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FIA FOUNDATION

INVESTING TO SAVE LIVES

AN IMPACT INVESTMENT CASE FOR PREVENTING ROAD TRAUMA

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The FIA Foundation is an independent UK registered charity which supports an international programme of activities promoting road safety, the environment and sustainable mobility, as well as funding motor sport safety research. Our aim is to ensure 'Safe, Clean, Fair and Green' mobility for all, playing our part to ensure a sustainable future.

The FIA Foundation Research Paper series seeks to provide interesting insights into current issues, using rigorous data analysis to generate conclusions which are highly relevant to current global and local policy debates.

Written by: Tom Davies & Jane Newman for Social Finance and Regina Hill & Rosemary Addis for Impact Strategist

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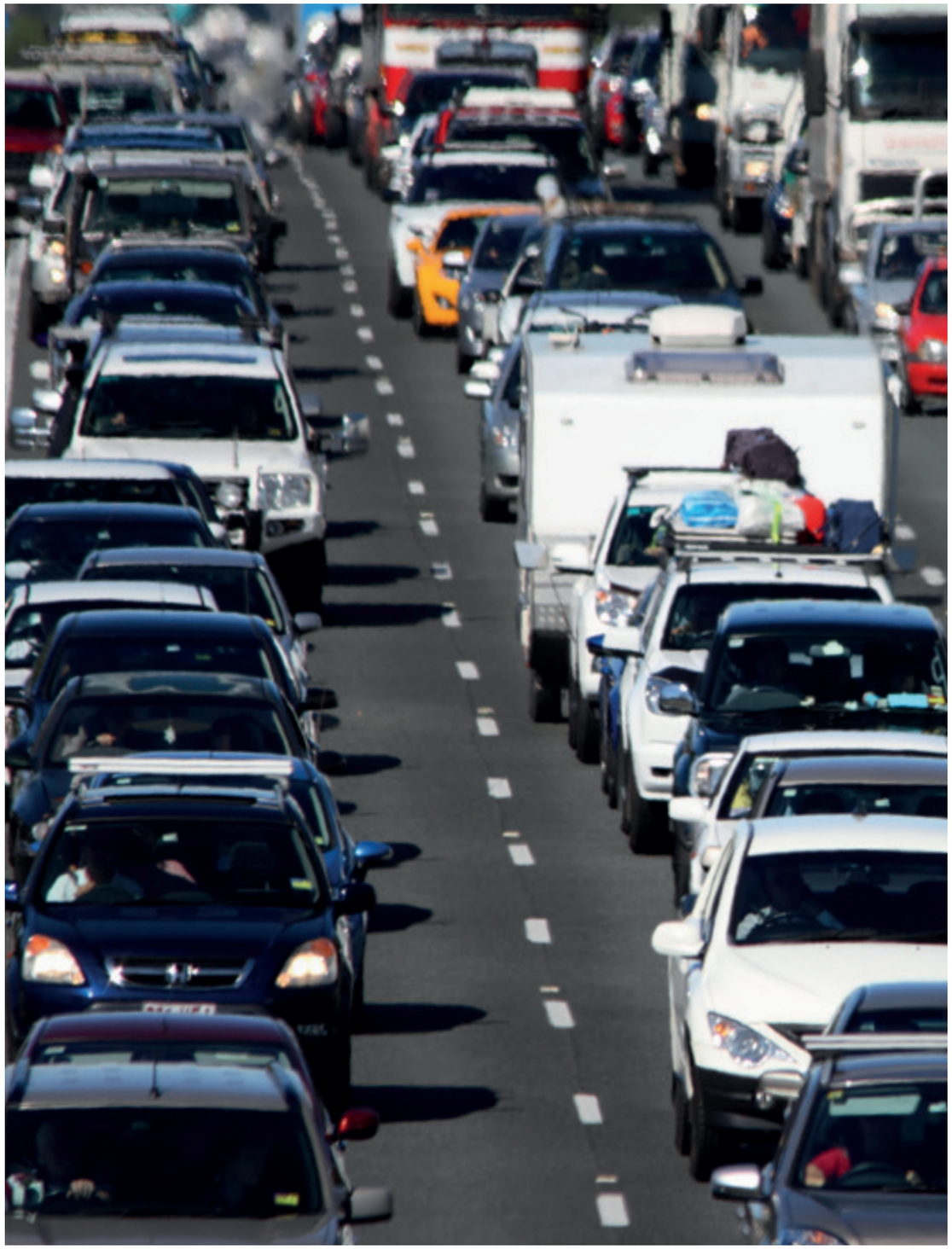


FOREWORD

With the launch of the UN Sustainable Development Goals, governments across the world have committed to an ambitious objective: to halve global road traffic deaths.

To achieve this target will require unprecedented, and sustained, political commitment and an increase in resources, both human and financial. An urgent priority must be for governments and donors to do more to finance large scale road safety interventions. This is why, with the support of the UN General Assembly, I am encouraging countries to consider establishing a new UN Road Safety Fund to help catalyse activity. It is the reason I have convened the FIA High Level Panel on Road Safety, bringing together leaders in business, government and international development finance to promote greater levels of investment in road traffic injury prevention.

This report, commissioned by the FIA Foundation, on whose board I am proud to serve in my capacity as FIA President, details the impact of road traffic crashes; the immense lifetime health costs; the burden on individuals and society. It provides compelling evidence of the effectiveness of two of the countermeasures available, road infrastructure safety upgrades and motorcycle helmet wearing initiatives. It demonstrates that, through a focus on 'safe system' network improvements on high risk highways, there is much that high income countries can do to further reduce their toll of road traffic injury. The report also shows that in middle and low income countries, where this epidemic is at its worst but reliable data is often lacking, road safety interventions can be successfully implemented and measured with transparent 'payment for results' metrics.

The scale of the global road traffic epidemic demands new thinking and innovative financing solutions. Harnessing the growing potential of the social impact investing market can deliver as yet untapped sources of funding for road safety and help to instil a new rigour in the development of road safety strategies and programmes. This report explores these opportunities and signposts directions for further research and action. I encourage institutional and philanthropic investors to join with us in taking this important work forward.

Jean Todt
UN Secretary General's
Special Envoy for Road Safety

INTRODUCTION – FIA FOUNDATION

The FIA Foundation has been exploring the potential to leverage social impact investment to achieve a breakthrough in road safety.

Targets included in the United Nations' Sustainable Development Goals (SDGs) for public health and sustainable cities commit countries to reducing road traffic deaths and injuries. The targets are universal and ambitious: halting the rise in fatal and serious injuries (FSIs) and halving the current toll. Beyond targets, this is about improving outcomes for people and communities and reducing the impost on government, business and donor agencies of the rising toll.

Meeting the SDG targets will require breakthroughs in thinking and practice to revolutionise the way road safety is understood as a long term public health investment. The difference that prevention could make is put in stark relief by data like the statistic from Cambodia that 99% of child passengers killed in motorcycle accidents were not wearing a helmet.[1]

This is the fourth research paper on financing for development commissioned by the FIA Foundation. It is our second major piece of work with Social Finance and Impact Strategist, two of the leading pioneers of new innovative financing mechanisms. The first, Breaking the Deadlock, set the groundwork for the case for investment in road safety and how social impact investment could be applied in this field. The work reflected in this report brings into relief both the potential to make the case for investment in prevention and the work ahead.

The analysis for this report is possible through collaboration of the Transport Accident Commission in Victoria, Australia, the Asia Injury Prevention Foundation in Cambodia, and the International Road Assessment Programme. We are very grateful to these organisations for their leadership, and particularly their willingness to contribute data. That has enabled us to shed light on how a different approach can provide new insights and help the whole field move faster and more effectively in achieving road safety goals.

The process of examining the available data through a different lens has, in itself, provided a unique opportunity that required us to challenge assumptions, offered new insights, and highlighted gaps in the evidence base to ground a clear investment case. This exercise reinforced for us how important it will be to continue to build the data and evidence base linking accidents, injury, cost and benefits. It also underscores that we do not need to wait to have all of the data everywhere in the world to make a start.

The time for action is now. Our focus and resolve to demonstrate the potential of impact investment to achieve a breakthrough in road safety has only increased through this process. There is significant potential for catalytic action and initiatives already underway that can serve as pilots, feasibility, investment design and data collection. The next step is to form a practical partnership to undertake priority action linked to achievement of the SDGs.

We welcome interest from others to join us in this unique opportunity to demonstrate the cost-effectiveness of road safety and improve the lives of millions affected by road trauma.

Saul Billingsley
Executive Director, FIA Foundation
September 2016

EXECUTIVE SUMMARY

The number of people who die or suffer serious injury due to road trauma is high and expected to grow.[2] Children and young people are the worst affected.[3] And the effects are most severe among communities that are already poor.[4] The Sustainable Development Goal (SDGs) include ambitious targets to reduce this toll and the significant human, financial, social and economic burden it produces.

The cases set out in this report apply an investment approach that values prevention. Each examines a different type of intervention in different country contexts and applies an investment model to demonstrate the improved outcomes and financial return that could be achieved by directing more capital to road safety.

Case 1 is set in Australia and models investment in large scale infrastructure improvements to raise the safety rating[5] on major roads in the States of Victoria and Queensland.[6] The case illustrates the potential to save lives and avoid serious injury and translate the resulting cost savings into a positive return on investment, even for highly developed road systems. Improvements to the Victorian road network, which has already benefited from substantial investment, are projected to save 40 lives and 240 serious injuries over 20 years and deliver expected lifetime (insurance) claims cost savings that translate to a benefit cost ratio (BCR) of ~ 1.6 and deliver an internal rate of return (IRR) of ~ 6%. Making similar improvements to a highway that has not benefited from equivalent levels of investment, the higher risk Bruce Highway in Queensland, is by contrast projected to save 340 lives and 2,660 serious injuries over 20 years and deliver greater cost savings: BCR ~ 2.7; representing an IRR of ~ 20%.

Case 2 is set in Cambodia and has a very different focus and context. The investment case is modelled on delivering improved outcomes as a result of interventions to increase safe behaviours on the road, specifically helmet use by motorcycle passengers in designated districts of Cambodia. The investment design employs an impact bond model that links financial return to the improvement in outcomes. A two year intervention, begun in 2014, is projected to save at least 14 fatal injuries and 260 other casualties and deliver an IRR (based on the expected cost savings modelled) of between 6% to 11% based on the targeted rates of increase in the observed use of helmets of 60% or better.

These cases demonstrate the potential for impact investment models that make financial sense and improve outcomes for people and communities. The process illustrates the data and investment logic required to underpin the case to direct more resources to prevention. The insights gained through the exercise highlight potential for a similar process to be applied in other settings, including projects underway in different parts of the world.

The investment case approach makes the cost-effectiveness of road safety interventions very concrete. The insights gained also underscore that there is a much greater dividend to be achieved by directing more capital to prevention. That is the dividend of reducing the human, social and economic consequences of road trauma for individuals, families, communities and, ultimately, society. These, often hidden, costs for families that lose income, lose opportunities for education and productive work and who are not always well-served by emergency or local health and care systems and services, are significant. They contribute to cycles of poverty and disadvantage. Preventive action not only reduces real costs of care, it can help break these cycles and that benefit can also be measured over time.

Sustained progress toward meeting the SDG targets requires clear and early multi-stakeholder commitment to action. A targeted collaboration between motivated stakeholders from governments, foundations, financial institutions, delivery agencies, and in the case of low and middle income countries (LMICs), donor agencies could unlock opportunities connected with the SDGs and current road safety initiatives to design financial products and test feasibility of different approaches with stakeholders and in the market. This would have a powerful demonstration effect, link finance to achievement of the SDG goals and inform and enable data collection and learning toward creation of an evidence base.

Such a practical partnership has real potential to deliver a breakthrough by evolving investment models that are sufficiently robust to underpin preventive action on road safety, at scale.

BREAKING THE DEADLOCK

More than 1.25 million people die on the world's roads each year and many more are seriously injured.[7] Road traffic injury is the leading cause of death for children and young people over age 10 in developed and developing countries alike.[8] There are promising indications that the Decade of Action on road safety has contributed to saving lives[9] - but there is still much work to do.

The SDGs for health and cities include clear targets for reducing FSIs from road trauma. However, current trends continue to head in the wrong direction, particularly in LMICs, which account for 90% of road traffic deaths despite having only 54% of the world's vehicles.[10] These levels of road injury create and entrench cycles of poverty.[11]

Road deaths and trauma have significant social and economic costs to the individuals, families and communities affected. Other stakeholders are also paying the cost of poor results: governments, insurers, corporations, non-government organisations, development institutions and donors.

Despite the clear imperative for action, road safety is one of many, often competing, claims for funding to improve people's lives. The SDG targets to reduce road trauma will not be met without investment in prevention. The investment case needs to be compelling. And better outcomes must be at the centre of design to deliver real improvements for people and communities affected by road trauma.

This report applies a framework for investment design that delivers improved outcomes, in this case through reduced road trauma, and a financial return. This is referred to as an 'impact investment' approach. The work illustrates through two case studies how a more granular understanding of the costs associated with road trauma illuminates who is currently bearing those costs and helps identify ways to align incentives toward action that will improve outcomes and reduce costs over time.

Two impact investment cases have been developed, each based on new data analysis that links targeted interventions to reductions in specific types of crashes and associated FSIs, and each showing how the resulting cost reductions can be translated into an investment proposition. Both are based on real life data. The Australian case studies draw on crash and claims data provided by the road authority responsible for planning, managing and developing the road network in Victoria, VicRoads, and the Transport Accident Commission (TAC), the government-owned social insurer in the State of Victoria. The Cambodian case study draws on data from a current road safety initiative aimed at increasing helmet use, implemented by Asia Injury Prevention Foundation (AIP Foundation). Both case studies illustrate how activity, injury and cost data can be used to demonstrate the cost-effectiveness of road safety interventions in concrete financial terms and design an investment product to direct the investment towards prevention.

While small in scale, the case studies provide encouraging insights that form a basis for developing the data and analytical frameworks that will support larger scale investments. They reinforce the potential for applying an impact investment approach to road safety that can connect those who bear the costs of road trauma and those who have the unfunded solutions to save lives and reduce injury. Working together these parties can open the door for a new investment approach that can help deliver on the UN target to halve deaths and serious injuries from road trauma and make a material contribution to breaking the deadlock on road safety.

TAKING AN IMPACT INVESTMENT APPROACH

The focus of this report is to illustrate in concrete terms the cost-effectiveness of prevention and how that can be translated into actionable investment vehicles to direct capital to prevention and, in turn, realise the financial dividend. The cases demonstrate this for two different scenarios and investment products in different country settings.

The two cases connect data on the incidence, effects and cost of road trauma to illustrate how the cost of dealing with causes of road trauma is more than met by cost savings that accrue over time from not having to deal with its effects. In terms of the benefit to be gained this is, in essence, the base case. Reductions in FSIs also translate to better outcomes for the people and communities affected, particularly those whose lived experience is altered dramatically by road death or serious injury.

Case 1 applies analysis to infrastructure improvements on two different road networks in Australia. Case 2 focuses on behavioural change, and applies analysis to a programme designed to increase rates of helmet use by motorcycle passengers in Cambodia. The investment case in each scenario is designed to test whether targeted preventive interventions would deliver a positive return on investment based on quantifiable, identified cost savings through reduction in FSIs, after taking into account the cost of implementing the interventions. Case 2 also incorporates property damage costs. The analysis does not quantify the altered circumstances of households, pain and suffering of individuals or the broader social and economic costs of road trauma or benefits of improved road safety.

The differences between the two cases provide useful points of contrast and comparison. The key differences that are relevant for any impact investment proposal, identified in Table 1, include the focus of the safe system intervention, nature of the investment, specific intervention, the country economic setting, current extent of road network development and the current data availability. These elements, in turn, frame a range of other considerations that affect the investment case such as availability of health care and other public services, and extent of coverage of any existing insurance system. The different country contexts illuminate how different levels of economic development impact on the financial, social and economic costs and benefits and by whom they are borne.

The investment case is data driven. This is critical to ensure the analysis of cost and benefit relates to the particular context and enable the improvements and their financial impacts to be quantified. The sample data sets informed an analysis that interrogates, for each scenario:

- key causes of FSIs for a target group;
- evidence of the relationship between the proposed intervention and that target group, focused on one element of the safe system;
- cost base for the proposed intervention, including maintenance costs over the time period;
- the likely relationship between the intervention and reduction in FSIs;
- the relationship between cost and types of injury, applying a high level cost reduction calculator methodology to the available data; and
- other factors for the scenario likely to influence willingness to pay for the preventive action, relative risk and cost that may affect the nature of the investment and investors.

FIGURE 1 – EXAMPLES OF THE CATEGORIES OF COSTS ASSOCIATED WITH FSIs FROM ROAD TRAUMA

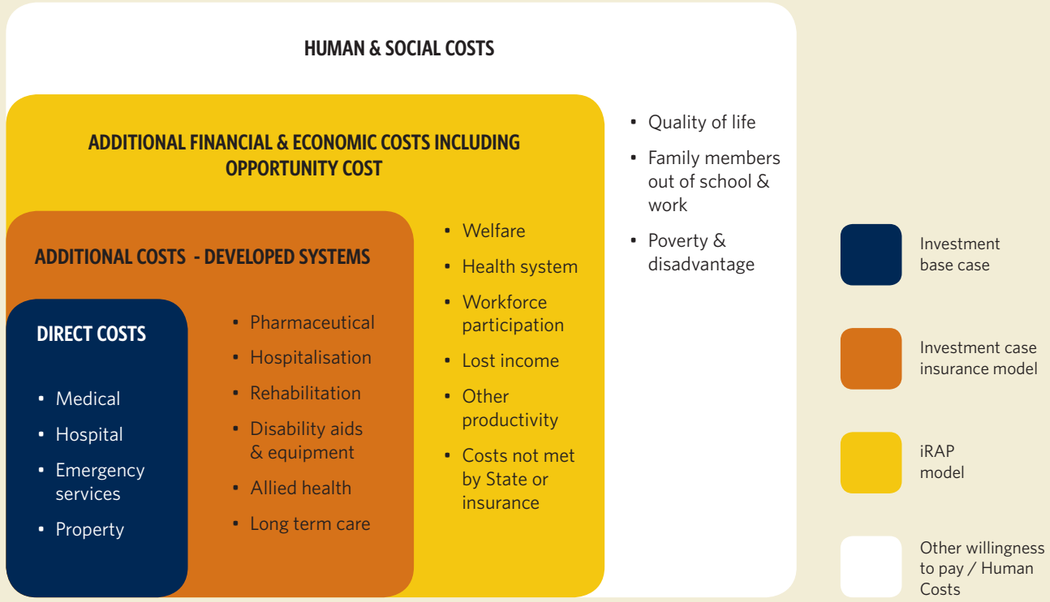


TABLE 1 – THE CASE STUDY PARAMETERS AND COMPARING THE APPROACH

CASE	SAFE SYSTEM FOCUS	NATURE OF INVESTMENT	INTERVENTION	COUNTRY ECONOMIC SETTING	ROAD NETWORK DEVELOPMENT	CURRENT DATA AVAILABILITY
CASE 1: AUSTRALIA - TAC [12]	Safer roads & roadsides	Infrastructure improvement	Multiple interventions to lift safety of high speed, high use corridors	High income	Developed (Victoria) and Moderate (Queensland)	High (with cost data drawn from Victorian based data set in both cases)
CASE 2: CAMBODIA – AIP FOUNDATION	Safer road users	Outcomes focus	Behaviour change to encourage helmet wearing and enforcement	Low-middle income	Low - moderate	Low - moderate

Overview of the investment cases

CASE 1: INFRASTRUCTURE IMPROVEMENTS IN AUSTRALIA

The investment case compares the return on investment for infrastructure interventions across two Australian road networks at different levels of maturity in terms of safety. The analysis draws on claim cost profiles of different types of crashes, linking insurance claims and claimant data to crash type, location, speed and injury type. This represents a new interrogation of a sample data set drawn from the highly detailed claims data maintained by the TAC in Victoria that has been mapped against crash data maintained by VicRoads.

