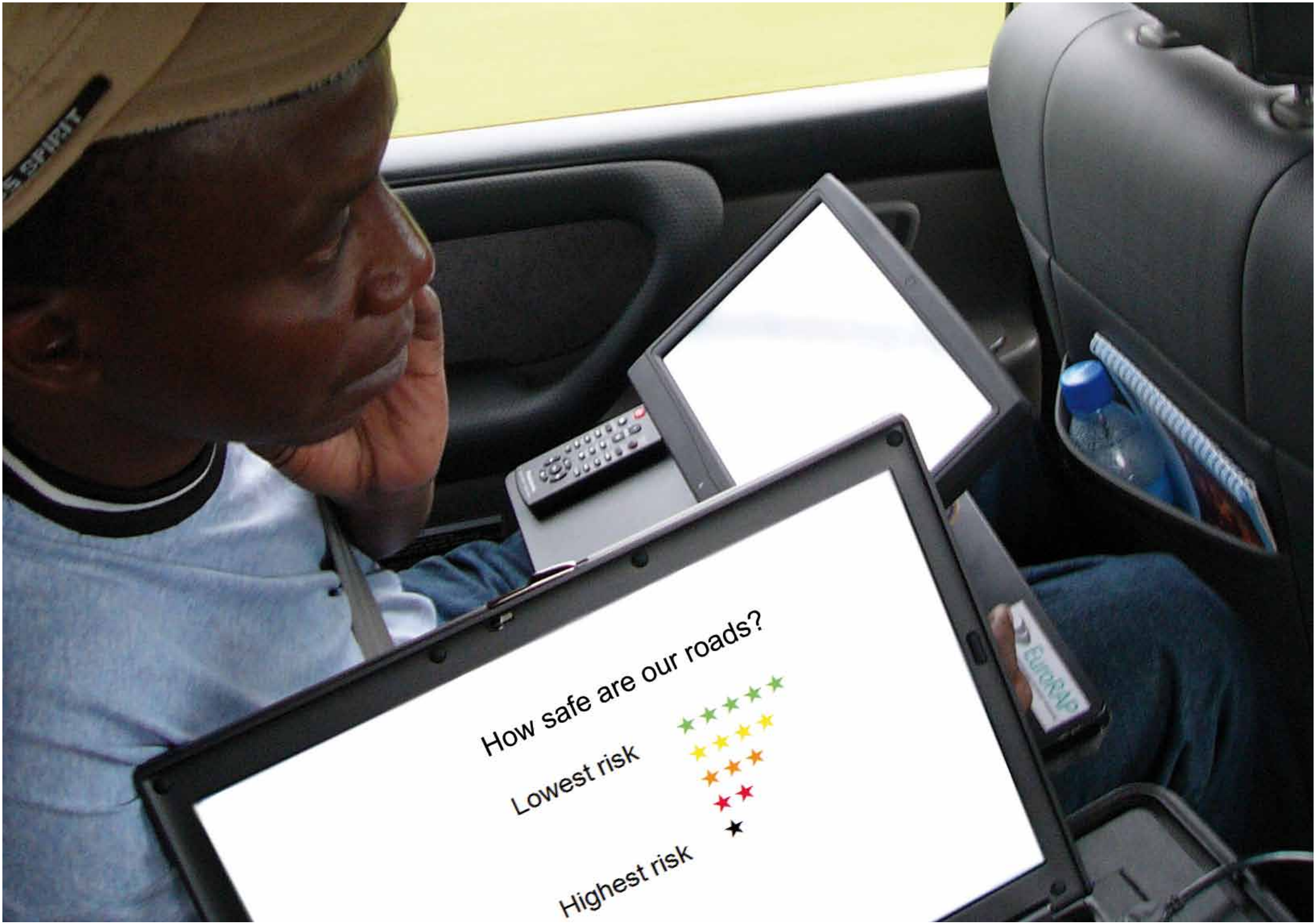
VACCINES FOR ROADS

Second edition

iRAP
INTERNATIONAL ROAD ASSESSMENT PROGRAMME


WE *CAN* CREATE
A WORLD FREE OF
HIGH-RISK ROADS

* LOCAL SAFETY CHAMPIONS LEADING ROAD ASSESSMENT PROGRAMME ACTIVITIES IN 70 COUNTRIES
* RISK ON HALF A MILLION KILOMETRES OF ROADS ASSESSED
* STRATEGIES TO PREVENT 50,000 DEATHS AND SERIOUS INJURIES A YEAR IN LOW-INCOME AND MIDDLE-INCOME COUNTRIES
* STAR RATINGS BEING USED TO DESIGN SAFE NEW ROADS


How safe are our roads?
Lowest risk
Highest risk

3,500 people will die on the world's roads today and 100,000 more will be seriously injured or disabled. But road death is not inevitable—it is preventable.

There has never been a more opportune moment to tackle this serious and rapidly worsening public health crisis by fundamentally changing the inherent safety of road systems around the world. Causes of road trauma are well known, as are 'vaccines' to prevent them. We know there is enormous potential to generate large social and economic returns from better investment; the United Nations Decade of Action for Road Safety 2011-2020 brings unprecedented international leadership and political-will to the cause. We can, and must, make this happen.

iRAP is an international charity dedicated to creating *a world free of high-risk roads*. We work on a global scale and are moving urgently to save lives. We act on sound research and compelling evidence. Road Assessment Programmes (RAPs) are a catalyst for change, providing political leaders, policy makers and road builders with the social, economic and engineering evidence and tools needed to transform entire road networks.

RAPs started with EuroRAP in 2001, as a partnership between automobile associations and road authorities leading in road safety. The programme created simple and objective measures of road safety risk and highlighted the vital role that road infrastructure can play in preventing crashes and reducing the severity of injuries. The approach spread rapidly throughout Europe, then to Australia, the United States and New Zealand, with local experts introducing their own innovative improvements. The focus then shifted to low-income and middle-income countries, where the road trauma crisis is most urgent. It culminated in the first edition of *Vaccines for Roads* in 2008 which presented pioneering work in Chile, Costa Rica, Malaysia and South Africa.

iRAP is now a global programme of local road safety champions leading RAP activities in more than 70 countries. Some half a million kilometres of roads have been assessed. This second edition of *Vaccines for Roads* describes that work, with a particular focus on results in low-income and middle-income countries. Sadly, about half the roads assessed in these countries are rated in the highest risk bands: one-star or two-stars. The reasons for this are clear and include the fact that 84% of the roads where pedestrians are present have no footpaths.

The good news is that Safer Roads Investment Plans are making the solutions equally clear. Construction of just 65km of footpaths on high-risk roads in Costa Rica, for instance, would prevent almost 3,000 deaths and serious injuries over 20 years and save $215 million in crash costs. Much of this cost would otherwise be borne by an already stretched health sector. The plans are helping to demonstrate that by investing in safer roads, the social and economic burden on families, communities, workplaces and hospitals can be significantly lessened. By setting ambitious policy targets such as *the elimination of one-star and two-star roads by 2020* or a requirement that *all new roads achieve four-stars*, countries can create a legacy of safe roads for future generations.

As a registered charity, iRAP benefits from the generous financial support of the FIA Foundation, the Road Safety Fund which is jointly managed by the FIA Foundation and the World Health Organisation, and the Global Road Safety Facility. This support enables us to provide safety tools and software to low-income and middle-income countries free-of-charge and give the programmatic support needed to ensure that assessments are completed to the same, high-quality consistency around the world. We are very fortunate to have lasting partnerships with many road authorities, automobile associations, multilateral development banks, research institutes, donors and non-government organisations. A network of accredited road safety professionals and companies capable of competitively bidding to provide high-quality iRAP assessments is also growing.

The central message of *Vaccines for Roads* is simple: large-scale, immediate improvements to high-risk roads will save lives today and long into the future.

Together, we *can* create a world free of high-risk roads.

