

## **Queensland's experience with speed limit reductions on 'Black Links'**

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### **Abstract:**

A high priority action in the 2008-09 Queensland Road Safety Action Plan was to "Identify high-risk roads or road sections for speed limit reductions where road improvements are not feasible in the short term." The premise for this action was that speed limit reductions, in combination with signage advising of crash history and increased police enforcement, would provide a significant low cost mass action opportunity to reduce the number and severity of crashes.

The former Departments of Main Roads and Queensland Transport collaborated with the Queensland Police Service to identify poorly performing corridors, which were termed "black links". A report to the Queensland Cabinet recommended that approximately 60 km of roads be reduced to 90 km/h (from 100 km/h). The majority of the identified corridors formed part of the heavily trafficked federally funded highway network.

This paper outlines early experiences with the reduction of speed limits, which were implemented in December 2008. It encompasses site selection details, before and after speed surveys, crash history, high visual impact sign design and enforcement and media considerations.

### **KEYWORDS**

Black Links, Safe System, Speed Management, Speed Limits

## Queensland's experience with speed limit reductions on 'Black Links'

### Background

Through many research studies, vehicle speed has been proven to be a consistent and major contributory factor in the occurrence and severity of road crashes. In 2007, there were 95 fatalities as a result of crashes involving speeding drivers and riders in Queensland, representing 27 per cent of the road toll. Crash studies have established that speeding contributes to increased stresses on the vehicle and the driver, increased stopping distance, decreased vehicle stability and increased risk of losing control on curves or during emergency manoeuvres. Australian research<sup>4</sup> suggests that speeds just 5 km/h above average in urban areas and 10 km/h above average in rural areas are sufficient to double the risk of a casualty crash—roughly equivalent to the risk associated with a blood/breath alcohol concentration (BAC) of 0.05.

During 2008, the Queensland road crash data analysis showed that the zones from 100km/h to 110km/h have fatal crash percentages several times higher than zones up to 60 km/h and about twice the percentage of zones between 70km/h and 90km/h.

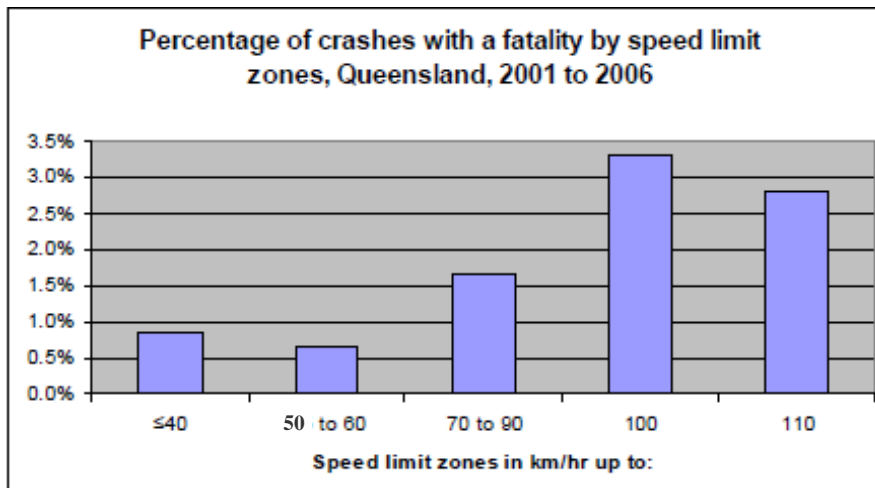


Figure 1 : Percentage of crashes with a fatality by speed limit zones, Queensland, 2001 to 2006

The 2008-2009 Queensland Road Safety Action Plan identified an initiative to reduce speed limits on some higher speed roads with above average crash rates. This was applicable to roads where extensive upgrades were likely to be not possible in the short term. Prior to their amalgamation, the former Queensland Transport and Department of Main Roads worked closely together to identify roads with above average crash rates and reduced speeds in those locations with improved signage and increased enforcement.

