

RAP Infrastructure Safety Management Tools

iRAP and its partners have developed a suite of tools that use the iRAP methodology to support infrastructure safety management globally and locally.

About iRAP

The International Road Assessment Programme (iRAP) is a registered charity dedicated to saving lives by eliminating high risk roads throughout the world. The [iRAP methodology](#) is internationally recognized and offers evidence-based approaches to guide planning, design, investment, advocacy and policy setting. The methodology and [specifications](#) are fully published and freely available and have been used in more than 100 countries to assess over 2 million km of roads and designs. iRAP's partners include road and transport agencies, research institutes, development banks, mobility clubs, NGOs and the road industry. iRAP and its partners use the tools to support continuous improvement efforts for the mutual benefit of all. iRAP is supported by the [FIA Foundation](#), [Global Road Safety Facility \(GRSF\)](#) and [FedEx](#).

Global Technical Committee (GTC)

The iRAP [Global Technical Committee \(GTC\)](#) governs development of the iRAP methodology, considers the latest road safety research and oversees the technical integrity of the use of the methodology worldwide. The GTC reports directly to the iRAP Board and is comprised of experts from leading road safety organisations and research agencies from around the world.

Innovation Framework

Apart from the tools developed by iRAP which can be applied globally, tools developed with iRAP partners that use the iRAP methodology are known as *RAPapps* or *Made Safer by iRAP* apps. These are fit-for-purpose applications that often meet local or organisation-specific needs and are managed within the iRAP [Innovation Framework](#). In addition to the suite of tools summarised in this document, several new tools and models are also [in development through the Framework](#).



Global

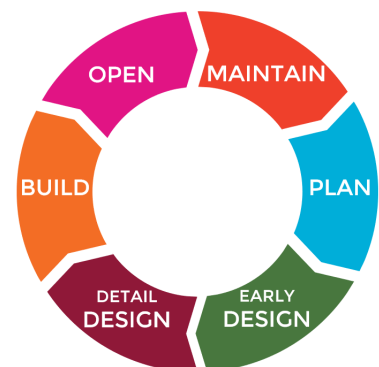


Local

All Phases of a Road's Lifecycle

The suite of tools can be used at all stages of a road's lifecycle:

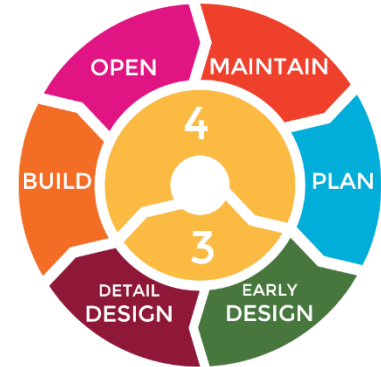
- ✓ Planning: includes strategy, policy and project concepts.
- ✓ Early design: includes feasibility and concept designs.
- ✓ Detailed design: includes final designs.
- ✓ Build: when traffic uses a road during construction.
- ✓ Open to traffic: after construction is complete.
- ✓ Maintaining and operating: normal operation of the road.



Global Goals and Targets

The suite of tools support achievement of [Sustainable Development Goals \(SDG\)](#) 3.6 and 11.2, the [Global Plan for the Decade of Action for Road Safety 2021-2030](#) sets a target of a 50% reduction in road deaths and injuries, and includes recommendations for the achievement of [Global Road Safety Performance Targets](#) 3 and 4:

- ✓ Target 3: *By 2030, all new roads achieve technical standards for all road users that take into account road safety, or meet a 3-star rating or better.*
- ✓ Target 4: *By 2030, more than 75% of travel on existing roads is on roads that meet technical standards for all road users that take into account road safety. According to the more detailed WHO guidance, this may be measured as a percentage of travel that is on existing roads that meet a 3-star rating or better for all road users.*



Training and Accreditation

























iRAP offers a range of [training](#) opportunities to build the knowledge and skills needed to establish a Road Assessment Program (RAP), plan and manage a project and perform assessments using the iRAP methodology and tools. The iRAP [accreditation](#)



























Photo credit: National Automobile Association of Uzbekistan (NACU).

Summary of Tools










Infrastructure safety management tools that make use of the iRAP methodology.

