A case study on raised intersection platform on urban arterial un-signalised intersection, South Australia

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Abstract

With growing safety concerns for cyclists and pedestrians at metropolitan intersections the Department of Planning, Transport and Infrastructure, South Australia, has committed to trial raised intersection platform as a part of a demonstration project. The objective was to reduce the chance of occurrence of vehicles side impacting (right angle and right turn crashes) cyclists or pedestrians at intersections and also to reduce the severity outcomes in the event of crashes occurring. Raised platform force motorists to slow down when approaching and exiting the intersection. The trial was implemented at only location is the first of its kind on an arterial road in South Australia at the un-signalised intersection of The Parade West and Rundle Street in Kent Town.

This study involved before and after comparison of data collected such as speed, traffic, and casualty crashes at treated sites after the platform was installed. There was not much time lapse after treatment, therefore casualty crash rates and crash types by road users group were compared to quantify the safety benefit. This study also involved an observation survey at the site and analysing complaints registered in the department after treatment to see if any unusual events are occurring or likely to occur in future.

Speed data analysis shows that the trial was successful in decreasing the speed of the traffic approaching intersection. On average, mean speed decreased from 37.2 km/h to 26.6 km/h and the 85th percentile speed decreased from 47.9 km/h to 34.0 km/h. Likewise, no serious injury crashes between vehicle-cyclist were reported since its installation as compared to two crashes during before period.

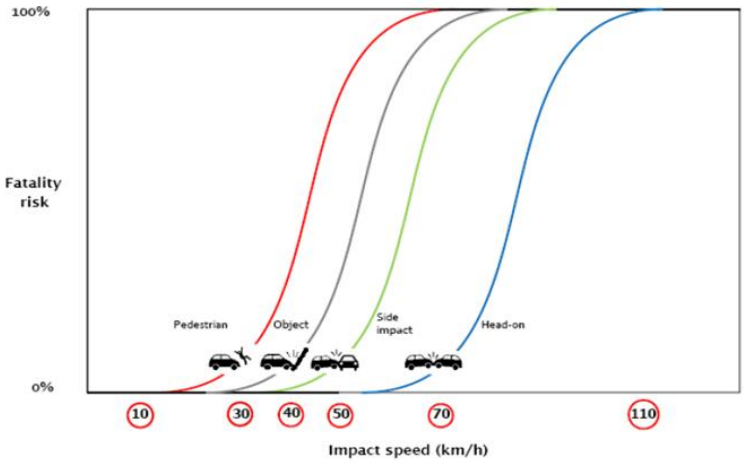
The project was successful to reduce the approaching speed limit on the intersection close to the survivable speed of 30km/h; outcomes of this study could be replicated at intersections where cyclist or pedestrian movements are high and their safety is critical.

Introduction

Almost half of all serious casualty crashes in metropolitan area occurred at intersections. Side impact collisions are a common occurrence at intersections and typically result from Right Angle and Right Turn type crashes. These crash types are proven to be the most predominant type resulting in serious injury crashes at intersections.

The Safe System approach recognised that in the event of a crash, the impact forces are within the boundaries of human tolerance. Figure 1 illustrates the estimated crash impact speeds based on the safest vehicles, where the forces are likely to exceed the tolerance of a human body and where chances of survival decrease rapidly beyond this impact speed. Safe System speed thresholds for car/pedestrian or cyclist crashes and car/car (side impact) crashes are 30 km/h and 50 km/h respectively.

Figure 1: Safe System speed threshold for crash types



IMPACT SPEEDS ABOVE WHICH CHANCES OF SURVIVAL DECREASE RAPIDLY		
Crash Type	Impact Speed	Example
Car/Pedestrian or Cyclist	30 km/h	Where there is a mix of vulnerable road users and motor vehicle traffic..
Car/motorcyclist		
Car/Pole or Tree	40 km/h	Where unprotected road hazards exist within defined clear zone.
Car/Car (Side impact)	50 km/h	Where there is a likelihood of side impact crashes (eg, intersections or access points).
Car/Car (Head-on)	70 km/h	Where there is no separation between opposing traffic streams

Source: Fact Sheet, RTA, NSW, 2011

There are many effective innovative treatments to reduce speed at intersections to achieve a safe environment for all road users. However, after considering and analysing the situation the Department of Planning, Transport and Infrastructure (DPTI) planned to install and evaluate the effectiveness of the raised intersection platform at an urban un-signalised intersection as a demonstration project.

