Conflicts and Crashes: A Tale of Three Strip Shopping Centres

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ABSTRACT

Strip shopping centres are generally defined as an attached row of stores or service outlets managed as a coherent retail entity. Most parking is usually located in front of the stores as on-street parking. These centres generally develop over time along major traffic routes and have high levels of pedestrian and parking activity associated with them. The complex and dynamic interaction between this traffic and land use activity often results in high crash rates along the Centre’s length.

The presence of strip shopping centres on arterial or major roads also tends to have an impact on the performance of the strategic road network. Considerations of road safety and the interaction between road users is important at a strategic level and the solutions may have broad impacts.

A study was conducted of three strip shopping centres with similar characteristics in the greater Hobart area and the crash performance was critically examined and compared against traffic volumes, pedestrian activity, parking activity and adjacent land use. Whilst many of the crash trends were similar between the three selected sites, there were some distinct differences that were of interest. The major reasons for the differences between the crash types and crash numbers between the sites were mainly associated with adjacent land use, pedestrian activity and layout of the main roads through the sites in terms of intersection control. Absolute traffic volumes appeared to play a lesser role in the crash rates compared to these other factors.

1 Introduction

Strip Shopping Centres form part of the fabric of urban infrastructure and are commonplace throughout Australia and overseas. They can loosely be described as an attached row of stores or service outlets managed as a coherent retail entity, with most parking usually located on-street in front of the stores. Open canopies may connect the storefronts, but a strip shopping centre may not have enclosed walkways linking the stores. A strip shopping centre may be configured in a straight line, or have an “L” or “U” shape along a road corridor.

These centres are usually located on busy roads and have high levels of activity associated with the adjacent land uses. The main street through a strip shopping centre serves an important traffic
carrying function as well as providing pedestrian access to the frontages and on-street parking supply. The complex and dynamic interaction between through traffic and land use activity often results in high crash rates along the Centre’s length.

This paper presents the findings of detailed crash analysis of three strip shopping centres that front onto a common main road corridor. Careful evaluation of crash rates with traffic data, parking patterns, pedestrian flows and adjacent land use was conducted at these sites and critically compared.

1.1 Historic Development of Strip Shopping Centres

Strip Shopping Centres generally develop over time along traffic routes for various reasons. Often these centres were developed prior to the widespread increased use of the private motor vehicle. This is illustrated in Figure 1.1, showing the shopping precinct of North Hobart in Elizabeth Street, where shops have developed along a major tram route (being a horse and cart track prior to this) in the early 1900’s and progressively developed into a major shopping precinct. Trams eventually gave way to the high demands of the motor vehicle, and Elizabeth Street has now become a major urban arterial road. Like many urban road corridors, the function of Elizabeth Street has evolved over time to cater for large numbers of vehicle movements. This massive increase in vehicular traffic could not have been foreseen in the early days of development of the road corridor.

This evolutionary method of forming a major arterial road is very different to the manner that modern high traffic carrying roads are constructed. Highways and freeways are designed to carry large volumes of traffic in a safe and efficient manner – one of the benefits of these roads is that they have restricted property access, little side friction and minimal (if any) pedestrian movements. Many urban arterial roads do not have the ability to modify access or activity from the adjacent land uses, and hence have a large array of conflicts associated with them.

Interestingly, the high traffic volumes and high associated activity in strip shopping centres appear to be dependent on each other in the sense that shops rely on passing trade of the main street, and the Centre itself provides a convenient shopping area for passing traffic. The conflict between the through traffic and Centre activity is not easily separated.
In order to obtain appropriate crash trends from varied forms of shopping strips in an urban environment, it would be necessary to investigate many sites with different characteristics such as type of road, number of lanes, configuration of parking, etc. It was determined to limit the study size to only consider three sites that were reasonably similar in their traffic function, land-use patterns and layout so that any crash trend similarities could be adequately determined. The three sites were selected on the basis that they could be studied in sufficient detail within the time and
resource constraints of the study.

The three sites selected were all in greater Hobart area that are hoped to be reasonably typical of strip shopping centres in urban environments. All three sites were contained along the same road corridor north of the central business district of the City of Hobart. The selected sites were as follows:

- North Hobart – Elizabeth Street between Federal Street and Burnett Street;
- Moonah – Main Road between Amy Street and Florence Street; and
- Glenorchy – Main Road between Elwick Road and Chapel Street.