The past application of reduced speed limits in high crash zones had demonstrated safety benefits on a number of roads, including the Ipswich Motorway, Mount Cotton Road and the Houghton Highway.

This paper outlines early experiences with the reduction of speed limits, which were implemented in December 2008 to April 2009. It encompasses site selection details, before and after speed surveys, crash history and high visual impact sign design.

**Method of analysis**

Selection criteria for identifying high frequency crash zones was developed based on a multi-variant approach taking into consideration the traffic volume, number of crashes, severity of crashes, type of crash, number of casualties, and casualty per crash ratio. The primary through roads under state control were analysed for this purpose. All reported road traffic crashes during 5 years, from July 2001 to June 2006 were considered.

The criteria for selecting black links were:

- At least two casualty crashes within 5 years (this was the basic criteria for federal 'Black Spot' funding);
- A daily traffic volume of more than 2,000 vehicles; and
- A speed limit of 80 km/h or greater

Various rules were identified for the data extraction that included analysing crash data based on one km road links and combined analysis of intersection and mid-block crashes. The indicators that were used to measure the performance of the road were: Equivalent Property Damage Only (EPDO) / 100 Million Vehicle kilometre travelled (MVKT), DCA social cost / 100MVKT, Casualties per km, and Casualties per crash ratio.

Also as part of the analysis, one kilometre road links were categorised into lane configuration types based on the following classifications.

- 1 lane, unsealed, unpaved;
- 2 or 3 lanes;
- 4 lanes; and
- 6 lanes+

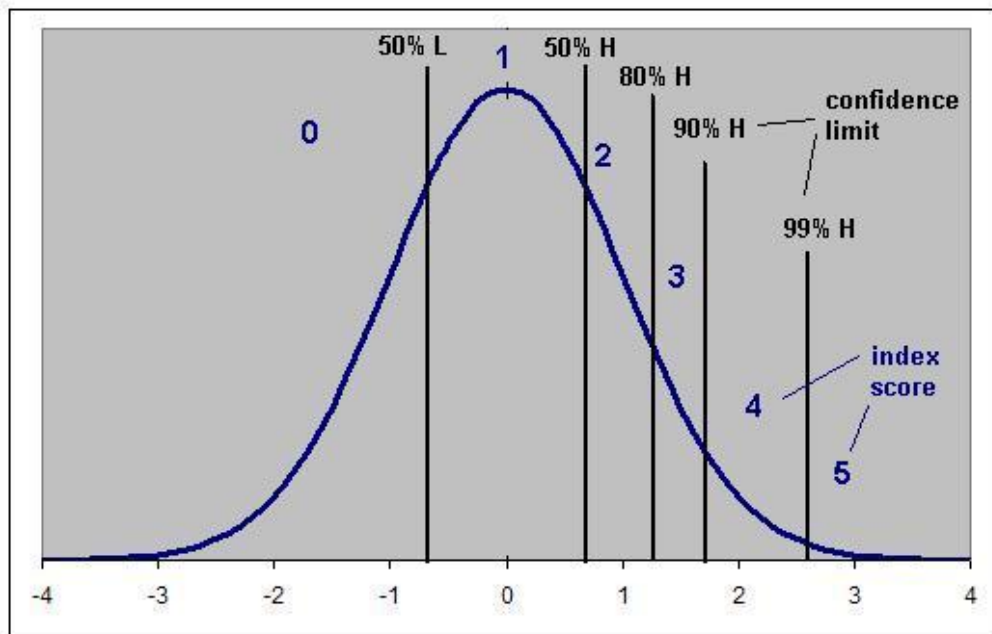
**Using Index Scores**

The multiple performance measures were calculated for each 1 km road link. The combined total was obtained by transforming the values to an even level, and this was done by calculating index scores based on a value's variation from the overall average. The mean and standard deviation for each road type and each performance measure was calculated and the following confidence limits were used for scoring values relative to the mean using the standard deviation: 50% lower limit, 80% upper limit, 90% upper limit and 99% upper limit. See Table 1 and Figure 2.

