, however 0.5m safety envelope is maintained.
	51.255	250	R	100	100	80	80	No	Yes	Yes	0.3	No	Yes	""	No	""
	51.604	260	L	100	100	80	80	No	Yes	Yes	0.3	Yes	Yes	""	No	Curve adequate for 19m Semi at advisory speeds.
	51.934	310	R	100	100		90	No	Yes	Yes	0.2	Yes	Yes	""	Yes	Curve adequate for 19m Semi below posted speed.
	52.294	530	R	100	100		100	Yes	Yes	Yes	0.1	Yes	Yes	""		Curve adequate
	53.123	300	R	100	100	90	90	No	Yes	Yes	0.2	Yes	Yes	""	No	Curve adequate at advisory speed
	53.762	430	L	100	100	90	100	Yes	Yes	Yes	0.2	Yes	Yes	""		Curve adequate
	54.072	300	R	100	100	80	80	No	Yes	Yes	0.2	Yes	Yes	""		Curve adequate at advisory speed
	54.382	240	L	100	100	80	80	No	Yes	Yes	0.3	Yes	Yes	""		""
	54.412	230	R	100	100		10	No	Yes	No	0.3	No	Yes	""	No	Staged turn across intersection. A 19m Semi would be a check vehicle only. Not a compliant movement.

NOTES:

1. **Compliant** means that a 19m semi-trailer can negotiate the curve without encroaching over the road centreline or sealed shoulder, while also allowing for a 0.5m clearance envelope each side of the vehicle.
2. **Technically Non-Compliant** means that a 19m semi-trailer can negotiate the curve without encroaching over the road centreline or sealed shoulder but does not maintain the 0.5m clearance envelopes
3. **Non-Compliant** means that not only are 0.5m clearance envelopes not met, but the vehicle cannot negotiate the movement without physically running off of the sealed pavement, running into an oncoming lane or contacting with a fixed object such as kerb, culvert or sign.

Kin Kin Rd - Range Section

Assessment of FULL SEALED width available for cars to pass on-coming heavy vehicles

Yes	**Compliant**	indicates a curve where the two vehicles can pass each other, while staying on the sealed surface and while maintaining the full clearance envelopes on both sides of the passenger vehicle.
TN	**Technically Non-Compliant**	indicates a curve where the two vehicles can pass each other, while staying on the sealed surface and while maintaining at least some portion of the clearance envelopes on the passenger vehicle.
No	**Non-Compliant**	indicates a curve where there is no safety envelope maintained to the passenger vehicle. This means that the vehicles can either just pass (with 0.5m or less between them) or cannot pass at all without moving off the sealed surface.

Input cells coloured red

35 total CURVES assessed

Corner	CH Start (Direction of Gazettal, from DVR)	Curve Radius	Left or Right (in direction of Gazettal)	At Speed condition:	Road Width Sealed width only	Width of Semi swept-path	Width of Semi swept-path with 0.5m envelope (both sides)	Width left for car	Enough width for car? TN = 2.0m to < 3.0m No = < 2.0m (See Notes below)	Width left for car if no 0.5m safety envelope on outside of trucks	Enough width for car - if no safety envelope for trucks? TN = 2.0m to < 3.0m No = < 2.0m	Curve Widening Required. As Per Austroads guidelines	Curve Widening Achieved? (See General Note 3.)	Swept paths compliant? Not compliant (N) if the truck crosses the centreline (no envelope)	Comments
					Road Width Analysis										
START OF RANGE	37.8	*Straight*													
"Road Narrows"	37.888	*S*													
I	38.168	200	R	Advisory	7	3.59	4.59	2.41	TN	2.91	TN	0.3	No	No	
I	38.428	125	R	Advisory	7	3.02	4.02	2.98	TN	3.48	Yes	0.6	No	TN	
I	38.558	95	L	Advisory	7	3.64	4.64	2.36	TN	2.86	TN	0.8	No	No	
I	38.828	100	R	Advisory	7	3.26	4.26	2.74	TN	3.24	Yes	0.7	No	TN	
I	39.117	140	L	Advisory	6.5	3.05	4.05	2.45	TN	2.95	TN	0.5	No	TN	
I	39.397	120	R	Advisory	6.5	2.92	3.92	2.58	TN	3.08	Yes	0.6	No	TN	
I	39.447	100	L	Advisory	6.5	3.21	4.21	2.29	TN	2.79	TN	0.7	No	No	
I	39.687	175	R	Advisory	6.5	3	4	2.5	TN	3	Yes	0.4	No	TN	
Williams Rd (CH 39.727)	39.727	*S*													
I	39.926	55	L	Advisory	5.2	4	5	0.2	No	0.7	No	0.8	No	No	Car can pass, but with little margin for error
I	39.986	55	R	Advisory	5.2	3.58	4.58	0.62	No	1.12	No	0.8	No	TN	
I	40.056	100	L	Advisory	5.2	3.17	4.17	1.03	No	1.53	No	0.7	No	TN	
I	40.106	60	R	Advisory	6	4.14	5.14	0.86	No	1.36	No	1+	No	No	
I	40.236	50	R	Advisory	6	3.73	4.73	1.27	No	1.77	No	1+	No	TN	
I	40.406	50	R	Advisory	6	3.81	4.81	1.19	No	1.69	No	1+	No	TN	
I	40.506	40	L	Advisory	8	4.37	5.37	2.63	TN	3.13	Yes	1+	Yes	TN	
I	40.616	50	R	Advisory	8	3.78	4.78	3.22	Yes	3.72	Yes	1+	No	No	
I	40.686	60	R	Advisory	8	3.73	4.73	3.27	Yes	3.77	Yes	1+	No	TN	
I	40.756	20	L	Advisory	8	5.89	6.89	1.11	No	1.61	No	1+	No	No	Car and truck cannot pass eachother without one or both running off the edge of their respective lanes
I	40.826	30	R	Advisory	8	4.62	5.62	2.38	TN	2.88	TN	1+	Yes	No	Car can pass, but with little margin for error
I	40.895	40	L	Advisory	8	4.46	5.46	2.54	TN	3.04	Yes	1+	No	No	
I	41.005	45	R	Advisory	8	3.99	4.99	3.01	Yes	3.513	Yes	1+	No	No	
I	41.085	30	L	Advisory	8	4.79	5.79	2.21	TN	2.71	TN	1+	No	No	Car can pass, but with little margin for error
I	41.135	30	R	Advisory	8	3.87	4.87	3.13	Yes	3.63	Yes	1+	No	TN	
I	41.195	50	L	Advisory	8	3.98	4.98	3.02	Yes	3.52	Yes	1+	No	TN	
I	41.245	50	R	Advisory	8	4.25	5.25	2.75	TN	3.25	Yes	1+	No	No	
I	41.335	60	R	Advisory	8	3.86	4.86	3.14	Yes	3.64	Yes	1+	No	TN	
I	41.515	30	L	Advisory	8.5	4.81	5.81	2.69	TN	3.19	Yes	1+	No	No	Car can pass, but with little margin for error
I	41.625	50	R	Advisory	8.4	4.06	5.06	3.34	Yes	3.84	Yes	1+	No	TN	
I	41.715	30	R	Advisory	8.4	4.77	5.77	2.63	TN	3.13	Yes	1+	No	No	Car can pass, but with little margin for error
I	41.864	80	L	Advisory	6.3	3.25	4.25	2.05	TN	2.55	TN	0.9	No	No	
I	41.954	60	R	Advisory	6.3	3.73	4.73	1.57	No	2.07	TN	1+	No	No	
I	42.034	60	L	Advisory	6.3	3.58	4.58	1.72	No	2.22	TN	1+	No	No	
I	42.074	45	R	Advisory	6.3	3.17	4.17	2.13	TN	2.63	TN	1+	No	No	
V	42.264	80	L	Advisory	6	3.45	4.45	1.55	No	2.05	TN	0.9	No	No	Car and truck cannot pass eachother without one or both running off the edge of their respective lanes
Sallwood Court (End of Kin Kin Range) (CH 42.43)	42.424	120	R	Advisory	10	3.17	4.17	5.83	Yes	6.33	Yes	0.6	Yes	Yes	

NOTES:

1. This assessment has ignored normal road conditions and rules around linemarking for the sake of purely assessing the available residual width for a car to pass an oncoming truck on the Kin Kin range. Noting that assessed swept paths show 19m Semi trailers and Truck and Dog combinations crossing the centreline to avoid tracking off of the sealed road.
2. Car width is 2.0m excluding mirrors. This is standard width measuring procedure according to Austroads swept-path templates
3. 3.0m is the minimum required technically-compliant width for a 2.0m car swept-path width + 0.5m envelope either-side to safely pass an on-coming truck. (Truck swept path has 0.5m envelope either- side included in calculation)
4. 2.0m is the absolute minimum width for a car to make it past an on-coming truck: 2.0m for car width only. (0.5m envelope is included in truck swept-path width, leaving 0.5m from car to an on-coming truck under this condition)
5. It is assumed that standard cars don't need curve widening
6. Existing road widths for the assessment has been determined between joint use of ChartView, DVR and AutoCad, due to aerial imagery view of the road being restricted by trees (and therefore being inaccurate for measuring on it's own).

7. Trucks were simulated going north with cars simulated heading south. The reverse was not considered at this time, however this would produce different results which are expected to yield relatively minor differences.
8. Swept paths assessed include 19m Semi Trailer and 3 and 4 axle "Truck and Dog" combinations. It was found the 19m semi trailer combination requires more lateral width due for swept paths. The results of this assessment are based on 19m semi trailer swept paths as the worst-case result of each of these heavy vehicle combinations assessed.
9. Chainages were taken from DVR 2020 Imagery

Kin Kin Rd - Range Section
Assessment of FULL SEALED + UNSEALED SHOULDER width available for cars to pass on-coming heavy vehicles

Yes	**Compliant** indicates a curve where the two vehicles can pass each other, using all width available and while maintaining the full clearance envelopes on both sides of the passenger vehicle.
TN	**Technically Non-Compliant** indicates a curve where the two vehicles can pass each other, using all width available and while maintaining at least some portion of the clearance envelopes on the passenger vehicle.
No	**Non-Compliant** indicates a curve where there is no safety envelope maintained to the passenger vehicle. This means that the vehicles can either just pass (with 0.5m or less between them) or cannot pass at all on the curve.

Input cells coloured red

Corner	CH Start (Direction of Gazettal, from DVR)	Curve Radius	Left or Right (in direction of Gazettal)	At Speed condition:	Road Width Analysis: Road Width Including unsealed shoulders	Width of Semi swept-path	Width of Semi swept-path with 0.5m envelope (both sides)	Width left for car	Enough width for car? TN = 2.0m to < 3.0m No = < 2.0m (See Notes below)	Width left for car if no 0.5m safety envelope on outside of trucks	Enough width for car - if no safety envelope for trucks ? TN = 2.0m to <3.0m No = < 2.0m	Curve Widening Required. As Per Austroads guidelines	Curve Widening Achieved? (See General Note 3.)	Swept paths compliant ? Not compliant (N) if the truck crosses the centreline (no envelope)	Comments
35		total CURVES assessed													
START OF RANGE	37.8	*Straight*													
"Road Narrows"	37.888	*S*													
I	38.168	200	R	Advisory	8	3.59	4.59	3.41	Yes	3.91	Yes	0.3	No	No	
I	38.428	125	R	Advisory	8	3.02	4.02	3.98	Yes	4.48	Yes	0.6	No	TN	
I	38.558	95	L	Advisory	8	3.64	4.64	3.36	Yes	3.86	Yes	0.8	No	No	
I	38.828	100	R	Advisory	8	3.26	4.26	3.74	Yes	4.24	Yes	0.7	No	TN	
I	39.117	140	L	Advisory	7	3.05	4.05	2.95	TN	3.45	Yes	0.5	No	TN	
I	39.397	120	R	Advisory	7	2.92	3.92	3.08	Yes	3.58	Yes	0.6	No	TN	
I	39.447	100	L	Advisory	7	3.21	4.21	2.79	TN	3.29	Yes	0.7	No	No	
I	39.687	175	R	Advisory	7	3	4	3	Yes	3.5	Yes	0.4	No	TN	
Williams Rd (CH 39.727)	39.727	*S*													
I	39.926	55	L	Advisory	7	4	5	2	TN	2.5	TN	0.8	No	No	Car can pass, but with little margin for error
I	39.986	55	R	Advisory	5.2	3.58	4.58	0.62	No	1.12	No	0.8	No	TN	
I	40.056	100	L	Advisory	7	3.17	4.17	2.83	TN	3.33	Yes	0.7	No	TN	
I	40.106	60	R	Advisory	7	4.14	5.14	1.86	No	2.36	TN	1+	No	No	
I	40.236	50	R	Advisory	7.8	3.73	4.73	3.07	Yes	3.57	Yes	1+	No	TN	
I	40.406	50	R	Advisory	7.8	3.81	4.81	2.99	TN	3.49	Yes	1+	No	TN	
I	40.506	40	L	Advisory	9.2	4.37	5.37	3.83	Yes	4.33	Yes	1+	Yes	TN	
I	40.616	50	R	Advisory	9.2	3.78	4.78	4.42	Yes	4.92	Yes	1+	No	No	
I	40.686	60	R	Advisory	9.2	3.73	4.73	4.47	Yes	4.97	Yes	1+	No	TN	
I	40.756	20	L	Advisory	9.2	5.89	6.89	2.31	TN	2.81	TN	1+	No	No	Car and truck cannot pass eachother without one or both running off the edge of their respective lanes
I	40.826	30	R	Advisory	9.2	4.62	5.62	3.58	Yes	4.08	Yes	1+	Yes	No	Car can pass, but with little margin for error
I	40.895	40	L	Advisory	9.2	4.46	5.46	3.74	Yes	4.24	Yes	1+	No	No	
I	41.005	45	R	Advisory	9.2	3.99	4.99	4.21	Yes	4.713	Yes	1+	No	No	
I	41.085	30	L	Advisory	9.2	4.79	5.79	3.41	Yes	3.91	Yes	1+	No	No	Car can pass, but with little margin for error
I	41.135	30	R	Advisory	9.2	3.87	4.87	4.33	Yes	4.83	Yes	1+	No	TN	
I	41.195	50	L	Advisory	9.2	3.98	4.98	4.22	Yes	4.72	Yes	1+	No	TN	
I	41.245	50	R	Advisory	8.2	4.25	5.25	2.95	TN	3.45	Yes	1+	No	No	
I	41.335	60	R	Advisory	8.2	3.86	4.86	3.34	Yes	3.84	Yes	1+	No	TN	
I	41.515	30	L	Advisory	8.5	4.81	5.81	2.69	TN	3.19	Yes	1+	No	No	Car can pass, but with little margin for error
I	41.625	50	R	Advisory	8.4	4.06	5.06	3.34	Yes	3.84	Yes	1+	No	TN	
I	41.715	30	R	Advisory	8.4	4.77	5.77	2.63	TN	3.13	Yes	1+	No	No	Car can pass, but with little margin for error
I	41.864	80	L	Advisory	7.8	3.25	4.25	3.55	Yes	4.05	Yes	0.9	No	No	
I	41.954	60	R	Advisory	7.8	3.75	4.75	3.05	Yes	3.55	Yes	1+	No	No	
I	42.034	60	L	Advisory	7.8	3.58	4.58	3.22	Yes	3.72	Yes	1+	No	No	
I	42.074	50	R	Advisory	7	3.17	4.17	2.83	TN	3.33	Yes	1+	No	No	
V	42.264	80	L	Advisory	7	3.45	4.45	2.55	TN	3.05	Yes	0.9	No	No	Car and truck cannot pass eachother without one or both running off the edge of their respective lanes
Sallwood Court (End of Kin Kin Range) (CH 42.43)	42.424	120	R	Advisory	9	3.17	4.17	4.83	Yes	5.33	Yes	0.6	Yes	Yes	

NOTES:

1. This assessment has ignored normal road conditions and rules around linemarking for the sake of purely assessing the available residual width for a car to pass an oncoming truck on the Kin Kin range. Noting that assessed swept paths show 19m Semi trailers and Truck and Dog combinations crossing the centreline to avoid tracking off of the sealed road.
2. Car width is 2.0m excluding mirrors. This is standard width measuring procedure according to Austroads swept-path templates
3. 3.0m is the minimum required technically-compliant width for a 2.0m car swept-path width + 0.5m envelope either-side to safely pass an on-coming truck. (Truck swept path has 0.5m envelope either- side included in calculation)
4. 2.0m is the absolute minimum width for a car to make it past an on-coming truck: 2.0m for car width only. (0.5m envelope is included in truck swept-path width, leaving 0.5m from car to an on-coming truck under this condition)
5. It is assumed that standard cars don't need curve widening
6. Existing road widths for the assessment has been determined between joint use of ChartView, DVR and AutoCad, due to aerial imagery view of the road being restricted by trees (and therefore being inaccurate for measuring on it's own).

