Safer Roads and iRAP in Malaysia:

2nd ROAD SAFETY WORKSHOP

16-18 August 2016
Kuala Lumpur, Malaysia

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Head
Highway & Traffic Engineering Unit
Road Safety Engineering & Environment Research Centre

The Role of Road Infrastructure

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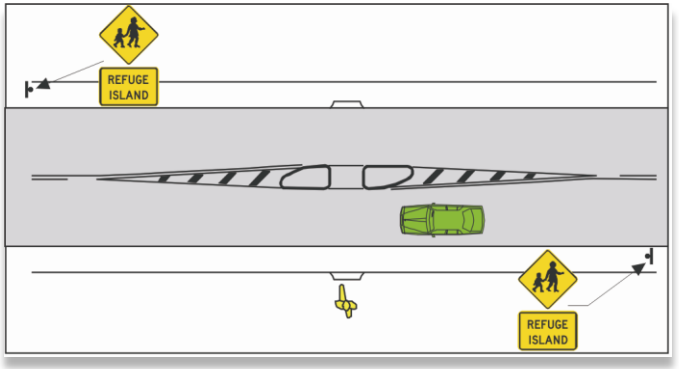
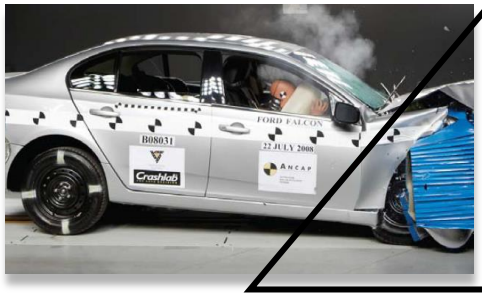
CAREC
Central Asia Regional Economic Cooperation Program

Safe System Approach

Safer Roads



Speed



Safer Vehicles

Safer Users

★★★★★ road user ★★★★★ vehicle ★★★★★ road

Why Safer Roads?

- Our road system kills
- We know how it kills
- We know how many it kills
- We know how to fix it

Why Safer Roads?

Why Safer Roads?

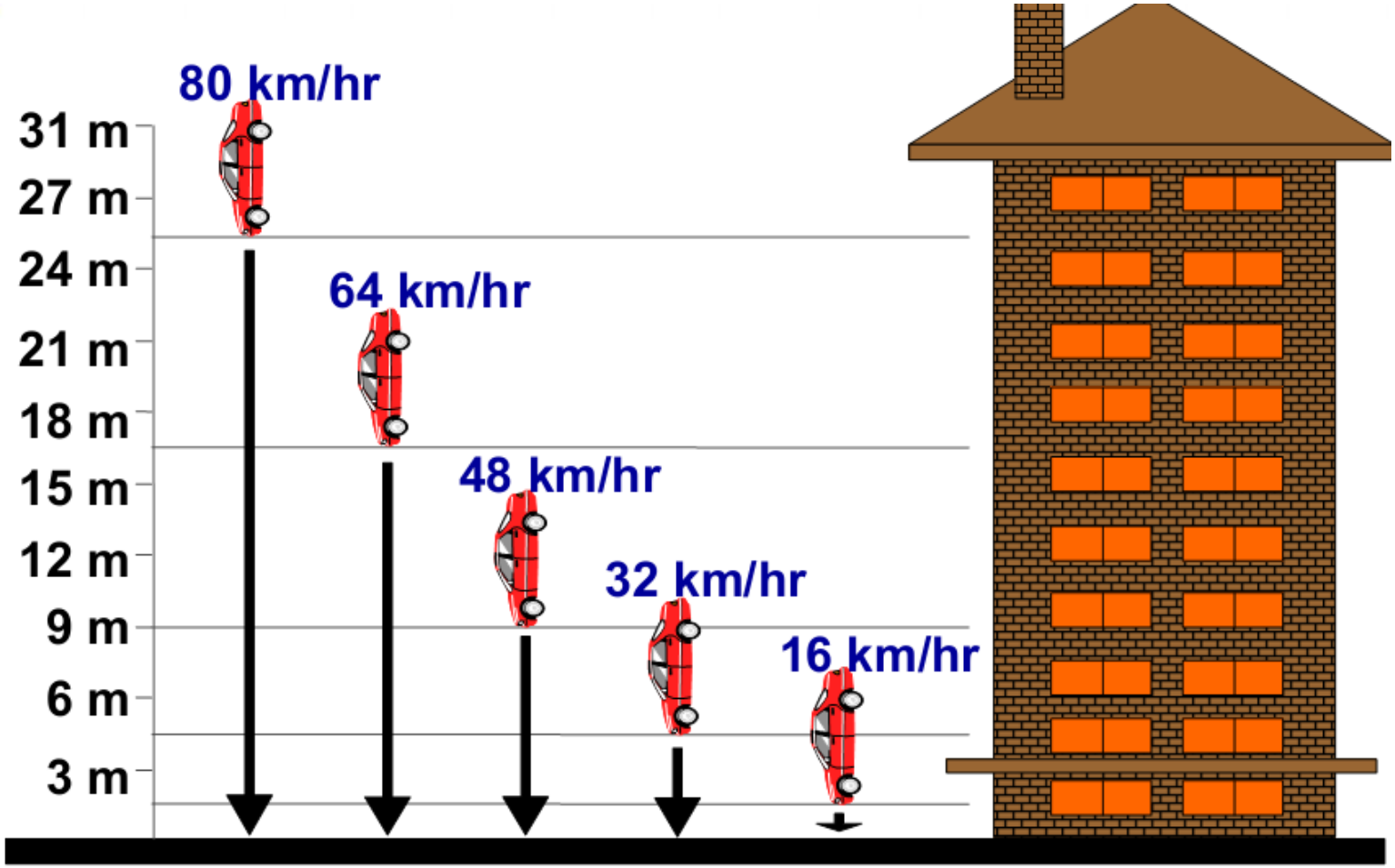
Why Safer Roads?

