

Business Case Summary

Towards Zero Infrastructure Program



September 2018

About this report

This document summarises the Final Business Case (Business Case) for the *Towards Zero Infrastructure Program*. The intent of the Program is to achieve sustainable and long-term reductions in road trauma on high-risk curves and in high-risk fatigue zones, and in pedestrian precincts, by upgrading existing road infrastructure. It is based on the premise that if a road user makes a mistake, the surrounding road infrastructure can significantly reduce the chance that it will result in death or serious injury. This program will complement existing expenditure on a range of road safety programs, including behavioural and educational activities, and improving safety standards of vehicles, to deliver a safer system for the community.

The Business Case for the *Towards Zero Infrastructure Program* was developed by Transport for NSW and submitted to Government in April 2018. This Business Case Summary has been prepared by Infrastructure NSW, the NSW Government's independent infrastructure advisory agency.

Strategic context

Reducing road deaths is a NSW Government priority

Every 41 minutes, someone is killed or seriously injured on NSW roads. Road crashes in NSW killed 392¹ people in NSW in 2017, and more than 12,000 were hospitalised. The number of people affected by this trauma, both in the immediate and the long term, is much larger. Recent research found that one in three people in NSW reported knowing someone who had been killed or hospitalised due to a road crash. The economic cost of this trauma is estimated at over \$7 billion per year.

The importance of road safety to the people of NSW is reflected in the State's Priorities, which include a Government commitment to make NSW roads the safest in the country. The commitment is accompanied by a goal to reduce the level of road fatalities by 30 per cent by 2021 (from 2011 levels)².

Safe System and NSW Road Safety Strategy 2021

Transport for NSW adopts the "Safe System" approach to road safety, which recognises that people make mistakes, but the cost of any mistake should not be death or life-disabling injury on the roads. This approach takes a holistic view of the road transport system and

the interactions among the key components of that system – the road user, the roads and roadsides, the vehicle and travel speeds³. Current road safety initiatives, therefore, focus on improving road infrastructure, promoting safer vehicles and equipment, managing speed and promoting compliance with the road rules through education and enforcement.

The *NSW Road Safety Strategy 2012-2021* identified that a key challenge for NSW is to reduce death and serious injury arising from four key crash types – run-off-road, head-on, intersection and pedestrians. Further, there is potential to address fatal and serious injury crashes on the road network through improved intersection design, eliminating or shielding road users from roadside objects or from opposing vehicles, and by considering pedestrians and bicycle riders⁴.

Towards Zero

In May 2016, the NSW Government launched the new *Towards Zero Strategy* to reduce road trauma, including a new public education campaign. The strategy included a reprioritisation of existing infrastructure programs, new policy initiatives, and several new programs along with new speed, fatigue and pedestrian safety campaigns integrated through the Safe System approach. The Safe System approach is an inclusive approach that considers all users of the road system, including drivers, motorcyclists, passengers, pedestrians, cyclists, and commercial and heavy vehicle drivers⁵.

Improving road safety infrastructure is known to reduce road trauma

Improvements to road infrastructure complement other road safety efforts such as increased enforcement and community education and engagement. These latter activities, while crucial, provide a relatively short-lived effect. Improvement to road safety infrastructure, however, provides stable and longer lasting safety benefits.

Investing in road safety infrastructure is highly effective as it performs its road safety function all year round. Regardless of other factors, safe infrastructure can help protect road users from fatal or serious injuries when mistakes are made. For example, safety barriers installed on a curve can protect vehicle occupants regardless of whether the driver was drinking, fatigued, speeding or made a mistake and misjudged the curve. A safety barrier can also provide benefits regardless of weather conditions.