Tool / protocol	Description	Access	UN target / road lifecycle	Type
Crash data				
Crash Risk Mapping	Uses detailed crash data to produce maps showing the risk arising from the interaction of road users, vehicles and the road environment.	 Global		
DRIVER	An open-source crash data system developed by the World Bank that can link with Risk Mapping and Star Ratings.	 Global		MADE SAFER BY 
Infrastructure ratings				
Star Ratings	An objective measure of the level of safety 'built-in' to the road for vehicle occupants, motorcyclists, bicyclists, and pedestrians.	 Global		
Star Rating for Schools (SR4S)	An evidence-based tool for measuring, managing and communicating the risk children are exposed to as pedestrians.	 Global		
Trauma estimation				
Fatal and Serious Injury (FSI) Estimates	Provides estimates of FSIs along each segment of an existing road or design and supports the prioritisation of investment.	 Global		
ANRAM	Uses iRAP Star Ratings and crash data to provide enhanced fatality and serious injury estimates for Australian roads.	 Local		 RAPapp <small>OF ROAD TO DESIGN TO IMPROVE ROAD TO ROAD USER SAFETY</small>
Investment planning				
Safer Roads Investment Plans	Draws on data underpinning Star Ratings and FSI Estimates to determine the most cost-effective road safety upgrades.	 Global		
Design				
Star Rating for Designs (SR4D)	A package of tools, knowledge products, support and other initiatives so that roads are <i>built safe, right from the start</i> .	 Global		

Summary of Tools (continued)

Tool / protocol	Description	Access	UN target / road lifecycle	Type
Light ratings				
EuroRAP RPS 1.0	Based on homogeneous sections and a limited set of road attributes that provide protection to car occupants.	 Local		
ThaiRAP Light Star Ratings	Developed and used in Thailand with a subset of the Star Rating methodology and linked to a road asset database.	 Local		
Austroads Stereotypes	Illustrate Star Ratings for a range of typical cross-section and operating speed scenarios on the Australian road network.	 Local		
Performance tracking				
Performance Tracking	Uses Star Rating and Crash Risk Mapping to measure changes in road safety performance over time.	 Global		
Policy and management				
Vaccines for Roads	Includes business cases for investment, examples of how crashes affect real people and statistics on the world's roads.	 Global		
Road Safety Toolkit	The Road Safety Toolkit provides free information on the causes and prevention of serious road crashes.	 Global		
Key Performance Indicators	Global Infrastructure KPIs provide the policy road map and recommended metrics for measuring road safety success.	 Global		
Road Safety Country Profiles	This GRSF guide gives an assessment on the magnitude and complexity of road safety challenges faced by low-and middle-income countries (LMICs).	 Global		

Summary of Tools (continued)

Tool / protocol	Description	Access	UN target / road lifecycle	Type
Enabling Software				
ViDA	iRAP's free-to-air online platform is the data processing engine for Star Ratings, FSI Estimates and Investment Plans, hosting data and analysing results, and the portal for iRAP's enhanced tools including SR4D and the Star Rating Demonstrator.	 Global		
Star Rating Demonstrator	The Star Rating Demonstrator is a tool which can be used for small assessments of existing roads or road designs and provides a simple way to understand the iRAP models.	 Global		
SR4D Web App	The SR4D Web App is a tool, supported by the World Bank, to assist with Star Rating designs and can be used for small to medium assessments of existing roads or road designs.	 Global		

Crash Risk Mapping

Crash Risk Maps use detailed crash data to capture the combined risk arising from the interaction of road users, vehicles and the road environment. Risk Maps provide an indication of the overall road system performance.

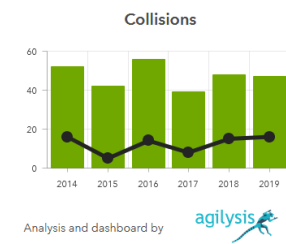
The maps provide an at-a-glance and objective view of where fatal and serious injury crashes have occurred and where serious crash risk is greatest. Using a global methodology allows benchmarking where desired (e.g. crash rates on motorways; pedestrian crash rates in cities). Primary metrics include crash rates per kilometre/mile and crashes rates per kilometre/mile travelled with more detailed versions including road user, age group or in relation to average crash rates for that road type.

Crash Risk Maps and [Star Ratings](#) are often used together as part of a strategic approach to managing risk and investment. They also provide a useful source of calibration for [FSI Estimates](#) and [Investment Plans](#).