These sites are outlined in more detail in the following sections.

2.1 North Hobart Site

North Hobart is a commercial/retail area well known for its diverse range of restaurants take away shops and cafes. The site is located along Elizabeth Street between Federal Street and Tasma Street. A typical view of the North Hobart strip shopping centre is shown in Figure 2.

![Figure 2.1 – North Hobart Site](image)

Numerous small boutique retail shops and medium sized supermarket/retail shops are located within the site. The site is approximately 1.2 kilometres north from Hobart GPO. Elizabeth Street continues to the northwest into the suburb of New Town and southwest into Hobart central business district.

Numerous side streets connect with Elizabeth Street in the form of t-junctions that connect with urban residential and commercial areas of North Hobart, West Hobart and Mount Stuart.
2.2 Moonah

The Moonah Commercial Precinct is the second largest regional retail/commercial centre in the municipality of Glenorchy. It is located at the southern edge of the Glenorchy Council boundary, where it connects to Hobart Council at Creek Road. The Centre is located on Main Road and extends between Florence Street and Amy Street. Moonah CBD is located approximately 5.3 kilometres north of Hobart GPO and approximately 2.4 kilometres south of Glenorchy CBD.

Moonah is a traditional street-based shopping centre with generally small stores catering to a predominantly local market. The area is surrounded by a large industrial area to the east and urban residential housing to the west. There are several large car parks that are accessed from the parallel roads either side of Main Road. There are several pedestrian access links to Main Road from these car parks.

![Figure 2.2 – Main Road, Moonah](image)

The majority of business at the site are retail outlets varying in size from small boutique shops to large retailers and furniture warehouse stores. Several small cafes and two small hotels are located within the site. There is also a small amount of office space typically occupying the upper storeys of the buildings along its length. To the northwest, Main Road continues into the suburb of Derwent Park where many hardware and industrial building supply outlets are situated before connecting with Glenorchy City.

2.3 Glenorchy

The Glenorchy Commercial Precinct is the largest regional retail/commercial centre in the municipality of Glenorchy. The CBD is predominantly contained along Main Road between Chapel Street and Eady Street. It is located approximately 7.7 kilometres north from Hobart GPO.
and 2.4 kilometres north of Moonah CBD.

There are several distinct sections to this site. The section between Elwick Road/ Eady Street and Peltro Street/ Terry Street has a narrow median strip with plantings and is characterised by small retail shops, service outlets and the Elwick Hotel. The next section between Terry Street and Tolosa Street contains a library (accessed from Terry Street), Council administration, government offices, police station and a civic park. The predominant land use of this section is nine to five weekday retail/ office uses. The section of Tolosa Street connecting with Main Road contains a public bus interchange. Continuing from Tolosa Street to Barry Street, Main Road is dominated by the frontage of Northgate Shopping Centre and numerous smaller shop fronts. Northgate Shopping Centre is largely internalised with only two pedestrian accesses from Main Road.

The large Northgate car park for Northgate has vehicular access from Main Road opposite Barry Street, King George V Avenue and Eady Street. Main Road between Barry Street and Chapel Street is less intensive land use with separate buildings and small businesses.

**Figure 2.3 – Main Road, Glenorchy**

Much traffic management has been undertaken over the years to discourage unnecessary through traffic on Main Road through the site. This has been done by various methods including and has reduced traffic volumes from 18,000 vehicles per day in the 1980’s to the current level of approximately 10,000 vehicles per day. The Glenorchy site is fortunate that bypass road corridors have been available to reduce unnecessary through traffic through Main Road. Interestingly, the reduction of traffic volume does not appear to have adversely affected the success of the Centre.
2.4 Comparison of Sites

The three sites vary in their overall length, number of intersections, intersection configurations, road widths, geometry and land use function. It is important to recognise that these distinguishing features of each site may all have influences on various crash trends.

Table 1 provides a comparison of various geometric and intersection information for each site.