1 Provisional data at January 2018.

2 <https://www.nsw.gov.au/improving-nsw/premiers-priorities/#safer-communities>

3 roadsafety.transport.nsw.gov.au/downloads/road_safety_strategy.pdf

4 roadsafety.transport.nsw.gov.au/downloads/road_safety_strategy.pdf

5 National Road Safety Action Plan 2018–2020 – http://roadsafety.gov.au/action-plan/files/National_Road_Safety_Action_Plan_2018_2020.pdf

Experience in other jurisdictions and research underpinning the National Road Safety Strategy has shown that the most effective method of reducing road fatalities is to improve the roads through treatments such as:⁶

- Addressing high risk curves through improved curve signage, widened shoulders, vehicle activated signage and safety barriers
- Reducing crash types commonly related to lane departure and driver fatigue by installing wide centre lines, flexible barriers, audio tactile (rumble) line marking and sealed shoulders
- Installing traffic calming, pedestrian refuges and crossings, and provide separation of vulnerable road users, as well as expanding 40km/h zones in high pedestrian and local areas, to improve pedestrian and bicycle rider safety, and reduce casualty crashes⁷.

Consistent with Safe System principles it is recognised that human error in the road environment is inevitable and that road infrastructure should accommodate this error and minimise the consequences⁸.

The Business Case notes that following a similar increase in road fatalities in 2009, the Federal Government revised its national plan. It was highlighted that for 700 lives saved every year across Australia, 332 or 47.4 percent could be saved by improving the roads.

Project need

Additional investment required to supplement current initiatives

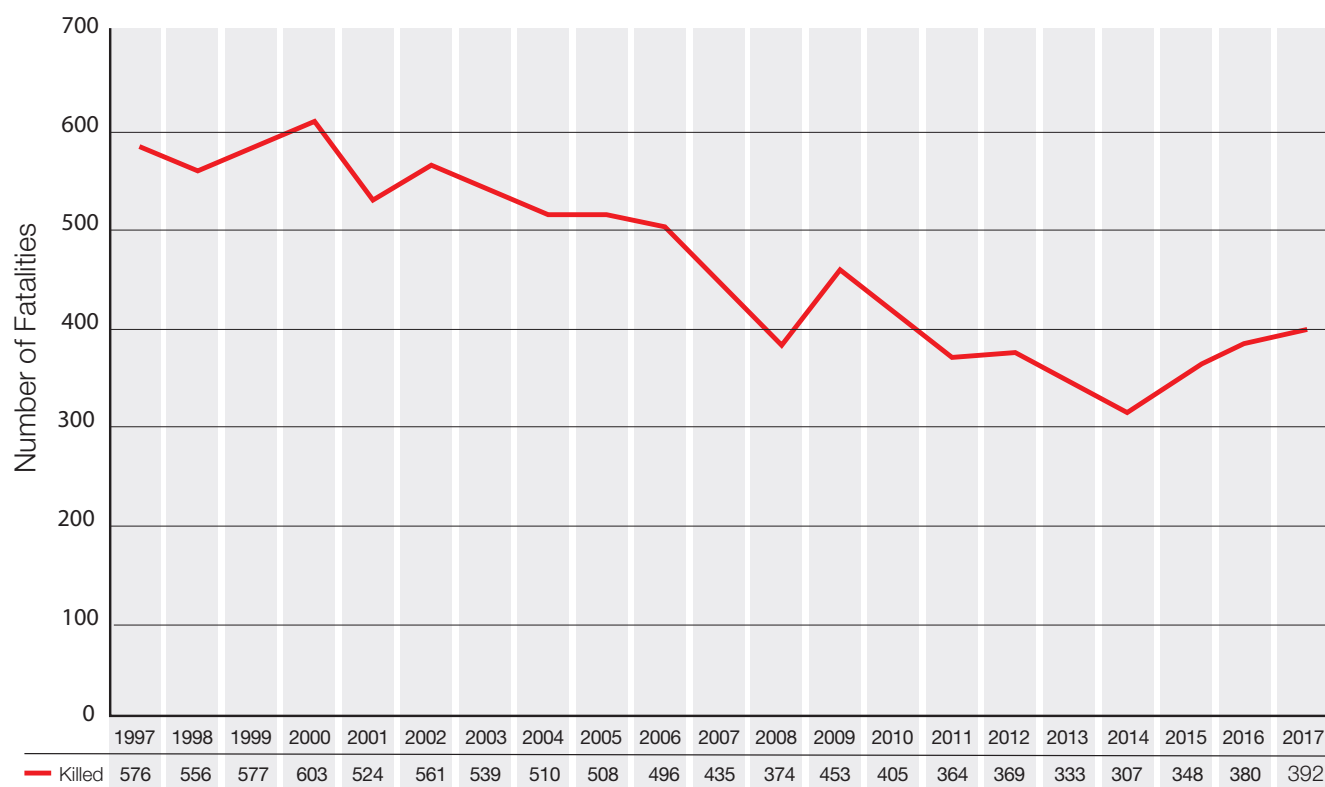
Fatalities on NSW roads have reduced markedly over the last 30 years due to sustained innovation and improved safety measures. In 2014, NSW recorded its lowest number of road fatalities for any given year, with 307 lives lost.