Why Safer Roads?

$$E = \frac{1}{2} m v^2$$

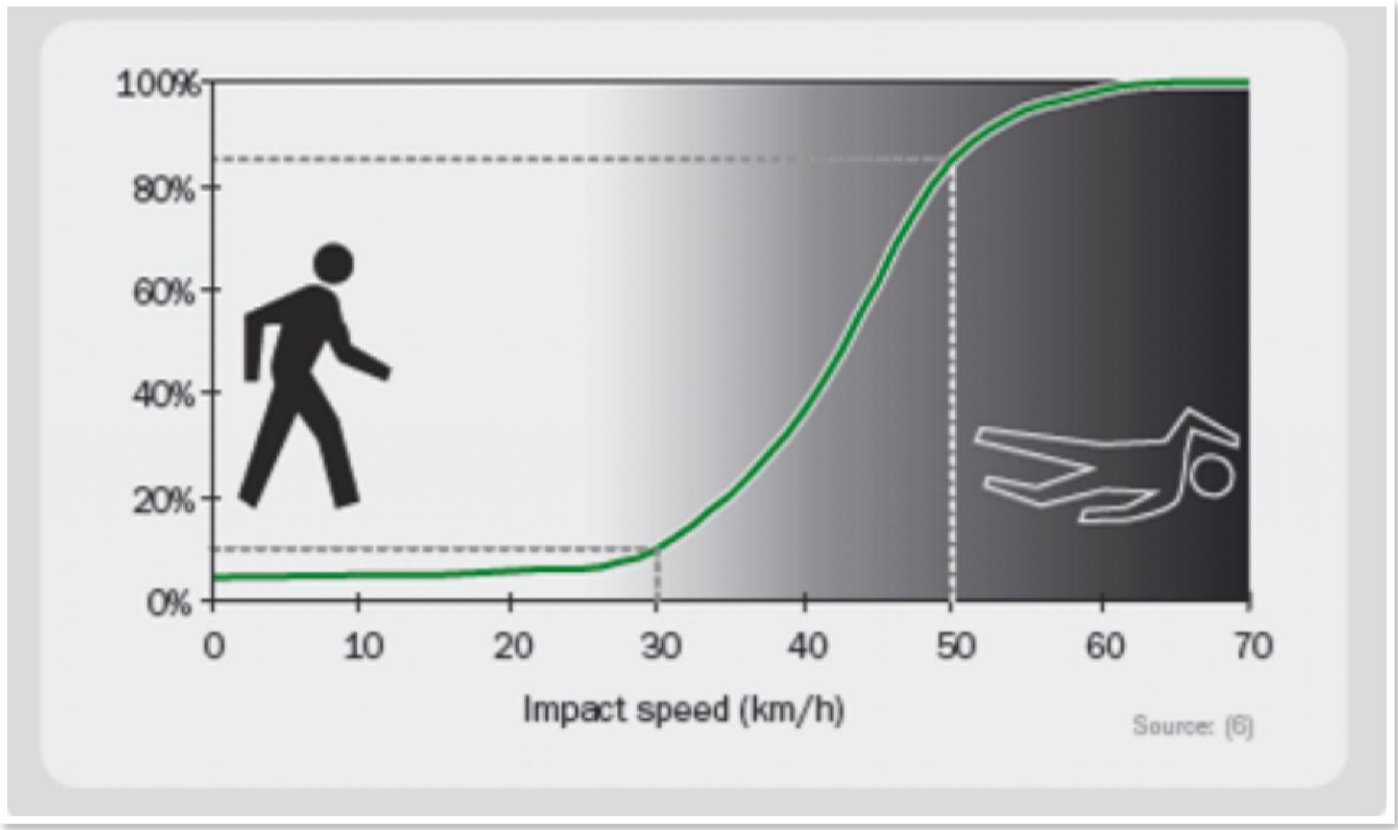
- E: Transferred to vehicle and human body
- m: Mass
- v^2: Velocity