Raised intersection platforms are similar to speed humps, with the key difference being that the elevation of the entire intersection is raised. Raised platforms are also effective in highlighting the presence of intersections and lowering vehicle speeds through the intersection. Reducing speeds closer to 30 km/h at intersections increases the chances of survivability of most vulnerable road users' (i.e. pedestrians and cyclists) in the event of crash.

This treatment has already been used in Europe and Australia. Studies have shown that the installation of intersection platforms has the potential to reduce the number of crashes by 20-60% and the number of casualties by 25% - 80%.

Background

The project was proposed at the un-signalised intersection of The Parade West and Rundle Street in Kent Town. The Parade West meets Rundle Street forming a T-intersection. The

posted speed limit for both roads is 50 km/h. Before and after plan view of the treated site is shown in Figure 2. Rundle Street is a key route for cyclists to and from the Adelaide CBD.

Figure 2: Plan view of intersection before and after platform was installed

This project is a result of one of the actions listed in South Australia's Road Safety Action Plan 2013-16 to install and demonstrate infrastructure treatments that support lower travel speeds and improve the safety of pedestrians and cyclists. The main objective of the project was to reduce the speed of traffic approaching the intersection thereby creating a safe speed environment (as close as possible to 30 km/h as defined in the Safe System speed threshold) for pedestrians and cyclists.

Method

Effectiveness of the raised intersection platform at this location was evaluated by considering various parameters into account such as speed and crashes before and after treatment, plus a site observation survey and analysis of any complaints registered within the department after construction.

Speed and traffic survey

Speed survey meters were placed at 50m and 100m from the centre of the intersection on both approaches of Rundle Street (bar of T-intersection) to compare speed profile before and after the platform was installed. In addition, traffic entering and leaving the intersection was also counted to see if drivers preferred to take an alternative route after construction. Figure 3 shows the locations of the speed meters installed on Rundle Street approaches.

Figure 3: Speed data collected locations on Rundle Street approaches

Speed information collected before and after installation were analysed and are presented in Table 1a and 1b. Table 1a consists of mean and 85th percentile speeds at 50m and 100m from the centre of the intersection on both Rundle Street approaches. On the western approach of Rundle Street at 50m, mean speed decreases from 35.4 km/h to 27.9 km/h, and 85th percentile decreases from 47 km/h to 35.2 km/h. Likewise, on the eastern approach of Rundle Street at 50m mean speed decreases from 39 km/h to 25.2 km/h, and 85th percentile speed decreases from 48.7 km/h to 32.7 km/h.

The average mean and 85th percentile (Table 1b) speed decrease on both approaches of Rundle Street at 50m are 10.7 km/h and 13.9 km/h respectively. Likewise, average decreases in mean and 85th percentile speeds at 100m are 2.9km/h and 2.8km/h respectively. Speed decreasing effects keep diminishing as vehicles move away from the platform ramp.

Table 1a: Before and after speed analysis

Site description		Before		After		Difference wrt Before case	
Approach	Survey locations	Mean Speed (Km/h)	85th Percentile (Km/h)	Mean Speed (Km/h)	85th Percentile (Km/h)	Mean Speed	85th Percentile
Western	50m west of The Parade West	35.4	47	27.9	35.2	-7.5	-11.8
	100m west of The Parade West	43.7	51.1	41.7	49.4	-2	-1.7
Eastern	50m east of The Parade West	39	48.7	25.2	32.7	-13.8	-16
	100m east of The Parade West	41.1	49.7	37.3	45.9	-3.8	-3.8

'-' sign indicates reduction

The mean and 85th percentile speed of all vehicles passing through the intersection (at 50m offset from intersection) are 26.6 km/h and 34.0 km/h respectively.