The intervention for each road network involves a mix of infrastructure improvements to high risk areas designed to raise the star rating or safety performance of the designated road corridors. The investment case is based on projected savings of future costs directly related to a reduction in FSIs estimated using the optimised investment model developed by iRAP. This model estimates the likely reduction in FSIs as a result of particular road infrastructure improvements that are known to have an impact on the likelihood of a crash and its severity. The costs are based on categories of costs met by the TAC as a universal, no-fault insurer. The investment case for Victoria involves a mature road network which has already benefited from significant investment in road infrastructure improvements by the TAC and VicRoads (the State network had 4.33 fatalities per 100,000 population in 2015).[13] The same analysis is then applied to the less mature Bruce Highway in Queensland which, prior to recent government investment, had been listed as one of the twenty-two most dangerous highways in the world.[14]

The investment illustrated is a direct investment in infrastructure assets which, in effect, brings forward capital that would otherwise be needed to meet the future claims costs. Based on the analysis for this report, other investment structures could be applied to capture the preventive value of infrastructure improvement in particular circumstances. That could include an impact bond model or a 'hybrid' model that combines infrastructure (asset) backed investment with an impact bond. It may also be possible to structure an investment or other financial incentives for prevention through improved road safety using existing mechanisms applied in infrastructure based projects such as shadow tolls or availability payment models.

CASE 2: INCREASING HELMET WEARING IN CAMBODIA

The investment case examined for Cambodia is quite different and is a function of a very different social and economic country context. It focuses on a specific behavioural intervention designed to increase helmet use by motorcycle passengers in designated districts in Cambodia. The investment case is modelled using known programme costs, estimates of costs avoided, and behaviour surveys and assumptions based on the valuable, but less robust, data from national crash and victim information systems.

The investment applied is an impact bond. This models the link between road user behaviours (helmet wearing), enforcement capacity (to increase compliance with requirements to wear helmets) and outcomes (increased helmet wearing, leading to reduction in FSIs) within an investment framework. The foundation of the investment case is estimated cost reductions directly related to the reduction in FSIs projected, based on the available data and target rates of improvement.

The nature of the costs and who bears them is very different in LMICs, due in large part to lack of service and support infrastructure. As the scenarios illustrate, the health and care system in Cambodia is significantly less developed than in Australia and there is no equivalent insurance based system. Many costs are therefore borne by family members and so are layered into the more hidden human and social costs associated with road trauma. This has significant implications in terms of creating and entrenching cycles of poverty and disadvantage. The positive opportunity is that new ways of directing investment to prevention can also contribute to reducing these difficult, often catastrophic, human and social consequences.

CASE 1: AUSTRALIA – THE TRANSPORT ACCIDENT COMMISSION

Safer roads & roadsides – investment in infrastructure

BOX 1 – CASE 1 OVERVIEW

OVERVIEW					
Safe system focus	**Nature of investment**	**Intervention**	**Country economic setting**	**Road network development**	**Current data availability**
Safer roads & roadsides	**Infrastructure improvement – asset backed**	**Multiple interventions to raise the star rating of the road**	**High income**	**Advanced (Victoria) compared to less advanced (Queensland)**	**High**

Key points of the investment case
- Large scale infrastructure improvements to raise the vehicle and motorcycle star rating on major roads with a speed limit of 100km per hour or more carrying over 5,000 vehicles per day
- Modelled for mature Victorian Highway network and compared to less mature Queensland Bruce Highway network (as mapped by iRAP in 2011 prior to the commencement of recent major upgrades)
- Infrastructure program improvements tailored to system based on the iRAP Safer Road Investment Plan that optimises potential deaths and injuries saved per dollar spent[15]
- Projected reduction in FSIs modelled on iRAP star rating and fatality estimation algorithms that are based on a global evidence base
- Financial benefits calibrated to the average claim costs for individual crash types based on the TAC claim costs data for the sample data set

Mature network analysis (Victoria Highway Network, Victoria):
- Improves road network overall from 40% 4-star or better to 78% 4-star or better for vehicle occupants and from 54% 3-star or better to 87% 3-star or better for motorcyclists[16]
- Saves 40 lives and 240 serious injuries over 20 years, equating to an estimated lifetime claims cost reduction of AUD$52.2M
- Investment case based on expected lifetime (insurance) claims cost savings: BCR ~ 1.6; IRR ~ 6% before any broader social and economic cost savings are taken into consideration

Less mature network analysis (Bruce Highway Network, Queensland):
- Improves the road network overall from 54% 3-star or better to 99% 3-star or better for vehicle occupants with 35% achieving 4-star or better and from 6% 3-star or better to 41% 3-star or better for motorcyclists[17]
- Saves 340 lives and 2,660 serious injuries over 20 years, equating to an estimated lifetime claims cost reduction of AUD$558.3M
- Investment case based on expected lifetime (insurance) claims cost savings: BCR ~ 2.7; IRR ~ 20% before any broader social and economic cost savings are taken into consideration

Insight
- Demonstrates significant value in investment for even highly developed road network, increasing when applied to less developed, higher risk road systems
- The investment case holds even without taking into account the private costs to individuals and their families, or the broader impacts on hospitals and the wider health system, communities, workplaces, governments and other road users.

Key Data Partners: the Transport Accident Commission (TAC), VicRoads and iRAP.
The TAC has partnered with FIA Foundation to support the analysis of its insurance claims data to demonstrate how data can be used to support the identification, prioritisation and funding of safe system investments.

iRAP have partnered with VicRoads and the Main Roads Department of Queensland in the development of this case study to inform the nature of the intervention and analysis of the investment case. In particular, the iRAP star rating system and modelling has been utilised in the analysis.

MICAELA'S STORY: ACQUIRED BRAIN INJURY

Adapted from TAC case study material - with thanks to Micaela Henderson

Thirty year-old Micaela Henderson suffered horrific injuries in a crash when she was thrown from a car that she was a passenger in that ran off a high speed rural road in western Victoria that had no barriers in place or tactile edge lining and hit a tree in January 2010.

She was airlifted to the Royal Melbourne Hospital where, having been resuscitated at the scene of the crash and in transit, she was placed into an induced coma.

Micaela, who was fortunate to escape with her life, suffered a serious brain injury as well as multiple fractures some of which have required repeated treatments. She has also required plastic surgery. She spent an extended time in hospital following the crash and has required ongoing treatment and support for her acquired brain injury.

The insurance coverage provided through TAC has assisted Micaela to access treatment and support so that she can get back on her feet working again. Remarkably, after learning how to walk and talk again, Micaela returned to study and now manages a landscaping business.

Notwithstanding the services covered by insurance and her positive spirit, Micaela's family and friends were greatly affected by her experience. "Even though I was the one who had suffered extensive trauma, my friends and family went through a great deal of trauma too. My recovery journey has not ended for me or for them. I certainly still have a long way to go and so do they. The people in my life, who have shared this horrific experience with me, still have depressing times thinking about the car accident and its effects."

"This, I have learnt first hand, has a massive impact on the people in your life. When you are involved in a car accident, the trauma does not just stop with you. It flows on to the people around you."

"I was one of the few lucky people who has managed to make a miraculous recovery. I am by no means completely recovered, nor will I ever be but I am striving to improve myself day after day. There are people out there who do not have the support that I experienced to recover like this and the impact their injuries have on their friends and family is overwhelming and heartbreaking. Don't ever think that my recovery means that the past 5 years is forgotten and my friends and family no longer suffer the effects of this because they do. I do however try to encourage them to look on the positive side and to focus on the fact that I am present."

CONCLUSION

The cost calculator that has been developed to inform this report indicates that a 30 year old female suffering a severe ABI such as the one the Micaela experienced would incur an average total lifetime claims cost in the vicinity of AUD$3.1M. Infrastructure investments such as the ones outlined in the Victorian investment case set out in this report would reduce the likelihood of crashes like the one that Micaela was involved in. They have the potential to avoid the cost, pain and suffering that follow from accidents like this, not just for people like Micaela, but for her family and friends as well.

Introduction – road safety in Australia

Australia is among the most developed countries by GDP measures and, overall, is relatively developed in its approach to road safety. The logic for investing to reduce road trauma has been recognised by governments across Australia. However, it is a vast country with different terrains and conditions, and road network development and the extent to which safe systems have been applied varies widely.

The State of Victoria has the most developed safe system approach. The role of the TAC is unique in the world. The TAC is a government owned, no-fault personal injury insurer. In line with the Victorian Government's Road Safety Strategy, the ultimate aim of the TAC is to work with road safety partners to achieve the vision of no road deaths or serious injuries in Victoria; to apply a safe system approach to work "Towards Zero". The TAC has a mandate to deliver improved road safety in addition to its role as an injury insurer. It has a focus on investment in road safety and has a strong track record of self-funding both infrastructure and community awareness and education campaigns to support the reduction of road trauma.[18] Notwithstanding the investment that has been made in the Victorian road system, there are still opportunities for improvement.

The situation for the Bruce Highway in Queensland is very different. It has been a notoriously dangerous highway with high crash rates that is less developed than the majority of Victorian national highways. The highway accounted for more than 17% of deaths on the entire national highway network prior to the recent upgrades.[19] It is a major transport route on the Eastern seaboard and carries significant volumes of traffic, including heavy vehicles.

Data analysis & approach

These investment cases draw on analysis of five years of TAC claims data covering all transport accident claims in Victoria from 2006-2010 that have been able to be mapped against VicRoads crash data. It links claims and claimant data, including detailed cost data, to crash type, location and speed. The data and methodology is set out in more detail in Appendix 2.

The TAC sample data set includes over 40,000 crashes and over 50,000 claims (Figure 2). Claims that could not be mapped against the data for crash type have been excluded from the data set. The most likely reason for the lack of crash data for a significant proportion of those excluded claims is that they relate to minor crashes (for which detailed crash data is not recorded). Therefore, the average total claims cost figures calculated may be slightly overstated (because of the exclusion of some lower cost minor claims). However, average claims cost for FSIs claims are less likely to be affected by this as they are more likely to have resulted from more serious crashes. Therefore, the data for FSIs is likely to be more accurate, and is the data that aligns best with the iRAP predictive tools that have been used in this analysis which focuses on FSI outcomes. The methodology used to project lifetime costs has been informed by the TAC's approach and developed further by applying further detail on cost categories relating to particular types of injuries.

Analysis of the TAC sample data set is the foundation for both the Victorian and Queensland case study scenarios.

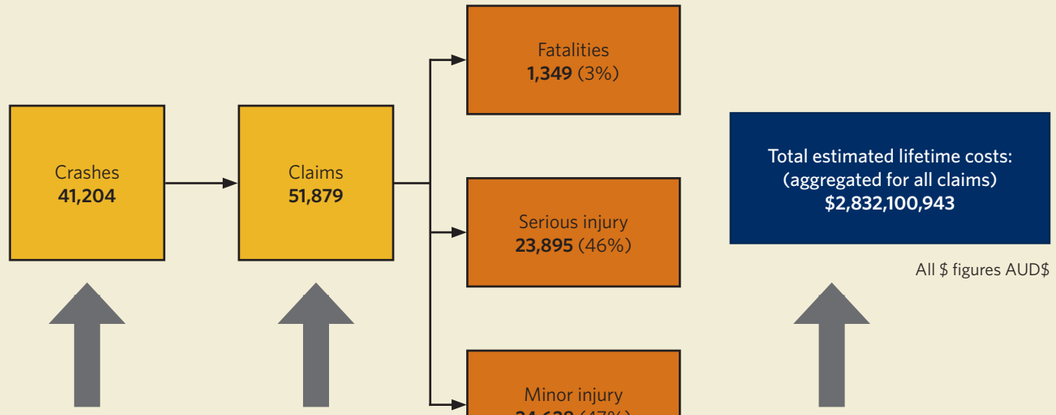
The base TAC sample data set indicates that there were approximately 41,204 crashes leading to 1,349 fatalities, 23,895 serious (hospitalised) injuries and 24,628 minor injuries in Victoria over the five year period from 2006 to 2010 (Figure 2). Modelling undertaken for this analysis shows projected lifetime insurance costs generated by those claims of AUD$2.83B.[20]

The assessment of current road infrastructure is based on iRAP data collected by VicRoads and analysis of the road networks.[22] Projected reductions in crash types and FSIs linked to modelled road and roadside improvements also comes from iRAP analysis.[23]

The primary focus in the case studies is on reducing personal injury based claim costs, based on the cost categories covered within the TAC system. These include ambulance / road accident rescue, paramedical, hospital, long term care and legal costs as well as compensation for lost income, impairment, to cover cost of dependents. The same analysis of costs and cost reductions have been used for the Victorian and Queensland scenarios given the relative comparability of the two settings within the same country. However, in the Queensland system the costs do not fall on the one (insurance) body. They are likely to be spread across a range of providers and, in some cases, those injured may not be insured, but will still incur the costs associated with lost income and other matters typically the province of insurance.

FIGURE 2 – IMPACT CALCULATOR DATA SET[21]

We have been working with a data set covering over 40,000 crashes and over 50,000 claims to get a sense of the claim cost profile of different types of crash



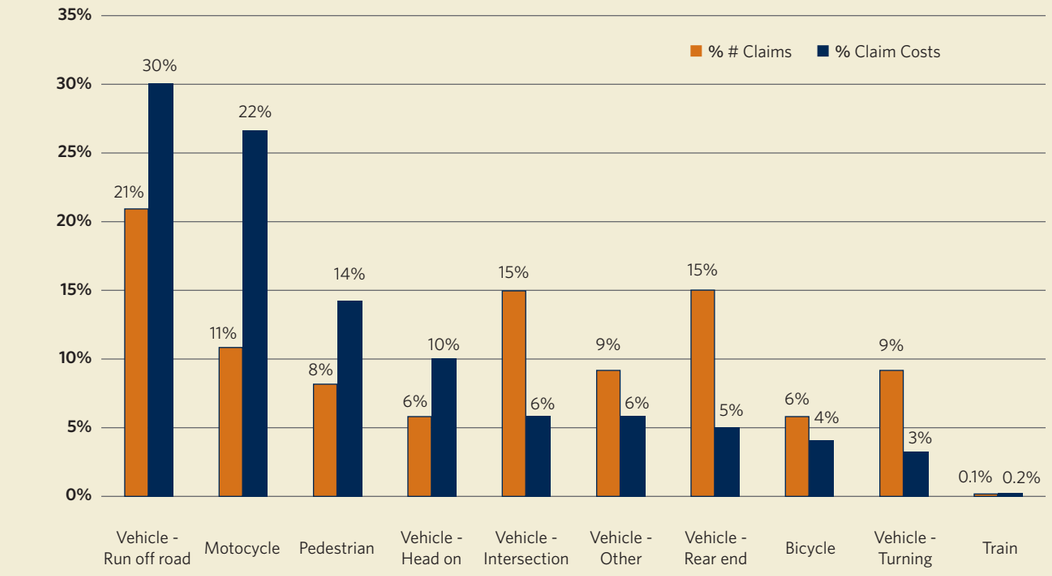
- Note: **Does not include** claims that have not been able to be mapped to VicRoads crash data
- Those claims are likely to include a significant proportion of minor clams

Plus 2,007 (4%) claims for which injury level not able to be identified

- Includes **insured costs only**
- Total estimated costs are likely to be slightly overstated because of exclusion of "unmapped" data set. FSI estimates are likely to be more accurate

Source: Analysis of TAC sample data set, 2016

FIGURE 3 – TAC DATA SET CLAIM NUMBERS AND TOTAL CLAIM COSTS STATE-WIDE BY CRASH TYPE (% TOTAL 2006 – 2010)



# FSIs	6,326	3,482	2,509	1,758	3,136	2.089	2,421	1,540	1,938	45

Source: Analysis of TAC sample data set, 2016 using Victorian crash data from 2006 - 2010

Focus of the investment

This investment case, in both scenarios, focuses on targeted infrastructure improvements to reduce the FSIs that occur on high volume roads. The focus is on the reductions in crash incidence and severity and associated injury related costs, which could be achieved by bringing forward funding to prevent more of these FSIs through targeted improvements to road infrastructure.

The investment case for infrastructure improvement

These scenarios demonstrate that there is an investment case to be made for both mature and less mature road systems based on financial considerations alone. However, the nature and scale of the investments and the resulting cost benefits vary.

At a state-wide level in Victoria 21% of all claims and 30% of all claim costs are associated with vehicle run-off road crashes. Motorcyclists account for a further 22% of claim costs, pedestrians 14% and vehicle head-on and intersection crashes 16% combined.

Just under a quarter of the FSIs and a third of the lifetime insurance costs incurred at a state-wide level are generated by crashes on high speed roads and highways.

The investment case focuses on the benefit of infrastructure-based improvements to high risk sections of high traffic volume roads and national highways to reduce the incidence of crashes likely to result in death or serious injury.

The intended effect of the infrastructure improvement program is to improve the star rating of the road network with an associated reduction in run off road, motorcycle, head on and intersection crashes in high risk locations. In each case, the interventions involve the installation of a mix of road infrastructure and roadside safety improvements including roadside barriers, roadside hazard removal, skid resistance, median barriers, intersection treatments and central hatching and delineation. The improvements were applied on major roads carrying traffic volumes of more than 5,000 vehicles a day. The interventions have been identified with that goal by applying iRAP's standard "Safer Roads Investment Plan" optimisation.[24]

Base Case – Victorian Road Networks

THE INTERVENTION - MULTIPLE INFRASTRUCTURE IMPROVEMENTS ON SELECTED HIGH VOLUME ROADS TO IMPROVE THE STAR RATING

The Victorian case study is focused on improving the safety of road and road side infrastructure to raise the star rating performance of the road and prevent and or reduce the severity of FSIs.