<table>
<thead>
<tr>
<th></th>
<th>NORTH HOBART</th>
<th>MOONAH</th>
<th>GLENORCHY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road length</td>
<td>535 metres</td>
<td>840 metres</td>
<td>715 metres</td>
</tr>
<tr>
<td>Number of intersections</td>
<td>8</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>No. signalised intersections</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>No. t-junctions</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>No. 4-way give way junctions</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of road links</td>
<td>7</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Number of signalised mid-block pedestrian crossings</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Average daily traffic volume</td>
<td>19,000 vehicles per day</td>
<td>21,500 vehicles per day</td>
<td>10,500 vehicles per day</td>
</tr>
<tr>
<td>85%ile speed</td>
<td>45 km/h</td>
<td>52 km/h</td>
<td>41 km/h</td>
</tr>
</tbody>
</table>

From Table 1, it is interesting to note that the North Hobart site has the shortest length of the three sites, but has the highest number of intersections along its length. The North Hobart site comprises of several closely spaced t-junctions, or staggered t-junctions. In contrast to the North Hobart site, Moonah has the longest overall length and lowest number of intersections along this length compared to the other two sites.

The Moonah site carries both the highest traffic volume and the higher 85%ile traffic speed. The Glenorchy site carries the lowest traffic volume of the three sites and also has the lowest 85%ile traffic speed.

Figures 2.4 and 2.5 show the hourly distribution of vehicle speeds and traffic volumes at the three sites respectively.
Figure 2.4 – 85%ile speeds by time of day

Figure 2.5 – Weekday hourly traffic volumes

Figure 2.4 shows the change in 85%ile vehicle speeds by time of day. The general distribution of these speeds across the entire day were similar for each site. Generally speaking, speeds were lower between the hours of 9:00am and 6:00pm. Moonah had the highest speeds overall, and Glenorchy showed the largest drop in speeds normal working hours. It should be noted that the Moonah traffic surveys were recorded just outside the busiest section of the strip shopping centre –
vehicle speeds would be expected to be lower within the higher activity areas.

Figure 2.5 shows that the general distribution of traffic volumes throughout the day were very similar between the sites. Glenorchy tended to have less pronounced peak hour volumes, with a ‘domed’ shape distribution of traffic across the day.

The sites also have distinct differences between their dominant activities as individual centres. North Hobart has a high level of evening activity associated with its numerous restaurants, cafes and bars, Moonah is a typical regional shopping centre with numerous separate boutique shops, and Glenorchy has a variety of larger retail outlets, offices and service outlets.

In comparing the distributions of the graphs shown in Figures 2.4 and 2.5, it appears that the decrease in vehicle speeds cannot be entirely explained by increase in traffic volumes alone. It is widely accepted that pedestrian and parking activity can have a strong influence on traffic flow characteristics. This is examined in more detail in following sections of this report.

Figure 2.6 shows the approximate traffic volumes of the surrounding road network (where available) for each site. This provides an indication of the traffic distribution of each site as well as how much traffic is travelling through the major intersections for each site. This cross traffic forms the basis of major vehicular conflicts across the road corridor of the sites.
The squares in Figure 2.6 represent signalised intersections.

Whilst Moonah and Glenorchy have similar traffic volumes along their road corridors, the fewer intersections connecting to Main Road in Moonah carry much higher volumes than the more numerous connecting roads to Elizabeth Street in North Hobart. Glenorchy carries a much lower traffic volume on the main road corridor, but has high volumes on the connecting roads.
2.5 Pedestrian Activity

The attraction of a shopping centre is generally determined by the type, quantity and quality of the shops, its convenience to the public it serves, its accessibility and character, the presence of associated activities, and several other factors. The most significant single indicator of attraction of a shopping centre is pedestrian volume, defined as the sum of the pedestrians along the footpath per unit time (Black et al. 1987). Pedestrian activity is usually presented as the number of pedestrians on both sides of the road per 100 metres of length (Austroads, Guide to Traffic Engineering Practice Part 13 – Pedestrians, 1995).

Pedestrian activity was investigated at the busiest locations at each site between 8:00am – 9:00am, 12:00pm – 1:00pm, and 3:00pm – 4:00pm. These surveys indicated that the Glenorchy site had a significantly higher number of pedestrians on the footpaths and crossing the road than the other two sites. Glenorchy also had the highest observed j-walking activity of the sites. The volume of pedestrians crossing the road in Glenorchy actually exceeded the traffic volumes during each survey time period.