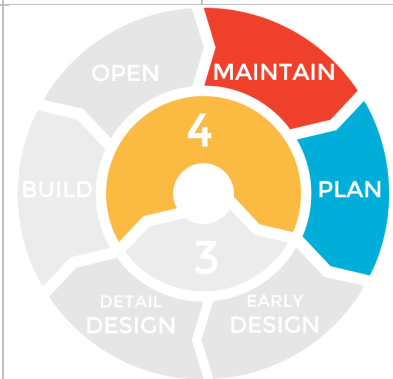
Maps



Analysis



Crash data



DRIVER

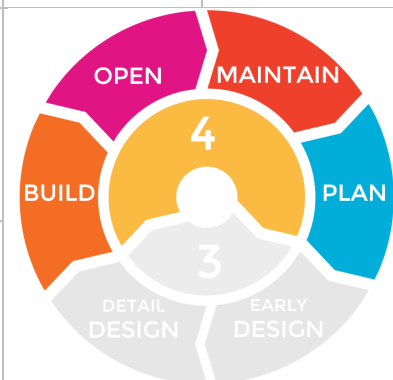
[Data for Road Incident Visualization, Evaluation, and Reporting \(DRIVER\)](#) is a web-based and open-source system developed by the World Bank for geospatially recording and analysing road crashes. The system incorporates a suite of analytical tools to support evidence-based investments and for monitoring the impact of interventions.

[ViDA](#) to provide [Star Rating](#) data, including Star Ratings and road attribute statistics. Crash data collected using DRIVER may also be used to create [Crash Risk Maps](#).

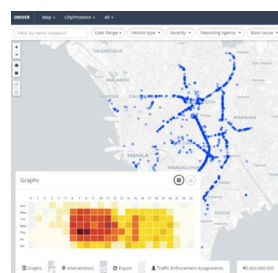
Crash data



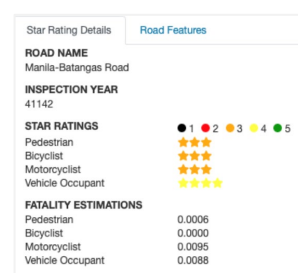
Global



Analysis



Star Ratings



Star Ratings

iRAP Star Ratings are used for [road safety inspection](#), [road safety impact assessments](#), and in [designs](#). Star Ratings are an objective measure of the level of safety which is 'built-in' to the road through more than 50 road attributes that influence risk for vehicle occupants, motorcyclists, bicyclists, and pedestrians. Star Ratings reflect the risk as it relates to an individual road user. 1-Star roads have the highest risk and 5-Star roads the lowest risk. Star Ratings can be produced without reference to detailed crash data.

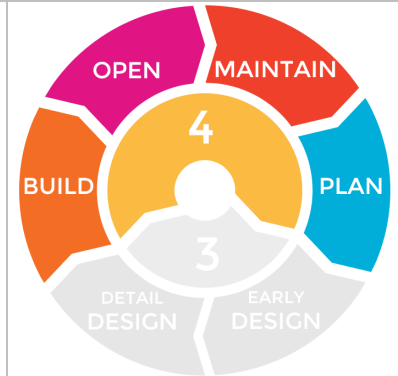
The Star Rating models underpin [FSI Estimations](#) and [Investment Plans](#), all of which are integrated in iRAP's online platform, ViDA.

Specifications and manuals for Star Rating Assessments are available at www.irap.org/specifications. There are also a range of tools available that can help, including the [Star Rating Demonstrator](#) for small assessments of one or more locations, the [Star Rating for Designs web application](#) for moderate-size assessments and design assessments.

Infrastructure ratings



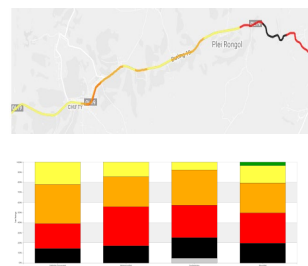
Global



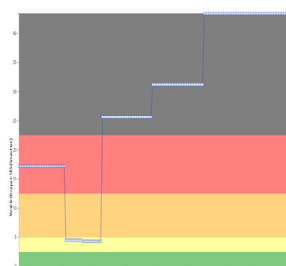
Road attributes

Road attribute	km
Sidewalk - passenger-side	0.00
Physical barrier	0.00
Non-physical separation >= 3.0m	0.00
Non-physical separation 1.0m to <3.0m	3.90
Non-physical separation 0m to <1.0m	19.80
None	112.30
Informal path >= 1.0m	2.20
Informal path 0m to <1.0m	4.90

Star Ratings



Risk worms



Star Rating for Schools (SR4S)

[Star Rating for Schools \(SR4S\)](#) is an evidence-based tool for measuring, managing, and communicating the risk children are exposed to on a journey to school. It supports quick interventions that save lives and prevent serious injuries from day one.

