3 Traffic and Crash Characteristics

3.1 Traffic Volumes

3.1.1 Existing

Traffic volume count data has been taken from RDC and TDC RAMM databases and is described in Table 4.

Subsection	Route Position (m)	Year	Traffic Volume (vpd)	% HCV
Settlers Road	185	2003	1,309	15%
Reporoa Road	200	2003	1,028	21%
Broadlands Road RDC	500	2003	1,863	17%
	13,800	2003	1,820	18%
Broadlands Road TDC	3,182	2004	2,418	16%
	3,382	2004	2,549	16%
	5,556	2004	2,333	15%
	16,666	2004	2,216	16%
	23,536	2004	2,664	18%
Miro Street	50	2003	4,606	20%
	647	2003	4,038	20%
Crown Road	504	2003	3,647	10%
	1,873	2003	1,798	15%

Table 4. Study route traffic volumes

Side Roads

Table 5 describes the traffic volumes of the side roads connecting with the study route.

Subsection	Side Road	Year	Volume	Comment
Settlers Road	Loop Road	2000	70	500m from Settlers - ESTIMATE
	Wharepapa Road	2001	47	1.5km from Settlers
	Birch Road	2003	494	680m from Settlers
Broadlands Road RDC	Homestead Road	2003	292	200m from Broadlands Rd
	Strathmore Road	2003	436	195m from Broadlands
	East Road	2003	267	180m from Broadlands
	Vaile Road	2001	80	1km from Broadlands
	Earle Road	1995	134	
	Allen Road	1990	120	At Broadlands - ESTIMATE
	Ohaaki Road	1999	350	At Broadlands - ESTIMATE

Subsection	Side Road	Year	Volume	Comment
Broadlands Road TDC	Tiverton Downs Road	2003	160	150m from Broadlands
	River Road	2003	396	Near Broadlands
	White Road	2000	248	At Broadlands
	View Road	2001	253	Near Broadlands
	Centennial Drive	2002	746	140m from Broadlands Rd
Broadlands Road TDC/Miro Street	Tauhara Road	2002	4225	200m from Broadlands Rd
Miro Street	Matai Street	2002	1112	
	Manuka Street	2000	910	Near northern int with Miro
Crown Road	Invergarry Road	2000	1885	By Crown Rd

Table 5. Side road traffic volumes

3.1.2 Future Trends

Future traffic flows are difficult to predict accurately. Based on historical count data available, traffic growth on the study route is currently in the vicinity of 1-2% per year for each subsection.

The future estimation of traffic needs to take the following factors into account, each of which is expected to have a significant impact on the use of the study route over the next 20 years.

Population Growth

Taupo and the Bay of Plenty are two of the fastest-growing areas in New Zealand in terms of population. Projections from the Taupo District Growth Model (2004) indicate that the total population of the Taupo District will increase by up to 80%, to 62,250, by 2024. Much of this growth will be in the Taupo urban area and Taupo West rural area. This growth is at a level above that historically seen in the Taupo area. Statistics New Zealand (2002) projected population growth of up to 16% in the Taupo District over the period 2001-2021.

Statistics New Zealand (2002) indicates projected mid-range population growth of 8% in the Rotorua District, to 72,300, over the period 2001-2021. Over the same period the total population of the Bay of Plenty region is expected to increase by approximately 25%.

This population growth is expected to lead to significant increases in traffic on road networks within each district. Correspondingly, it is assumed there will be an increase in interregional traffic wishing to travel between Hawkes Bay, Taupo and the Bay of Plenty, a proportion of which will use the study route. We estimate the magnitude of this increase will be above historical arithmetic growth rates of 1-2% per year.

East Taupo Arterial (ETA)

Gabites Porter (2001) developed a 1999 Taupo traffic model for the TDC as part of the ETA project. This model estimates traffic in 1999 and 2016 with and without construction of the ETA, but does not assess the effects on traffic flows of staged construction of the ETA. This model was developed before the most recent Taupo Growth Model, and is being updated to include the land use information found by the Growth Model.

