iRAP
INTERNATIONAL ROAD ASSESSMENT PROGRAMME

International Road Assessment Programme

A WORLD FREE OF HIGH RISK ROADS

iRAP India

Project Summary

About iRAP

The International Road Assessment Programme (iRAP) is registered charity dedicated to saving lives through safer roads.

iRAP works in partnership with government and non-government organisations to:

- inspect high-risk roads and develop Star Ratings and Safer Roads Investment Plans
- provide training, technology and support that will build and sustain national, regional and local capability
- track road safety performance so that funding agencies can assess the benefits of their investments.

The programme is the umbrella organisation for EuroRAP, AusRAP, usRAP, KiwiRAP and ChinaRAP. Road Assessment Programmes (RAP) are now active in more than 70 countries throughout Europe, Africa, Asia Pacific, North, Central and South America.

iRAP is financially supported by the FIA Foundation for the Automobile and Society and the Road Safety Fund. Projects receive support from the Global Road Safety Facility, automobile associations, regional development banks and donors.

National governments, automobile clubs and associations, charities, the motor industry and institutions such as the European Commission also support RAPs in the developed world and encourage the transfer of research and technology to iRAP. In addition, many individuals donate their time and expertise to support iRAP.

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L.Rogers 28 October 2015

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1 Introduction

By any measure, road crashes represent an enormous public health challenge for India. Roads have an alarmingly high rate of death and injury nationally, and extremely high rates on particular stretches. This level of road trauma is not an inevitable outcome of rapid development – it is preventable.

As part of efforts to curb road road deaths and serious injuries, the World Bank Global Road Safety Facility (GRSF) invited the International Road Assessment Programme (iRAP) to work with the Ministry of Road Transport and Highways (MoRTH), public works departments, research institutes, local engineering firms and motoring clubs to assess the safety of Indian roads.

This report summarises the results for roads in Andhra Pradesh, Assam, Gujarat, Haryana, Karnataka, Kerala, Rajasthan, Tamil Nadu, Telangana and Uttar Pradesh surveyed between 2010 and 2014. Most of the roads are rated just 1- or 2-stars for safety and its is estimated that 76,000 deaths and serious injuries occur on the roads each year at a cost of INR 182.2 billion (USD 2.8 billion).

The reasons for this enormous level of trauma are in part due to the fact that 97% of the roads where pedestrians are likely to use the road have no formal footpaths. However, iRAP Safer Roads Investment Plans make a good economic case for the solutions. By giving people a safe place to walk for instance, new footpaths on 440km of road in Kerala could prevent 4,600 deaths and serious injuries over 20 years and save INR 3.4 billion (USD 52.2 million) in crash costs. Much of this cost would otherwise be borne by an already stretch health sector.

Investments to improve many of the roads have been included in World Bank financed projects worth more than $5.4 billion. Designs for around 20% of the roads assessed have been star rated, helping to ensure that safety is built-in to the plans prior to construction. Government and consulting engineers from each of the states have participated in training and briefings on the assessments.

The results contained in this report and the interactive online results (at http://vida.irap.org) help to show that by making targeted investments in priority roads the social and economic burden on familes, communities, workplaces and hospitals can be significantly reduced.

2 Road Network and Survey

By systematically inspecting roads we can develop an understanding of the level of risk that is 'built in' to 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.

Detailed road attribute surveys were undertaken on 10,444km of roads across 10 states. The inspections were done using a road survey vehicle (as shown in the image above) equipped with GPS, video cameras, distance measuremnt devices and survey software which analaysts used to record around 50 different road attribute features that are known to influence the likelihood and severity of a crash on each 100 metre segment of road.

The inspections create a permanent image, location and road attribute database that can easily be accessed and reviewed by local engineers and planners.

The attributes recorded include intersection type and design, road cross-section and markings, pavement condition, roadside hazards, footpaths and other facilities for vulnerable road users. The data collection was led by local firm Indian Road Survey and Management (IRSM) for the surveys conducted in 2010-2012 and by the Czech-based engineering consultants AF-CITYPLAN during July and August 2014. Detailed crash investigation studies were also carried out by JP Research India so that the true nature of crashes on the roads could be fully understood.

2.1 Survey equipment

The surveys undertaken by IRSM used a Hawkeye 2000 digital imaging system with three high resolution cameras manufactured by ARRB Group, whereas the 2014 surveys conducted by AF-CITYPLAN used 2 forward facing cameras. Both systems recorded a panoramic view of the road and roadside verges in front of the vehicle, with the field of view sufficiently wide to identify intersections, roadside usage and also roadside hazards.

The cameras used by IRSM were also calibrated to allow the measurement of particular features of the road such as lane and shoulder widths and distance to road side hazards which are important components in the safety assessment of the road.

