

ECONOMIC BENEFITS OF SRIP 3 – A ROAD SAFETY INFRASTRUCTURE PROGRAM FOR VICTORIA, AUSTRALIA

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This paper presents the economic benefits gained from the implementation and completion of the AU\$650 million Safer Road Infrastructure Program Stage 3 (SRIP3) in Victoria between 2007 and 2013. The program was evaluated by the Monash University Accident Research Centre in 2016 (1) and the results were used in this paper to demonstrate the contribution of this program to the economy of Victoria.

Safe roads have been demonstrated to contribute to a country's prosperity by facilitating the movements of people and goods in a safe and efficient way. Unsafe roads cause road crashes which cause financial loss to both individuals and companies, employers and employees, leading to loss of business opportunities and reduction of the nation's gross income, and these are in addition to the pain and suffering the victims and others have to endure. In the past two decades, Victoria has continuously invested in road infrastructure improvements to reduce serious casualties on its road network via various road safety infrastructure programs including this SRIP 3 and the current AU\$1.4 billion Safe System Road Infrastructure Program. Victoria's road network has progressively become safer for the transport of goods and people as well as providing a safer work environment for many employees including those whose job is driving. In short, Victoria has enjoyed a large reduction of crashes/casualties since these investments, and at the same time, experienced unprecedentedly strong economic growth.

PURPOSE AND BACKGROUND

This paper aims to demonstrate the link between safe roads and economic growth by presenting the economic benefits gained from the AU\$650 million Safer Road Infrastructure Program Stage 3 (SRIP3), implemented and completed by VicRoads (the road authority of Victoria) between 2007 and 2013. The economic benefits of this program were estimated by the Monash University Accident Research Centre (MUARC) in early 2016.

Investments in Infrastructure Improvements for Road Safety Gain in Victoria

In the past two decades, Victoria has continued to invest in a series of road infrastructure programs with an aim to make its road network safer to reduce serious casualties occurring on its road network. The major programs include:

- AU\$240 million Statewide Blackspot Program (1999-2004);
- Safer Road Infrastructure Program (SRIP) between 2005 and 2013, in three stages (SRIP1, SRIP2 & SRIP3) with a combined value over a billion Australian dollars; and
- Current 10-year 2013-23 AU\$1.4 billion Safe System Road Infrastructure Program (SSRIP) starting in mid 2013 which, based on the platform Safe System, aims to move Victoria towards Zero (zero serious casualties).

All programs have been funded by the Transport Accident Commission (known as TAC, a government owned third party injury insurance entity).

The results of the evaluation of the SRIP3 provides the most up to date understanding of the performance of this kind of road safety program therefore the outcome of this program has been used as the basis of discussion in this paper.

THE INVESTMENT OF SRIP3

SRIP3 is a \$650 million road infrastructure improvement program delivered from 2007 to 2013. The program consists of a range of projects implemented over the state's arterial road network, covering both metropolitan areas and rural areas. Each project was developed with specific treatment addressing high frequency crash locations at both intersections and along road segments as well as along significant lengths of an important highway route, the Princes Highway East.

The sample size of completed projects used in the evaluation includes 553 projects valued at AU\$481 million:

- Intersection: 365 projects valued at AU\$157 million.

Implemented treatments consist of new traffic signals, new roundabouts, splitter islands, fully controlled right turn signals, signalising left turns and right turn lanes;

- Run-off-road: 164 projects valued at AU\$288 million

Implemented treatments consist of shoulder sealing, safety barriers, culvert extension, driveable culvert end walls, audio tactile edge and centre lines.

- 24 projects with 40km/h speed limit reduction at strip shopping centres valued at AU\$5 million; and
- 148 Greyspot projects for high risk intersections valued at AU\$31 million;

The six projects on the Princes Highway East were not completed at the time of evaluation and were excluded from the evaluation.

