Motorcycle safety route review: A case study

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Abstract

There is an increasing trend in the number of motorcycle crashes not only within NSW but generally across Australia. While rider behaviour may be a critical factor in many of the crashes, road authorities, through a safe systems approach need to focus even more to provide a safer road environment for these vulnerable road users.

This case study focuses on Putty Road which runs from the north west outskirts of Sydney, north through the Wollemi National Park to just south of Singleton (north west of Newcastle). It is a well publicised route for recreational motorcyclists and is known as a scenic route with a challenging alignment for riders. Unfortunately, motorcyclists are over represented in the casualty crash statistics for this road.

In mid 2007 the RTA's Road Safety and Traffic Management Branch in Newcastle undertook analysis of an 82km section of the Putty Road to determine options to reduce motorcycle crashes. A working party (consisting of road safety practitioners, asset maintenance staff and NSW police) was formed to examine road use, driver behaviour and various elements of the current design of the road. The group identified a range of low cost treatments that were able to be implemented in a short time frame and were targeted at areas where clusters of crashes were occurring. The treatments adopted included installation of high visibility signage, motorcycle specific awareness campaigns, speed zone reductions and a number of engineering treatments. Analysis of the crash statistics in the three years since the treatments were installed shows a decrease in motorcycle crashes. The strategy used for this route has since been adopted for other motorcycle routes in the Hunter Region.

Keywords

Safe systems, motorcycles, crash rates, speed, signage, awareness

Introduction

Putty Road

Putty Rd (MR503) is a State Road that runs from Windsor, in the far western parts of Sydney to the town of Singleton approximately 80km north west of Newcastle. It is 156km in length and is shown in Figure 1 by the yellow line.

Figure 1 : Putty Rd Winsor to Singleton

This rural road has many challenging geographical issues, such as steep batter slopes and rock walls, resulting in limited shoulder widths and lengths of guardrail which do not always have adequate deflection behind it. The road has many curves with a varying range of radii and curve alignments. The curves with lower radii are generally difficult to realign because of constraints imposed by the terrain. Despite this, overtaking opportunities exist at fairly regular intervals.

On weekdays Putty Road is primarily used by local residents and heavy vehicle drivers carrying goods. On weekends it is a popular motorcycle route used by recreational riders connecting to several other motorcycle routes and providing access to vineyards and other recreational activities. The road has a winding alignment bordering Wollemi and Yengo National Parks with relatively low traffic volumes. Overall the pavement, linemarking, signage and safety barriers are in good condition. Motorcycle specific signage has been installed along with the more standard curve warning signposting, curve advisory speed signs and chevron alignment markers. There are several shelters and stopping points available to motorists and riders. The most popular stopping point was Halfway House, however it has recently been destroyed by fire.

A study was undertaken by the RTA's Hunter Regional Office which focused on the northern extent of Putty Road in the Singleton local government area. The study area focussed on the 82km northern section of the road, prompted by an increasing number of serious motorcycle crashes in 2007. Prior to the review, the majority of the road was signposted as 100km/h except for a 16.8km length of 80km/h through Howes Valley. Police enforcement was difficult in many parts due to narrow shoulder widths, site distance constraints and OH&S issues.

Profile of Putty Road

- **Traffic volumes on Putty Rd**

Average daily traffic volumes measured in 2007 showed slightly less than 1,000 vehicles per day. 2011 figures show similar traffic volumes. Traffic data surveys were undertaken as part of the review over a 5-week period in mid 2007 to examine vehicle usage. Traffic volumes are fairly constant across the days of the week. However, the counts obtained showed a change in the distribution of road users when comparing weekday and weekend traffic. The percentage of heavy vehicles reduces from 19% of traffic on weekdays to 7.7% on weekends, while the percentage of motorcycles increases from 3.7% of vehicles on weekdays to 13.7% of vehicles on weekends. Light vehicle usage remains fairly stable across the week with 77.3% weekdays and 78.6% on weekends.

While the majority of vehicle types are light vehicles, there is clearly a change in the function of the road for other vehicle types from freight movement during weekdays to recreational motorcyclists on the weekends.

- **Crashes on Putty Road**

Crash analysis was undertaken as part of the safety review. The crash rate is high for a low volume road with 165 crashes recorded between January 2002 and December 2007. There was also a corresponding high rate of casualty crashes with 68% of crashes resulting in injury (105) or a fatality (8).

