Assessing Road Risk & Designing Safety Investment Plans

Brendan Halleman
International Road Federation

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1. **Assessing Road Risk**
2. (Brief) Overview of RTI cost valuation
3. Building Safer Road Investment Programs
4. Certifying Road Safety Auditors
5. Knowledge Resources

Assessing Road Risk

Road Safety Impact Assessments
Design-stage RSAs / Design-stage iRAP survey

Road Safety Audits

Pre-opening Stage RSAs

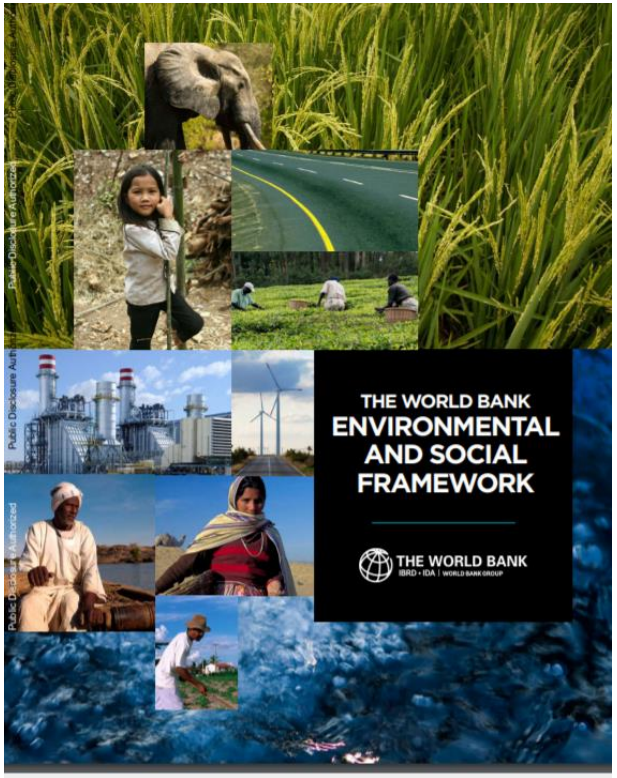
Black Spot Programs

Road Safety Inspections
Network Safety Management
Existing road iRAP survey

Assessing Road Risk

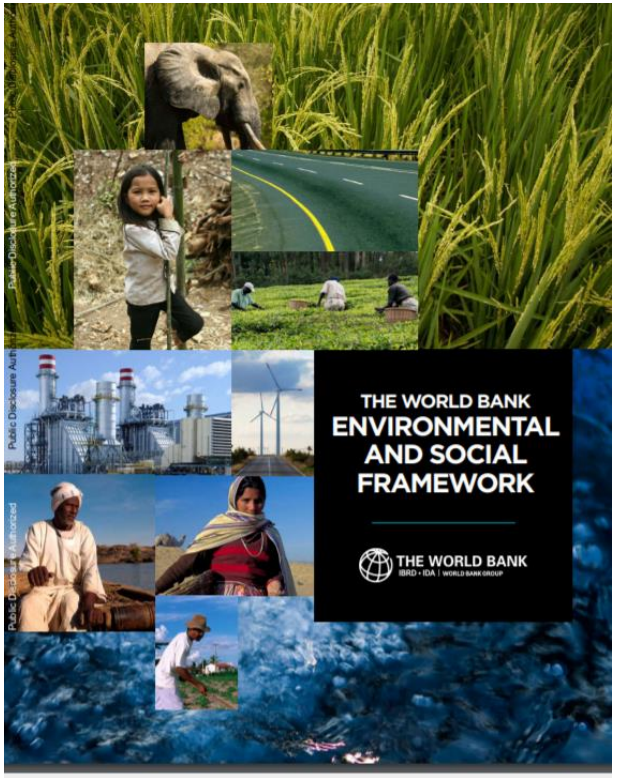
"The Borrower will identify**, evaluate and monitor the potential traffic and road safety risks** to workers, affected communities and road users throughout the project life cycle and, where appropriate, will develop measures and plans to address them…..

Where appropriate, the Borrower will undertake a road safety assessment for each phase of the project, and will monitor incidents and accidents, and prepare regular reports of such monitoring."



Assessing Road Risk

"For projects that operate construction and other equipment on public roads or where the use of project equipment could have an impact on public roads or other public infrastructure, **the Borrower will take appropriate safety measures to avoid the occurrence of incidents and injuries to members of the public associated with the operation of such equipment**."