Some examples of common treatments implemented in SRIP3 projects are illustrated in Figures 1 to 6 below.



**FIGURE 1 Before and After Intersection Treatments:
Turning Lanes and Splitter Islands**



**FIGURE 2 Before and After Intersection Treatments:
New Traffic Signals And Roundabout**



FIGURE 3 Before and After Treatment Wire Rope Safety Barriers



FIGURE 4 Before and After Treatment Guardfence And Curve Signing

THE EVALUATION OF SRIP3

Evaluation Method

The evaluation has been conducted aiming to assess the impact of the program on reducing the frequency and severity of crashes both for the program as a whole as well as for both broad and specific treatment types implemented under the program. Economic worth of the program has also been estimated. Key points of the evaluation method:

- Police reported crash data over the period 2000-2014 with injury severity validated by matching with TAC claims data.
- Average of eight years of pre-treatment crash data of each treated site was analysed in order to minimise regression-to-the-mean effects.
- Quasi-experimental study design with comparison sites matching key characteristics of the treated sites such as road geometry, speed limit and locality.
- Poisson regression to measure the magnitude and statistical significance of net crash changes at treated sites relative to changes at the comparison sites.

Evaluation Results

Overall Results

The SRIP3 was associated with the below statistically significant ($p < 0.0001$) reductions and savings over an average treatment life of 17 years:

- 21% casualty crash representing a saving of 6,440 casualty crashes or an annual saving of 377 casualty crashes;
- 26% serious casualty crash representing a saving of 2,927 serious casualty crashes or an annual saving of 169 serious casualty crashes;
- 25% in casualties representing a saving of 10,819 injuries or an annual saving of 630 injuries;
- 29% in serious casualties representing a saving of 4,133 serious casualties or an annual saving of 238 serious casualties.

Economic Benefits based on Human Capital costs at a discount rate of 6.5%:

- Present value savings AU\$1.815 billion
- Net Present Worth AU\$1.308 billion
- Annual saving AU\$118 million
- Benefit Cost Ratio 3.6

Results by Location, Treatment and Crash Type

The evaluation also estimated that the treatment of sites located in Melbourne produced an 18% reduction in casualty crashes and a 24% reduction in serious casualty crashes ($p < 0.0001$). The treatment of rural sites was associated with a 31% reduction in both casualty and in serious casualty crashes ($p < 0.0001$).

The evaluation also found that intersection treatments resulted in larger casualty crash reductions than road segments. Serious casualty crash reductions for intersections were greater than 40%. Road segment serious casualty crash reductions were less than half that for intersection treatment types (21%). It was estimated that casualty crashes were reduced by 37% for intersection treatments compared with 13% for road segment treatments. Due to limited data at Greyspots

and 40 km/h strip shopping centre, the evaluation was generally unable to draw conclusions about the effectiveness of these treatments

The most effective road segment treatments for casualty crashes were shoulder sealing with safety barriers and tactile edge or centre lines without shoulder sealing or safety barriers, with significant casualty crash reductions greater than 50%.

The most effective treatment for opposite and adjacent intersection casualty and serious casualty crash were roundabout installations and installation of both fully controlled right turn and installing/extending the right turn lane. The most effective for same direction serious casualty crash reduction was skid resistance surfaces with or without other treatments and traffic signal treatments.

Table 1 below is a simplified version of a table in the Executive Summary of the MUARC evaluation report which summarises the key overall estimates of effectiveness of the program and their 95% confidence limits:

TABLE 1 Estimated Crash And Injury Reductions Of SRIP3 And By Major Treatment Groupings (simplified version of page XIV of Executive Summary)

Program Level	Casualty Crash Reduction	Serious Casualty Crash Reduction	Casualty Reduction	Serious Casualty Reduction	BCR
Whole Program	21%	26%	25%	29%	3.6
Intersection Treatments	37%	41%	42%	46%	6.1
Road Segment Treatments	13%	21%	14%	23%	2.0
Metropolitan	18%	24%	23%	28%	4.1
Rural	31%	31%	30%	31%	3.2

Results by Road User

The evaluation found that installation of both fully controlled right turns and right turn lane were found to be associated with a 90.3% reduction in casualty pedestrian injuries.