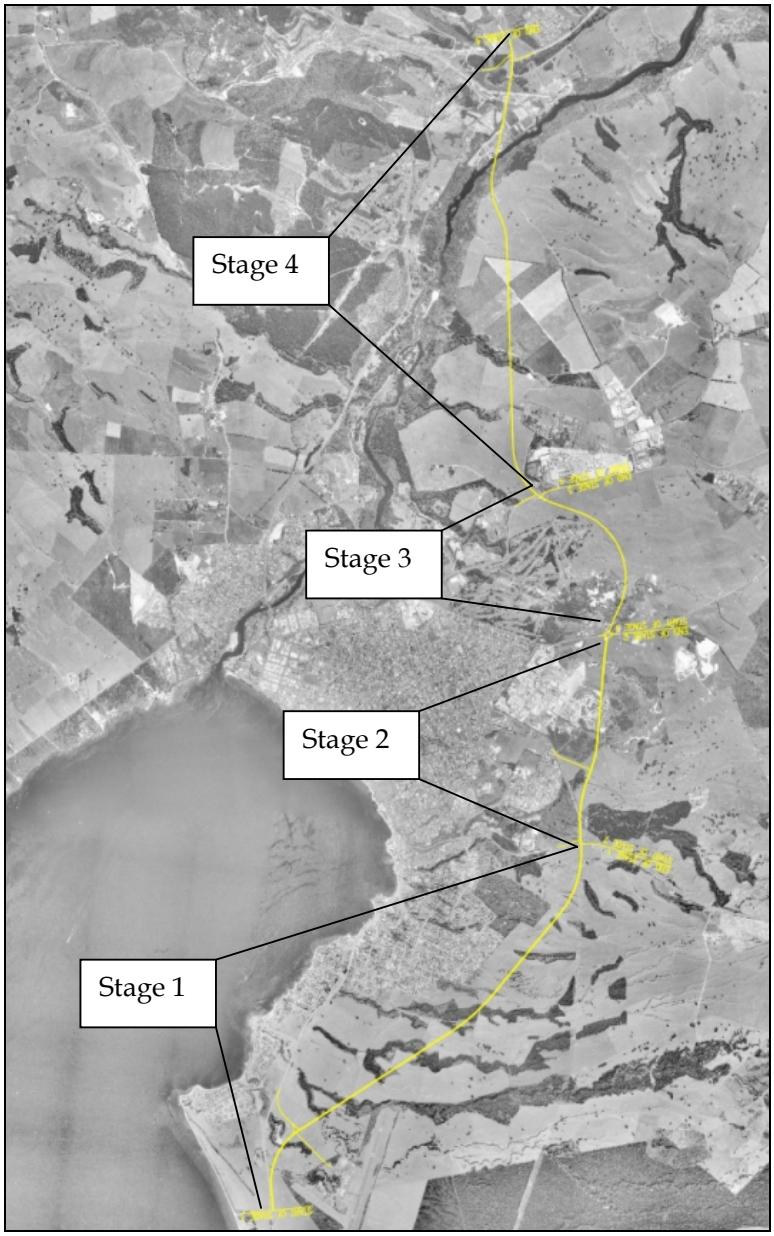


Figure 2. Proposed stages of ETA

The effect of staged construction on subsections of the study route will differ for each subsection. Figure 2 outlines the proposed stages of the ETA. Expected effects on the study route are shown qualitatively in Table 6 below.

Subsection	Effect on Traffic Volume	
	Stages 1 and 2 Completed	**Stages 3 and 4 Completed**
Settlers Road	Increase	Decrease
Reporoa Road	No Change	No Change
Broadlands Road RDC	Increase	Decrease
Broadlands Road TDC	Increase	Decrease
Miro Street	Decrease	No Change
Crown Road	Increase	No Change

Table 6. Effect of ETA on traffic volumes

Construction of stages 1 and 2 will create a bypass of the Taupo urban area for interregional travellers between areas to the south and east of Taupo and Rotorua/BoP. This bypass will be quicker and encourage more of these travellers to use the ETA and Broadlands Road to/from Rotorua, as an alternative to SH1 and SH5.

The southern section of Crown Road is likely to be utilised as part of the ETA, with a new connection to the ETA planned from Crown Road approximately 400m south of the Invergarry Road intersection, as shown in the plan in Appendix 5 of this report. The nature of Crown Road is expected to change with the proposed land development in the area. Crown Road will no longer be part of an inter-regional alternative route to SH5, and will instead become more of a collector road providing access to proposed commercial/industrial developments in the area. Miro Street will no longer be part of an inter-regional route and will experience a decrease in traffic overall.

Completion of the ETA through construction of stages 3 and 4 will complete the Taupo urban bypass. A proportion of interregional travellers to/from Rotorua are expected to continue along the ETA and SH5 instead of turning at Broadlands Road, resulting in a decrease of traffic on Broadlands Road. Traffic volumes on Crown Road and Miro Street will tend to be unaffected by this.

It is likely that Broadlands Road will remain a relatively popular alternative to SH5 between Taupo and Rotorua, particularly for local traffic.

The traffic model gives an indication of the likely magnitude of traffic volume changes on the study route as a result of completion of the ETA. This is shown in Table 7 below.

Road Name	Location	2016 Without ETA	2016 With ETA	% Change
Broadlands Road	North of Tauhara/Miro intersection	3,273	3,247	-0.8%
Miro Street	North end near Broadlands Rd	3,179	2,979	-6.3%
	South end near Crown Rd	7,972	7,576	-5.0%
Crown Road	Miro St to Invergarry Rd	3,473	3,871	+11.5%
	Invergarry Rd to SH5/ETA	1,623	2,525	+55.6%

Table 7. Taupo traffic model effects of ETA (from Gabites Porter (2001))

For the purposes of this study we have assumed stages 1 and 2 of the ETA will be constructed by 2008, with stages 3 and 4 completed by 2010.

Heavy Vehicles

With the high percentage of heavy vehicles currently using the study route it is important to consider the future trends of these road users. For this report the forestry and dairy industry were approached, to discuss their expected use of the route over the next twenty years.

Key responses and issues raised by forestry include:

- Unless the forestry customer base expands significantly, for example new sawmills are built or existing plants increase capacity/output, not much of an increase in logging trucks is expected on the study route. Forecasts of supply and demand, and subsequent transport requirements, are still in progress. A nominal increase in logging trucks on the route of say 10% over the twenty-year period has been quoted
- The proposed ETA could provide alternative access to customers on Centennial Drive, negating the need to use Broadlands Road for logging trucks from the southeast.
- Forestry would be interested in exploring the possibility of upgrading the crossing of Broadlands Road TDC from Broadlands Forest into Tiriti Road (approximate RP 23,800) to a standard capable of accepting the large off-highway double unit they employ in their off-road operations.

Key responses and issues raised by the dairy industry include:

- The number of dairy tankers using the study route is unlikely to change significantly over the next twenty years or so.
- A major factor that could have a bearing on dairy movements in the area is profitability in the dairy industry, which may encourage some farmers to change from dry stock farming to dairy farming if profitability improves. However, in the Taupo catchment this will be discouraged as part of efforts to protect Lake Taupo.

These responses suggest the numbers of heavy vehicles using the study route can be expected to remain relatively constant. A conservative assumption would be to assume the current proportion of heavy vehicles in the traffic stream, approximately 15-20%, will remain constant.

There is a possibility that the proportion of heavy vehicles on the initial section of Broadlands Road TDC may decrease slightly when the ETA is complete.

Racetrack Development

The proposed redevelopment of Centennial Park racetrack will generate short-term traffic increases on the study route, particularly during large national or international events. Appendix 5 of this report includes excerpts from Opus (2003) that assesses traffic effects, and proposed traffic management strategies. Traffic during these events will be managed according to Traffic Management Plans (TMP's) developed by organisers. Due to the relatively short and infrequent nature of large events, the effect on the study route overall is considered to be minor, if event traffic is managed properly.

Traffic Projections

In projecting the future traffic on the study route, we have used the Taupo traffic model and population growth predictions to make the assumptions regarding quantitative traffic volume changes listed in Table 8 below:

Subsection	Annual Growth Rate 2004-2008	Change 2008	Annual Growth Rate 2008-2010	Change 2010	Annual Growth Rate 2010-2024
Settlers Road	3%	8%	3%	-5%	3%
Reporoa Road	3%	-	3%	-	3%
Broadlands Road RDC	3%	8%	3%	-5%	3%
Broadlands Road TDC	3%	8%	3%	-5%	3%
Miro Street	3%	-5%	3%	-	3%
Crown Road	3%	5%	3%	-	3%

Table 8. Traffic volume change assumptions

Table 9 and Figure 3 show the estimated future traffic volumes on the study route.