	Motorcycle	**Non Motorcycle**
Crashes 2002 - 07	• 91 crashes • 77 injury • 4 deaths	• 74 crashes • 28 injury • 4 deaths
Crash profile	• 89% casualty crashes • 86% between 10am–3pm • 79% weekend • 98% daylight • 99% dry conditions • 86% single vehicle • 80% off road on curve; 76% hit guardrail	• 43% casualty crashes • No time of day pattern • 24% weekend, 76% weekday • 64% daylight • 81% dry conditions • 88% single vehicle • 58% crashes off road on curve; 14% hit animal; 13% lost control on straight

Figure 2: *Crash profile 2002-07 comparing motorcycle crashes and non-motorcycle crashes*

Some interesting points to note from figure 1 and further analysis are:

1) 55% of crashes are related to motorcyclists, while motorcyclists make up only approx 5% of vehicles across an average week
2) Most motorcycle crashes occurred on a weekend, where motorcycles represent nearly 14% of vehicles on the road.

3) Weather and lighting were not primary contributing factors to the motorcycle crashes – most of which occurred around the middle of the day with 98% occurring in daylight and 99% in dry conditions. In contrast, non-motorcycle crashes were more unpredictable as to the time, day of the week, lighting conditions, weather conditions, crash type etc.

Longer term analysis of motorcycle crashes between 1996 and 2010 shows that:

1) 71% of crashes are coded as 'speed' related
2) 36% of motorcycle crashes occurred on a public holiday or during school holiday periods.
3) The percentage of crashes by time of day, weather / road surface conditions and crash type are similar to the 2002-07 period used for analysis above

- **Crash locations on Putty Road**

Crashes are generally dispersed over the 82km study area. However, several crash clusters were identified for further analysis with the intention of implementing specific road safety treatments in these areas. It is difficult to determine the precise location for many crashes with the route having very few landmarks (such as side roads, creeks etc). As a result NSW Police often code crashes to the nearest 500m, 1km or even several kilometres from a landmark. Given there are often many curves in close proximity to each other, establishing the curve relating to a particular crash can be very difficult.

- **Speeding**

Speed has been identified as a major factor contributing to motorcycle casualty crashes. This can be verified by speed survey data and crash reports obtained from NSW Police. RTA crash statistics show 63% of all crashes over the period 2002-2007 coded speed as a factor. It should be noted that it is difficult to always correctly identify speed as a factor in crashes so the true number of speed related crashes may vary from this figure. There are several explanations for the high speeds of motorcyclists, but the two main contributing factors are likely to be the low perceived likelihood of being detected and the desire for motorcyclists to test themselves in this challenging road environment.

Speed surveys were conducted by the RTA in May/June 2007. Two survey locations were chosen both in 100km/h speed zones on straight sections of road. Figures 3 and 4 below show the distribution of speeds recorded at one of the locations for non-motorcyclists and motorcyclists respectively. The y-axis shows the number of vehicles recorded travelling at a certain speed (indicated on the x-axis) during the survey period. The blue vertical line on each graph shows the posted speed limit (100km/hr), while the black dotted line shows the 85th percentile speed (ie. the highest 15% of vehicle speeds recorded were higher than this speed).

The graphs show a much higher propensity for speeding by motorcyclists as compared to non-motorcyclists. Data collected shows mean, median, 85th percentile and maximum speeds for motorcyclists are well above non-motorcyclists, with the distribution positively skewed.

