Assessing Road Risk & Designing Safety Investment Plans

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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. Other Risk Diagnosis Tools
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

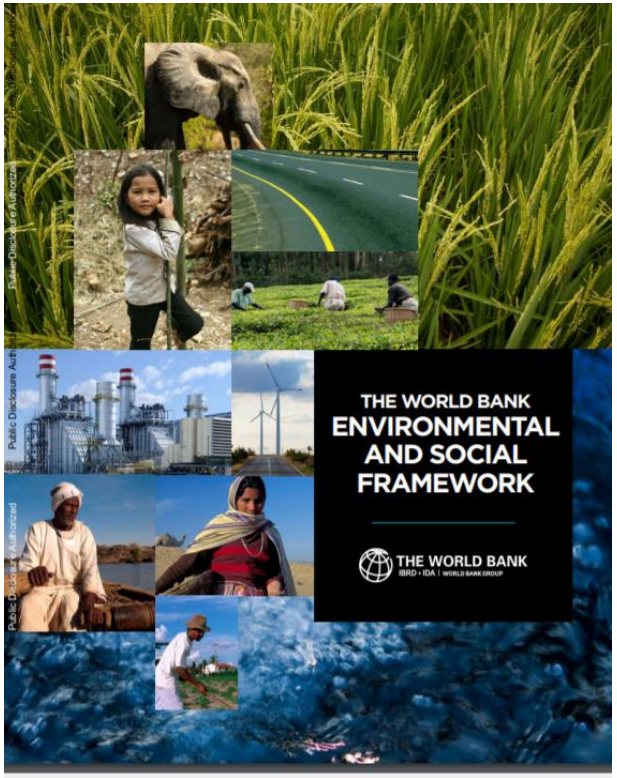
Assessing Road Risk


delta
delta
PATRICK
FILA

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."



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Why Use Economics?

- Scarcity of resources
- Choice between alternatives

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

Economic valuation

Types of costs

Perspective

Marginal vs. incremental

Time preference (present vs. future)

Economic valuation

Methods of economic appraisal

- Remedial costs (health care costs)
- Loss output (net of future earnings)
- Reconstruction costs (material damage)
- Pain and suffering

Willingness to pay

Stated Preference: Use of surveys to estimate what individuals are willing to pay in order to have a lower risk of injury, or what they are willing to accept for a higher risk of injury

- 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?

Revealed Preference observes actual behavior in a proxy market

Willingness to pay

$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 do not have an SP-based 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 WPT 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

Developing countries:

Country	VSL	Per Capita GDP	VSL/per capita GDP	Year	Currency	Method
Cambodia	18,864	317	60	2002	$	HC
Philippines	41,330	982	42	2003	$	HC
Thailand	2,741,064	85,890	32	2002	B	HC
Vietnam	162,620,000	7,582,788	21	2003	D	HC
Lao	4,617	336	14	2003	$	HC
Indonesia	255,733,113	8,645,085	30	2002	Rp	HC
Malaysia	1,200,000	15,811	76	2003	RM	WTP
India	1,311,000	23,578	56	2004	Rs	WTP
Myanmar	4,806,909	144,967	33	2003	MK	HC
Bangladesh	889,528	16,169	55	2002	Tk	HC
Latvia	276,327	4,807	57	2006	LVL	HC
Poland	1,056,376	27,585	38	2006	PLM	HC
Lithuania	1,018,269	16,405	62	2003	LTL	HC

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:

If we compare the ratios between developed countries and LMICs it is clear that the developed countries' ratios tend to be higher particularly when they are based on a WTP approach.

Clustered values of VSL/per capita GDP if countries are grouped according to the methodology used.

Supports the concept of a rule-of-thumb approach based on the ratio of VSL to GDP per capita for obtaining workable estimates of the VSL for LMICs.

Rule of thumb

Findings:

Fatalities: a reasonable rule of thumb to use for the default values for the economic appraisal model is 70 as a central ratio value, with a range of 60-80 for sensitivity analysis.

Serious injuries: a reasonable value of serious injury for the economic appraisal model is 25% of the value of a fatality, with a range of 20%-30% for sensitivity analysis. The equivalent values in terms of multiplier of GDP per capita are a central value of 17 with a range of 12 to 24 for sensitivity analysis.

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	—

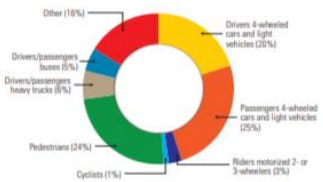
[a] National Statistics Office of Georgia - GEOSTAT. Defined as died within 30 days of crash.