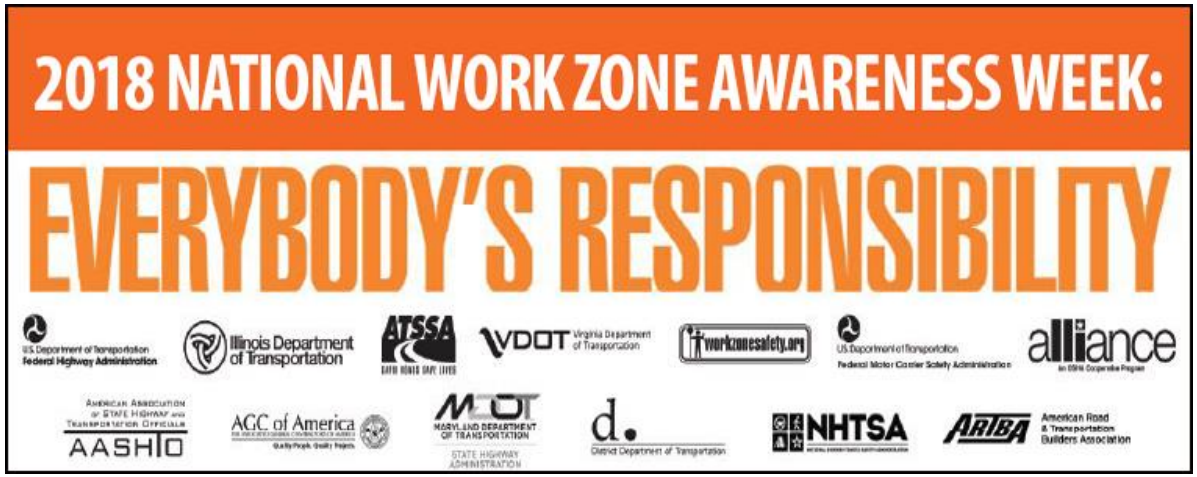

delta
delta
PATRICK
FILA

Assessing Road Risk

In the United States (2015):

- 25,485 injuries reported in a work zone
- 669 fatalities
- 164 lives could have been saved if comparable crash/injury rate

In EaP Countries?



Assessing Road Risk

Road Safety Impact Assessments
Design-stage RSAs / **<u>Design-stage iRAP survey</u>**

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Pre-opening Stage RSAs

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<u>Existing road iRAP survey</u>

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Why Use Economics?

- Scarcity of public resources
- Choice between alternatives

Monetary values = universal language to advocate, prioritize, plan and measure

Economic valuation

Types of costs:

- Direct (health care) vs. indirect (loss of output)
- Human Capital vs. Willingness to Pay
- Stated Preference vs. Revealed Preference
  - Would you rather be blind or deaf? Would you rather lose an arm or a leg?
  - Would you accept surgery with a 50% survival rate? A 5% survival rate?
  - Would you rather have 10 healthy years or 20 years with 50% disability?

Economic Valuation

$5,000 for a 5% reduction in risk of death = VOSL = $ 100,000

➔ Benefits: incorporates intangible costs that are not captured by human capital approach, such as pain and suffering

➔ Disadvantages: requires a high level of analytical thinking on the part of the respondent; surveys are difficult to implement. **Many countries have not established a VSL**

Rule of thumb

Hypothesis: the level of income in a country is a primary determinate of the value of statistical life.

Principle: draw on available data from WTP and Human Capital studies from a range of countries.

Method: Data were collected for a range of developed and developing countries and ratios of VSL to GDP per capita were calculated.

Rule of thumb

Developed countries:

Country	Official VSL	Per capita GDP	VSL/per capita GDP	Year	Currency	Method
Australia	1,832,310	40,654	45	2003	Aus $	HC
Austria	2,676,374	31,028	86	2006	€	WTP
Canada	1,760,000	36,806	48	2002	C$	HC
France	1,156,925	27,232	42	2005	€	HC
Germany	1,161,885	26,753	43	2004	€	HC
Iceland	284,000,000	3,840,943	74	2006	ISK	HC+PGS
Netherlands	1,806,000	28,807	63	2002	€	HC + PGS
New Zealand	3,050,000	37,536	81	2005	NZ$	WTP
Sweden	18,383,000	295,436	62	2005	SK	WTP
United Kingdom	1,384,463	19,663	70	2004	£	WTP
United States	3,000,000	36,311	83	2002	$	WTP

Rule of thumb

Value of Serious Injury:

Country	Fatalities	Serious injuries	VSL	VSI	Serious injuries/ fatalities	VSI/VSL %
Australia	1,634	22,000	1,832,310	397,000	13.4	22%
Austria	730	6,774	2,676,374	316,722	9.2	12%
Canada	2,936	17,830	1,760,000		6.1	
France	5,318	39,811	1,156,925	124,987	7.5	11%
Germany	5,842	80,801	1,161,885	87,267	13.8	8%
Netherlands	987	11,018	1,806,000		11.1	
New Zealand	405	3,950	3,050,000	535,000	9.8	18%
Sweden	440	4,022	18,383,000	3,280,000	9.1	18%
United Kingdom	3,221	31,130	1,384,463	155,563	9.7	11%
United States	42,815	356,000	3,000,000	464,663	8.3	15%

Rule of thumb

Findings:

Fatalities: a reasonable rule of thumb to use for the default values for the economic appraisal model is **70 x GDP/capita**

Serious injuries: a reasonable value of serious injury for the economic appraisal model is **17x GDP/capita**

RTI Cost Valuation

GEORGIA

Population: 4 340 895 • Income group: Middle • Gross national income per capita: US$ 3 570

INSTITUTIONAL FRAMEWORK

Lead agency	Ministry of Regional Development and Infrastructure of Georgia
Funded in national budget	Yes
National road safety strategy	Yes
Funding to implement strategy	Partially funded
Fatality reduction target	30% (2014–2019)

SAFER ROADS AND MOBILITY

Formal audits required for new road construction projects	Yes
Regular inspections of existing road infrastructure	Yes
Policies to promote walking or cycling	Subnational
Policies to encourage investment in public transport	Subnational
Policies to separate road users and protect VRUs	Subnational

SAFER VEHICLES

Total registered vehicles for 2013	951 649
Cars and 4-wheeled light vehicles	774 453
Motorized 2- and 3-wheelers	4 830
Heavy trucks	151 057
Buses	21 309
Other	0
Vehicle standards applied[a]	
Frontal impact standard	No
Electronic stability control	No
Pedestrian protection	No

[a] UNECE WP.29.