**Table 1: Index Score Ranges**

Confidence Limit Ranges		Z Score		Index Score
Start	End	Start	End	
	< 50% Lower	<-0.676	-0.676	0

50% Lower	50% Upper	-0.676	0.676	1
50% Upper	80% Upper	0.676	1.282	2
80% Upper	90% Upper	1.282	1.653	3
90% Upper	99% Upper	1.653	2.601	4
>99% Upper		2.601	>2.601	5



**Figure 2: Index Score Graph**

The z score of each measure for each segment was calculated using the mean and standard deviation. The z score was used to derive an overall risk score for that measure. For example if the mean was 100 and the standard deviation was 20, and the value for a particular section was 150, the z-score would be +2.5 meaning the value of 150 was 2.5 standard deviations from the mean value. This z score of +2.5 falls within the 90% to 99% upper limit, resulting in a score index of 4.

The index scores for each performance measure were added and the road segments were selected by identifying clusters of high scoring road links. Road segments with clusters of high scores were listed and ranked to produce a list of locations.

### **Identified sites**

Following a review of crash records and through consultation between Main Roads and Queensland Police Service officers, the following sections of roads were identified as locations for the black link intervention:

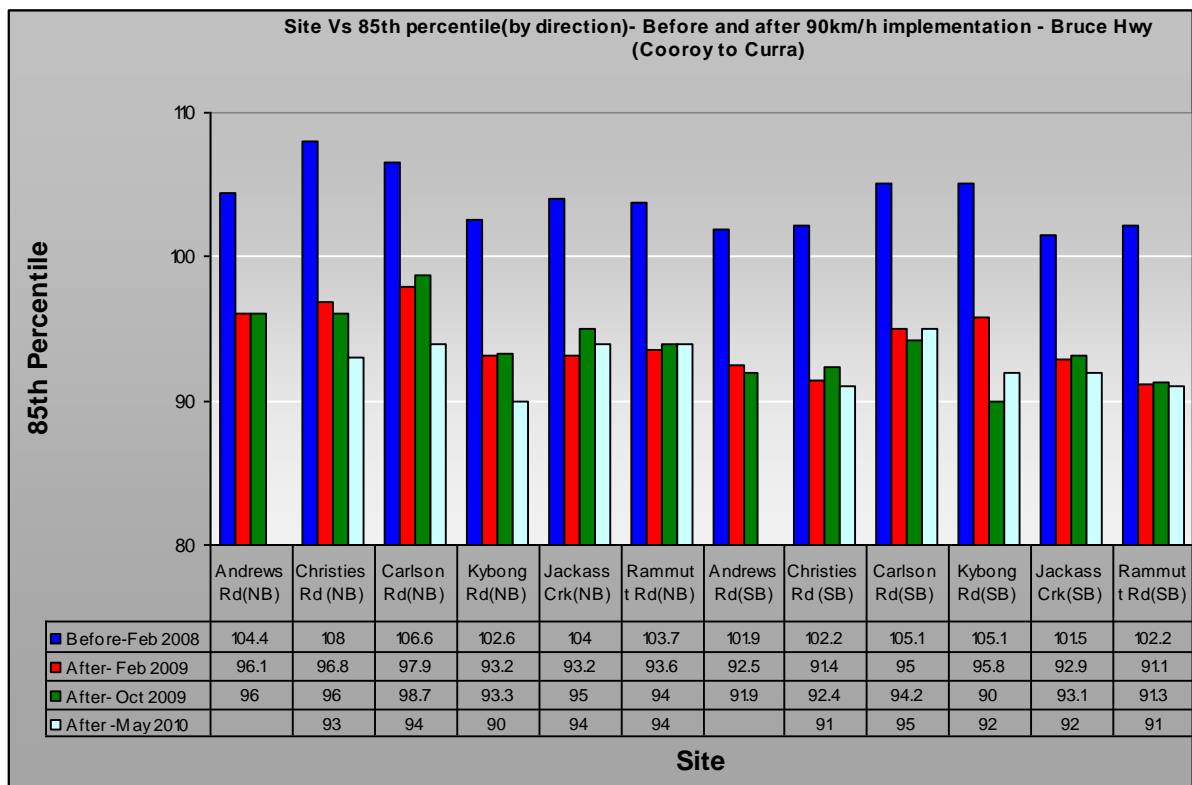
1. Bruce Highway (Cooroy – Gympie)
2. Bruce Highway (Gympie to Maryborough)
3. Bruce Highway (Innisfail – Cairns)
4. Warrego Highway (Toowoomba – Dalby)
5. Mount Lindesay Highway (Brisbane – Beaudesert)



