

NO ROOM FOR A MEDIAN TREATMENT? – THINK AGAIN

Rob Partridge (Presenter)
BE (Hons) Civil, GIPENZ, ANZIM
National Discipline Leader – Road Safety
MWH New Zealand Ltd (Wellington)
Rob.D.Partridge@mwhglobal.com

ABSTRACT

Calabar Road is a busy four lane section of State Highway 1 (SH1) that runs adjacent to Wellington International Airport; it has narrow lanes and is confined on both sides. An intersecting road (Wexford Road) had a poor safety record associated with right turning movements. Previous attempts to resolve the right turning risk had failed and given the inability to widen cost effectively, an innovative solution was required to completely ban right turns. Saferoads Separation Kerb with Snaploc flexible posts, a recent road safety product, was installed on the existing double yellow centrelines. This was the first time this product had been used for highway purposes in New Zealand.

This paper will outline the installation, maintenance and road safety success of 340 metres of separation kerb with flexible posts. It will consider the crash history prior to installation and for the three years since installation. It will also look at the impact on highway speeds and the maintenance requirements. This presentation will highlight the successful New Zealand application of a road safety treatment that can be used in our drive to provide a safer road system increasingly free of death and serious injury.

INTRODUCTION

The aim of this technical note is to provide feedback to the industry on the application and performance of a separation kerb and flexible post treatment installed on double yellow lines on a narrow four lane carriageway, in order to restrict right turning movements from a side road. This was the first application of this treatment for this purpose in New Zealand. The particular product installed was the Saferoads Separation Kerb with Snaploc flexible posts.

The technical note will outline the reasons for selecting the site for this treatment and will also discuss the details of the scheme and the installation process. Finally, the success of the treatment at this site will be reviewed in terms its safety performance, the impact on vehicle speeds and maintenance.

BACKGROUND

Site Details

Calabar Road is a four lane section of State Highway 1 (SH1) carrying 23,000 vehicles per day. It runs parallel to Wellington International Airport, between the roundabouts with Cobham Drive and Broadway; a length of approximately 950 metres. Calabar Road is confined by the airport on the west and residential properties and a large bank on the east. The carriageway itself has four narrow 3.2m wide lanes and there are no shoulders. Footpaths run on both sides of Calabar Road as far as Caledonia Street and on the eastern side from Caledonia Street to Broadway. Calabar Road has a posted speed limit of 70km/h.

The particular section of Calabar Road of interest, as shown in Figure 1, is at the intersection with Wexford Road. Wexford Road is a minor side road located on a crest curve with movements in/out of less than 750 vehicles per day. Other than for residential access, Wexford Road provides access to two viewing areas for planes and commercial premises for Weta Digital. Visibility to the north, for vehicles exiting Wexford Road, is limited by a high bank to 20m from 5m behind the kerb line and 50m from 3m behind the kerb line. These values are well below the minimum safe intersection sight distance (SISD) for a design speed of 65km/h of approximately 125m¹. Visibility to the south is 60m from 5m behind the kerb line and over 200m from 3m behind the kerb line.



Figure 1: Site location

For the five year period 2005 to 2009 there were nine right turning crashes at this intersection. This consisted of four 'GD' rear end type crashes involving vehicles turning right into Wexford Road and five 'JA' right turn against crashes involving vehicles exiting Wexford Road. Four of these were non-injury crashes, four minor injury crashes and one resulted in a fatality. The fatal crash involved two motorcycles ('JA' type). As a result of the numerous right turning crashes there was a desire to restrict vehicles from undertaking these movements.

¹ Table 3 contains the 85th percentile speeds for Calabar Road. SISD calculated using formula from Austroads Part 4a.

Initial treatment and site constraints

A project was instigated to address the right turning crash issue as part of The NZ Transport Agency's (NZTA's) minor safety funding. The site had numerous constraints but most notably there was a lack of ability to widen the road to enable the placement of a traditional solid median or median barrier. As discussed earlier, the airport is located on the western side of Calabar Road along with a narrow footpath/cycle path. On the eastern side, to the north of Wexford Road, there is a large bank and a footpath containing trolley bus poles to the south. Moving the trolley bus poles and cutting the bank were both investigated, but were ruled out due to considerably high costs. Although consulted on, it was not deemed appropriate at this stage to close the side road completely, thus banning all movements.

With the above restrictions a treatment was developed that involved installing a triangular splitter island along with minor widening, 'no right turn' signage, and removal of the gap in the double yellow lines. These works were completed in October 2009. A number of site visits were undertaken following installation to check the effectiveness of the treatment. It was found that the majority of right turn movements into Wexford Road had ceased (although not all); however right turning movements out were still occurring, in fact the majority of drivers simply ignored the signs and island guidance.