POST-CRASH CARE

Emergency room injury surveillance system	Yes
Emergency access telephone numbers	112
Permanently disabled due to road traffic crash	—

DATA

Reported road traffic fatalities (2013)	514[a] (54% M, 17% F)
WHO estimated road traffic fatalities	514
WHO estimated rate per 100 000 population	11.8
Estimated GDP lost due to road traffic crashes	—

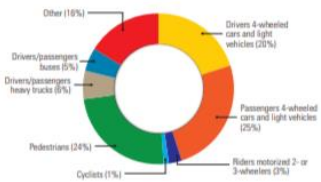
[a] National Statistics Office of Georgia - GEOSTAT. Defined as died within 30 days of crash.

SAFER ROAD USERS

National speed limit law	Yes
Max urban speed limit	60 km/h
Max rural speed limit	90 km/h
Max motorway speed limit	110 km/h
Local authorities can modify limits	No
Enforcement	0 1 2 3 4 5 6 ⑦ 8 9 10
National drink–driving law	Yes
BAC limit – general population	< 0.03 g/dl
BAC limit – young or novice drivers	< 0.03 g/dl
Random breath testing carried out	Yes
Enforcement	0 1 2 3 4 5 6 7 ⑧ 9 10
% road traffic deaths involving alcohol	5%[a]
National motorcycle helmet law	Yes
Applies to drivers and passengers	Yes
Law requires helmet to be fastened	No
Law refers to helmet standard	No
Enforcement	0 1 2 3 4 5 6 ⑦ 8 9 10
Helmet wearing rate	—
National seat-belt law	Yes
Applies to front and rear seat occupants	No
Enforcement	0 1 2 3 4 5 6 7 ⑧ 9 10
Seat-belt wearing rate	80% Drivers', 80% Front seats'
National child restraint law	No
Restrictions on children sitting in front seat	Yes
Child restraint law based on	—
Enforcement	—
% children using child restraints	—
National law on mobile phone use while driving	Yes
Law prohibits hand-held mobile phone use	Yes
Law also applies to hands-free phones	No
National drug-driving law	Yes

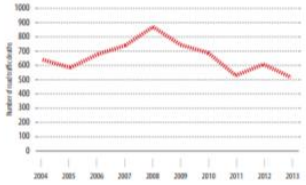
[a] 2013, Ministry of Internal Affairs of Georgia.

DEATHS BY ROAD USER CATEGORY



Source: 2013, National Statistics Office of Georgia-GEOSTAT.

TRENDS IN REPORTED ROAD TRAFFIC DEATHS



Source: National Statistics Office of Georgia-GEOSTAT.

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WORLD BANK GROUP
Transport & Digital Development

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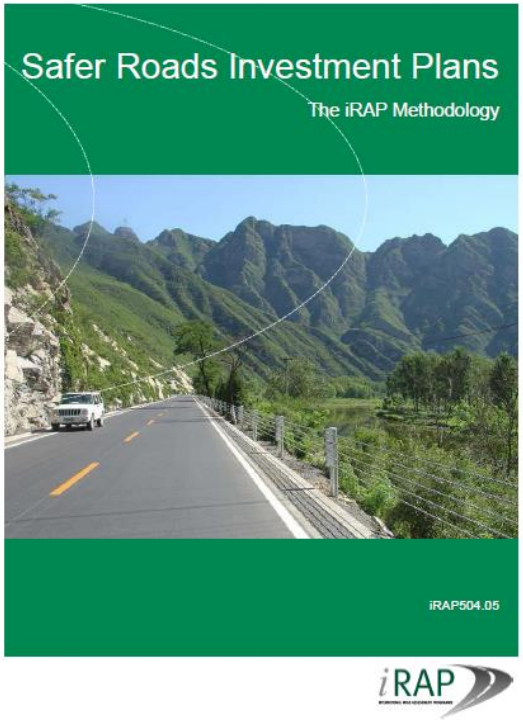
Building a SRIP

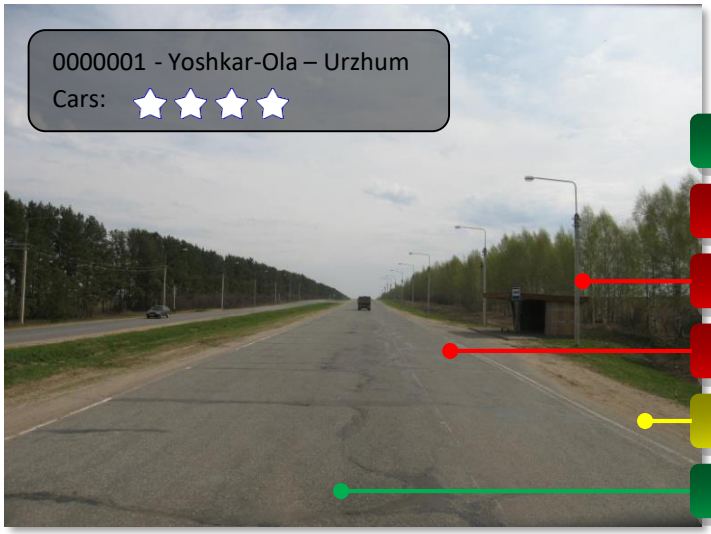
The International Road Assessment Program (iRAP) surveys new and existing roads to assess objective levels of safety through a Road Protection Score (RPS).