Based on analysis of the sample TAC data set, FSIs associated with the crash types targeted by the intervention on major roads with a speed limit of 100km per hour or more are estimated to increase lifetime TAC insurance claims costs by an average of AUD$143,945 per claim per annum.

That figure is based on analysis of a range of costs that are covered by the TAC as insurer, including claims administration, paramedical, hospital, medical and long term care costs as well as compensation for lost income, impairment and costs relating to dependents. Almost half of these lifetime claim costs, approximately 47%, are incurred in the first two years post-crash with the remaining 53% of costs being long-term costs incurred more than two years after the crash.

COST OF INTERVENTION

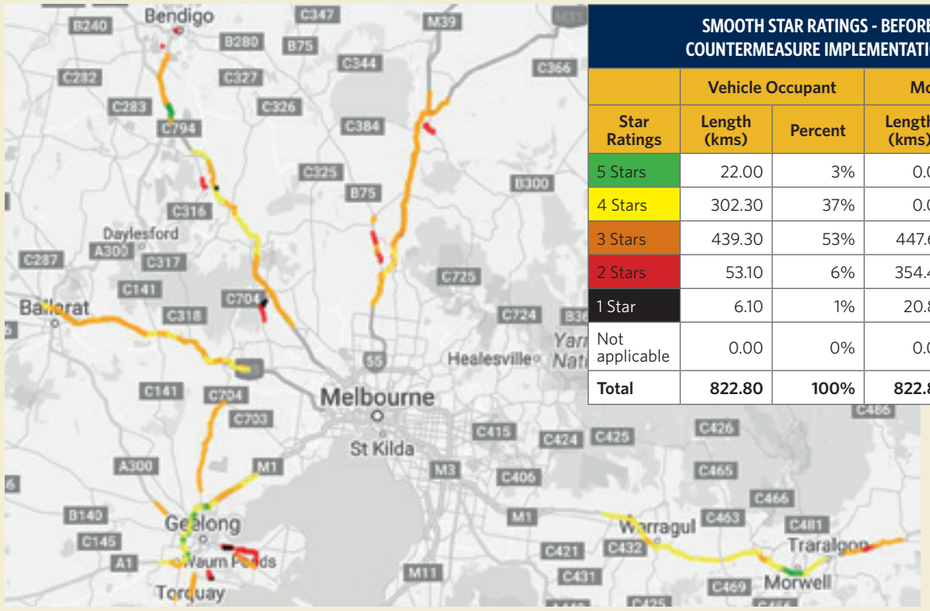
The proposed improvements are projected to cost approximately AUD$28.4M in upfront capital investment and a total of AUD$33.4M over a twenty year investment period (including maintenance costs) (Table 2). (It is noted that the TAC does not pay all

TABLE 2 – PROJECTED INVESTMENT COST

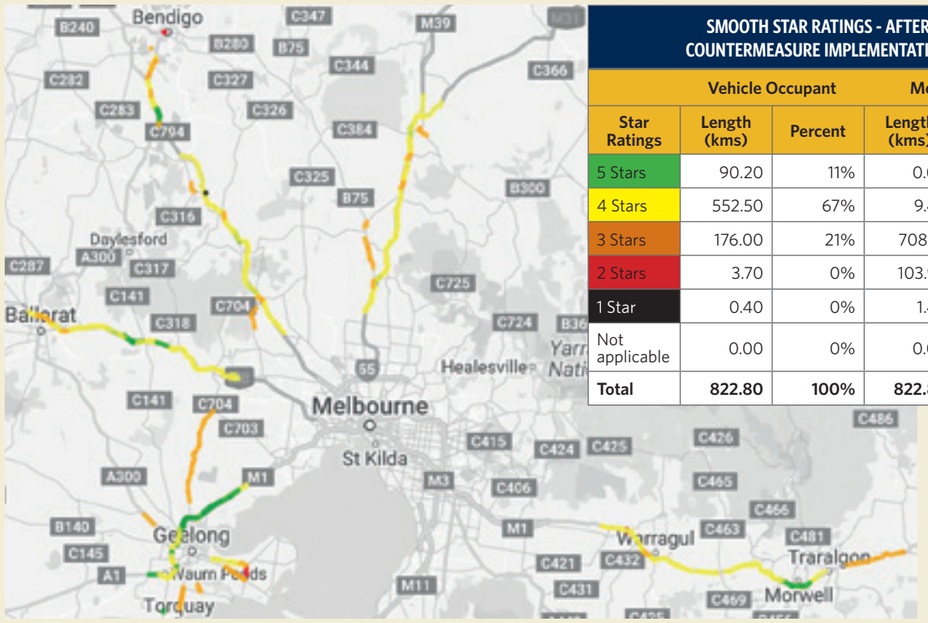
COUNTERMEASURE	KM APPLIED	TOTAL INITIAL INSTALLATION COST – AUD$	MAINTENANCE CYCLE (YEARS)	MAINTENANCE COST PER CYCLE – AUD$	TOTAL MAINTENANCE COST OVER TIME PERIOD – AUD$	TOTAL COST OVER TIME PERIOD – AUD$
Roadside Barriers	116	$17,000,000	1	$170,000	$3,230,000	$20,230,000
Roadside Hazard Removal	297	$8,400,000	10	$420,000	$420,000	$8,820,000
Skid Resistance	5	$650,000	20	-	-	$1,300,000
Median Barrier	5	$1,200,000	1	$24,000	$456,000	$1,656,000
Intersection Treatments	5	$1,000,000	10	$50,000	$50,000	$1,050,000
Central Hatching / Delineation	2	$100,000	5	$50,000	$100,000	$300,000
Combined Total	**-**	**$28,350,000**	**-**	**-**	**$4,256,000**	**$33,356,000**

Source: iRAP analysis utilising VicRoads data, 2016

FIGURE 4 - IMPACT OF INVESTMENT ON ROAD SAFETY STAR RATINGS[25]



SMOOTH STAR RATINGS - BEFORE COUNTERMEASURE IMPLEMENTATION				
	Vehicle Occupant		Motorcyclist	
Star Ratings	Length (kms)	Percent	Length (kms)	Percent
5 Stars	22.00	3%	0.00	0%
4 Stars	302.30	37%	0.00	0%
3 Stars	439.30	53%	447.60	54%
2 Stars	53.10	6%	354.40	43%
1 Star	6.10	1%	20.80	3%
Not applicable	0.00	0%	0.00	0%
Total	**822.80**	**100%**	**822.80**	**100%**



SMOOTH STAR RATINGS - AFTER COUNTERMEASURE IMPLEMENTATION				
	Vehicle Occupant		Motorcyclist	
Star Ratings	Length (kms)	Percent	Length (kms)	Percent
5 Stars	90.20	11%	0.00	0%
4 Stars	552.50	67%	9.40	1%
3 Stars	176.00	21%	708.10	86%
2 Stars	3.70	0%	103.90	13%
1 Star	0.40	0%	1.40	0%
Not applicable	0.00	0%	0.00	0%
Total	**822.80**	**100%**	**822.80**	**100%**

Source: iRAP analysis, 2016

TABLE 3 – PROJECTED FSI AND MINOR INJURY REDUCTION

TIME PERIOD	REDUCTION IN NUMBER OF INJURIES & CLAIMS			
	FATALITIES	SERIOUS INJURIES	MINOR INJURIES	TOTAL CLAIMS
Per year	2	12	10	24
Over 20 years	40	240	200	480

Source: Analysis of TAC sample data set and iRAP analysis, 2016

maintenance costs associated with road improvements, those additional costs are covered by Government road infrastructure authorities. For completeness the full set of costs has been included in this analysis.) The proposed investment plan would improve the Victorian network from the existing 40% 4-star or better standard to 78% 4-star or better for vehicle occupants, with all 1 or 2-star roads, the most dangerous, eliminated by the investment. The network would also improve from 54% 3-star or better to 87% 3-star or better for motorcyclists, with all 1-star roads for motorcyclists eliminated after the investment (Figure 4).

PROJECTED FSIs & COSTS AVOIDED

Using the iRAP intervention assessment model together with the TAC data it is projected that the interventions could reduce the incident of road trauma by approximately 14 FSIs and 10 minor injuries per year (Table 3).
A reduction in the number and severity of claims would translate to a reduction in claims costs which based on the sample data set, are estimated at AUD$2.5M per annum or AUD$34.7M when accrued over a 20 year time horizon; and total lifetime claims cost reductions are estimated to be closer to AUD$52.2M (Table 4).

TABLE 4 - REDUCTION IN CLAIM COSTS (% TOTAL BASED ON SAMPLE DATA SET 2006 – 2010)
The total projected cost savings can be broken down by the key categories of costs:

COST CATEGORY	% COSTS AVOIDED	COSTS AVOIDED ACCRUED OVER 20 YEARS - AUD$	LIFETIME COSTS AVOIDED - AUD$
Claims administration	2%	$549,591	$825,485
Ambulance / road accident rescue	3%	$1,122,210	$1,685,559
Hospital	15%	$5,315,435	$7,983,782
Medical	6%	$2,024,927	$3,041,440
Paramedical	15%	$5,286,533	$7,940,372
Long term care costs	24%	$8,362,359	$12,560,260
Income	14%	$5,018,327	$7,537,526
Impairment	5%	$1,874,660	$2,815,739
Dependency	14%	$4,945,710	$7,428,455
Legal	1%	$238,964	$358,924
Total claims cost reduction	**100%**	**$34,738,716**	**$52,177,542**

Source: Analysis of TAC sample data set and iRAP analysis, 2016

TABLE 5 – PROJECTED REDUCTION IN SPECIFIC INJURY TYPES (SUB-SET OF INJURIES LISTED)

FSI BREAKDOWN BY INJURY TYPE	REDUCTION IN NUMBER OF INJURIES & CLAIMS	20 YEAR COSTS AVOIDED – AUD$	LIFETIME COSTS AVOIDED – AUD$
Severe ABI	70	$8,657,433	$13,003,462
Brain Injury (Mild) / Head Injury	37	$4,575,234	$6,872,000
Quadriplegia	33	$4,056,231	$6,092,458
Paraplegia	14	$1,716,835	$2,578,686
Other	286	$10,379,734	$15,590,358

Source: Analysis of TAC sample data set and iRAP analysis, 2016

Assuming that the profile of injuries caused by the avoided crashes aligns with past trends then those costs reductions would translate to reductions in a number of severe long term, high cost injury types, including by way of example those listed below (Table 5).

BENEFIT COST RATIO

The investment case takes into account only the insured personal injury related costs covered by TAC, and only those savings that would be realised within the 20 year investment period. That delivers a BCR of 1.0 for the proposed infrastructure improvements based on the projected FSIs avoided (Figure 5). When the full lifetime claims cost saving is taken into account (that is, including savings that would be realised beyond the investment period) the BCR would be closer to 1.6 and would have an internal rate of return (IRR) of approximately 6%.

This indicates that there is a positive investment case for an insurer to 'bring forward' funding that would otherwise be paid out in insurance claim costs for interventions of the type proposed to help reduce road trauma and associated costs.

In fact, the TAC has already undertaken direct, asset-backed investments of the type described through the Victorian Safe System Road Infrastructure Program (SSRIP) for many years. Further investments in like infrastructure based interventions would continue to support the TAC to move 'Towards Zero' in line with its zero road death and serious injury target.

The Victorian Government recently announced an AUD$1B package of road improvements, driver training programs and research aimed at reducing the State's road toll. The package includes AUD$340M to be spent on barriers along black spots on regional roads and AUD$60M to be spent on metropolitan accident spots with an overall goal of reducing road deaths to below 200 by 2020.[26]

THE BROADER SOCIAL AND ECONOMIC BENEFITS OF PREVENTION

The above analysis looks at the tangible financial costs that would be saved by the TAC over time. Once private costs to individuals and their families, and the broader impacts on hospitals and the wider health system, communities, workplaces, governments and other road users are factored in, the social and economic case for action is even more compelling.

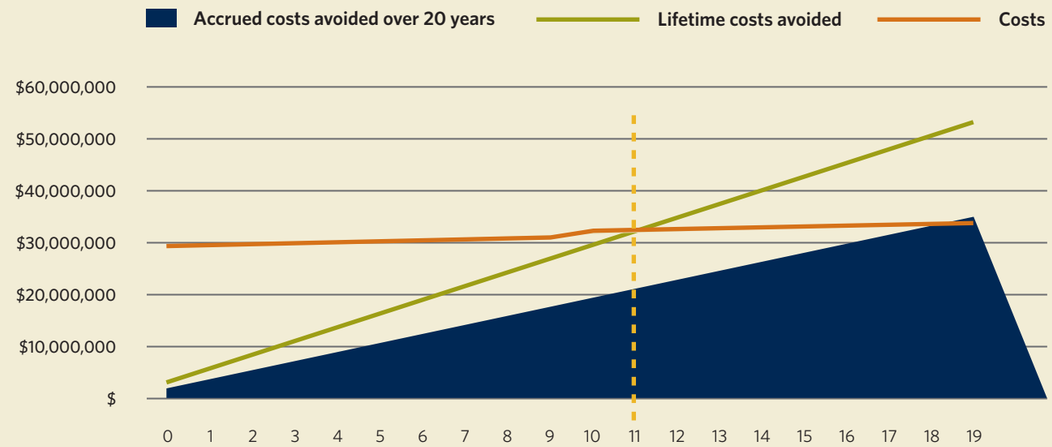
The Australian Bureau of Infrastructure, Transport and Regional Economics (BITRE) has developed 'willingness to pay' estimates to value the benefit of avoided road trauma that combine values for costs that are borne by individuals and their families, including provisions for non-economic costs such as pain and suffering, (private costs) and the broader social costs of road trauma borne by the community based on the impact that road trauma has on the health system, workplaces, government and other road users (social costs).

Based on the BITRE cost model the combined private and social benefit of the above investment would be approximately AUD$323.8M and would have a BCR of approximately 9.7 and an internal rate of return (IRR) of 130%.[27]

FIGURE 5 – PROJECTED COSTS AVOIDED

PERIOD	EST. COST AVOIDED - AUD$
Per annum	$2.5M
Accrued over 20 years	$34.7M
Lifetime	$52.2M

BCR	NPV	IRR
1.0	$1.38M	1%
1.6	$18.82M	6%



Source: Analysis of TAC sample data set and iRAP analysis, 2016

Comparison Case – Bruce Highway Queensland

THE INTERVENTION - MULTIPLE INFRASTRUCTURE IMPROVEMENTS ON SELECTED HIGH VOLUME ROADS TO IMPROVE THE STAR RATING

The investment case for infrastructure improvement on the Bruce Highway in Queensland[28] applies equivalent treatments in a different context. The aim of running the second investment case was to test the investment case based on claims costs saved for a less mature, higher risk setting as a point of comparison. The TAC sample data set was used to inform the cost calculations. Data from Main Roads Department of Queensland was used to inform the cost of interventions and the iRAP assessment model was used to model the projected reduction in FSIs attributable to improved safety of the road.

TABLE 6 – PROJECTED INVESTMENT COST

COUNTERMEASURE	KM APPLIED	TOTAL INITIAL INSTALLATION COST - AUD$	MAINTENANCE CYCLE (YEARS)	MAINTENANCE COST PER CYCLE	TOTAL MAINTENANCE COST OVER TIME PERIOD - AUD$	TOTAL COST OVER TIME PERIOD - AUD$
Roadside Barriers	506	$70,000,000	20	$ 700,000	$13,300,000	$83,300,000
Roadside Hazard Removal	63	$23,000,000	20	$460,000	$8,740,000	$31,740,000
Skid Resistance	35	$4,000,000	10	-	-	$8,000,000
Median Barrier	177	$15,000,000	10	$75,000	$1,425,000	$31,425,000
Intersection Treatments	154	$23,000,000	20	$230,000	$230,000	$23,230,000
Central Hatching / Delineation	50	$3,000,000	10	$1,500,000	$3,000,000	$9,000,000
Combined Total	**-**	**$153,000,000**	**-**	**-**	**$29,364,500**	**$204,364,500**

Source: iRAP analysis, 2016

It has also been done to demonstrate how granular claims cost data can be applied to a different setting, in this case in the same country, to help build the case for investment.

COST OF INTERVENTION

The scale of the investment program would be significantly larger than the Victorian one given the less mature existing condition of the network. The proposed interventions are projected to cost AUD$153M in initial capital investment and approximately AUD$204.4M over the full twenty year analysis period (including maintenance costs) (Table 6).

The proposed program would improve the road network overall from 54% 3-star or better to 99% 3-star or better for vehicle occupants with 35% 4-star or better and from 6% 3-star or better to 41% 3-star or better for motorcyclists based on iRAP star ratings (Figure 6).