Rob McInerney
Chief Executive Officer

A SAFE SYSTEM

Road deaths and injuries are a function of the way people behave, the different types of vehicles in use and their speeds, and road design. Despite this complexity, the way in which a genuinely safe road system can be created is well understood

Numerous publications show how death and serious injury can be prevented globally, including: *Towards Zero: Ambitious Road Safety Targets and the Safe System Approach,* produced by the Organisation for Economic Cooperation and Development (OECD), the multilateral development banks' *A Shared Approach to Managing Road Safety,* and the United Nations' *Global Plan for the Decade of Action for Road Safety 2011-2020.* The following principles broadly underpin the safe system approach and inform iRAP's approach:

- Mistakes, errors of judgment and poor decisions are intrinsic to humans. The road system needs to be designed and operated to account for this.
- Humans are fragile. Unprotected, we cannot survive impacts that occur at greater than around 30km/h.
- People who behave with disregard for the safety of themselves and others should expect tough policing and tough penalties.
- Safety can be built into the road system comprehensively and systematically, involving more than just 'patching up' apparent problem areas.
- The 'engineered' elements of the system—vehicles and roads—can be designed to be compatible with the human element, recognising that, while crashes might occur, the total system can be designed to minimise harm.

Countries leading in road safety have put these principles into practice with outstanding results.

After decades of building roads, causes of death and serious injury are well known...

Bicyclists are typically killed or seriously injured when cycling along the road and at intersections

Pedestrians are typically killed or seriously injured when walking along or across the road

Vehicle occupants are typically killed or seriously injured in run-off road, head-on or intersection crashes

Motorcyclists are typically killed or seriously injured in run-off road, head-on or intersection crashes

As just one example, the Swedish Road Administration defined a safe road transport system as one where: the driver uses a seat belt, does not exceed the speed limits, and is sober; the vehicle has a five-star rating by the Euro NCAP (European New Car Assessment Programme); and the road has a four-star rating by EuroRAP. Research showed this combination to be a stunning success: just 2-3% of road deaths occurred when these conditions were met, despite them coinciding with 30% of traffic flow.[1]

Sweden then took even more progressive steps towards improving road features to harness the substantial synergies that occur when speed and forgiving infrastructure interact in a compatible way.[2] For example, by 2020 three quarters of traffic flow with speeds over 80 km/h will be on roads with a median barrier, where the risk of death or serious injury in a head-on crash is significantly reduced.[3]

Although the specific approach to creating a safe system might vary from country to country, the principles are universal. The moral imperative for taking this approach is compelling. So too is the economic imperative; it is estimated that a single road death costs as much as 60-80 times a country's gross domestic product (GDP) per capita, yet the economic savings from targeted safety upgrades typically exceed the cost of their construction and maintenance.[4] It was found in the United Kingdom that by investing less than 10% of existing road budgets, one-star and two-star roads could be eliminated in the next decade, saving 6,000 lives and generating crash-cost savings of £25-£35 billion.[5]

...as are engineering treatments to prevent unnecessary suffering.[6]

Bicycle paths like this one in China reduce the risk that bicyclists will be struck by fast-moving cars, trucks or buses, by physically separating travel lanes. Well-designed on-road bicycle lanes can reduce bicyclist crashes by 25-40%

Pedestrian footpaths, like this one in the Philippines, can reduce the likelihood that people will be struck by vehicles while walking by as much as 40-60%. 'Raised table' pedestrian crossings help to reduce traffic speeds and lower the risk of injury

Energy-absorbing safety barriers, like this one in New Zealand, significantly reduce the risk of death or injury. Prior to being upgraded, this section of road rated two-stars and three-stars under KiwiRAP. Now it rates four-stars. Fatal and serious injury crashes decreased by 63%

Well-designed roundabouts can reduce casualty crash risk at intersections by more than 60% and have been shown to be highly cost-effective

This exclusive motorcycle lane in Malaysia, the first of its kind in the world, ensures that motorcyclists do not need to mix with heavier and often faster-moving traffic. The construction of this lane resulted in a 39% reduction in motorcycle crashes

ROAD SAFETY INSPECTIONS

By systematically inspecting roads, countries can develop an understanding of the level of risk that is 'built in' to their road networks. This provides a basis for targeting high-risk sections of road for improvement before people are killed or seriously injured. Inspections are especially useful when crash data is unavailable or unreliable

iRAP inspections use specially equipped vehicles to collect digital, panoramic images or videos of roads. These images are then used to record (or 'code') road design attributes that are known to influence the likelihood of a crash and its severity. The inspections create a permanent video and database record that can be reviewed easily by local engineers and planners.

The attributes, which are recorded at 100 metre intervals, include:

- traffic speeds
- number of lanes
- lane width
- paved shoulder width
- audio-tactile lines
- median type
- curvature and curve quality
- roadside design/obstacle
- delineation
- pavement condition
- overtaking demand
- intersection layout, volume and quality
- minor access point density
- bicycle facilities
- pedestrian crossing facilities and quality
- sidewalk provision
- side friction/roadside activities.

Countries do not need to inspect every road in order to make a large difference; in India, about two-thirds of deaths occur on state and national highways which account for just 6% of the network.[7] iRAP encourages countries to focus inspections on their busiest roads, where the largest safety gains can be made. In Mexico, for example, assessments cover around 45,000km of federal roads, which is a little more than 10% of the nation's roads (and around one third of paved roads).[8] To enable the cost-effective assessment of roads, there is a global network of accredited suppliers who are capable of competitively bidding to undertake high-quality inspections and coding (see www.irap.org for a list).


PELCO

STAR RATINGS FOR ROADS IN LOW-INCOME AND MIDDLE-INCOME COUNTRIES

Star Ratings are an objective measure of the likelihood of a crash occurring and its severity. They draw on road safety inspection data and the extensive real-world relationships between road attributes and crash rates

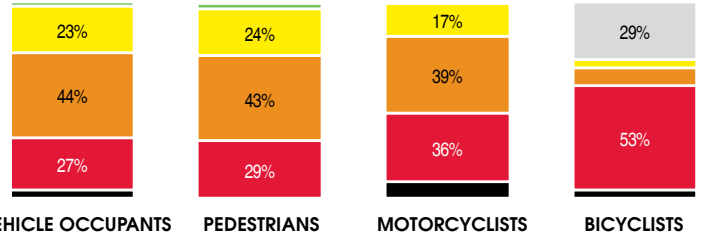
Research shows that a person's risk of death or serious injury is highest on a one-star road and lowest on a five-star road [9]

By measuring the risk associated with road attributes, Star Ratings can provide a better indicator of the influence of road attributes on risk than crash numbers alone.[10] The focus of Star Ratings is on attributes that influence the most common and severe types of crashes for vehicle occupants, motorcyclists, pedestrians and bicyclists.

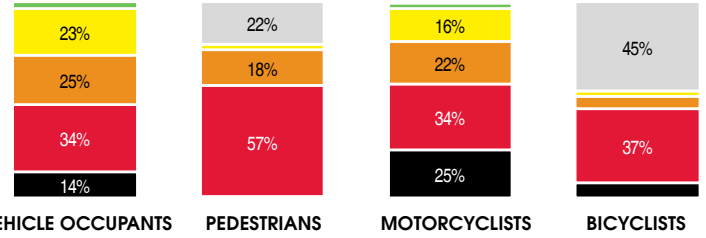
The charts on this page help to explain why low-income and middle-income countries experience such high rates of death and serious injury. Significant proportions of the roads are rated just one-star or two-stars.

The road safety inspections and Star Ratings provide countries and international finance institutions with a set of highly objective indicators that can be used in setting ambitious road safety targets. National targets have been shown to play an important role in altering the community's view of the inevitability of road trauma and driving action to save lives.[11] The Netherlands, for example, has committed to bring all one-star and two-star roads on the national road network up to at least three-stars, while New Zealand is ensuring that all Roads of National Significance will be at least four-stars.[12,13]

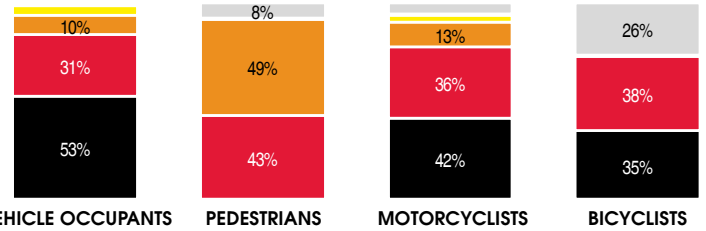
Latin America and the Caribbean (19,900km assessed)



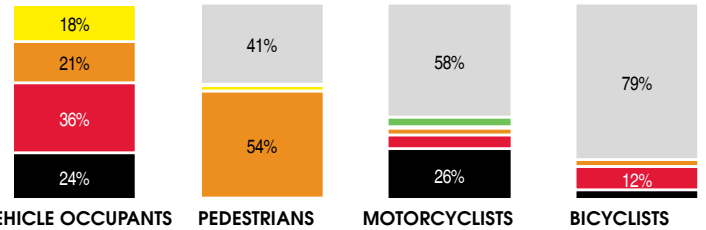
Asia Pacific (15,300km assessed)



Africa (10,100km assessed)



CIS States/Eastern Europe (6,800km assessed)



The assessments in low-income and middle-income countries found that many of the roads assessed to date lack the most basic engineering safety features such as footpaths, safety barriers, paved shoulders and safe intersection design. The risk factors on this page play a significant role in the Star Rating results and provide a basis for planning life-saving treatments.