## Results - Bruce Highway (Cooroy to Curra)

The speed limit reduction was implemented on 15 Dec 2008 for the section between Cooroy to Curra on Bruce Highway. The 85<sup>th</sup> percentile speed was measured at different locations, by direction, on different dates before and after implementation, February 2008, February 2009, October 2009, and May 2010. The site vs 85<sup>th</sup> percentile speed graph was produced below.

The speed surveys showed that the measures appeared to be successful in reducing speeds on these roads.



**Figure 4 : 85<sup>th</sup> percentile speed before and after 90 km/h implementation**

- 85th percentile speeds have reduced up to 11 km/h at all locations after 90km/h implementation
- Reduced speeds were sustained for 18 months after speed limit was reduced

At the time of writing this paper, the validated 'all crash data' for Queensland was available until September 2009 only as the crash data after that period has not been finalised. This allowed analysis of just 5 to 9 months worth of data, after the projects became operational. As such the 5- 9 months data was projected for a 12 months period to compare with the yearly crash data.

Whilst it is too early to determine the success of the schemes in terms of crash reduction, the graphs were prepared with the available data to see the initial outcomes.

For analysis purpose, the crash data were extracted for the last 5 years before the implementation and compared against the crash data obtained after implementation of the speed limit reduction. The crash data were reported for individual crash types, KSI's and total crashes.