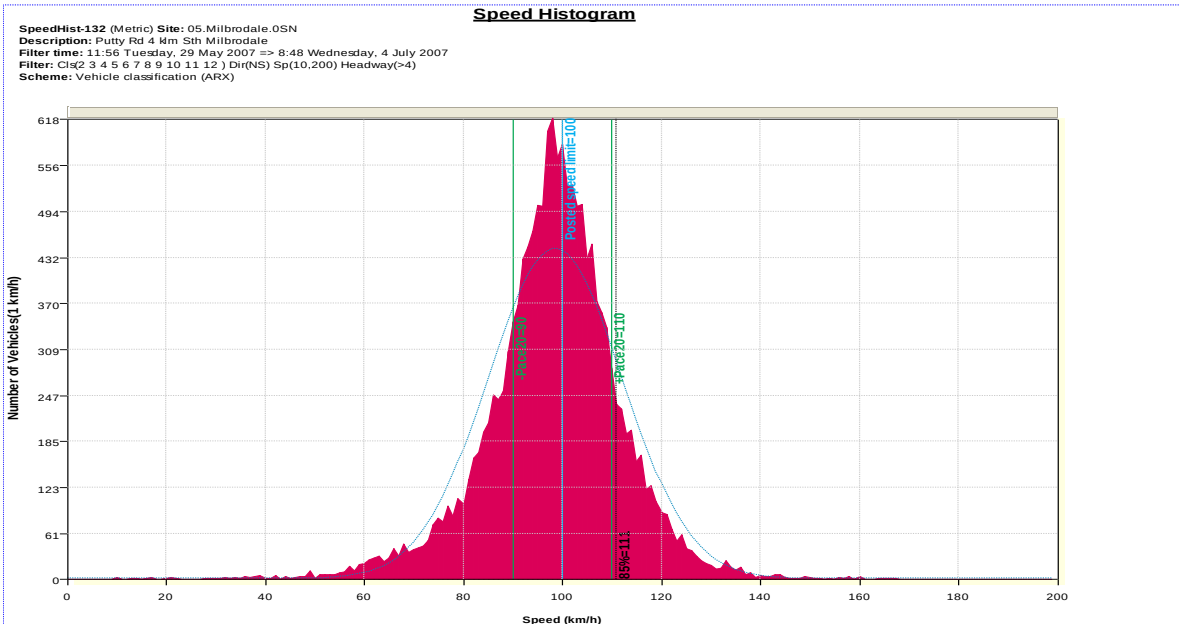

Figure 3: *Distribution of speeds recorded for non-motorcyclists (100km/hr section)*