BICYCLISTS AT RISK

85% of roads where bicyclists are present carry traffic at 40km/h or more and have no bicycle facilities

PEDESTRIANS AT RISK

Pedestrians are present on most roads, both rural and urban. 84% of roads where pedestrians are present carry traffic at 40km/h or more and have no footpaths

MOTORCYCLISTS AT RISK

68% of roads with high motorcycle flows (>20% of vehicles) carry traffic at 60km/h or more and do not have any motorcycle facilities

HEAD-ON RISK

58% of roads are undivided single lane carriageways that carry traffic at 70km/h or more and have medium to high overtaking demand

INTERSECTION RISK

55% of intersections on roads that carry traffic at 60km/h or more do not have roundabouts, are not signalised, or are not grade separated

RUN-OFF ROAD RISK

66% of curved sections of road carry traffic at 60km/h or more and have hazardous roadsides

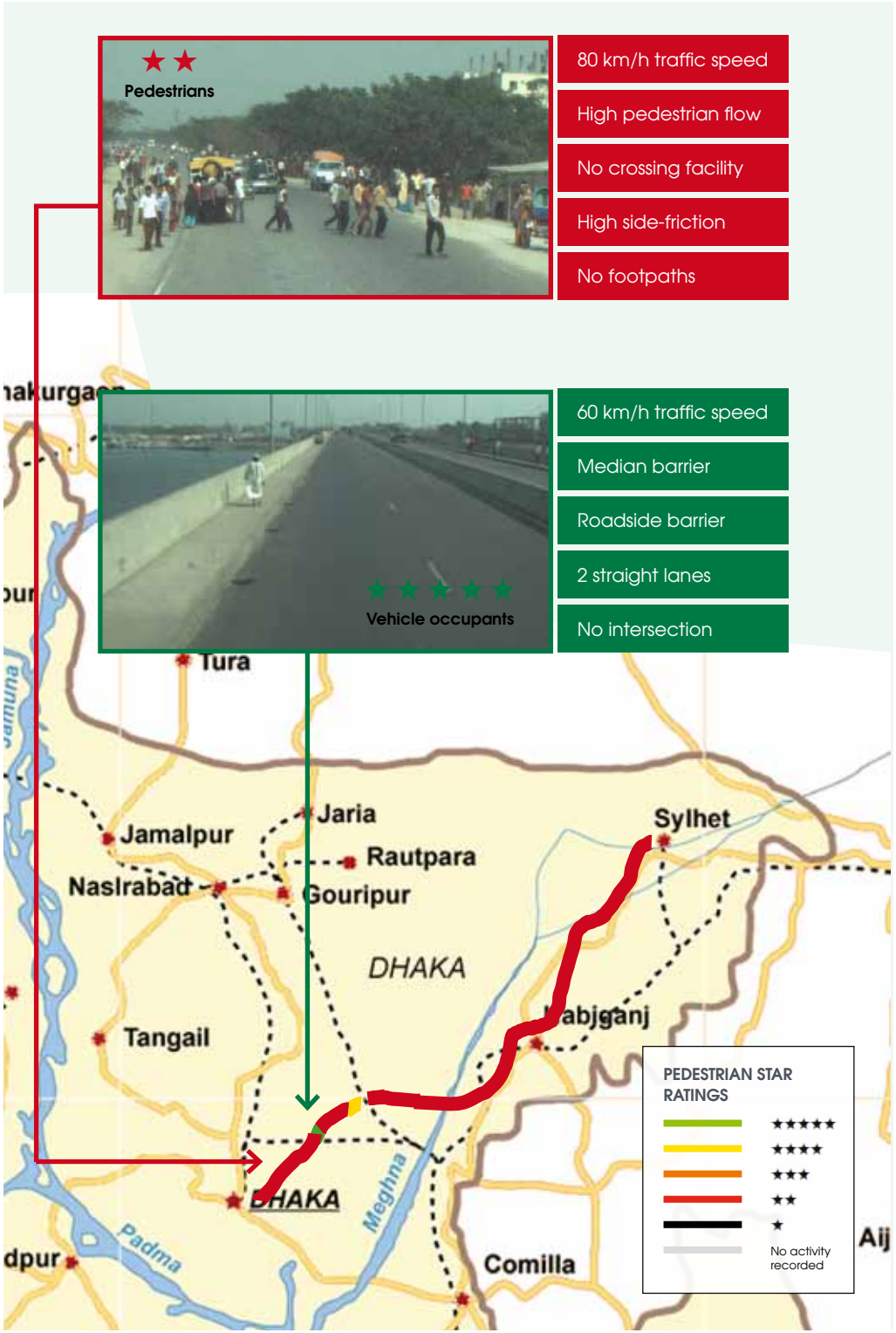
SNAPSHOT: THE DHAKA-SYLHET HIGHWAY

The 229km-long Dhaka-Sylhet Highway in Bangladesh is one of the most deadly in the world. 180 people were reportedly killed on the road in 2008, although the true number could be much higher.[14] On a per-kilometre basis, the reported death rate is a staggering 10 times higher than Britain's most persistently high-risk roads [15]

Stories of deaths on the Dhaka-Sylhet Highway accumulate at an alarming rate: former finance minister M. Saifur Rahman was killed in September 2009 when his car swerved off the road; at least 11 people were killed and 32 were injured when two buses collided near Belabo in 2010; 56 people were killed in 29 crashes on a notorious curve near Itakhola during 2010.

At the invitation of the FIA Foundation, the Government of Bangladesh and local road safety organisations, iRAP assessed the highway in 2010. Although the road had been upgraded only a few years earlier, it was still rated mostly two-stars or less for all road users. Shortcomings identified included a lack of paved shoulders and safety barriers, few if any pedestrian facilities and many hazardous intersections. The picture showing pedestrians at risk (top right) is a common scene on the highly dangerous highway. The subsequent economic analysis found that with such high rates of death and injury, even modest safety improvements were likely to prevent thousands of deaths and serious injuries—and generate large economic savings.

The assessment did also have one very positive finding: a short section of the highway was rated five-stars (see right). This demonstrates that with the application of safe-system principles in design and suitable investment, the construction of low-income risk roads is possible in Bangladesh.