Subsection	Projected Traffic Volume	
	2014	**2024**
Settlers Road	1,724	2,114
Reporoa Road	1,428	1,743
Broadlands Road RDC	2,453	3,008
Broadlands Road TDC	3,315	4,065
Miro Street (Northern end)	5,096	6,296
Miro Street (Southern end)	5,860	7,240
Crown Road (Miro-Invergarry)	4,990	6,070
Crown Road (Invergarry-SH5)	2,772	3,372

Table 9. Estimated future traffic volumes

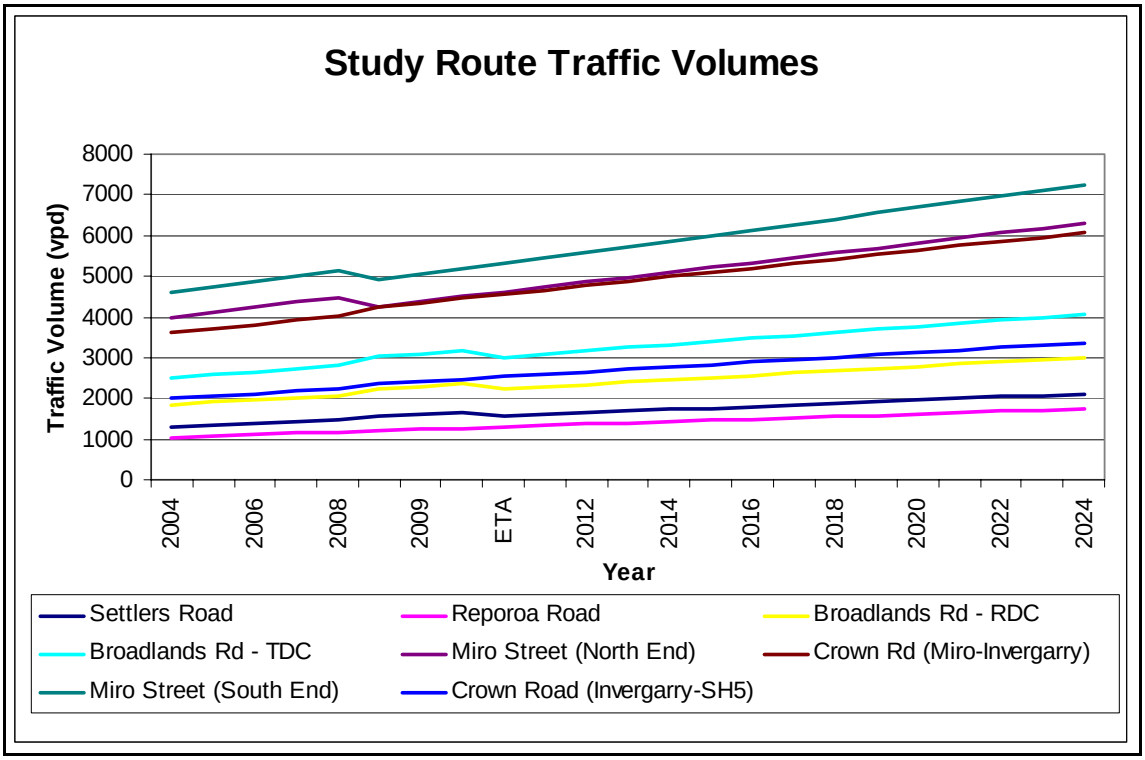


Figure 3. Estimated traffic volumes

Side Roads

Traffic volumes on many of the side roads on the study route will not experience significant increases over the next 20 years. Increases will generally be dependent on the extent of development along each side road.

Table 10 estimates side road traffic volume growth over the next 20 years to 2024. Many of the side roads are expected to have minimal development along them in this period; a nominal arithmetic traffic growth rate of 1% has been applied to these roads.

Side Road	Growth Rate (%/year)	2014 Traffic Volume (vpd)	2024 Traffic Volume (vpd)
Invergarry Road	2%	2413	2790
Manuka Street	2%	1165	1347
Matai Street	2%	1379	1601
Tauhara Road	3%	5746	7014
Centennial Drive	2%	925	1074
View Road	1%	286	311
White Road	1%	283	308
River Road	2%	483	562
Tiverton Downs Road	1%	178	194
Ohaaki Road	1%	403	438
Allen Road	1%	149	161
Earle Road	1%	159	173
Vaile Road	1%	90	98
East Road	1%	296	323
Strathmore Road	1%	484	528
Homestead Road	1%	324	353
Birch Road	2%	603	701
Wharepapa Road	1%	53	58
Loop Road	1%	80	87

Table 10. Side road traffic growth

Cyclists

Broadlands Road is used heavily as a training route by cyclists, in particular from January-March in the lead-up to the NZ Ironman race in early March, and to some extent in October-November as a lead-up to the "Round the Lake" cycle race in late November.

With TDC pledging financial support to the NZ Ironman race until at least 2007[1] the race is expected to stay in the area until at least then. However, after this there is no guarantee the race will stay in Taupo, and will depend on the commitment the TDC and community make to host the event. Since moving from Auckland to Taupo six years ago, competitor numbers have more than doubled for the event, and organisers of the 2004 event had to cap the entry numbers. In the future competitor numbers may be further increased if the facilities can cope[2]. Therefore we expect the number of cyclists using Broadlands Road to increase as competitor numbers increase.

The main issue for cyclists is safety. The number of heavy vehicles using the road, combined with the relatively narrow seal width, creates a potential hazard for cyclists. However, there is currently no reported crash problem involving cyclists on the study route. In the last five years there was one cycle versus vehicle crash, where a van failed to

[1] Source: TDC website, http://www.taupo.govt.nz

[2] Source: New Zealand Ironman website, http://www.ironman.co.nz

give way to a cyclist at the Broadlands Road/Centennial Drive intersection in February 2000, resulting in serious injuries to the cyclist.

Surface texture was also identified as an issue for cyclists, where the preference is for a smoother surface. However, in high-speed rural areas larger chip sizes are, and will continue to be, used as these provide a safe travelling surface for vehicles, particularly in wet conditions. Surface treatments are available to improve texture on cycle lanes, but these are generally more expensive and therefore limited by budgetary constraints.

One way of reducing the hazard for cyclists is to separate them as much as possible from the traffic stream. Good-quality sealed shoulders, such as that already existing on the western side of Broadlands Road between Miro Street and Centennial Drive, could be extended to provide this separation and reduce the potential for serious crashes.