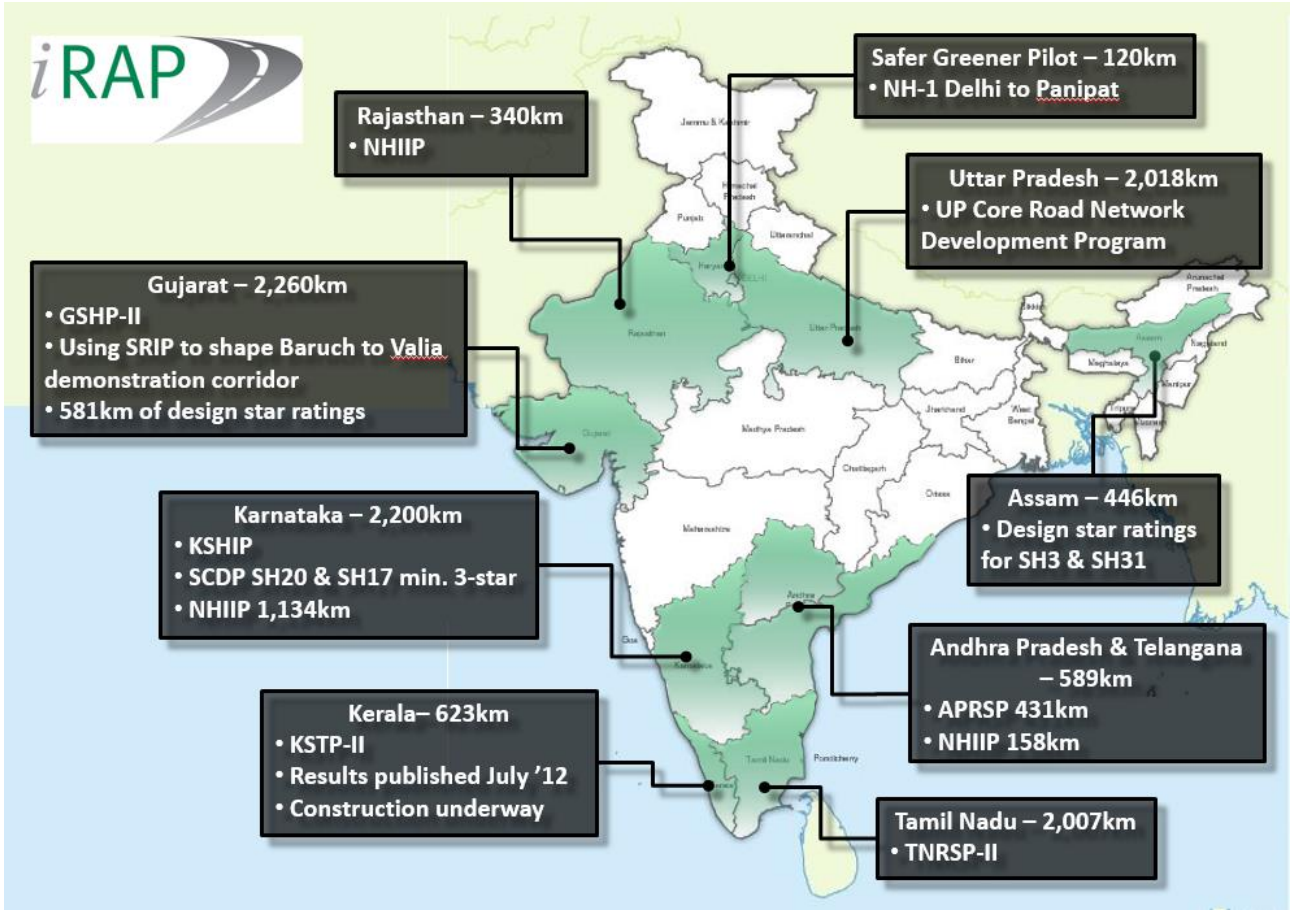
2.2 Surveyed road network by state

The table below contains the list of projects and the length of roads surveyed in each state.

Table 1 Road list and surveyed lengths

Project Name	State	Survey year	Length (km)
Lucknow – Muzaffarpur National Highway Project NH1	Haryana	2010	120
Andhra Pradesh Road Sector Project	Andhra Pradesh and Telangana	2011	431
Assam State Roads Project	Assam	2011	446
National Highways Interconnectivity Improvement Project (NHIIP)	Andhra Pradesh Karnataka Rajasthan Telangana	2012	1,632
Gujarat State Highway Project II (GSHP II)	Gujarat	2011 - 2012	2,261
Second Karnataka State Highway Improvement Project (KSHIP II)	Karnataka	2011	908
Second Kerala State Transport Project (KSTP II)	Kerala	2012	623
Tamil Nadu Road Sector Project (TNRSP II)	Tamil Nadu	2014	2,007
Uttar Pradesh Core Road Network Development Program (UPCRNDP)	Uttar Pradesh	2014	2,018
Total			**10,446**