7. Trucks were simulated going north with cars simulated heading south. The reverse was not considered at this time, however this would produce different results which are expected to yield relatively minor differences.
8. Swept paths assessed include 19m Semi Trailer and 3 and 4 axle "Truck and Dog" combinations. It was found the 19m semi trailer combination requires more lateral width due for swept paths. The results of this assessment are based on 19m semi trailer swept paths as the worst-case result of each of these heavy vehicle combinations assessed.
9. Chainages were taken from DVR 2020 Imagery

Annexure D

Road Crash Data

Kin Kin Road (141)

Kin Kin Road (141) Engineering Review

November 2022

Queensland Government

Summary of all Road Crashes since 1 January 2010

Date	Location	Direction of Travel		Description on Crash			Mitigating Factor	Severity	Speed Limit	Road Feature	Road Condition
		Unit 1	Unit 2/3	Crash Type	Cause	Description					
19/02/2012	26.24	South		Hit Object (Tree)	Animal on road	Driver swerved to avoid kangaroo and lost control into tree		Medical	100	Right Curve	Gravel Road
9/04/2012	29.672	North		Hit Object (Tree)	Curve	Driver an off road on curve and hit tree	Inexperience	Hospital	100 (40Adv)	Right Curve	Good, edge lines, partial shoulder seal
30/05/2020	30.833	North		Hit Object (Gravel Pile)	Mechanical Failure	Car lost wheel	Defective Vehicle	Medical	100	Right Curve	Avg, no edge lines, rough gravel shoulder
4/09/2012	31.995	East		Angle	Fail to Give Way	Car did not stop when entering road and hit bicyclist		Medical	100	Straight/Cross Roads	Avg, no edge lines, rough gravel shoulder
21/08/2020	32.461	North		Hit Object (Tree/Embank)	Animal on road	Driver swerved to avoid hare and lost control down embanlment into trees		Hospital	100 (70Adv)	Left Curve	Avg, no edge lines, avg gravel shoulder
7/11/2012	33.688	North		Ran off road (Overturned)	Overturned	Lost control and overturned	Speed/DUI	Fatal	100	Straight	Avg, no edge lines, avg grass shoulder
1/11/2012	34.192	South	Cow	Hit Animal	Cattle on Road	Animal on Road		Hospital	100	Straight	Avg, no edge lines, avg grass/gravel shoulder
9/07/2016	34.74	South	North	Head On	Cross dividing line	In Kin Kin town. Driver has moved right as if turning but continued straight	DUI	Medical	60	Left Curve	Good, in town
6/09/2015	36.928	North		Hit Object (Trees)	Curve	Ran off road on curve and into bush while intoxicated	DUI	Medical	100 (40Adv)	Right Curve	Good, edge lines, partial shoulder seal
11/07/2017	36.976	North		Ran off road (Overturned)	Animal on road	Dog ran across road in wet conditions		Hospital	100 (40Adv)	Right Curve	Good, edge lines, partial shoulder seal
11/02/2020	37.309	North		Hit Object (Rock)		Fell asleep and hit decorative rock in driveway	Fell asleep	Hospital	100 (50Adv)	Left Curve	Good, edge lines, partial shoulder seal
17/11/2020	38.136	South		Fell of Motorcycle	Tight curve	Lost control on tight curve (Motorcycle)	Speed	Hospital	100 (70Adv)	Right Curve	Avg, no edge lines, rough gravel shoulder
10/08/2010	38.21	North		Ran off road (Overturned)	Opposing vehicle	Lost control avoiding another vehice on wrong side of road and ran off road		Hospital	100 (60Adv)	Left Curve	Avg, no edge lines, minimal shoulder
31/05/2018	38.565	North		Hit Object (Fence)	Stopping abruptly	Motocyle stopped abruptly to make a turn and hit fence		Hospital	100	Straight	Avg, no edge lines, avg grass shoulder
17/06/2015	38.901	North	South	Sideswipe	Cross dividing line	Sideswipe between motorcycle rounding a curve and car		Hospital	100 (60Adv)	Left Curve	Avg, no edge lines, avg grass shoulder
7/06/2020	40.941	North	North	Sideswipe	Turn across Dbl lines	Car turned right across DBL Lines. Following motorcycle crashed into right rear	Fail to Keep Left	Medical	60 (40Adv)	Right Curve	Good, edge lines, partial shoulder seal
30/01/2021	41.046	North	South	Sideswipe	Hit rear trailer wheels	Motorcycle and B Double. Trailer wheels on DBL. Wheels hit by rider		Hospital	60 (40Adv)	Left Curve	Good, edge lines, partial shoulder seal
24/10/2010	41.713	North	South	Head On	Cross dividing line	Motorcycle rounded sharp sharp curve on wrong side of road and into car	Fail to Keep Left	Hospital	100	Left Curve	Avg, narrow range section, so CL markings
7/12/2011	41.924	South		Hit Object (Tree)	Wet/slippery	Ran off road and hit tree on wet slippery road		Hospital	100	Right Curve	Avg, narrow range section, so CL markings
16/04/2010	43.24	South		Hit Object (Tree)	Ran off road	Ran off road and hit tree after entering road an accelerating fast while intoxicated	DUI/Fatigue	Hospital	100	Straight	Avg, no edge lines, avg grass shoulder
2/05/2016	44.087	North		Ran off road (Overturned)	Intoxicated	Ran off road and overturned while heavily intoxicated	DUI	Medical	100 (70Adv)	Left Curve	Avg, edge lines, avg grass shoulder
4/08/2014	44.199	North		Hit Object (Power Pole)	Fatigue/Drugs	Car left road and hit power pole at 3:30am - tested for drugs	Drug Driving	Hospital	100	Straight	Avg, edge lines, avg grass shoulder
17/12/2018	44.505	South		Hit Object (Unknown)	Wet/slippery	Hit object. Wet road		Medical	100	Left Curve	Avg, edge lines, avg grass shoulder
10/10/2011	45.169	East	South	Angle	Fail to Give Way	Car failed to give way to another car at intersection		Medical	100	Left Curve/Intersect	Good, Intersection with widening
6/11/2012	45.17	East	North	Angle	Fail to Give Way	Car failed to give way to another car at intersection		Minor	100	Right Curve/Intersect	Good, Intersection with widening
22/02/2018	45.171	East	North	Angle	Fail to Give Way	Car failed to give way to another car at intersection		Hospital	90	Right Curve/Intersect	Good, Intersection with widening
26/04/2010	45.171	East	North	Angle	Fail to Give Way	Car failed to give way to another car at intersection		Property	90	Right Curve/Intersect	Good, Intersection with widening
17/11/2018	45.21	West	South	Angle	Fail to Give Way	Car failed to give way to another car at intersection		Hospital	90	Left Curve/Intersect	Good, Intersection with widening
31/01/2015	45.516	South		Hit Object (Rock)	Fell off Bicycle	Bicyclist hit something on road (rock/pothole) and went over handlebars		Medical	100	Straight	Good, edge lines, Good shoulder seal
3/09/2011	45.676	South		Hit Object (Tree)	Ran off road	Ran off road and hit tree while heavily intoxicated and distracted	DUI/Distracted	Hospital	100 (60Adv)	Right Curve	Good, edge lines, partial shoulder seal
6/05/2012	45.875	South	North	Ran off bridge (Overturned)	Opposing vehicle	Vehicle coming other failed to Giving Way		Hospital	100 (60Adv)	Narrow Bridge	One lane bridge
12/09/2010	45.953	North		Fell of Motorcycle	Curve/wet/slippery	Motocycle lost control on wet road and landed in table drain		Hospital	100 (60Adv)	Right Curve	Good, edge lines, Good shoulder seal
9/09/2010	46.2	East	North	Angle	Fail to Give Way	Car failed to give way to another car at intersection (15 year old driver)	Under age	Medical	100	Left Curve/Intersect	Good, Intersection with widening
6/02/2016	46.344	South		Hit Object (Culvert)	Wet/slippery	Ran off road in wet slippery and hit culvert		Medical	90	Left Curve	Good, edge lines, Good shoulder seal
14/09/2019	46.433	South	Kangaroo	Hit Animal	Animal on road	Hit animal (Kangaroo)		Medical	90	Left Curve	Good, edge lines, Good shoulder seal
24/01/2013	46.98	South		Hit Object (Small Trees)	Wet/slippery	Driver lost control on wet slippery road and hit small trees at Louis Bazzo Drive		Medical	100	Right Curve/Intersect	Good, Intersection with widening
15/12/2012	46.98	West	South	Angle	Fail to Give Way	Angle - Car failed to give way to another car at intersection		Minor	100	Right Curve/Intersect	Good, Intersection with widening
28/12/2020	46.98	West	South	Angle	Fail to Give Way	Angle - Car failed to give way to another car at intersection		Hospital	90	Right Curve/Intersect	Good, Intersection with widening
31/01/2012	46.985	West	North	Angle	Fail to Give Way	Angle - Car failed to give way to another car at intersection		Hospital	100	Left Curve/Intersect	Good, Intersection with widening
24/03/2020	47.068	North	North/South	Rear End	Wet/slippery	Car stored to turn right, hit form behind forcing stored car into oncoming vehicle	SD over crest	Hospital	90	Left Curve	Good, edge lines, Good shoulder seal
4/11/2010	47.66	South		Ran off road (Overturned)	Animal on road	Animal on road. Driver swerved to avoid and overturned		Property	100	Straight	Good, edge lines, Good shoulder seal
11/02/2010	47.662	North		Ran off road (Table Drain)	Intoxicated	Lost control and got stuck in table drain	DUI	Property	100	Straight	Good, edge lines, Good shoulder seal
6/01/2012	47.663	North		Hit Object (Tree)	Animal on road	Driver swerved to avoid animal and hit tree		Hospital	100	Straight	Good, edge lines, Good shoulder seal
30/12/2020	48.029	North	South	Sideswipe	Water/parked car	Driver hit water on road when passing stopped vehicle and hit side of oncoming car		Hospital	90	Straight	Good, edge lines, Good shoulder seal
2/11/2019	48.049	South		Hit Object (Tree)	Ran off road	Ran off road and hit tree		Minor	90	Left Curve	Good, edge lines, Good shoulder seal
19/10/2019	48.061	North		Hit Object (Tree)	Ran off road in wet	Ran off road and hit tree in wet slippery conditions	Inexperience	Hospital	90	Right Curve	Good, edge lines, Narrow shoulder seal Left
27/11/2010	48.554	North	North	Rear End	Turning vehicle	Rear end with vehicle waiting to turn right		Medical	60	Left Curve	Good, Intersection with widening
29/10/2015	48.856	West	North	Hit Pedestrian		Pedestrian ran out in front of vehicle		Hospital	60	Straight	In Pomona - kerbed
30/10/2020	48.887	North	North	Rear End	Turning vehicle	Motorcycle was turning onto road and collided with rear of ute waiting to turn right		Hospital	60	Right Curve	In Pomona - kerbed Intersection
7/05/2016	48.9	West	West	Rear End	2 Turning vehicles	Two vehicle turning left off road in slip lane and waiting for right turner		Medical	60	Right Curve	In Pomona - kerbed Intersection
6/06/2017	48.9	South	North	Angle	Fail to Give Way	Angle - Car turning right off road hit oncoming vehicle		Minor	60	Left Curve	In Pomona - kerbed Intersection
4/03/2010	49.12	North	West	Angle	Fail to Give Way	Car entering from side street failed to give way to another car at intersection		Property	60	Right Curve	In Pomona - Intersection
11/04/2010	49.29	West		Hit Object (Abutment)	Hit bridge	Driver struck abutment of bridge while intoxicated	DUI	Hospital	60	Straight	Short/Narrow two lane bridge
17/06/2015	49.475	South	South	Rear End	Turning vehicle	Rear and with vehicle waiting to turn right into day care		Medical	60	Straight	In Pomona - kerbed
15/02/2013	50.457	South		Ran off road (Overturned)	Wet/slippery	Car hit water on road and overturned		Medical	100	Right Curve	Good, edge lines, Good shoulder seal
23/04/2018	50.638	South	South/South	Rear End	Turning vehicle	Vehicle was waiting to turn right when 3 vehicle following had nose/tail		Hospital	100 (80Adv)	Left Curve	Good, edge lines, Good shoulder seal
6/06/2010	51.242	South		Hit Object (Tree)	Ran off road	Ran off road and hit tree. Loose gravel on shoulder		Medical	100	Right Curve	Good, edge lines, Good shoulder seal
24/05/2018	51.609	North		Ran off road (Overturned)	Medical Issue	Ran off edge of road, overcorrected and overturned	Sneezing Fit	Medical	100	Right Curve	Good, edge lines, Good shoulder seal
2/12/2010	51.623	North	South	Sideswipe/Head on	Oil of road	Vehicle hit oil on wet road and collided with oncoming vehicle		Medical	100	Right Curve	Good, edge lines, Good shoulder seal
14/02/2011	53.052	North	South	Sideswipe/Head on	Cross dividing line	Sideswipe/Head-on. Car crossed onto wrong side on a bend and a hit oncoming car		Medical	100	Left Curve	Good, edge lines, Good shoulder seal
26/07/2015	53.733	North		Ran off road (Overturned)	Intoxicated Learner	Ran off road and overturned while intoxicated	DUI	Medical	100	Right Curve	Good, edge lines, Good shoulder seal
29/11/2019	53.8	North		Rear End	Travel too close	Rear end. Car in front slowed for traffic and vehicle behind ran into it		Medical	100	Right Curve	Good, edge lines, Good shoulder seal
28/04/2013	54.288	North		Ran off road (Overturned)	Speed/Due Care	Ran off road and overturned		Medical	100	Right Curve	Good, edge lines, Good shoulder seal
11/02/2012	54.65	South	North	Angle	Fail to Give Way	Angle - Car has failed to give way to oncoming car when turning right		Hospital	80	Intersection	Good, Intersection with widening

Denotes Property Damage Only crashes which stopped being reported in the Road Crash 2 data base after 2010.

Queensland Government

Annexure E

Literature Review

Kin Kin Road (141)

Kin Kin Road (141) Engineering Review

November 2022

Queensland Government

Annexure E | Literature Review

Research papers and reports were reviewed to identify if there are characteristics of the Kin Kin Road that would be more likely to increase the crash risk. While most reports deal with the effects of heavy vehicles on crash rates more generally, some reports assist with an understanding of the likely effect on crash rates on the Kin Kin Road. The literature search was conducted using the terms 'heavy vehicles' or 'trucks' and 'crash rate'. Over 40 references applicable to two-lane rural roads were identified and reviewed.

Sobhani et al (2017) looked at the serious injuries and fatalities sustained in crashes involving heavy vehicles in Victoria. They concluded that *"there is a higher probability of an FSI injury from a crash involving a vehicle 'leaving a driveway' versus changing lanes while crashes involving slow or stopping vehicles or parking vehicles are less likely to result in an FSI injury compared to vehicles changing lanes"*.
Cairney (2005) investigated the relationship between advisory speeds, road geometry including the cross-section, on the propensity for crashes involving motorcycles or trucks. He concluded that *"truck crashes are under-represented on downgrades and over-represented on steeper upgrades" and "trucks have a smaller percentage of crashes occurring where there is no sealed shoulder than do other vehicles".*

Tziotis et al (2009) listed the road and environmental factors that *"contributed, or potentially contributed to the occurrence or severity of a crash."* They concluded that the major factors are:

- poor road pavement (i.e. poorly maintained, poor drainage or too narrow)
- unsealed or only partially sealed shoulders
- unexpected transition between roads of varying standard (NZ)
- poor sight distance for overtaking
- insufficient or poorly positioned signage
- roadside hazards located within the clear zone (e.g. trees, poles, culverts).

Other significant factors were reported to be:

- confusing road alignment
- safety barriers either not provided or inadequate
- steep embankments
- linemarkings either not provided or poorly maintained.

These general statements are acknowledged by road design engineers and asset managers. Other studies addressed the use of longer articulated vehicles including road trains; for instance, Ryan et al (1998), Ibbotson (1998) and Williamson et al (2003).

TMR Brownfield study

The Brownfield study discussed the effect of changing both the lane widths and the shoulder widths. Contrary to the Highway Safety Manual (AASHTO, 2010; Bahar et al, 2009) which assumes that the safety effects of changing the width of the lanes and shoulders are independent, the Brownfield Guide considered these terms to be not independent. This was supported by Mclean (2001). The Brownfield Guide used the crash modification factors (CMFs) developed by Gross et al (2009) and information from TMR. These CMF values, listed in Table 1 were then used to develop the Brownfield recommended cross-sections.

Table 1: Crash Modification Factors (CMF) relative to a road with 3.5 metre lanes and 2.0 metre shoulders

Shoulder width (metre)	Lane width (metre)		
	3.0	**3.25**	**3.5**
0.75		1.22*	1.19*
1	1.24*	1.16	1.13
1.25	1.20	1.14	1.11
1.5	1.16	1.08	1.05
1.75	1.12	1.06	1.02
2	1.10	1.03	1.00

** Extrapolated values (subject to further evaluation and Australian data).*

Crash Modification Factors (CMF) for a wide centreline treatment is expected to be less than 0.80. (That is, saving more than 20 per cent of the injury crashes.)
The Kin Kin Road has limited pavement widths, curves with tight radius and very narrow shoulders. From a literature review is it concluded that:

- Truck crashes are less frequent on roads with a narrow pavement width.
- The major factors for truck crashes were poorly maintained roads, too narrow roads and unsealed or only partially sealed shoulders.
- From a Western Australian study, the most common crash type was truck rear-end crashes.
- Heavy vehicle crashes are likely to involve fatigue and slightly more likely to involve speeding.
- Heavy vehicles have higher rollover rates.
- Given the freight task, it is better to use longer vehicles than shorter ones.
- Unrealistic schedules can increase the heavy vehicle crash risk.

The risk analysis for the Brownfield guide indicates that total pavement width is a better measure than using a combination of lane widths and shoulder widths. This assists in justifying the use of wide centreline treatments where the paved width remains the same even though the line marking has seemingly reduced the lane widths.

REFERENCES

AASHTO, 2010, Highway Safety Manual Edition 1, American Association of Highway and Transportation Officials, Washington DC

Bahar, G, Parkhill, M, Tan, E, Philp, C, Morris, N, Naylor, S, White, T, Hauer, E, Council, F, Persaud, B, Zegeer, C, Elvik, R, Smiley, A & Scott, B 2009, Highway safety manual knowledge base, Transportation Research Board, Washington, DC, USA.