For cyclists, intersection treatments produced a significant 46% casualty reduction and a significant reduction of 44% was found with metropolitan intersection treatments; there was no significant reductions in cyclist injuries at treated rural intersections. However significant reductions of 66% for the program as a whole and 89% for cyclists on treated rural road segment. Effective intersection treatments for cyclists included new traffic signal and LED upgrades, right turn bans, fully controlled right turns, bus and bicycle lane installations at intersections.

A reduction of 37% in serious motorcyclist casualties was found at the whole program level and 63% at intersection level. Effective intersection treatments for motorcyclists included new traffic signals, fully controlled right turns with extended right turn lanes.

Crash Savings and Economic Benefits

The present value of future savings expected based on treatment lifetime and the estimated annual crash cost savings at treated sites was estimated to be \$1,815M. The capital expenditure required to complete the 553 treatments was \$434M, and when future maintenance costs are added to this value, the present value of completing and maintaining treatments using a discount rate of 6.5% was estimated to be \$507M.

Statistically significant economic worth as a result of associated casualty crash reduction was observed for regional and program level aggregations including intersection and road segment treatments. Intersection treatments exhibited a greater economic worth than road segment treatments with three times the BCR of road segment treatments (6.1 c.f. 2.0)

Impacts of the SRIP3 results on future programs

The successful results of the SRIP3 has encouraged the TAC not only to continue with the funding for infrastructure improvements for Victoria, but also to increase substantially the scale of funding for the next program which is currently being delivered under a new strategy which aims to provide a transition to Safe System compliance. This Safe System Road Infrastructure Program (SSRIP) is a 10 year program with a total funding of AU\$1.4 billion aims to move the Victoria road network to Safe System compliance and to achieve the Towards Zero, Victoria's Road Safety Strategy 2016-2020.

DISCUSSION

Safe roads have been demonstrated to contribute to a country's prosperity by facilitating the movements of people and goods in a safe and efficient way. Unsafe roads cause road crashes which cause financial loss to both individuals and companies, employers and employees, leading to loss of business opportunities and reduction of the nation's gross income, and these are in addition to the pain and suffering the victims and others have to endure. Safe roads also stimulate the economy of a nation by encouraging expansion of businesses through safe connection to and from newly developed areas thus stimulate economic growth of the region they serve.

Unsafe roads cause road crashes which cause financial loss to individuals and companies, employers and employees, leading to:

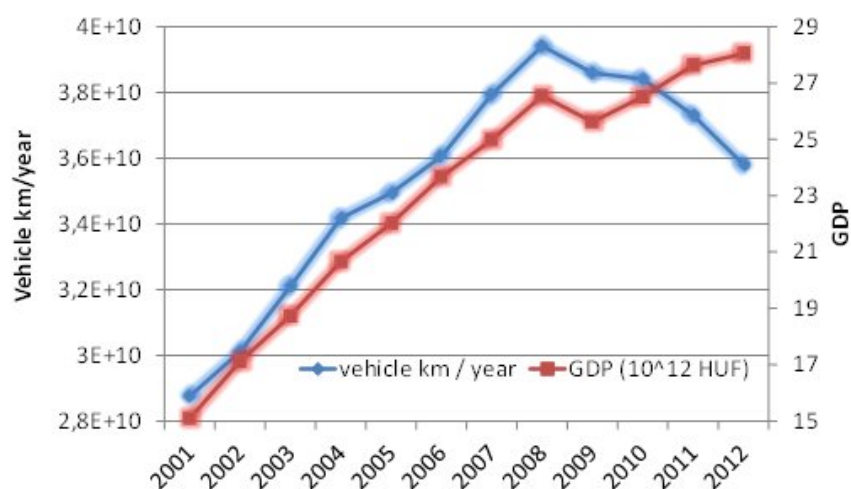
- Loss of business opportunities;
- Increase costs to business;
- Reduction of the nation's gross income; and
- Pain and suffering.