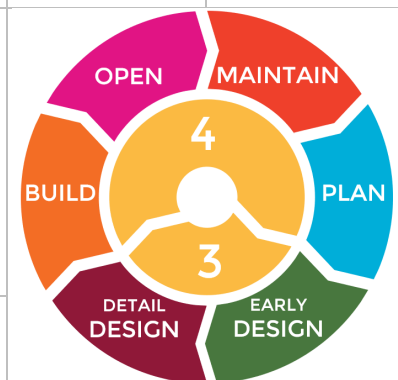
Risk can be assessed for pedestrians and 1-Star roads are the highest risk and 5-Star roads the lowest risk. SR4S can be performed without reference to detailed crash data.

SR4S is supported by a [stand-alone app](#) that enables Star Ratings to be produced at multiple locations around schools.

Infrastructure ratings



Global



SR4S app



STAR RATING FOR SCHOOLS



Impact



Fatal and Serious Injury (FSI) Estimates draw on the road attribute data used for Star Ratings, flow data for each road user and network-level crash data to provide an estimation of FSIs along each segment of a road and support the prioritisation of investment. When used with designs, FSI Estimates can be an effective measure for understanding the implications of design decisions and comparing road design solutions.

FSI estimations can be created for vehicle occupants, motorcyclists, bicyclists, and pedestrians using [ViDA](#), and they support [road safety inspection](#) and [road safety impact assessment](#) processes. FSI estimations are used with [Star Ratings](#), [SR4D](#), and [Investment Plans](#).

Maps



Analysis

BEFORE IMPROVEMENTS



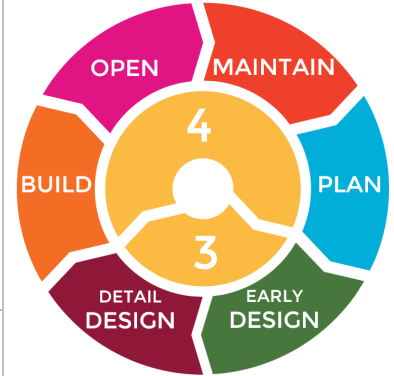
AFTER IMPROVEMENTS



Trauma estimation



Global



ANRAM

Australian National Risk Assessment Model (ANRAM) uses the iRAP Star Rating methodology and actual historical crash data to provide enhanced fatality and serious injury estimates for Australian roads.

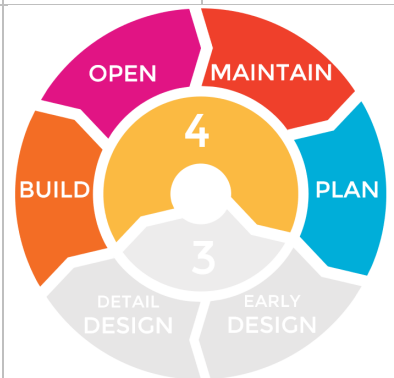
The model was developed as part of an MOU agreement between [Austroads](#), [AAA](#), [ARRB](#) and iRAP and uses a Bayesian analysis to blend the iRAP [FSI Estimates](#) and actual crash history into the ANRAM FSI estimate. Severe crash history is used to supplement the predicted results, and in doing so, accounts for road user and other location-specific risk (e.g. speeding, drink driving, fatigue).

The approach requires high-quality geo-spatial crash data to develop the local models and integration within [ViDA](#) can be enabled. ANRAM is an internal tool used by Australian road authorities and is not currently available for global use.

Trauma estimation

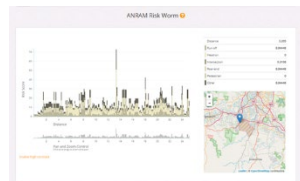


Local



Risk profiles

Maps



Safer Roads Investment Plans

Investment Plans draw on data underpinning [Star Ratings](#) and [FSI Estimates](#) to determine the most cost-effective road upgrades prevent deaths and serious injuries. They provide an optimised investment of likely safety countermeasures and the business case for that investment.

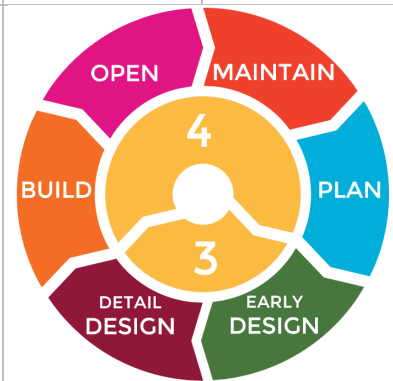
Investment Plans can support investment decision making on existing roads and within road designs. Planners, designers and engineers can use this information together with their expertise and local knowledge to develop detailed implementation plans and designs and measure the ultimate impact on Star Ratings and FSIs saved.