Cairney P, 2005, Further aspects of the relationship between geometric features and crashes, Austroads Report, AP-R279/05

Gross F, Jovanis PP, Eccles K & Chen K-Y, 2009, "Safety Evaluation of Lane and Shoulder Width Combinations on Rural, Two-Lane, Undivided Roads". FHWA report FHWA-HRT-09-031

Ibbotson RM, 1998, Taxonomy of heavy vehicle accidents, International Journal of Crashworthiness Vol 3 (1), pp73-84, Taylor and Francis

McLean J, 2001, Economic evaluation of Road Investment Proposals – Improved Prediction models for road crash savings. Austroads Report AP-R184/01

Ryan GA, Spittle JA & Cooper JM, 1998, Truck crashes in Western Australia, 1988-1992, Road Accident Prevention Research Unit, University of Western Australia Research report RR 69.

Sobhani A, Makwasha T, Carslake J, Goldsmith P, Nieuwesteeg M, 2017, Understanding the Factors Influencing Heavy Vehicle Related Fatal and Serious Injuries in Victoria, Australia, Proceedings of the 2017 Australasian Road Safety Conference, 10-12 October, Perth, Australia (Extended abstract only)

Tziotis M, Pyta V & McLean JR, 2009, Heavy vehicle safety in rural and remote areas, Austroads report AP-T136/09

Williamson A, Irvive P & Friswell R, 2003, What is the Involvement of Heavy Vehicles in Crashes in NSW, Road Safety Research, Policing and Education Conference, Vol 1 pp 288-294, Roads and Traffic Authority (RTA) New South Wales

R.J. Troutbeck

RPEQ 07149

Appendix G

Independent review of the TMR Engineering Review of Kin Kin Road

Report for the Department of Transport and Main Roads

Report by

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28 October 2022

1. Background

The purpose of this independent review is to comment on the process and outcome of an engineering review by the Queensland Department of Transport and Main Roads (TMR) on the Engineering review of the Kin Kin Road.

The TMR report demonstrates that TMR responds to its duty of care in operating the road and gives strong consideration to the community's concerns and expectations. In this case, the community was concerned about the increased number of heavy vehicles on this road.

The report has been written by TMR, although I have been involved in some discussions and I have written a literature report which was not able to provide any significant guidance to assist the TMR review.

This report is independent of the TMR report and is to provide assurance on the engineering process and conclusion reached in the TMR report. Any statements in this report are my opinion.

2. Brief overview

The TMR report is comprehensive and covers topics including

- The traffic mix and volume, now and predicted
- Speed limits and the changes over time
- The Kin Kin quarry haulage operations
- The road geometry
- The ability of heavy vehicles to negotiate the road
- The crash history and a comparison with other roads
- An evaluation of the existing bridges
- The effect on the wildlife
- Road surface and pavement condition
- Heavy vehicle management

These topics provide a comprehensive engineering review of the road. However, the report also provides a review of other non-TMR assessments of the road.

The TMR report then continues by outlining current and future works on the road together with the use of additional signs to warn drivers of the presence of heavy vehicles on the road.

In my opinion, the TMR report is comprehensive and there are no further topics that should have been included.

3. Context of the road.

An important point underlying the development and upgrading of any road is to appreciate the context or the environment of the road.

Discussion in Part 1 of the *Austroads Guide to Road Design* (AGRD01) which deals with the objectives of road design, centres around knowing the context of the road's environment. In road design, this is often termed "context sensitive design". While the discussion in Part 1 is about road design, it is also applicable to the engineering development of upgrades and to a review of an existing road. These concepts are universal.

The Austroads guide states:

Good design requires creative input based on experience and a sound understanding of the principles to develop an optimum solution that is within the context of the project and balances often competing and contradictory factors.

…

All road design is a compromise between the ideal and what is a reasonable solution. It needs to consider the objectives of the project, the objectives of road design and the context of the site. Due to the nature of the design process, the final design solution cannot generally be considered as 'correct' or 'incorrect' but rather as more or less efficient (in terms of moving traffic), safe (in terms of fatal and serious injury crash reduction), or costly (in terms of construction costs, life-cycle costs and environmental impacts).

Applying these concepts to an existing road produces the following question.

- Are the traffic operations on the road consistent with the context or the road environment? The last two terms need to be broadly defined.
- Is the geometry and configuration of the road consistent with this context?
- Can any proposed updates to the road make the traffic operations and road geometry more consistent with the context of the road?

These questions hinge on a description of the context of the road. The TMR review states:

The road is generally an undivided two-lane, two-way sealed roadway with a winding alignment on a rolling to undulating terrain, in most sections. The road traverses the Kin Kin Range from Chainage 39.75km to 42.43km which is characterised by a section of steep and winding alignment. Nunan Range lies just to the north of the Gympie Regional Council/Noosa Shire Council boundary. This section of road remains unsealed, however only the first 540 metres of the unsealed roadway on the northbound approach to the range lies within NCR's [North Coast Regions] area of responsibility. Five single lane timber bridges are located along the road within the section managed by NCR.

…

Kin Kin Road functions as a rural arterial/distributor road connecting rural communities and centres in the Noosa and Cooloola Hinterland, east of the Bruce Highway, with larger population centres of Gympie, Cooroy, Tin Can Bay and other hinterland areas in the Noosa Shire and Gympie Regional Council local government areas.

…

The entire road is identified as a school bus route with a number of services operating along the route. Road signs are displayed on both sides of the Kin Kin Range warning of school buses operating during the hours of 6:30 – 8:00am and 3:30 – 4:45pm. There is some pedestrian activity associated with the school bus services with school children using the road edge or narrow verges to access bus stops from their places of residence

In addition to servicing the local agricultural and tourist industries, the road is a popular route for recreational motorcyclists, particularly on weekends. Recreational bicycle riders also frequent the route and there is an annual bicycle event, the Noosa Classic, which is held along part of this road. The area is also popular with horse riding being in a rural area in proximity to the Noosa Trail

While this is a rural arterial it cannot be considered to be a high speed route. The road section through the range is naturally more constrained and the environment is one that generally dictates lower speeds.

Maintaining the context and character of the road is important in managing speeds along the road and hence safety. For the most part, the road is "self-explaining" and, as the Austroads Guide to Road Design Part 1 states, allows "road users to readily comprehend the type of road and what could be expected in terms of the elements of the design".

It would be then inappropriate to consider this to be a major transport route and any upgrades should preserve the general nature of the road. The TMR report demonstrates that TMR engineers are cognisant of this issue when preparing their engineering assessment and planning and designing future works.

4. Managing a network

Managing the operation of a network is about managing the risks to the travelling public. Unfortunately, risk across the network cannot be eliminated, but it needs to be managed and minimised. The engineering of the road or its upgrade is committed to this end. Engineering practices have been developed from experience and studies that demonstrate a minimisation of risk. These practices have been applied in the TMR report.

Risk is demonstrated in crash statistics. Crash statistics for a road section are important but, unfortunately, they identify issues after crashes have occurred and engineers must then react. Crash statistics taken over a number of roads can enable a road agency to predict potential black spots and to be more responsive to safety issues or identify sites with an increased risk. The TMR practices through the Australian National Risk Assessment Model (or ANRAM) provide a more proactive approach to managing risk. These engineering approaches to manage risk are based on collective evidence from a number of routes and allow the road agency to be consistent and equitable in the use of funds.

The management of risk then requires a review of the current safety issues on the road in question and the review of the demonstrated safety of the road in comparison with similar roads and other roads on the network. This engineering approach is not to exclude the perceived safety by the community. Often the community will be able to perceive concerns before they are evident in the crash data. TMR has addressed these community concerns within its report.

I accept and agree with the following comment in the report:

> *In TMR's stewardship role for all its road infrastructure across Queensland, compromises have to be made between what is ideal and what is desired and what is a practicable outcome in terms of cost, safety, driver expectation, economic drivers, environmental impacts and social issues. Judgements must be made on the value of improving the standard of a road and the impact this might have on the ability to make improvements elsewhere on the road system. These judgements are usually made based on the level of safety of the road in question and the Benefit Cost Ratio (BCR) resulting from the proposed improvements*

5. Managing speed limits

Reducing speed limits is the best way of addressing safety. However, the speed limit cannot be reduced to a point where it is not complied with. Section 2.3 has indicated the posted speed limits have been reduced over time from 100 km/h to between 70 and 90 km/h. Importantly, the section in the range has been decreased from 100 km/h to 60 km/h.

The TMR engineering review described the speeds of vehicles on Kin Kin Road and stated:

> *Analysis of the speed data shows common themes at all surveyed sites. The results showed that:*
>
> - *the poorest levels of compliance was demonstrated by Class 1 and Class 2 vehicles*
> - *compliance increased with increasing vehicle classes*
> - *heavy truck and trailer combinations demonstrate the highest level of compliance.*

While speeding is not condoned, a close review of the data in Tables 6, 7 and 8 in the TMR report indicate that if vehicles are exceeding the speed limit, they predominately do so by less than 10 km/h. Typical, some drivers will travel over the speed limit, no matter what the speed limit is. However, it has to be said that the present compliance with the posted speed limit is very good, especially for heavier vehicles.

TMR has appropriately concluded:

> *Whilst TMR does not condone any form of speeding, the speed survey data generally shows very high numbers and proportions of heavy vehicles complying with the posted speed limits when compared to levels of speed compliance recorded for passenger type vehicles.*

6. Vehicle movements along curves.

When a longer articulated vehicle negotiates a corner of an intersection, the rear of the trailer will "cut the corner" even though the prime mover does not. Figure 16 in the TMR report explains this situation. It shows an articulated vehicle completing a right hand 90° turn with the prime mover travelling in a straight line and the trailer offset. The swept path is the area that the vehicle travels over and the maximum width of the swept path can be much larger than the width of the vehicle.

The wider swept paths are exhibited by vehicles moving outside their lanes into adjacent lanes or the wheels of the trailer moving onto the shoulder. On reasonably narrow roads and at intersections it is not uncommon for the vehicles to encroach onto the other lanes. While this is not the preferred action, it is tolerated. The TMR report has investigated the ability of two vehicles to negotiate a curve at the same time (from different directions) and established that while vehicles negotiating some curves did encroach on the other lane, the road still provided adequate pavement for both vehicles in most cases. The report states:

> *For the 26 curves identified where the heavy vehicle could not stay within its own lane, the vehicle cannot physically negotiate the curve without crossing into the oncoming lane or tracking tyres over the edge of the sealed pavement. It should be noted, however, this is mitigated by the presence of some width of unsealed, trafficable shoulder beyond the sealed pavement edge for most of the length*
>
> *…*
>
> *Outside of the Kin Kin Range section, there are seven curves that were identified where the heavy vehicle could not stay within its own lane– five north and two south of the range. This does not mean that a car travelling in the opposing direction to the heavy vehicle on these curves will suddenly be faced with a truck on the wrong side of the road. As mentioned above, on many of these curves there is additional unsealed shoulder width available for the truck to utilise. Typically, a truck driver will encroach upon the centreline of the road to avoid dropping a tyre off the edge of the sealed surface, if there is nobody coming the other way and visibility is adequate. When a vehicle is approaching from the other direction, or visibility around the curve is limited, the truck driver will typically place the vehicle closer to, or a tyre over the edge of the seal or carriageway.*

The TMR assessment reviewed the ability of the heavy vehicle drivers to negotiate the curves if the centre line was not there and if the drivers made greater use of the unsealed shoulder. The analysis found that a heavy vehicle and a passenger car can negotiate the curve at the same time. The report states:

> *Outside of the Kin Kin Range section, only seven of the curves failed to achieve this functionality. But when taking all factors into account, including extra width due to intersections at the curves and/or additional unsealed shoulder width, it can be shown that even these curves are quite functional. This is evidenced by the fact that examination of crash records from 2010 to June 2021 (based on injury-related data from QPS), show no reported crashes involving heavy vehicles on the sections either side of the Kin Kin Range. It is noted that the crash database is continually updated, but details of crashes that might have occurred in the most recent months may not be available. Similarly, crashes that have occurred within the last 12 months may still be under investigation and these details could change. Therefore, for the purposes of this report, only crashes recorded up to June 2021 have been analysed.*

It was concluded that there was generally sufficient pavement width to accommodate a heavy vehicle and a passenger car meeting at a curve. It acknowledged that at some curves there would be minimal clearance between the vehicles. I agree with this conclusion. It is reasonable and the outcome is consistent with the context of the road and the environment.

7. Current design standards

The current design standards should not be applied to existing roads without question and, as the report indicates, they were not applied to this road.

The TMR report reviewed the visibility distances around curves. The concluding comments in Section 3.4 are acceptable. The report states:

> *While falling short of the current day geometric standard in a number of areas, this section of Kin Kin Road does provide a fairly good level of service and capability. The sections with more limited sight distance are also the lighter trafficked sections which assists in overall functionality, particularly on the tighter curves. It has been demonstrated that interaction between heavy and passenger vehicles can occur safely and that the lack of crash history involving heavy vehicles is evidence of this. While seal widths are short of current-day standards, the presence of trafficable, unsealed shoulders assists in the safe functionality of the road.*
>
> *Visibility is restricted in many areas, particularly around curves, however the roadside environment is consistent throughout, so even when drivers are confronted with areas of reduced sight distance it is not unexpected and contributes to a heightened state of alertness while driving the road*

8. Review of the crash statistics

The report discusses the crash rates in two periods 2000 to 2009 and 2010 to 2020. In the latter period, there was an 18 per cent reduction. This is most likely the result of lower speed limits.

The TMR report compared the crash history on the Kin Kin Road and on other State-controlled roads within Noosa Council. Of the 60 injury sustaining crashes reported between 2010 to 2021, there was one crash involving a heavy vehicle and a motorcycle. The report states:

> *Only one reported crash involved a heavy vehicle but neither the truck nor the roadway could be considered as having directly contributed to this crash.*

The Australian National Risk Assessment Model (ANRAM) evaluates the historic safety record and predicts safety issues. This allows TMR to compare the actual and predicted crash records and identify inconsistencies. The ANRAM assessment also included a comparison with all state-controlled roads in the North Coast Region. A similar analysis was undertaken for three other roads in the region.

Crash databases are never up to date as the more recent information is often subject to correction and verification. As pointed out in Section 4.1 of the TMR engineering review, ”only crashes recorded up to June 2021 have been analysed”. This is an acceptable position for TMR to take.

The conclusions in the TMR report are considered to be acceptable. The report states:

> *In summary, comparison of the figures above seemingly indicates that Kin Kin Road has a lower risk of predicted serious crashes compared to other roads in NCR which have similar characteristics. In comparison to the NCR network overall, Kin Kin Road is not ranked in the top 20 roads in terms of risk of fatal or serious injury crashes (30% of network road length has an ANRAM FSI/km score greater than Kin Kin Road).*

9. Review of other material

The TMR report also includes a number of other supporting analyses. These include:

- An evaluation of the state of the timber bridges.
- An evaluation of the pavement and the bitumen sealed width which has been progressively widened from a single lane road to the existing two lanes.
- The maintenance of the road.
- Vegetation management.
- Review of a report on the operation of the Quarry and the use of roads for hauling the rock.

10. Further development and management of the road

The TMR report has indicated that the North Coast Region has been seeking and awarded additional funds to undertake improvement to the road. These are documented in its report.

In addition, an assessment of the advisory signs on the road has indicated that additional signs warning of a winding road and steep grades should be installed. These signs indicate that trucks should reduce speeds. Other signs indicating a narrow pavement and shoulders will also be used. These are likely to have limited effect as trucks are currently complying with the speed limits but these signs help to indicate the narrow road and formation widths for this road.

11. Concluding remarks

After reviewing the TMR engineering review of the Kin Kin Road, I am satisfied that the TMR report is comprehensive, thorough, and balanced. It has been developed and written using appropriate engineering principles. I have no hesitation in recommending that this report be used as required.

R J Troutbeck

Prof R.J. Troutbeck

Principal Troutbeck & Associates

Emeritus professor Queensland University of Technology

RPEQ 07149

6 November 2022

In the Planning and Environment Court
Held at Maroochydore

Application No 32 of 2010

Between	**KIN KIN COMMUNITY GROUP INC**	Applicant
And	**SUNSHINE COAST REGIONAL COUNCIL (FORMERLY NOOSA SHIRE COUNCIL)**	First Respondent
And	**JOHN WALLACE SHEPPERSON**	Second Respondent
And	**NEILSENS QUALITY GRAVELS PTY LTD ACN 010 620 916**	Third Respondent

AFFIDAVIT

ROBERT CHARLES HOLLAND of 99 Longman Terrace, Chelmer in the State of Queensland, Traffic Engineer, being under affirmation says:

1 Exhibited to this affidavit and marked **'RCH-1'** is a report prepared by me in this proceeding.

Affirmed by **ROBERT CHARLES HOLLAND** on 19 August 2010 at Brisbane, Queensland, in the presence of:

....	 3047
Deponent	Commissioner for Declarations/Lawyer

AFFIDAVIT OF ROBERT CHARLES HOLLAND

Filed on behalf of the Applicant

Form PEC-4

p&e Law
1 The Esplanade
Cotton Tree Qld 4558
Phone: 07 5479 0155
Fax: 07 5479 5070
Ref:MGriffin:1801 (99531)

In the Planning and Environment Court
Held at Maroochydore

Application No D32 of 2010

Between	**KIN KIN COMMUNITY GROUP INC**	Applicant
And	**SUNSHINE COAST REGIONAL COUNCIL (FORMERLY NOOSA SHIRE COUNCIL)**	First Respondent
And	**JOHN WALLACE SHEPPERSON**	Second Respondent
And	**NEILSENS QUALITY GRAVELS PTY LTD ACN 010 620 916**	Third Respondent

Exhibit '**RCH-1**' to the affidavit of **ROBERT CHARLES HOLLAND** affirmed on 19 August 2010.