Why Safer Roads?



★★★★★ road user ★★★★★ vehicle ★★★★★ road

Why Safer Roads?



Common Road Improvements

Road markings

Patched road surface

Advance warning sign

Provision of street lights

About iRAP

About iRAP

iRAP tells us:

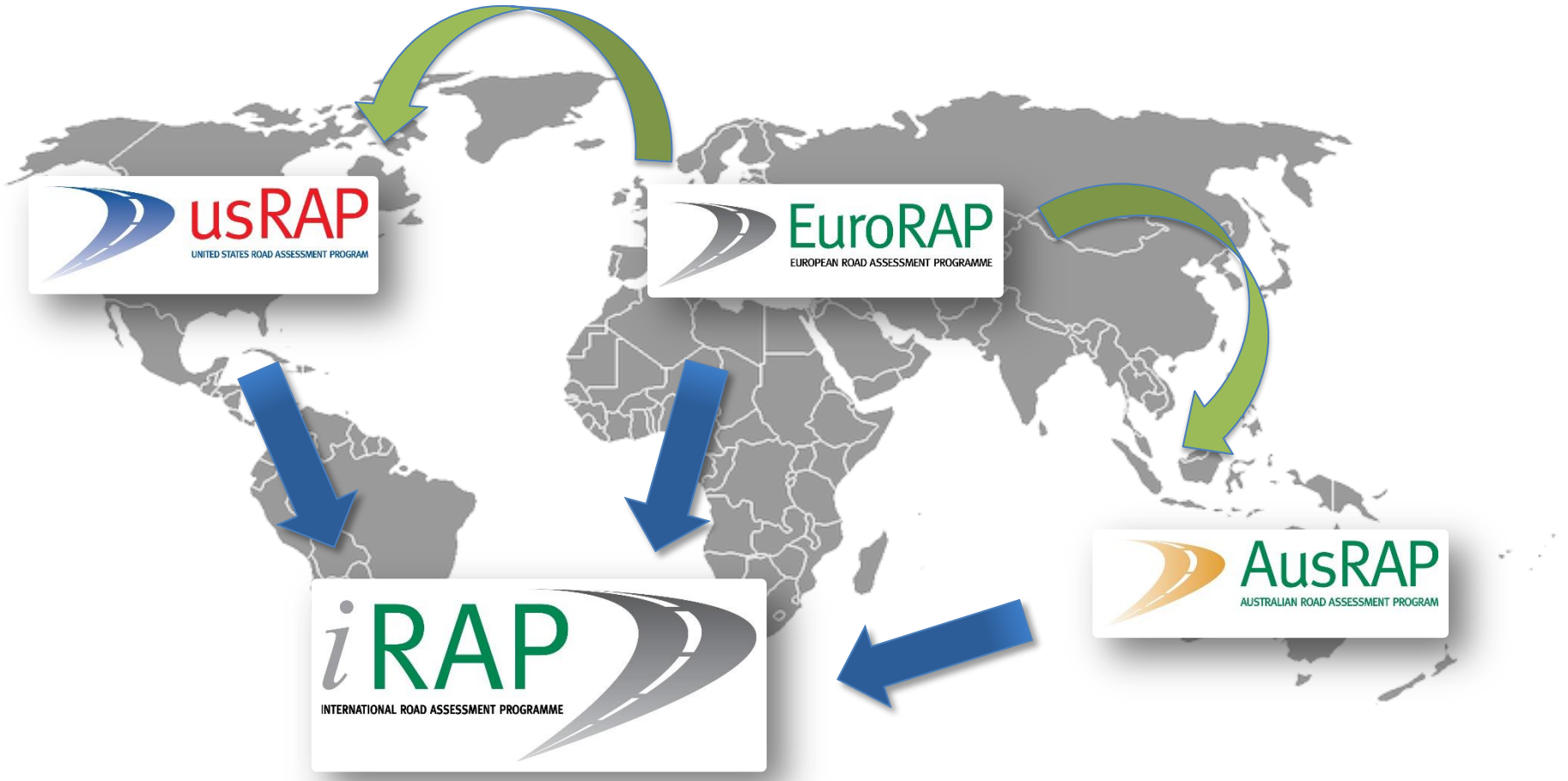
- What is the **current condition** of our road infrastructure.
- **How safe** are the road environment.
- **What can be done** to improve the current conditions.
- How much is the **return of investment** of each improvement.