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

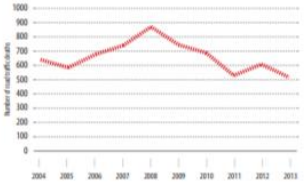
[a] 2013, Ministry of Internal Affairs of Georgia.

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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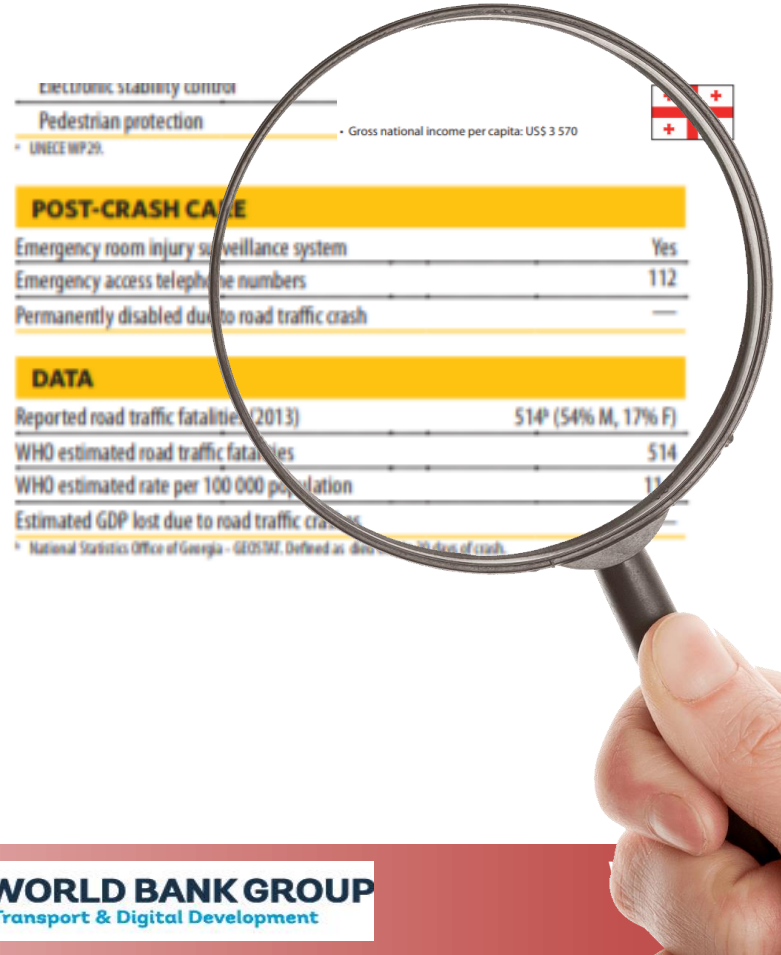

IRF

EaP | Eastern Partnership

WORLD BANK GROUP
Transport & Digital Development

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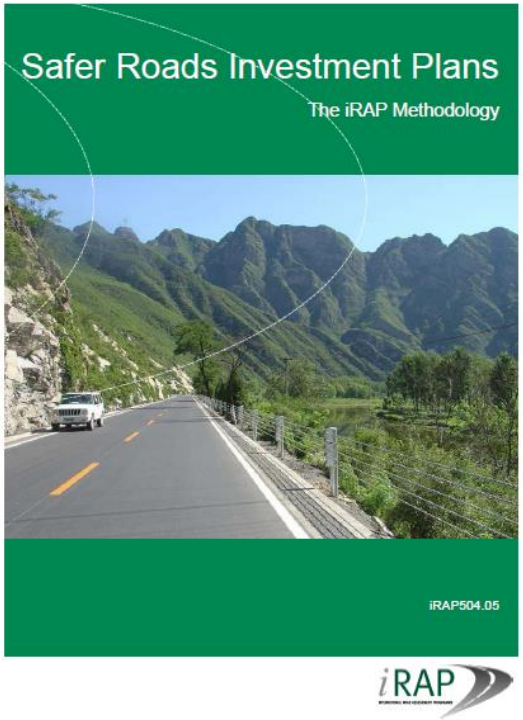
Introducing iRAP