Investment Plans are created using [ViDA](#), and they support [road safety inspection](#) and [road safety impact assessment](#) processes. Investment Plans are used with [Star Ratings](#), [SR4D](#), and [FSI Estimates](#).

Investment planning



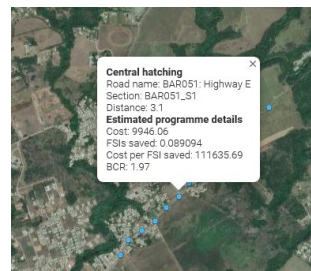
Global



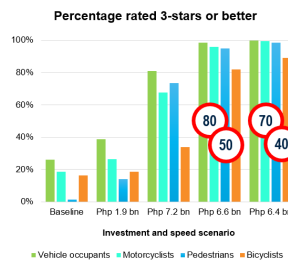
Tables

Countermeasure	Length / Sites
Central hatching	84.10 km
Traffic calming	69.60 km
Pedestrian fencing	27.20 km
Improve Delineation	30.60 km
Improve curve delineation	140.10 km
Clear roadside hazards - passenger side	41.10 km
Skid Resistance (paved road)	23.10 km
Unsignalised crossing	31 sites
Clear roadside hazards - driver side	19.70 km
Footpath provision driver side (adjacent to road)	16.00 km
Footpath provision passenger side (adjacent to road)	17.00 km
Shoulder sealing passenger side (<1m)	16.20 km
Footpath provision passenger side (informal path >1m)	6.00 km
Footpath provision driver side (informal path >1m)	4.50 km
Footpath provision passenger side (>3m from road)	1.80 km
Footpath provision driver side (>3m from road)	1.30 km

Maps



Analysis



Star Rating for Designs (SR4D)

Star Rating for Designs (SR4D) is a package of tools, knowledge products, support and other initiatives tailored specifically for road designers and the design process, so that roads are specified and *built safe, right from the start*.

Risk can be assessed for vehicle occupants, motorcyclists, bicyclists, and pedestrians. 1-Star designs are the highest risk and 5-Star designs the lowest risk. SR4D can be performed without reference to detailed crash data and can support [road safety impact assessment and Road Safety Audits](#).

SR4D may be produced for sections of design using the [Star Rating Demonstrator](#) or for longer design lengths using the [SR4D web app](#) which was developed with support from the [GRSF](#). SR4D is often used with [Fatality and Serious Injury Estimates](#) and [Investment Plans](#) to optimise the safety of a design, assess design options and maximise lives saved.

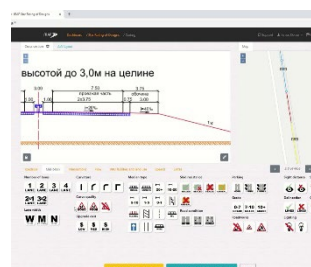
Design



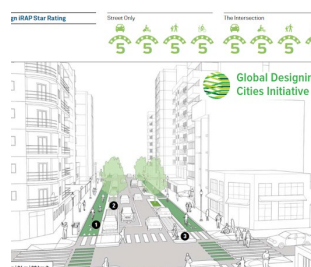
Global



Web app



Safe designs



EuroRAP RPS 1.0

The [EuroRAP RPS 1.0 model](#) was based on a limited set of road attributes, such as safety barriers, that afford protection to car occupants in the event of a crash.

The model was developed in 1999 with the (then) [Swedish National Road Administration](#), the [Dutch Ministry of Transport, National Roads Authority Republic of Ireland](#), [Transport Research Laboratory \(TRL\)](#) and with contributions from the [English Highways Agency](#), [Germany federal research agency, BAST](#), leading [European motoring organisations](#) and [EuroRAP](#).

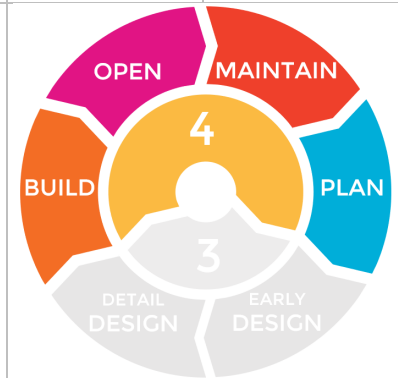
The EuroRAP model was used over the period 2004-10 to assess roads, initially in Sweden and Germany, then in 10 countries by 2011 to produce The European Road Safety Atlas.

Following demand by users worldwide for more detailed assessments and economic modelling covering all road users, the EuroRAP model evolved into today's iRAP tools.