3.2 Road Crashes

3.2.1 Crash History

Road crash data for the study route has been obtained from the Land Transport Safety Authority (LTSA) Crash Analysis System (CAS) database, and analysed for the five-year period 1 July 1998 – 30 June 2003.

Crash locations and severity for this five-year period are shown on the Route Data Sheets in Appendix 1, and the complete crash list is given in Appendix 6. During this period, a total of 70 crashes were recorded on the study route, including 2 fatal, 5 serious injury, 16 minor injury and 47 non-injury crashes.

Peer Group Data

Crash statistics for the study route have been compared where possible against Peer Group data for similar road types. All Territorial Local Authorities (TLA's) in New Zealand have been grouped into Peer Groups by the LTSA, based on several characteristics including size and urban/rural ratio of road network. Table 11 lists the Peer Group members relevant to this study.

Peer Group C	**Peer Group D**	
Rotorua	**Taupo**	South Waikato
Gisborne	Ashburton	Southland
Hastings	Far North	Tasman
Kapiti Coast	Franklin	Thames-Coromandel
New Plymouth	Horowhenua	Waikato
Porirua	Masterton	Waimakariri
Timaru	Matamata-Piako	Waipa
Upper Hutt	Rodney	Waitaki
Wanganui	Selwyn	Western BOP
Whangarei	South Taranaki	Whakatane

Table 11. LTSA - Peer group members

LTSA publish Road Safety Reports annually for each TLA that compares local road crash statistics with Peer Group and national figures. The most recent Road Safety Reports for RDC and TDC, for the five-year period 1998-2002, have been obtained for comparison with study route crashes.

Crash Rates

Transfund (2002) outlines a method for calculating typical mid-block injury crash rates for any particular length of road, which takes into account:

- Traffic volumes
- Road length
- Road width
- Terrain type

This typical crash rate is the number of mid-block injury crashes that can be expected on a road, given in reported injury crashes/year. Comparing this number with actual reported mid-block injury crashes gives an indication of the relative safety of a road.

Table 12 compares reported midblock injury crash rates on the study route with typical rates as calculated using the Transfund method. Details of the calculation are given in Appendix 6 of this report.

Subsection	Length (km)	Average ADT (vpd)	Midblock Injury Crash Rate (injury crashes/year)	Typical Crash Rate (injury crashes/year)
Settlers Road	6.130	1,300	0.80	0.51
Reporoa Road	2.252	1,050	0	0.15
Broadlands Road RDC	13.800	1,850	0.40	1.64
Broadlands Road TDC	24.522	2,500	2.20	4.06
Miro Street	1.053	4,300	0.20	0.21
Crown Road	1.733	3,600	0.20	0.29

Table 12. Midblock injury crash rate comparison

The midblock injury crash rates for all subsections except Settlers Road are comparable or lower than the typical injury crash rate for roads with similar width and traffic volume characteristics. Settlers Road has a midblock injury crash rate 60% higher than typical.

Severity

The graphs and Table 13, Table 14 and Table 15 below show the severity of injury crashes on each subsection in terms of the road type (Rotorua Rural, Taupo Rural and Taupo Urban), and gives a comparison with local and LTSA peer group crash statistics. Reporoa Road is not included as no injury crashes were reported during the five-year analysis period.