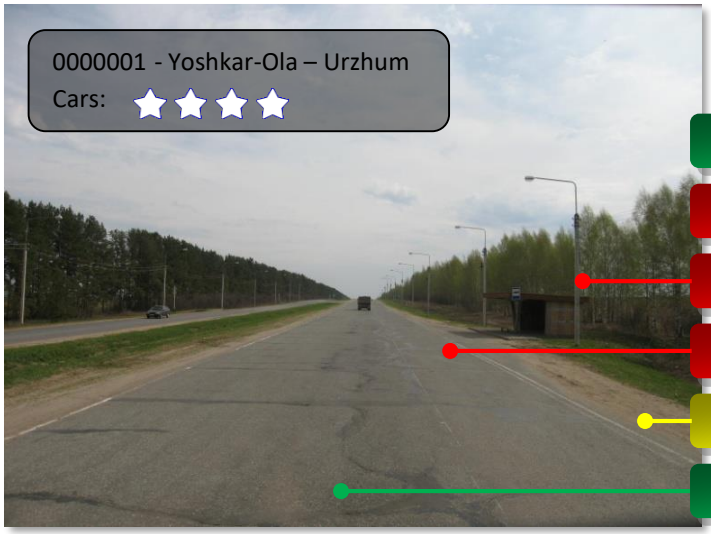
The International Road Assessment Program (iRAP) surveys new and existing roads to assess objective levels of safety through a Road Protection Score (RPS).

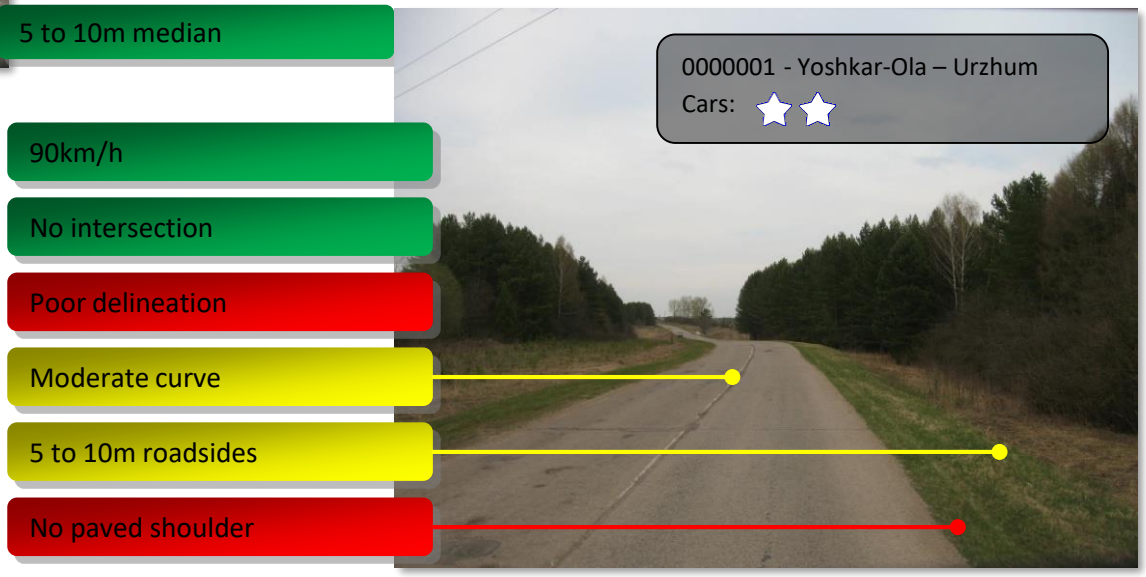
The RPS is a measure of the likelihood of a crash occurring and its severity, based on a road's speed environment and a detailed inventory of road design elements.

iRAP also generates and ranks a range of possible countermeasures.