Figure 1 Map showing projects by state

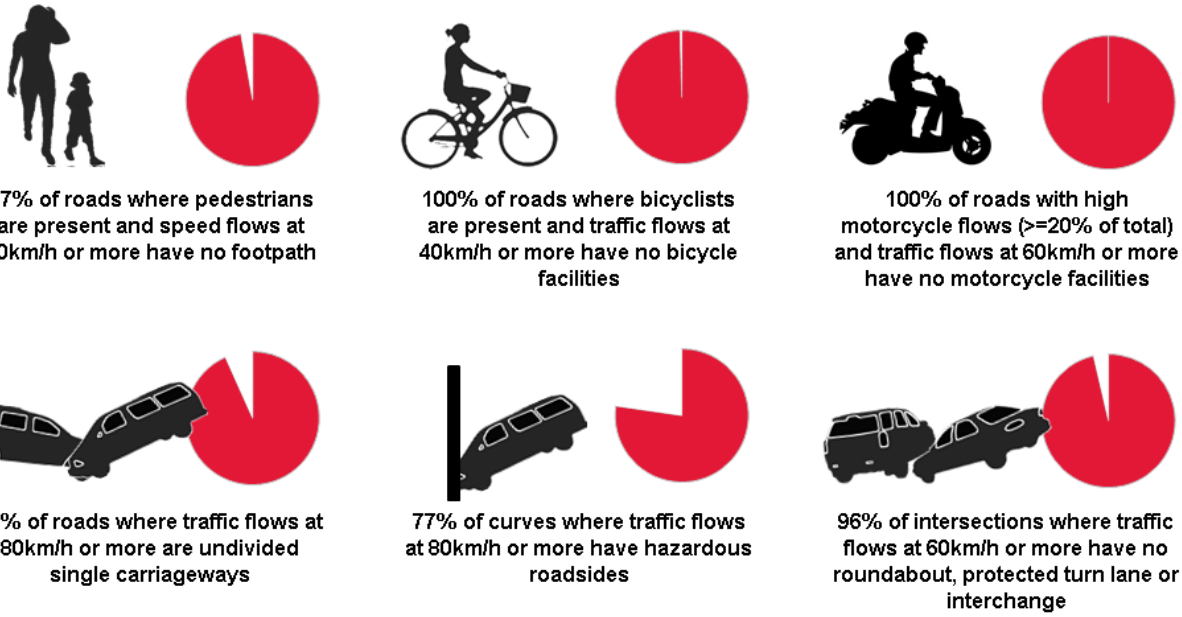


3 Key Road Attributes

iRAP inspections create a rich source of data that provides an insight into why road trauma remains one of the world's leading public health challenges. The results shown below are based on the full 10,444km dataset across 10 states, including rural and urban road sections on both the national and state highway network. These risk factors play a significant role in the iRAP Star Rating results and provide a basis for investigating and designing life-saving treatments.

Data produced from the assessments in India show that the county's roads contain high-risk design flaws that contribute to the high numbers of deaths and serious injuries across all states.

Figure 2 Road attributes



4 Crash Statistics

Road crashes in India result in high levels of death and serious injury. The latest official figures show that 139,671 people were reported killed and close to 500,000 were seriously injured in road crashes in India in 2014.[1] 16 lives are lost every hour in India and urgent action is required to improve safe road design in order to significantly reduce these avoidable tragedies.

Many of the states that have been surveyed in India to date experience very high levels of road trauma. The table below shows a summary of road death data for each of the states currently using iRAP surveys.

Table 2 Road deaths in relation to road length and population within selected Indian states

State	Recorded road deaths 2014 (and rank)*	Total road length (km)**	Population (and rank)***	Deaths per 100,000 population
Andhra Pradesh & Telangana	7,908 (8) & 6,906 (9)	261,657	49,386,799 (10) & 35,286,757 (12)	16.0 & 19.6
Assam	2,522 (18)	288,135	31,169,272 (15)	8.1
Gujarat	7,955 (7)	165,640	60,383,628 (9)	13.2
Haryana	4,483 (13)	42,476	25,353,081 (18)	17.7
Karnataka	10,452 (4)	305,448	61,130,704 (8)	17.1
Kerala	4,049 (14)	185,030	33,387,677 (13)	12.1
Rajasthan	10,289 (5)	226,124	68,621,012 (7)	15.0
Tamil Nadu	15,190 (2)	238,004	72,138,958 (6)	21.1
Uttar Pradesh	16,287 (1)	435,969	199,281,477 (1)	8.2

* Ranking out of 36 states and union teritories (ranked 1 means highest number of deaths in country)
** Basic Road Statistics of India 2012-13
*** Census of India 2011

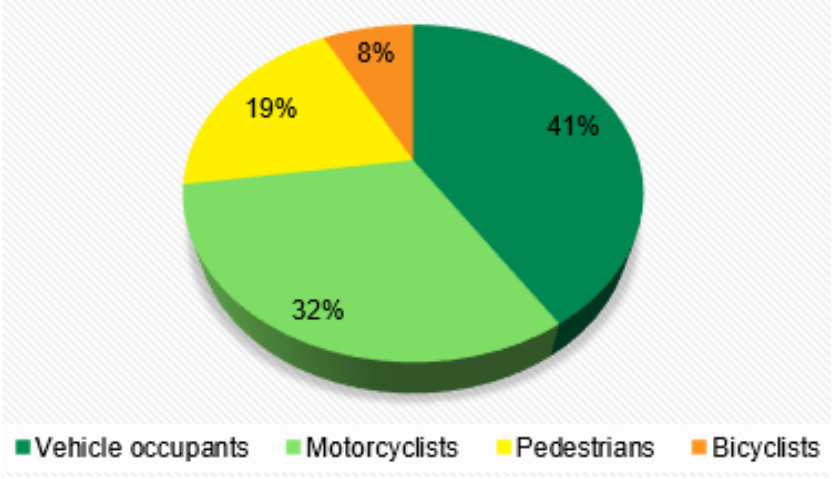
By any measure road crashes represent an enormous public health challenge for India. In one example, crash scene investigations conducted by JP Research India as part of iRAP assessments on a 53km stretch in Karnataka recorded nine deaths and 17 serious injuries during a period of just 45 days. That equates to annualised rate of 2.6 deaths and serious injuries per km – an astronomically high rate by international standards.

[1] Road Accidents in India 2014, MoRTH

In Uttar Pradesh the crash data collected as part of the project gives an indication of the death rates experienced on many of the corridors assessed. For example the annual average number of deaths (2011-13) on the SH29 Farrukhabad (Ramganga River) to Bewar (52.5km) is 103.3, at a rate of 1.97 deaths per km per year. On SH12 Orai to Bela (112.1km) 109 deaths per year are occurring at a rate of 0.97 deaths per km per year and 461 deaths per billion vkt. On a 10.1km section of SH59 Muzaffarnagar to Gagalheri, 343 road deaths were recorded in a three year period (2011-2013), this equates to a staggering 11.3 deaths per km per year and 4,750 deaths per billion vkt.