The RPS is a measure of the likelihood of a crash occurring and its severity, based on a road's speed environment and a detailed inventory of road design elements.

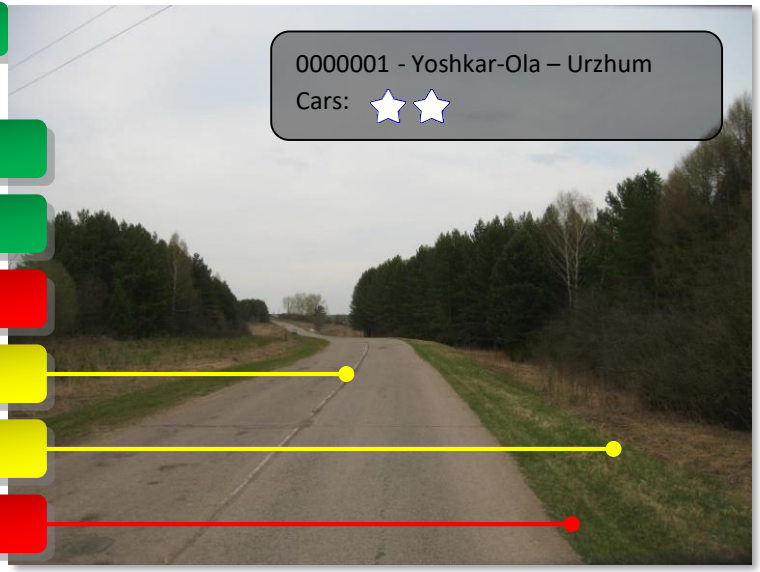
iRAP also generates and ranks a range of possible countermeasures.



Building a SRIP

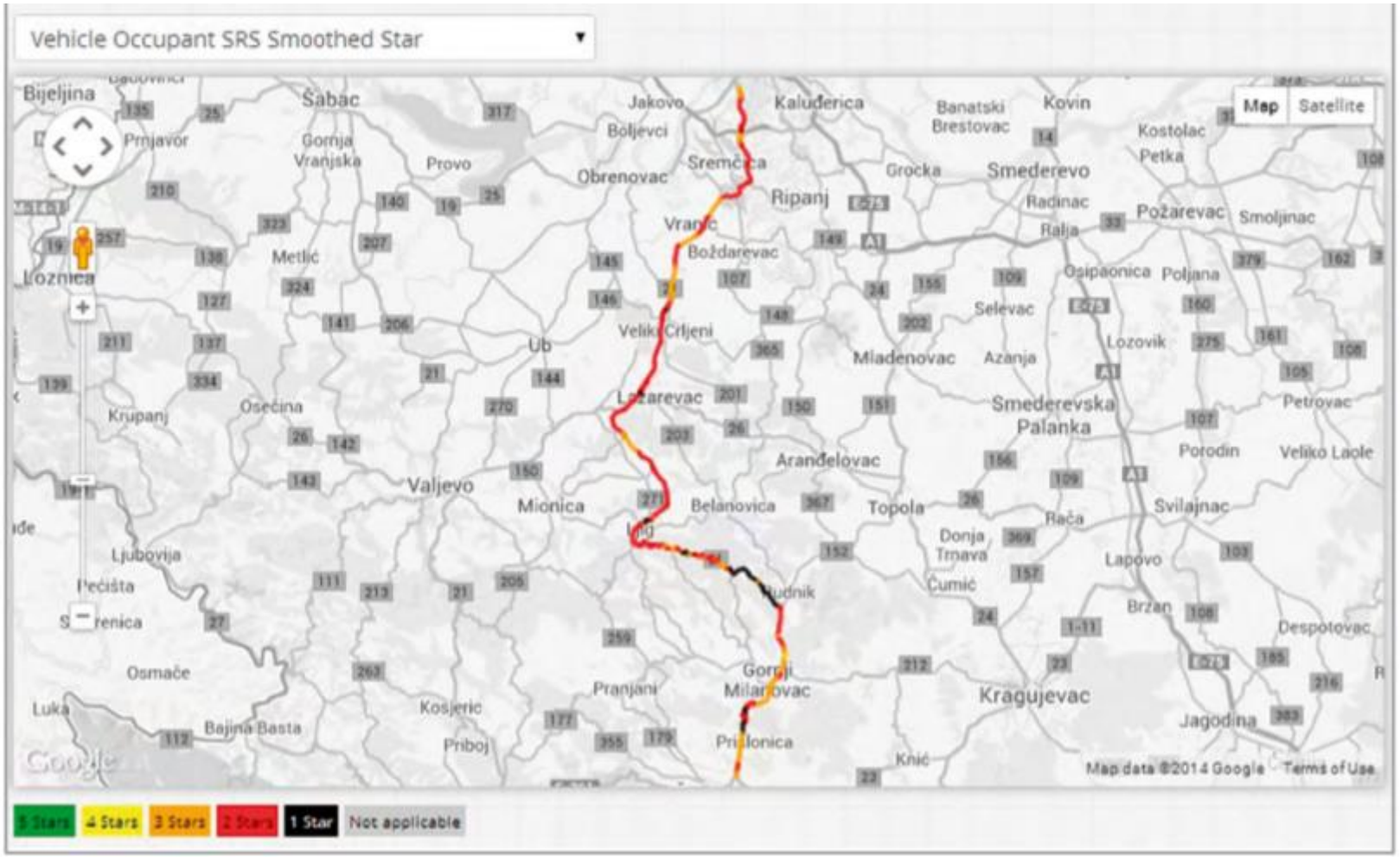


- 90km/h
- Poor delineation
- Hazardous roadside objects
- No rumble strip
- Medium unpaved shoulder
- 5 to 10m median