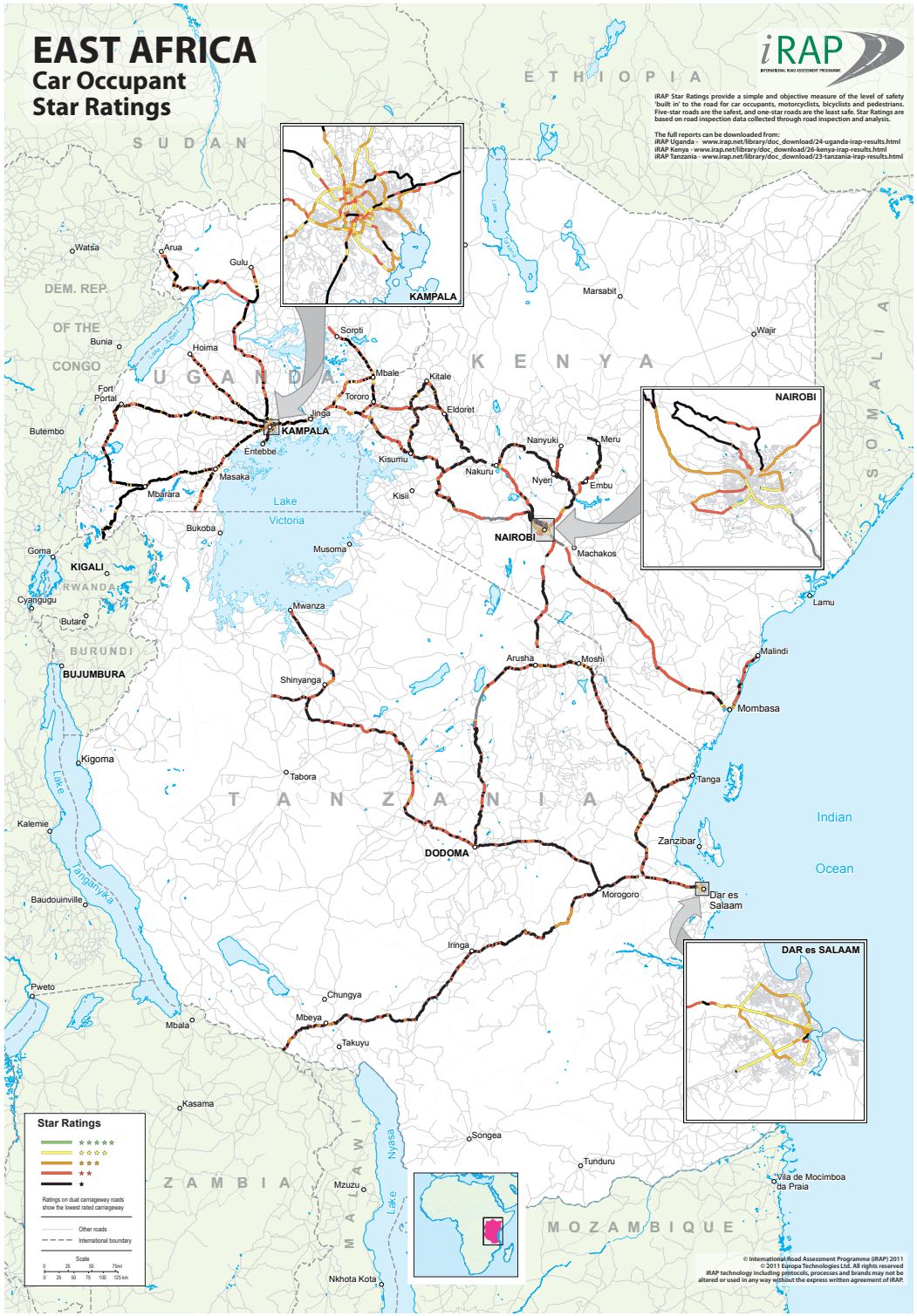
SNAPSHOT: REGIONAL ASSESSMENTS

One benefit of iRAP's approach is that assessments can cross borders of neighbouring countries, providing an internationally consistent basis for measuring risk and tracking performance

The first regional assessments were completed by EuroRAP, and culminated in the *European Road Safety Atlas*, which was financed by the European Commission and covers 240,000km of roads in 20 countries (atlas.eurorap.org). Since then, major regional assessments have been undertaken in numerous other countries around the world.

In East Africa, Star Rating maps of roads in Kenya, Uganda and Tanzania combine to illustrate levels of risk across some of the most important economic and trade routes in the region. As the map indicates (right), the large majority (85%) of the 8,000km-long network are rated one-star or two-stars for vehicle occupants, although roads in the urban areas where traffic speeds are lower tend to have better ratings. These results form the basis for road safety improvements (see Uganda snapshot).

In Latin America and the Caribbean, Star Ratings were produced for a 3,300km section of the Pacific Corridor, which carries 95% of products traded within the region. The Corridor passes through Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama. The Star Rating maps for the Pacific Corridor help governments and the Inter-American Development Bank target investments at the highest-risk sections of roads, where the most lives can be saved and largest economic gains can be made.



SNAPSHOT: HIGH INCOME COUNTRIES SHARING KNOWLEDGE AND EXPERTISE

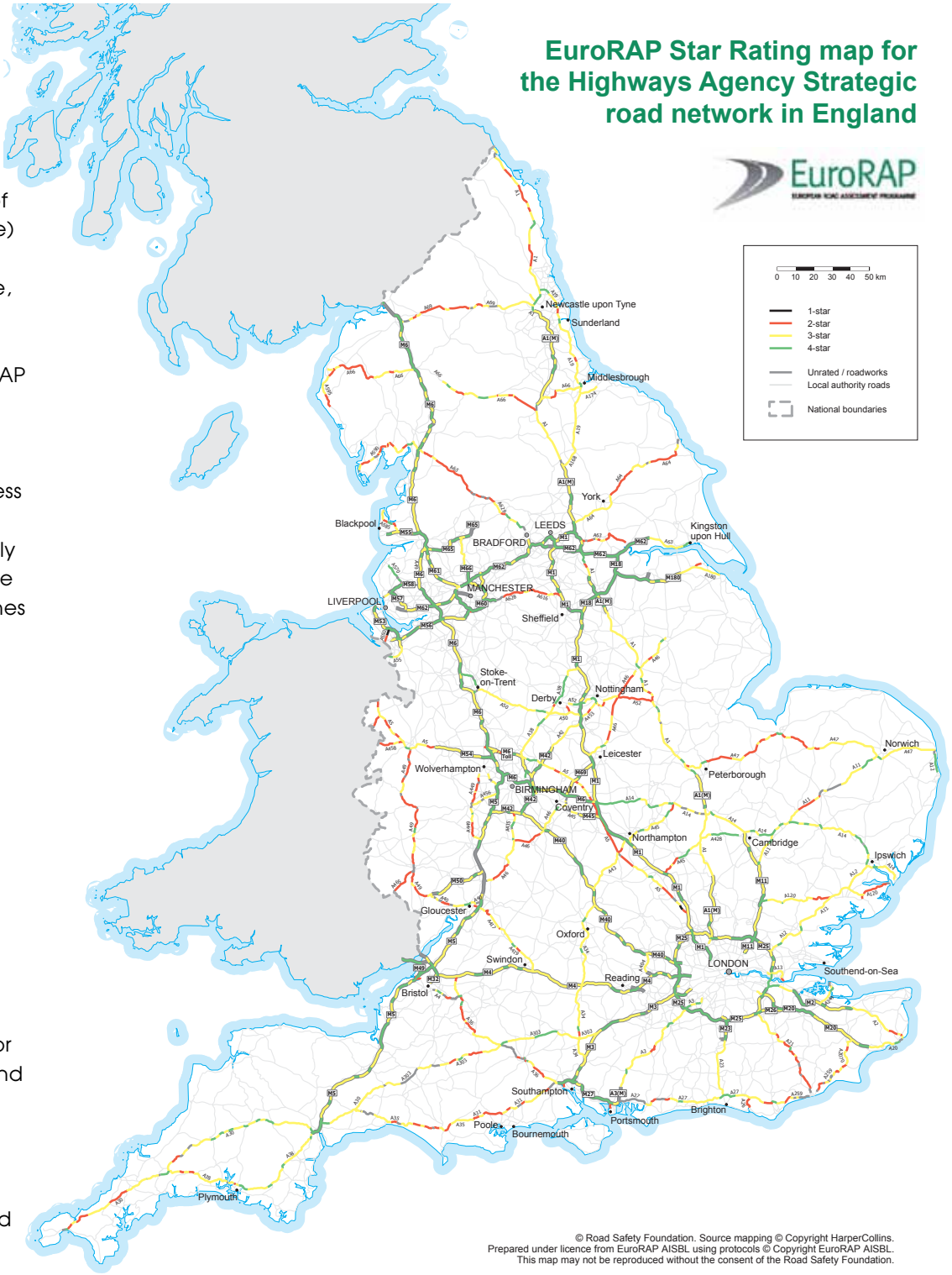
By taking a lead in assessing roads and advocating for safety in their own countries, and by sharing their experience globally, EuroRAP, AusRAP, usRAP and KiwiRAP are helping to drive reductions in road trauma around the world

High-income country programmes have assessed risk on hundreds of thousands of kilometres of roads (see right for example) and play a vital role in shaping road safety policy and directions. For example, Slovenian Risk Mapping results published in November 2009 received widespread support and led to the inclusion of EuroRAP in the national *Road Safety Operational Plan* for 2010-11.[16]

The high-income programmes also harness the substantial expertise of many road safety professionals. They are continuously innovating, searching for ways to improve systems, which results in better approaches to assessing roads and new ideas about how to improve infrastructure safety. The joint EuroRAP-EuroNCAP report *Roads That Cars Can Read* is just one example. The learning from this process can then be shared throughout the iRAP family around the world. For instance, at a recent iRAP Asia Pacific Workshop, which brought together experts from around 25 countries, KiwiRAP shared its experience in guiding, and measuring the benefits of, investment in median barriers that dramatically reduce the risk of head-on crashes. Similarly, usRAP has provided substantial technical support for assessments throughout Latin America and the Caribbean.