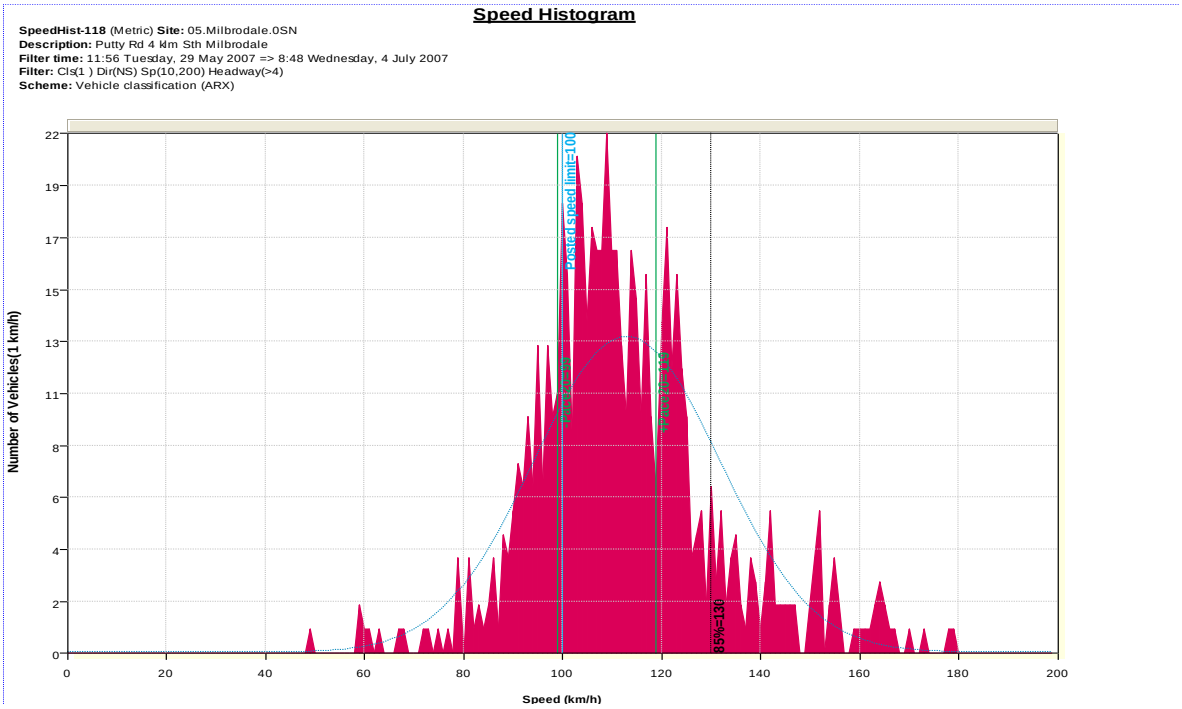

Figure 4: *Distribution of speeds recorded for motorcyclists (100km/hr section)*

Putty Road Safety Review

A review of safety issues was undertaken mid 2007 for the 82km length of Putty Road. The review initially involved site investigations, analysis of the crash history, and analysis of traffic information for the route. Further information was also collected during site inspections. A workshop was then held involving a team that included representatives from within the RTA of road safety, traffic management, road design, asset maintenance and NSW Police that patrol the area. The focus of the workshop was ensuring the best safety outcomes through an integrated approach and program of works. The project team had an objective of reducing the number and severity of crashes by providing low cost, effective safety engineering works and behavioural programs that could be implemented within a short time frame.

The project team considered a wide range of issues including pavement condition, speed zones, signage, linemarking, road geometry, clearzone widths, Police enforcement, potential blackspot projects, driver awareness campaigns (eg banners / billboards / display boards / portable VMS) safety barriers, heavy vehicle issues and incident management.

Key outcomes from the safety review

The action plan identified a range of treatments that could be implemented in a short timeframe by December 2007. The key road safety issues that were implemented were:

- changes to speed zones
- provisions for police enforcement of speeding
- improvements to signage, linemarking and delineation
- campaigns to improve driver/rider awareness of road safety issues and change driver/rider behaviour

In addition, the action plan looked at longer term road safety engineering treatments requiring a larger investment including installation of safety barrier, shoulder widening, sealing the outside of curves and realignment of curves. Given the uncertainty of future funding for larger scale engineering works such as these, the focus of the action plan was initially on low cost treatments with funding available.

Speed Zoning

As part of the action plan a 14.8km section of Putty Road had its speed reduced from 100km/hr to 80km/h. This section was primarily winding road and had the highest concentration of casualty crashes along the 82km section of road.

The results of a comparison of the annual average crash rates for the 6 years prior to the speed zone change (2002-07) and 2.5 years of data collected after the speed zone change (2008-mid 2010) are shown in Figure 5. There is a decrease in annual crash rates for motorcyclists and other vehicle types following the speed zone reduction.

	Prior to speed zone reduction (100km/hr)	After speed zone reduction (80km/hr)
Average fatal crashes per year	0.83	0.4
Average injury crashes per year	7.5	5.6
Average reported crashes per year (includes fatal, injury and towaway crashes)	10.0	8.0
Average number of crashes coded as 'speeding' per year	6.0	4.4
Average number of crashes by motorcylists per year	7.2	5.2
Average number of crashes on weekends per year	6.7	5.2

Figure 5: *Comparison of crash rates before and after speed zone change*

Police Enforcement

The speed zone reductions have been supported by additional Police enforcement and campaigns to reinforce road safety messages and remind drivers of the risks associated with speeding. The targeted campaigns (such as banners, billboard structures, variable message signs) were placed both on the open road and in surrounding townships at key rest area locations.

The RTA has worked with NSW police to increase motorist and rider awareness of speeds and the increased potential for Police presence. This was supported by the installation of "Motorcycle Safety Enforcement Areas next 50 kms" signage; the installation of 7 police enforcement bays and the use of 4 portable VMS sites warning of police enforcement activities and encouraging riders to slow down. The location of police enforcement bays was determined in consultation with NSW Police.

Signposting and Linemarking Upgrades

RTA looked at ways to improve rider safety through improvements to existing signage, raising awareness of the dangers for motorcyclists and education of riders on safe driving techniques.

<u>Review of existing signage</u>

A review of existing signage found some signage to have poorer visibility in varying light conditions, and some non-standard signage. A strategy for upgrading signage was implemented with a focus on standardising the signage along the route.

Approval was also obtained to upgrade the existing signposting with fluoro background signage, particularly in locations with high crash rates. The fluoro signage provided curve warning and speed advisory information. The benefit of this signage is increased visibility in varying light conditions. During the day the fluoro signs are more visible than the previous signs which could get lost in the background and / or shade.

Delineation

Delineation around the outsides of curves was reviewed to determine opportunities to enhance the definition of the curve and provide better guidance to drivers. All curves along the length were reviewed against current standards. 174 chevron alignment markers (CAMs) were installed along the 82km length of the study area.