- 90km/h
- No intersection
- Poor delineation
- Moderate curve
- 5 to 10m roadsides
- No paved shoulder

Building a SRIP



Building a SRIP

Chainage (km)	Countermeasure	Cost (20 years)	Cumulative cost (20 years)	BCR
14.0	Improve curve delineation	$2,367	$2,367	717.6
13.5	Improve curve delineation	$2,367	$4,734	583.9
13.6	Improve curve delineation	$2,367	$7,100	547.2
13.9	Improve curve delineation	$2,367	$9,467	531.8
37.7	Improve curve delineation	$1,775	$11,242	352.7
12.6	Improve curve delineation	$2,367	$13,609	319.4
14.0	Improve delineation	$4,636	$18,245	303.6
28.2	Improve curve delineation	$1,775	$20,020	285.3
17.3	Road resurface	$32,836	$1,962,972	47.0
92.5	Improve curve delineation	$1,775	$1,964,747	46.4
101.0	Improve curve delineation	$1,775	$1,966,522	46.4
101.5	Improve curve delineation	$1,775	$1,968,297	46.4
101.7	Improve curve delineation	$1,775	$1,970,072	46.4
88.6	Improve delineation	$3,477	$1,973,549	45.6
10.3	Shoulder sealing (>1m)	$29,000	$2,002,549	45.4
17.0	Shoulder sealing (>1m)	$29,000	$2,031,549	45.2
32.5	Shoulder sealing (>1m)	$17,400	$2,048,949	45.2
16.3	Shoulder sealing (>1m)	$17,400	$2,066,349	45.1
72.0	Improve curve delineation	$2,959	$2,069,308	44.5
107.556	Sideslope improvement - right	$27,270	$100,532,381	1.0
107.856	Sideslope improvement - left	$27,270	$100,559,651	1.0
107.956	Sideslope improvement - left	$27,270	$100,586,921	1.0
18.096	Grade separated pedestrian facility	$2,727,300	$103,314,221	0.9
30.39	Roadside barriers - left	$26,400	$103,340,621	0.9
30.39	Roadside barriers - right	$26,400	$103,367,021	0.9
97.259	Footpath provision (separated from road)	$36,000	$103,403,021	0.9

The most cost effective countermeasure is listed first

With a $2 million budget, all countermeasures with a BCR greater than 45.6 could be considered

If budget was unlimited, all countermeasures with a BCR greater than 1 could be considered

Countermeasures with a BCR below 1.0 are often not considered

Building a SRIP

Safer Road Investment Plans:

Table 5 Safer Roads Investment Plan options for Serbia (20 year analysis period)

	Threshold Benefit Cost Ratio		
	1	3	5
Estimated cost to build and maintain	€ 112 m	€ 44 m	€ 22 m
KSI saved	7,629	5,592	4,217
Value of safety benefit	€ 456 m	€ 334 m	€ 252 m
Cost per KSI saved	€ 15,000	€ 8,000	€ 5,000
Overall Benefit Cost Ratio	4	8	11

KSI = Killed and Serious Injuries

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ROAD SAFETY AUDIT TEAM LEADER (SENIOR ROAD SAFETY AUDITOR) QUALIFICATION REQUIREMENTS

COUNTRY/ STATE/ PROVINCE	PROFESSIONAL REQUIREMENTS	ADDITIONAL REQUIREMENTS	TRAINING COURSE REQUIREMENTS	ONGOING REQUIREMENTS FOR CONTINUED CERTIFICATION
DENMARK	Minimum 3 Years as Road Safety Engineer etc.	Successfully pass a test in road safety knowledge to qualify to take the RSA Course	3 Day Course - Must Pass Written Exam	Attend RSA seminar every two years
MALAYSIA	Minimum ten (10) years working experience as Civil Engineer; or eight (8) years working experience as Civil Engineer with Masters' Degree qualification in road engineering discipline; or six (6) years working experience as Civil Engineer with Doctorate qualification in road engineering discipline;	Minimum three (3) years' experience in road design and minimum three (3) years' experience in engineering related to road safety; Be a Professional Engineer registerd with the Board of Engineers Malaysia for a minimum of two (2) years	Attend a course covering Stage 1 to Stage 5 inclusive in Road Safety Audit conducted by an organisation accredited by the Board and obtain a certificate therefrom.	???
VICTORIA, AUSTRALIA	Minimum five (5) years' experience in a relevant road design, road construction or traffic engineering field;	Participate in a minimum of five (5) formal road safety audits undertaken under guidance of a Senior Road Safety Auditor, including at least three (3) at design stages;	Successfully receive a certificate from a recognised road safety audit training course, of at least two (2) days duration;	Must undertake at least one Road Safety Audit each year
NEW SOUTH WALES, AUSTRALIA	Minimum five (5) years' experience in a relevant road design, road construction or traffic engineering field;	Participate in a minimum of five (5) formal road safety audits undertaken under guidance of a Senior Road Safety Auditor, including at least three (3) at design stages; Successful completion of a one (1) day Lead Auditor training program; Must have a letter of reference from a recognized Level 3 Auditor	Successfully receive a certificate from a recognised road safety audit training course, of at least two (2) days duration; To qualify for the Certificate of Competence, the Auditor must complete a course that covers Road Safety Legal Issues, Legislation and Policy, Collision Investigation, Road Safety Audit, Road Safety Engineering, and Road Design. • Collision Investigation • Road Safety Audit • Road Safety Engineering • Road Design	Must undertake at least one Road Safety Audit each year