PROJECTED FSIs & COSTS AVOIDED

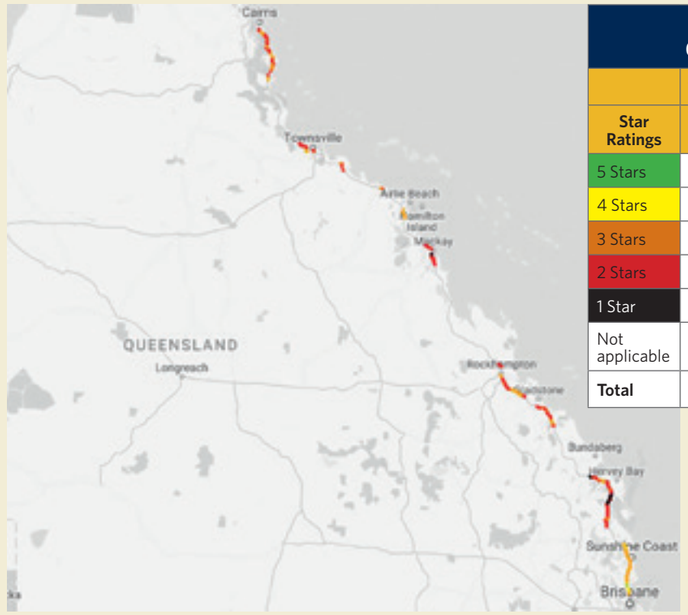
Using the iRAP intervention assessment model it is projected that the interventions could reduce the incidence of road trauma by approximately 150 FSIs and 100 minor injuries per year (Table 7). That would equate

TABLE 7 – PROJECTED FSI AND MINOR INJURY REDUCTION

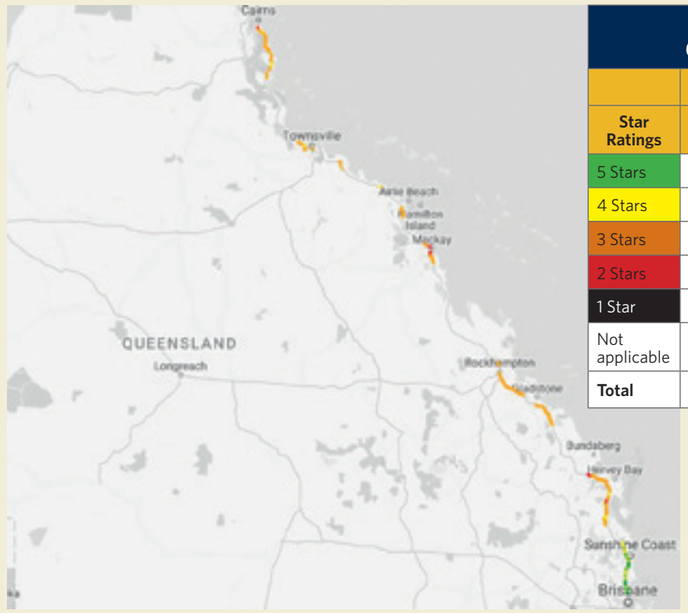
TIME PERIOD	REDUCTION IN NUMBER OF INJURIES & CLAIMS			
	FATALITIES	SERIOUS INJURIES	MINOR INJURIES	TOTAL CLAIMS
Per year	17	133	100	250
Over 20 years	340	2,660	2,000	5,000

Source: Analysis of TAC sample data set and iRAP analysis, 2016

FIGURE 6 - IMPACT OF INVESTMENT ON ROAD SAFETY STAR RATINGS



SMOOTH STAR RATINGS - BEFORE COUNTERMEASURE IMPLEMENTATION				
	Vehicle Occupant		Motorcyclist	
Star Ratings	Length (kms)	Percent	Length (kms)	Percent
5 Stars	3.00	0%	0.00	0%
4 Stars	41.90	7%	0.00	0%
3 Stars	294.20	47%	40.10	6%
2 Stars	272.60	43%	426.90	68%
1 Star	15.70	3%	160.40	26%
Not applicable	0.50	0%	0.50	0%
Total	**627.90**	**100%**	**627.90**	**100%**



SMOOTH STAR RATINGS - AFTER COUNTERMEASURE IMPLEMENTATION				
	Vehicle Occupant		Motorcyclist	
Star Ratings	Length (kms)	Percent	Length (kms)	Percent
5 Stars	85.80	14%	0.00	0%
4 Stars	129.80	21%	2.30	0%
3 Stars	399.30	64%	259.10	41%
2 Stars	12.50	2%	365.40	58%
1 Star	0.00	0%	0.60	0%
Not applicable	0.50	0%	0.50	0%
Total	**627.90**	**100%**	**627.90**	**100%**

Source: iRAP analysis, 2016

to an FSI reduction of 44% funded purely from the direct claim cost savings.

The nature and extent of the cost reductions relating to that number of FSI has been made based on the TAC cost data given the relatively comparable costs, services and service conditions in Queensland. It is noted that the actual claim costs in Queensland would be shared between the compulsory third party insurance providers and the Queensland National Injury Insurance Scheme and are not structured in the same way as TAC.[29]

Based on that assumed cost base, a reduction in the number and severity of claims would translate to a reduction in claims costs[30] which, based on the TAC sample data set, are estimated at AUD$27.0M per annum or AUD$371.7M when accrued over a 20 year time horizon; and total lifetime claims cost reductions are estimated to be closer to AUD$558.3M (Table 8). The total projected cost savings can also further broken down by the key categories of costs set out in Table 8.

TABLE 8 – REDUCTION IN CLAIM COSTS (% TOTAL BASED ON SAMPLE DATA SET 2006 – 2010)

COST CATEGORY	% COSTS AVOIDED	COSTS AVOIDED ACCRUED OVER 20 YEARS - AUD$	LIFETIME COSTS AVOIDED - AUD$
Claims administration	2%	$5,880,100	$8,831,908
Ambulance / road accident rescue	3%	$12,006,577	$18,033,876
Hospital	15%	$56,870,098	$85,418,872
Medical	6%	$21,664,798	$32,540,520
Paramedical	15%	$56,560,882	$84,954,430
Long term care costs	24%	$89,469,286	$134,382,844
Income	14%	$53,691,327	$80,644,359
Impairment	5%	$20,057,077	$30,125,725
Dependency	14%	$52,914,393	$79,477,405
Legal	1%	$2,556,691	$3,840,149
Total claims cost reduction	**100%**	**$371,671,228**	**$558,250,088**

Source: Analysis of TAC sample data set and iRAP analysis, 2016

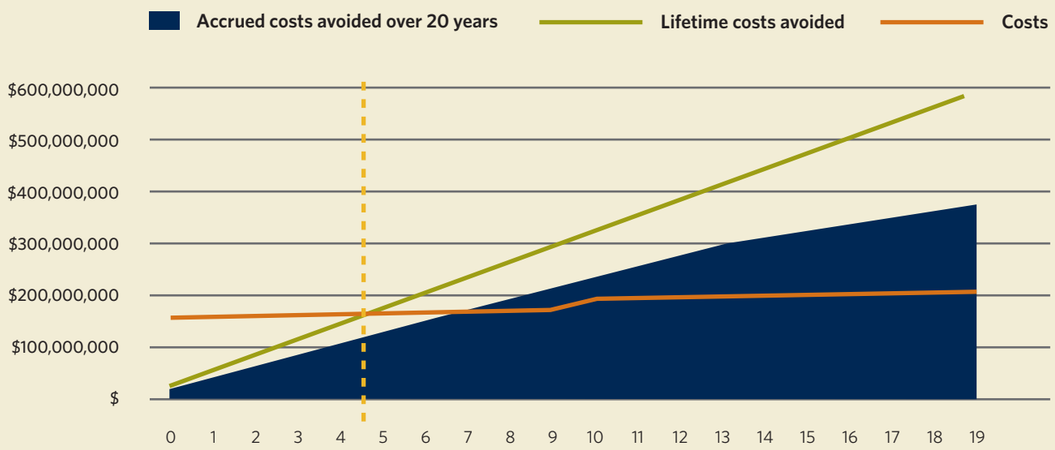
BENEFIT COST RATIO

The investment case is based on the same analysis of high-volume roads carrying 5,000 vehicles a day or more and using the TAC sample data set for the modelling of claim costs and savings over the same 20 year period. As the existing road network is less safe (54% 3-star or better in Queensland versus 93% 3-star or better in Victoria) more higher return treatments can be applied with an overall BCR of 1.8 (Figure 7). When the full lifetime claims cost saving is taken into account (that is, including savings that would be realised beyond the initial 20 year investment period) the BCR would be closer to 2.7 and would have an IRR of approximately 20%. As expected, the investment business case on higher risk roads is greater and highlights the high returns available by targeting impact investment to these higher risk, less developed road networks. There is therefore an even stronger investment case to 'bring forward' funding for interventions of the type proposed on higher risk networks such as the one analysed here compared to more mature networks such as the Victorian one.

FIGURE 7 – PROJECTED COSTS AVOIDED

PERIOD	EST. COST AVOIDED - AUD$
Per annum	$2.5M
Accrued over 20 years	$371.7M
Lifetime	$558.3M

BCR	NPV	IRR
1.8	$167.39M	12%
2.7	$354.00M	20%



Source: iRAP analysis, 2016

The Australian Federal and Queensland State Governments have directly funded improvements to the Bruce Highway since 2011.[31] Those improvements have started to translate into reductions in FSIs. The Australian and Queensland Governments have committed $8.5B to a ten year Bruce Highway Upgrade Programme from 2013.[32]

BROADER SOCIAL AND ECONOMIC BENEFITS OF PREVENTION

The greater impact of the investment on FSI reductions given the less mature nature of the network translates into both a higher upfront investment cost and a higher return. Based on the BITRE cost model which takes additional combined private and social benefit into account, the case for infrastructure improvement of the Bruce Highway on a willingness to pay measure would be approximately AUD$3.3B and would have a BCR of approximately 17.2 and full return of capital costs within the first year.[33]

CASE 2: CAMBODIA – ASIA INJURY PREVENTION FOUNDATION

Safer road users – investment in changing behaviours

BOX 2 – CASE 2 OVERVIEW

OVERVIEW					
Safe system focus	**Nature of Investment**	**Intervention**	**Country economic setting**	**Road Network Development**	**Current data availability**
Safer road users	Outcomes focus – impact bond	Behaviour change to increase motorcycle passenger helmet use	Low-middle income	Low-moderate	Low-moderate

Key points of the investment case

- Impact bond case study concerning the recently completed "Head Safe. Helmet On" initiative, a behaviour change intervention to increase motorcycle passenger helmet use in Cambodia integrating a school-based programme, mass media and grassroots awareness-raising campaign, and legislative and enforcement advocacy
- Intervention-level data includes cost-benefit and return on investment analysis and actual baseline and mid-term results data

Impact Bond Analysis

- Saves 14 fatal injuries and 260 other casualties over 3 years
- Investment case of modelled outcomes framework based on expected financial cost savings: an IRR of 4% at the target improvement rate of 60% observed helmet wearing and up to 6% depending on increased helmet usage before any broader social and economic costs taken into consideration
- Broader savings and benefits in economic, social and human cost
- Explores impact of 'hidden' costs of Road Traffic Injuries (RTI) to households and to the economy; highlights the case to capture and quantify these hidden costs, leading to a more compelling case for investing in prevention

Insight
Design of an investment case focused on outcomes has the power to align incentives towards social impact, and the potential to provide incentives for sustained preventive action

Key Data Partner: Asia Injury Prevention Foundation (AIP Foundation)
AIP Foundation is a leading NGO dedicated to preventing road injuries and fatalities in LMICs, with a track record of delivering influential advocacy and behaviour change programmes in Vietnam, Thailand, Cambodia, China, and Uganda

PHO & PHAL'S STORIES: HIDDEN COSTS FOR HOUSEHOLDS[34]

With thanks to M. Ericson & P. Kim, and to Pho, Prek and their families.[34]

EVEN MINOR INJURIES CAN IMPACT HOUSEHOLD INCOME

Sixteen year-old Pho Sreychan was riding her bicycle to school when she was hit by a truck on the highway. Pho broke her arm in the accident and spent three days in hospital.

The family received no compensation but was able to pay Pho's $128 medical expenses from the sale of a cow for $454. The household's income temporarily fell by 11 percent from pre-accident levels as her mother was providing care. Pho recovered fully within two months, and the household's income has since recovered.

FOR SERIOUS INJURIES THE IMPACT ON HOUSEHOLDS CAN BE SIGNIFICANT

Eighteen year-old Phal Prek collided with another motorcycle. His most serious injury was a badly broken leg and he spent 30 days in hospital. Prek's mother cared for him, and he returned to work as a construction labourer six months after the accident.

Phal's medical costs required the family to sell their farming land and house (to the value of $1,645), farming implements and animals, motorbike, bicycle, television and a number of other possessions. The family received $15 compensation, but reported selling assets totalling $2,304. Phal's younger brother stopped going to school for two years and his father left the district to work as a labourer. The landless family lives in a thatch house with an earthen floor and its real income has fallen by 38 percent from pre-accident levels.

CONCLUSION

These case studies demonstrate the alarming potential impact of RTIs on private households in LMICs. As the case of Phal illustrates in particular, the immediate medical costs that result from an injury have far-reaching impacts upon his family's quality of life, financial resilience, and by his brother's dropping out of school, their long-term social outcomes - impacts that are rarely captured in traditional valuations of the costs of RTIs in LMICs.

Introduction – road safety in Cambodia

Cambodia is in many ways a typical LMIC with regard to road safety. The number of registered motor vehicles has risen by more than 160% since 2009, but the rate of deaths and serious injuries on the roads has also increased. In 2013 there were an estimated 2,500 Road Traffic Fatalities.[35]

Motorcycle use in Cambodia is very high; in 2012 motorcycles represented 80% of the total motorised vehicle fleet.[36] Death and injury among motorcycle drivers and passengers is also very high. Motorcyclists account for 73% of fatalities on the roads.[37] Low levels of helmet use in the country play a major part in this: in 2014, 80% of motorcycle drivers killed in a crash were not wearing a helmet and 69% of motorcycle drivers and passengers suffered head injuries in crashes. A staggering 99% of children killed were not wearing a helmet.[38]

AIP Foundation - Key case study data partner

AIP Foundation is a leading NGO dedicated to preventing road injuries and fatalities in LMICs, with a track record of delivering influential advocacy and behaviour change programmes in Vietnam, Thailand, Cambodia, China, and Uganda.

In Cambodia, AIP Foundation was instrumental in lobbying for legislation that passed in 2015 making motorcycle passenger helmet use mandatory, and are now implementing an innovative two-year behaviour change intervention, "Head Safe. Helmet On" (HSHO).[39] Commencing in June 2014, HSHO is a holistic behaviour change intervention that brings together a range of public stakeholders to create a societal shift in attitudes towards helmet use. Building on recent legislation, its target is to increase motorcycle passenger helmet use in six target districts in Cambodia from an average of 10% in 2014 to 60% in 2016. If successful, AIP Foundation intend to seek support to scale up the intervention to other provinces of Cambodia and expand into neighbouring countries.[40]

Focus of the investment - impact bond approach to financing behaviour change

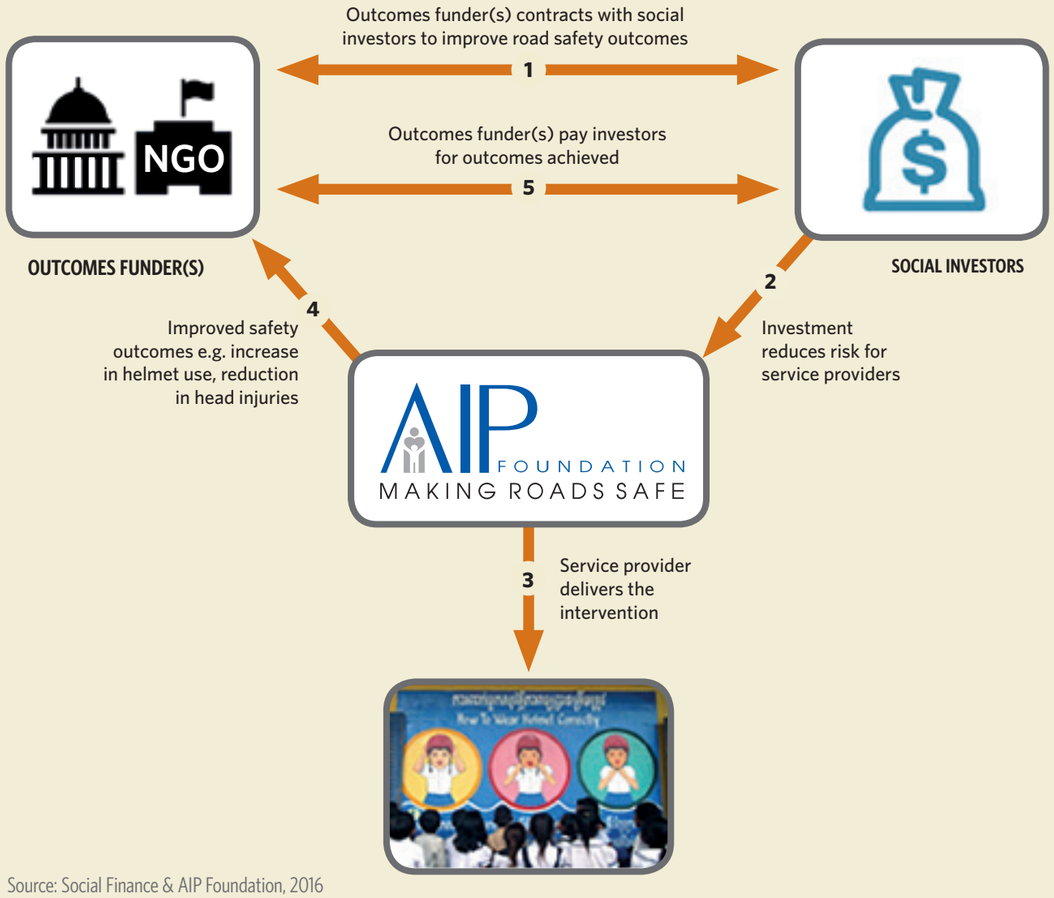
This case study explores how an investment case can be applied to the HSHO model to link the reduction in FSIs from increasing passenger helmet use to avoided costs. Specifically, the investment case models how the HSHO model could be financed using an impact bond.

Impact bonds are a relatively new form of financial instrument, developed to facilitate investment in preventive programmes designed to achieve improved social outcomes. The financial return on investment is linked to the success in achieving those outcomes. Impact bonds are being explored in various LMIC contexts for a number of social issues as a way of transferring risk for delivery away from governments, who may not have the resources to finance innovative programmes that are not proven, to social investors, while also placing the focus on outcomes rather than outputs, rigorous data collection, and adaptive management.

Impact bonds represent a partnership between outcomes funder(s), service provider(s) and social investor(s) (Figure 8). Investors provide up-front capital to finance a programme or set of interventions with the objective of achieving specified social outcomes that the outcomes funder wants to achieve and is willing to pay for if, and only if, the project achieves the agreed outcomes. In that case the outcomes funder repays investors their capital, plus a return. Risk of achieving outcomes is shared between investors and the outcomes funder(s). In high-income countries, the outcomes funder is usually a government agency, while in LMICs, donor agencies or philanthropic foundations might act as an outcomes funder, either instead of or alongside a government agency.