More information is available on the following websites: www.eurorap.org, www.ausrap.org, www.kiwirap.org.nz and www.usrap.us.

EuroRAP Star Rating map for the Highways Agency Strategic road network in England



SAFER ROADS INVESTMENT PLANS

To date, Safer Roads Investment Plans have been used to identify improvements in low-income and middle-income countries that could prevent more than 50,000 deaths and serious injuries per year, saving around $1.2 billion per year in crash costs avoided. The countermeasures identified are often relatively low cost yet they can last for decades

Where Star Ratings provide a measure of risk on a road, Safer Roads Investment Plans identify ways in which the Star Ratings can be improved in a cost-effective way.

The evidence that well-targeted road safety improvements save lives, at both individual locations and across networks, is unassailable. On a section of the A4128 in the United Kingdom, for example, speed reductions, improved signs and markings, intelligent road studs, traffic calming and upgraded pedestrian crossings helped cut the number of fatal and serious crashes from 19 in 2004-06 to two in 2007-09—an 89% reduction.[15]

In Victoria, Australia—a jurisdiction that has already made substantial reductions in crash rates—an initial $130 million investment in simple but strategic improvements across 113 projects resulted in a 22% reduction in run-off road, head-on and intersection casualty crashes.[17] As a result, the program was expanded to $650 million over 10 years.[18]

Safer Roads Investment Plans draw on this type of international experience. The plans include extensive planning and engineering information such as road attribute records, countermeasure proposals and economic assessments for 100m sections of road. They are supported by the iRAP online software which makes this information highly accessible.

The table below shows a snapshot of recommendations that have been made. For example, by investing in 1,600km of safety barriers on important national roads in Tanzania that have poor vehicle occupant Star Ratings, an estimated 30,000 deaths and serious injuries could be prevented. Similarly, sections of road in Chile which have a poor pedestrian Star Rating and significant pedestrian activity are likely to benefit from the installation of footpaths (or sidewalks).

Selected countermeasure recommendations (20 year analysis)

Countermeasure type	Country	Sites/length	Deaths and serious injuries prevented	Benefit cost ratio
Safety barriers	Tanzania	1,600 km	30,000	3
Duplication	Bangladesh	40 km	8,400	5
Footpaths	Chile	530 km	6,100	28
Delineation improvements	Vietnam	700 km	5,500	8
Pedestrian crossings	Costa Rica	310 sites	3,100	19
Shoulder widening	Serbia	290 km	1,200	10
Motorcycle lanes	Malaysia	270 km	900	15
Signalise intersections	Indonesia	80 sites	900	12

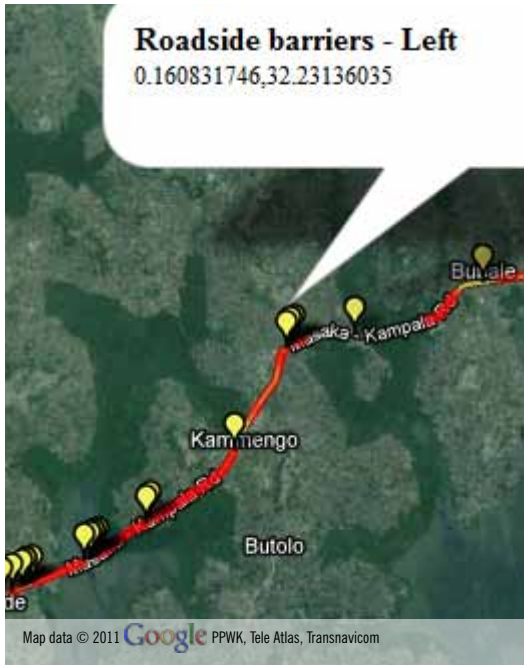
SNAPSHOT: SAFER ROADS IN UGANDA

Targeted safety improvements in Uganda will prevent thousands of deaths and serious injuries over the next decade

iRAP Uganda is a collaboration with the Ministry of Works and Transport, the Uganda National Roads Authority and the Automobile Association of Uganda which has assessed some 2,400km of national roads.

Many of the safety improvements identified in the project coincided with improvements put in place by the road authority with financing from the World Bank, the European Union and the government of Uganda. On the 136km-long Masaka-Mbarara Road, for example, improvements included paving shoulders (see right), clearing roadside hazards, installing roadside safety barriers (see right), better delineation, provision of footpaths and traffic calming and construction of roundabouts.

As a result of these improvements, the length of one-star roads for vehicle occupants, on this road has dropped by 47%. It is estimated that 144 deaths or serious injuries will be prevented each year as a result of the improvements.



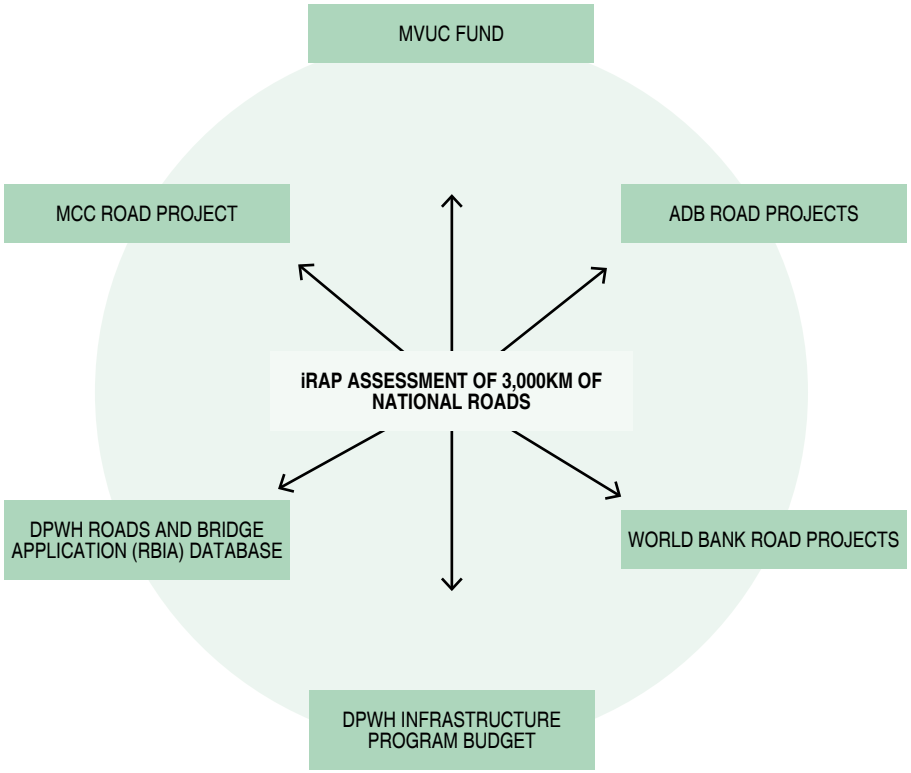
SNAPSHOT: LEVERAGING INVESTMENT IN THE PHILIPPINES

Network-level Safer Roads Investment Plans provide a means of leveraging existing investments for road safety

With financial assistance from the Global Road Safety Facility, the Philippines Department of Public Works and Highways (DPWH) and the Automobile Association of the Philippines (AAP) led iRAP assessments of approximately 3,000km of national roads. Although these represent just fewer than 10% of national roads, they carry almost 30% of traffic. The most comprehensive plan developed in the project identified investments totalling $150 million which could prevent an estimated 27,000 deaths and serious injuries over 20 years.