About iRAP

iRAP is a not-for-profit working in partnership with government and non-government organisations to:

- assess high-risk roads and create targeted safety plans
- provide training, technology and support
- track road safety performance

Development of iRAP



★★★★★ road user ★★★★★ vehicle ★★★★★ road

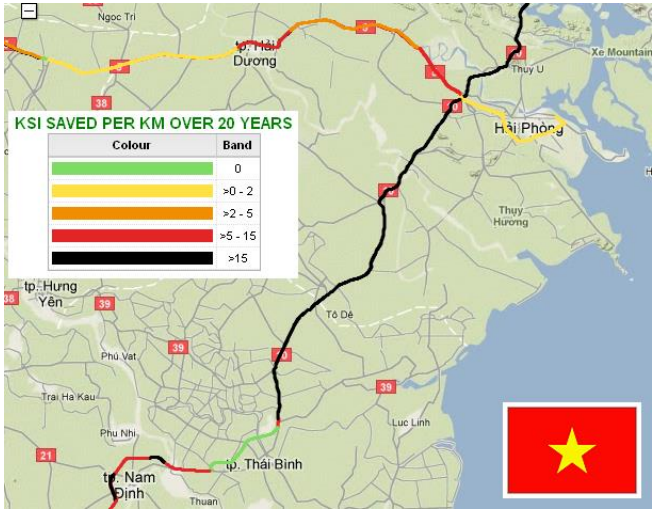
About iRAP

- **Risk Mapping**
  - Crash Density (per km)
  - Individual Crash Risk (per vkt)

- **Star Rating**
  - Explain engineering safety
  - Inspection based
  - Vehicles, Motorcycles, Pedestrians & Cyclists
  - Rural and Urban areas

About iRAP

- **Fatality Estimation**
  - Crash assignment model for countries with poor data
- **Safer Roads Investment Plans**
  - 70+ countermeasures
  - Full economic analysis
  - Minimum BCR criteria
  - Saving 1 in 4 fatalities & SIs