SoRSA UK	**Minimum of four (4) years experience working in Accident Investigation or Road Safety Engineering**	**Undertake a minimum of five (5) Road Safety Audits during previous twenty-four (24) months**	**Ten (10) day formal training in Accident Investigation & Road Safety Engineering**	**Attend minimum of two (2) day training course in Accident Investigation or two (2) day training course in Road Safety Engineering every twelve (12) months; Undertake a minimum of five (5) Road Safety Audits each year for Road Safety Audit Team Leader**
SOUTH AFRICA	**Registered Professional Engineer or a Professional Engineering Technologist with the Engineering Council of South Africa or an international body recognized by the employer**	**A minimum of ten (10) years experience in Road Safety and/or Traffic and Transportation Engineering and/or Geometric Design; Has participated in a minimum of two (2) Road Safety Audits in the past three (3) years**	**Successfully complete a Road Safety Audit Course to the equivalent of at least five (5) Continuing Professional Development (CPD) points**	**???**
SWEDEN	**Minimum five years experience in civil engineering, and a technical or scientific education of not less than high school level, or have acquired the equivalent knowledge in other ways.**	**Complete training course for road safety auditors and demonstrate that he or she meets the knowledge requirements. The auditor shall have an overall knowledge of road safety; EC directive, laws and regulations, concepts in road safety area such as RSA, vulnerable, road construction, non-yielding obstacles, geometrical design, human behavior and limitation etc**	**The training course should content general information on road safety, audit fundamentals, traffic safety analysis and road safety audit. The training course STA organized had a length of five days.**	**A road safety auditor should undergo regular refresher training. The training shall include relevant new knowledge and new relevant evidence and analysis of and reflection on own and others' safety reviewers.**
IRELAND	Chartered Engineer or equivalent with at least two years experience of collision investigation and remedial measures	Take part in ten road safety audits as team member. Have completed as team member at least two audits of a similar category of scheme to that for which approval is being sought, and at least two audits of a similar stage.	Certificate of Competence in Road Safety Audit from University College Dublin	Complete at least five road safety audits within the preceding three years.

Certifying Road Safety Auditors

STATEMENT OF POLICY

by the International Road Federation

"Minimum Requirements for Road Safety Audit Team Leaders"

https://www.irf.global/policy-statements/

Certifying Road Safety Auditors

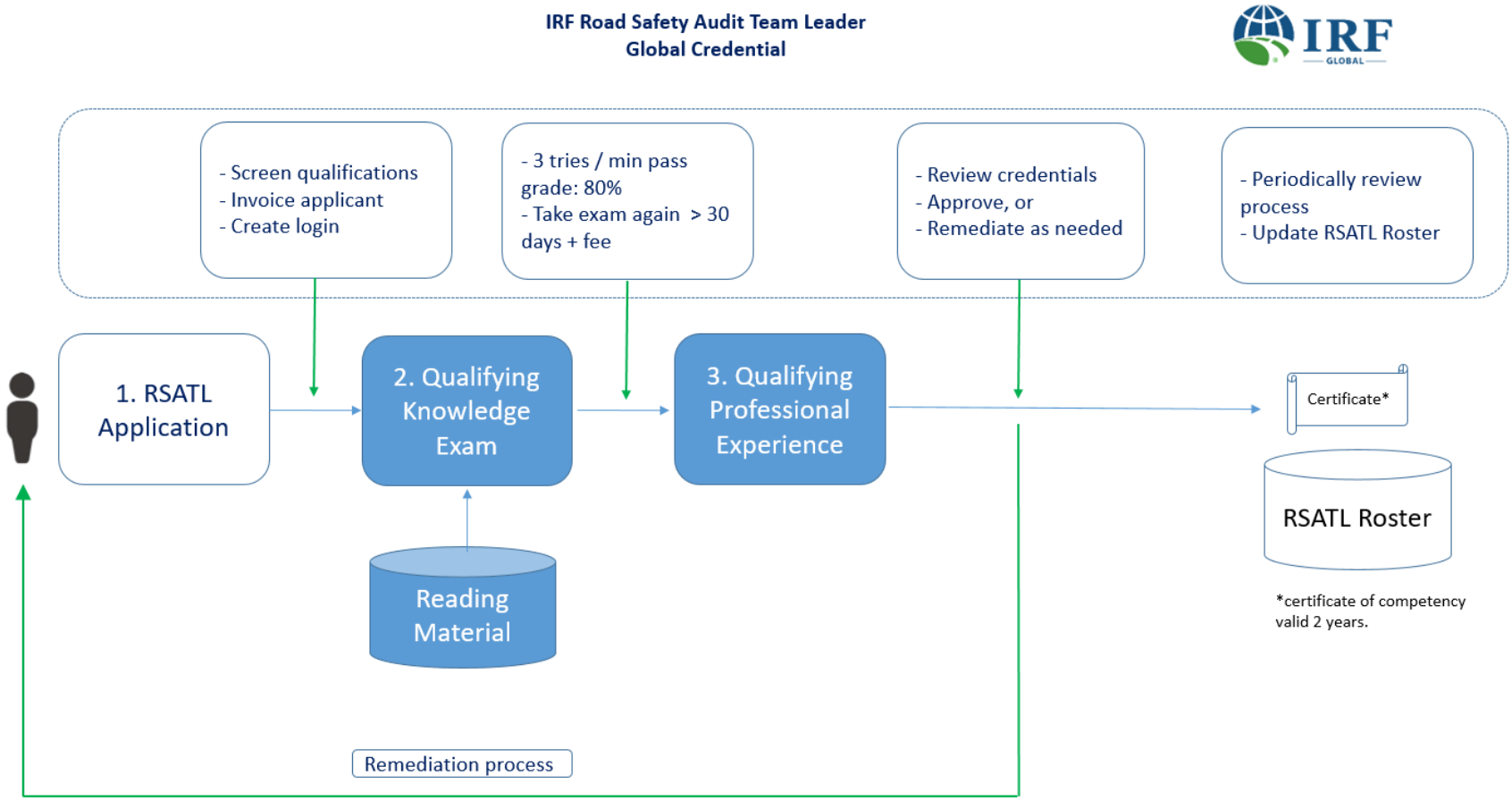
A minimum of five (5) years relevant experience in a road design, road construction, traffic law enforcement or traffic engineering field