Introducing iRAP





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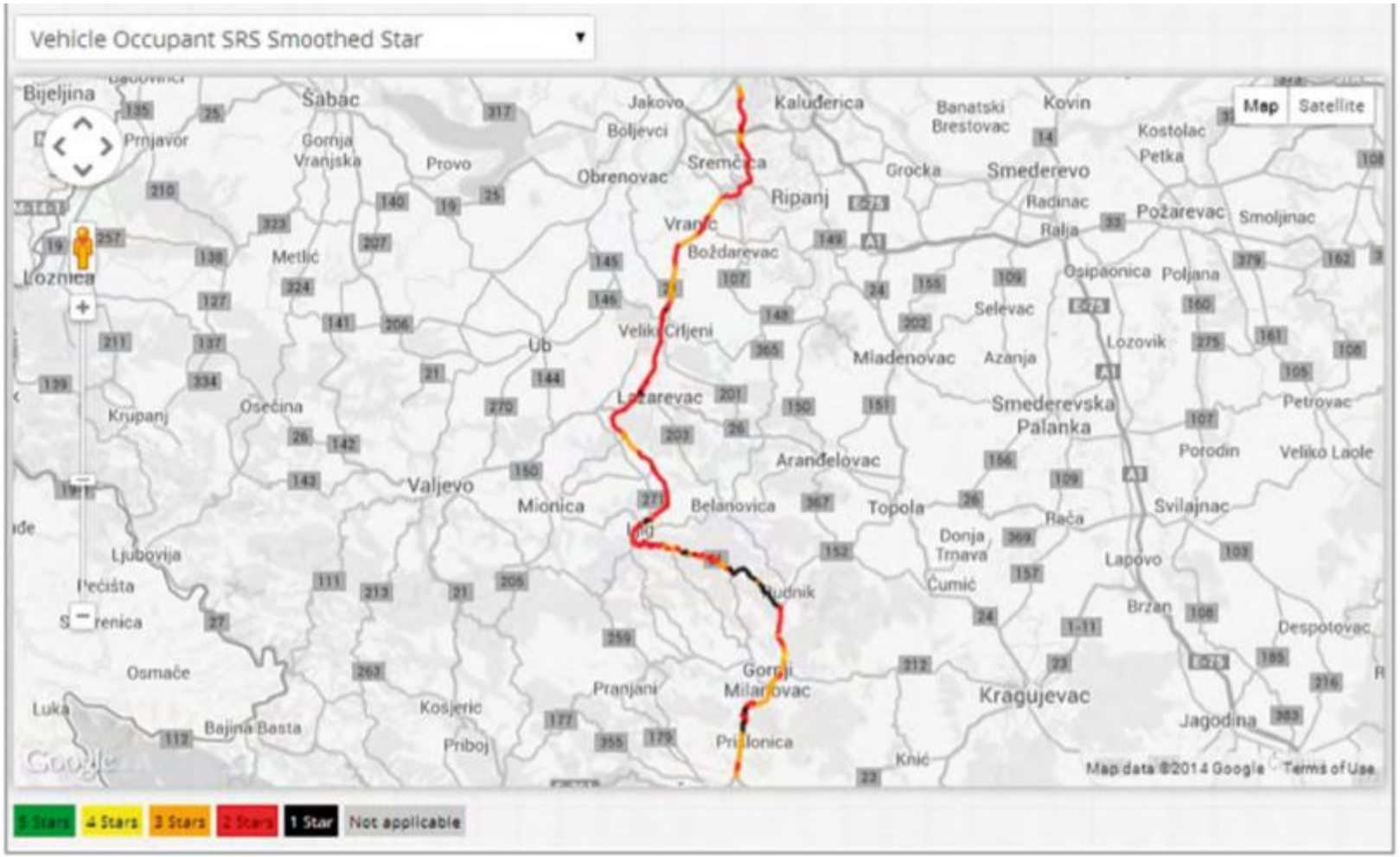

Introducing iRAP

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

iRAP vs. Road Safety Audits

Topic	Road Safety Audit → Qualitative	iRAP → Quantitative
Method of data collection	On-site visits / design plans	Survey to collect mages at 10m to 20m intervals / design plans
Assessment	Checklist Covers broad number of issues	Coding of fixed list of attributes at 100m intervals Application of risk factors
Reporting of risk	Checklist	Star Rating Scores, Star Ratings, estimates of deaths and serious injuries, estimate of economic cost
Recommendations	List of countermeasures and further work	List of countermeasures at 100m intervals, deaths and serious injuries that could be prevented, economic savings