Current statistics indicate that fatalities have been rising since 2015. They also confirm the disparity between metropolitan and country road safety outcomes with people four times more likely to die on a country road.

While most fatalities occur in country areas, each year over 50 lives are lost, and 1,700 people are seriously injured, in residential and neighbourhood streets. Transport interchanges, shopping precincts and local streets require infrastructure and urban design that supports safe interaction between drivers, walkers and riders.

Modelling suggests that the road safety system is facing pressure. NSW has a rising population, more vehicles on the road (registrations have increased by 21 per cent since 2009) and increasing economic activity. Further investment is needed to supplement current initiatives to reduce road trauma to the level needed.

Figure 1 : Annual Fatalities on NSW Roads from 1997 to 2017



6 NRSS (2009) highlighted that road improvements provided the greatest opportunity to reduce road fatalities, followed by providing safer vehicles, changing driver behaviours, and using new technology.

7 Austroads Road Safety Engineering Toolkit – <http://engtoolkit.com.au/>

8 roadsafety.transport.nsw.gov.au/downloads/road_safety_strategy.pdf

The key contributors are known

Crashes on curved roads, crashes associated with driver fatigue and crashes involving pedestrians have been significant long-term causes of death and serious injury. Analysis of the rising road toll since 2015 in NSW shows that these three factors continue to be major causes of road trauma.

Curves

Most fatalities occur outside metropolitan areas. Almost 8 in 10 fatalities on country roads that have a speed limit of 100km/h or higher involve the vehicle crossing the centre line (54 per cent) or running off the road to the left (23 per cent). Key routes across the country road network currently lack the basic safety features that help drivers to recover if they make errors that protect them from hazards if they crash. For example, much of the existing road network is not protected from roadside hazards, such as trees, or from vehicles travelling in the opposing direction.

Fatigue

The risk presented by curves is compounded by factors such as fatigue. Fatigue is second to speeding as a behavioural factor in deaths on NSW roads, contributing to 75 deaths, in 2017⁹.

Pedestrians

Pedestrians are unprotected from physical forces in the event of a crash and susceptible to the most serious outcomes. In urban areas, increases in population and activity tend to generate higher pedestrian traffic and changed travel patterns. To improve the liveability and safety in our urban environments, new or upgraded pedestrian safety measures are required in areas where pedestrians and vehicles interact.

Project description

The Towards Zero Infrastructure Program proposes to use engineering treatments that have been proven to reduce the number and severity of crashes. These improvements will focus on:

- High risk curves
- Locations with a history of fatigue crash types (primarily run-off road and head-on crashes) and
- Areas with high numbers of pedestrian crashes.

High risk curves

Research led by the Transport for NSW's Centre for Road Safety has shown that there is a high correlation between the radius of a curve and the risk and severity of a crash. Curves most likely to be associated with crashes causing casualties are categorised as P1 curves (with a radius of 200 to 600 metres) and P2 curves (with a radius of 10 to 200 metres). There are approximately 4,100 P1 and P2 curves on the State's 20,000 kilometre state road network. Just over a quarter of these curves (1,067) accounted for half of the road trauma from curve crashes.