The distribution of deaths by road user type is often shown to under-report pedestrian fatalities. In fact several Indian states such as Arunachal Pradesh, Himachal Pradesh, Manipur, Sikkim, Telangana, West Bengal and Chandigarh did not record a single pedestrian fatality in 2014 despite recording a combined total of 14,457 other road user deaths that year. Using available crash data from Uttar Pradesh and taking into account the possible under reporting of pedestrian fatalities the figure below shows the estimated distribution of deaths in that state and is likley typical of other similar states.

Figure 3 Estimated deaths by road user type – Uttar Pradesh



The World Health Organization (WHO) estimated that 207,551 people were killed in 2013. We estimate that this equates to an economic cost of $US 24 billion per year, 1.3% of Gross Domestic Product (GDP) with an estimated 3-4% of GDP lost due to all road traffic crashes.

5 iRAP Star Rating Results

iRAP Star Ratings are based on road infrastructure features and the degree to which they impact the likelihood and severity of road crashes. The focus is on the features which influence the most common and severe types of crash on roads for motor vehicles, motorcyclists, pedestrians and bicyclists. They provide a simple and objective measure of the relative level of risk associated with road infrastructure for an individual road user. 5-star (green) roads are the safest, while 1-star (black) roads are the least safe. Star Ratings were not assigned to roads where there was very low use by that type of road user. For example, if no bicyclists use a section of road, then a bicyclist Star Rating is not assigned to it.

The Star Ratings are based on Star Rating Scores (SRS). The iRAP models are used to calculate an SRS at 100 metre intervals for each of the four road user types, based on relative risk factors for each of the road attributes. The scores are developed by combining relative risk factors using a multiplicative model. More information on the risk factors used within the model can be found within the Methodology Documents at www.irap.org.

Table 3 Star Rating Table

	Vehicle Occupant		Motorcyclist		Pedestrian		Bicyclist	
Star Ratings	Length (kms)	Percent	Length (kms)	Percent	Length (kms)	Percent	Length (kms)	Percent
5 Stars	17.00	0%	4.30	0%	0.00	0%	4.80	0%
4 Stars	343.00	3%	173.80	2%	56.00	1%	61.30	1%
3 Stars	2,214.00	21%	1,654.00	16%	897.50	9%	1,357.70	13%
2 Stars	4,000.20	38%	2,975.60	28%	2,118.60	20%	1,965.00	19%
1 Star	3,817.80	37%	5,584.30	53%	6,742.10	65%	5,523.80	53%
Not applicable	51.60	0%	51.60	0%	629.40	6%	1,531.00	15%
Totals	**10,443.60**	**100%**	**10,443.60**	**100%**	**10,443.60**	**100%**	**10,443.60**	**100%**