....
Deponent

(D 23407)
....
Commissioner for Declarations / Lawyer

CERTIFICATE OF EXHIBITS
TO THE AFFIDAVIT OF
ROBERT CHARLES HOLLAND

Filed on behalf of the Applicant

UCPR r 435

Form 47

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RCH-1

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In the Planning and Environment Court

No. D32 of 2010

Held at Maroochydore

Between:	KIN KIN COMMUNITY GROUP INC	Applicant
And:	SUNSHINE COAST REGIONAL COUNCIL	First Respondent
And:	JOHN WALLACE SHEPPERSON	Second Respondent
And:	NEILSENS QUALITY GRAVELS PTY LTD ACN 010 620 916	Third Respondent

TRAFFIC REPORT

Prepared for the Planning and Environment Court of Queensland

by

Robert Holland

19th August 2010

10.030.4.r

S.A. Holland BE.MEngSc MIEAust, RPEQ
R.C. Holland BE. DipCE. MEngSc. MIE Aust, RPEQ

TABLE OF CONTENTS

ATTACHMENTS

1. INTRODUCTION

This report presents an assessment of the traffic-related issues associated with the declarations sought by the Kin Kin Community Group Inc regarding the quarry proposed by Neilsens Quality Gravels Pty Ltd (Neilsens) at Sheppersons Lane, Kin Kin.

The site is shown on the locality plan at Attachment A.

This report has been prepared by Mr Robert Holland to assist the Court at the hearing of that matter. His qualifications and experience are appended.

2. BACKGROUND

The background to the matter is set out in the report by Senior Development Planner to Council's Strategy and Planning Committee dated 17th February 2010, and it is not proposed to re-iterate the content of that submission herein.

By e-mail dated 18 September 2009, the Neilsens' Services Group Chief Executive Officer advised that:

- the quarry was expected to generate about 30-40 truck loads per day (80 truck movements);
- most customers would send their own trucks;
- quarry trucks, in effect, will use the shortest route available;
- most trucks are expected to be truck-dog combinations;
- Dr Pages Road will be used if it is the shortest distance to the delivery point.

In such circumstances, the relevant traffic-related considerations relate entirely to the adequacy of the access routes on which the quarry will rely.

It is anticipated the market the quarry may serve has three segments:

- the area served by the Bruce Highway south of Pomona. This area would be accessed from the quarry via Kin Kin Road, Pioneer Road and the highway itself (green on Attachment A).
- Gympie and surrounding districts. This area would be most directly accessed from the quarry via Cedar Pocket Road to Tin Can Bay Road (red on Attachment A). .
- Tewantin, Noosa and the northern end of the Sunshine Coast, which would be accessed most directly via Dr Pages Road, Cootharaba Road and Junction Road connecting to Boreen Point-Tewantin Road (blue on Attachment A).

These access routes are considered in turn below.

3. SHEPPERSONS LANE

Sheppersons Lane is described in the above Council report.

Additional noteworthy features of it (noting that it is of course currently an unsealed single lane road) include:

- it abuts and provides access to "Sheppersons Park", it forms part of the Kin Kin Countryside Trail, the Kin Kin-Macdonald Trail and the mapped Noosa Trail Network, and it adjoins the Living Valley Health Retreat and three dwellings.

- it is understood it is actively used as a walking/jogging trail in association with the health retreat, and for hiking and horse riding along the Noosa Trail Network.

In these circumstances, if used by quarry trucks, its narrow unsealed width represents a danger for other road users, as well as a potential noise and dust nuisance to other members of the public. It also represents a possible long term maintenance issue to Council and thus to the general community

The above Council report states that the intersection of Sheppersons Lane and Kin Kin Road was upgraded by Council in accordance with the requirements of what is now the Department of Transport and Main Roads (Main Roads). While that may have been correct at the time, the intersection is deficient by current standards on the following basis.

The absolute minimum intersection layout now specified by Main Roads (Figure 13.58 of the Road Planning and Design Manual. copy at Attachment B), requires that the shoulder on the western side of Kin Kin Road, opposite Sheppersons Lane, be constructed and sealed to a width of at least 6.6m (measured from the road centreline) for a distance of approximately 50m. This is intended to allow a through vehicle to safely pass to the left of a right turning vehicle. This shoulder construction has not been undertaken.

4. KIN KIN ROAD SOUTH OF THE SITE

Kin Kin Road is a State-controlled road under the jurisdiction of Main Roads.

It is a bus route and south of Kin Kin Township. carries about 3400 vehicles per day. In general it has a sign-posted speed limit of 100 kilometres per hour.

To use the applicant's own words (as set out in the "Road Transport Protocol" dated April '10). Kin Kin Road is "narrow, winding and contains numerous hills, 3 single lane bridges and other testing driving conditions, particularly operation of the local School Bus".

In response to an enquiry from Councillor Lew Brennan regarding the impact of the quarry on the State-controlled road system, Main Roads, by letter dated 14 January 2010, pointed out that in relation to truck and dog combinations. there are no specified conditions or standards that a road must conform to in order to carry such vehicles.

What that letter failed to state however is that in fact, there ARE specified road standards for roads dependent on the volume of traffic they carry, as detailed hereunder.

4.1 Carrigeway Widths: Austroads is the national association of Australian road and traffic authorities. That Authorities' publication "Rural Road Design: A Guide to the Geometric Design of Rural Roads" provides (Table 11.1, copy at Attachment C) the following guidelines for the minimum widths of roads, as follows:

	Traffic Volume (vehicles per day)				
	1-150	150-500	500-1000	1000-3000	>3000
Carrigeway Width:	3.5	6.2	6.2-7.0	7.0	7.0
Total Shoulder Width:	2.0	1.5	1.5	2.0	2.5
Sealed Shoulder Width:	0.5	0.5	0.5	1.0	1.5

The minimum carriageway widths specified in the Main Roads' Road Planning and Design Manual (Section 7.2.2, copy at Attachment D) are as follow:

	Traffic Volume (vehicles per day)		
	<700	700-1700	>1700
Carriageway Width:	6.0	6.5	7.0

Section 7.3.2 of the Manual (copy at Attachment E) specifies shoulders should be sealed to a width of 0.5m for traffic flows less than 2000 vehicles per day and a width of at least 1.0m for greater traffic flows.

On that basis, in order to comply with current standards, Kin Kin Road south of the site should have an overall sealed width of at least 9.0m, comprising a 7.0m wide carriageway and a 1.0m wide sealed shoulder on each side.

According to either set of criteria, Kin Kin Road south of the site is therefore grossly sub-standard.

4.2 Bridge Widths: The bridge over Kin Kin Creek is only 5.5m wide between kerbs, with no vehicle or pedestrian railings, and no separate pedestrian walkway.

Two bridges south of that point are both sign-posted as single-lane one-lane bridges, in one case with give-way signs facing the direction in which loaded quarry trucks would be travelling.

Section 7.10.1 of the Road Planning and Design Manual (copy at Attachment F) provides that for bridges less than 20m long, the bridge width should match the width of the road approaches and for bridges more than 20m long, the width should be the width of the traffic lanes on the approaches plus 1.0m clearance on each side.

The Austroads provisions are the same (copy at Attachment G).

On that basis, according to both national and Queensland standards, three bridges on Kin Kin Road south of the site are significantly deficient.

5. CEDAR POCKET ROAD

Cedar Pocket Road is a lightly trafficked road with a sign-posted speed limit of 100 kilometres per hour.

The width of its carriageway varies, down to a minimum of approximately 3.6m, south of Tatnell Bridge. In general, it has centre-line line-marking.

It features three bridges (Sorensen Bridge, Tatnell Bridge and the bridge over Deep Creek), which are all narrow and sign-posted for one-lane operation, with one direction of flow facing a give-way sign.

Accordingly, for the same reasons as detailed above, Cedar Creek Road is deficient in terms of both its sealed width and the widths of its bridges.

6. JUNCTION ROAD

Although 0.7km of this road is currently being upgraded to a sealed carriageway standard, approximately 4.1km of this route will remain unsealed on completion of that work.

The unsealed section appears to pass through a relatively low-lying area, where truck usage during or soon after adverse weather may well result in significant pavement damage.

7. DISCUSSION

7.1 Single Lane Bridges: The inherent danger with single lane bridges is that:

- minor errors of judgement can have catastrophic results if the driver who theoretically has right-of-way as per the signing insists upon it; or
- drivers of large vehicles may rely on the "might-is-right" rule; or
- as traffic flows increase, creating a possible perception of excessive delays, particularly if the predominant flow is that having "right-of-way", some "minor flow" drivers may become impatient and select inappropriately short gaps in the opposing traffic stream.

The consequences of such behaviour can be catastrophic for those involved, since the result is a head-on collision situation.

7.2 Narrow Two Lane Bridges: The inherent danger with narrow 2-lane bridges typified by the Kin Kin Road bridge over Kin Kin Creek, is that in the event vehicles attempt to pass each other while on the bridge, the required driving task is quite difficult.

Quarry trucks are normally constructed to the maximum allowable legal width of 2.5m. Outside that, trucks are permitted to have 200mm wide mirrors.

That is, the actual width of a quarry truck can be, and usually is, 2.9m

Since the Kin Kin Creek bridge is only 5.5m wide, it can be seen that a truck must be driven very close to the edge of the bridge in order to pass any oncoming vehicle, and particularly another truck or school bus.

This is a very difficult manoeuvre, particularly at more than walking pace, a speed unlikely to be commonly experienced on that bridge.

There is therefore a high risk of side-swipe collisions involving trucks on that bridge, a danger accentuated by the lack of bridge railings to prevent vehicles falling into the creek.

7.3 Narrow Carriageways: The inherent problem associated with narrow carriageways, particularly as traffic volumes increase, is that there is a resulting likelihood of undue wear, and thus degradation, of the outer edge of the carrigeway. Particularly where the shoulders are not sealed, thus allowing water to enter, and thereby weaken, the road pavement, this will lead to the outer edge of the carriageway breaking up. Unless very well maintained, the result is that drivers will tend to position their vehicle closer to, or over, the road centreline, with consequent inherent risk of collision, or forcing oncoming drivers onto pot-holed carrigeway edges or possible poorly maintained unsealed shoulders. If this happens at speed, in locations where drivers are not expecting to have to avoid oncoming vehicles "hugging" the centreline, the result can be a high-speed "off-road" accident. It is also relevant to note that over long lengths, guideposts have been installed along Kin Kin Road very close to the carrigeway edge, with the result that many drivers would instinctively NOT move onto the shoulder even if it was otherwise prudent for them to do so. Conversely, if a quarry truck does move over onto the possible pot-holed carrigeway edge or shoulder, the truck, and particularly an unloaded dog-trailer, can jump laterally a significant distance on hitting a pot-hole, possibly even across the road centreline.

At best, the break-up of the edge of the carrigeway will result in gravel being moved onto the sealed running surface, leading to windscreen breakage and unexpected skidding if at bends.

It is for all these reasons that the above guides specify that carrigeway and shoulder widths should increase as traffic volumes increase.

8. COUNCIL REQUIREMENTS

Council's letter dated 2 December 2003 extended the previous development approval subject, amongst other things, to the submission of a Traffic Management Plan.

A Quarry Management Plan dated 20th March 2005 was then prepared. It contained no proposed limits on production rates. Sections 2.1 and 3.9.2 of that Plan both state that the product will be delivered to customers via the Pomona – Kin Kin Road to the Bruce Highway.

The Neilsens' "Road Transport Protocol" dated April '10 states that "the ***main*** haulage route for trucks using the Kin Kin Quarry is the Pomona-Kin Kin Road (my emphasis)". In my opinion, this is an honest statement of intent consistent with the CEO's e-mail referred to earlier, bearing in mind his statement that:

- most customers would send their own trucks;
- quarry trucks, in effect, will use the shortest route available;
- Dr Pages Road will be used if it is the shortest distance to the delivery point.

The second and third points make obvious commercial sense, and the first point suggests that the quarry operator would be unable to nominate access routes, even if so desired.

9. CONCLUSION

All the access roads which the site might utilise for access are deficient by current standards. They are therefore inherently unsuitable to accommodate the number and type of trucks envisaged in association with the proposed quarry.

Accordingly, for the scale of development now proposed, the conditions attached to the original town planning approval of the quarry are inadequate.

If the road system on which the quarry relies for access is retained in its present state, the combination of narrow bridges and carriageways on that network and the imposition of 30-40 loaded quarry trucks per day will exacerbate an existing unsatisfactory situation with regard to the safety of existing road users, and will increase road maintenance costs ultimately borne by the general community.

If a Material Change of Use application were to be made now for the quarry, conditions would need to be formulated effectively restricting quarry trucks to a specific road (probably Kin Kin Road between the site and the Bruce Highway), with associated upgrading of the existing bridges and carrigeway widths on that route.

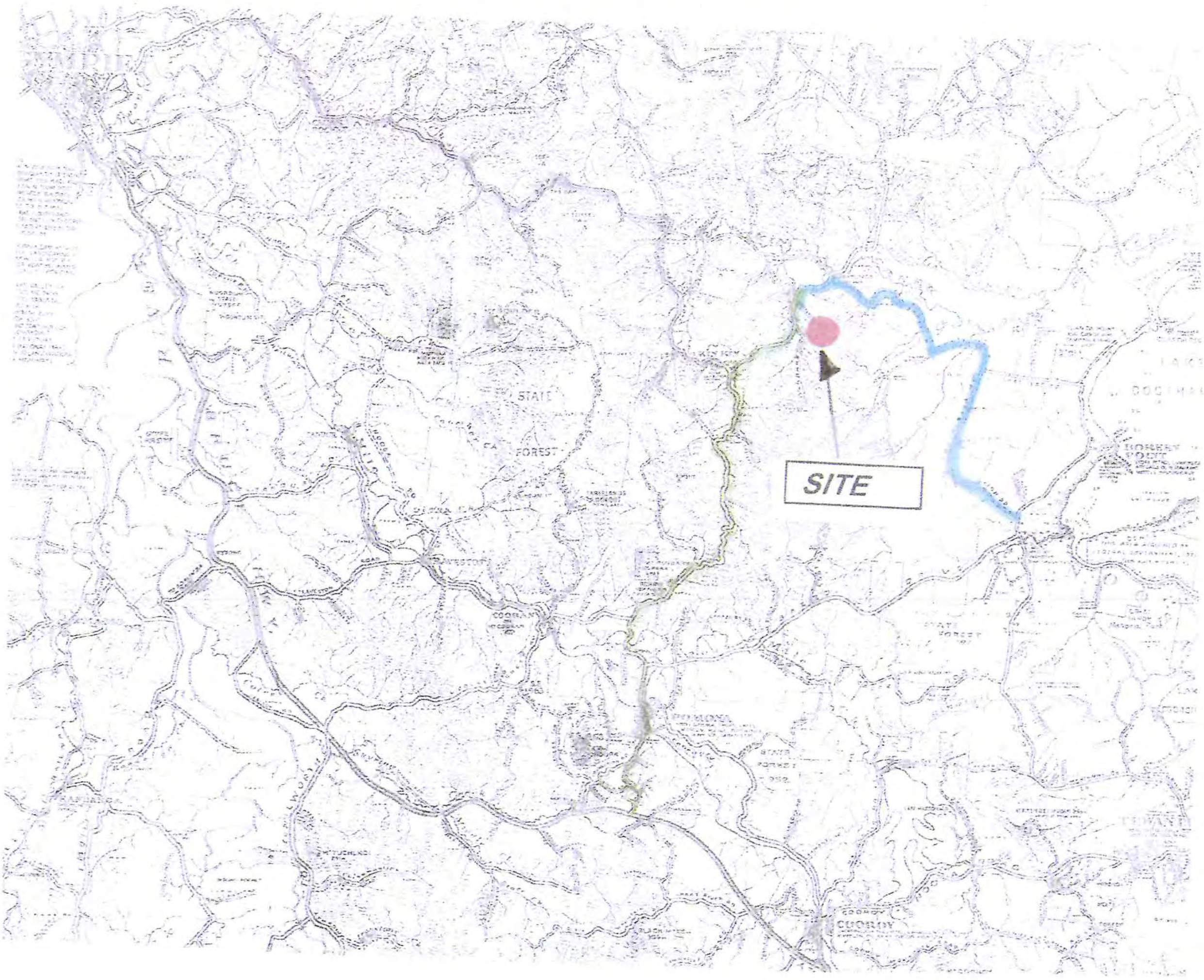
It is noted in this respect though that in my view, effective restriction of quarry trucks to a single specified route may well be unrealistic, impractical or unacceptable, particularly bearing in mind the quarry operator's advice that the majority of customers would send their own trucks.

19. 8. 10

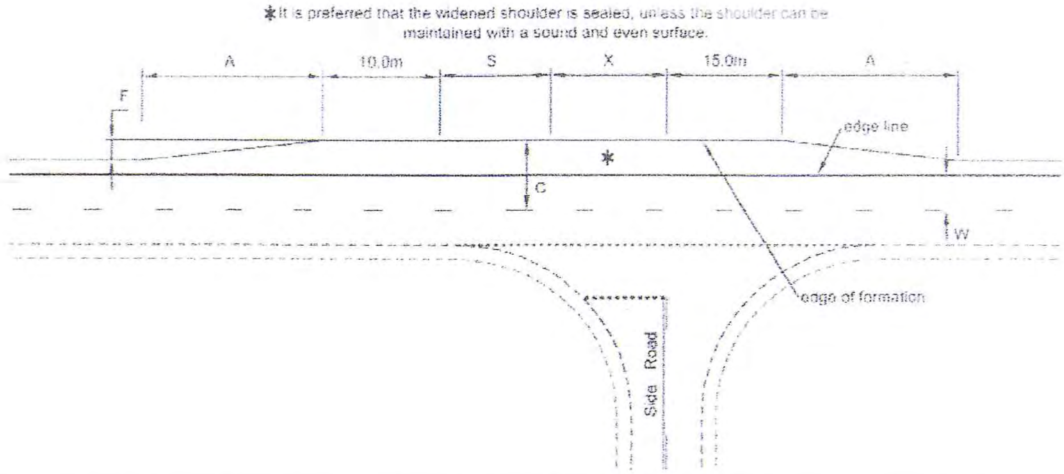
R C HOLLAND

PRINCIPAL
HOLLAND TRAFFIC CONSULTING PTY LTD

ATTACHMENT A: LOCALITY PLAN



ATTACHMENT B: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, FIGURE 13.58



W= Nominal through lane width (m) (including widening for curves). Width to be continuous through the intersection.