The way in which high risk curves are treated will depend on the characteristics of the location. The range of measures may include:

- Centre and edge audio-tactile line marking
- Barriers and edge marking
- Guideposts
- Enhanced warning signs
- Retro-reflective pavement markers
- Road safety barriers
- Sealed road shoulders
- Speed limit reduction
- Wide centre line, and
- Road realignment.

Some of these measures, such as audio-tactile line markings (or rumble strips), are designed to prevent crashes and others, such as road safety barriers, are known to reduce the severity of a crash. Interventions such as reducing the speed limit are effective in both preventing crashes and reducing the severity of crashes.

Fatigue

The Business Case analyses data collected by the Centre for Road Safety to examine crashes where fatigue was listed as a behavioural factor, along with research that associates fatigue crashes with circadian rhythms. The analysis included head-on crashes and run-off road crashes that occurred between 10pm and 6am, and 2pm and 4pm.

The Business Case also included analysis undertaken for rolling 10 kilometre sections of road where fatigue crashes were most concentrated. There were 3,412 kilometres of road lengths with more than 2.8 crashes that resulted in a fatality or serious injury¹⁰. 10 kilometre stretches of road with between 6 and 15 fatalities or serious injuries totalled 233 kilometres and were classified as P1. Road lengths with between 3 and 6 fatalities or serious injuries totalled 2,120 kilometres and were classified as P2 in the Business Case.

⁹ Provisional data at January 2018.

¹⁰ 2.8 or greater FSI per 10-kilometres is the current definition of a "black length".

Some of the measures used on high risk curves, for example the use of audio-tactile markings and safety barriers, are also known to be effective treatments for fatigue crashes.

The range of possible measures to address fatigue crashes also includes:

- Enhancing warning signs
- Implementing traversable clear zones at the side of the road
- Lane widening
- Sealing road shoulders, and
- Widening centre lines.

Under the program opportunities will be explored to apply treatments along a route to address multiple crash risks and reduce the severity when a crash occurs.

Pedestrians

The Business Case analysed pedestrian crash data¹¹ over five years to identify locations with a high concentration of pedestrian fatalities or serious injuries. There were 43 locations which had more than 10 pedestrian crashes resulting in a fatality or serious injury over five years (2012-2016).

Infrastructure and non-infrastructure measures will be considered to improve pedestrian safety and may include:

- Providing pedestrian crossings, refuges and traffic calming devices, as well as expanding 40km/h zones in high pedestrian and local areas
- Signal phasing to provide pedestrians more time and space (through pedestrian green phases without vehicle conflicts for example)
- Safer crossing points to simplify decisions
- Measures to reduce road widths and therefore, expose pedestrians onto roads for a shorter period of time
- Giving pedestrians legal priority over motorists (wide, flat and elevated pedestrian crossings for example)
- Pedestrian fencing to stop unsafe crossing.
- Reduced speed limits.

Option identification and assessment

The Business Case considered three options for investment and compares them to a Base Case.

The Base Case would see the NSW Safer Roads Program continue at its current level. The Program has \$20 million allocated to address high risk curves locations and \$19 million over four years (2016/17 to 2019/20) targeting crashes attributed to fatigue. A further \$13 million is committed to improving pedestrian safety over four years (2016/17 to 2019/20).

Against this Base Case, the Business Case considered three options which was the period over which all options in the Program have been evaluated over the period to 2039. Each option proposed applying the same range of treatments to address high risk curves, fatigue and pedestrian safety, but at different levels of investment.

Option 1 proposes an investment of \$500 million over five years. This is estimated in the Business Case to prevent 347 fatalities and 2,657 serious injuries or 3,004 fatal and serious injuries in total during the period to 2039.

Option 2 proposes doubling this investment to \$1 billion. This would improve the capacity to address road fatalities and serious injuries and further reduce crash-related costs to the community. Option 2 is estimated to prevent 628 fatalities and 4,820 serious injuries (5,448 fatal and serious injuries in total).