SEPARATION KERB TREATMENT

In light of the risk of a serious or fatal right turning crash still occurring at the intersection, consideration was given to installing ground mounted flexible posts along the centreline. It was agreed that this again would not completely remove the risk but rather further discourage it, and certainly not prevent motorcyclists or cyclists undertaking right turning movements. At this point a new road safety product came to our attention that could potentially solve the problem without fully closing the side road. The product was the Saferoads Separation Kerb with the option of Snaploc flexible posts on top. With a base width of only 265mm, refer Figure 2, the separation kerb could simply be placed within the footprint of the existing double yellow lines without any need to widen.

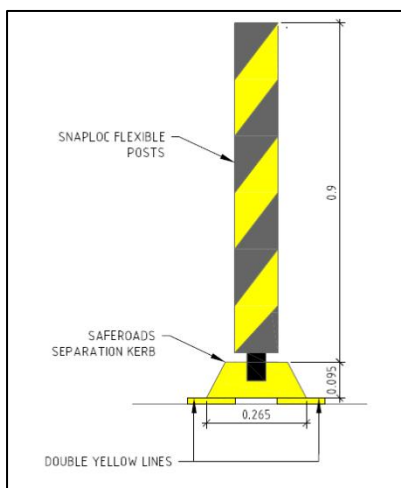


Figure 2: Separation Kerb Treatment

The NZTA agreed to the proposal of installing this product as a trial on Calabar Road for 340 metres, from Cobham Drive to Caledonia Street, with the knowledge that it could be removed easily if necessary. The length was chosen to discourage U-turning on the state highway by forcing vehicles to use an alternative route or the roundabouts at either end of Calabar Road. Snaploc flexible posts were placed at 4.5m centres, except for 21m either side of the Wexford Road where they were spaced at 1.5m centres to further discourage vehicles from driving over the kerb.

The total cost to install the treatment, including Level 2 traffic management was approximately \$75,000 (2011 dollars). The per metre rate for the kerb and posts, excluding traffic management, was around \$200/metre.

Installation

Due to the high traffic volumes on Calabar Road installation was required to be undertaken at night which included noise restrictions after 11pm. The noise from the generator and drill were the main concerns and the contractor, Fulton Hogan, worked closely with the Wellington City Council to enable work to occur throughout the night. A noise box was created that moved with construction, reducing the noise to acceptable levels for nearby residents. Installation was completed in six nights, at the end of June 2011, at an average rate of 56 metres per night.



Photos 1 & 2: Separation kerb with flexible posts at completion

POST-CONSTRUCTION ASSESSMENT (as at November 2014)

Safety Performance

Crash data has been reviewed from 2005 through until August 2014² for turning movements at the intersection of Calabar Road and Wexford Road. The data is contained in Table 1 and is separated into pre and post treatment, with post treatment split between the splitter island treatment and the separation kerb treatment³.

Non-Injury	Minor	Serious	Fatal
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Key to Crash Severity in Tables 1 & 2

	Pre-Treatment					Splitter		Separation Kerb		
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Right Turn In	1	-	-	1	2	-	-	-	-	-
Right Turn Out	1	1	1	-	1	-	-	-	-	-
Left Turning	-	-	1	-	-	-	-	-	1	-

Table 1: Turning crashes at the intersection of Calabar Rd and Wexford Rd (2005-2014)

Table 1 shows that since 2010 there have been no crashes involving right turning vehicles at this intersection. Although no crashes were recorded when the splitter island treatment was in place the majority of vehicles were still turning right out of Wexford Road and the risk of a crash involving this movement still existed. Following installation of the separation kerb treatment, site observations showed that right turning movements were nearly impossible, although there were some SUV or 4x4 tyre marks on the kerb suggesting that some drivers attempted the right out manoeuvre.

The crash record was also checked on Caledonia Street from Calabar Road to Kauri Street (including intersections) for right turning and U-turning movements; vehicles can turn here rather than travel to the Broadway roundabout. Table 2 sets out this crash data.

	Pre-Treatment							Splitter		Separation Kerb				
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014				
Caledonia Street	1	2	1	2	1	1	1	-	3	1	-	1	-	3

Table 2: Right turning or U-turning crashes on Caledonia Street (2005-2014)

² Data can take up to 3 months to appear in CAS.

³ The completion date for the splitter island treatment was 30 October 2009 and 21 June 2011 for the separation kerb treatment.

Table 2 shows that there is no evidence to date⁴ that there has been an increase or migration to of right turning or U-turning crashes on Caledonia Street between Calabar Road and Kauri Street since either treatment was installed. The crash record does not contain any U-turning movements' post 2009 (there were two between 2005 and 2008).

In addition to preventing right turning movements the separation kerb treatment has the added benefit of reducing the likelihood of head-on crashes occurring on Calabar Road⁵.

Impact on speed

It was anticipated that the separation kerb and flexible post treatment would have the added safety benefit of reducing vehicle speeds along this section of Calabar Road. Speed surveys were therefore undertaken both prior to installation and post construction using MetroCount dual tubes. Both surveys were undertaken just south of Wexford Road and conducted over four days. The 'free' speed results are shown in Table 3⁶.