C = On straights - 6.5m minimum
- 7.0m minimum for Type 1 & Type 2 Road Trains
On curves - widths as above + curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle)

A = $\frac{0.5 \times V \times F}{3.6}$
Increase length A on tighter curves. Where the design through vehicle is larger than or equal to a 19m semi-trailer, the minimum speed used to calculate A is 80km/h.

V = Design speed of major road approach (km/h)

F = Formation/carriageway widening (m)

S = Storage length to cater for one design turning vehicle (m) (minimum length 12.5m)

X = Distance based on design vehicle turning path, typically 10 - 15m

Figure 13.58 Basic Right Turn Treatment (BAR) on a Two Lane Rural Road

ATTACHMENT C: AUSTROADS' "RURAL ROAD DESIGN: A GUIDE TO THE GEOMETRIC DESIGN OF RURAL ROADS", TABLE 11.1

Table 11.1: Single Carriageway Road Widths

Element	Design AADT				
	1-150	150-500	500-1,000	1,000-3,000	>3,000
Traffic Lanes	3.5 (1 x 3.5)	6.2 (2 x 3.1)	6.2-7.0 (2 x 3.1/3.5)	7.0 (2 x 3.5)	7.0 (2 x 3.5)
Total Shoulder	2.0	1.5	1.5	2.0	2.5
Shoulder Seal	0.5	0.5	0.5	1.0	1.5

Note:

- *Traffic lane widths include centre-lines but are exclusive of edge-lines.*
- *Shoulder beyond the seal can be lightly constructed, gravel surface suitable for supporting occasional heavy wheel load.*
- *Short lengths of wider shoulder seal or lay-bys to be provided at suitable locations to provide for discretionary stops.*
- *Wider shoulder seals may be appropriate depending on requirements for cyclists, maintenance costs, soil and climatic conditions or to accommodate the tracked width requirements for Large Combination Vehicles.*
- *Full width shoulder seals may be appropriate beside guard barrier and on the high side of superelevation.*

ATTACHMENT D: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL., SECTION 7.2.2

7.2.2 Two Lane Two Way Rural Roads

Minimum traffic lane widths for two lane two way rural road applications should be determined from Table 7.4.

Where the intended design speed through mountainous terrain will be in excess of 80 km/h, or 100 km/h in undulating terrain, or where there is a predominantly high percentage of heavy vehicles (20% for 500 AADT and 5% for 2000 AADT), a lane width of 3.5 m is desirable.

Refer to Section 7.2.1 for discussion on various heavy vehicles.

Table 7.4 Guidelines for Traffic Lane Width (Two Lane Rural Roads)

Width of Traffic Lanes		Anticipated AADT at Opening: Low Future Growth (<3)%	Reasonable Future Growth (3-6)%	High Future Growth (>6)%
Two Lanes	(6.0)	up to 700	up to 500	up to 300
	(6.5)	700-1700	500-1200	300-900
	(7.0)*	over 1700	over 1200	over 900

* Where local conditions dictate, widths in excess of 7.0m may be considered

If in using the table, volumes fall near the boundary of groups, consider carefully whether to use higher or lower value

ATTACHMENT E: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, SECTION 7.3.2

7.3.2 Two Lane Two Way Rural Roads

Widths

Table 7.7 lists shoulder width requirements for two lane rural roads with minimal pedestrian and/or bicycle traffic.

A taper of 1:50 should be applied between different width shoulders that adjoin one another. This taper transition may need to be lengthened to ensure the taper's appearance is satisfactory.

Table 7.7 Guidelines for Shoulder Widths

Nominal Shoulder Width (m)	Situation
0.5-1.0*	Normally widths less than 1.0 m will be used only where overlaying is being carried out with full formation sealing, and widening of formation is not justified.
1.0*	Minimum shoulder width for general use (i.e. unless special reasons dictate otherwise). Appropriate also when shoulder seal is desired and material cost/properties dictate full normal paving material.
1.5*	Normal shoulder width with sealed or partly sealed shoulders. Depends on availability of suitable material.
2.0-2.5*	Suitable shoulder width on higher volume roads when periodic provision to stop completely clear of traffic lanes is difficult to provide.
3.0*	Special cases where local issues dictate (e.g. high speed high volume rural routes where incidence of stopped vehicles unable to exercise choice as to location of stop may be significant). Normally only occurs on arterial outlets to major urban areas, especially if recreational routes.

* Shoulders between 0.5 m and 1.5 m do not enable a vehicle to stop clear of traffic lanes. 2.0 m shoulders enable it to stop largely clear. A vehicle travelling 100 km would expect to encounter some 4 to 5 stopped vehicles for every 1000 vehicles/hour using the road. Of these something less than 5% would have little

ATTACHMENT E: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, SECTION 7.3.2 (cont)

choice as to the exact location of the stop. There is evidence that safety does not improve significantly for shoulder widths over 1.5-2.0 m. Continuous 2.5 m shoulder can therefore be justified only on the highest volume roads and where speeds are also high. What is important, however, is to provide frequent opportunities to stop completely clear of the road (by flattening slopes on at least some low fills, or making provision at the transition of cut and fill) on all roads with shoulders less than 1.5 m, and also on higher volume roads with shoulders less than 2.5 m.

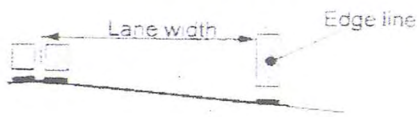
Shoulder Sealing

Shoulders should be sealed to a width of 0.5m (min.) from the edge of the sealed lane when the predicted AADT is less than 2000, and 1.0m (min.) when the predicted AADT is greater than 2000. When provision is made for cyclists, a wider sealed shoulder is required (see Chapter 5).

A full width seal should be provided:

- Adjacent to a lined table drain, kerb or dyke;
- Where a safety barrier is provided adjacent to a 1.0 m wide shoulder;
- On the outer shoulder of a superelevated curve;
- On floodways;
- Where environmental conditions require it;
- Where rigid pavement is proposed;
- Where required to minimise maintenance costs;
- In high rainfall areas.

Edge lines should be marked so that their inside edge corresponds to the outside of the lane.



Note: Sealing is sometimes continued beyond the shoulder point and down the batter slope on the high side to protect the pavement from ingress of water. On floodways, the seal is continued down the batter on both sides where no other protection of the batters is provided.

ATTACHMENT F: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, SECTION 7.10.1

7.10 Bridges and Clearances

7.10.1 Road Bridge Widths

Bridges comprise a relatively small proportion of the total road length, but they are proportionally much more expensive. They do, however, have a much longer life than other elements of the road structure and the width determined for a bridge should be based on a longer period of traffic growth than for other elements.

Bridge widths shall be determined from Table 7.17 or from Table 7.18. Departure from the indicated widths may be required to satisfy particular situations.

For example, if the bridge is located in or near built-up areas, or is part of a local or regional cycle route, it will need to be designed to accommodate cycle and/or pedestrian traffic. This may be in form of wider shoulders or a separate pedestrian facility on one or both sides of the bridge.

On roads with significant numbers of road trains, sufficient width is required to allow two road trains to pass safely. This will be particularly important if the bridge is on a curve.

The widths for National Highways shown in Table 7.17 are derived from the published Standards and guidelines for National Highways:

- For lengths less than 20m - the carriageway width (see sections 7.2.5 and 7.3.7 for the elements of width);
- Where the AADT across the bridge is expected to exceed 1000 per lane within 20 years of the works being opened to traffic - the width of the traffic lanes plus 2.4m; and
- For all other cases - the width of the traffic lanes plus 1.2m.

In all cases, the needs of cyclists must be considered and appropriate allowance made.

The widths for roads other than National Highways shown in Table 7.18 are based on the following approach:

- For bridges shorter than 20m in length - the carriageway width (see section 7.2 and 7.3 for the elements of width);
- For bridges longer than 20m - the width of the traffic lanes plus 1.0m clearance each side.

7

ATTACHMENT F: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, SECTION 7.10.1 (Cont)

Table 7.18 Bridge Carriageway Widths - Other than National Highways

Bridge			Two Way							One Way			
			Two Lane			Single Lane					Two Lane		
Length	AADT	Shldr	Lanes	Shldr	Width	Shldr	Lane	Shldr	Width	Shldr	Lanes	Shldr	Width
Any	<100	1.0	6.0	1.0	8.0	0.6	3.0	0.6	4.2	-	-	-	
Any	100-500	1.0	6.0	1.0	8.0	2.0	3.0	1.0	6.0	-	-	-	
Any	500-1000	1.0	6.5	1.0	8.5	2.0	3.25	1.0	6.25	-	-	-	
<20	1000-2000	1.5	6.5	1.5	9.5	2.0	3.25	1.0	6.25	-	-	-	
>20	1000-2000	1.0	6.5	1.0	8.5	2.0	3.25	1.0	6.25	-	-	-	
<20	>2000	2.0	7.0	2.0	11.0	2.0	3.5	1.0	6.5	2.0	7.0	1.0	10.0
>20	>2000	1.0	7.0	1.0	9.0	2.0	3.5	1.0	6.5	1.0	7.0	1.0	9.0

NOTES:

1. Wherever possible, bridge carriageway widths should equal the approach carriageway widths.
2. Use 3.0m shoulders adjacent to a barrier centreline marking or consider further widening to provide for auxiliary lane/s
3. Add appropriate lane widths to the two lane configurations to determine multi-lane bridge widths.
4. All culverts are to be designed for full width of formation.
5. AADT's are within 20 years.
6. If a bridge is part of cycle route and/or is in a built-up area, extra shoulder width will be required to allow adequate cyclist access, and pedestrian facilities will be required

ATTACHMENT G: AUSTROADS' "RURAL ROAD DESIGN: A GUIDE TO THE GEOMETRIC DESIGN OF RURAL ROADS", SECTION 9.13

9.13 Bridge Considerations

Bridge carriageway width and width of road on the approaches to the bridge are based on providing a consistent level of service along a section of road. The following factors should be considered:

- Road geometry;
- Traffic volumes and composition;
- Terrain;
- Climatic conditions; and
- Bridge location.

The traffic lane widths provided on the bridge should not be less than the widths provided on the approach roadway. On short bridges (20m long or less for most rural roads), it is normal practice to carry the full width of shoulders and pavement, including auxiliary lanes, across the bridge.

Where necessary, additional bridge width should be provided:

- To carry a kerbed footway on the bridge and on the approaches; and

- To achieve satisfactory sight distance and curve widening.

Auxiliary lane lengths and, in particular, tapers should not be reduced in order to avoid widening on bridges. If possible, it may be preferable to relocate the auxiliary lane.

The following principles are to be adopted for the alignment of elevated structures on major rural roads:

- Avoid multiple and varying geometrics on the structure, including superelevation transitions, where possible;

- Skew angle should not exceed 35°;

- Avoid curve radii below 500 m;

- Avoid short end spans on bridges;

- Provide a constant crossfall on bridges;

- If curvature is unavoidable, the bridge should lie fully within the circular arc and the radius should be as large as possible with maximum 6% superelevation; and

- The designer should seek advice from bridge engineers in relation to construction economies, provision for future duplication and the location of tangent points.

Further consideration of geometric requirements for bridges is set out in the Austroads Bridge Design Code (Ref. 29).

STATEMENT TO THE COURT

In the Planning and Environment Court

No. D32 of 2010

Held at Maroochydore

Between:	KIN KIN COMMUNITY GROUP INC	Applicant
And:	SUNSHINE COAST REGIONAL COUNCIL	First Respondent
And:	JOHN WALLACE SHEPPERSON	Second Respondent
And:	NEILSENS QUALITY GRAVELS PTY LTD ACN 010 620 916	Third Respondent

I have been instructed by the Kin Kin Community Group to investigate the traffic-related aspects of the matter.

I acknowledge that I have read and understood the Planning and Environment Court Rules 2008 with respect to expert evidence and I understand my duty to the Court and I have complied with that duty.

I have not received or accepted instructions to adopt or reject a particular opinion in relation to the issues in dispute. I confirm that the factual matters stated in this report are, as far as I know, true and I have made all enquiries I consider appropriate. The opinions I have stated in this report are genuinely held and the report contains references to all matters, in my knowledge, that I consider significant. Access to any readily ascertainable additional facts would not assist me in reaching a more reliable conclusion.

My qualifications and experience are contained in the following statement of my qualifications and experience.

19.8.10

APPENDIX:

DETAILS OF MR HOLLAND'S QUALIFICATIONS AND EXPERIENCE

ROBERT CHARLES HOLLAND

Director
Holland Traffic Consulting Pty Ltd
Consulting Traffic Engineers

Date of Birth: 26th January, 1946
Nationality: Australian
Residence: 99 Longman Terrace, Chelmer

QUALIFICATIONS

Dip.C.E., Footscray Institute of Technology 1971
B.E. (Civil), University of Melbourne 1968
M.Eng.Sc. (Traffic & Transport), University of NSW 1973
Member, Institution of Engineers, Australia
Registered Professional Engineer, Queensland

On 1st January 2000, in conjunction with Stuart Holland, Mr Holland established the specialist traffic engineering consulting firm of Holland Traffic Consulting Pty Ltd.

From 1987 to 1999, Mr Holland was a principal of the specialist traffic engineering consulting firm of Beard & Holland Pty Ltd, carrying out projects including:

* development of traffic engineering solutions to a range of problems associated with development proposals including large and small shopping centres, conventional and "green street" residential subdivisions, tourist resorts, expansion of major industrial complexes, city-wide garbage disposal schemes, commercial car parks, a transit station, Central City office developments and licensed sporting clubs in a geographic area extending from Cairns to northern New South Wales.

* supply of advice regarding a range of traffic engineering matters to Local Authorities and Queensland Department of Transport,

* for Brisbane City Council, a review of Central Business District parking requirements and policies, a traffic and parking study of Kangaroo Point and traffic and parking studies associated with the Latrobe & Given Terraces Development Control Plan (with Brannock Humphreys),

* for Queensland Department of Transport and Bundaberg City Council, the Bundaberg Traffic Study including upgrading of Bourbong Street,

* for Queensland Department of Transport, a traffic and parking study of the central area of Rockhampton, and

* provision of expert testimony to the Planning and Environment Court and the preceding Local Government Court, and participation in the overall preparation for such cases.

From 1977 to l987, Mr Holland was responsible for Research & Planning in the Traffic Planning Branch of Brisbane City Council. This work involved the review of the traffic engineering aspects of all development proposals received by Council. It also included the preliminary investigation and design of the Council's major traffic schemes, often in close consultation with Queensland Transport (then Main Roads Department). He was also extensively involved in policy investigations and advice, and the corporate management of the Department He was one of a team of three which undertook a complete review of the management and organization of the Department of Development and Planning.

Traffic engineering projects and investigations for which Mr Holland was directly responsible with the Brisbane City Council included:

* the investigation of alternative schemes for a CBD mall, the preliminary and functional design of the Queen Street mall and the actual closure of Queen Street to road traffic (as Acting Director, Traffic Planning Branch),
* supply of traffic engineering input to the Town Plan Review, including a complete review of Ordinance Parking requirements,
* development of the road network associated with closure to traffic of the EXPO site,
* upgrading of Fairfield Road,
* location, likely usage and implications of cross river bridges at Toowong, New Farm and Indooroopilly,
* Windsor-Lutwyche Local Area Traffic Management,
* all preliminary traffic planning for the Brisbane bid for the Olympic Games,
* feasibility and review of alternatives for a Stones Corner mall,
* continuous involvement with the traffic engineering assessment of all development proposals, (eg. The Myer Centre, Indooroopilly and Toombul Shoppingtown extensions, Garden City extensions, Stafford City Shopping Centre, Aspley Hypermarket, Post Office Square, Central Station redevelopment, Toowong Station redevelopment, Council's own Boondall Olympic Village Scheme, and many subdivisions), together with involvement in the formulation of corporate recommendations on all aspects of these developments,
* development, adoption and implementation of Council policies on car parking and truck manoeuvring areas,
* control of collection of all Council's traffic data,
* provision of expert testimony to the Local Government Court, and
* between November l986 and May 1987, head of the Working Group created to undertake the Brisbane Traffic Study.

In the period 1966 to 1977, Mr Holland was employed by the Country Roads Board, (now Vic Roads) in Victoria, primarily in the road design, road planning and traffic engineering fields. Experience was also gained in structural design and road construction fields. The first two years were occupied as a cadet of the Board undertaking full-time undergraduate studies. This period also included the undertaking, under full Board sponsorship, of the M.Eng.Sc. course at the University of New South Wales. From 1973 to 1977, he was responsible for all traffic engineering investigations and design over half of Victoria, being leader of a group responsible for traffic investigations into projects such as:

* a complete review of the eastern approaches to the Westgate Bridge, including estimates of traffic volumes on the bridge,

* extension of the Westgate Bridge approach roads to St Kilda Road,

* the Ballarat pedestrian mall,

* traffic aspects of the Scoresby and Healesville Freeways,

* widening from four to eight lanes of the Nepean Highway, Elsternwick to Moorabbin, and

* a complete review of Chapter 8 of the NAASRA publication "Guide to Traffic Engineering Practice".