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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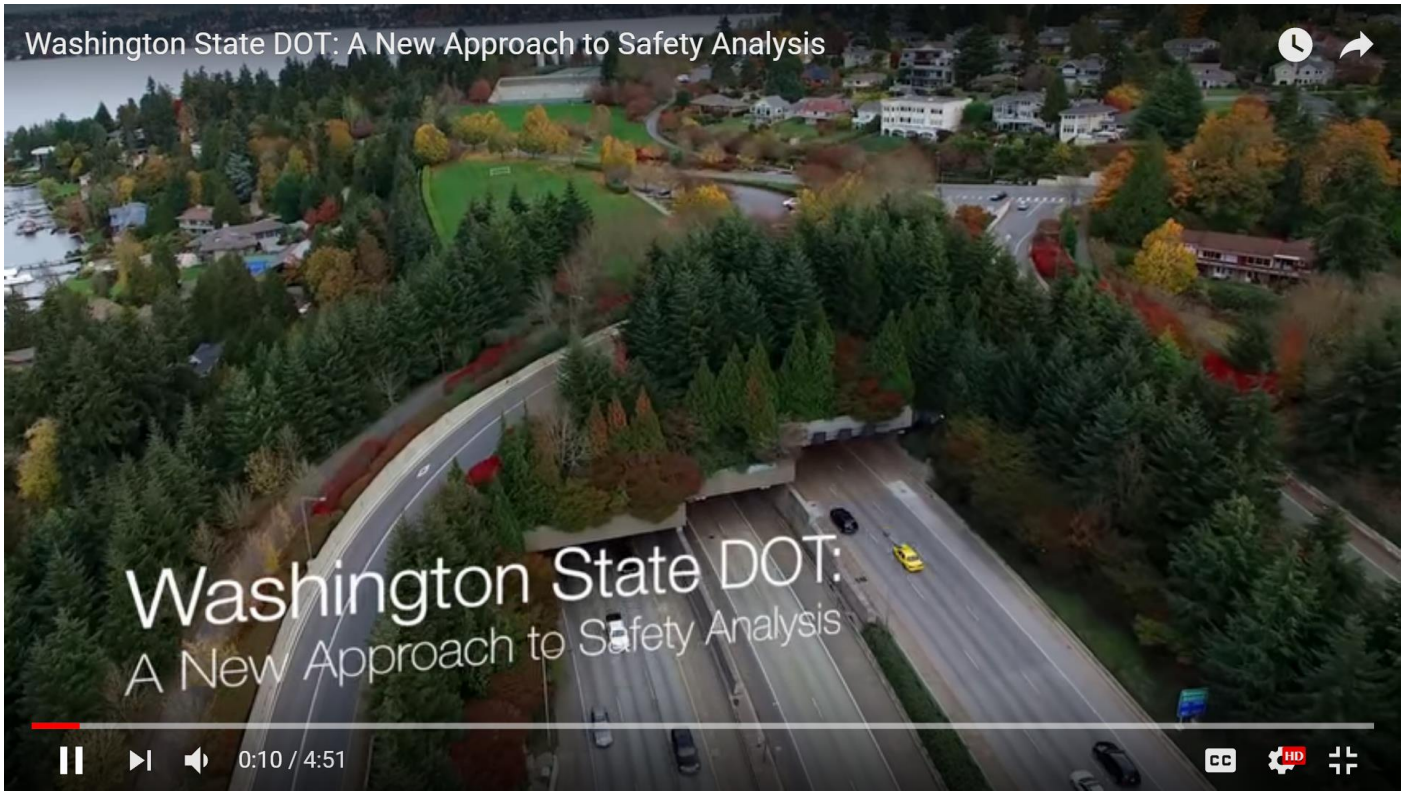
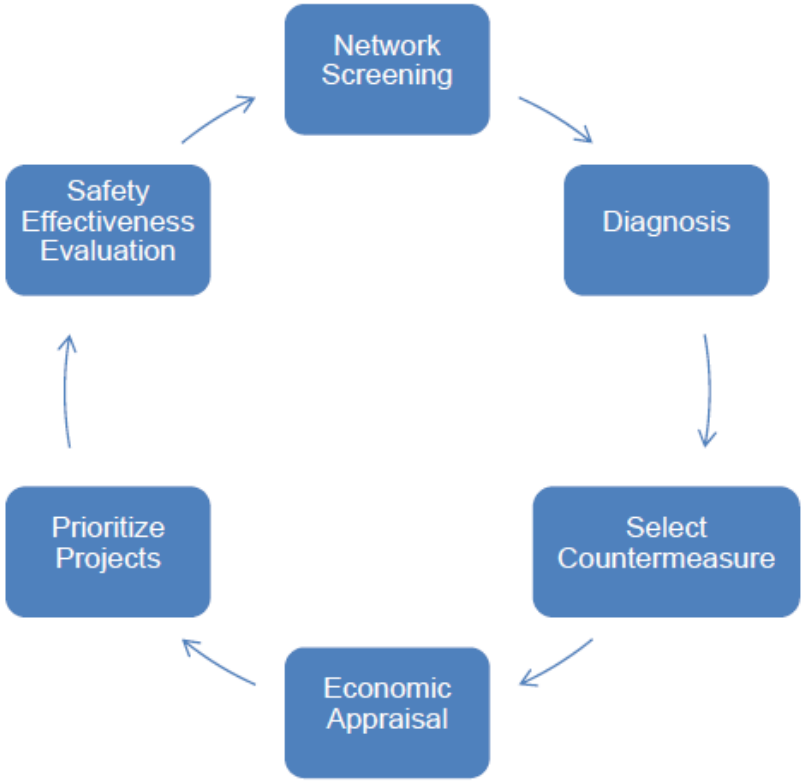
Managing Risk on your Roads