By identifying complementary objectives with projects as diverse as the Millennium Challenge Corporation (MCC)-financed improvements of roads in Samar, the Motor Vehicle User Charge `additional pavement width' fund and the black spot program, opportunities to leverage existing finance to implement the majority of safety recommendations were identified. For example, although the `additional pavement width' fund is specifically designed to increase road capacity, the iRAP project found that by improving overtaking facilities, and thereby reducing the risk of head-on crashes, significant safety benefits would also be achieved through the construction of additional lanes on parts of the network.

As a result of the success of the first project in the Philippines, a second phase of assessments was financed by the Australian Government overseas aid program, AusAID.



STAR RATING ROAD DESIGNS

Apart from assessing existing roads, Star Ratings are being used to ensure that safety is built-in to designs for major upgrades and new roads prior to construction

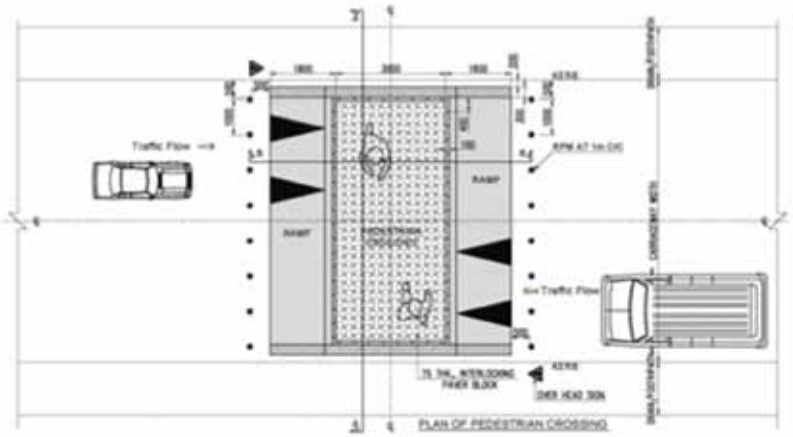
It is critically important that people's safety and well-being is not overlooked in favour of more traditional objectives such as reducing congestion and travel times. The seven major multilateral development banks are improving safety performance measures for the road designs they finance.[19] Similarly, the Commission for Global Road Safety recommends that desired design speeds for new roads should be subject to achieving minimum safety ratings.[20]

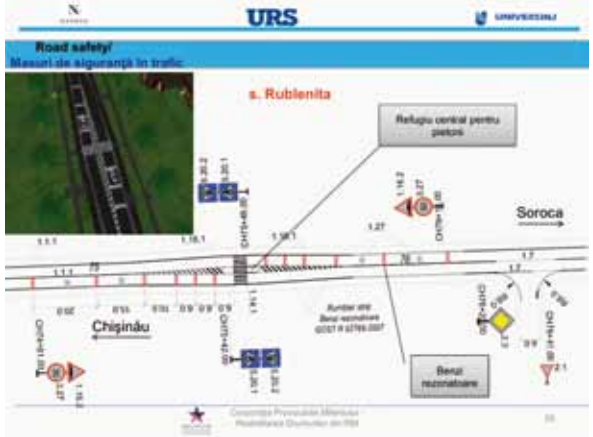
The Karnataka State Highway Improvement Project (KSHIP) in India provides a good example of how Star Ratings are being used to design safer roads:

1. The World Bank initially set a target of three-stars for road safety demonstration corridors.[21] The Government then extended this target to include around 500km of additional roads.
2. With funding support from the Global Road Safety Facility and Bloomberg Philanthropies, road safety inspections were carried out and baseline Star Ratings calculated for the existing roads.
3. Consulting engineers and road authority engineers used Star Ratings to test the safety impact of various design options, such as `raised pedestrian crossings' (see below left).
4. Final designs were based on optimised Star Ratings and met local design standards and budget and environmental requirements.

This process resulted in designs with significantly better Star Ratings than the existing roads. For example, the percentage of road rated one-star or two-stars for vehicle occupants reduced from 86% to 2%. It was estimated that the new designs would result in 55% fewer deaths and serious injuries than currently occur.[22]

A project in the Republic of Moldova produced similarly impressive results. With the support of the MCC, the Global Road Safety Facility and engineers from URS Corporation and Universinj, designs that particularly focused on pedestrians in villages (see below right) increased the percentage of road rated four-stars from 8% to 84%. Final designs were estimated to reduce risk of deaths and serious injuries by 40%.[23]





TRACKING PERFORMANCE

The establishment of road safety targets requires that safety performance be monitored over time. Governments and funding agencies can also benefit from evaluating the road safety impacts of their investments

In countries where reliable crash data is available, Risk Mapping has been used to compare crash rates over time. These countries include Australia, Austria, Belgium, Bosnia and Herzegovina, Croatia, Czech Republic, Ireland, Italy, the Netherlands, New Zealand, Poland, Slovakia, Slovenia, Spain, Sweden, Switzerland, the United Kingdom and the United States.[24] For example, the Spanish automobile association (RACC) found that the number of high crash risk stretches or very high crash risk stretches has decreased from 36% to 7.3% over 10 years (from 1999-2001 to 2008-2010).[25] In Poland, researchers at the Technical Institute of Gdansk, together with experts from the motoring club PZM and the Foundation for Civil Engineering found that although 42% of total national roads were rated as high risk for the period 2008-2010, this was 19% (3,000km) less than in 2005-2007.[26] In the Czech Republic, UAMK and CityPlan published risk rates on national roads from 2003 to 2010. They found that the number of lower-risk sections was increasing and the number of highest risk ones was decreasing.[27]

Safety performance indicators also provide an effective means of monitoring performance. Measures such as helmet and seat belt wearing rates have been used effectively in assessing road safety behaviour, as have speed measurements and conflict studies, and iRAP Star Ratings provide a set of safety performance indicators for road infrastructure.[28] In New Zealand, KiwiRAP Star Ratings are included in weekly road death reports to the Minister for Transport. By combining this with information about behaviour-related issues such as seat belt wearing and speeding and Australasian NCAP Star Ratings for cars, the Minister is able to gain a balanced view of the factors that influenced each death. In Malaysia, the road authority (JKR) used Star Ratings to rapidly estimate the change in infrastructure-related risk as a result of improvements at several high-risk sites under the black spot program (see image). [29]

PUTTING RESEARCH INTO PRACTICE

The iRAP methodology is based on sound research and compelling evidence. Throughout the United Nations Decade of Action for Road Safety 2011-2020, we will ensure iRAP is at the forefront of putting research into practice

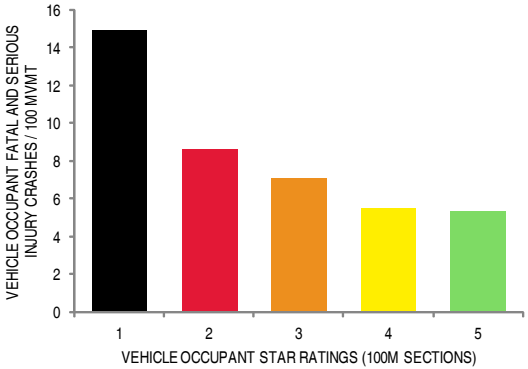
The iRAP methodology was derived from EuroRAP and AusRAP models by leading researchers at TRL (United Kingdom), ARRB Group (Australia), MRI Global (United States), the world's automobile clubs and with particular assistance from the Swedish Road Administration.[10] The model's ongoing development and oversight is governed by a Global Technical Committee (GTC) comprised of iRAP members with significant expertise in road infrastructure safety, and representatives from iRAP Centres of Excellence.

Through application in dozens of countries and extensive research, iRAP methodology has undergone continual review and validation. At the broadest level, the road safety improvement programmes proposed for the four initial pilot countries (and many countries since then) have provided useful and practical information for local safety engineers.[10] This is unsurprising, given that the methodology shares its heritage with programmes that have a demonstrated record of saving lives. As Star Ratings are often used where there is little crash data available, it is nevertheless important to understand whether they correlate with actual crashes. Studies of this topic have been conducted in Australia (see below centre), Germany, Iceland, Italy, Netherlands, New Zealand (see below right), Spain, Sweden, the United Kingdom and the United States (see below left).[30] In each case, a demonstrable relationship between Star Rating and crash rate was found.