Light ratings



Local



ThaiRAP Light Star Rating

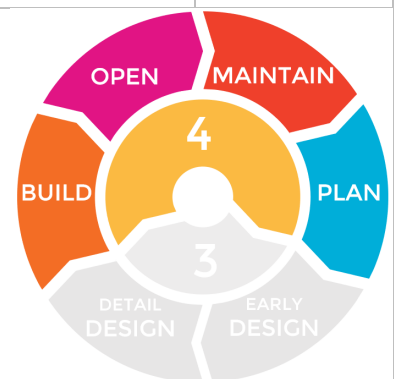
Developed by the [Thai Rural Roads Department \(DRR\)](#), the [ThaiRAP](#) Lite Star Ratings are based on a subset of road attributes used in the iRAP Star Rating methodology, drawn from the DRR road asset database. They are primarily focussed on vehicle occupants and motorcyclists using rural road networks and are used to quickly identify high-risk sections for further analysis..

ThaiRAP lite Star Ratings are an internal tool of DRR and are not currently available for global use.

Light ratings



Local



Rapid screening



Vaccines for Roads

The [Vaccines for Roads](#) tool provides information that can support planning for road safety at the national and local levels, including country-by-country business cases for investment in safer roads, examples of how crashes affect real people and country-by-country statistics on the safety of roads. The resource includes a high-level summary of Star Rating performance as well as key attributes that impact safety for all road users and supports the [iRAP recommended KPIs for infrastructure road safety](#).

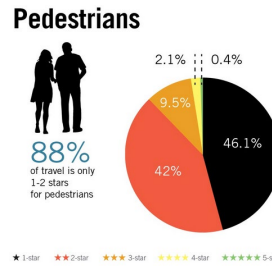
Business cases

Nigeria	
Annual number of fatalities (2010-2017)	39,802
Population	189,589,632
Fatalities per 100,000 population	21
Annual number of fatalities and serious injuries	437,822
Annual cost of fatalities and serious injuries	\$21,629,924,711
Annual cost of fatalities and serious injuries (% of GDP)	0.2%
What can be achieved with >75% of travel on 3-star or better roads for all road users by 2030	
Infrastructure and Speed Management Investment required	\$3,787,400,000
Annual Investment as a % of GDP (2020-2030)	0.07%
Reduction in fatalities per year	13,471
Reduction in fatalities and serious injuries (FSI) over 20 years	2,963,718
Economic Benefit	\$108,721,578,093
Benefit Cost Ratio	29

Human impact



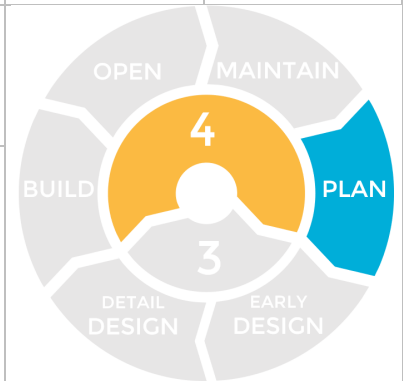
Global metrics



Policy and management



Global



Road Safety Toolkit

The [Road Safety Toolkit](#) provides free information on the causes and prevention of serious road crashes.

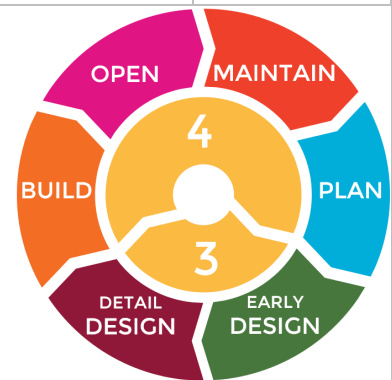
Building on decades of road safety research, the Toolkit has helped engineers, planners and policy makers develop safety plans for car occupants, motorcyclists, pedestrians, bicyclists, heavy vehicle occupants and public transport users. The Toolkit supports achievement of the Sustainable Development Goals, the 2nd Decade of Action target and the Global Road Safety Performance Targets.

The Toolkit is the result of collaboration between the International Road Assessment Programme (iRAP), the [Global Transport Knowledge Partnership \(gTKP\)](#), [World Bank Global Road Safety Facility \(GRSF\)](#), [ARRB](#), [Austroads](#), [Global Road Safety Partnership \(GRSP\)](#) and [Global NCAP](#).

Policy and management



Global



Free information

The Road Safety Toolkit provides free information on the causes and prevention of road crashes that result in death and injury.

Global National United Road Safety Targets

Did You Know?

- The Road Safety Toolkit provides free information on the causes and prevention of road crashes that result in death and injury.