Successfully receive a certificate from a recognized Road Safety Audit training course with a minimum of at least sixteen (16) hours duration; as well as at least one recognized certified training course of eight (8) hours or a minimum of eight (8) Professional Development Hours (PDHs) that covers Road Safety Legal Issues, Legislation and Policy, Collision Investigation, Road Safety Engineering, or Road Design.

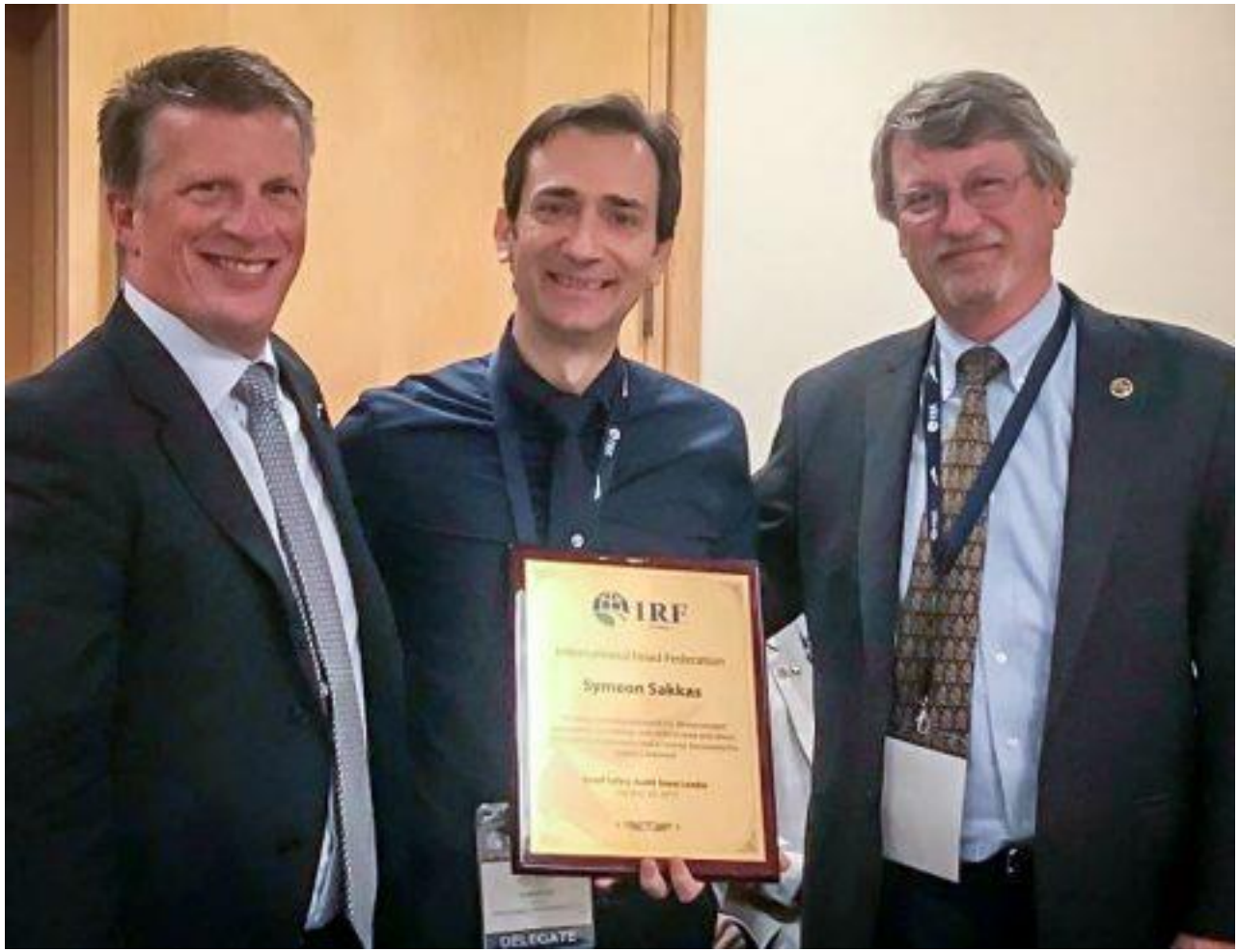
RSA Experience: provide verifiable evidence of participation on RSA teams that conducted a minimum of three (3) large road safety audits/inspections requiring over ten (10) person-days level of effort each OR six (6) small road safety audits/inspections requiring less than ten (10) person-days level of effort each, with an explanation of the applicant's participation and knowledge gained.