The pedestrian volumes from these surveys are shown in Table 2.2.

<table>
<thead>
<tr>
<th></th>
<th>TIME</th>
<th>PEDESTRIANS CROSING ROAD</th>
<th>PEDESTRIANS J-WALKING</th>
<th>PEDESTRIANS ON FOOTPATH</th>
<th>TRAFFIC VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Hobart</td>
<td>8-9 am</td>
<td>123</td>
<td>75</td>
<td>207</td>
<td>1,367</td>
</tr>
<tr>
<td></td>
<td>12-1 pm</td>
<td>327</td>
<td>173</td>
<td>702</td>
<td>1,394</td>
</tr>
<tr>
<td></td>
<td>3-4 pm</td>
<td>294</td>
<td>108</td>
<td>748</td>
<td>1,421</td>
</tr>
<tr>
<td>Moonah</td>
<td>8-9 am</td>
<td>186</td>
<td>79</td>
<td>322</td>
<td>1,720</td>
</tr>
<tr>
<td></td>
<td>12-1 pm</td>
<td>330</td>
<td>107</td>
<td>588</td>
<td>1,726</td>
</tr>
<tr>
<td></td>
<td>3-4 pm</td>
<td>274</td>
<td>498</td>
<td>464</td>
<td>1,885</td>
</tr>
<tr>
<td>Glenorchy</td>
<td>8-9 am</td>
<td>438</td>
<td>181</td>
<td>204</td>
<td>587</td>
</tr>
<tr>
<td></td>
<td>12-1 pm</td>
<td>1,060</td>
<td>430</td>
<td>282</td>
<td>863</td>
</tr>
<tr>
<td></td>
<td>3-4 pm</td>
<td>965</td>
<td>370</td>
<td>303</td>
<td>859</td>
</tr>
</tbody>
</table>

It is likely that the higher volume of pedestrians crossing the road (j-walking and crossing at lights) at the Glenorchy site could be attributed to the lower corresponding traffic volume. By contrast, the North Hobart site showed a sharp increase in the number of pedestrians on the footpath between the morning survey and the afternoon surveys, but a corresponding increase in j-walking was not recorded.

The Glenorchy site had a much higher volume of pedestrians crossing the road than actually
recorded on the footpaths. This is a curious result that did not occur at the other sites. This can mostly be explained by the fact that many of these crossing movements were between the bus interchange and Northgate Shopping Centre and pedestrian movements were therefore not recorded along the Main Road footpaths.

From qualitative observations of these pedestrian surveys, the impact of pedestrians crossing the road effected vehicle travel speeds and altered free-flow states of vehicular traffic. Pedestrian crossing movements were also limited by traffic volumes on the main roads.

2.6 Parking Activity

Parking and unparking manoeuvres are conducted on the section of the roadway between the footpath and the vehicle carriageway. In most cases, parking operations involve the loading or unloading of people and/or goods, requiring some sort of associated pedestrian activity. The act of parking itself also has an interaction with the traffic flow. With these factors in mind, it is considered that parking activity has an impact on both traffic flow and pedestrian activity.

Vehicle speeds are affected by parking movements depending on the duration of the parking activity and the associated traffic volume (Black et al, 1989). The delays caused by parking movements can provide gaps in the traffic stream that enables pedestrians to cross the road.

Detailed parking surveys were conducted at the three sites. This key findings are shown in Table 2.3.

<table>
<thead>
<tr>
<th>Table 2.3 – Parking surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Hobart</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Total on-street parking spaces</td>
</tr>
<tr>
<td>Minimum parking occupancy</td>
</tr>
<tr>
<td>Maximum parking occupancy</td>
</tr>
</tbody>
</table>

Glenorchy experienced the highest occupancy, with peaks approaching 100%. Whilst Moonah experienced an overall low parking occupancy rate, the section of Main Road between Albert Road and Hopkins Street had much higher occupancies than the remainder of the road.