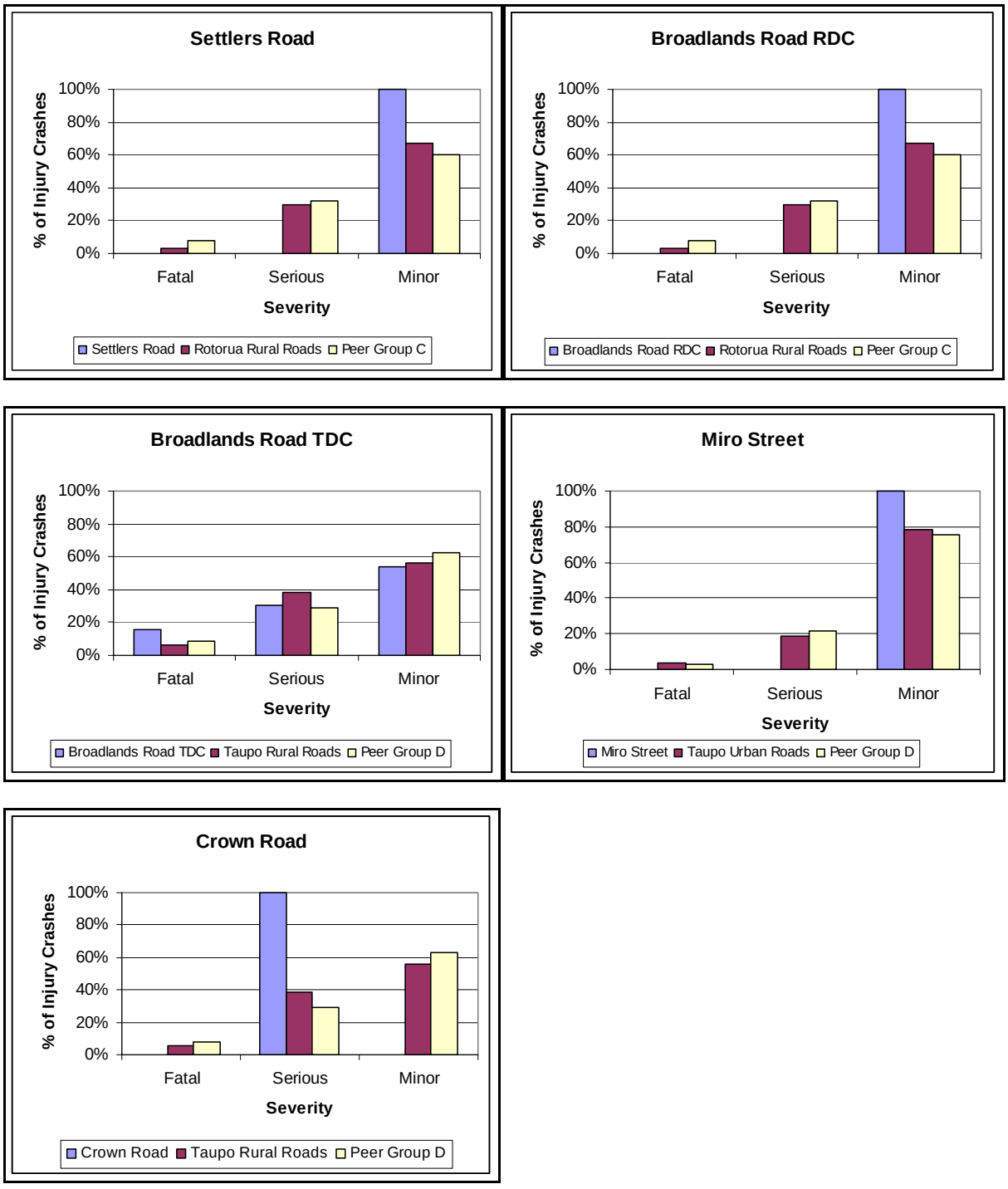


Figure 4. Severity of injury crashes on study route

Rotorua Rural	Subsection				Rotorua Rural Local Roads 1998-2002	Peer Group C 1998-2002
	Settlers Road		Broadlands Road			
	No.	%	No.	%		
Fatal	0	0%	0	0%	3%	8%
Serious	0	0%	0	0%	30%	32%
Minor	5	100%	3	100%	67%	60%

Table 13. Injury crashes in Rotorua Rural study route area

Taupo Rural	Subsection				Taupo Rural Local Roads 1998-2002	Peer Group D 1998-2002
	Broadlands Road		Crown Road			
	No.	%	No.	%		
Fatal	2	15%	0	0%	6%	8%
Serious	4	31%	1	100%	38%	29%
Minor	7	54%	0	0%	56%	63%

Table 14. Injury crashes in Taupo Rural study route area

Taupo Urban	Subsection		Local Roads 1998-2002	Peer Group D 1998-2002
	Miro Street			
	No.	%		
Fatal	0	0%	3%	3%
Serious	0	0%	19%	22%
Minor	1	100%	78%	75%

Table 15. Injury crashes in Taupo Urban study route area

Broadlands Road – TDC (Subsection 4) has a relatively high severity of crashes compared with local and peer group statistics.

Movement Types

Crashes on the study route have been compared with peer group and national statistics for the crash movement type to identify any crash trends. The following graphs detail this comparison.

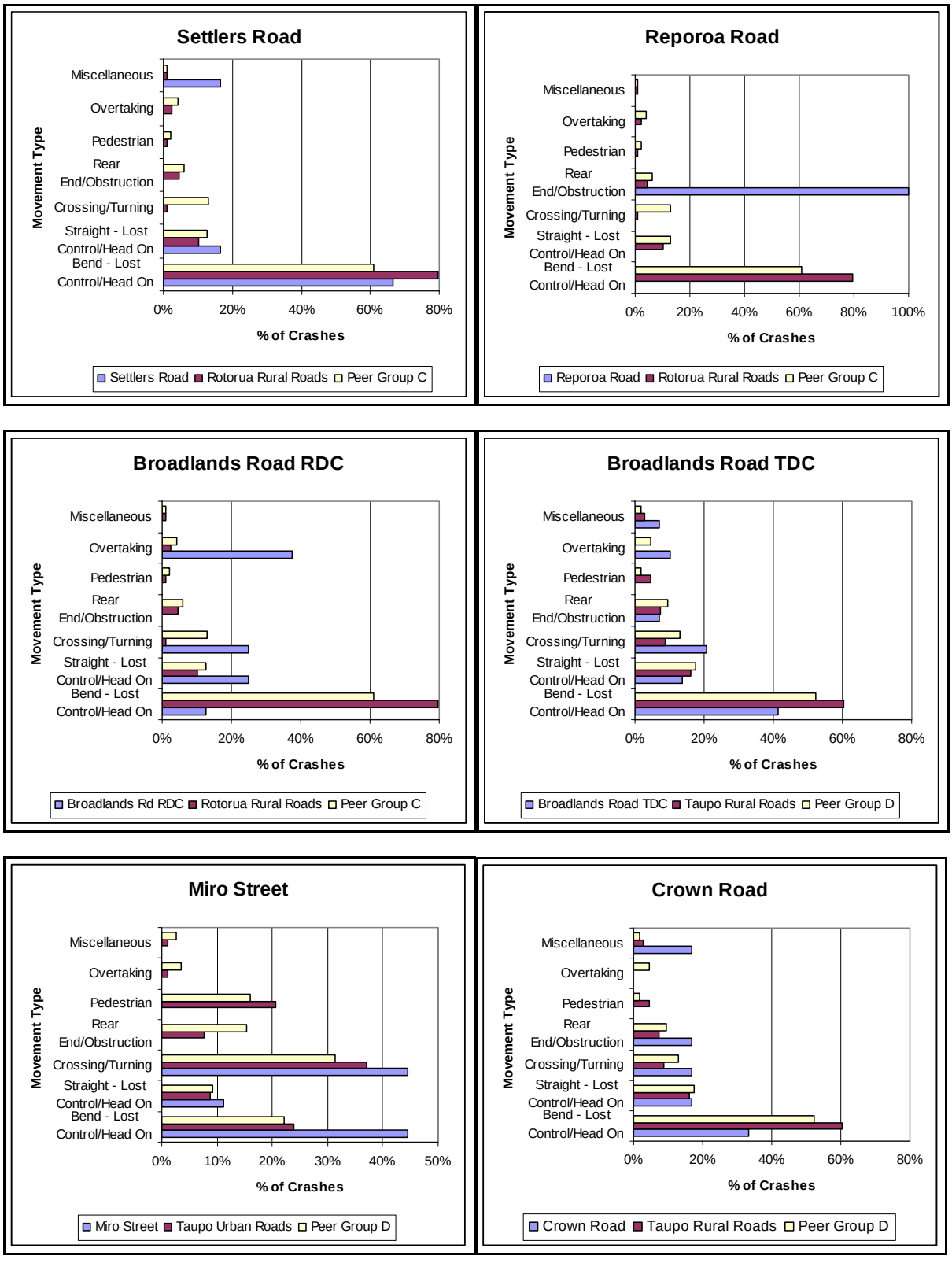


Figure 5. Crash movement types on study route subsections

The tables below consider movement types for the subsections combined into their road types for each district.