On-Going Recertification Requirements: Conduct as Team Leader a minimum of six (6) audits or inspections every twenty-four (24) months. Achieve sixteen (16) Professional Development Hours (PDHs) in Accident Investigation, Road Safety Engineering, or related discipline every twenty-four (24) months

Certifying Road Safety Auditors



Certifying Road Safety Auditors



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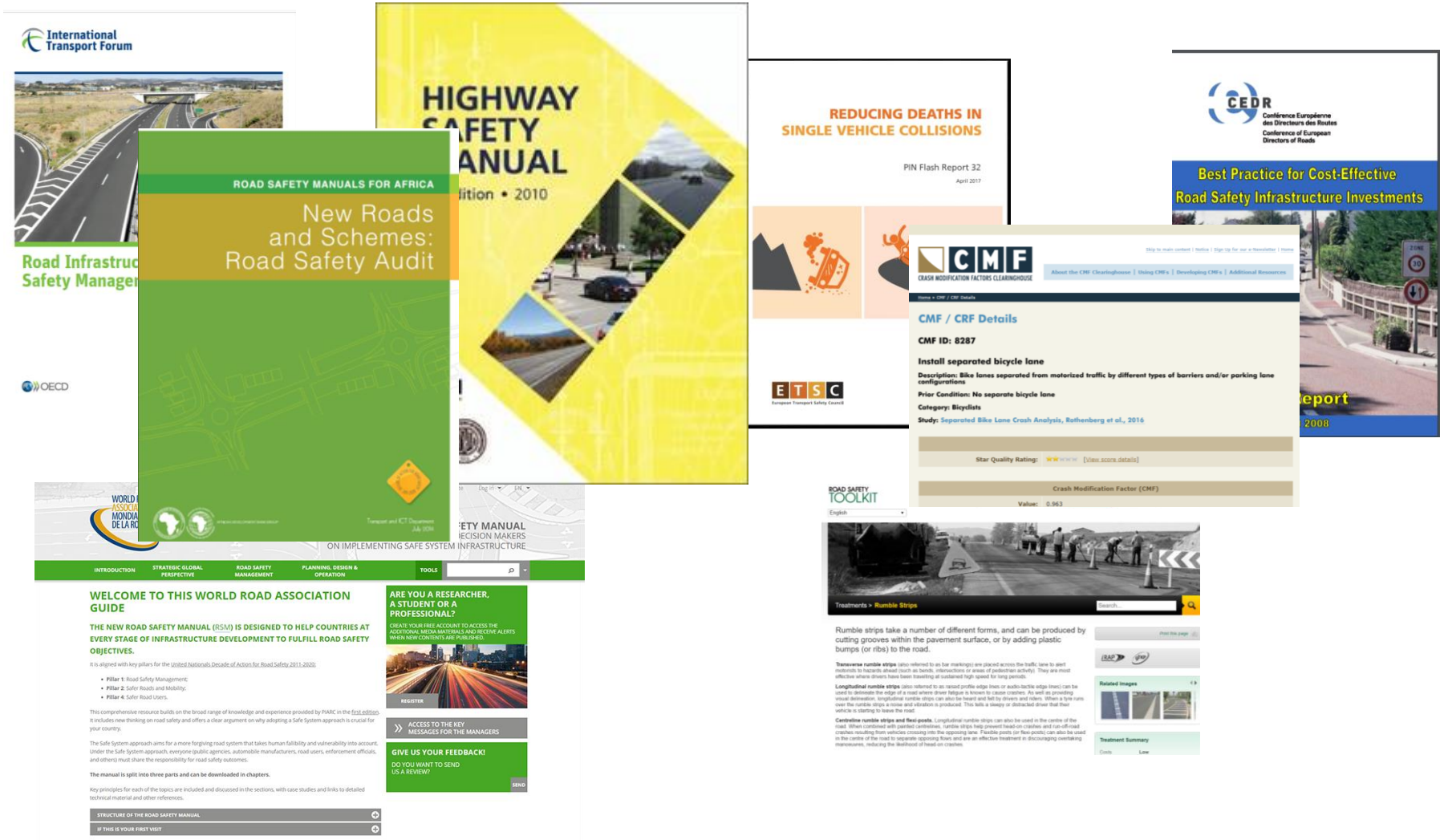
Knowledge Resources



Knowledge Resources

Road Infrastructure Safety Management, ITF/OECD
https://www.itf-oecd.org/road-infrastructure-safety-management
Highway Safety Manual, AASHTO
http://www.highwaysafetymanual.org/Pages/default.aspx
Road Safety Manual, PIARC
https://roadsafety.piarc.org/en
Road Safety Toolkit, iRAP
http://toolkit.irap.org/
Crash Modification Clearinghouse
http://www.cmfclearinghouse.org/
Work Zone Safety Clearinghouse
https://www.workzonesafety.org/
Reducing Deaths in SVCs, ETSC
http://etsc.eu/reducing-deaths-in-single-vehicle-collisions-pin-flash-32/
IRF Policy Statements & Webinars
https://www.irf.global/irf-knowledge

Knowledge Resources

Thank you for your attention

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