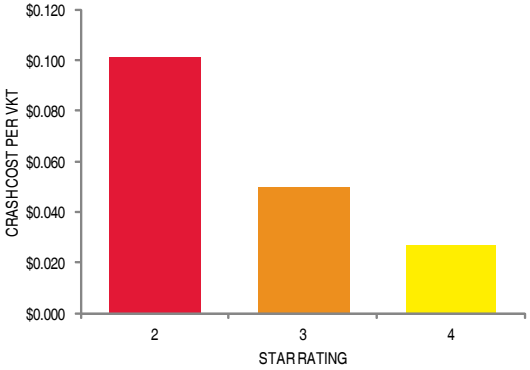
In 2010, the Global Road Safety Facility sponsored a workshop to open the methodology to independent review, especially with respect to speed.[31] Participants included representatives from the Institute of Transport Economics (Norway), the Dutch national road safety institute (SWOV) and the Korea Transport Institute (KOTI). The workshop concluded that the methodology was impressive, comprehensive and systematic, and that it provides researchers with a strong platform to guide research needs globally.

iRAP draws on decades of research and experience by dedicated road safety professionals around the world. As we move through the United Nations Decade of Action for Road Safety 2011-2020, we will also put new knowledge into practice. There is more to learn about road infrastructure risk in low-income and middle-income countries particularly, such as finding optimal ways to help pedestrians cross busy roads. We will achieve this in partnership with leading researchers and road authorities around the world, including those discussed earlier along with the Malaysian Institute of Road Safety Research (MIROS), the Mexican Institute of Transport (IMT), the Research Institute of Highway (RIOH) in China and the Transport Research Board (TRB) in the United States.

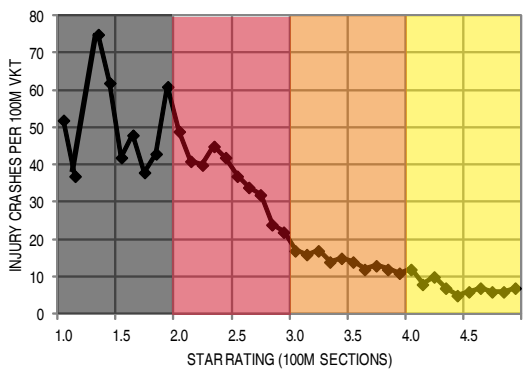
Star Ratings and serious crashes, Washington and Iowa, USA



Star Ratings and crash costs, Queensland, Australia



Star Ratings and injury crash rates, New Zealand



LOCAL OWNERSHIP AND EXPERTISE

Countries that have successfully reduced deaths and serious injuries invariably benefit from engagement in the issues at all levels, from political leaders to policy makers, professionals and the community. iRAP works to build the pyramid of leadership, skills and enthusiasm necessary to transform the safety of roads

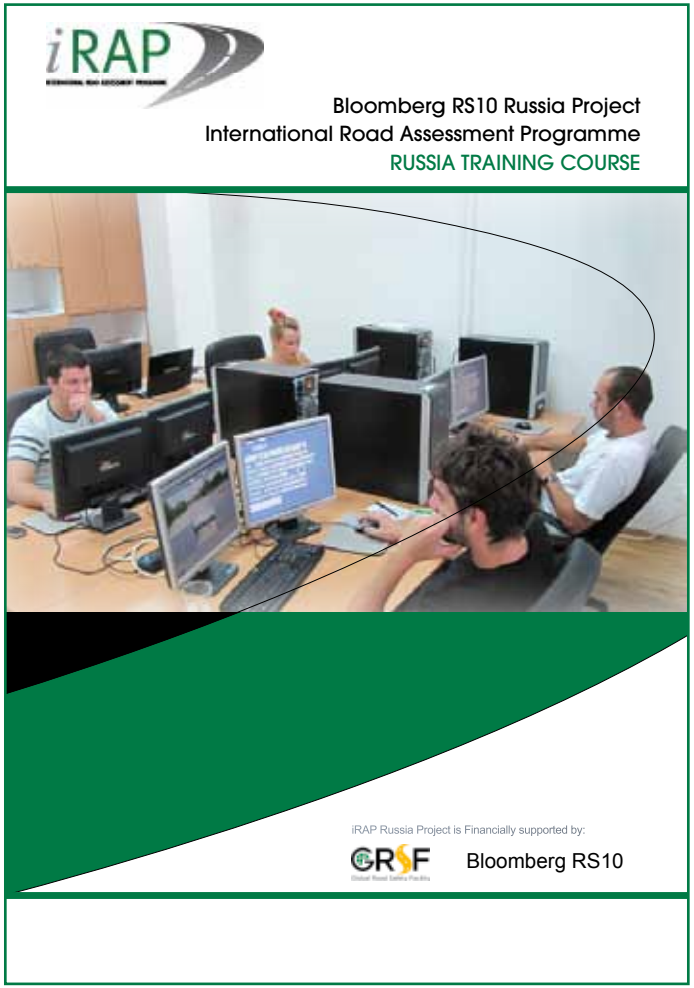
There is substantial expertise in road safety around the world, though much of it is concentrated in high-income countries. For example, anecdotal evidence suggests there are around 500 road safety specialists in the Australian State of Victoria, which has a population of just 5.5 million people (and a world-class rate of 5.3 deaths per 100,000 population).[32] At the other end of the spectrum, it is unusual for a low-income or middle-income country to have more than a handful of such specialists, despite its road safety challenge usually being vastly larger than that of Victoria.

Part of iRAP's strategy is to create sustainable learning opportunities, often combined with delivery of projects, to strengthen institutional road safety capacity. Elements of the strategy include:

- training modules that can be combined to create courses that match the needs of participants (see next page)
- university accreditation for courses, including the 'iRAP programme and project leader's module' that was developed with support from the Centre for Accident Research and Road Safety – Queensland (CARRS-Q), the Malaysian Institute of Road Safety Research (MIROS) and the Australia-Malaysia Institute
- on-the-job training during projects, such as participation in road safety inspections and coding
- mentoring road authority engineers and key stakeholders to ensure they are familiar with all parts of a project and fully understand the methodology, results and are able to implement recommendations
- regional workshops, that provide opportunities to share knowledge and experience and build networks.

iRAP training modules that can be combined to create courses that match the needs of participants

Training module	Who
iRAP overview An overview of iRAP's vision, Risk Mapping, Performance Tracking, Star Rating and Investment Plans, Road Safety Toolkit, global activities and 'family' members	Policy makers, senior management, programme stakeholders
iRAP programme and project leaders How to deliver iRAP projects, basic theory and analysis knowledge, reporting and communications	Programme leaders, project managers and team members, consultants and suppliers
iRAP road safety inspections and coding Good road inspection practice (including system calibration, planning, data collection techniques and data handling) and iRAP coding (including coding of test sections, quality assurance and use of software to upload results for processing)	Programme leaders, project managers and team members, inspection crews, coding supervisors and teams
Using iRAP results to eliminate high risk road How to use Risk Map, Performance Tracking, Star Rating and Investment Plan results to eliminate high risk-roads	Policy makers, senior management, programme stakeholders, planners
Establishing and procuring iRAP activities The business case for improved road engineering safety. The three stages of project preparations, project delivery and implementation of countermeasures. Includes reviews, pre-project economics and likely returns, standard terms of reference, contract and quality assurance documentation, and accredited supplier details	Development bank personnel, government / road authority managers, programme managers
Designing five-star roads How the iRAP Star Rating model, Road Protection Scores, Star Rating Demonstrator and Road Safety Toolkit enable designers to set and/or meet minimum Star Rating design specifications	Project managers, road designers, consultants, construction teams and planners
Five-star communications How to make the most of RAP and opportunities to build organisational and community awareness and enthusiasm for road safety and investment in safer roads.	Policy makers, media specialists, senior management, programme leaders and stakeholders



1.7 MILLION REASONS TO INVEST

Road crashes are the number one killer of young people worldwide. What greater incentive could we need to invest in safer infrastructure? A response that is commensurate with the enormous scale of this public health crisis is urgently required

Society's willingness to blame road users for deaths has lulled us into a sense that designs which are fundamentally unsafe are adequate. This must change: pedestrians without footpaths, roadside hazards without safety barriers, high-speed undivided roads must become things of the past. The United Nations Decade of Action for Road Safety 2011-2020 requires that we take a fresh, honest look at the causes of death and injury—and the solutions.