Mr Holland also supplied expert advice to the Tasmanian Government regarding roadworks required to accommodate traffic flows from the temporary bridging of the Derwent River consequent to the Tasman Bridge disaster.

Annexure F

Holland Report 2010

Kin Kin Road (141)

Kin Kin Road (141) Engineering Review

November 2022

Queensland Government

In the Planning and Environment Court
Held at Maroochydore

Application No 32 of 2010

Between	**KIN KIN COMMUNITY GROUP INC**	Applicant
And	**SUNSHINE COAST REGIONAL COUNCIL (FORMERLY NOOSA SHIRE COUNCIL)**	First Respondent
And	**JOHN WALLACE SHEPPERSON**	Second Respondent
And	**NEILSENS QUALITY GRAVELS PTY LTD ACN 010 620 916**	Third Respondent

AFFIDAVIT

ROBERT CHARLES HOLLAND of 99 Longman Terrace, Chelmer in the State of Queensland, Traffic Engineer, being under affirmation says:

1 Exhibited to this affidavit and marked **'RCH-1'** is a report prepared by me in this proceeding.

Affirmed by **ROBERT CHARLES HOLLAND** on 19 August 2010 at Brisbane, Queensland, in the presence of:

.... Deponent

.... Commissioner for Declarations/Lawyer

AFFIDAVIT OF ROBERT CHARLES HOLLAND

Filed on behalf of the Applicant

Form PEC-4

p&e Law
1 The Esplanade
Cotton Tree Qld 4558
Phone: 07 5479 0155
Fax: 07 5479 5070
Ref:MGriffin:1801 (99531)

In the Planning and Environment Court
Held at Maroochydore

Application No D32 of 2010

Between	**KIN KIN COMMUNITY GROUP INC**	Applicant
And	**SUNSHINE COAST REGIONAL COUNCIL (FORMERLY NOOSA SHIRE COUNCIL)**	First Respondent
And	**JOHN WALLACE SHEPPERSON**	Second Respondent
And	**NEILSENS QUALITY GRAVELS PTY LTD ACN 010 620 916**	Third Respondent

Exhibit '**RCH-1**' to the affidavit of **ROBERT CHARLES HOLLAND** affirmed on 19 August 2010.

....
Deponent

(D 23407)
....
Commissioner for Declarations / Lawyer

CERTIFICATE OF EXHIBITS
TO THE AFFIDAVIT OF
ROBERT CHARLES HOLLAND

Filed on behalf of the Applicant

UCPR r 435

Form 47

p&e Law
1 The Esplanade
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Ref: MGriffin:1801 (99533)

RCH-1

HTC
HOLLAND TRAFFIC CONSULTING PTY LTD
ABN 46 011 068 152

From our Chelmer office

Bob Holland

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In the Planning and Environment Court

No. D32 of 2010

Held at Maroochydore

Between:	KIN KIN COMMUNITY GROUP INC	Applicant
And:	SUNSHINE COAST REGIONAL COUNCIL	First Respondent
And:	JOHN WALLACE SHEPPERSON	Second Respondent
And:	NEILSENS QUALITY GRAVELS PTY LTD ACN 010 620 916	Third Respondent

TRAFFIC REPORT

Prepared for the Planning and Environment Court of Queensland

by

Robert Holland

19th August 2010

10.030.4.r

HTC
HOLLAND TRAFFIC CONSULTING

TABLE OF CONTENTS

ATTACHMENTS

1. INTRODUCTION

This report presents an assessment of the traffic-related issues associated with the declarations sought by the Kin Kin Community Group Inc regarding the quarry proposed by Neilsens Quality Gravels Pty Ltd (Neilsens) at Sheppersons Lane, Kin Kin.

The site is shown on the locality plan at Attachment A.

This report has been prepared by Mr Robert Holland to assist the Court at the hearing of that matter. His qualifications and experience are appended.

2. BACKGROUND

The background to the matter is set out in the report by Senior Development Planner to Council's Strategy and Planning Committee dated 17th February 2010, and it is not proposed to re-iterate the content of that submission herein.

By e-mail dated 18 September 2009, the Neilsens' Services Group Chief Executive Officer advised that:

- the quarry was expected to generate about 30-40 truck loads per day (80 truck movements);
- most customers would send their own trucks;
- quarry trucks, in effect, will use the shortest route available;
- most trucks are expected to be truck-dog combinations;
- Dr Pages Road will be used if it is the shortest distance to the delivery point.

In such circumstances, the relevant traffic-related considerations relate entirely to the adequacy of the access routes on which the quarry will rely.

It is anticipated the market the quarry may serve has three segments:

- the area served by the Bruce Highway south of Pomona. This area would be accessed from the quarry via Kin Kin Road, Pioneer Road and the highway itself (green on Attachment A).
- Gympie and surrounding districts. This area would be most directly accessed from the quarry via Cedar Pocket Road to Tin Can Bay Road (red on Attachment A). .
- Tewantin, Noosa and the northern end of the Sunshine Coast, which would be accessed most directly via Dr Pages Road, Cootharaba Road and Junction Road connecting to Boreen Point-Tewantin Road (blue on Attachment A).

These access routes are considered in turn below.

3. SHEPPERSONS LANE

Sheppersons Lane is described in the above Council report.

Additional noteworthy features of it (noting that it is of course currently an unsealed single lane road) include:

- it abuts and provides access to "Sheppersons Park", it forms part of the Kin Kin Countryside Trail, the Kin Kin-Macdonald Trail and the mapped Noosa Trail Network, and it adjoins the Living Valley Health Retreat and three dwellings.

- it is understood it is actively used as a walking/jogging trail in association with the health retreat, and for hiking and horse riding along the Noosa Trail Network.

In these circumstances, if used by quarry trucks, its narrow unsealed width represents a danger for other road users, as well as a potential noise and dust nuisance to other members of the public. It also represents a possible long term maintenance issue to Council and thus to the general community

The above Council report states that the intersection of Sheppersons Lane and Kin Kin Road was upgraded by Council in accordance with the requirements of what is now the Department of Transport and Main Roads (Main Roads). While that may have been correct at the time, the intersection is deficient by current standards on the following basis.

The absolute minimum intersection layout now specified by Main Roads (Figure 13.58 of the Road Planning and Design Manual. copy at Attachment B), requires that the shoulder on the western side of Kin Kin Road, opposite Sheppersons Lane, be constructed and sealed to a width of at least 6.6m (measured from the road centreline) for a distance of approximately 50m. This is intended to allow a through vehicle to safely pass to the left of a right turning vehicle. This shoulder construction has not been undertaken.

4. KIN KIN ROAD SOUTH OF THE SITE

Kin Kin Road is a State-controlled road under the jurisdiction of Main Roads.

It is a bus route and south of Kin Kin Township. carries about 3400 vehicles per day. In general it has a sign-posted speed limit of 100 kilometres per hour.

To use the applicant's own words (as set out in the "Road Transport Protocol" dated April '10). Kin Kin Road is "narrow, winding and contains numerous hills, 3 single lane bridges and other testing driving conditions, particularly operation of the local School Bus".

In response to an enquiry from Councillor Lew Brennan regarding the impact of the quarry on the State-controlled road system, Main Roads, by letter dated 14 January 2010, pointed out that in relation to truck and dog combinations, there are no specified conditions or standards that a road must conform to in order to carry such vehicles.

What that letter failed to state however is that in fact, there ARE specified road standards for roads dependent on the volume of traffic they carry, as detailed hereunder.

4.1 Carrigeway Widths: Austroads is the national association of Australian road and traffic authorities. That Authorities' publication "Rural Road Design: A Guide to the Geometric Design of Rural Roads" provides (Table 11.1, copy at Attachment C) the following guidelines for the minimum widths of roads, as follows:

	Traffic Volume (vehicles per day)				
	1-150	150-500	500-1000	1000-3000	>3000
Carrigeway Width:	3.5	6.2	6.2-7.0	7.0	7.0
Total Shoulder Width:	2.0	1.5	1.5	2.0	2.5
Sealed Shoulder Width:	0.5	0.5	0.5	1.0	1.5

The minimum carriageway widths specified in the Main Roads' Road Planning and Design Manual (Section 7.2.2, copy at Attachment D) are as follow:

	Traffic Volume (vehicles per day)		
	<700	700-1700	>1700
Carriageway Width:	6.0	6.5	7.0

Section 7.3.2 of the Manual (copy at Attachment E) specifies shoulders should be sealed to a width of 0.5m for traffic flows less than 2000 vehicles per day and a width of at least 1.0m for greater traffic flows.

On that basis, in order to comply with current standards, Kin Kin Road south of the site should have an overall sealed width of at least 9.0m, comprising a 7.0m wide carriageway and a 1.0m wide sealed shoulder on each side.

According to either set of criteria, Kin Kin Road south of the site is therefore grossly sub-standard.

4.2 Bridge Widths: The bridge over Kin Kin Creek is only 5.5m wide between kerbs, with no vehicle or pedestrian railings, and no separate pedestrian walkway.

Two bridges south of that point are both sign-posted as single-lane one-lane bridges, in one case with give-way signs facing the direction in which loaded quarry trucks would be travelling.

Section 7.10.1 of the Road Planning and Design Manual (copy at Attachment F) provides that for bridges less than 20m long, the bridge width should match the width of the road approaches and for bridges more than 20m long, the width should be the width of the traffic lanes on the approaches plus 1.0m clearance on each side.

The Austroads provisions are the same (copy at Attachment G).

On that basis, according to both national and Queensland standards, three bridges on Kin Kin Road south of the site are significantly deficient.

5. CEDAR POCKET ROAD

Cedar Pocket Road is a lightly trafficked road with a sign-posted speed limit of 100 kilometres per hour.

The width of its carriageway varies, down to a minimum of approximately 3.6m, south of Tatnell Bridge. In general, it has centre-line line-marking.

It features three bridges (Sorensen Bridge, Tatnell Bridge and the bridge over Deep Creek), which are all narrow and sign-posted for one-lane operation, with one direction of flow facing a give-way sign.

Accordingly, for the same reasons as detailed above, Cedar Creek Road is deficient in terms of both its sealed width and the widths of its bridges.

6. JUNCTION ROAD

Although 0.7km of this road is currently being upgraded to a sealed carriageway standard, approximately 4.1km of this route will remain unsealed on completion of that work.

The unsealed section appears to pass through a relatively low-lying area, where truck usage during or soon after adverse weather may well result in significant pavement damage.

7. DISCUSSION

7.1 Single Lane Bridges: The inherent danger with single lane bridges is that:

- minor errors of judgement can have catastrophic results if the driver who theoretically has right-of-way as per the signing insists upon it; or
- drivers of large vehicles may rely on the "might-is-right" rule; or
- as traffic flows increase, creating a possible perception of excessive delays, particularly if the predominant flow is that having "right-of-way", some "minor flow" drivers may become impatient and select inappropriately short gaps in the opposing traffic stream.

The consequences of such behaviour can be catastrophic for those involved. since the result is a head-on collision situation.

7.2 Narrow Two Lane Bridges: The inherent danger with narrow 2-lane bridges typified by the Kin Kin Road bridge over Kin Kin Creek, is that in the event vehicles attempt to pass each other while on the bridge, the required driving task is quite difficult.

Quarry trucks are normally constructed to the maximum allowable legal width of 2.5m. Outside that, trucks are permitted to have 200mm wide mirrors.

That is, the actual width of a quarry truck can be, and usually is, 2.9m

Since the Kin Kin Creek bridge is only 5.5m wide, it can be seen that a truck must be driven very close to the edge of the bridge in order to pass any oncoming vehicle, and particularly another truck or school bus.

This is a very difficult manoeuvre, particularly at more than walking pace, a speed unlikely to be commonly experienced on that bridge.

There is therefore a high risk of side-swipe collisions involving trucks on that bridge, a danger accentuated by the lack of bridge railings to prevent vehicles falling into the creek.

7.3 Narrow Carriageways: The inherent problem associated with narrow carriageways, particularly as traffic volumes increase, is that there is a resulting likelihood of undue wear, and thus degradation, of the outer edge of the carrigeway. Particularly where the shoulders are not sealed, thus allowing water to enter, and thereby weaken. the road pavement, this will lead to the outer edge of the carriageway breaking up. Unless very well maintained, the result is that drivers will tend to position their vehicle closer to, or over, the road centreline, with consequent inherent risk of collision, or forcing oncoming drivers onto pot-holed carrigeway edges or possible poorly maintained unsealed shoulders. If this happens at speed, in locations where drivers are not expecting to have to avoid oncoming vehicles "hugging" the centreline, the result can be a high-speed "off-road" accident. It is also relevant to note that over long lengths, guideposts have been installed along Kin Kin Road very close to the carrigeway edge, with the result that many drivers would instinctively NOT move onto the shoulder even if it was otherwise prudent for them to do so. Conversely, if a quarry truck does move over onto the possible pot-holed carrigeway edge or shoulder, the truck, and particularly an unloaded dog-trailer, can jump laterally a significant distance on hitting a pot-hole, possibly even across the road centreline.

At best, the break-up of the edge of the carrigeway will result in gravel being moved onto the sealed running surface, leading to windscreen breakage and unexpected skidding if at bends.

It is for all these reasons that the above guides specify that carrigeway and shoulder widths should increase as traffic volumes increase.

8. COUNCIL REQUIREMENTS

Council's letter dated 2 December 2003 extended the previous development approval subject, amongst other things, to the submission of a Traffic Management Plan.

A Quarry Management Plan dated 20th March 2005 was then prepared. It contained no proposed limits on production rates. Sections 2.1 and 3.9.2 of that Plan both state that the product will be delivered to customers via the Pomona – Kin Kin Road to the Bruce Highway.

The Neilsens' "Road Transport Protocol" dated April '10 states that "the ***main*** haulage route for trucks using the Kin Kin Quarry is the Pomona-Kin Kin Road (my emphasis)". In my opinion, this is an honest statement of intent consistent with the CEO's e-mail referred to earlier, bearing in mind his statement that:

- most customers would send their own trucks;
- quarry trucks, in effect, will use the shortest route available;
- Dr Pages Road will be used if it is the shortest distance to the delivery point.

The second and third points make obvious commercial sense, and the first point suggests that the quarry operator would be unable to nominate access routes, even if so desired.

9. CONCLUSION

All the access roads which the site might utilise for access are deficient by current standards. They are therefore inherently unsuitable to accommodate the number and type of trucks envisaged in association with the proposed quarry.

Accordingly, for the scale of development now proposed, the conditions attached to the original town planning approval of the quarry are inadequate.

If the road system on which the quarry relies for access is retained in its present state, the combination of narrow bridges and carriageways on that network and the imposition of 30-40 loaded quarry trucks per day will exacerbate an existing unsatisfactory situation with regard to the safety of existing road users, and will increase road maintenance costs ultimately borne by the general community.

If a Material Change of Use application were to be made now for the quarry, conditions would need to be formulated effectively restricting quarry trucks to a specific road (probably Kin Kin Road between the site and the Bruce Highway), with associated upgrading of the existing bridges and carrigeway widths on that route.

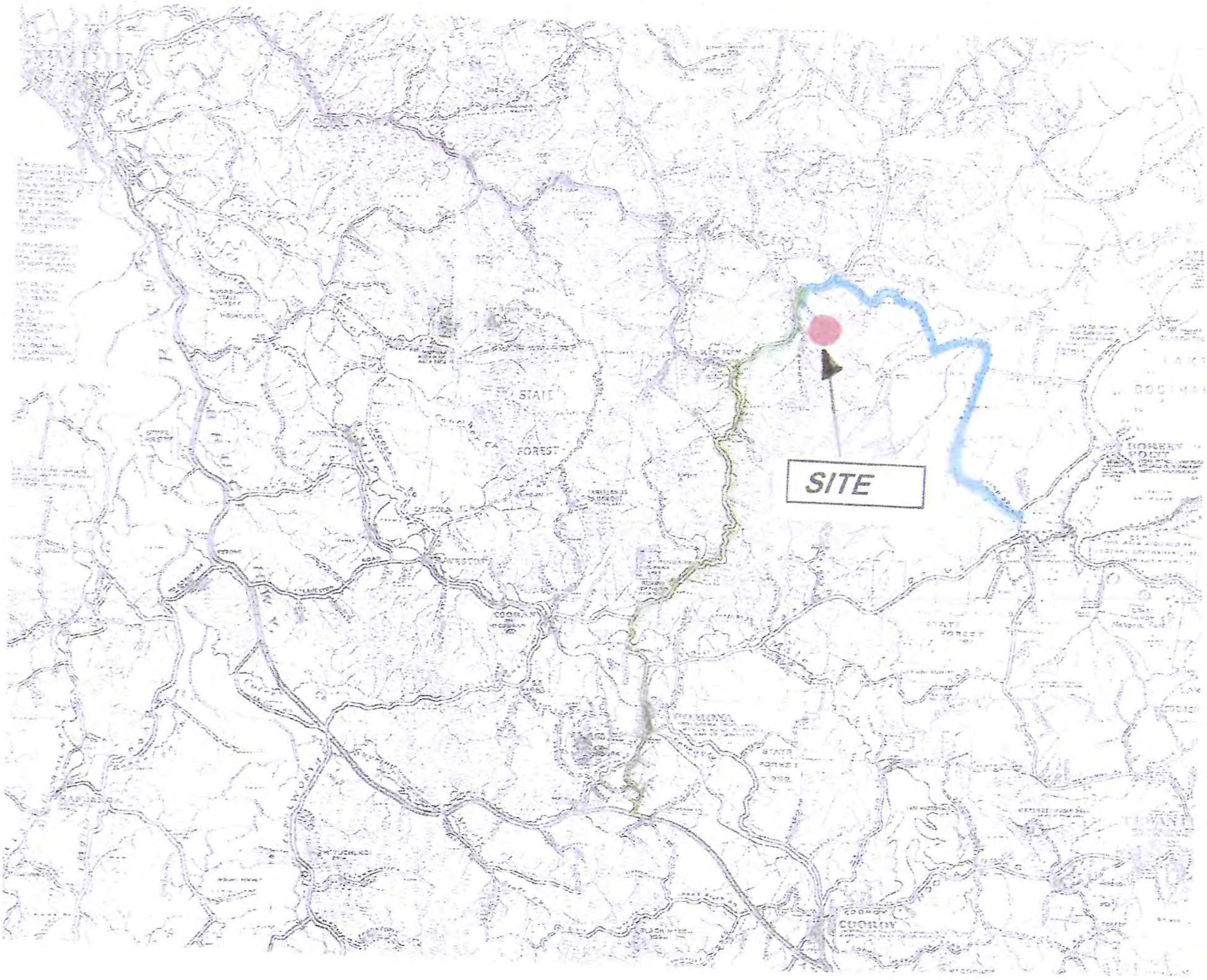
It is noted in this respect though that in my view, effective restriction of quarry trucks to a single specified route may well be unrealistic, impractical or unacceptable, particularly bearing in mind the quarry operator's advice that the majority of customers would send their own trucks.