Figure 4 **Star Rating Map – vehicle occupants**

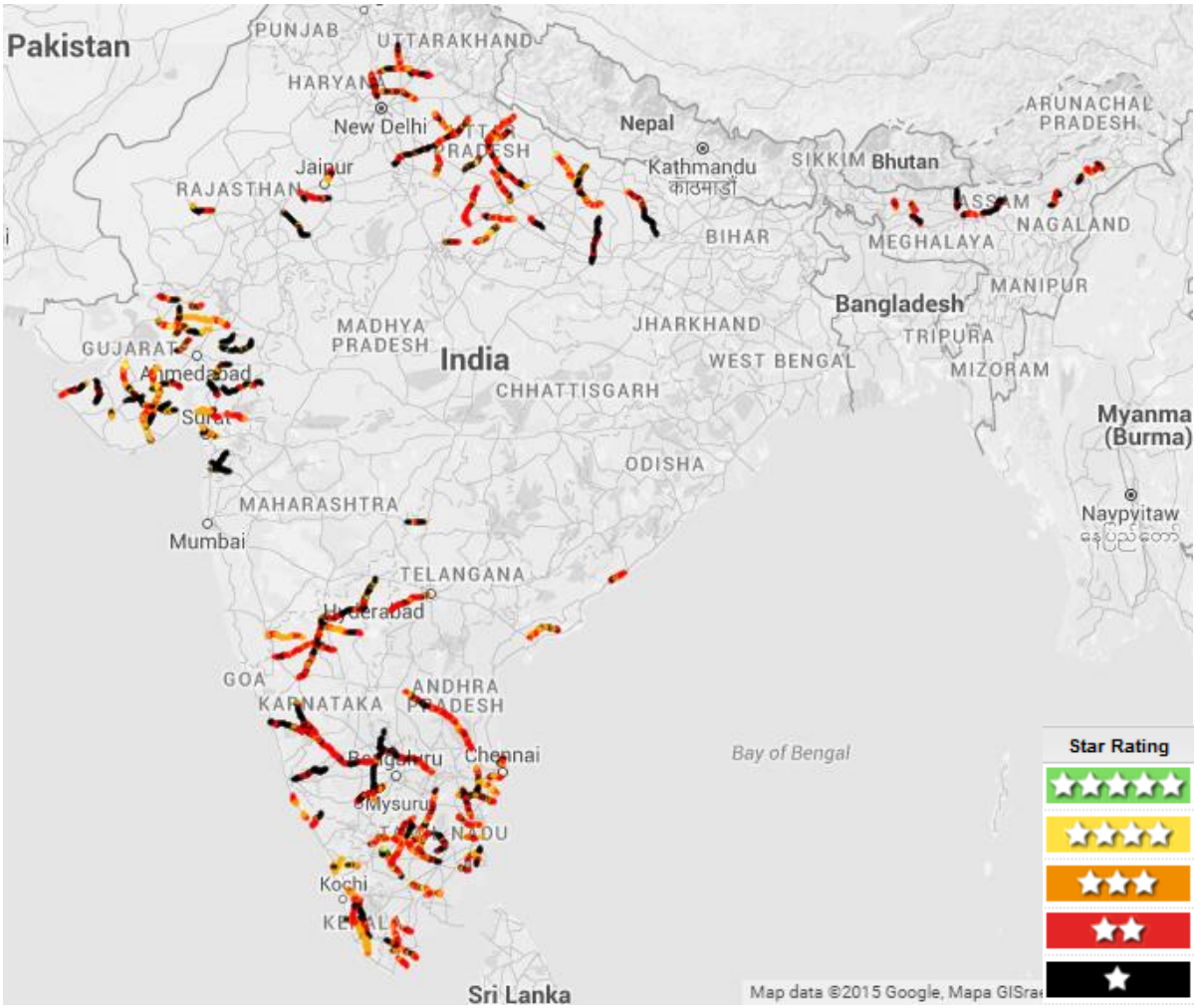
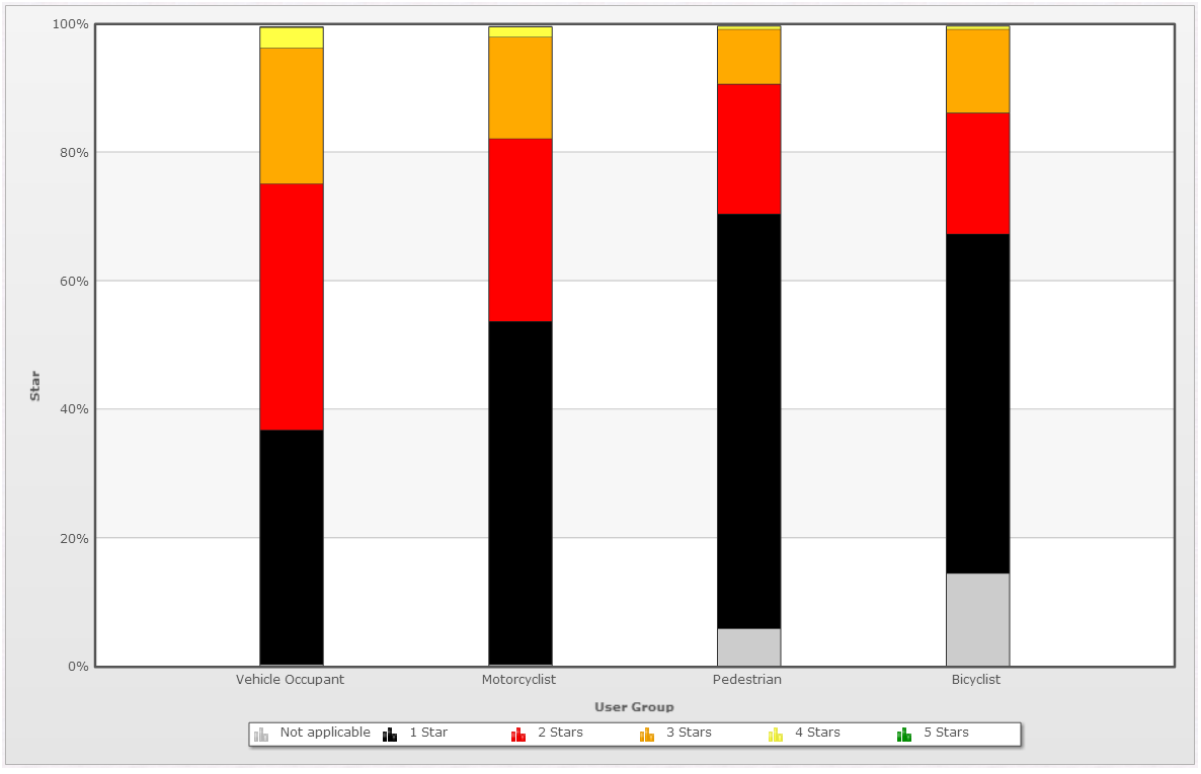


Figure 5 **Star Rating Chart**



6 Safer Roads Investment Plan

iRAP considers more than 90 proven road improvement options to generate affordable and economically sound Safer Road Investment Plans (SRIP) that will save lives. Road improvement options range from low-cost road markings and pedestrian refuges to higher-cost intersection upgrades and full highway duplication.

Each countermeasure proposed in the SRIPs is supported by strong evidence that, if implemented, it will prevent deaths and serious injuries in a cost-effective way). Nevertheless, each countermeasure should be subject to additional prioritisation, concept planning and detailed design before implementation.

The detailed list of safety treatments shown in the investment plans suggest that significant safety improvements can be made to the surveyed road network through the implementation of several key route safety and mass action treatments. Where traffic volumes are highest, treatments such as carriageway duplication (the construction of additional lanes to create a dual carriageway), 2+1 arrangements and overtaking lanes with some form of physical median to prevent head-on collisions are estimated to prevent 223,500 FSIs over a 20 year period. Provision of footpath and crossing facilities for pedestrians is likely to prevent 82,000 FSIs and intersection upgrades more than 100,000 FSIs over a 20 year period. Details of the top 8 safety treatments by estimated FSIs prevented are shown in Figure 6.