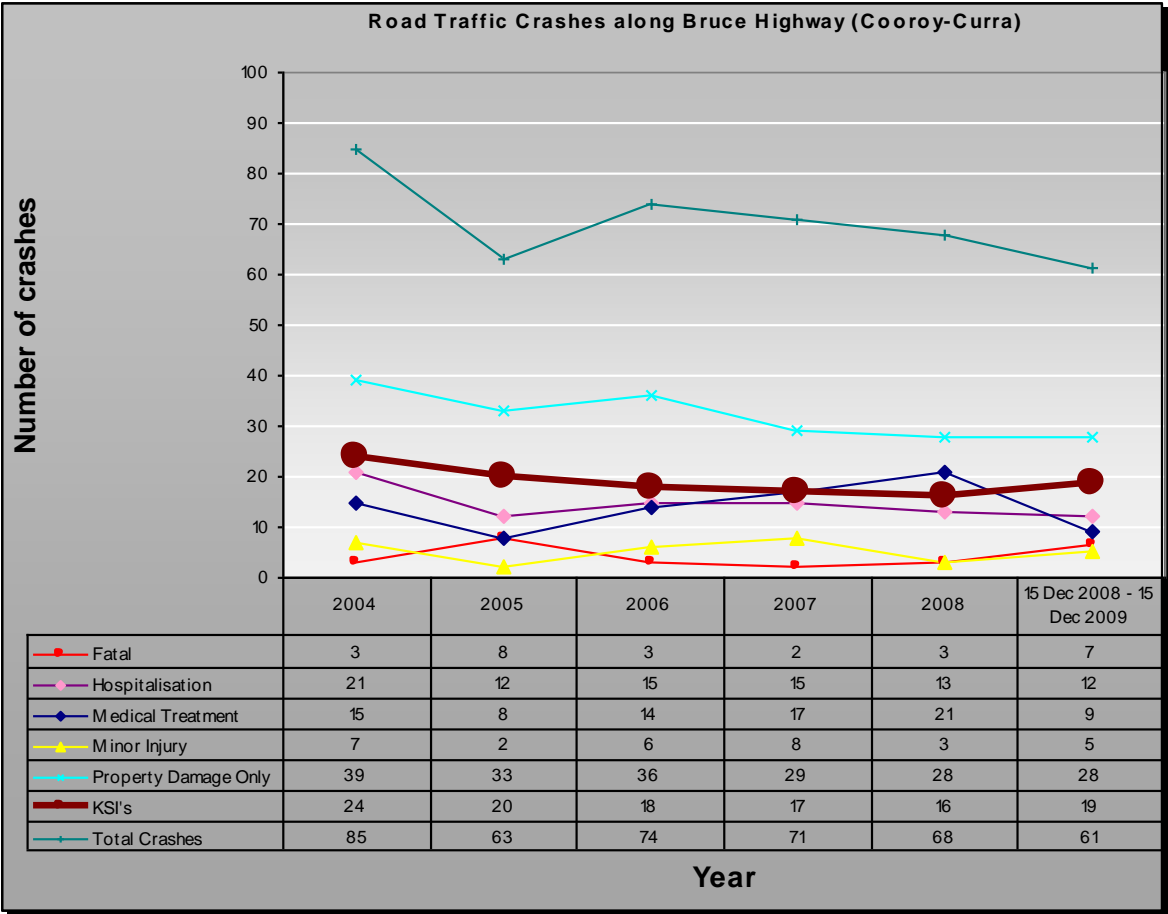
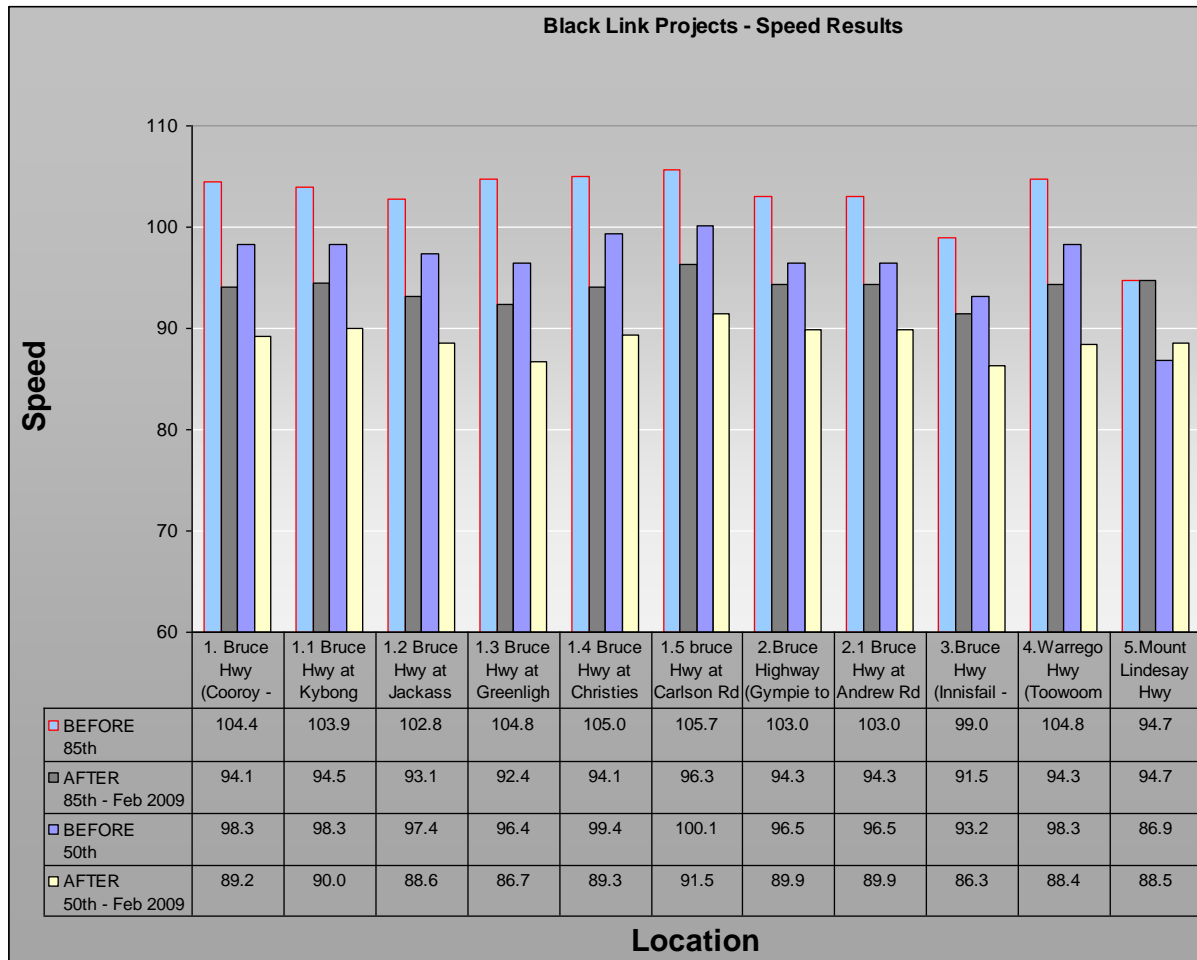