Impact bonds were first pioneered in the UK in 2010 and have since attracted global interest as an instrument that can enable governments to pilot innovative programmes that focus on prevention, or find the capital necessary to scale up proven interventions, through a risk sharing mechanism with private or philanthropic investors. There are now over 60 impact bonds launched across 15 jurisdictions, targeting a range of social issues.[41]

FIGURE 8 – AN IMPACT BOND MODEL TO INCREASE HELMET USE BY MOTORCYCLE PASSENGERS



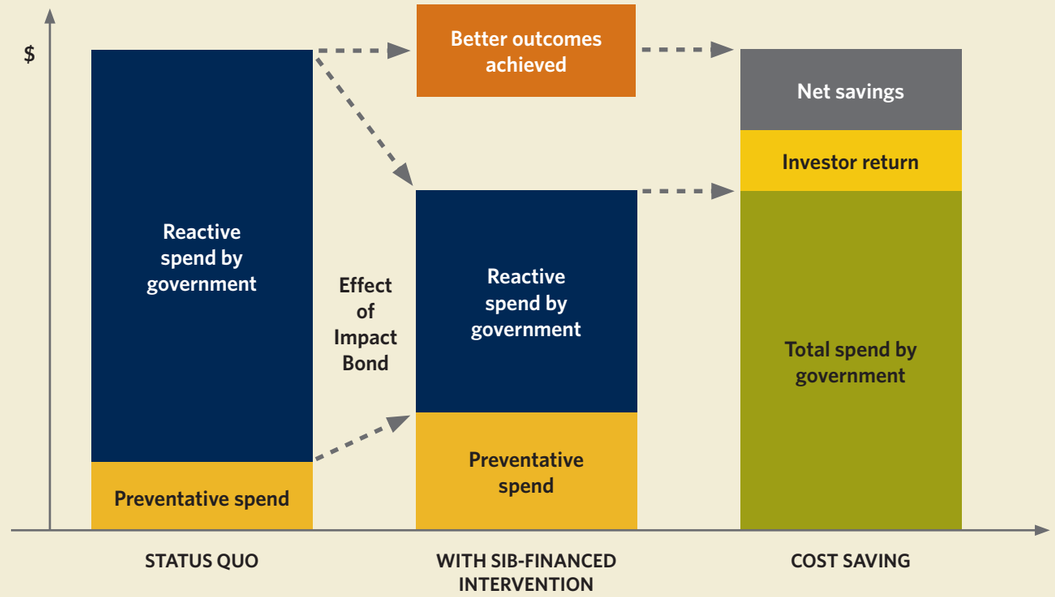
Source: Social Finance & AIP Foundation, 2016

The potential benefits of the impact bond model in an LMIC context include:

- Outcomes funders only pay for success;
- A focus solely on outcomes (rather than inputs or activities) allows for flexibility and adaptive management to overcome challenging delivery circumstances;
- Monitoring outcomes requires rigorous data collection and measurement, which builds the evidence base to understand what works; and
- Fosters partnership working between stakeholders that may not typically work together e.g. NGOs, donors, investors, and government.

The intention of the design is to encourage and facilitate investment in a preventive intervention, in order to avoid or avert a problem, and the costs (reactive spend) associated with it (Figure 9). Understanding the costs of the problem and, in consequence, the costs that could be avoided if the improvement in agreed outcomes can be achieved is a key determinant of how to value outcomes and set a price for success.

FIGURE 9 - ALLOCATION OF COST SAVINGS FROM PREVENTATIVE SPEND IN AN IMPACT BOND



Source: Social Finance & AIP Foundation, 2016

The HSHO model provides a suitable test case for an impact bond in a LMIC context. There is a strong theory of change based on success in other jurisdictions, the model is data driven and there is a robust measurement framework. There are also variables for implementation of the intervention that enable sharing of risk and return, and there is uncertainty as to the effectiveness of the programme when transferred from another country.

- Replication risk: while AIP Foundation has evidence of its effectiveness in other countries,[42] it is not certain to achieve the same level of effectiveness when the programme is transferred to a new country, when untested local adaptations to the programme are also likely to be required. Uncertainty, or risk, may lead to reluctance on the part of governments or other potential outcome funders to fund a programme directly, even when there is a strong case for cost saving if the outcomes are achieved. By sharing risk with investors, an impact bond structure unlocks the opportunity to fund programmes on the basis of the outcomes actually achieved.[43]

- Data driven intervention: the HSHO programme has a solid measurement and evaluation framework, and already has a strong focus on capturing data on the effectiveness of the programme. This enables success metrics to be identified based on which an impact bond can be developed. It also means that the programme can contribute to expanding the evidence base for this type of behavioural road safety intervention in LMICs. The level and robustness of data collection in Cambodia on road accidents, while well developed for an LMIC context, is still far behind that of high income countries. Programmes with a strong monitoring and evaluation component which collect data on outcomes are important not only for their impact, but also for their contribution to the body of research and evidence base.

The impact bond investment case modelled below is based upon the HSHO design and model, in particular target levels of increased helmet wearing aimed for by the programme. Specifically, increasing motorcycle passenger helmet use at a district level from 10% to 60%.

At the time of writing this report, end of programme surveys have been conducted but the results have not been published. The survey results illustrate some of the variables and learning from the implementation process. In particular, while significant improvement has been seen in the school based element of the programme and a high level of awareness of the new law among the wider public was reported, there was a shortfall in reaching the original overall district level target. The relationship between these factors is still being explored, in particular, the extent to which the shortfall is due, wholly or in part, to significant delays in the enforcement element of the programme.[44] For the purpose of this case study, modelling has been based on the original programme design and targeted final passenger use rate of 60%, as if the whole programme, including the enforcement element, had been delivered for the period planned.[45]

The investment case for the HSHO behavioural intervention

THE INTERVENTION - HSHO MODEL OVERVIEW

The HSHO model is designed to dramatically increase motorcycle passenger helmet use in three provinces of Cambodia (six districts in total), including Phnom Penh. The starting point is a baseline of 10% passenger helmet use at a district level, established through helmet observations conducted immediately prior to the commencement of the intervention in June 2014. The intervention aims to increase passenger helmet use to 60% by June 2016, with the overall objective of reducing the total number and severity of deaths and head injuries sustained on the road.

The HSHO model has three core components (Figure 10), designed to complement each other to influence public attitudes and change behaviour:

- A **school based programme,** in which free helmets are provided to students at 18 primary schools across the target districts, accompanied by education and training for students, teachers and parents delivered in the classroom and assemblies and at other events.
- A **behaviour change campaign,** delivered through mass media channels (TV, radio, print) and consisting of advertisements and other initiatives; also street-based awareness events and direct communication activities.
- Activities focused on the **enabling environment,** in particular improved enforcement of the passenger helmet law, and engaging with enforcement and wider stakeholders through a series of meetings, workshops, and study tours. In addition, advocacy and working with stakeholders to develop an enforcement action plan.

FIGURE 10 – 'HEAD SAFE. HELMET ON' (HSHO) IN PRACTICE

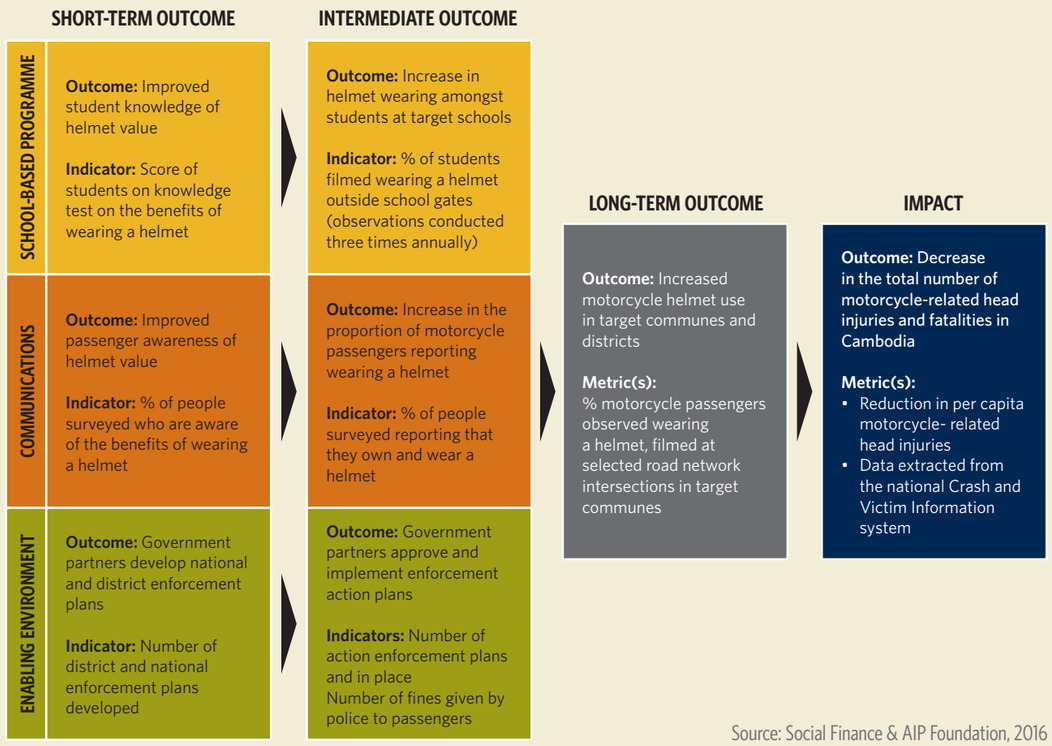
School-based programme:
School-based education and events targeting 21,000 students and 22,000 teachers and parents

Behaviour change campaign:
Targets 121,000 commune residents through a mass multimedia and grassroots campaign; 48,500 will receive literature and/or helmet voucher

Enabling environment:
Targets 650 senior and operational stakeholders engaged at commune, district, and national levels to improve enforcement of 2015 passenger helmet law

Source: Social Finance &AIP Foundation, 2016

FIGURE 11 – HSHO OUTCOMES FRAMEWORK



Source: Social Finance & AIP Foundation, 2016

HSHO's monitoring and evaluation (M&E) framework (Figure 11) covers a range of: outputs; short, intermediate and long term outcomes; and impact: [46]

COSTS OF THE HSHO INTERVENTION

The full two-year HSHO programme cost is US$ 1.1M[47]. The investment case assumes that the impact bond would finance the existing HSHO programme over the same timeframe with the same cost structures delivering the intervention to the current design.

MODELLING THE HSHO INTERVENTION AS AN IMPACT BOND

The HSHO model is well-defined. Therefore, the questions to consider when developing an impact bond investment framework for it focus on identifying appropriate, measurable outcomes that are aligned with success and on the payment framework.

OUTCOME METRICS – DEFINING SUCCESS

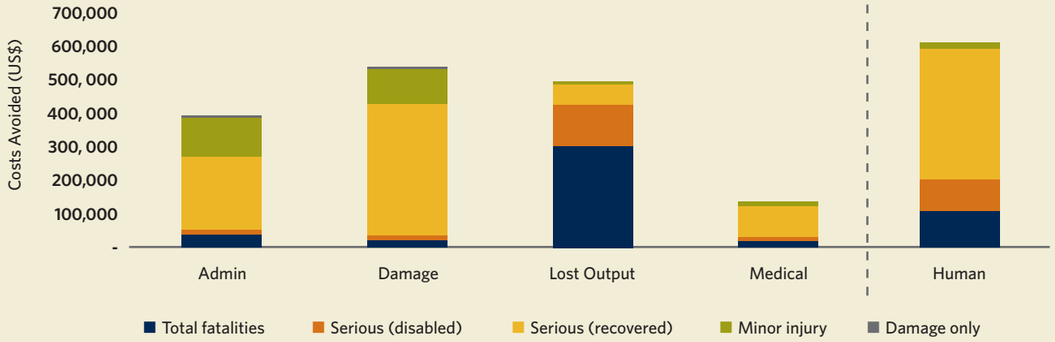
For the purpose of the investment case, outcome metrics need to track the effect of HSHO on helmet wearing and link that to the number of FSIs on the roads in the relevant districts. Two principle outcome metrics were considered: Option 1: increase in the observed percentage of motorcycle passengers wearing a helmet (i.e. the long-term outcome under the HSHO M&E framework); and Option 2: decrease in total number of head injuries and fatalities resulting from motorcycle accidents.

Of these, Option 2 would ideally be the better choice, as it is more closely aligned with the impact objective under HSHO's M&E framework and is more directly linked to the financial and economic benefit in terms of costs avoided to a government or other outcomes funder on whom cost falls. However, the difficulty with Option 2 is the reliability of data on crashes and casualties in Cambodia, such that it is not possible to use this as an outcome metric in an impact bond underpinning outcomes payments.[48] Therefore, for the purpose of the investment case, it has not been used, and Option 1 is preferred. Option 1, increase in helmet use, is a proxy measure for the ultimate intended impact of reducing injuries, but can be (and under the HSHO model, is) measured directly; external factors, such as an increase in motorisation over the two year intervention period, can also more readily be accommodated. Importantly, use of such a proxy measure takes account of the good evidence that exists for the efficacy of helmets in preventing fatalities and reducing the severity of injuries,[49] enabling a link to be drawn between helmet wearing and FSI, particularly head injuries.

PROJECTED BENEFITS - VALUING THE OUTCOMES

For the purposes of the investment case, AIP Foundation cost-benefit data[50] was separated into economic costs of FSI and broader human costs. Figure 12 shows the distribution of lifetime avoided costs assessed by AIP Foundation (see Appendix 2 for methodology) across five different cost categories, if the intervention achieves the targeted increase in helmet usage.

FIGURE 12 - DISTRIBUTION OF AVOIDED COSTS OF THE HSHO INTERVENTION FROM TARGETED INCREASE IN HELMET USE



Source: Social Finance & AIP Foundation, 2016

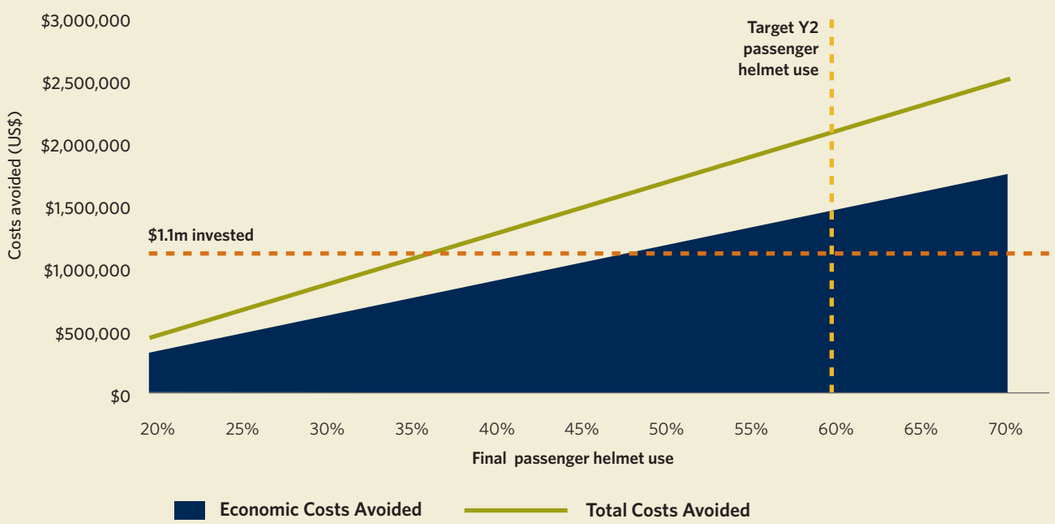
It is startling that the smallest cost category is Medical (6%), which constitutes immediate medical expenditure at a health facility following an accident. This suggests the relative expense of healthcare in Cambodia and an unwillingness to seek more health support than is absolutely necessary, and also the likelihood that significant hidden are costs not captured in this analysis.[51]

BENEFITS & COSTS

The investment case is modelled on the current costs based on AIP Foundation calculations excluding human costs.[52] That modelling projects that the targeted increase in helmet use from the baseline of 10% to 60% in the three HSHO provinces would result in costs avoided of US$1.4M, offering a return compared to the programme cost of US$1.1M.

Although costs avoided are over a person's lifetime, the large majority occur within the intervention timeframe or shortly thereafter. Damage and Administration are immediate costs, as are Medical. Healthcare is expensive relative to income in Cambodia and private medical insurance ownership is low, so that households typically avoid incurring additional formal medical expenditure where possible.[53] Of the five cost categories included in the calculation, 'lost output' is the principal category for which future projected costs are included; for fatal injuries, the economy (and private households) will experience this cost over a number of years.[54]

FIGURE 13 – ECONOMIC COSTS AND HUMAN COSTS AVOIDED OVER THE TWO YEAR HSHO INTERVENTION



FINAL PASSENGER - HELMET USE	FSIs PREVENTED	TOTAL COSTS AVOIDED	ECONOMIC COSTS AVOIDED ONLY
20%	48	$423,400	$304,600
30%	93	$820,100	$590,000
40%	137	$1,216,900	$875,400
50%	182	$1,613,600	$1,160,800
60%	227	$2,010,400	$1,446,200
70%	272	$2,407,100	$1,73 1,700

Source: Social Finance & AIP Foundation, 2016

Figure 13 shows how different success rates for HSHO, measured as a percentage increase in observed helmet wearing, affects the investment case for the intervention. For the intervention to pay for itself out of direct costs avoided, increased helmet wearing at a rate of almost 48%[55] is required. While lower than the HSHO target of 60%, this nonetheless requires a significant improvement from the 2014 baseline of 10% in challenging delivery circumstances. However, if a government or another outcome funder places value on the Human Cost element from the AIP Foundation calculations,[56] the breakeven point is at a lower final helmet use rate of 37%.

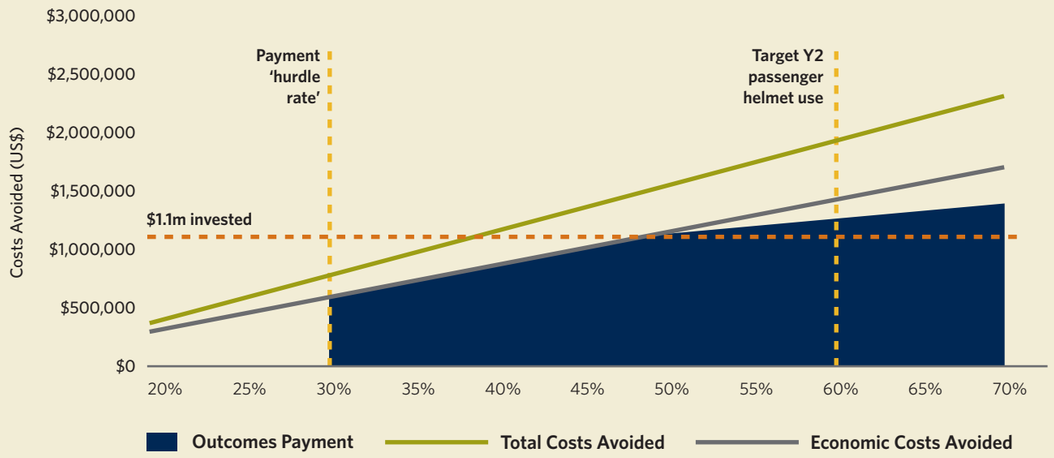
We can use this understanding of the relationship between impact of the intervention and costs avoided can be used to model an illustrative impact bond payment framework for the HSHO model (Figure 14).