Option 3 proposes a smaller investment of \$250 million. This would have a reduced effect on preventing road fatalities and serious injuries and crash-related costs to the community, although it's relative effect would be enhanced by the fact that the worst parts of the road network would be improved. With less funding and potentially higher unit costs than Options 1 and 2, the overall safety outcome of this option is reduced. Option 3 is estimated to prevent 190 fatalities and 1,453 serious injuries (1,644 fatal and serious injuries in total).

All options assume that the works will be prioritised to start with the highest risk locations. The proportionate impact will be lower for Option 2 than for Option 1 as the relative priority of locations reduces. However, this Option is expected to benefit from lower unit costs from large-scale investment.

¹¹ Completed using Kernel Density Analysis which captures casualty crashes involving pedestrians within a 500m range and overlays them based on point density. The polygons were then normalised where 10 or more pedestrian casualty crashes occurred.

Economic evaluation

A full economic cost-benefit analysis was undertaken of the project in accordance with NSW Treasury guidelines¹². The costs and benefits were assessed over a project period of 20 years. A standard discount rate of 7 per cent¹³ was used to express all costs and benefits in 2017 values.

Costs

Standard average costs were used for each element of the program. The treatment of a high-risk curve was assumed to cost \$600,000. Measures to reduce the risk and impact of fatigue-related crashes were assumed to cost, on average, \$600,000 per 10 kilometre length of road. Improving pedestrian safety at each identified priority location was assumed to cost \$1 million.

Benefits

The key benefit of the program is generated by reducing road fatalities, serious injuries, moderate and minor injuries. The analysis quantified the benefit of fewer fatalities and serious injuries. It did not include the benefits of achieving fewer moderate and minor injuries.

The Business Case adopted a measure of fatalities and serious injuries prevented per \$100 million invested, per annum, to measure road safety benefits. This measure has been subject to local and international scrutiny and is widely used¹⁴. Based on performance in other jurisdictions which use this indicator to measure road safety performance, the analysis estimated there would be:

- 40 fewer fatalities and serious injuries each year for every \$100 million invested in engineering measures targeting high risk curve and fatigue, and
- 35 fewer fatalities and serious injuries each year for every \$100 million invested in engineering measures targeting pedestrian crashes.

The benefit of fewer fatalities and serious injuries is quantified by estimating the value the NSW community places on the reduction in road trauma and is expressed as a “willingness to pay” that is, what the community reports it would be willing to pay to achieve the outcome¹⁵.

The methodology captures the cost of lost lives, pain and suffering caused by injuries, vehicle costs (for towing, repairs and having the vehicle unavailable), and the general costs of travel delays, insurance administration, police attendance, property damage and fire services.

To estimate the benefit of the proposed Program, reductions in the number of fatalities and serious injuries were multiplied by the Willingness to Pay (WTP) costs.

Outcome of the analysis

The three options described above were assessed in the Business Case with the outcome of the Economic Analysis summarised in Table 1.

The highest BCR is delivered by Option 3. This results from a relatively smaller budget with relatively higher benefits from addressing the highest priority road safety risk locations. However, the scale of Option 3 is not sufficient to help meet the State’s Priority target to reduce road fatalities and was not recommended.

The Business Case recommends Option 1 as the preferred option, with an allocation of \$500 million, and a BCR of 5.59. Option 1 can be readily implemented with existing governance structures and balances overall benefits, and funding availability.

Table 1 Outcome of the Economic Analysis

Cost and benefit	Option 1 \$'m	Option 2 \$'m	Option 3 \$'m
Cost (nominal \$m)	\$500	\$1,000	\$250
Cost (present value \$m)	\$385.10	\$770.20	\$192.50
Benefit (nominal \$m)	\$4,670.70	\$8,454.20	\$2,559
Benefit (present value \$m)	\$2,151.90	\$3,894.80	\$1,179
Benefit Cost Ratio (BCR)	5.59	5.06	6.12
NPV (\$m)	\$1,766.80	\$3,124.70	\$986.40

¹² With assistance from Jacobs Consulting.

¹³ With sensitivity testing at 3 per cent and 10 per cent.

¹⁴ Including as the basis of funding decisions for road safety programs in Victoria, Tasmania, Western Australia and New Zealand.