Treatments

Publication Overview - Road Safety

Did You Know?

- Publication Overview - Road Safety

Did You Know?

- Publication Overview - Road Safety

Key Performance Indicators

The Global Plan for the [Decade of Action for Road Safety 2021-2030](#) calls on all countries to achieve at least a 50% reduction in road deaths and injuries by 2030 and adopt recommendations to achieve the Global Road Safety Performance Targets agreed by Member States. The [iRAP Global Infrastructure Key Performance Indicators \(KPIs\) for road safety](#) provide the policy road map and recommended metrics for measuring success.

KPIs for infrastructure safety



DECADE OF ACTION

How do we achieve the #GlobalGoals by 2030?

- Reduce road deaths and injuries by 50%
- Ensure all new roads are 3-star or better for all road users
- Upgrade existing roads to 3-star or better for all road users

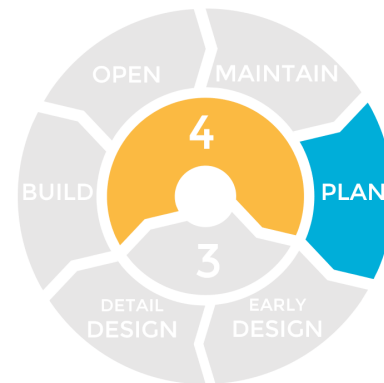
iRAP Global Standard	Protocol / Attribute	Primary KPI (refer https://www.iRAProads.org for sample of global national performance)
iRAP Coding Manual	Sidewalk	Percentage of roads where pedestrians are present and traffic flows at 40km/h (25mph) or more have formal footpaths or sidewalks
iRAP Coding Manual	Operating Speed	Percentage of roads where pedestrians cross and traffic flows at 40km/h (25mph) or more have pedestrian crossing facilities
iRAP Coding Manual	Operating Speed	Percentage of roads where motorcyclists are present and traffic flows at 60km/h (40mph) or more have dedicated motorcycle facilities
iRAP Coding Manual	Operating Speed	Percentage of roads where bicycles are present and traffic flows at 40km/h (25mph) or more have dedicated bicycle facilities
iRAP Coding Manual	Operating Speed	Percentage of roads where traffic flows at 60km/h (40mph) or more have divided carriageways
iRAP Coding Manual	Operating Speed	Percentage of roads where traffic flows at 60km/h (40mph) or more have low-risk roadsides
iRAP Coding Manual	Operating Speed	Percentage of roads where traffic flows at 60km/h (40mph) or more do not have sharp curves
iRAP Coding Manual	Operating Speed	Percentage of intersections where traffic flows at 60km/h (40mph) or more have turning provision
iRAP Coding Manual	Operating Speed	Percentage of railway crossings where traffic flows at 60km/h (40mph) or more have active protection
iRAP Coding Manual	Operating Speed	Percentage of roads where traffic flows at 60km/h (40mph) or more have dedicated overtaking provision
iRAP Coding Manual	Operating Speed	Percentage of school star rating data points that are 3-star or better for children

Policy and management



Global

MADE SAFER BY **iRAP**



Country Profiles

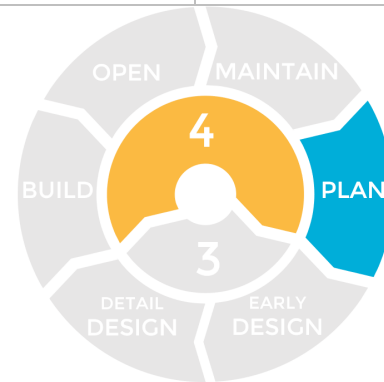
The [Global Road Safety Facility \(GRSF\)](#) presented the [Guide for Road Safety Opportunities and Challenges: Low- and Middle-income Country Profiles](#) during the 3rd Global High-Level Conference on Road Safety in Stockholm. The guide gives a precise assessment on the magnitude and complexity of road safety challenges faced by low-and middle-income countries (LMICs) and helps policy makers understand the road safety framework in context of their own country systems and performance. Drawing on iRAP assessment data and results, the guide also helps countries to build and appreciate the business case for vital road safety investment.