The consequence of road crashes is no doubt a significant factor affecting the economic development and growth of a state/country. Investigation by the International Road Assessment Program (iRAP) indicates a strong relationship between the reduction of serious casualties and the economic benefits in its publication 'Vaccines for Roads', Third Edition 2015 (2). Table 1 below is an extract from Page 31 of the above publication which estimated that for every serious casualty saved, the economic benefit return would be \$0.707 million for the group of high income countries or \$0.141 million for an average country over a period of 20 years.

TABLE 2 iRAP Estimates Of Economic Benefits As A Result of Reduction In Serious Casualties

Benefits that could be achieved over 20 years by improving just ten percent of each country's roads, by income group					
	Low	Lower middle	Upper middle	High	All
Improve 10% of roads	108,000 km	610,000 km	992,000 km	1,546,000 km	3,255,000 km
Build viable countermeasures	\$8 billion	\$61 billion	\$149 billion	\$464 billion	\$681 billion
Reduction in fatalities	384,000	1,483,000	1,528,000	283,000	3,678,000
Reduction in fatalities and serious injuries	4,224,000	16,313,000	16,808,000	3,113,000	40,458,000
Economic benefit	\$83 billion	\$663 billion	\$2,766 billion	\$2,202 billion	\$5,715 billion
Benefit cost ratio	11	11	19	5	8

Further evidence of the relationship between safe roads and the economy is also found in the study 'Case Study on the Relationship between Road Safety and Economy in Hungary' by A. Torok published in the American Journal of Vehicle Design in 2015 (3). The article investigates the road safety challenges of Hungary, focusing on previous research results. As depicted in the article, Figure 5 below shows a strong relationship between the transport growth and national Gross Domestic Products (GDP) over a period of 12 years from 2001 to 2012.

**FIGURE 5 Time Trend of GDP And Transport Performance In Hungary**

Source: Hungarian Central Statistical Office. Hungarian Road Management Company

Economic Benefit of Reduction In Serious Casualties in Victoria

According to TAC records, on a five year average (2011-2015), 5,851 persons were hospitalised (Source: <https://www.tac.vic.gov.au/road-safety/statistics/tac-hospitalisation-reports/claims-involving-hospitalisation-annual>). Based on the Willingness To Pay (WTP) approach, the average cost per injured person was AU\$0.421 million and that would translate to an annual cost of nearly AU\$2.5 billion. This cost to the community is significant and can be reduced and ultimately avoided.

The iRAP publication 'Vaccines for Roads' (2) provides a mechanism to estimate the economic benefits if the road network becomes safer. The predicted SRIP3 saving of 4,133 serious casualties is indicated in the evaluation by MUARC would generate a benefits of \$3.5 billion to the Victorian economy over a period of 20 years.

This paper demonstrates an association between road safety programs and reduced casualty and serious casualty crashes at treated sites and found the program to be cost effective in generating overall benefits to the community and also to the economy of the State.

As a result of the investment on road infrastructure programs, the savings in casualties have made the State of Victoria:

- Safer transport of people and goods;
- Safer work environment for employees including those whose job is driving.

In short, Victoria has enjoyed a large reduction of crashes/casualties as a result of these investments, and at the same time, experienced unprecedentedly strong economic growth in the last decade.

CONCLUSION

The Victorian experience has provided a very strong evidence of the relationship between safe road network and the economic benefits it can generate. Whilst the human suffering caused by road crashes is huge and often immeasurable, the overall wellbeing for a community including the potential economic prosperity to be gained by improving the safety of the road network cannot be ignored by any government.

REFERENCES

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