¹⁵ This approach is recommended by Transport for NSW Economic Appraisal Guidelines and National Transport Guidelines.

Deliverability

The Business Case proposes individual project proposals be developed by Roads and Maritime Services or councils and submitted via the Safer Roads online portal which is currently being used successfully. The characteristics of the projects being sought, and the criteria against which they will be assessed, are clearly defined. The Centre for Road Safety assesses projects in collaboration with Roads and Maritime Services for alignment with the program's intent and prepares a prioritised program of works for delivery.

Procurement

The Program will be delivered by Roads and Maritime Services with individual projects managed by Roads and Maritime Services Regions or local councils as the appropriate road authority. Existing market tested contracts may be used, and Roads and Maritime Services will work with Transport for NSW and local councils to explore alternative approaches that deliver efficiencies and minimise delivery risk. For example, Roads and Maritime Services may also develop a centralised procurement option for the delivery of large-scale treatments if this delivers cost effectiveness benefits to the Program.

Timeframe

The Program is scheduled to be delivered over five years from 2018/19 to 2022/23, beginning with \$50 million program in the first year, increasing to annual expenditure of \$125 million in year 2 and \$200 million in year 3, with the remaining \$125 million being delivered across years 4 and 5. Projects for the first year have been identified and initial funding has been committed.

Key risks and mitigations

The Business Case includes a comprehensive approach to risk management¹⁶ including the identification and management of key risks. An initial risk register has been developed and is being progressively reviewed and revised.

Key risks relate to the importance of accurate costing and robust delivery practices given the large number of individual projects, and the need for prioritisation to be communicated clearly to the community. The governance framework has processes in place to identify, mitigate and monitor risks.

The Infrastructure NSW view

Consistent with the NSW Government's Infrastructure Investor Assurance Framework¹⁷, Infrastructure NSW routinely assesses business cases and provides advice to Government on the efficacy of their findings. The Towards Zero Infrastructure Program Business Case was reviewed in March 2018.

The *State Infrastructure Strategy 2018-2038* notes that regional NSW is significantly over-represented in the State's road toll. Despite being home to just over 20 per cent of the NSW population, country areas represent two thirds of all fatalities and one third of serious injuries. The State Infrastructure Strategy acknowledges the critical role infrastructure investments play in the Safe System approach and recommends that transport programs adopt an increased focus on achieving goals related to road safety¹⁸.

The proposed *Towards Zero Infrastructure Program* is supported by a strong policy framework including the *Road Safety Plan 2021 and Government's Future Transport Strategy 2056*. The identification and treatment of safety risks relies on a systems approach to road safety and draws on leading international and Australian research to quantify road improvement benefits and the associated crash reductions. The Program will put NSW road safety practice on a highly regarded international systems platform.

The Program will be implemented by Roads and Maritime Services, a role it currently plays in the Safer Roads Program. Any risk associated with delivering a large number of small projects is reduced by the fact that this is usual practice for Roads and Maritime Services and effective working relationships in place within Transport for NSW and councils throughout NSW. The Centre for Road Safety has an annual review process in place to provide a whole-of-program perspective of what otherwise might be a series of unconnected projects. This will allow lessons to be learned and innovation to be identified.

Three options were considered in the Business Case, with budgets from \$250 million to \$1 billion. The large number of separate projects expected to be funded makes the Program scalable and provides flexibility to expand in line with budget allocations. A Program consisting of individual projects also has the flexibility of being able to remove and replace projects if required.

Overall, Infrastructure NSW is satisfied that the preferred option, an investment of \$500 million over five years, is likely to deliver significant road safety benefits aligned to the targets set. With appropriate project management controls in place, the program appears deliverable and is demonstrated to have a strong BCR of 5.6.

¹⁶ Aligned with the ISO 31000 standard for managing enterprise risk and with Transport Enterprise Risk Management (TERM).

¹⁷ Infrastructure NSW (2016), *Infrastructure Investor Assurance Framework*.

¹⁸ Infrastructure NSW (2018), *State Infrastructure Strategy 2018-2018: Building Momentum*, page 125.