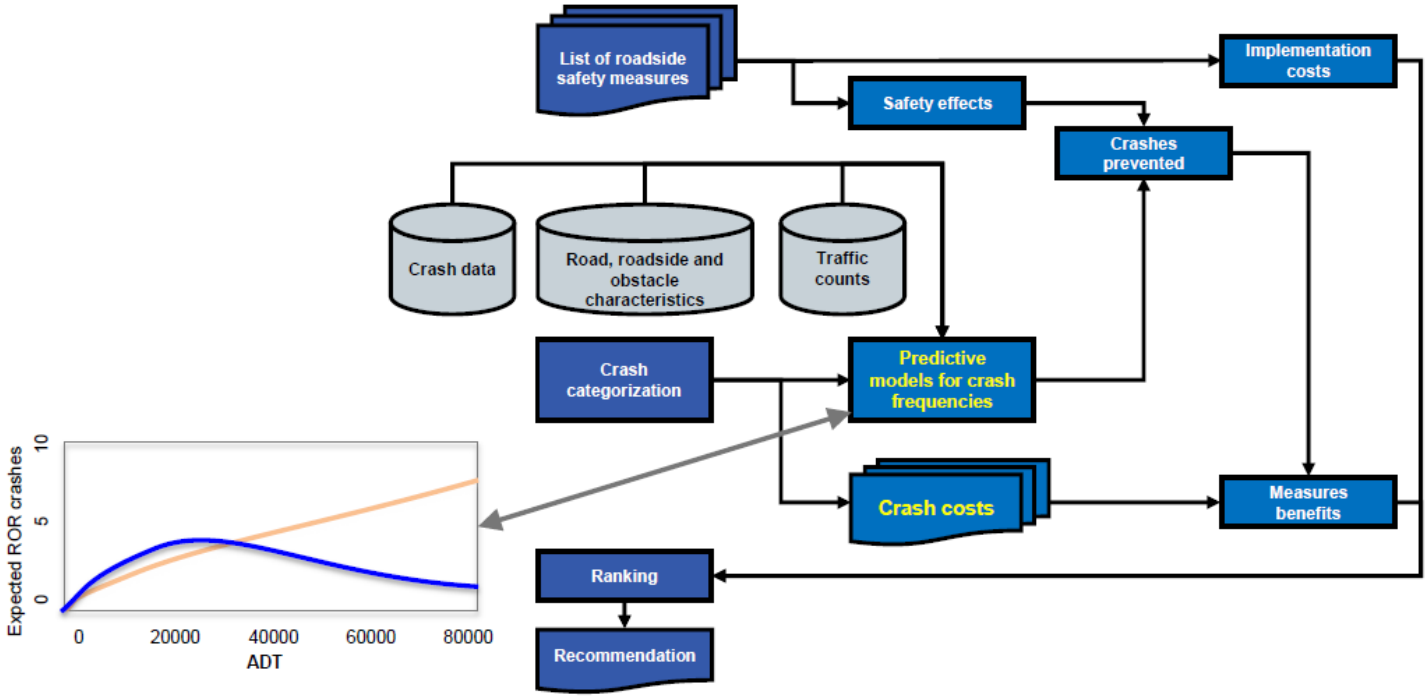


A New Approach to Safety Analysis at Washington State DOT

Managing Risk on your Roads

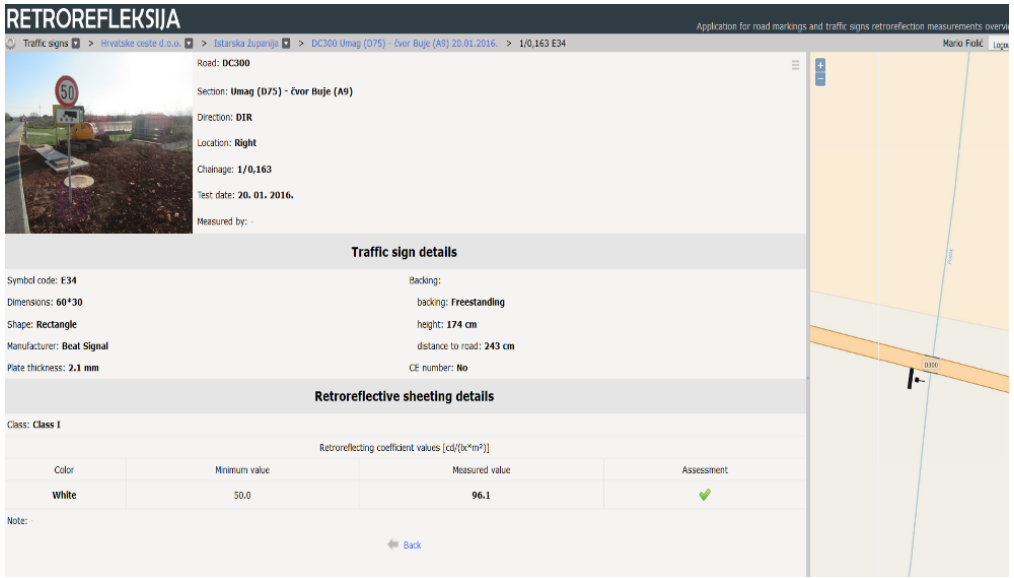


Managing Risk on your Roads



in Portugal

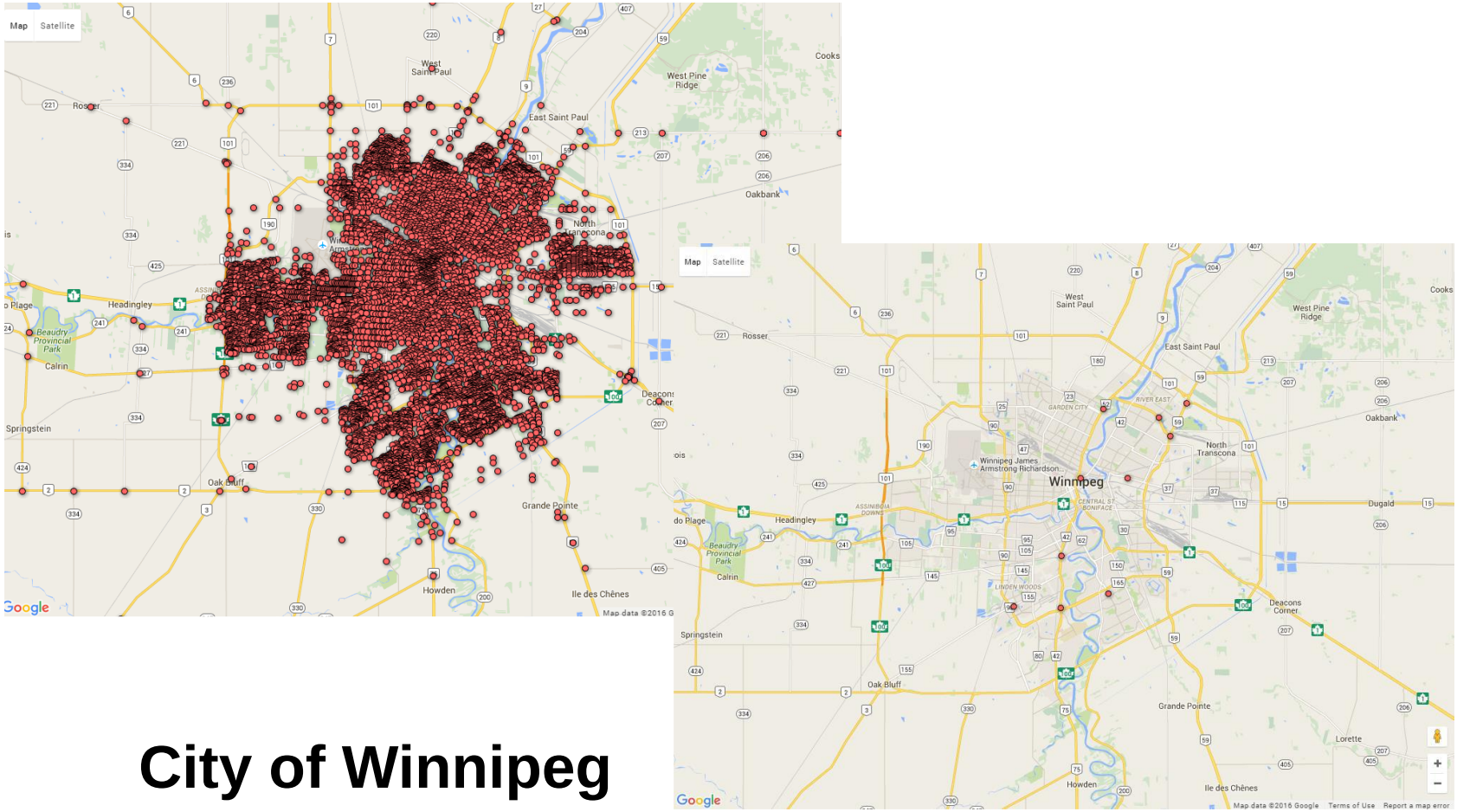
Managing Risk on your Roads



- Average age of technically correct signs: **6,34 years**
- Average age of technically defective signs: **11,54 years**

in Croatia

Managing Risk on your Roads



City of Winnipeg

Summary

- Build solid data collection system
- Make an economic case for road safety investments
- Use your road asset management systems to guide period safety improvement needs
- Leverage technological enablers.
- Set high standards for the professionals involved in designing and auditing your roads