Based on the estimates of the number of deaths and the related cost of deaths and serious injuries in each country, we calculate that serious road trauma costs the world more than $1.5 trillion per year. At the same time, road authorities spend approximately $500 billion each year on road infrastructure. In many cases, less than 1% of this is earmarked for road safety. Given this imbalance, it should come as no surprise that we are facing a global epidemic. As the Global Commission for Road Safety highlights, we are simply not investing enough in safety. A scaling-up of investment is essential—it is morally, socially and economically justified.

It is reasonable to ask what a commensurate global response on infrastructure safety is. What would it take to emulate the examples discussed earlier for Sweden, Australia and the United Kingdom on a large scale? By drawing on existing data, research and our experience in undertaking iRAP assessments on every continent, we have attempted to answer this question. In doing so, we now have the outline of a business case for global investment in safe roads (see right).[33]

The business case not only supports World Bank guidelines that the safety component of road projects should constitute between 5% and 10% of total project costs, and recommendations by the Commission for Global Road Safety and the United Nations' *Global Plan for the Decade of Action for Road Safety 2011-2020* that 10% of total project costs should be allocated to safety. It also shows that investing a *further* 10% of total project costs in safety is economically justified. It shows that, on average, a death or serious injury can be prevented for as little as $2,000 in low-income countries.

The case for global investment in safety is compelling. A Decade of Action in high-return road investment *can* create a world free of high-risk roads.

10%

Target for improvement of the busiest and highest-speed roads (which typically account for more than half of all road deaths)

$1,000 billion

Invest $1,000 billion worldwide by 2020 (that is, the equivalent of about one-fifth of current spending on roads worldwide)

1.7 million

Prevent 1.7 million deaths and serious injuries every year from 2020 onwards

$5,400 billion

Save $5,400 billion in crash-cost savings over 20 years

RAPs SUPPORTING THE DECADE OF ACTION IN PRACTICAL WAYS

To achieve global reductions in road trauma, a significant scaling-up of road safety awareness, action, expertise and knowledge sharing is needed. The Global Plan for the Decade of Action for Road Safety 2011-2020, established by the World Health Organization and the United Nations Road Safety Collaboration, is designed to achieve this. The following are examples of how RAPs are taking practical steps to enabling each of the Plan's five pillars to contribute to cuts in road trauma. The second pillar, Safer Roads and Mobility, is co-chaired by iRAP and the International Road Federation (IRF)

HOW RAPs ARE SUPPORTING PILLAR 1 OF THE UN GLOBAL PLAN: ROAD SAFETY MANAGEMENT

The New Zealand Transport Minister receives a report on each fatal crash which includes the KiwiRAP (www.kiwirap.org) Star Rating of the road.

Ministers from countries as varied as the Netherlands, Malaysia and Paraguay have announced policy goals based on raising Star Ratings, such as eliminating one-star and two-star national roads by 2020.

usRAP (www.usrap.us), which has assessed some 100,000km of roads in eight States, provides performance benchmarks that support the goals of 'Towards Zero Deaths: A National Strategy'.

AusRAP (www.ausrap.org), which has assessed some 30,000km of roads, is collaborating with Austroads on the integration of Star Ratings and investment plans with broader planning tools to support the national road safety strategy.

The President of the Philippines takes a personal interest in improving the Star Ratings of the nation's roads, providing crucial road safety leadership.

iRAP is partnering with the Multilateral Development Banks to help implement MDB *Road Safety: A Development Priority.*

RAPs are contributing to good governance by increasing understanding and support of safety programs and reinforcing public agency accountability for safety.

The Prime Minister of the Republic of Moldova shows outstanding leadership, staying well-briefed on iRAP road safety inspections

Mexico will inspect and Star Rate more than 45,000km of roads as part of strategy to provide safe roads for economic and social development.

There is an ever-growing body of evidence making the business case for investment in safety. *Saving Lives, Saving Money* identified potential savings of between £25 billion and £36 billion by 2020 in the UK.

Organisations such as the Slovak Motoring Club are using EuroRAP (www.eurorap.org) Risk Maps to measure actual performance against national road safety targets during the Decade of Action.

HOW RAPs ARE SUPPORTING PILLAR 2 OF THE UN GLOBAL PLAN: SAFER ROADS AND MOBILITY

Thanks to the support of our donors and partners, iRAP is able to provide its tools and software to developing countries free-of-charge. Along with programmatic support for their use, this is enabling hundreds of thousands of kilometres of high-risk roads to be assessed and improved.

The European Road Safety Atlas (atlas.eurorap.org) assesses 240,000km of roads across 20 countries. It reveals that 42% of the roads rated had unacceptably high risk, and over a quarter of roads Star Rated scored less than the recommended minimum three-star rating.

Road authorities in India and the Republic of Moldova have used Star Ratings to find ways to improve designs for new roads.

Star Ratings provide baseline safety indicators for roads being rehabilitated in the Philippines with finance from the Millennium Challenge Corporation.

Performance tracking shows how risk changes over time. AusRAP, for example, found that on the top 15 most improved sections of Australian national roads, casualty crashes declined from 963 to 424—a 56% reduction—between 2000-04 and 2005-09.

Working with Illinois DOT and usRAP, Kane County DOT has developed a plan that would provide nearly $24 in benefits for each $1 spent on safety engineering improvements.

KiwiRAP found that although just 5% of New Zealand's 10,000km long State Highway network rated 4- stars or better, 28% of travel occurs on these roads, indicating that investment has been well targeted.

iRAP training courses, like this one in Peru, are being delivered around the world. Content for courses is also being provided by organisations such as the Institute of Transportation Engineers (ITE).

iRAP Centres of Excellence—ARRB Group, the Transport Research Foundation, the Mexican Institute of Transport (IMT) and the Malaysian Institute of Road Safety Research (MIROS) and MRI Global are enabling large-scale use of assessments. They provide training, undertake research and development and deliver projects.

Barriers to Change: Designing Safe Roads for Motorcycles (www.eurorap.org) found that while safe road design has cut deaths and injuries significantly, there is room for improvement for bikers.

ROAD SAFETY TOOLKIT

Free information on the causes and prevention of serious road crashes

Building on decades of road safety research, the Road Safety Toolkit (toolkit.irap.org) helps engineers, planners and policy makers develop safety plans for vehicle occupants, motorcyclists, pedestrians, bicyclists, heavy vehicle occupants and public transport users.

In Malaysia, Star Ratings have been used by the Public Works Department (JKR) to make immediate assessments of reductions in risk at dangerous roads fixed under the national black spot program.

Projects such as in Belize bring together a range of organisations, including road authorities, NGOs, police, finance departments, consultants and donors to ensure they benefit from diverse expertise.

Assessments in Paraguay showed how an investment of $25 million will avoid 18,500 accidents.

HOW RAPs ARE SUPPORTING PILLAR 3 OF THE UN GLOBAL PLAN: SAFER VEHICLES

Roads That Cars Can Read—a joint initiative of EuroRAP and EuroNCAP—found that the condition of road signs and markings could be the greatest hurdle in reaping benefits of vehicle technology such as 'Lane Support' and 'Speed Alert.'

In coming years, motorists in the US will be able to use their in-car navigation system to request not only the quickest way from point A to point B, but the safest way using usRAP Risk Maps.

usRAP is exploring the use of Risk Maps to help state and local law enforcement officials target enforcement activities at roads with high risk rates and specific issues, such as drink driving.

HOW RAPs ARE SUPPORTING PILLARS 4 AND 5 OF THE UN GLOBAL PLAN: SAFER ROAD USERS AND POST-CRASH RESPONSE

RAPs are engaging the public in road safety. Risk-aware road users are more likely to adapt their behaviour to reduce their risk, and will better understand the need for traffic laws and speed limits.

Companies such as BHP Billiton use Star Ratings and Risk Maps to understand and minimise risk for their employees and local communities.

Risk Maps, Star Ratings and fatality estimations help identify where the need for post-crash care is greatest.

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