Movement Type	Number	%	Rotorua Rural Local Roads	Peer Group C
Bend - Lost Control/Head On	13	48%	80%	61%
Straight - Lost Control/Head On	5	19%	10%	13%
Crossing/Turning	2	7%	1%	13%
Rear End/Obstruction	1	4%	5%	6%
Pedestrian	0	0%	1%	2%
Overtaking	3	11%	2%	4%
Miscellaneous	3	11%	1%	1%
Total	27	100%	100%	100%

Table 16. Rotorua Rural (Settlers Road, Reporoa Road and Broadlands Road RDC) crash movements

Movement Type	Number	%	Taupo Rural Local Roads	Peer Group D
Bend - Lost Control/Head On	14	40%	60%	52%
Straight - Lost Control/Head On	5	14%	16%	18%
Crossing/Turning	7	20%	9%	13%
Rear End/Obstruction	3	9%	7%	9%
Pedestrian	0	0%	4%	2%
Overtaking	3	9%	0%	5%
Miscellaneous	3	9%	3%	2%
Total	35	100%	100%	100%

Table 17. Taupo Rural (Broadlands Road TDC, Crown Road) crash movements

Movement Type	Number	%	Taupo Rural Local Roads	Peer Group D
Bend - Lost Control/Head On	4	44%	24%	22%
Straight - Lost Control/Head On	1	11%	9%	9%
Crossing/Turning	4	44%	37%	31%
Rear End/Obstruction	0	0%	8%	15%
Pedestrian	0	0%	21%	16%
Overtaking	0	0%	1%	4%
Miscellaneous	0	0%	1%	3%
Total	9	100%	100%	100%

Table 18. Taupo Urban (Miro Street) crash movements

Broadlands Road RDC has a relatively low proportion of bend – loss of control/head on type crashes, which will in part be due to the straight, flat nature of the road with relatively few curves.

Broadlands Road RDC and TDC are both over-represented in overtaking type crashes compared with peer group and national statistics.

Weather

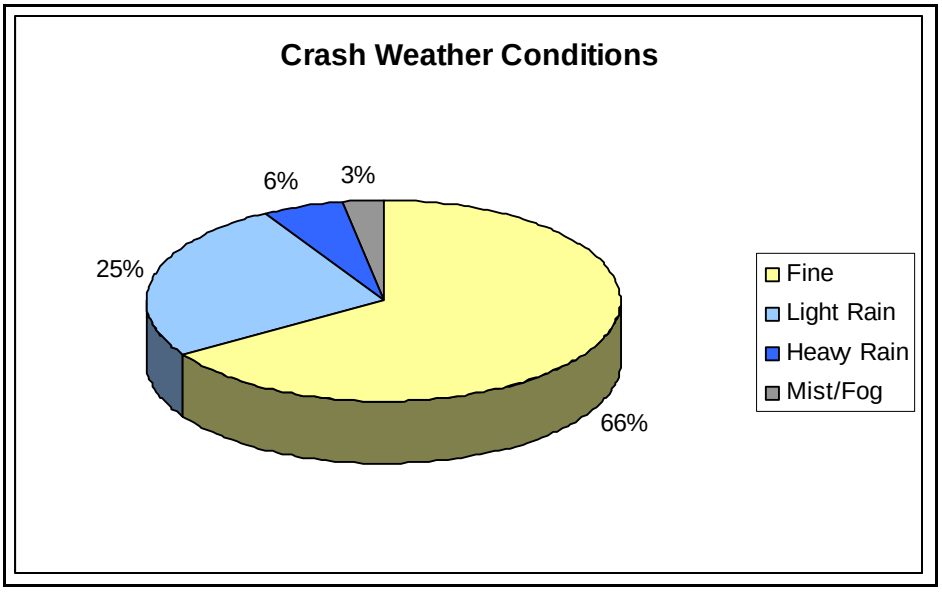
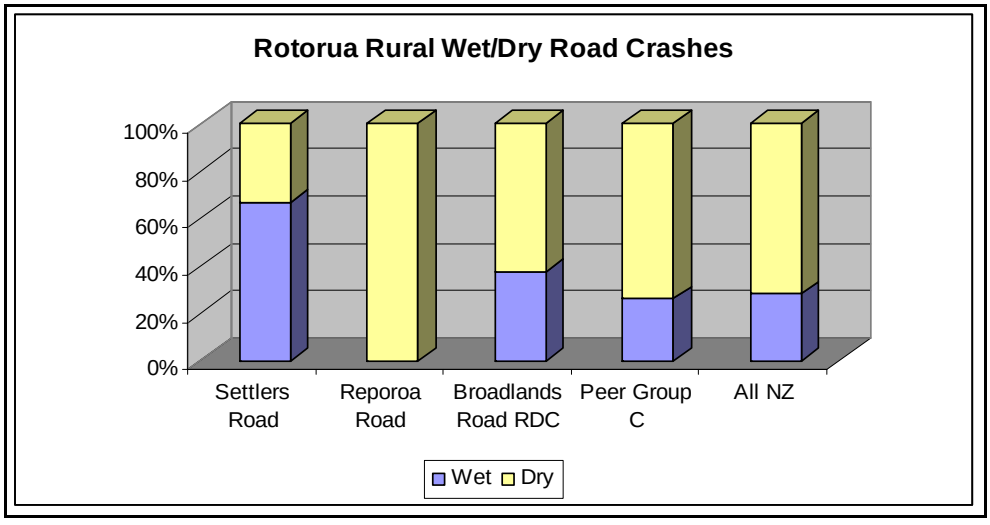


Figure 6. Crash weather conditions

Figure 6 shows that most crashes on the study route occurred in fine weather conditions.

Wet Road Crashes

The wetness of the road in reported crashes has been compared with peer group and national statistics, separated into categories – Rotorua Rural, Taupo Rural and Taupo Urban. This comparison is shown in the graphs below.