Figure 5 : Road traffic crashes along Bruce Highway (Cooroy – Curra)

- The total road crashes have decreased by 16% compared to 'before' 5 years average (average = 72, after implementation = 61)
- The KSI crashes had increased from 16 in 2008 to 19 after implementation, however this may need some adjustment in terms of VKT ( before implementation= 2.46 million VKT, after implementation 2.5 million VKT). Additionally, 3 non-speed related fatal crashes occurred in a 4 month period after the 10 km/h speed reduction, which partly accounts for this increase on KSI crashes
- As 9 months data were used to project 12 months data, the actual number of crashes after implementation may be changed.

## Before and after survey results – all Black Links

The speed survey was conducted at various locations for all identified black links before and after the speed limit reduction. The reporting was undertaken for both the 85<sup>th</sup> percentile speed and 50<sup>th</sup> percentile speed.



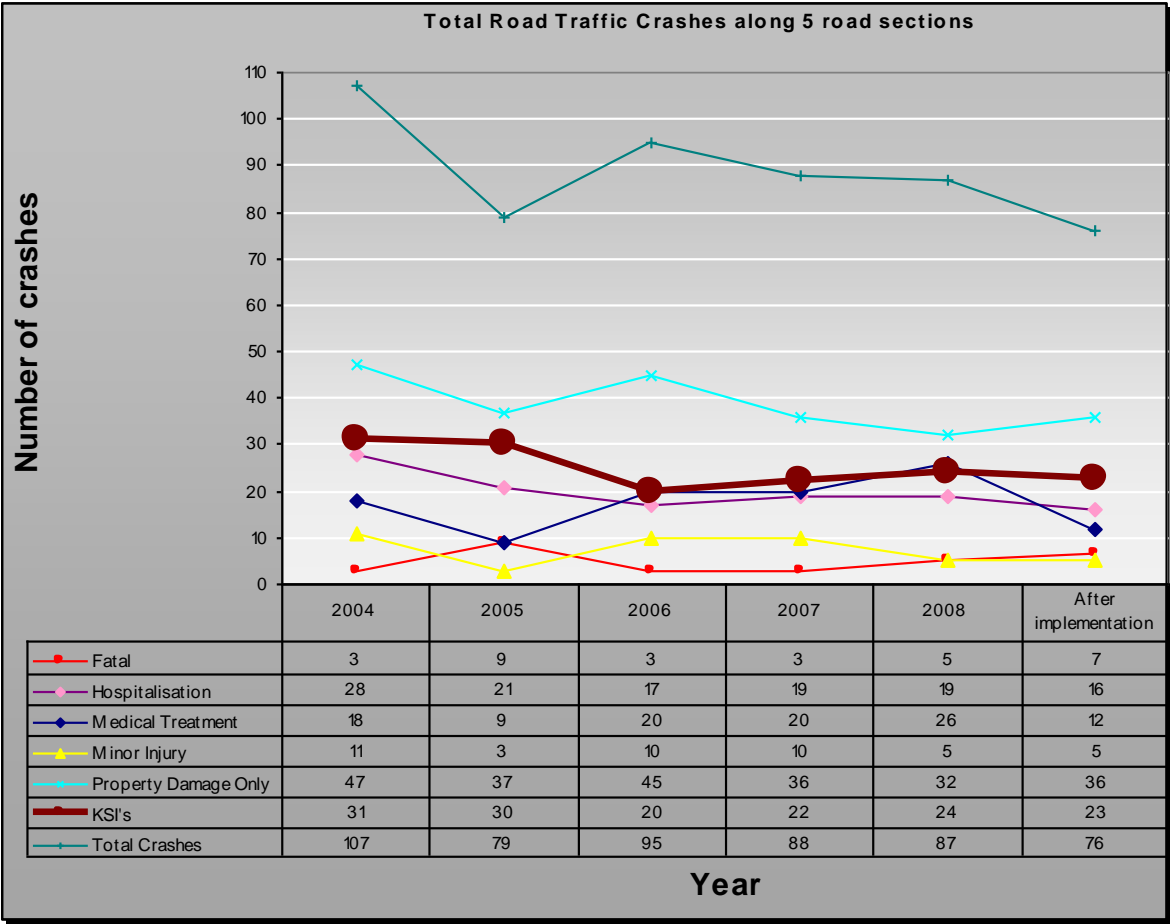
**Figure 6 : Black links speed reductions – initial survey comparison**