Table 1b: Before and after speed of all vehicles through intersection

	Avg. drop in speed		Avg. speed after treatment	
	Mean Speed	85th Percentile	Mean Speed	85th Percentile
At 50m from The Parade West	-10.7	-13.9	26.6	34.0
At 100m from The Parade West	-2.9	-2.8	39.5	47.7

'-' sign indicates reduction

In addition, total vehicles travelling equal and 5km/h over the posted speed limit (50 km/h) were also compared. On average 109 veh/day travelling 5 km/h over the posted limit during the before period dropped to 4 veh/day in the after period. It is evident that speed compliance through the intersection is greater in the period after treatment.

Total vehicles entering and exiting the intersection were also surveyed and analysed. Data shows that vehicles passing through the intersection decreased by 5%; in contrast the total number of cyclists passing through the intersection increased by 12% after treatment. These variations could have occurred by chance and it could be validated by using control sites. However, it was not considered in this study.

Crash data analysis

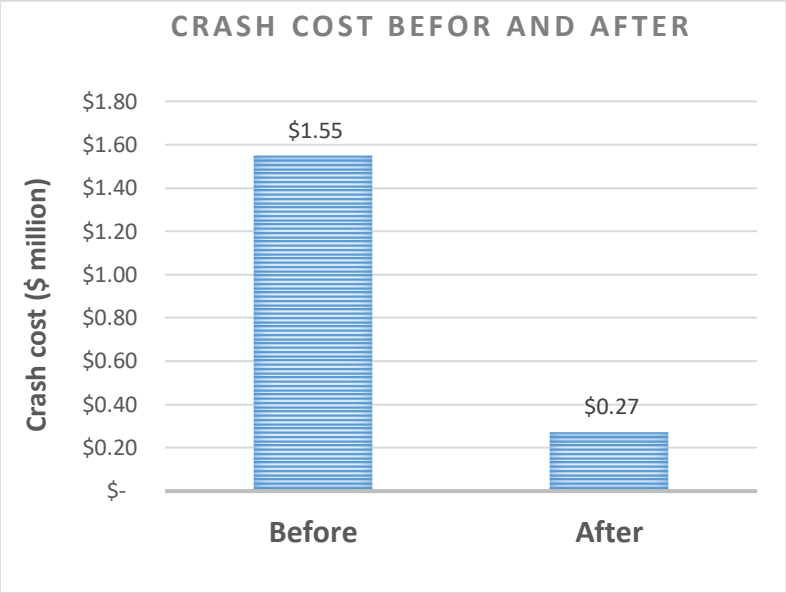
The raised platform project was completed in May 2015 and any crash that occurred during this month was discarded in quantifying the benefit of the treatment. In order to quantify crash savings, five year before and three and eight month (the longest possible time) after period crash rates were compared. Table 2 shows the casualty crashes by crash type before and after. There were 2.4 casualty crashes per year during the 'before' period and this increases to 2.7 casualty crashes per year in the 'after' period. However, no serious injury crashes were recorded in the after period compared to two crashes in the before period. There is an increase in the number of total casualty crashes, however crashes resulted in lower severity outcomes. This is demonstrated in Table 3 by comparing total casualty crash cost before and after. Total crash cost of $1.55 million during the before period decreased to $0.27 million in the after period with total savings of $1.28 million so far.

Table 2: Before and after casualty crashes by crash type

Crash type	5 year before				3 year 8month			
	Fatal	Serious injury	Minor	Total	Fatal	Serious injury	Minor	Total
Right Turn		1	5	6			5	5
Right Angle		1		1			1	1
Rear end			4	4			2	2
Side swipe			1	1			1	1
Roll over				0			1	1
Total	0	2	10	12	0	0	10	10
Per year	0	0.4	2	2.4	0	0	2.7	2.7
% reduction					-	-100%	37%	14%

*- sign indicates reduction in number

Table 3: Crash cost before and after



Before and after crash data were also analysed by road user group. Table 4 shows that vehicle with cyclist type of crashes are still occurring in the same ratio but are minor injury in nature.