About iRAP

CONCEPT OF STAR RATINGS

Head-on crashes Run-off crashes Junction crashes

Likelihood
of a crash to occur

Protection
to road users

★★★★★ road user ★★★★★ vehicle ★★★★★ road

About iRAP

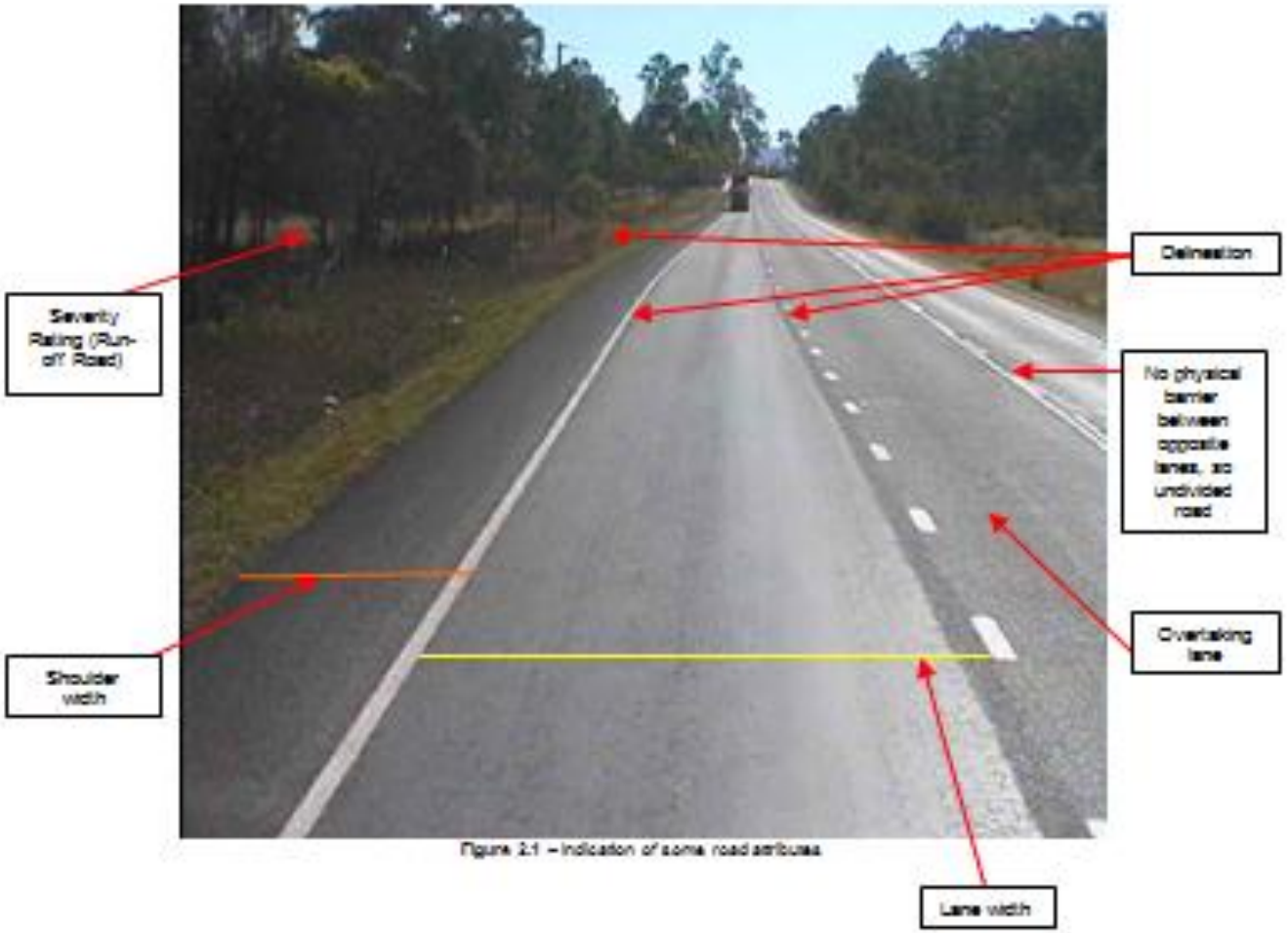


Figure 2.1 – Indication of some road attributes