3 Crash Analysis

Six years of crash data for each site was obtained from the Department of Infrastructure, Energy and Resources (DIER), between the beginning of 1998 to the end of 2003. A total of 427 crashes were recorded along the main streets of the strip shopping centres during that time. The overall crash types for each site is shown in Table 3.1.
There were five prominent crash types at the selected sites. These crash types were significant in terms of their consistently high frequency of occurrence at each site. These crash types ranked in order of most to least frequent were: rear end, angle, parked vehicle, side swipe (same direction) and hit pedestrian. The remaining crash types were significantly less frequent. Pedestrian and side swipe crashes ranked higher than parked vehicle crashes for the Glenorchy site.

Figures 3.1, 3.2 and 3.3 compare the distribution of total crashes with the traffic volumes at each site.
Figure 3.1 – North Hobart hourly traffic volumes and total crashes

Figure 3.1 – Moonah hourly traffic volumes and total crashes
The above graphs clearly show a strong correlation between hourly traffic volumes and total crash rates. In all cases, the pattern of crashes closely follows the hourly traffic distribution for each site. It is interesting to note that whilst the shape of the traffic volumes and the distribution of crashes for each site show a strong resemblance, there is no common constant between the three sites. For example, Glenorchy has nearly half the traffic volume of the other two sites, but does not have half the crash rate. This tends to indicate that traffic volumes alone do not dictate crash rates at these sites.

In terms of standardised crashes along the road links only (not including crashes occurring at intersections), the sites recorded the following crash rates per million vehicle kilometres travelled:

- North Hobart 1.9 crashes per million vehicle kilometres;
- Moonah 2.7 crashes per million vehicle kilometres; and
- Glenorchy 4.3 crashes per million vehicle kilometres.

Clearly the higher crash numbers and lower traffic volume at Glenorchy has contributed to a higher standardised crash rate compared to the other sites.

This standardised crash rate compares to the following typical standardised crash rates for selected other roads with varying hierarchical function:

- Brooker Highway, Glenorchy – 0.5 crashes per million vehicle kilometres;
- Forest Road (local residential street, West Hobart) – 1.0 crashes per million vehicle kilometres;
- Beach Road (minor urban collector road, Kingston) – 1.2 crashes per million vehicle kilometres.
It can be seen that in general, the strip shopping centres have a much higher standardised crash rate compared to higher order traffic carrying roads as well as typical residential streets.

The spread of crashes along the length of each site provides information on the crash concentrations. This is critical in comparing crash rates with traffic, pedestrian and parking activities. Both Glenorchy and North Hobart sites had a 60%/40% split between crashes occurring at intersections and links. Moonah had a 40%/60% split between intersection and link crashes. It is likely that this is directly related to the number of intersections located along the length of each site. In terms of specific locations of crashes, the highest frequencies generally tended to occur at traffic signals and within road links. Generally traffic signal locations corresponded to connecting roads with high traffic volumes. T-junctions tended to have low frequencies of recorded crashes.

3.1 Specific Crash Trends

Some key findings from the crash analysis of individual crash types is presented below:

- Glenorchy had a significant peak of rear end crashes occurring between 2:00pm and 4:00pm. This corresponds to minimal parking occupancy and high pedestrian activity;
- North Hobart had a significant peak of rear end crashes occurring during evening hours. This may be associated with evening activity associated with restaurants and bars;
- North Hobart recorded the highest number of angle collisions. This corresponds to an overall higher number of intersections along the length of the site. Most of these crashes occurred during the afternoon peak (this pattern was not apparent for the other two sites);
- There was a reasonable relationship between the location of parked vehicle crashes and the number of parking manoeuvres along the length of the sites;
- Moonah recorded a significant peak of parked vehicle crashes between 1:00pm and 2:00pm. North Hobart recorded a significant peak of parked vehicle crashes during evening hours. Glenorchy recorded a significant peak of parked vehicle crashes during the afternoon peak. These patterns appear to correspond with associated land uses at the three sites;
- Pedestrian crashes by time of day tended to follow a similar distribution to total crash distributions for each site. An exception to this was between 3:00pm and 4:00pm – nearly 20% of all pedestrian crashes occurred during this time. This corresponds to high pedestrian activity associated with school finishing times;
- A high proportion of young pedestrians were involved in crashes at the Glenorchy and Moonah sites. North Hobart had a high proportion of pedestrians involved in crashes between the ages of 21-50 years (60% of all pedestrian crashes compared to ~20% for the other sites). This appears to be a function of land use and proximity to educational facilities;
- Glenorchy recorded the highest number of pedestrian crashes. This corresponded with the highest pedestrian activity of the sites. It also appears that major pedestrian generators (such as entrances to large shopping complexes, and bus interchanges) tended to concentrate
pedestrians crossing the at certain locations. The remaining sites had a much more evenly distributed pedestrian generators across the length of the sites;