There was only one crash recorded involving cyclist during the after period. The cyclist fell off a bike and the reason behind it was unknown. Since this crash had happened immediately after the project was completed, it is apparent that the cyclist was surprised with the new treatment installed.

Table 4: Before and after crashes by road user types

	Before		After	
Crash between road user group	**5 year**	**per year**	**3year 8months**	**per year**
Vehicle + cyclist	8	1.6	7	1.9
Vehicle + Vehicle	4	0.8	2	0.5
Cyclist alone	0	0	1	0.3
Total	**12**	**2.4**	**10**	**2.7**

Observation survey

The proposed intersection is on an arterial route providing bus services. Initially, the ramp of the raised platform was designed on 1:20 (75mm in 1.5m) slopes as suggested by the Austroads guideline. However, after construction it was observed that drivers were not able to see/feel the difference. Thus, the effectiveness of the raised platform could not be observed. The ramp slope was then revised to 1:12 (100mm in 1.2m) causing vehicles to slow down on all approaches.

Complaints registered

As a part of the study the authors also followed up if the department had received any formal complaints after construction to analyse responses received from members of the public regarding this demonstration project. It was noted that not a single complaint was registered.

Discussion

Unlike local roads, site identification for demonstration project on arterial roads was difficult. Parameters considered for its identification are very crucial to make the project successful. The following factors were considered while identifying the project site:

- Pedestrian or cyclist movement
- Crash history of vehicle to cyclist/pedestrian crashes
- Consulting with key stakeholders that are most likely to be impacted by the project such as public transport providers and emergency services
- Drainage issues
- Street lighting facilities
- Road function and hierarchy

Raised intersection platforms have been trialled at various locations throughout Europe and Australia at local road intersections in order to reduce speed to provide a safe environment for the most vulnerable road users. The key objective of these platforms is to reduce the speed to a level at which an impact is likely to be survivable, i.e 30 km/h speed for car/pedestrian or cyclist.

Speed data collected for this demonstration project confirms that the mean speed on the raised platform, which is a key conflict area between vehicle and cyclist, is less than 30 km/h; whereas the 85th percentile speed is 34 km/h (Table 1b). Hence, the demonstration project is successful in decreasing the mean speed limit below the targeted level, however the 85th percentile speed is 4 km/h more than expected. In contrast, the project is successful in dropping the 85th percentile speed by 13.9 km/h (Table 1b) compared to the before case. In addition, the number of vehicles compliant within the posted limit is more after treatment.

Crash analysis indicates that the crash rate has increased during the after period compared to the before period, however there are no serious injury crashes (FSI) recorded in the after period compared to two FSI in the before period. This indicates that crash numbers might go up, however crashes are resulting in lower severity outcomes. The department will continue to review the situation to see the long term trend related to crashes.

Many researchers have shown that raised platforms cause traffic to rat race due to lower speeds and discomfort caused by the humps. This study shows a decrease in total traffic by 5% and an increase in cyclist numbers by 12% after one year of construction. However, this study was unable to consider control sites to see if this traffic fluctuation was by chance.

Initially, the platform ramp was constructed at design slope of 1:20 (75mm in 1.5m) because of bus routes. However, immediately after construction its effectiveness could not be observed, as motorists were travelling at their own speed without hindrance. Therefore, the ramp slope was then revised to 1:12 (100mm in 1.2m) causing vehicles to slow down on all approaches. The project was again reviewed one year after construction and it was seen that while some

low clearance cars such as Corvette, Celica and Alfa Romeo etc. were scraping at the entry ramp even though they were travelling at very slow speed no formal complaints were registered in the department. However, this issue could be addressed by choosing a gentler slope than 1:12. Interestingly, it was also observed that cyclists do not slow down as much as vehicles do at the intersection.

Conclusion and Recommendation

In conclusion, the main purpose of this project was to reduce the speed of through traffic to safer speeds for cyclists or pedestrians and the project was successful in reducing operational speeds as close as possible to the survivable speed of 30km/h. It is evident that the raised platform discouraged drivers from speeding through the intersection and the outcomes of this study could be replicated at other urban intersections where cyclist or pedestrian movements are high.

References

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