Figure 6 Safer Roads Investment Plans – top 8 countermeasures

Additional lane

Length:	5193km
Investment:	INR 84 bn
FSI Prevented:	223,500
Economic Benefit:	INR 189 bn

Intersection upgrade

Sites:	21,219
Investment:	INR 40 bn
FSI Prevented:	107,200
Economic Benefit:	INR 91 bn

Safety barriers

Length:	9,602km
Investment:	INR 22 bn
FSI Prevented:	96,000
Economic Benefit:	INR 81 bn

Pedestrian footpath

Length:	12,871km
Investment:	INR 26 bn
FSI Prevented:	53,000
Economic Benefit:	INR 45 bn

Delineation

Length:	6,766km
Investment:	INR 2.4 bn
FSI Prevented:	41,000
Economic Benefit:	INR 35 bn

Bicycle lane

Length:	6,412km
Investment:	INR 9.2 bn
FSI Prevented:	31,000
Economic Benefit:	INR 26.3 bn

Pedestrian crossing

Sites:	16,538
Investment:	INR 12 bn
FSI Prevented:	29,600
Economic Benefit:	INR 25 bn

Traffic calming

Length:	1,721km
Investment:	INR 5.6bn
FSI Prevented:	27,000
Economic Benefit:	INR 23 bn

Using actual crash data where available, an estimate of the number of deaths and serious injuries that occur on the surveyed network has been made. Crash modification factors are then used to provide an estimate of the number of road deaths and serious injuries that are likely to be prevented through the infrastructure improvements that are proposed in each investment plan. More information on the crash modification factors used in the model is available in the iRAP Road Attribute Risk Factor factsheets in the Documents section of the iRAP website at: http://irap.org/about-irap-3/methodology.

Assuming that the proposed countermeasures do not lead to an increase in vehicle operating speeds, it is estimated that fatal and serious injuries (FSIs) are likely to reduce by 58%, preventing almost 44,000 deaths and serious injuries each year and 878,000 deaths and serious injuries over the next 20 years.

Table 4 Economic Analysis

Surveyed network		10,443.6.km	
Investment (20 years)	INR 260 billion		US $ 4 billion
Economic benefit (20 years)	INR 700 billion		US $ 10.77 billion
Benefit cost ratio (BCR)		2.7	
Estimated cost of FSIs on surveyed network per year	INR 173 billion		US $ 2.66 billion
Deaths and serious injuries	Deaths (per year)	Deaths and serious injuries (per year)	Deaths and serious injuries (20 years)
Before countermeasures	*6,900*	*75,900*	*1,518,000*
After countermeasures	*2,910*	*32,000*	*640,000*
Prevented	*3,990*	*43,900*	*878,000*
Reduction		58%	
Cost per death and serious injury prevented	INR 315,000		US $ 4,850

Currency conversion rate used: 1USD = 64.958 INR (26.10.15)

7 Star Rating Designs

There is a growing international agreement on the need for a greater emphasis on safety in road designs. The Commission for Global Road Safety has recommended that "desired design speeds for new roads should be subject to achieving minimum safety ratings" and the UN Secretary General has recently called for appropriate star rating targets for the highest volume 10% of roads in each country and the adoption of minimum 3-star standard and road safety audits for all new road construction.[2]

By providing a means of objectively measuring the impact on risk of various design iterations, the Star Rating design process is helping harness the potential of designers to find creative solutions to challenging safety problems. For governments and development banks, the process opens the opportunity to set performance-based targets for vehicle occupants, motorcyclists, pedestrians and bicyclists that not only improve safety but create a high level of transparency and accountability. The Star Rating design process has been successfully used in conjunction with existing mechanisms such as Road Safety Audits and highway design standards.

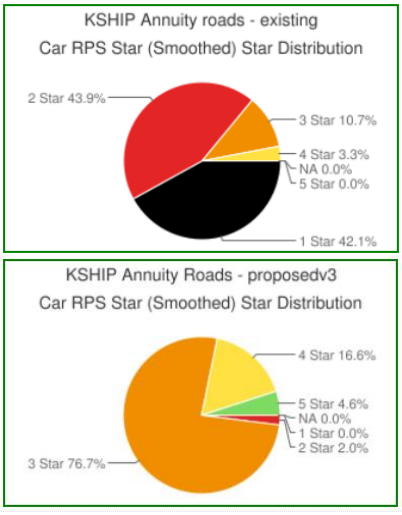
India was the first country to use iRAP Star Ratings for the assessment of road designs on a large scale. A number of states within India are now using Star Ratings during the road design process to help ensure the safety of designs is optimized, providing a platform to make evidence-based improvements. This method has been used by the project implementation unit at the Karnataka State Highway Improvement Project (see case study below), the Roads & Buildings Department in Gujarat, Assam Public Works Department, the Kerala State Transport Project and the Uttar Pradesh Core Road Network Development Program to help shape the design of almost 2,000km of roads with outstanding success.

Figure 7 Karnataka case study

Karnataka was the first jurisdiction in the region to commit to setting minimum Star Ratings for new road designs.

1. The World Bank initially set a three-star target for demonstration corridors. The Government then extended this to include 500km additional roads.
2. Star Ratings were calculated for the existing roads.
3. Detailed supporting data, including from road crash investigations, were collected.
4. Consulting and road authority engineers used Star Ratings to test the impact and suitability of various safety options for the roads, such as 'raised pedestrian crossings' and safety barriers.
5. Designs were optimised using a combination of Star Ratings, road safety audits, design standards, budget constraints 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.