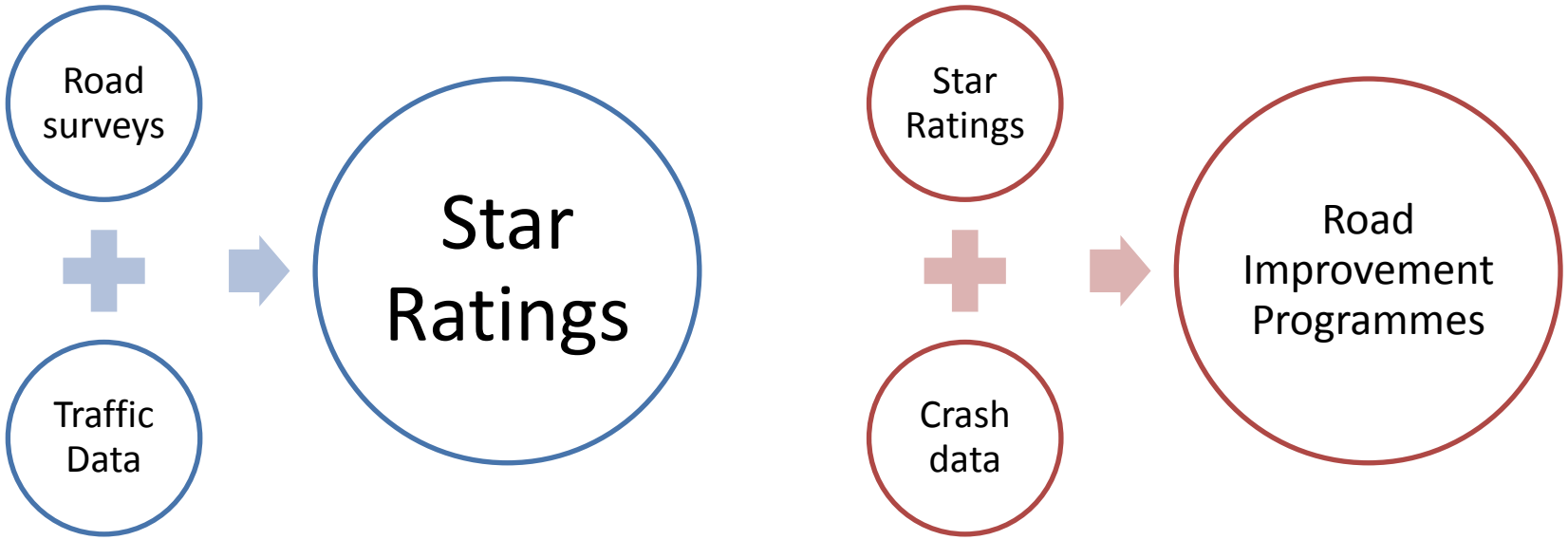
Development of iRAP

Major outputs of iRAP:

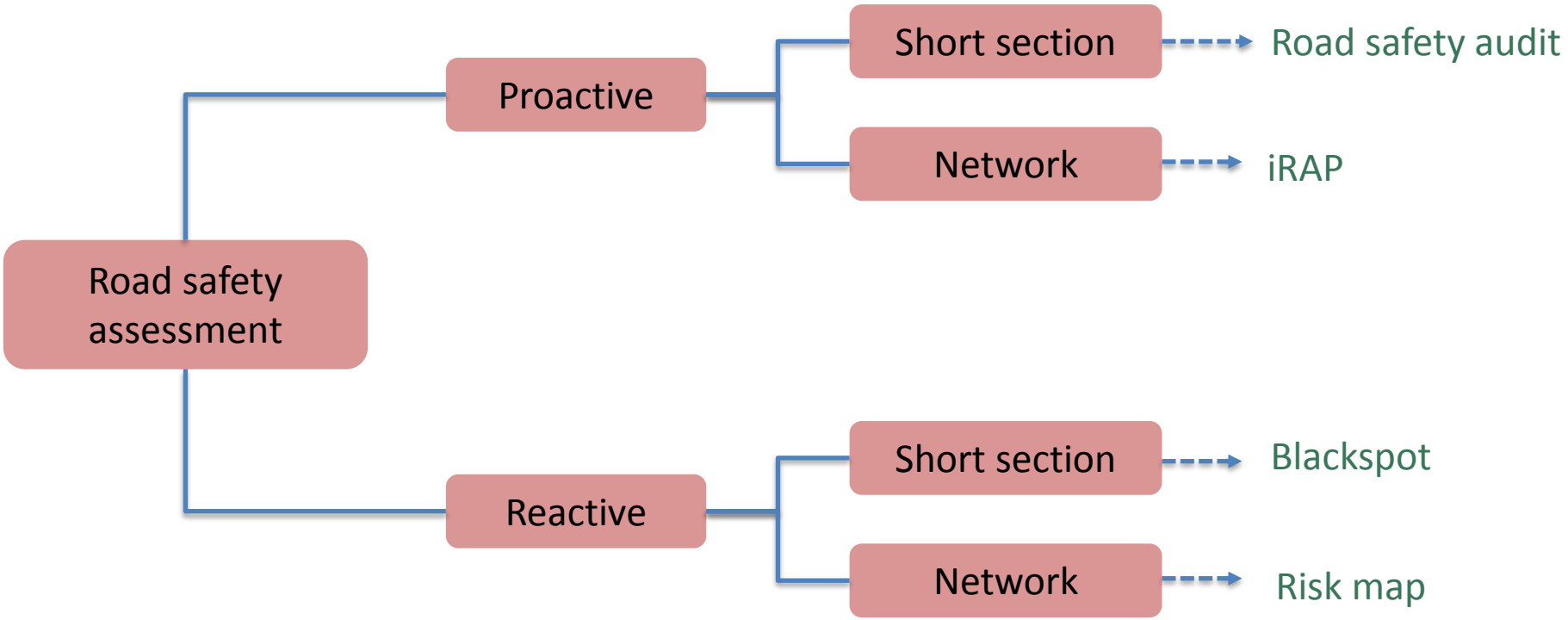
1. Star Ratings (for every 100m section)
   - Based on visual assessment of over 50 road attributes.
   - Assess road attributes with regard to likelihood and severity of a crash.