19.8.10

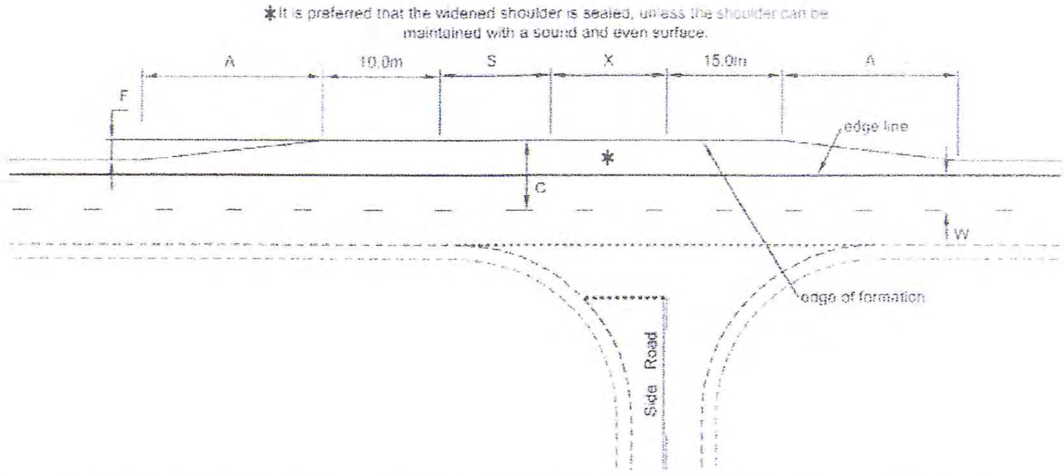
R C HOLLAND

PRINCIPAL
HOLLAND TRAFFIC CONSULTING PTY LTD

ATTACHMENT A: LOCALITY PLAN



ATTACHMENT B: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, FIGURE 13.58



W= Nominal through lane width (m) (including widening for curves). Width to be continuous through the intersection.

C = On straights - 6.5m minimum
- 7.0m minimum for Type 1 & Type 2 Road Trains
On curves - widths as above + curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle)

A = $\frac{0.5 \times V \times F}{3.6}$

Increase length A on tighter curves. Where the design through vehicle is larger than or equal to a 19m semi-trailer, the minimum speed used to calculate A is 80km/h.

V = Design speed of major road approach (km/h)

F = Formation/carriageway widening (m)

S = Storage length to cater for one design turning vehicle (m) (minimum length 12.5m)

X = Distance based on design vehicle turning path, typically 10 - 15m

Figure 13.58 Basic Right Turn Treatment (BAR) on a Two Lane Rural Road

ATTACHMENT C: AUSTROADS' "RURAL ROAD DESIGN: A GUIDE TO THE GEOMETRIC DESIGN OF RURAL ROADS", TABLE 11.1

Table 11.1: Single Carriageway Road Widths

Element	Design AADT				
	1-150	150-500	500-1,000	1,000-3,000	>3,000
Traffic Lanes	3.5 (1 x 3.5)	6.2 (2 x 3.1)	6.2-7.0 (2 x 3.1/3.5)	7.0 (2 x 3.5)	7.0 (2 x 3.5)
Total Shoulder	2.0	1.5	1.5	2.0	2.5
Shoulder Seal	0.5	0.5	0.5	1.0	1.5

Note:

- *Traffic lane widths include centre-lines but are exclusive of edge-lines.*
- *Shoulder beyond the seal can be lightly constructed, gravel surface suitable for supporting occasional heavy wheel load.*
- *Short lengths of wider shoulder seal or lay-bys to be provided at suitable locations to provide for discretionary stops.*
- *Wider shoulder seals may be appropriate depending on requirements for cyclists, maintenance costs, soil and climatic conditions or to accommodate the tracked width requirements for Large Combination Vehicles.*
- *Full width shoulder seals may be appropriate beside guard barrier and on the high side of superelevation.*

ATTACHMENT D: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL., SECTION 7.2.2

7.2.2 Two Lane Two Way Rural Roads

Minimum traffic lane widths for two lane two way rural road applications should be determined from Table 7.4.

Where the intended design speed through mountainous terrain will be in excess of 80 km/h, or 100 km/h in undulating terrain, or where there is a predominantly high percentage of heavy vehicles (20% for 500 AADT and 5% for 2000 AADT), a lane width of 3.5 m is desirable.

Refer to Section 7.2.1 for discussion on various heavy vehicles.

Table 7.4 Guidelines for Traffic Lane Width (Two Lane Rural Roads)

Width of Traffic Lanes		Anticipated AADT at Opening Low Future Growth (<3)%	Reasonable Future Growth (3-6)%	High Future Growth (>6)%
Two Lanes	(6.0)	up to 700	up to 500	up to 300
	(6.5)	700-1700	500-1200	300-900
	(7.0)*	over 1700	over 1200	over 900

* Where local conditions dictate, widths in excess of 7.0m may be considered

If in using the table, volumes fall near the boundary of groups, consider carefully whether to use higher or lower value

ATTACHMENT E: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, SECTION 7.3.2

7.3.2 Two Lane Two Way Rural Roads

Widths

Table 7.7 lists shoulder width requirements for two lane rural roads with minimal pedestrian and/or bicycle traffic.

A taper of 1:50 should be applied between different width shoulders that adjoin one another. This taper transition may need to be lengthened to ensure the taper's appearance is satisfactory.

Table 7.7 Guidelines for Shoulder Widths

Nominal Shoulder Width (m)	Situation
0.5-1.0*	Normally widths less than 1.0 m will be used only where overlaying is being carried out with full formation sealing, and widening of formation is not justified.
1.0*	Minimum shoulder width for general use (i.e. unless special reasons dictate otherwise). Appropriate also when shoulder seal is desired and material cost/properties dictate full normal paving material.
1.5*	Normal shoulder width with sealed or partly sealed shoulders. Depends on availability of suitable material.
2.0-2.5*	Suitable shoulder width on higher volume roads when periodic provision to stop completely clear of traffic lanes is difficult to provide.
3.0*	Special cases where local issues dictate (e.g. high speed high volume rural routes where incidence of stopped vehicles unable to exercise choice as to location of stop may be significant). Normally only occurs on arterial outlets to major urban areas, especially if recreational routes.

* Shoulders between 0.5 m and 1.5 m do not enable a vehicle to stop clear of traffic lanes. 2.0 m shoulders enable it to stop largely clear. A vehicle travelling 100 km would expect to encounter some 4 to 5 stopped vehicles for every 1000 vehicles/hour using the road. Of these something less than 5% would have little

ATTACHMENT E: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, SECTION 7.3.2 (cont)

choice as to the exact location of the stop. There is evidence that safety does not improve significantly for shoulder widths over 1.5-2.0 m. Continuous 2.5 m shoulder can therefore be justified only on the highest volume roads and where speeds are also high. What is important, however, is to provide frequent opportunities to stop completely clear of the road (by flattening slopes on at least some low fills, or making provision at the transition of cut and fill) on all roads with shoulders less than 1.5 m, and also on higher volume roads with shoulders less than 2.5 m.

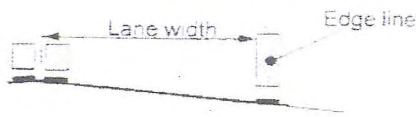
Shoulder Sealing

Shoulders should be sealed to a width of 0.5m (min.) from the edge of the sealed lane when the predicted AADT is less than 2000, and 1.0m (min.) when the predicted AADT is greater than 2000. When provision is made for cyclists, a wider sealed shoulder is required (see Chapter 5).

A full width seal should be provided:

- Adjacent to a lined table drain, kerb or dyke;
- Where a safety barrier is provided adjacent to a 1.0 m wide shoulder;
- On the outer shoulder of a superelevated curve;
- On floodways;
- Where environmental conditions require it;
- Where rigid pavement is proposed;
- Where required to minimise maintenance costs;
- In high rainfall areas.

Edge lines should be marked so that their inside edge corresponds to the outside of the lane.



Note: Sealing is sometimes continued beyond the shoulder point and down the batter slope on the high side to protect the pavement from ingress of water. On floodways, the seal is continued down the batter on both sides where no other protection of the batters is provided.

ATTACHMENT F: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, SECTION 7.10.1

7.10 Bridges and Clearances

7.10.1 Road Bridge Widths

Bridges comprise a relatively small proportion of the total road length, but they are proportionally much more expensive. They do, however, have a much longer life than other elements of the road structure and the width determined for a bridge should be based on a longer period of traffic growth than for other elements.

Bridge widths shall be determined from Table 7.17 or from Table 7.18. Departure from the indicated widths may be required to satisfy particular situations.

For example, if the bridge is located in or near built-up areas, or is part of a local or regional cycle route, it will need to be designed to accommodate cycle and/or pedestrian traffic. This may be in form of wider shoulders or a separate pedestrian facility on one or both sides of the bridge.

On roads with significant numbers of road trains, sufficient width is required to allow two road trains to pass safely. This will be particularly important if the bridge is on a curve.

The widths for National Highways shown in Table 7.17 are derived from the published Standards and guidelines for National Highways:

- For lengths less than 20m - the carriageway width (see sections 7.2.5 and 7.3.7 for the elements of width);
- Where the AADT across the bridge is expected to exceed 1000 per lane within 20 years of the works being opened to traffic - the width of the traffic lanes plus 2.4m; and
- For all other cases - the width of the traffic lanes plus 1.2m.

In all cases, the needs of cyclists must be considered and appropriate allowance made.

The widths for roads other than National Highways shown in Table 7.18 are based on the following approach:

- For bridges shorter than 20m in length - the carriageway width (see section 7.2 and 7.3 for the elements of width);
- For bridges longer than 20m - the width of the traffic lanes plus 1.0m clearance each side.

7

ATTACHMENT F: MAIN ROADS' ROAD PLANNING AND DESIGN MANUAL, SECTION 7.10.1 (Cont)

Table 7.18 Bridge Carriageway Widths - Other than National Highways

Bridge		Two Way								One Way			
		Two Lane				Single Lane				Two Lane			
Length	AADT	Shldr	Lanes	Shldr	Width	Shldr	Lane	Shldr	Width	Shldr	Lanes	Shldr	Width
Any	<100	1.0	6.0	1.0	8.0	0.6	3.0	0.6	4.2	-	-	-	
Any	100-500	1.0	6.0	1.0	8.0	2.0	3.0	1.0	6.0	-	-	-	
Any	500-1000	1.0	6.5	1.0	8.5	2.0	3.25	1.0	6.25	-	-	-	
<20	1000-2000	1.5	6.5	1.5	9.5	2.0	3.25	1.0	6.25	-	-	-	
>20	1000-2000	1.0	6.5	1.0	8.5	2.0	3.25	1.0	6.25	-	-	-	
<20	>2000	2.0	7.0	2.0	11.0	2.0	3.5	1.0	6.5	2.0	7.0	1.0	10.0
>20	>2000	1.0	7.0	1.0	9.0	2.0	3.5	1.0	6.5	1.0	7.0	1.0	9.0

NOTES:

1. Wherever possible, bridge carriageway widths should equal the approach carriageway widths.
2. Use 3.0m shoulders adjacent to a barrier centreline marking or consider further widening to provide for auxiliary lane/s
3. Add appropriate lane widths to the two lane configurations to determine multi-lane bridge widths.
4. All culverts are to be designed for full width of formation.
5. AADT's are within 20 years.
6. If a bridge is part of cycle route and/or is in a built-up area, extra shoulder width will be required to allow adequate cyclist access, and pedestrian facilities will be required.

ATTACHMENT G: AUSTROADS' "RURAL ROAD DESIGN: A GUIDE TO THE GEOMETRIC DESIGN OF RURAL ROADS", SECTION 9.13

9.13 Bridge Considerations

Bridge carriageway width and width of road on the approaches to the bridge are based on providing a consistent level of service along a section of road. The following factors should be considered:

- Road geometry;
- Traffic volumes and composition;
- Terrain;
- Climatic conditions; and
- Bridge location.

The traffic lane widths provided on the bridge should not be less than the widths provided on the approach roadway. On short bridges (20m long or less for most rural roads), it is normal practice to carry the full width of shoulders and pavement, including auxiliary lanes, across the bridge.

Where necessary, additional bridge width should be provided:

- To carry a kerbed footway on the bridge and on the approaches; and
- To achieve satisfactory sight distance and curve widening.

Auxiliary lane lengths and, in particular, tapers should not be reduced in order to avoid widening on bridges. If possible, it may be preferable to relocate the auxiliary lane.

The following principles are to be adopted for the alignment of elevated structures on major rural roads:

- Avoid multiple and varying geometrics on the structure, including superelevation transitions, where possible;
- Skew angle should not exceed 35°;
- Avoid curve radii below 500 m;
- Avoid short end spans on bridges;
- Provide a constant crossfall on bridges;
- If curvature is unavoidable, the bridge should lie fully within the circular arc and the radius should be as large as possible with maximum 6% superelevation; and
- The designer should seek advice from bridge engineers in relation to construction economies, provision for future duplication and the location of tangent points.

Further consideration of geometric requirements for bridges is set out in the Austroads Bridge Design Code (Ref. 29).

STATEMENT TO THE COURT

In the Planning and Environment Court

No. D32 of 2010

Held at Maroochydore

Between:	KIN KIN COMMUNITY GROUP INC	Applicant
And:	SUNSHINE COAST REGIONAL COUNCIL	First Respondent
And:	JOHN WALLACE SHEPPERSON	Second Respondent
And:	NEILSENS QUALITY GRAVELS PTY LTD ACN 010 620 916	Third Respondent

I have been instructed by the Kin Kin Community Group to investigate the traffic-related aspects of the matter.

I acknowledge that I have read and understood the Planning and Environment Court Rules 2008 with respect to expert evidence and I understand my duty to the Court and I have complied with that duty.

I have not received or accepted instructions to adopt or reject a particular opinion in relation to the issues in dispute. I confirm that the factual matters stated in this report are, as far as I know, true and I have made all enquiries I consider appropriate. The opinions I have stated in this report are genuinely held and the report contains references to all matters, in my knowledge, that I consider significant. Access to any readily ascertainable additional facts would not assist me in reaching a more reliable conclusion.

My qualifications and experience are contained in the following statement of my qualifications and experience.

MHolland

19.8.10

APPENDIX:

DETAILS OF MR HOLLAND'S QUALIFICATIONS AND EXPERIENCE

ROBERT CHARLES HOLLAND

Director
Holland Traffic Consulting Pty Ltd
Consulting Traffic Engineers

Date of Birth: 26th January, 1946
Nationality: Australian
Residence: 99 Longman Terrace, Chelmer

QUALIFICATIONS

Dip.C.E., Footscray Institute of Technology 1971
B.E. (Civil), University of Melbourne 1968
M.Eng.Sc. (Traffic & Transport), University of NSW 1973
Member, Institution of Engineers, Australia
Registered Professional Engineer, Queensland

On 1st January 2000, in conjunction with Stuart Holland, Mr Holland established the specialist traffic engineering consulting firm of Holland Traffic Consulting Pty Ltd.

From 1987 to 1999, Mr Holland was a principal of the specialist traffic engineering consulting firm of Beard & Holland Pty Ltd, carrying out projects including:

* development of traffic engineering solutions to a range of problems associated with development proposals including large and small shopping centres, conventional and "green street" residential subdivisions, tourist resorts, expansion of major industrial complexes, city-wide garbage disposal schemes, commercial car parks, a transit station, Central City office developments and licensed sporting clubs in a geographic area extending from Cairns to northern New South Wales.
* supply of advice regarding a range of traffic engineering matters to Local Authorities and Queensland Department of Transport,
* for Brisbane City Council, a review of Central Business District parking requirements and policies, a traffic and parking study of Kangaroo Point and traffic and parking studies associated with the Latrobe & Given Terraces Development Control Plan (with Brannock Humphreys),
* for Queensland Department of Transport and Bundaberg City Council, the Bundaberg Traffic Study including upgrading of Bourbong Street,
* for Queensland Department of Transport, a traffic and parking study of the central area of Rockhampton, and
* provision of expert testimony to the Planning and Environment Court and the preceding Local Government Court, and participation in the overall preparation for such cases.