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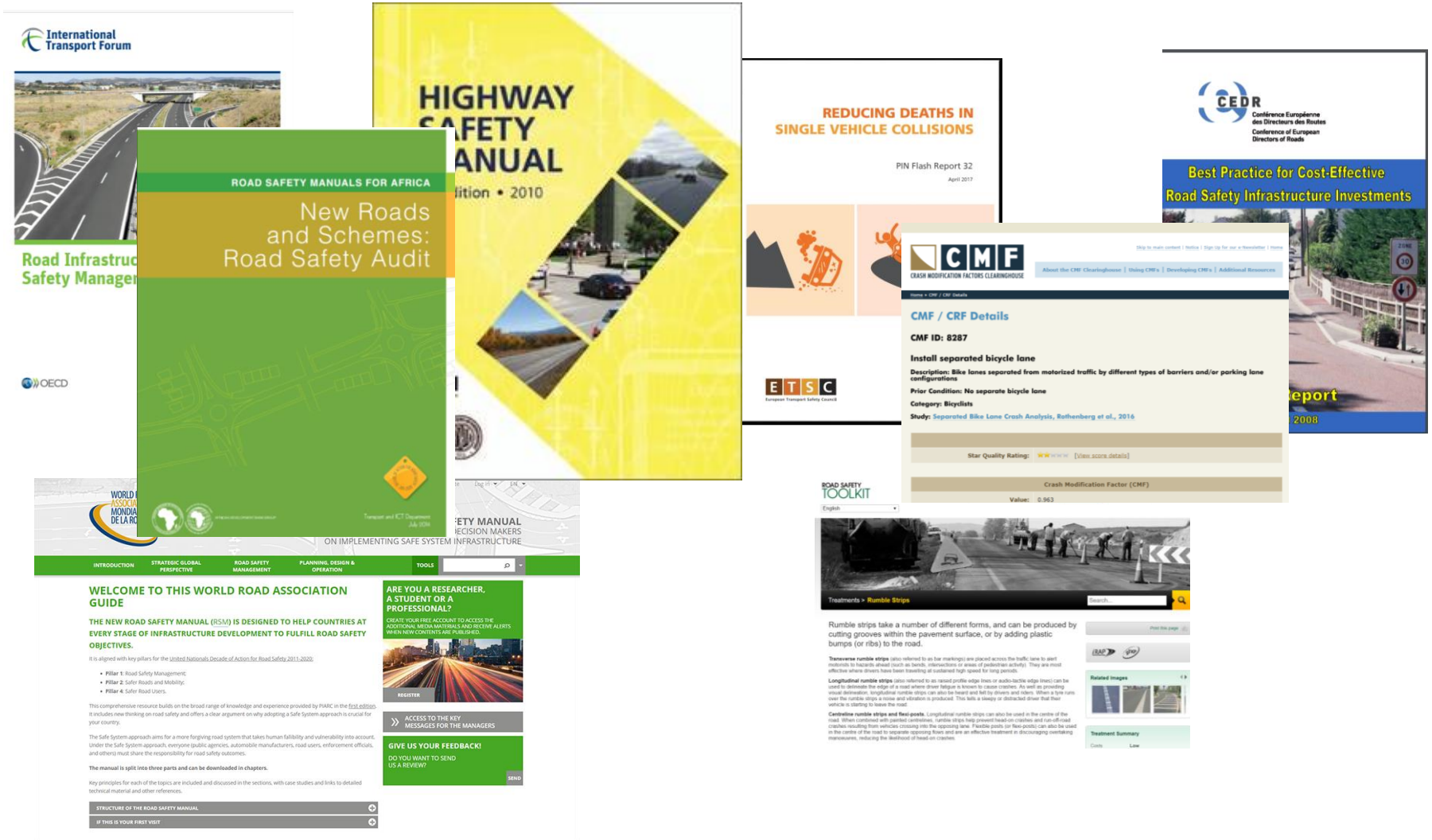
Knowledge Resources



Knowledge Resources

Back up slides