The key assumptions on which the framework is based and the modelling insights flowing from them are:

- Baseline district passenger helmet use measured before the intervention of 10% (May 2014).
- Elements of the HSHO model implemented on time and on budget.
- A single measurement point - final passenger helmet use is measured once in the last month of the intervention (May 2016). The full amount of outcomes payments is contingent upon this final measurement (as opposed to progressive/interim payments).
- Outcomes funder(s) are willing to pay for outcomes on the basis of financial costs avoided only. That is, outcomes payments are in direct proportion to cost savings generated by the intervention.
- There is a 'hurdle' rate of 30% helmet use - the model assumes that a minimum level of improvement from the 10% baseline must be achieved before any part of the investment is repaid. Beyond that, outcomes payments increase in direct proportion to avoided costs up to the breakeven point.
- After the breakeven point (48% passenger helmet use), outcomes payments still increase in proportion to costs avoided but at a lower rate. This illustrates how savings above the investor breakeven point might be shared between investors and outcomes funders.
- From an investor perspective, this is also the point at which principal is repaid and they would start to see a return on their investment.
- A cap has been applied on the total amount of outcomes payments when helmet use equals or exceeds 70%. This is at a total repayment of US$1.4M, or a 26% return on capital invested over two years.[57] This represents a significant impact – 14 fatal injuries and 260 other casualties avoided, and US$1.73M in economic costs avoided.

The analysis presented is a simplified, illustrative, model that could be developed and adapted, whether to incentivise different behaviour and outcomes or to reduce risk elements to investors or outcomes funders. For example, progress payments made midway into the programme for intermediate outcomes would accelerate return of capital to investors and improve the financial profile for them; conversely deferring all or a proportion of the outcomes funding to be contingent upon observed behaviour measured, say, 3 or 6 months after the end of programme delivery would incentivise a delivery model that focused on sustained behaviour change. A different approach could be to weight outcome payments towards particular groups of people, for example children, if the overall objective was to focus impact on preventing injuries to children. There are many ways in which the basic model can be adapted; the key is to be clear about the sustainable change that is sought, and to align outcomes and stakeholders towards that objective.

FIGURE 14 - EXAMPLE OUTCOMES PAYMENT FRAMEWORK FOR THE HSHO IMPACT BOND



Source: Social Finance & AIP Foundation, 2016

INSIGHTS THAT INFORM THE WAY FORWARD

The investment cases set out in this report demonstrate the potential for an impact investment approach to be applied to road safety. They show how an impact investment logic can be applied to different interventions in different settings utilising different investment products and structures. The analysis provided a number of insights that can inform and accelerate that work. It reinforces key challenges previously identified: the size of the investment task, capacity for implementation and data to inform the evidence base. It also sheds light on opportunities.

Having credible, reliable and meaningful data that illustrates the relationship between accidents, injury and cost and that demonstrates the efficacy of particular interventions is critical to an investment case. The work for this report starts to break down the categories of data and that could be applied more broadly, by using existing data sets and by developing protocols for future collection. Approached collaboratively by organisations active in road transport and safety, this could inform an evidence base for investment in prevention.

The investment cases modelled in this report are small compared with the size of the investment challenge, estimated at more than US$680B over the next 2 decades.[58] This underscores the need for approaches that can scale. Demonstration initiatives that have a strong investment case in their own right could provide both proof of concept and learning that can be translated across different settings and to inform larger investment vehicles over time.

The investment cases also illustrate the multi-stakeholder nature of road safety and road trauma. In Australia, the infrastructure investment case required input from the TAC, VicRoads and modelling from iRAP. In Cambodia, the collaboration with schools, enforcement agencies, state agencies collecting data and media are all critical elements for implementation of the HSHO programme. The investment approach needs to take into account the different parties involved in delivery. Clearer focus on this element can address capacity issues and shed light on what parties have an incentive to invest in building capacity.

The focus on who stands to benefit from successful preventive measures can help identify a broader pool of potential funders and investors with an interest in safer roads. And, focussing on the financial case highlights the significant wider impact of prevention through avoidance of broader social and economic costs, including often catastrophic costs to households.

Data is critical

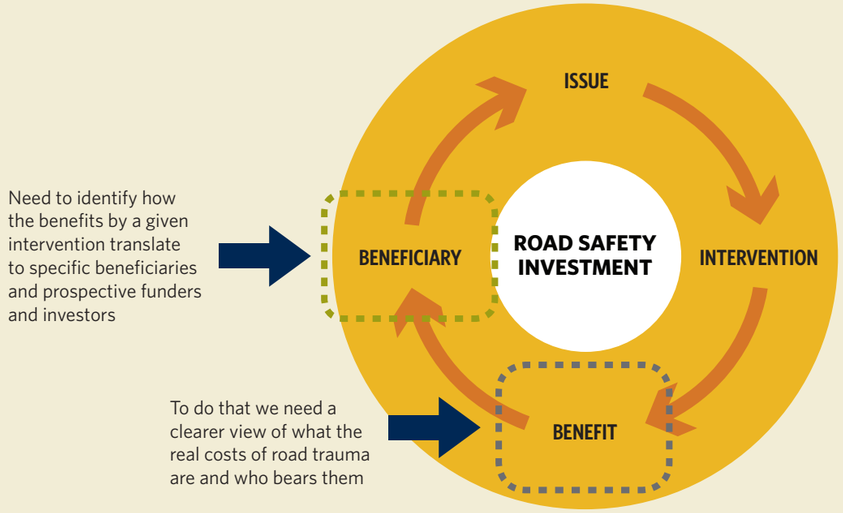
Data is critical to inform the investment case and enable measurement of performance. Given the volume of data in the road safety field, it was both surprising and encouraging that applying a different lens could elicit different data samples and provide new insights.

The methodologies applied to arrive at the investment cases in this report are set out in Appendix 2. The key difference between the investment case analysis and the significant body of work that has considered the social and economic costs of road trauma is the categories of data and their relationship to one another. Granular data in a format that can be mined by crash types, injuries and detailed financial costs underpins the analysis. And, as the cases show, where data is available for specific key cost categories including emergency services, medical, hospital, dependency, welfare and related costs and legal expenses, that significantly strengthens the investment modelling. Where the model can draw on data collected over a period of time, it is stronger still.

Identifying more clearly the data required to underpin an investment case also shed light on the gaps, including gaps in what is collected, how consistently, and the quality of data. Not surprisingly, variability in what data is collected and its consistency and veracity varies across different settings.

While the data gaps highlight that there is significant work to be done, the calculator approach tested in the investment cases can be applied as first step to identify key data categories. Provided the data is

FIGURE 15 –THE 'MISSING PIECE' OF THE FUNDING PUZZLE: IDENTIFYING AND SIZING THE BENEFIT FOR PROSPECTIVE FUNDERS AND INVESTORS OF INVESTING IN ROAD SAFETY



Source: Breaking the Deadlock, 2015

available and can be calibrated to the satisfaction of investors and other stakeholders, the investment logic grounded in data can be adapted for different settings and interventions and the calculator approach can be developed to inform methodologies that prioritise collection of key data points. This can be designed to link with both the elements of the safe system for road safety and to the policy and action priorities developing for the SDGs.

Prospective funders and investors

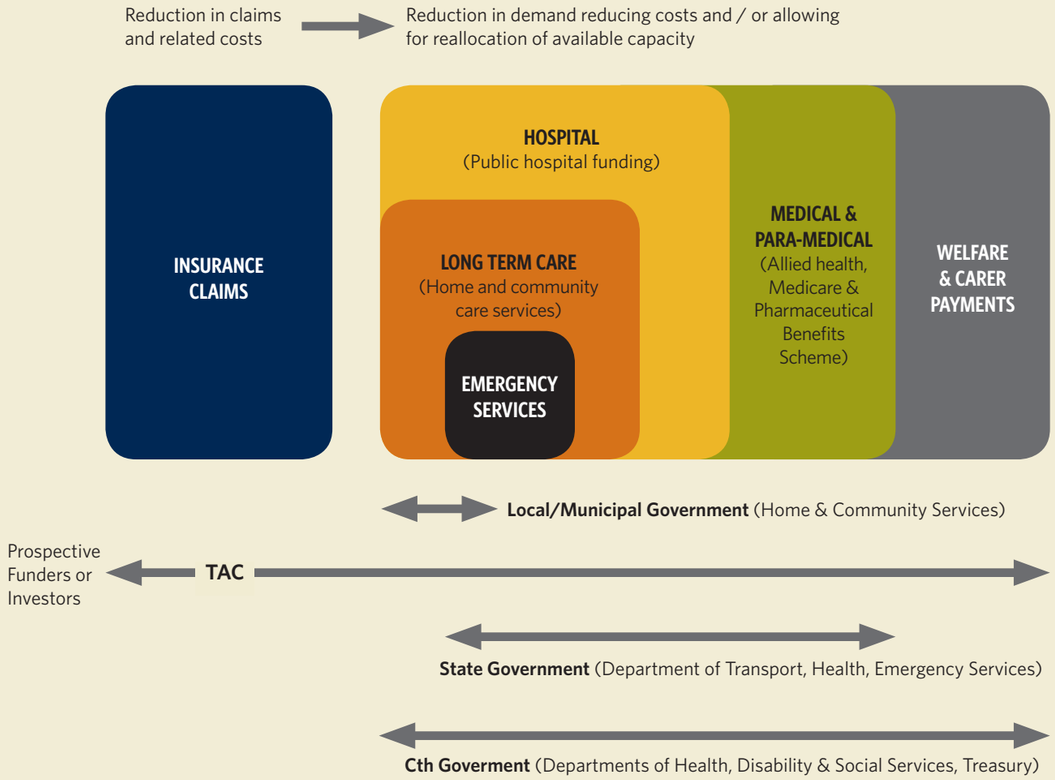
The assessment of costs based on data also helps clarify who will benefit. This will vary across different settings, particularly whether and what healthcare and insurance systems exist. In many cases, it is parties who, in addition to the people injured and their families, bear the costs incurred (Figure 15) of FSI and their effects, including governments, other health and service providers, employers, insurers and donor organisations. This is significant when considering how best to draw capital into road safety investments.

Once it is clearer who bears the costs of poor results, this can inform consideration of how to align or change incentives for those parties to become prospective funders and investors of prevention on the basis it is a better financial outcome for them as well as a better outcome for the people and communities affected by road trauma.[59]

The analysis of who bears the costs now also highlights where those costs are creating more demand for services. This can highlight the areas of government beyond those with direct responsibility for roads and safety that benefit from reduced costs and demand. Projected cost reduction data could support productive dialogue with this broader group of interested parties about using investment in road infrastructure as an (indirect) mechanism to manage broader service system constraints and costs, while promoting community wellbeing and safety through reduction in road trauma.

Case 1: investment in road infrastructure in Australia, is a strong example. The analysis identified benefits that point toward investment from an insurer and/or government. The TAC is already a leading global example of an insurer providing the funding for infrastructure improvements.

FIGURE 16 – SERVICE AREAS THAT WOULD ALSO BENEFIT THROUGH INCREASED CAPACITY AND/OR REDUCED COSTS FROM REDUCED FSIs
(Note: visual representation of funder alignment only, the size of the boxes is not indicative of size of potential benefit)



Source: Analysis of TAC sample data-set, 2016

There are early signs of other government interest. For example in New South Wales, Australia the government has taken a leadership role through its Social Impact Investment Policy,[60] and has recently signalled specific interest in innovative financing for road safety.[61]

The analysis also identified Commonwealth, state and local (municipal) governments responsible for health and allied health service provision would be particular beneficiaries of the reduction in demand for services (Figure 16). The reduction would free up capacity for alternative service provision, potentially offset or delay the need to invest in additional service capacity and/or reduce the costs required to be incurred in providing some services.

In some jurisdictions, toll road operators have been open to innovative approaches and incentives to improve road networks to 3-star or better safety levels. For example, in New Zealand, a concession project was tendered by government to deliver a minimum 4-star standard piece of road infrastructure with penalty payments due if crashes do occur.[62]

Case 2: an impact bond in Cambodia sets out a different basis for identifying which party or parties have an interest in funding prevention. The costs projected to be avoided by reducing the FSI to motorcycle passengers through successful delivery of the HSHO model provides the framework of an investment case for government and other bi-lateral

aid or development donors to provide funding or to act as an outcomes funder.

The Cambodian government would have a financial interest in paying for success as an outcomes funder as it will benefit from a successful intervention, for example through savings in medical costs[63] and reduction in lost economic output. An impact bond structure would also enable the government's resources to pay for outcomes to be aligned with the direct public financial benefit. The same analysis can also help identify other stakeholders with a direct financial interest in the success of the programme who could be suitable funders, including potential outcomes funders.

In the LMIC context, the economic impact of fatalities and injuries to road users is significant,[64] yet funding for specific safety projects in countries like Cambodia is modest.[65] Development Finance Institutions such as the World Bank or ADB are active in LMIC, including Cambodia, making large scale investments targeting economic and social development. The objectives for that investment can be undermined by the significant cost of accidents on the road. As part of poverty reduction and safe and sustainable transport initiatives these organisations are interested in orienting part of their funding towards road safety outcomes as part of a more integrated approach to achieving development goals. Their involvement in public private partnership financing instruments also makes them important institutions for structuring of any impact bonds or equivalent mechanisms.[66]

Social investment funds, and more financially oriented investors will also be interested, if their mandate allows it and the risk and return profile meets their requirements. In appropriate circumstances, this could include institutional investors such as pension funds and sovereign wealth funds.

Foundations and donor organisations that seek to improve road safety and reduce the human cost of road trauma are also potential outcome funders, in line with their mission and purpose. Foundations and donor organisations have a powerful role to play in complementary funding of measures such as capacity development and providing credit enhancement that can mobilise other investors in the early stages, when proof of concept and track record are being established. They may also be well placed to act as outcome funders alongside governments for impact bond models to support this approach.

Other parties could also be incentivised to invest in prevention. Progressive companies whose workforce are at risk of injury are one such category. They may be willing to contribute, either because they see the benefit of averting accident and injury among their workforce, increasing productivity, reducing property and stock damage, or through their corporate social responsibility budgets. Similarly, local companies, including insurance companies, may be interested to invest in order to support the community and gain a better understanding of the cost.

Socially motivated private individuals for whom the human impact of accident and injury, in particular in LMIC countries are another potential party. Some foundations whose mission is to support improved road safety, better healthcare, or alleviate poverty may also see merit in investing from their corpus of funds into road safety initiatives or combining grant and investment capital to mobilise more capital and direct it to prevention.

Road trauma and poverty - the hidden costs to households

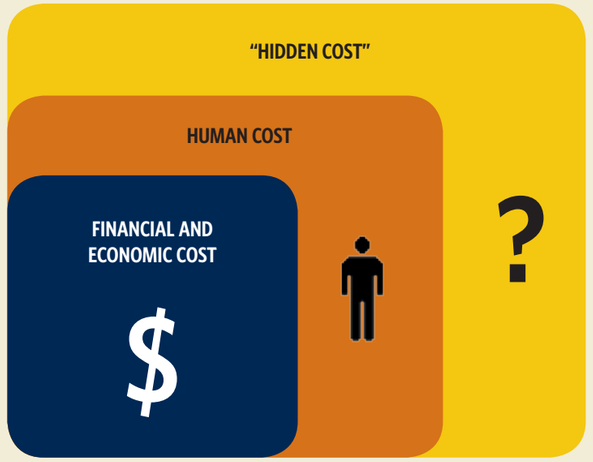
The extent to which many of the costs and impact with broader social and economic consequences are 'hidden' underscores the imperative for action, not only to meet SDGs relating to road safety, but also to meet other SDGs that target the impacts of poverty.

There are impacts on individuals and families wherever road trauma occurs. The extent to which care is available and costs are covered by health systems, insurers or other means varies widely, even across high income countries. Few countries have any system as comprehensive as the TAC in Victoria, Australia. And even in the Victorian example, the positive investment case is significantly enhanced by a multiplier effect once other economic and social costs and benefits are factored into the value equation.

For LMICs, lifetime economic and broader costs of FSI are highly likely to be understated as there is no comprehensive welfare or insurance system and serious road trauma often results in catastrophic costs to households.[67] These are rarely one-off costs and have far reaching social and economic consequences. The available data and practitioner experience suggests these hidden costs are significant and not typically accounted for, but will be an important consideration in developing strategies to meet targets for reduction.

Comparison of the two investment cases sheds some light on the dimensions of the issue as the TAC data set provides a more comprehensive reference point for understanding the full cost of an accident. This helps to identify cost categories in Cambodia that are absorbed by households and not currently captured (Figure 17), although the cost structures will be quite different across country settings.

FIGURE 17 – SPREAD OF COSTS OF FSIs, INCLUDING 'HIDDEN COSTS' TO HOUSEHOLDS
(Note: figure size is not indicative of magnitude of cost)



Source: Social Finance & AIP Foundation, 2016

It is common in LMIC countries for a substantial burden of direct and indirect costs to be borne by households. A study conducted in Vietnam found that 84% of households in which a family member suffers a traumatic brain injury as a result of a motorcycle accident face treatment costs totalling more than 40% of household income (after basic subsistence expenditure).[68] This is generally regarded as a catastrophic level of expenditure which will impair the living standard of a household.[69] In Cambodia private medical and other insurance coverage is very low, and as a result the two most common sources of money to cover the costs of FSI is household income (68%) and savings (31%).[70]

This large, but relatively immediate financial cost is generally accounted for in FSI cost analyses in LMICs (indeed is captured in the AIP Foundation case study). The hidden cost, however, refers to the significant repercussions that result from this catastrophic expenditure, which can have wide-ranging impacts upon the economy, individual household finances, and wider social and developmental outcomes, and is not typically captured in road safety cost analysis conducted in LMICs.[71]

Such catastrophic expenditure reduces a household's resilience to future financial shocks as well as affecting economic productivity into the medium and long term. A study of the impact of FSIs in Cambodia across a range of welfare indicators shows that household income is on average 21% lower after an accident, and after a serious accident households are often left without valuable productive assets such as land, vehicles, and livestock.[72]

Secondary financial and social impacts are also severe. For instance, it is common for children to leave school as a result of an injury to a family member, whether to provide care for the injured person or as a result of reduced household income, and the average absence is very long at 81 weeks.[73] This is damaging in terms of both education outcomes and future economic potential. Caring responsibilities also fall disproportionately on female family members, widening the gender income gap, while high a large proportion of participants in the study also reported deterioration in both child and maternal health.[74]

The bottom line is that poor people are not only more likely to die or be seriously injured in road accidents, but the economic and social impact on them is more dramatic. This creates and reinforces cycles of poverty and limits access to pathways to break the cycle, including education and employment.[75]

CONCLUSION

The SDGs put the focus on action now which will bring down the number of FSIs and meet the targets for improvement in road safety. That will take resources. Impact investment can strengthen the case for capital to be directed to prevention and can mobilise new and additional resources for road safety.