From 1977 to l987, Mr Holland was responsible for Research & Planning in the Traffic Planning Branch of Brisbane City Council. This work involved the review of the traffic engineering aspects of all development proposals received by Council. It also included the preliminary investigation and design of the Council's major traffic schemes, often in close consultation with Queensland Transport (then Main Roads Department). He was also extensively involved in policy investigations and advice, and the corporate management of the Department He was one of a team of three which undertook a complete review of the management and organization of the Department of Development and Planning.

Traffic engineering projects and investigations for which Mr Holland was directly responsible with the Brisbane City Council included:

* the investigation of alternative schemes for a CBD mall, the preliminary and functional design of the Queen Street mall and the actual closure of Queen Street to road traffic (as Acting Director, Traffic Planning Branch),
* supply of traffic engineering input to the Town Plan Review, including a complete review of Ordinance Parking requirements,
* development of the road network associated with closure to traffic of the EXPO site,
* upgrading of Fairfield Road,
* location, likely usage and implications of cross river bridges at Toowong, New Farm and Indooroopilly,
* Windsor-Lutwyche Local Area Traffic Management,
* all preliminary traffic planning for the Brisbane bid for the Olympic Games,
* feasibility and review of alternatives for a Stones Corner mall,
* continuous involvement with the traffic engineering assessment of all development proposals, (eg. The Myer Centre, Indooroopilly and Toombul Shoppingtown extensions, Garden City extensions, Stafford City Shopping Centre, Aspley Hypermarket, Post Office Square, Central Station redevelopment, Toowong Station redevelopment, Council's own Boondall Olympic Village Scheme, and many subdivisions), together with involvement in the formulation of corporate recommendations on all aspects of these developments,
* development, adoption and implementation of Council policies on car parking and truck manoeuvring areas,
* control of collection of all Council's traffic data,
* provision of expert testimony to the Local Government Court, and
* between November l986 and May 1987, head of the Working Group created to undertake the Brisbane Traffic Study.

In the period 1966 to 1977, Mr Holland was employed by the Country Roads Board, (now Vic Roads) in Victoria, primarily in the road design, road planning and traffic engineering fields. Experience was also gained in structural design and road construction fields. The first two years were occupied as a cadet of the Board undertaking full-time undergraduate studies. This period also included the undertaking, under full Board sponsorship, of the M.Eng.Sc. course at the University of New South Wales. From 1973 to 1977, he was responsible for all traffic engineering investigations and design over half of Victoria, being leader of a group responsible for traffic investigations into projects such as:

* a complete review of the eastern approaches to the Westgate Bridge, including estimates of traffic volumes on the bridge,
* extension of the Westgate Bridge approach roads to St Kilda Road,
* the Ballarat pedestrian mall,
* traffic aspects of the Scoresby and Healesville Freeways,
* widening from four to eight lanes of the Nepean Highway, Elsternwick to Moorabbin, and
* a complete review of Chapter 8 of the NAASRA publication "Guide to Traffic Engineering Practice".

Mr Holland also supplied expert advice to the Tasmanian Government regarding roadworks required to accommodate traffic flows from the temporary bridging of the Derwent River consequent to the Tasman Bridge disaster.

Annexure G

Professor Rod Troutbeck's independent review of the TMR Engineering Review of Kin Kin Road

Kin Kin Road (141)

Kin Kin Road (141) Engineering Review

November 2022

Queensland Government

Appendix G

Independent review of the TMR Engineering Review of Kin Kin Road

Report for the Department of Transport and Main Roads

Report by

Prof Rod Troutbeck
Troutbeck and Associates
59 Montpelier Street,
Clayfield 4011

28 October 2022

1. Background

The purpose of this independent review is to comment on the process and outcome of an engineering review by the Queensland Department of Transport and Main Roads (TMR) on the Engineering review of the Kin Kin Road.

The TMR report demonstrates that TMR responds to its duty of care in operating the road and gives strong consideration to the community's concerns and expectations. In this case, the community was concerned about the increased number of heavy vehicles on this road.

The report has been written by TMR, although I have been involved in some discussions and I have written a literature report which was not able to provide any significant guidance to assist the TMR review.

This report is independent of the TMR report and is to provide assurance on the engineering process and conclusion reached in the TMR report. Any statements in this report are my opinion.

2. Brief overview

The TMR report is comprehensive and covers topics including

- The traffic mix and volume, now and predicted
- Speed limits and the changes over time
- The Kin Kin quarry haulage operations
- The road geometry
- The ability of heavy vehicles to negotiate the road
- The crash history and a comparison with other roads
- An evaluation of the existing bridges
- The effect on the wildlife
- Road surface and pavement condition
- Heavy vehicle management

These topics provide a comprehensive engineering review of the road. However, the report also provides a review of other non-TMR assessments of the road.

The TMR report then continues by outlining current and future works on the road together with the use of additional signs to warn drivers of the presence of heavy vehicles on the road.

In my opinion, the TMR report is comprehensive and there are no further topics that should have been included.

3. Context of the road.

An important point underlying the development and upgrading of any road is to appreciate the context or the environment of the road.

Discussion in Part 1 of the *Austroads Guide to Road Design* (AGRD01) which deals with the objectives of road design, centres around knowing the context of the road's environment. In road design, this is often termed "context sensitive design". While the discussion in Part 1 is about road design, it is also applicable to the engineering development of upgrades and to a review of an existing road. These concepts are universal.

The Austroads guide states:

Good design requires creative input based on experience and a sound understanding of the principles to develop an optimum solution that is within the context of the project and balances often competing and contradictory factors.

…

All road design is a compromise between the ideal and what is a reasonable solution. It needs to consider the objectives of the project, the objectives of road design and the context of the site. Due to the nature of the design process, the final design solution cannot generally be considered as 'correct' or 'incorrect' but rather as more or less efficient (in terms of moving traffic), safe (in terms of fatal and serious injury crash reduction), or costly (in terms of construction costs, life-cycle costs and environmental impacts).

Applying these concepts to an existing road produces the following question.

- Are the traffic operations on the road consistent with the context or the road environment? The last two terms need to be broadly defined.
- Is the geometry and configuration of the road consistent with this context?
- Can any proposed updates to the road make the traffic operations and road geometry more consistent with the context of the road?

These questions hinge on a description of the context of the road. The TMR review states:

The road is generally an undivided two-lane, two-way sealed roadway with a winding alignment on a rolling to undulating terrain, in most sections. The road traverses the Kin Kin Range from Chainage 39.75km to 42.43km which is characterised by a section of steep and winding alignment. Nunan Range lies just to the north of the Gympie Regional Council/Noosa Shire Council boundary. This section of road remains unsealed, however only the first 540 metres of the unsealed roadway on the northbound approach to the range lies within NCR's [North Coast Regions] area of responsibility. Five single lane timber bridges are located along the road within the section managed by NCR.

…

Kin Kin Road functions as a rural arterial/distributor road connecting rural communities and centres in the Noosa and Cooloola Hinterland, east of the Bruce Highway, with larger population centres of Gympie, Cooroy, Tin Can Bay and other hinterland areas in the Noosa Shire and Gympie Regional Council local government areas.

…

The entire road is identified as a school bus route with a number of services operating along the route. Road signs are displayed on both sides of the Kin Kin Range warning of school buses operating during the hours of 6:30 – 8:00am and 3:30 – 4:45pm. There is some pedestrian activity associated with the school bus services with school children using the road edge or narrow verges to access bus stops from their places of residence

In addition to servicing the local agricultural and tourist industries, the road is a popular route for recreational motorcyclists, particularly on weekends. Recreational bicycle riders also frequent the route and there is an annual bicycle event, the Noosa Classic, which is held along part of this road. The area is also popular with horse riding being in a rural area in proximity to the Noosa Trail

While this is a rural arterial it cannot be considered to be a high speed route. The road section through the range is naturally more constrained and the environment is one that generally dictates lower speeds.

Maintaining the context and character of the road is important in managing speeds along the road and hence safety. For the most part, the road is "self-explaining" and, as the Austroads Guide to Road Design Part 1 states, allows "road users to readily comprehend the type of road and what could be expected in terms of the elements of the design".

It would be then inappropriate to consider this to be a major transport route and any upgrades should preserve the general nature of the road. The TMR report demonstrates that TMR engineers are cognisant of this issue when preparing their engineering assessment and planning and designing future works.

4. Managing a network

Managing the operation of a network is about managing the risks to the travelling public. Unfortunately, risk across the network cannot be eliminated, but it needs to be managed and minimised. The engineering of the road or its upgrade is committed to this end. Engineering practices have been developed from experience and studies that demonstrate a minimisation of risk. These practices have been applied in the TMR report.

Risk is demonstrated in crash statistics. Crash statistics for a road section are important but, unfortunately, they identify issues after crashes have occurred and engineers must then react. Crash statistics taken over a number of roads can enable a road agency to predict potential black spots and to be more responsive to safety issues or identify sites with an increased risk. The TMR practices through the Australian National Risk Assessment Model (or ANRAM) provide a more proactive approach to managing risk. These engineering approaches to manage risk are based on collective evidence from a number of routes and allow the road agency to be consistent and equitable in the use of funds.

The management of risk then requires a review of the current safety issues on the road in question and the review of the demonstrated safety of the road in comparison with similar roads and other roads on the network. This engineering approach is not to exclude the perceived safety by the community. Often the community will be able to perceive concerns before they are evident in the crash data. TMR has addressed these community concerns within its report.

I accept and agree with the following comment in the report:

> *In TMR's stewardship role for all its road infrastructure across Queensland, compromises have to be made between what is ideal and what is desired and what is a practicable outcome in terms of cost, safety, driver expectation, economic drivers, environmental impacts and social issues. Judgements must be made on the value of improving the standard of a road and the impact this might have on the ability to make improvements elsewhere on the road system. These judgements are usually made based on the level of safety of the road in question and the Benefit Cost Ratio (BCR) resulting from the proposed improvements*

5. Managing speed limits

Reducing speed limits is the best way of addressing safety. However, the speed limit cannot be reduced to a point where it is not complied with. Section 2.3 has indicated the posted speed limits have been reduced over time from 100 km/h to between 70 and 90 km/h. Importantly, the section in the range has been decreased from 100 km/h to 60 km/h.

The TMR engineering review described the speeds of vehicles on Kin Kin Road and stated:

> *Analysis of the speed data shows common themes at all surveyed sites. The results showed that:*
>
> - *the poorest levels of compliance was demonstrated by Class 1 and Class 2 vehicles*
> - *compliance increased with increasing vehicle classes*
> - *heavy truck and trailer combinations demonstrate the highest level of compliance.*

While speeding is not condoned, a close review of the data in Tables 6, 7 and 8 in the TMR report indicate that if vehicles are exceeding the speed limit, they predominately do so by less than 10 km/h. Typical, some drivers will travel over the speed limit, no matter what the speed limit is. However, it has to be said that the present compliance with the posted speed limit is very good, especially for heavier vehicles.

TMR has appropriately concluded:

> *Whilst TMR does not condone any form of speeding, the speed survey data generally shows very high numbers and proportions of heavy vehicles complying with the posted speed limits when compared to levels of speed compliance recorded for passenger type vehicles.*

6. Vehicle movements along curves.

When a longer articulated vehicle negotiates a corner of an intersection, the rear of the trailer will "cut the corner" even though the prime mover does not. Figure 16 in the TMR report explains this situation. It shows an articulated vehicle completing a right hand 90° turn with the prime mover travelling in a straight line and the trailer offset. The swept path is the area that the vehicle travels over and the maximum width of the swept path can be much larger than the width of the vehicle.

The wider swept paths are exhibited by vehicles moving outside their lanes into adjacent lanes or the wheels of the trailer moving onto the shoulder. On reasonably narrow roads and at intersections it is not uncommon for the vehicles to encroach onto the other lanes. While this is not the preferred action, it is tolerated. The TMR report has investigated the ability of two vehicles to negotiate a curve at the same time (from different directions) and established that while vehicles negotiating some curves did encroach on the other lane, the road still provided adequate pavement for both vehicles in most cases. The report states:

> *For the 26 curves identified where the heavy vehicle could not stay within its own lane, the vehicle cannot physically negotiate the curve without crossing into the oncoming lane or tracking tyres over the edge of the sealed pavement. It should be noted, however, this is mitigated by the presence of some width of unsealed, trafficable shoulder beyond the sealed pavement edge for most of the length*
>
> *…*
>
> *Outside of the Kin Kin Range section, there are seven curves that were identified where the heavy vehicle could not stay within its own lane– five north and two south of the range. This does not mean that a car travelling in the opposing direction to the heavy vehicle on these curves will suddenly be faced with a truck on the wrong side of the road. As mentioned above, on many of these curves there is additional unsealed shoulder width available for the truck to utilise. Typically, a truck driver will encroach upon the centreline of the road to avoid dropping a tyre off the edge of the sealed surface, if there is nobody coming the other way and visibility is adequate. When a vehicle is approaching from the other direction, or visibility around the curve is limited, the truck driver will typically place the vehicle closer to, or a tyre over the edge of the seal or carriageway.*

The TMR assessment reviewed the ability of the heavy vehicle drivers to negotiate the curves if the centre line was not there and if the drivers made greater use of the unsealed shoulder. The analysis found that a heavy vehicle and a passenger car can negotiate the curve at the same time. The report states:

> *Outside of the Kin Kin Range section, only seven of the curves failed to achieve this functionality. But when taking all factors into account, including extra width due to intersections at the curves and/or additional unsealed shoulder width, it can be shown that even these curves are quite functional. This is evidenced by the fact that examination of crash records from 2010 to June 2021 (based on injury-related data from QPS), show no reported crashes involving heavy vehicles on the sections either side of the Kin Kin Range. It is noted that the crash database is continually updated, but details of crashes that might have occurred in the most recent months may not be available. Similarly, crashes that have occurred within the last 12 months may still be under investigation and these details could change. Therefore, for the purposes of this report, only crashes recorded up to June 2021 have been analysed.*

It was concluded that there was generally sufficient pavement width to accommodate a heavy vehicle and a passenger car meeting at a curve. It acknowledged that at some curves there would be minimal clearance between the vehicles. I agree with this conclusion. It is reasonable and the outcome is consistent with the context of the road and the environment.

7. Current design standards

The current design standards should not be applied to existing roads without question and, as the report indicates, they were not applied to this road.

The TMR report reviewed the visibility distances around curves. The concluding comments in Section 3.4 are acceptable. The report states:

> *While falling short of the current day geometric standard in a number of areas, this section of Kin Kin Road does provide a fairly good level of service and capability. The sections with more limited sight distance are also the lighter trafficked sections which assists in overall functionality, particularly on the tighter curves. It has been demonstrated that interaction between heavy and passenger vehicles can occur safely and that the lack of crash history involving heavy vehicles is evidence of this. While seal widths are short of current-day standards, the presence of trafficable, unsealed shoulders assists in the safe functionality of the road.*
>
> *Visibility is restricted in many areas, particularly around curves, however the roadside environment is consistent throughout, so even when drivers are confronted with areas of reduced sight distance it is not unexpected and contributes to a heightened state of alertness while driving the road*

8. Review of the crash statistics

The report discusses the crash rates in two periods 2000 to 2009 and 2010 to 2020. In the latter period, there was an 18 per cent reduction. This is most likely the result of lower speed limits.

The TMR report compared the crash history on the Kin Kin Road and on other State-controlled roads within Noosa Council. Of the 60 injury sustaining crashes reported between 2010 to 2021, there was one crash involving a heavy vehicle and a motorcycle. The report states:

> *Only one reported crash involved a heavy vehicle but neither the truck nor the roadway could be considered as having directly contributed to this crash.*

The Australian National Risk Assessment Model (ANRAM) evaluates the historic safety record and predicts safety issues. This allows TMR to compare the actual and predicted crash records and identify inconsistencies. The ANRAM assessment also included a comparison with all state-controlled roads in the North Coast Region. A similar analysis was undertaken for three other roads in the region.

Crash databases are never up to date as the more recent information is often subject to correction and verification. As pointed out in Section 4.1 of the TMR engineering review, "only crashes recorded up to June 2021 have been analysed". This is an acceptable position for TMR to take.

The conclusions in the TMR report are considered to be acceptable. The report states:

> *In summary, comparison of the figures above seemingly indicates that Kin Kin Road has a lower risk of predicted serious crashes compared to other roads in NCR which have similar characteristics. In comparison to the NCR network overall, Kin Kin Road is not ranked in the top 20 roads in terms of risk of fatal or serious injury crashes (30% of network road length has an ANRAM FSI/km score greater than Kin Kin Road).*

9. Review of other material

The TMR report also includes a number of other supporting analyses. These include:

- An evaluation of the state of the timber bridges.
- An evaluation of the pavement and the bitumen sealed width which has been progressively widened from a single lane road to the existing two lanes.
- The maintenance of the road.
- Vegetation management.
- Review of a report on the operation of the Quarry and the use of roads for hauling the rock.

10. Further development and management of the road

The TMR report has indicated that the North Coast Region has been seeking and awarded additional funds to undertake improvement to the road. These are documented in its report.

In addition, an assessment of the advisory signs on the road has indicated that additional signs warning of a winding road and steep grades should be installed. These signs indicate that trucks should reduce speeds. Other signs indicating a narrow pavement and shoulders will also be used. These are likely to have limited effect as trucks are currently complying with the speed limits but these signs help to indicate the narrow road and formation widths for this road.

11. Concluding remarks

After reviewing the TMR engineering review of the Kin Kin Road, I am satisfied that the TMR report is comprehensive, thorough, and balanced. It has been developed and written using appropriate engineering principles. I have no hesitation in recommending that this report be used as required.

R J Troutbeck

Prof R.J. Troutbeck

Principal Troutbeck & Associates

Emeritus professor Queensland University of Technology

RPEQ 07149

6 November 2022