[2] A/70/386. UN General Assesmbly, Seventieth Session: Agenda item 13 – Improving Global Road Safety, 22 September 2015

8 Training

The provision of training and technical support for staff in each of the ten PWDs was considered a fundamental element of the project in order to maximise the potential benefits of the iRAP results and to build road safety capacity within the participating road authorities.

8.1 Coder training

iRAP coder training was hosted by the Federation of Indian Automobile Associations (FIAA) at the Automobile Association of Upper India (AAUI) training facility in New Delhi from January 24 to 28, 2011. The course was delivered by an experienced team consisting of staff from iRAP, ARRB Group and Indian Road Survey and Management (IRSM) and attended by 26 PWD staff from Assam, Andhra Pradesh, Gujarat and Karnataka.

8.2 Building local capacity

In order to build road safety capacity within each of the Public Works Departments, project directors, managers, design consultants and local engineers (often those directly involved in preparing the World Bank funded projects) were provided with an understanding of the iRAP Star Rating methodology through seminars, workshops and tuition on how to use the iRAP results to identify high-risk routes and to investigate recommended countermeasures for inclusion within planned upgrades.

Figure 8 Discussing the survey requirements

Sessions were held for managers, engineers and design consultants to help ensure that at all levels, safe road design is given the highest priority during both the planning and design stages. The workshops were designed to enable participants to use local results to gain a better understanding of how the recorded road attributes (the coded data) influence risk for road users and how the iRAP Safer Roads Investment Plans can help to reduce that risk.

Other sessions included instruction on how to use the reports and download files within the iRAP online software to fully analyse the results; using the Road Safety Toolkit http://toolkit.irap.org/ to improve knowledge and understanding of current best practice in road safety engineering; and tuition on how to use the iRAP Demonstrator to assess individual sites and design plans.

Figure 9 A road safety workshop for PWD staff and design consultants in Lucknow, March 2015

8.3 Ongoing training and support

To date, 18 formal training sessions with some 185 attendees have been held, and hundreds of hours of on-the-job training and mentoring have been logged. Road engineers from Indian PWDs regularly participate in the annual iRAP Asia Pacific Workshop.

All of the participating states are being provided with ongoing training and support as required to ensure iRAP recommended countermeasures are investigated and considered for inclusion in the planned upgrades. The Star Rating of proposed designs is currently underway in several states and plans for further training as part of additional iRAP work in India is being developed.

Figure 10 IndiaRAP workshop 7 October 2015

9 Upgrades – construction begins

The iRAP assessment results are now being used by road authority engineers and design consultants across India to ensure that new road upgrades and rehabilitation works reduce risk for all road users. Construction is already underway on several key priority corridors in Gujarat, Kerala, Karnataka and Assam.

In 2012 the baseline assessment in Kerala was completed on 622km of the state highway network. The results were used to shape the proposed designs and to calculate the projected changes to the numbers of deaths and serious injuries on the roads due for upgrades. In 2014 construction commenced on five separate corridors totalling aproximately 200km with an estimated 51% reduction in FSIs.

Figure 11 **Laying the road base (WMM), Thalassery to Valavupara, Kerala**

Star Rating results and Safer Roads Investment Plans have been used by the Gujarat PWD and design consultants to improve the safety of all road users within the designs for the rehabilitation of 12 priority corridors totalling 545km in length.

A comparison of the Star Rating tables for the baseline results and the proposed design (shown below in table 5) show that the percentage of high-risk (1- or 2-star) sections has reduced from 82% to 51% for vehicle occupants, with 1-star sections reducing from 70% to 12%. High-risk road sections for motorcyclists have reduced from 87% to 68%, with 1-star sections reducing from 76% to 20%. High-risk sections for pedestrians have seen a reduction from 90% to 73%. High-risk sections for bicyclists have dropped from 74% to 60%, with 1-star sections reducing from 60% to 21%. The proposed upgrades are expected to prevent an estimated 3,000 FSIs over 20 years.

Table 5 **Baseline v Design Star Ratings (GSHP-II)**

Star Ratings	Vehicle Occupants		Motorcyclists		Pedestrians		Bicyclists	
	Baseline	*Design*	Baseline	*Design*	Baseline	*Design*	Baseline	*Design*
5 Star	1%	*7%*	0%	*2%*	0%	*2%*	0%	*0%*
4 Star	2%	*16%*	1%	*8%*	0%	*5%*	1%	*6%*
3 Star	15%	*26%*	12%	*22%*	10%	*20%*	13%	*19%*
2 Star	12%	*39%*	11%	*48%*	53%	*65%*	14%	*39%*
1 Star	70%	*12%*	76%	*20%*	37%	*8%*	60%	*21%*
Not applicable	0%	*0%*	0%	*0%*	0%	*0%*	13%	*15%*

Figure 12 **Construction phase, Gujarat India**

10 Conclusion

With road traffic fatalities now the leading cause of death for young people aged 15 to 29 worldwide and 92% of road traffic deaths occurring in low and middle-income countries, key partners in global road safety have come together in an attempt to tackle this rapidly worsening public health crisis through accelerated investment in road safety and by fundamentally changing the way we design, build and maintain our road infrastructure networks around the world. As such, the United Nations has declared 2011-2020 the Decade of Action for Road Safety and the new Sustainable Development Goals has an ambitious target to halve road deaths by 2020. In order to achieve our goals significant efforts must be made to systematically improve road safety management, road infrastructure, road user behaviour and vehicle safety.

It is recognised that investment in the transport network plays an important role in a country's economic development and poverty reduction. To this end, the Government of India has invested heavily in road building programmes in recent years in order to improve mobility and reduce journey times. However, it is of paramount importance that every opportunity be taken to ensure that these new roads and rehabilitation projects focus on the need for safe road infrastructure for all road users, particularly the young and vulnerable.