The cases demonstrate a threshold case for including impact investment in the toolkit to meet the SDGs. The priority is to start the process of feasibility and to trial different investment cases and products. That can start with design and testing of impact investment models connected to road safety initiatives and new infrastructure already underway or planned. Practical application will assist in testing the market and appetite with different types of investors. This can also illustrate how some of the funding already going to road safety could be used to mobilise additional capital and improve outcomes in road safety. As there is are a significant number of infrastructure and safety initiatives already underway across the world, the starting point is to identify a small number where sufficient data is available or could be collected to develop the type of analysis set out in this report and test the feasibility of an impact investment approach.

Identifying early projects where impact investment models can be developed and feasibility tested will yield demonstrations of efficacy and valuable learning and tools that can be applied elsewhere.

At a minimum, that process will inform decision making, including how data and research dollars are directed to develop the data and evidence base.

Data will provide a foundation stone for the investment case for prevention across different settings. Insights from development of the investment cases in this report can be used to inform more systematic data collection. Action now to build on this work and collect more consistent and reliable data on the incidence and costs of accident and injury types, who (for example in health systems or the insurance sector) bears which costs, as well as detailing cost and effects of specific interventions will also deliver a valuable resource.

Over time, these twin priorities of investment design and data development can inform an evidence base for investment in road safety at scale. This will take a multi-stakeholder commitment to a practical partnership to develop the evidence base that will link interventions and outcomes more effectively and better align incentives between investment, cost savings and improved road safety. A number of parties stand to benefit, including those already active such as governments, insurers and donor organisations.

That action needs to start now if we are to meet the SDG targets on road safety and prevent many millions of avoidable human tragedies.

APPENDIX 1: CATEGORIES OF IMPACT INVESTMENT

TABLE 9 – CATEGORIES OF IMPACT INVESTMENT

FINANCE MECHANISM	ASSET BACKED	IMPACT BONDS	DIRECT INVESTMENT
CHARACTERISTICS	Asset-backed social investment for road safety would focus on improving the physical infrastructure of a road or road network. Asset-backed investments will likely fall into two categories, a revenue-supported model and a cost-saving model. Could be revenue supported directly from road users or through a 'shadow toll' system, fines, levies or a combination. A cost-saving model could be developed where there is a financial interest in reducing the number and severity of injuries over a road or road network over a period of time. Unlike traditional asset-backed lending, road safety infrastructure is unlikely to have significant inherent value and linking repayment to cashflows that are expected to result from a cost-reduction to the borrower may prove too uncertain to attract commercial investors. While such considerations may be a barrier to commercial investment, or result in a much higher cost of capital, there may be a willingness from social impact investors to accept non-conventional options if there is a sufficiently robust impact case.	The impact bond model is most suited to situations where there is an element of implementation risk, therefore uncertainty about impact being achieved. Impact bonds can involve a number of delivery organisations, and are highly dependent on context. Impact bonds allow funders to share the risk of a programme's effectiveness to deliver outcomes with investors. As such, it may have particular application in developing countries, where country governments do not have the resources or capacity to invest in road safety. It could allow international donors, foundation and other funders to allocate their resources efficiently to projects that achieve results, as well as build up an evidence base.	Direct investment to support and promote road safety through e.g. debt or equity investment in social enterprises, NGOs or 'profit with purpose' companies that are working to improve road safety. Examples could include start up capital to a helmet manufacturing facility where there is a lack of local suppliers; or providing working capital to a construction company which has a contract to maintain roads in a remote area of a developing country, yet are unable to source bank finance through other channels because of the risks of the environment in which they operate. Social investment may have a role to act as first movers or invest in particularly fragile states. Over time, as road safety continues to climb the international agenda mainstream investors such as car manufacturers could become involved, or venture capital and/or institutional investors.
SAFER SYSTEM COMPONENT(S)	Safer roads and road sides	Safer road users, post crash response, road safety management	Safer vehicles, safer road users, safer road management

APPENDIX 2: DATA ANALYSIS METHODOLOGY

Australia – The Transport Accident Commission

OVERVIEW

The analysis in this report utilises a 'calculator' approach to quantify the benefits that will flow from an investment.

In the case of the TAC Data Sample Set the analysis is focused on five years of claims data covering all transport accident claims from 2006-2010 that have been able to be mapped against VicRoads crash data. This has been undertaken to link the claims and claimant data to crash type, location and speed (see below). There are a number of claims for which mapping has not been possible. It is likely that that set of data will include a higher proportion of minor claims. Therefore, current average total claims cost figures may be overstated. Average total claims cost for FSIs only are less likely to be affected and therefore these values have been used for the iRAP analysis.

For the Victorian and Queensland analysis, iRAP Star Rating and Investment Plan data was available from previous assessments by the automobile clubs and government as part of the AusRAP programme. This includes detailed road condition data every 100 metres for over 50 road attributes known to influence the likelihood or severity of a crash. The iRAP models draw on a global evidence base on the effectiveness of individual treatments and the methodology and specifications are fully documented and available in the public domain.[76] The relationship between star ratings and crash costs per kilometre travelled is well founded at the global level with a number of global reports available.[77]

Countermeasure costs data was sourced from discussions with VicRoads and Main Roads Department of Queensland representatives. Both the Victorian and Queensland data sets were calibrated to reflect the expected number of deaths and injuries on the selected networks at the time of the baseline assessments as sourced from the respective road agency.

METHODOLOGY

The Transport Accident Commission (TAC) provided a full record of costs incurred by road accident victims occurring in the State of Victoria from January 2006 to June 2015. This data was merged with VicRoads data on the nature of each road accident, and characteristics of the people involved (age, gender, injury sustained). The resulting data set comprised of over 360,000 individual claims, each with 10 variables describing the accident, and 107 separate cost items. The task was to use the data to illustrate average cost of road trauma in Victoria from certain types of accident and/or victim, and produce an analysis of the different factors that drive costs in the system, as well as insights into where these costs are borne. The data set was organised to link with iRAP's system for modelling interventions and star rating improvements to reduce fatalities and serious injuries caused by road accidents.

First the costs were aggregated into 12 high-level cost categories, which required understanding how cost items related to each other and how costs were distributed across years. The data was cleaned and claims that could be used for analysis were identified. Claims with missing information on the accident type were excluded from the data set and, upon examination, it became clear that crashes occurring in more recent years (2011 onward) were unsuitable as their costs had not stabilised. Analysis was therefore based on crash data for the period between 2006 and 2010. By the end of this process, the data set had been reduced to 78,000 claims, with the calculator and pivot tables being driven by ~20m active data points.

In order to calculate average lifetime cost for each claim, there was extensive collaboration with the TAC to develop a set of assumptions on the definition of each cost category, whether costs were likely to continue into the future and, if so, for how long and at what rate. For example, certain cost categories, such as Long Term Care (LTC) were identified as ongoing, with different escalation rates and cessation dates. For these cost categories, the basic parameters of cost were explored with TAC to agree a basis of escalation and/or continuation. In the case of LTC, for example, a simplistic escalation factor was included reflecting increased care costs and care need for each claimant for whom this applied, until their (standardised) estimated date of death.

To facilitate analysis, data points pertaining to age and speed limit were grouped into ranges and data sought, including injury detail and level of severity, and worked them into the data set. Further work was done with iRAP to render the analysis of TAC data compatible with the iRAP system, by mapping the 85 TAC crash types onto 10 iRAP crash types, as well as harmonising injury levels.

Finally, a series of pivot tables were produced to analyse average lifetime cost by factors such as gender, age, crash type, injury type and speed limit of the road.

OUTPUT

The result of this analysis is a cost calculator which can be used to analyse an informative subset of road accidents in Victoria; and provides a data-informed picture of the distribution of costs resulting from road accidents in a context such as Victoria. It is important to note that the calculator is designed as a practical tool that is informed by, but does not seek to precisely replicate, the TAC average cost data. The TAC data is not categorised in precisely the same way and, as noted above, the calculator uses a subset of data. In the area of recurring cost and LTC for example, it has used simplified assumptions rather than apply an actuarial projection to each and every claim. It should also be noted that the TAC data informs a comprehensive, but not complete, view of the cost of accidents in Victoria. Uninsured costs are not captured, for example, nor are public sector costs such as welfare or lost taxation.

The purpose of the cost calculator is to shed light on the profile of road users most at risk of different types of accident, the types of crashes that result in the highest costs and inform road safety policy in Victoria and beyond.

Cambodia – Asia Injury Prevention Foundation

OVERVIEW

For this case study an impact bond model was created in order to test the feasibility of social investment to finance behaviour change interventions in a LMIC context. Developing an impact bond requires, among other things: an analysis of the particular social issue or problem in question; identification of the individuals or groups of people among whom positive social impact is targeted (the target population); an analysis of the outcomes that indicate the aimed for positive social impact has been achieved among the target population; and an assessment of the services or interventions that are capable of delivering those outcomes at the required level of success. The impact bond model brings together these elements within a framework that develops an understanding of outcomes achieved at different levels and how risk and return might be shared among the outcome funders and the investors that pre-fund an intervention.

Three categories of data inform the model for this investment case: i) data about the underlying social issue, including the number and type of motorcycle crashes, and their financial and wider social impacts; ii) data on the cost of the social issue and the economic and social costs of motorcycle crashes in Cambodia; and iii) data and information on the intervention being modelled, including the costs of HSHO and the evidence base to support how outcomes could be defined and measured and data that informs baselines and targets.

METHODOLOGY

Social Finance worked closely with AIP Foundation in development of the case study. The Foundation provided invaluable support in designing the scope and goals, to providing and sourcing information, to providing feedback and valuable insight.

Detailed deliverables provided by AIP Foundation included an outline of the HSHO intervention design, target population and geography, the monitoring and evaluation framework, and baseline and select year one actual results. Cambodia's Road Crash and Victim Information System (RCVIS) system, a leading system of its kind in LMICs, provides a source of data on the number of road accidents on Cambodia's roads, and the number and severity of injuries that resulted, by bringing together reporting from the Ministry of the Interior (Police) and the Ministry of Health (public health facilities). As outlined in the paper, while this is a valuable official source of road crash and casualty data, issues with consistency of reporting from different districts and facilities mean it was not used as the primary metric to measure success for an impact bond.

AIP Foundation had conducted a prior analysis of the potential cost savings from the HSHO intervention, which was the basis for the cost-benefit analysis presented here. This analysis drew on a methodology – the human capital method – originally employed by the Asian Development Bank in 2003 and updated by Handicap International in 2012 to understand the economic and human costs of fatalities and injuries on the road.[78] This separates costs into five cost categories: Property Damage, Administration, Medical Costs, Lost Output, and Human Costs. These costs are then mapped against five injury types: Fatality, Serious - disabled, Serious - recovered, Minor injury, and Damage only. Estimates for each cost category were developed through interviews with key stakeholders (e.g. insurance companies, health centres), household surveys, and data requests.[79]

A cost-benefit model then brought together this information to estimate the likely economic costs avoided of the HSHO intervention at different levels of success. The model separated out 'Human Cost', which includes pain, suffering and grief, in order to base the model on economic costs that are borne by different stakeholders.

The case study and model assumes that each element of HSHO is implemented in accordance with the programme design, and as scheduled. This assumption is important, as each element is designed to reinforce the others, following a progression from: change of law; mass media campaign at national level, reinforced at local level and through school and community based education and awareness programmes; free helmets to primary school children and voucher programme for surrounding communities; and enforcement of the new law. In practice, as the report notes, the enforcement component was substantially delayed. The positive impact of a good enforcement regime was not, in consequence, seen by the final measurement date. No adjustment has been made for actual observed findings (positive or negative).

A further important strand was an analysis of the broader economic and social impacts of RTIs in LMICs, what we have termed the 'hidden costs'. This was informed in the first instance by the findings of the analysis of the TAC data set, and the significant and often longstanding financial costs involved with long-term injury and care. It was then supplemented by a

desk-based review of academic literature of the costs of RTIs and their impact upon households in Cambodia and SE Asia more broadly, and by discussion with experts at AIP Foundation.

OUTPUT

Social Finance constructed a simple impact bond model using the categories of information outlined above, which presents a potential method of financing the HSHO with social investment. To determine this investment case, Social Finance made assumptions about what is an appropriate level of compensation for investors relative to the risk of financing the intervention.

The model includes a theoretical hurdle rate, the minimum level of success (30%) needed to be achieved before any outcome payment would be made. This is set at an illustrative level, to demonstrate the importance of building in incentives to achieve meaningful change before any success payments are made. It assumes that outcome payments would be made based on economic costs avoided, which are shared between the outcomes funder and the investor: below a success rate of 30%, investors receive no payments; between 30% and 'breakeven point' when investors' prefunding of the $1.1m programme costs are repaid, 100% of costs avoided are paid to investors; above the breakeven point, 50% of costs avoided each to investor and outcomes funder.

There are other ways to model an investment into this project; the case presented is intended to be a simple, transparent option, displaying a typical balance of risk and return based on Social Finance's knowledge of the Social Impact Bond and Development Impact Bond markets.

ENDNOTES

[1] IRTAD Road Safety Annual Report 2015.
[2] WHO 2015, p.2., WHO 2013, p.vii and Harvard 2011, p.5.
[3] Unicef and FIA Foundation: Rights of Way: Child Poverty and Traffic Injury in the SDGs 2016.
[4] ibid.
[5] iRAP measure of the level of safety provided by a road's design on scale of 1 – 5, where 5 is the safest.
[6] Based on iRAP safety rating.
[7] WHO 2015, p.2., WHO 2013, p.vii and Harvard 2011,, p.5.
[8] Unicef and FIA Foundation: Rights of Way: Child Poverty and Traffic Injury in the SDGs 2016.
[9] WHO 2015 which indicates that the number of road traffic deaths has plateaued since 2007, contradicting the forecast trends based on population increases and rising motorisation over the same period.
[10] WHO 2015, p.2.
[11] Unicef and FIA Foundation: Rights of Way: Child Poverty and Traffic Injury in the SDGs 2016.
[12] TAC claims data has been used to assess the investment case associated with infrastructure improvement scenarios across two networks, one in Victoria and another in Queensland. Queensland does not have a single, no-fault insurer such as the TAC. Given the relative comparability of the Victorian and Queensland settings TAC data has been used in the Queensland analysis.
[13] Australian Automobile Association, Benchmarking the Performance of the National Road Safety Strategy (NRSS), December 2015, p.11.
[14] https://www.gapyear.com/articles/216021/the-22-most-deadly-highways-in-the-world
[15] All treatments included in the program selected to have a BCR > 5 based on iRAP modelling.
[16] Based on iRAP star ratings.
[17] Based on iRAP star ratings.
[18] The Victorian SSRIP program of infrastructure improvements in operation since 2013 is an example of this, BITRE 2014., p.7. A recent commitment of the Victorian Government extends the approach: http://www.premier.vic.gov.au/saving-lives-victorias-new-road-safety-strategy/
[19] Queensland Government, Bruce Highway Action Plan: "Out of the crisis", October 2012.
[20] A road crash is an unpremeditated event reported to police, or other relevant authority, that results in death, injury or property damage, and is attributable to the movement of a road vehicle on a public road. A road death or fatality is a person who dies within 30 days of a crash as a result of injuries received in that crash. This excludes deaths resulting from deliberate acts and deaths due to natural causes. A serious injury (hospitalised injury) is a person who is confirmed as being admitted to hospital as a result of a crash, irrespective of the length of stay.
[21] Note that some minor injury claims were able to be mapped to VicRoads crash data and so have been included in the data set.
[22] http://irap.org/en/about-irap-3/methodology
[23] http://irap.org/en/about-irap-3/methodology?download=139:irap-methodology-fact-sheet-11-countermeasures
[24] The approach involves the selection of individual interventions expected to deliver the greatest reduction in deaths and serious injuries per dollar spent using a benefit to cost ratio cut off of 5 to 1 (i.e. that is all treatments must have a BCR > 5 to be included in the program).
[25] Note that TAC and VicRoads dedicated infrastructure investment in road safety has been active for over 10 years with many high-return treatments already applied to the selected network (as reflected in the current safety star rating).
[26] http://www.premier.vic.gov.au/saving-lives-victorias-new-road-safety-strategy/
[27] Full social willingness to pay estimate based on BITRE model: Fatality = AUD$7,787,700, Serious Injury AUD$259,000 (in 2014 dollars).
[28] As assessed by iRAP prior to the commencement of recent major upgrades in 2011.
[29] See: http://lifetimecare.initiatives.qld.gov.au/ and http://www.maic.qld.gov.au/
[30] Assumed to equate to the claims costs based on the TAC sample data set.
[31] Queensland Government, Bruce Highway Action Plan: "Out of the crisis", October 2012.
[32] http://investment.infrastructure.gov.au/funding/projects/brucehighway.aspx
[33] Full social willingness to pay estimate based on BITRE model: Fatality = AUD$7,787,700, Serious Injury AUD$259,000 (in 2014 dollars).
[34] These case studies have been reproduced with the kind permission of Matthew Ericson and Pagna Kim: Ericson, M., Kim, P., (2011), 'How Road Traffic Injuries Affect Household Welfare in Cambodia Using the MDG Benchmarks.' Asian Studies Review 35(2): 209–34.
[35] WHO 2015. The estimated rate is 17.4 per 100,000 population.
[36] IRTAD 2015.
[37] Cambodia National Road Safety Committee (RCVIS), 2014 Summary Report, Road Crashes and Casualties in Cambodia, 2014.
[38] IRTAD 2015.
[39] The HSHO intervention is funded by USAID-DIV, FIA Foundation, and The UPS Foundation (£1.1m) with in-kind support from US-CDC, the Road Safety Fund and AIP Foundation (£200k).
[40] The project concludes in June 2016, with final results published in September 2016.
[41] Social Finance, Social Impact Bonds, The Early Years, 2016; for latest figures a global database of Social Impact Bonds can be found at http://www.socialfinance.org.uk/database/
[42] In Asia, AIP Foundation operates programmes in China, Thailand, and Vietnam. In Africa, AIP Foundation has representatives in Tanzania and Uganda.
[43] A good example of an uncertainty, or risk, that would need to be managed in the design of an impact bond can be seen from the HSHO implementation, where one component of the intervention, agreeing the enforcement plan with local police and other stakeholders, delayed enforcement measures of the new law coming into effect, with consequential impact on the end of term results. In practice, it is the role of impact bond developers to identify and mitigate risks to outcome funders and investors so that they are fairly balanced between the parties and interests of all are fairly aligned towards achieving the targeted outcomes.
[44] The operational design of the programme provided for enforcement to commence in July 2015, to run alongside and reinforce other components for 12 months. However, AIP Foundation reported that enforcement plans were delayed, with enforcement only commencing in January 2016. Delays were due to: structural and leadership change in the national body responsible for coordinating the law and its roll out; legislative timelines to adopt a sub-decree on traffic offence penalties; and limited capacity to ensure public awareness of changes to the law (i.e. increased fines) before enforcement began. AIP Foundation continues to work with the Cambodian authorities and other stakeholders to realise the full benefits of the programme.
[45] Final evaluation of HSHO will be available from AIP Foundation from September 2016: see www.aip-foundation.org
[46] This is a summary of the HSHO M&E framework, and includes only the final outcomes and indicators. AIP Foundation monitor and report on a range of additional outputs and indicators related to project activities.
[47] Excludes in-kind contributions, estimated at US$200k – see note 35.
[48] AIP Foundation uses data from Cambodia's RCVIS to set a pre-intervention baseline and to observe changes in the number of fatalities and injuries post-intervention, but this data is not sufficiently robust to support an investment model. While RCVIS collects national data from both police forces and health facilities on the number and type of crashes on the roads and the number and severity of injuries, evaluation of RCVIS has shown inconsistencies in reporting from police and health facilities such that there is a risk under- or overstating the impact of the HSHO intervention (Surveillance of road crash injuries in Cambodia: an evaluation of RCVIS. Traffic Injury Prevention 2013). This paper states the likelihood that the 'RCVIS may largely undercount the total crash burden in Cambodia,' such that 'the true number of road traffic casualties is unknown.'
[49] Liu, BC., et. al., Helmets for preventing injury in motorcycle riders, Cochrane Database of Systematic Reviews 2008.
[50] AIP Foundation calculation using a methodology previously employed by Handicap International and ADB: Analysis of 2011 Road Crash Cost in Cambodia, 2012; ADB-ASEAN, The Cost of Road Traffic Accidents in Cambodia 2003. The valuation of the costs of different accident types are taken from Handicap International's 2012 report. These costs are not adjusted for inflation, and may understate the current costs of RTIs.
[51] See A missing piece - understanding the hidden costs to households.
[52] Human Costs reflect pain, grief, and suffering. The ADB 2003 costs analysis, updated by Handicap International in 2012 and presented here, uses the Transport Research Laboratory methodology, which equates Human costs to 28% of the total resource associated with fatalities, 50% of serious injury costs, and 8% of minor injuries.
[53] See A missing piece: understanding the hidden costs to households below for more detailed discussion of the costs of FSIs to private households in LMICs.
[54] Due to the high proportion of young adults killed as a proportion of all motorcycle fatalities in Cambodia, the average number of lost output years is 29. Handicap International 2012.
[55] This figure is calculated using a total intervention cost, equivalent to total investment, of $1.1m. If in-kind contributions are included in the total intervention cost, this would bring total investment requirement to $1.3m. In this case, final passenger helmet use would have to be 55% to break even in terms of economic costs avoided only.
[56] Taking it closer to the 'willingness to pay' assessment in Case 1.
[57] This represents a maximum IRR of 11%. The outcomes framework modelled here suggests one interpretation of a reasonable balance of risk and return for social investors.
[58] Breaking the Deadlock, 2015, p11 based on iRAP Business Case for Safer Roads www.irap.org/en/about-irap-2/a-business-case-for-safer-roads
[59] Breaking the Deadlock 2015, p17.
[60] http://www.osii.nsw.gov.au/assets/office-of-social-impact-investment/files/Social-Impact-Investment-Policy.pdf
[61] http://www.osii.nsw.gov.au/assets/office-of-social-impact-investment/files/Statement-of-Opportunities-2016.pdf
[62] http://www.nzta.govt.nz/assets/projects/transmission-gully/docs/schedule-11.pdf
[63] Without more detailed information it is difficult to determine the extent to which savings are immediately cashable.
[64] Estimated by iRAP at $220B: http://irap.org/en/about-irap-2/a-business-case-for-safer-roads
[65] Funding from NGOs and private companies dedicated specifically to road safety improvements averaged only $1.5m annually between 2012 and 2014. This excludes investment in traffic signs, road maintenance, and public transportation, which impacts upon road safety in the country. AIP Foundation.
[66] http://www.worldbank.org/en/news/feature/2015/12/21/results-focused-impact-bonds-can-improve-development-outcomes-by-involving-the-private-sector
[67] Wesson, H., et al., The Cost of injury and trauma care in low and middle-income countries: a review of economic evidence, Health Policy and Planning 2014; Van Damme, Win., Out-of-pocket health expenditure and debt in poor households from Cambodia, Tropical Medicine and International Health 2004.
[68] Hoang, et al., The costs of traumatic brain injury due to motorcycle accidents in Hanoi, Vietnam 2008; research in Vietnam since suggests that those motorcyclists that do not wear helmets incur 1.41 times more costs that those who helmets.
[69] H. Nguyen, et al., Catastrophic household costs due to injury in Vietnam, Injury, Int. J Care Injured 2013.
[70] The Cambodia Demographic and Health Survey 2014. Only 1.3% of the total costs that result from RTIs are ultimately covered by commercial insurance.
[71] In developed contexts, although the costs of FSIs are very high, as demonstrated by the TAC case study, private households are generally shielded from them to a much greater extent by insurance and public safety nets.
[72] Ericson & Kim 2011, How road traffic injuries affect household welfare in Cambodia using the Millennium Development Goals Benchmarks, Asian Studies Review 2011.
[73] Ericson & Kim 2011.
[74] Ericson & Kim 2011.
[75] Unicef and FIA Foundation, Rights of Way: Child Poverty & Road Traffic Injuries in the SDGs, 2016, p6.
[76] http://irap.org/en/about-irap-3/methodology
[77] http://irap.org/en/about-irap-3/research-and-technical-papers
[78] Handicap International 2012, ADB 2003.
[79] For example, Property Damage is determined mostly through insurance company policy data and interviews; Medical through interviews and data requests from health centres; and Lost Output through household surveys.
[80] https://sustainabledevelopment.un.org/
[81] https://www.towardszero.vic.gov.au/what-is-towards-zero/road-safety-action-plan