Policy and management

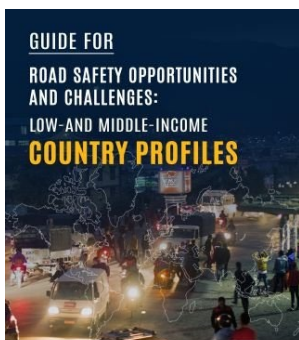


Global

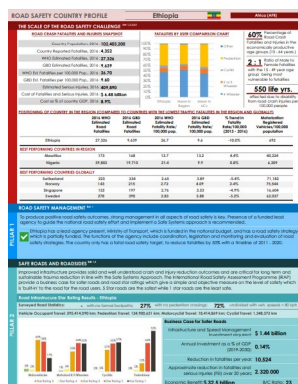
MADE SAFER BY **iRAP**



Guide



Profiles

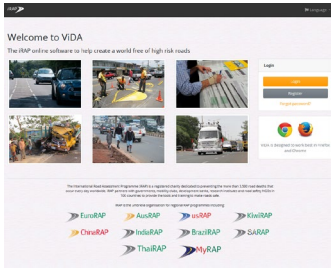


ViDA

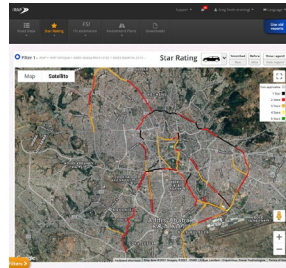
ViDA is iRAP's free-to-air online platform. It is the data processing engine for Star Ratings, FSI Estimates and Investment Plans, hosting data and analysing results, and the portal for iRAP's tools: SR4D, the Star Rating Demonstrator..

ViDA is free to access and use and enables users to investigate interactive reports, create data and manage secure access to their data. ViDA can be integrated within road authority systems utilizing its API. This enables data to be transferred from asset management tools and the Star Ratings accessed.

Free online



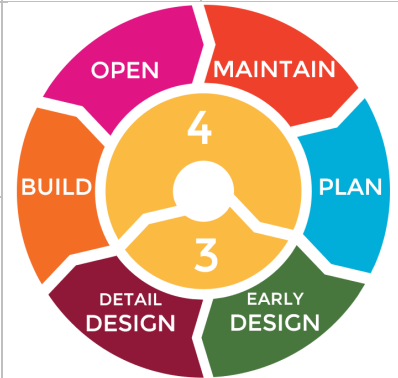
Interactive



Enabling software



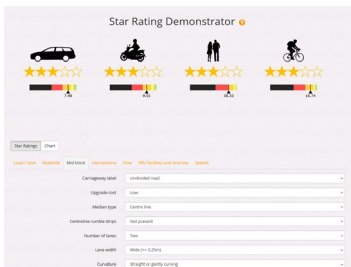
Global



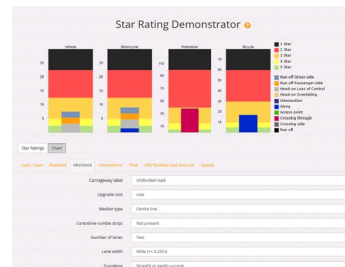
Star Rating Demonstrator

The iRAP Star Rating Demonstrator is a tool within [ViDA](#) that enables [Star Ratings](#) and [Star Rating for Designs \(SR4D\)](#) at individual locations. With the Demonstrator, it is possible to quickly produce a Star Rating and test the effect that changes to road attributes will have in risk and Star Ratings. The Demonstrator is also a valuable teaching and learning tool, enabling those learning about Star Ratings (from politicians to University students) to gain an intuitive insight into road infrastructure risk management. The Demonstrator was developed with the ChinaRAP team.

Rapid ratings



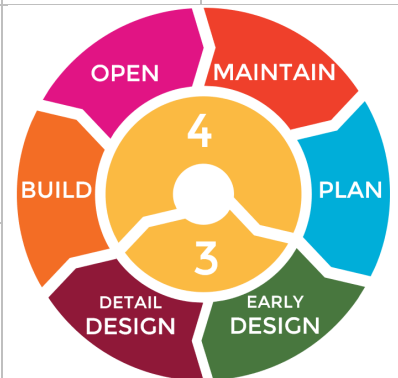
Analysis



Enabling software



Global



SR4D Web App

The SR4D Web App is a tool developed with support from the World Bank to assist with [Star Rating designs](#) and can be used for small to medium assessments of existing roads or road designs.

It does so by enabling the road designer to access information about the existing road conditions (through imaging such as Google Street View) and upload designs directly into the application. The SR4D Web App may also be used to Star Rate existing roads (i.e. without designs) where Google Street View or Mapillary imagery is available.

It is designed to make Star Ratings available as part of the road design process so that designers can consider the key road safety elements and the implications of a design as they undertake a road design.

The SR4D Web App is free to use and can be accessed via [ViDA](#).

Enabling software



Global



Web app