Speed Measure	Southbound (km/h)			Northbound (km/h)		
	Before	After	Difference	Before	After	Difference
Mean	58.1	58.7	0.6	60.9	52.6	-8.3
85 th Percentile	65.3	65.9	0.6	68.2	58.2	-10.0
95 th Percentile	69.4	69.9	0.5	72.9	61.6	-11.3
Std. Deviation	8.0	8.1	0.1	8.0	6.0	-2.0

Table 3: Before and after 'free' speed survey results

Typically with large samples, such as those surveyed, very small changes become statistically significant using a statistical T-test⁷. However speed data recorded by dual tubes typically contains an error of up to 2% and hence statistical significance of driver behaviour (in terms of speed) cannot be determined when results vary by an amount less than this.

For the southbound direction, towards the airport, the before and after results were very similar and within the error of the dual tube measurements, and hence cannot be considered statistically significant. It can therefore be concluded that for southbound vehicles the introduction of the separation kerb and flexible post treatment had little or no effect on speed.

For northbound vehicles there was a marked reduction in all the speed measures and greater than the error within the dual tube measurements. A statistical T-test was undertaken and this showed that the mean change in speed data for northbound vehicles was statistically significant at the 99.9% confidence level.

In trying to understand why vehicles reduced speed in one direction of travel and not the other the author believes that this may have something to do with how vehicles approach this section of Calabar Road. Southbound vehicles travel from a lower speed environment due to a roundabout approximately 200 metres north of the speed tube locations. Northbound vehicles however, travel along a straight undivided section of four lane road for approximately 500 metres before they encounter the separation kerb and flexible post constriction, leading to a lowering of speed.

Given the discussion above, the author concludes that the treatment was successful in reducing free flow mean speed by approximately 10% (accounting for dual tube error) where the approach speeds were not restrained e.g. by an exit from a roundabout.

⁴ Further years of crash data would be required to completely rule out crash migration.

⁵ The crash record on Calabar Road did not contain any head-on crashes prior to or post treatment for comparison.

⁶ Data was filtered for vehicles with a minimum 4 seconds of headway. Data was removed where there was evidence of precipitation. No construction or maintenance work was being undertaken in the vicinity during these survey periods.

⁷ All samples were deemed to fit a normal distribution with a skew within the -1 to 0 range and hence a T-test can be used.

Maintenance Assessment

As this product had not been installed in this situation in New Zealand before performance and maintenance over time were unknown. These aspects have been monitored over the 3½ years since installation and the key findings are:

- Only two posts have been replaced. When replacement was undertaken, or when posts were removed⁸, this was done using a mobile closure. Each post could be removed with the tool provided and replaced in less than a minute. For comparison, some ground mounted flexi-post products can take up to 10-15 minutes to replace and require a semi static road closure on state highways, thus increasing costs.
- The kerb and posts visually appear more robust, with less wear and tear, than ground mounted flexi-posts in similar locations.
- The kerb and posts did not cause any significant issues during resurfacing. The OGPA surface was simply milled adjacent to the kerb and replaced.
- There have been no drainage issues, or build-up of detritus against the kerb⁹.
- Within six months of installation the kerb lost its original yellow colour, turning pale with a white film. The supplier paid for cleaning with a solution, however the discolouration remained. The supplier has recognised this defect and is working to rectify this in future products. It is noted that this has not affected the safety performance of the treatment nor is there any physical deterioration of the kerb.
- The flexible posts were requested to be 900mm in height to allow for over dimension vehicles. This required the posts to be cut down by 100mm and black caps installed on top; some of the black caps have come loose and fallen off¹⁰.
- The water spraying/blasting routine used for cleaning signs has also been successful in cleaning the kerb and posts of road grime.

CONCLUSION

Overall, the findings of this technical note were positive for the separation kerb with flexible post treatment and the following conclusions are made:

- The use of the Saferoads Separation Kerb with Snaploc flexible posts successfully eliminated right turning crashes at the intersection of Calabar Road and Wexford Rd. In addition there has been no evidence of crash migration to Caledonia Street to date.
- The treatment was successful in reducing free flow mean speeds by approximately 10% where the approach speeds were not restrained (northbound in this instance).
- Installation was relatively straight forward with between 50-60m being installed per night and contractors were able to work with noise restrictions by using a sound box.
- There have been no significant maintenance concerns or costs in the 3½ years since installation and the treatment has been more robust than ground mounted flexi-posts.
- There was discolouration of the kerb and some black caps have come off the posts, although this has not affected the road safety effectiveness of the treatment.
- The treatment can be removed and reused should the road be realigned.
- Finally, the author considers that there are many similarly confined locations on New Zealand roads where widening to provide standard median treatments is not viable and where this treatment could be applied in order to provide a safer road system increasingly free of death and serious injury.

⁸ The closely spaced posts at the intersection were removed in June 2012 so that all posts were at 4.5m centres.

⁹ The treatment was on a vertical curve with little or no superelevation of the carriageway and the surfacing was OGPA.

¹⁰ The author suggests using full height posts on roads where over-dimension vehicles are not present to avoid black caps.

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