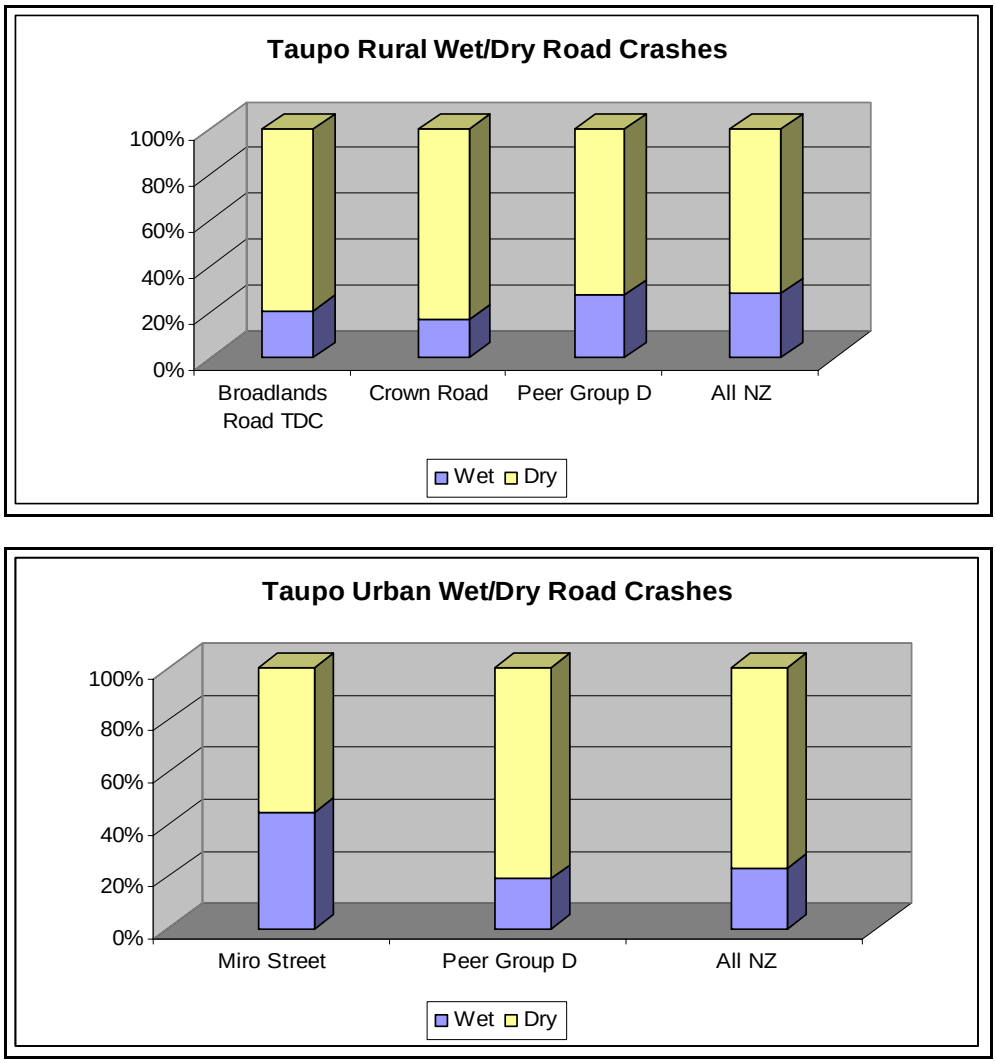


Figure 7. Wet road crashes on each subsection

Analysis of the road wetness for crashes on each subsection shows the following:

- 67% of the 18 reported crashes on Settlers Road occurred on a wet road surface, far greater than comparable peer group roads and national statistics
- Broadlands Road RDC has a higher proportion of crashes occurring on wet roads compared with peer group and national statistics
- Broadlands Road TDC and Crown Road wet road crashes are below peer group and national figures
- Miro Street has a higher proportion of wet road crashes than comparable peer group and national statistics
- Rutting of the pavement, and insufficient skid resistance and surface texture, on sections of the study route could be contributing to the relatively high rate of wet road crashes on some sections.

Crashes in Darkness

Figure 8 below compares the proportion of crashes on the study route occurring in darkness with the respective peer group averages.

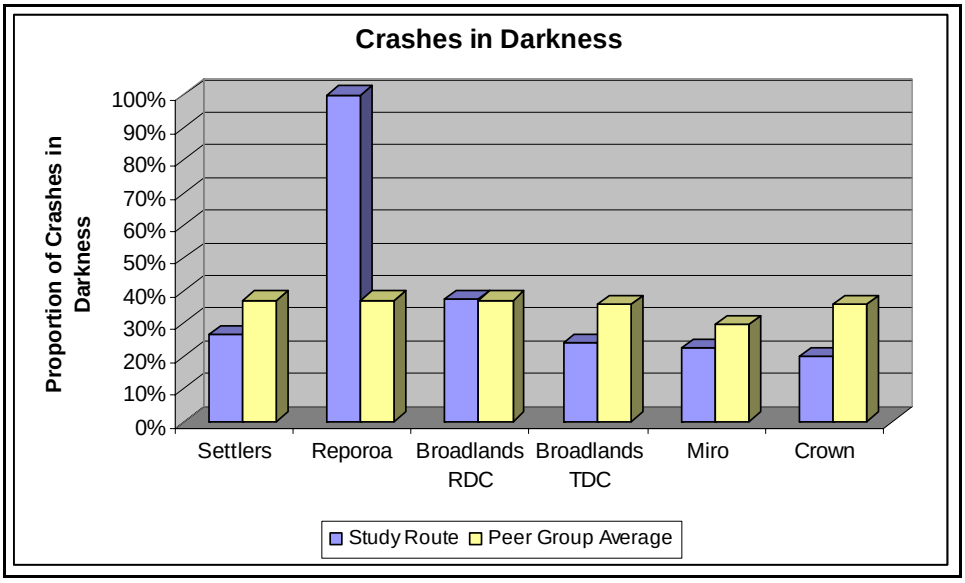


Figure 8. Crashes in darkness

The proportion of crashes on the study route occurring in darkness is generally below the respective peer group averages. This suggests there is currently adequate reflective delineation on the route.

It should be noted that there was only one crash recorded on Reporoa Road during the five-year analysis period. While this crash occurred in darkness, the sample size is too small to draw any relevant conclusions for this road.

3.2.2 Black Spots

The LTSA definition of a crash black spot is "A site where 5 or more crashes OR 3 or more SERIOUS or FATAL crashes have been recorded in a 5-year period, within a 510m DIAMETER for RURAL areas, or a 70m DIAMETER for URBAN areas".