The road assessment program in India covering over 10,000km of State and National Highways across 10 States, has demonstrated that there is potential to improve safety by providing safe road infrastructure for all major road user groups.

The safe road treatments, suitable to local conditions, recommended under these combined programmes are predicted to prevent close to 44,000 deaths and serious injuries each year which would result in crash cost saving of INR 100 billion each and every year.

Star Rating the design of roads being taken up under various state road improvement program (see table 4 below) is helping the state road authorities and design consultants to assess the potential risk to road users prior to construction and amend the designs to include recommended treatments that are proven to reduce the likelihood and severity of road crashes. States like Karnataka and Gujarat have adopted safe corridor demonstration projects under World Bank funding which includes setting a policy level target of designing the road with minimum 3-star ratings for all road users.

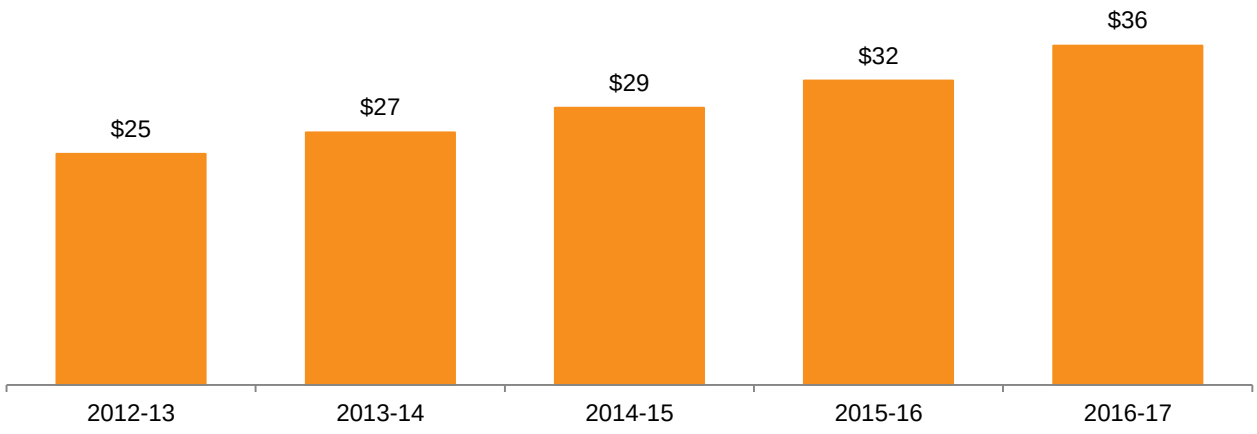
Major World Bank funded projects where iRAP assessments are influencing the safety of design and construction are summarised in the table below. The combined value of these projects is in excess of US$5.6 billion.

Table 6 World Bank financed projects that use iRAP assessment results

Project Name	Location	Total project value (USD million)
National Highways Interconnectivity Improvement Project (NHIIP)	India - various	1,152
Andhra Pradesh Road Sector Project	Andhra Pradesh and Telangana	645
Assam State Roads Project	Assam	397
Gujarat State Highway Project II (GSHP II)	Gujarat	566
Second Karnataka State Highway Improvement Project (KSHIP II)	Karnataka	1003
Second Kerala State Transport Project (KSTP II)	Kerala	445
Second Tamil Nadu Road Sector Project (TNRSP II)	Tamil Nadu	778
Uttar Pradesh Core Road Network Development Program (UPCRNDP)	Uttar Pradesh	570
Efficient & Sustainable City Bus Services	Mumbai	113
Total		**5,669**

However, this is just a fraction of the total investment. 66,000km of new roads will be built at a rate 30km per day. $29 billion will be invested in 2014-15 alone. As an indication of the cost of assessing roads, conducting commercially-tendered iRAP assessments of the busiest 10% of roads would cost less than 0.1% of one year's road budget.

Figure 13 Investment in roads and bridges ($US billion)



With the increasing death toll on the Indian road network it is strongly recommended that national and state Government set policy targets to stabilise and then reduce the forecasted level of road traffic fatalities in line with the recommendations discussed in the *Global Plan for the Decade of Action for Road Safety 2011-2020*. Recommendations include:

- Set a target to eliminate high risk (1- and 2-star) roads by the end of the Decade of Action for Road Safety (2020).
- Set minimum Star Ratings for all new road designs to ensure that no more 'killer roads' are built. For example, adopt the policy that all new roads shall be built to a minimum 3-star standard for all road users.
- iRAP Star Rating and Investment Plans for the highest risk or highest volume 10% of roads in the country.

For further information on the setting of road safety policy targets, the development of local and national action plans and implementing sustainable road safety strategies, refer to the *Global Plan for the Decade of Action for Road Safety 2011-2020*.

In order to achieve the best road safety gains on the network, efforts that go beyond the engineering improvements discussed in this report will be necessary. Significant benefits could be realised through the coordinated improvement of road user behaviour such as improving speed limit compliance, seat belt and helmet

wearing rates and reducing alcohol use, improving the safety of the vehicle fleet, as well as road infrastructure. The Road Safety Toolkit (http://toolkit.irap.org) and United Nations Road Safety Collaboration Good Practice Manuals provide further information on these issues.

iRAP will continue to help prevent millions of deaths and serious injuries by working with central and state governments, development banks, private investors and non-government organizations to leverage investment in cities, highways and rural roads.

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