- A high incidence of pedestrians involved in crashes at the North Hobart site were noted to be intoxicated on the individual Police reports. This could be attributed to the high number of licensed venues at this site;

- A high occurrence of drivers involved in crashes in North Hobart had a blood alcohol level greater than the legal limit of 0.05. This could be attributed to the high number of licensed venues at this site;

- Overall, the severity of pedestrian crashes was far higher than any other crash type. 72% of all pedestrian crashes involved some form of injury and 38% involved hospitalisation. This compares to 22% of all recorded crashes involving injury and 17.2% of all crashes involving hospitalisation. This is consistent with other studies and demonstrates the vulnerability of pedestrians as road users;

- The most common vehicle movement involved in a pedestrian crash was a ‘straight ahead’ manoeuvre. Reversing and turning movements were the next most common vehicle movements. This highlights the interaction between through traffic, parking manoeuvres and pedestrians;

- Few crashes involved bicycles or motorcycles at the sites;

- Few crashes involved a single vehicle losing control and colliding with street furniture or running off the road; and

- Few crashes involved buses. A slightly higher occurrence of bus crashes was noted at the Glenorchy site – this may be attributed to the location of the bus interchange connecting to the middle of this site.

6 Conclusions

The three sites selected, whilst being on a common road corridor, had distinct differences in terms of traffic flows, pedestrian activity and land use. These sites appeared to be a good representation of urban strip shopping centres on main two-lane, two-way urban arterial roads.

Conflicts between through traffic and activity associated with the strip shopping centres can be readily observed between through traffic, parking movements and pedestrian activity. The reduction of vehicle speeds and capacity are the most easily identified impacts of these conflicts. The conflicts also appear to be strongly represented within the road safety performance of the sites. Standardised crash rates in strip shopping centres appear to be much higher than for higher order traffic carrying roads as well as local streets.

The types of crashes occurring within strip shopping centres can give some indication of the conflicts present along the main road corridor. These conflicts arise due to associated land use and generated pedestrian and parking activity. There were five significant crash types at the selected
sites. These were: rear end, angle, parked vehicle, side swipe (same direction) and hit pedestrian.

A strong correlation between hourly traffic volumes and total crash rates was noted at the sites. In all cases, the pattern of crashes closely follows the hourly traffic distribution for each site. Glenorchy however had the highest number of crashes of the sites, but had nearly half the traffic volume. This indicates that traffic volumes alone do not dictate crash rates at these sites. It appears that whilst traffic volumes are linked, factors such as pedestrian movements and parking activity play a much more significant role in crash trends.

Pedestrian crashes generally had high associated severities and accounted for a significant proportion of all injury crashes across the sites. This highlights the vulnerability of these road users.

From these findings, it is clear that there are strong road safety issues associated with strip shopping centres. The combination of high traffic volumes and high activity within the centres is strongly represented in the crash histories. It is equally apparent that strip shopping centre activity impacts on traffic flow and the strategic function of the roads that pass through them. With these issues in mind, how can prioritisation of these conflicts be effectively achieved?

Clearly issues of road safety must take priority over road capacity and efficiency. It is not usually possible to remove either the through traffic or the associated land use activity – these two functions are too closely interconnected to be separated. Much work has been done to manage conflicts by well-known traffic calming and traffic management techniques. If road safety performance is to be enhanced further in these sorts of roads, further work must be done to reduce the risks associated with the conflicts, or reduce the consequences of collisions.

Perhaps the most important aspect of road safety in these roads is the reduction of crashes involving pedestrians given their vulnerability. By careful evaluation of the location of major pedestrian generators and provision of appropriate pedestrian crossing devices and other road safety initiatives, this should be achievable on a site-by-site basis.

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