Centreline markings were reviewed. Double unbroken centrelines (BB lines) were introduced through the winding curves to form a continuous barrier to limit overtaking opportunities on sections of the road with poor forward sight distance. This resulted in an additional 17.3km of BB lines.

Specific curves were identified for larger scale, longer term strategies to improve alignment, superelevation and to provide wider sealed shoulders as additional funding becomes available.

Campaigns to improve driver awareness

Road Safety Banners were installed at 4 locations along the route. These banners display current messages such as “Look Out for Motorcycles”, “Slow Down on Bends”, “Look Out for Yourself” and “Plan your Corners”. The banners are a highly visible method of reinforcing key messages. It was difficult to locate suitable locations capable of having large banners particularly when clear zones and sight distances need to be retained.

Large billboard structures were installed at the extremities of the 16km length of 80km/h speed limit (the highest crash rate section). The billboards are 4m x 2m in size and display current ‘Plan Your Corners’ artwork. Smaller billboards were installed at sites where riders often rest such as the Halfway House and Boggy Swamp rest area. The smaller billboards display ‘Plan Your Corners’, ‘Gear Down’ and ‘Position’ campaign messages.

Display cases were also installed at sites where riders take rest. The cabinets are 1290mm x 900mm and lockable. The cases display current RTA motorcycle information and resources including additional information from RTA websites targeting all road users on issues such as licensing and road rules. A concrete parking area was provided in front of the display cabinet at Halfway House to encourage riders to park their motorcycles in front and view the display while resting.

Crash rates following remedial works

A comparison was done of the crash rates for 6 years before remedial works were undertaken (2002-2007) and the 3 years after remedial works (2008 – 2010). Given the different time periods, the results are presented as average crashes per year.

For non-motorcycle crashes:

- Total crashes decreased from an average of 12.3 per year to 10.3 per year
- There were 4 fatal crashes in 6 years to end 2007, and none in the 3 year period following
- Casualty crashes decreased from an average of 4.7 per year to 4.3 per year
- Towaway crashes decreased from an average of 7 per year to 6

For motorcycle crashes:

- Total crashes decreased from an average of 15.2 per year to 10.0 per year
- There were 4 fatal crashes in 6 years to end 2007, and 1 fatal in the following 3 years
- Casualty crashes decreased from an average of 12.8 per year to 9.3 per year
- Towaway crashes decreased from an average of 1.7 per year to 0.3 per year

While the average number of crashes saved per year may not appear large in comparison to the crashes occurring on much busier roads, the reduction as a percentage of the crashes occurring on Putty Road is significant. For example, total motorcycle crashes decreased by approximately one third.

Figure 6 shows the number of motorcycle, non-motorcycle and total crashes over the period 1996 – 2010. For motorcyclists there is an increasing trend over time. This result aligns with the increasing trend in motorcyclist crashes across NSW. The number of non-motorcyclist crashes has fluctuated over time but typically results in 5-10 crashes per year.