TERMINOLOGY & ACRONYMS

AIP Foundation Asia Injury Prevention Foundation: a non-profit organisation with the mission to provide life-saving road safety knowledge and skills to the developing world with the goal of preventing road fatalities and injuries

Availability payment model An availability payment is a payment for performance (irrespective of demand). In the context of road infrastructure it requires the asset to be open and functioning and meeting defined performance, safety and quality criteria

BCR Benefit cost ratio

BITRE Australian Bureau of Infrastructure, Transport and Regional Economics

Claims costs This refers to the categories of costs covered by the TAC included in the data set as set out in the analysis for Case 1

DIB Development Impact Bond

FSI Fatal and Serious Injury

GDP Gross Domestic Product

HSHO Head Safe, Helmet On: A behaviour change intervention, implemented by AIP Foundation, to increase motorcycle passenger helmet wearing in Cambodia

Impact Bonds (DIB/SIB) Outcomes-contingent contracts between investors, service providers and outcomes funders. Investors provide upfront finance for a service delivered by a separate service providers (usually a social sector organisation or NGO), and an outcomes funder pays investors their principal plus a return depending on successful achievement of pre-agreed social outcomes. The outcomes funder in a Social Impact Bond (SIB) is a government commissioner. The outcomes funder in a Development Impact Bond (DIB) is a donor organisation (for example bilateral or multilateral donors or charitable Foundations), and therefore operate in developing context

Investment case Investment case is used in this report to describe the impact investment logic applied to the case for preventive interventions in road safety

Impact investment Investment designed to deliver measureable positive benefit to society as well as a financial return; sometimes referred to as social impact investments or social finance

iRAP The International Road Assessment Programme: a registered charity, providing tools and training dedicated to preventing the more than 3,500 road deaths that occur every day worldwide

iRAP Safer Roads Investment Plan iRAP Safer Roads Investment Plan: The optimised investment model developed by iRAP to estimate the likely reduction in FSIs as a result of particular road infrastructure improvements that are known to have an impact on the likelihood of a crash and its severity

IRR Internal Rate of Return: a measure used to evaluate the risk adjusted return or attractiveness of an investment. It represents the interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equal zero

LMIC Low or Middle Income Country

RCVIS Cambodia Road Crash and Victim Information System

RTI Road traffic injury

Shadow toll A contractual payment made by a government per driver using a road to a private company that operates a road built or maintained using private finance where payments are based, at least in part, on the number of vehicles using a section of road, often over a 20- to 30-year period and take into account road safety considerations

SDGs Sustainable Development Goals: universal targets for global development outlined in the "Transforming our world: the 2030 Agenda for Sustainable Development", a new, ambitious and universal development agenda[80] which continues to build on the Millennium Development Goals

SIB Social Impact Bond

SSRIP The Victorian Safe System Road Infrastructure Programme (SSRIP): announced in March 2013, the SSRIP allocates AUD$1B in funding over ten years (2013 to 2022) towards a series of road infrastructure projects including: treatments at intersections, run-off-road treatments for black lengths and long routes, run-off-road mass action treatments and pedestrians and cyclist safety treatments. The current Victorian road safety strategy is outlined in the State Government's "Towards Zero 2016-2020 Road Safety Strategy"[81]

Star Rating System iRAP measure of the level of safety provided by a road's design on scale of 1 – 5, where 5 is the safest

TAC The Transport Accident Commission: government-owned social insurer in Victoria, Australia. It pays for the medical treatment and benefits people injured in transport accidents receive, promotes road safety and works to improve Victoria's traffic system

UN United Nations

VicRoads Government body responsible for planning, developing and managing the road network in the state of Victoria, Australia

WB World Bank

WHO World Health Organisation

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REFERENCES

Allens Linklaters, 'Social Benefit Bonds – Their Role in the Funding Challenge for Social Infrastructure and Services', March 2015.

Asian Development Bank, The Cost of Road Traffic Accidents in Cambodia, ADB-ASEAN 2003. [ADB 2003]

Australian Automobile Association, Benchmarking the Performance of the National Road Safety Strategy (NRSS), December 2015.

Blincoe, L., Miller, T., Zaloshnja, E. and Lawrence, B., The Economic and Societal Impact of Motor Vehicle Crashes 2010 (revised), Report No. DOT HS 812 013, National Highway Traffic Safety Administration., Washington DC, 2015. [NHTSA 2015]

Bliss, T., & Raffo, V., Improving Global Road Safety: Towards Equitable and Sustainable Development. Guidelines for Country Road Safety Engagement, 2013. [Bliss & Raffo 2013]

Cambodia National Road Safety Committee (RCVIS), 2014 Summary Report, Road Crashes and Casualties in Cambodia, 2014.

Cockfield, S., Road Safety – The experience of the Transport Accident Commission in Victoria Australia., Discussion paper 2011|24, International Transport Forum OECD., Paris, 2011. [Cockfield 2011]

Ericson, M., Kim, P., (2011), 'How Road Traffic Injuries Affect Household Welfare in Cambodia Using the MDG Benchmarks.' Asian Studies Review 35(2): 209–34. [Ericson & Kim 2011]

FIA Foundation, Breaking the Deadlock: A Social Impact Investment Lens on Reducing Costs of Road Trauma and Unlocking Capital for Road Safety, 2015. [Breaking the Deadlock 2015]

FIA Foundation, Rights of Way: Child Poverty & Road Traffic Injury in the SDGs, 2016.

Global Impact Investing Network (GIIN) May 2016, 2016 GIIN Annual Impact Investor Survey. [GIIN 2016]

Handicap International, Analysis of 2011 Road Crash Cost in Cambodia, 2012. [Handicap International 2012]

Hendrie, D, Miller, T., Economic Evaluation of Public Health Laws and Their Enforcement, Public Health Law Research, 2012.

Hoang., et al., The costs of traumatic brain injury due to motorcycle accidents in Hanoi, Vietnam 2008.

ICF International, The Cambodia Demographic and Health Survey 2014.

The International Road Assessment Programme, The Global Cost of Road Crashes Fact Sheet, 2013. [iRAP 2013]

The International Road Assessment Programme, True Cost of Road Crashes: Valuing Life and the Cost of a Serious Injury. [iRAP Valuation]

iRAP Intervention Assessment (Investment Plan) Model Methodology Papers. http://irap.org/en/about-irap-3/methodology. [iRAP Model]

International Traffic Safety Data and Analysis Group, Road Safety Annual Report 2015. [IRTAD 2015]

Liu, BC., et. al., Helmets for preventing injury in motorcycle riders, Cochrane Database of Systematic Reviews 2008.

Multilateral Development Banks (MDB), Road Safety Guidelines, MDB Road Safety Initiative, 2014. [MDB 2014]

Nguyen, H., et al., Catastrophic household costs due to injury in Vietnam, Injury, Int. J Care Injured 2013.

OECD and International Transport Forum 2008, Towards Zero: Ambitious Road Safety Targets and the Safe System Approach. [OECD, 2008]

Parker, EM., et. al., Surveillance of road crash injuries in Cambodia: an evaluation of RCVIS, Traffic Injury Prevention 2013.

Philpott, V., The 22 Most Deadly Highways in the World, Gapyear, based on Driving Experiences Map from the World Health Organisation's global status report on world safety for 2013.

Porter, M & Kramer, M 2011, 'Creating Shared Value: How to reinvent capitalism and unleash a wave of innovation and growth', Harvard Business Review, Jan–Feb, 2011. [Harvard 2011]

Queensland Government, Queensland Main Roads data for the Bruce Highway, 2015.

Queensland Government, Bruce Highway Action Plan: "Out of the crisis", October 2012.

Smith, G., Zhang, T., Shaanxi Road Safety Demonstration Corridor., iRAP Innovation Workshop., ChinaRAP, 2014. [Smith & Zhang, 2014]

Social Finance, Social Impact Bonds, The Early Years, 2016.

Soubbotina, TP., & Sheram, KA., Beyond Economic Growth: Meeting the Challenges of Global Development, The World Bank 2000.

United Nations, Open Working Group proposal for Sustainable Development Goals. [UN, 2014]

United Nations, Sustainable Development Goals, 2015. http://www.un.org/sustainabledevelopment/sustainable-development-goals/ [UN, 2015]

Van Damme, Win., Out-of-pocket health expenditure and debt in poor households from Cambodia, Tropical Medicine and International Health 2004.

Wesson, H., et al., The Cost of injury and trauma care in low and middle-income countries: a review of economic evidence, Health Policy and Planning 2014.

The World Bank, Implementation Status and results, India Second Gujarat State Highway Project, Report No.ISR15587, The World Bank 2014. [The World Bank 2014]

The World Bank, 'Road crashes have more impact on poverty than you probably thought', 2015.

World Health Organisation, Decade of Action for Road safety 2011 – 2020: Saving Millions of Lives., WHO, 2011. [WHO 2011]

World Health Organisation, Global Status Report on Road Safety 2013: Supporting a Decade of Action, WHO 2013. [WHO 2013]

World Health Organisation, Global Status Report on Road Safety 2015. [WHO 2015]

ABOUT THE FIA FOUNDATION

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The FIA Foundation supports safe, clean, fair and green mobility to improve health and protect lives around the world. It funds an international programme of activities promoting road safety, the environment and sustainable mobility, as well as supporting motor sport safety research.

The Foundation works with a wide range of international partners. It is a contributor to major global action campaigns including the Decade of Action for Road Safety 2011-2020 and played a leading role in ensuring road safety targets were included in the UN's Sustainable Development Goals.

The FIA Foundation commissioned this work to take a new lens on opportunities to unlock capital to achieve a global breakthrough on road safety and reduce the costs of road trauma. We thank the Transport Accident Commission of the State of Victoria, AIP Foundation and the International Road Assessment Programme for their cooperation in undertaking this research, and we invite collaboration from interested organisations to translate the ideas in this paper to action.

ABOUT THE AUTHORS

Impact Strategist

Impact Strategist designs breakthrough social innovation and impact investment strategies to tackle complex social problems and create new social and economic value. Impact Strategist is led by Executive Director Rosemary Addis, who is a global leader and strategist in social innovation and investment and works with business, governments, foundations and strategists globally to find solutions to complex social issues and develop new value creation opportunities. Rosemary led the team for this initiative which included Social Finance UK, and Regina Hill, Regina Hill Effective Consulting Pty Ltd.

Rosemary established and Chairs Impact Investing Australia and the Australian Advisory Board on Impact Investing. In 2015 she was recognised for her contributions to innovation as one of the AFR/Westpac 100 Women of Influence. Rosemary is a member of the Global Social Impact Investment Steering Group, the NSW Government Social Investment Expert Advisory Group and the Bridges Impact + Global Advisory Council. She is widely published on social innovation and investment including: Inviting Investment in Social Enterprise (2007), IMPACT-Australia: investment for social and economic benefit (2013), Delivering on Impact (2014); Catalyzing Impact Investment (in IIPC Benchmark Report, 2014), The role of governments and policy in social finance (Nicholls et al (eds) OUP, 2016), Breaking the Deadlock: A Social Impact Investment Lens on Reducing Costs of Road Trauma and Unlocking Capital for Road Safety (2016), and Blueprint to Market: Impact Capital Australia (2016). Her work also led to publication of Place Based Impact Investment in Australia (2012) and Networked Incubation in Government: a case study of the incubation of Children's Ground (2013).

Regina Hill has 15 years' experience in consulting and research across sectors. Her expertise includes programme design, implementation and evaluation and organisational strategy. She is a trusted adviser on complex policy and strategy issues to a range of State and Federal Government Departments, Philanthropy Australia, Victorian Council of Social Services, and a number of Australia's leading philanthropic trusts and foundations. Prior to founding Effective Consulting and Effective Philanthropy, Regina was a Senior Consultant at global firm A T Kearney. Regina's experience spans a broad range of social and policy issues. Her specialist measurement and evaluation experience have led to development of a best practice guide for alternative schooling and education models and she also has an integrated management and social impact measurement software tool in development.

Impact Strategist Pty Ltd ABN 60 104 200 384
T + 61(0)434 669 068 - Web **www.impactstrategist.com**

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Social Finance is a not for profit organisation that works with government, the social sector and the financial community to find new ways of tackling entrenched social problems in the UK. It is a leading social investment adviser and since its establishment in 2007 has mobilised over £100 million of investment for social ventures.

Its unique 70 member team comprises individuals with substantial financial, consulting and social expertise who share a common passion for solving entrenched social problems. Social Finance is an established player within the social investment industry, with teams working with charities, other social enterprises, central government departments, local authorities, global development organisations, foundations and investors, and with experts in a range of social sector fields.

The Social Finance team for this initiative is led by Jane Newman, International Director, and Tom Davies.

Social Finance published works and technical guides include: Technical Guide: Building a Case for Prevention (March 2014); A Technical Guide to Developing Social Impact Bonds (January 2013); Investing in Social Outcomes: Development Impact Bonds (October 2013); Social Impact Bonds: The Early Years (July 2016).

Social Finance Limited 131-151 Great Titchfield Street, London W1W 5BB - Web **www.socialfinance.org.uk**

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