We have identified two black spots on the study route as shown in Figure 9, and detailed in Table 19 below:

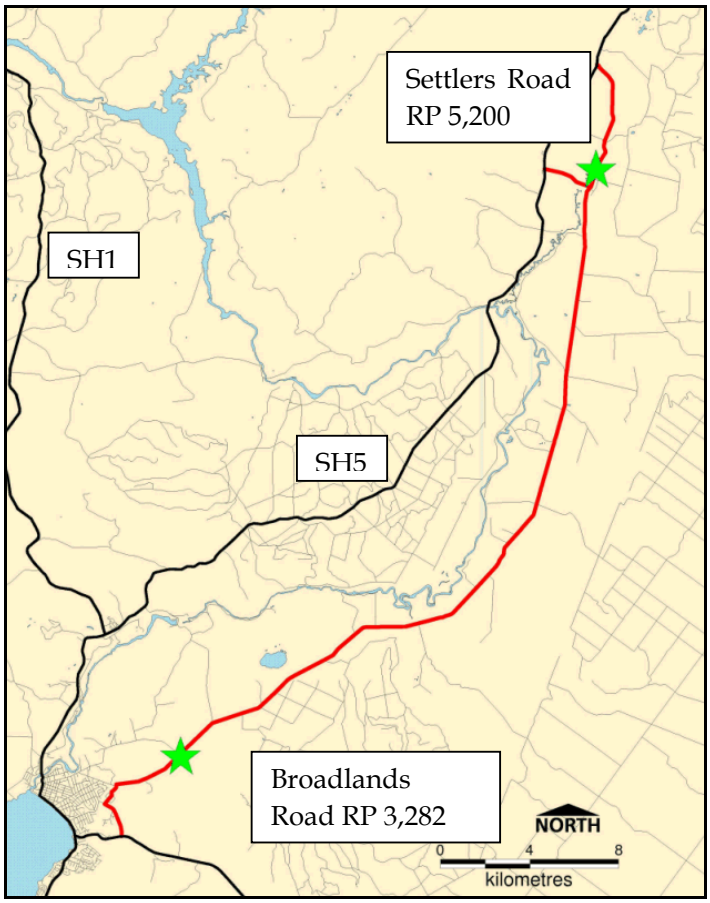


Figure 9. Crash black spot locations

Road Name	Location	Reported Crashes July 1998-June 2003
Settlers Road	Reverse Curve at RP 5,200m	5 Non-injury
Broadlands Road TDC	RP 3,282m Centennial Dr Intersection	2 Serious 3 Non-injury

Table 19. Study route blackspots

The Settlers Road black spot mainly involved loss of control type crashes, while the Broadlands Road black spot involved crossing/turning movements in the serious injury crashes.

As outlined in Section 9.4 of this report, the Settlers Road blackspot has been identified for a possible realignment to remove the tight reverse curve.

3.2.3 Crash Summary

- In the five-year period 1 July 1998 – 30 June 2003 there were 71 crashes on the study route – 2 fatal, 5 serious injury, 16 minor injury and the balance non-injury.

- One serious injury crash involved a cyclist.
- Broadlands Road TDC has a relatively high severity of crashes compared with local and peer group statistics.
- Settlers Road has a mid-block injury crash rate 60% higher than the typical rate for similar roads. This is based on a total of 4 injury crashes in the five-year period.
- Overtaking crashes are over-represented on both sections of Broadlands Road compared with local and peer group statistics
- Settlers Road has a very high proportion of wet road crashes (67%) compared with peer group (26%) and national (28%) statistics for rural roads.

3.2.4 Future Upgrading Effects

Based on possible upgrades identified in Section 9 of this report, we expect that upgrading will have the following effects on crashes on the study route:

- Localized seal widening at intersections will reduce potential conflict between turning and through traffic and improve safety at these locations, especially with increasing traffic volumes.
- Seal widening will help to reduce the occurrence of head-on, loss-of-control, and overtaking type crashes.
- Curve easing and improvements will improve the ability of vehicles to safely traverse corners.
- Concentrating rehabilitation works on pavements in relatively poor condition, that is, in areas with significant rutting and low skid resistance, will reduce overtaking and loss-of-control type crashes, and help to reduce wet road crashes particularly on Settlers Road.

3.3 Level of Service

3.3.1 Definition

Level of Service (LOS) describes the quality of service provided by the length of road. In general terms, as the amount of traffic increases, if the road remains unchanged the level of service decreases. Six grades of LOS have been identified, as given in Austroads, Part 2 (1988):

Level of Service	Description
A	Free Flow – Individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre is excellent.
B	Stable Flow – reasonable freedom to manoeuvre, although the general level of comfort and convenience is a little less than Level of Service A.
C	Stable Flow – restricted freedom to manoeuvre and the general level of comfort and convenience declines noticeably at this level.
D	Close to Limit of Stable Flow, approaching unstable flow, little control over speed and manoeuvres.
E	Volumes are at or close to capacity. No freedom to select desired speed or manoeuvre. Unstable flow and minor disturbances within the traffic stream will cause breakdown.
F	Forced Flow.

Table 20. Level of Service

For rural roads, the Level of Service is calculated for the **peak hour daily flow** on the road and is dependant on the following factors:

- Sight Distance
- Geometric Alignment
- Seal Width
- Grade of Road
- Directional Split of Traffic Flow (assumed to be 70/30 on rural subsections and 60/40 on urban subsections to reflect the high proportion of commuting one-way traffic in the peak flow).

Austroads (1988) suggests peak hour flows can be assumed to be from 10-15% of the AADT (Average Daily Traffic volume in vehicles per day). We have assumed the peak hour volume is 10% of the AADT.

3.3.2 Standards and Guidelines

Transportation Research Board (1997) states that LOS E corresponds to the maximum flow rate, or capacity, on a road. However for most design or planning purposes LOS D or C are usually used as the maximum capacity because they ensure a more acceptable quality of service to road users.

For this report we have assumed a LOS of C or greater is desirable for the peak hour.

3.3.3 Current and Future Level of Service

Table 21 lists the current and future peak hour LOS on each subsection of the study route based on the current road layout and geometry, and estimated future traffic volumes as given in Section 3.1 of this report. Detailed calculations are included in Appendix 4 of this report.

Road Name	2004 LOS	2014 LOS	2024 LOS
Settlers Road	LOS B	LOS B	LOS B
Reporoa Road	LOS A	LOS A	LOS B
Broadlands Road - RDC	LOS B	LOS B	LOS B
Broadlands Road - TDC	LOS B	LOS C	LOS C
Miro Street	LOS C	LOS C	LOS C
Crown Road	LOS B	LOS C	LOS C

Table 21. Peak hour Level of Service