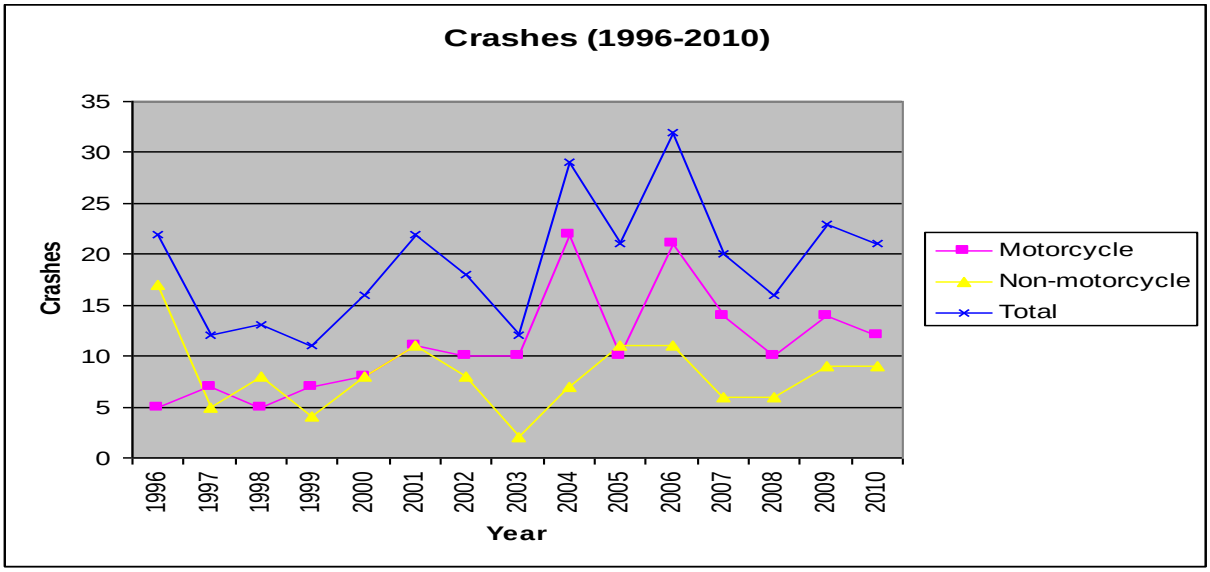

Figure 6: *Crashes recorded over the period 1996-2010*

Figure 7 shows a 3 year moving average of the data shown in figure 6. There is a break in the trend following works undertaken in late 2007. While the number of reported crashes since the works were undertaken has improved since the period 2004-2006, the results are not as low as those recorded in the late 1990's. This is expected with an increase in the number of registered motorcycle riders over time and the more recent promotion of this route as a great recreational ride through motorcycle magazines and clubs.

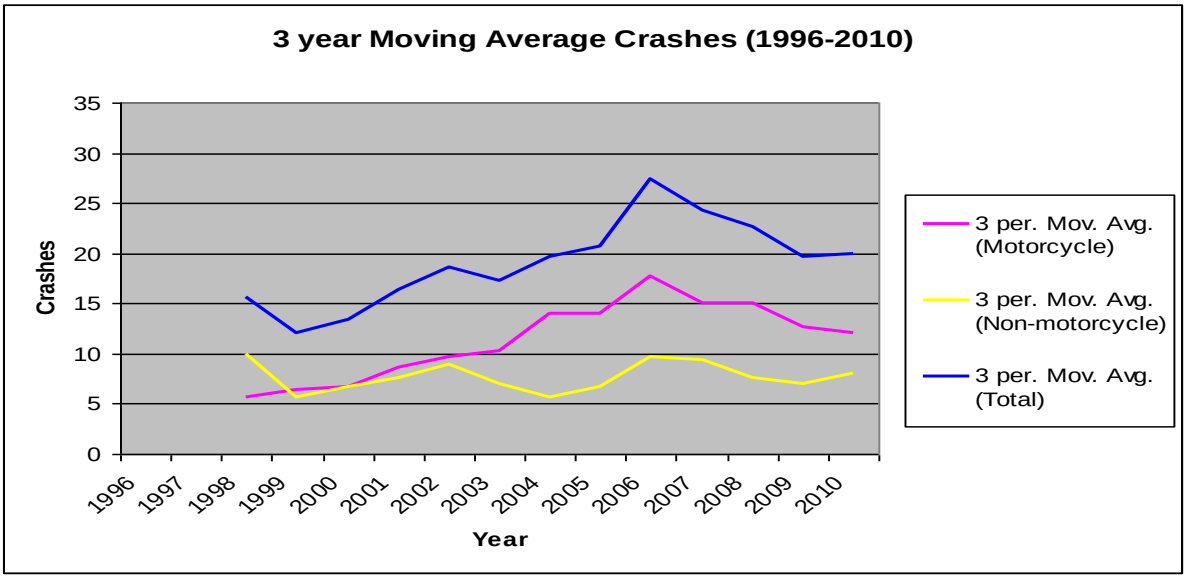

Figure 7: *3 year moving average crashes (1996-2010)*

Conclusion

The strategy used to reduce the number and severity of motorcycle crashes on Putty Road has proven to be effective. While the works were only completed by the end of 2007, early results show a reduction in motorcycle crash rates.

The main focus of the strategy was on lower, more cost effective treatments that could be implemented in a short time frame including speed zone reductions, additional police enforcement, upgrading and improving signposting linemarking and delineation and awareness campaigns to reinforce safety messages to motorcyclists.

The RTA Hunter Region has applied the approach to improving road safety for Putty Road to other popular motorcycle routes with higher crash rates for motorcyclists such as Old Pacific Highway, Thunderbolts Way and Wollombi Rd, the results of which have yet to be analysed. It is intended that a similar approach will be adopted for other major motorcycle routes with a poor crash history.