- The 85<sup>th</sup> and 50<sup>th</sup> percentile speeds at all identified black link sites except Mount Lindesay highway have reduced after the implementation of the 10km/h speed reduction.
- The 85<sup>th</sup> percentile speed remained same and the 50<sup>th</sup> percentile speed slightly increased on Mount Lindesay highway. This was likely to be due to motorists driving to the road conditions already and when the speed was officially changed, there was no further reduction.
- The 85<sup>th</sup> percentile speeds along all road sections except Mount Lindesay highway reduced between 7 to 12 km/h.
- The 50<sup>th</sup> percentile speeds or means speeds have reduced between 6 to 10 km/h except on Mount Lindesay highway.



As discussed above, the validated 'all crash data' for Queensland was available to September 2009 only. The 5- 9 months data after the implementation was projected for a 12 months period and the graph was presented with the available data to see the initial outcomes.

The 5 years crash data before the implementation were compared against the crash data after implementation. The data that were compared included individual crash types, KSI's and the total crashes.



**Figure 7 : Combined road traffic crashes along 5 sections of road identified for the black link intervention**

- The total crashes for all five road sections combined have decreased by about 17% compared to the last five years average (average = 91, after implementation = 76).
- The KSI crashes had reduced by 11% compared to the 'before' five years average (average = 25, after implementation = 23).
- As 9 months data were used to project 12 months data, the actual number of crashes after implementation may be changed.

## Conclusion

- Speed surveys undertaken before and after the speed limit reduction indicated that there is significant speed reduction even without the change in speed environment or the physical appearance of the road.
- The reduction in speed was maintained during a number of speed surveys conducted at later dates, compared to the speed before the implementation.
- The road crashes also reduced after the speed limit reduction but will need further review once the crash data are available for at least 36 months after the implementation.
- Even though it is too soon to definitively measure any reductions to crash rates as a result of the reduction in speed limits, the measured reductions in vehicle speeds are encouraging and it is believed that these measures will save many serious crashes and casualties over time. As such, it is proposed that new Black Link sites should be considered.

## References

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4. Kloeden, C.N., Pente, G. and McLean A.J. (2001). Travelling speed and the risk of crash involvement on rural roads. Road Safety Research Report CR 204. Canberra: Australian Transport Safety Bureau.