2. Recommended countermeasure programmes
   - More than 90 types of countermeasure programmes.
   - Based on benefits-to-cost ratio of each programme.

About iRAP


Road surveys
Traffic Data
Star Ratings
Star Ratings
Crash data
Road Improvement Programmes

Development of iRAP



About iRAP

- Commitment to provide mutual support
- Strong adherence to protocols and branding
- Commitment to high quality standards and operating within established procedures
- Use of accredited suppliers and trained staff
- Adhere to international & country agreements in relation to communication of the results

About iRAP

- Annual Regional Workshops
- Annual Global Workshops
- Innovation Workshops
- Local Centre of Excellence

iRAP Asia Pacific Workshop & GRSP Summit

Beijing, PEOPLES REPUBLIC OF CHINA
24-26 May 2016

iRAP Innovation Workshop

Washington, UNITED STATES OF AMERICA,
21-23 Sept 2016

iRAP Pilot Studies

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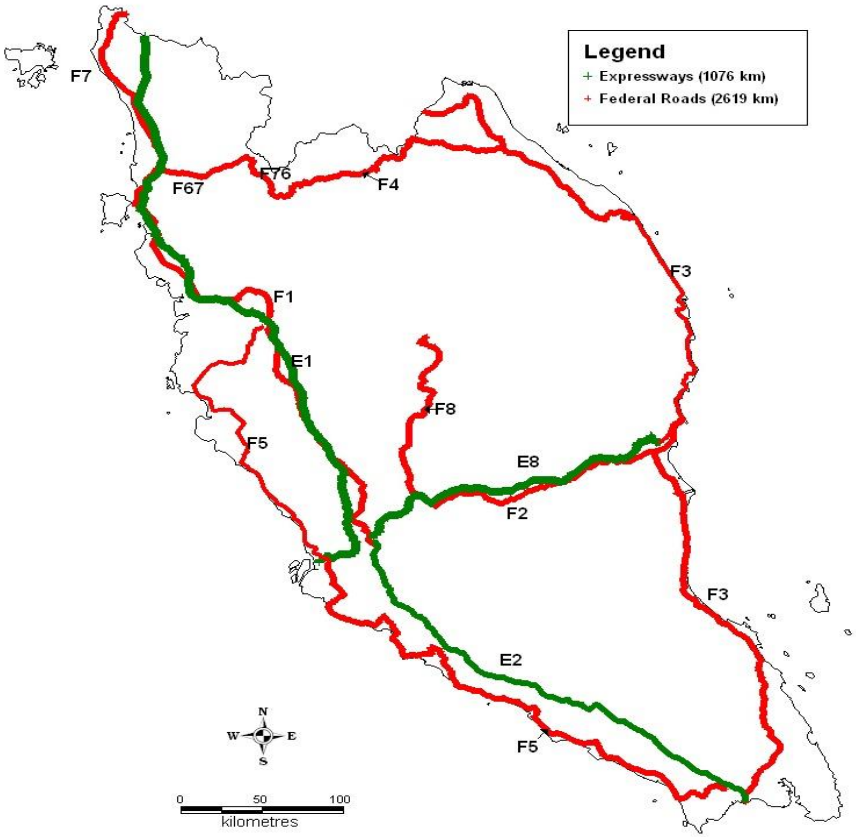
iRAP Malaysia Pilot Study

Pilot Countries

★★★★★ road user ★★★★★ vehicle ★★★★★ road

iRAP Malaysia Pilot Study

Surveyed Roads in 2007



- 3,700 km of roads in Peninsular Malaysia was surveyed over a 5-week period.
- Expressways (E1, E2, E8)
- Federal Roads (F1, F2, F3, F4, F5, F7, F8, F67 and F76)

iRAP Malaysia Pilot Study

- ARRB Hawkeye 2000 3 camera digital imaging system.
- Brought all the way from Australia.
- GPS and Geometry Systems

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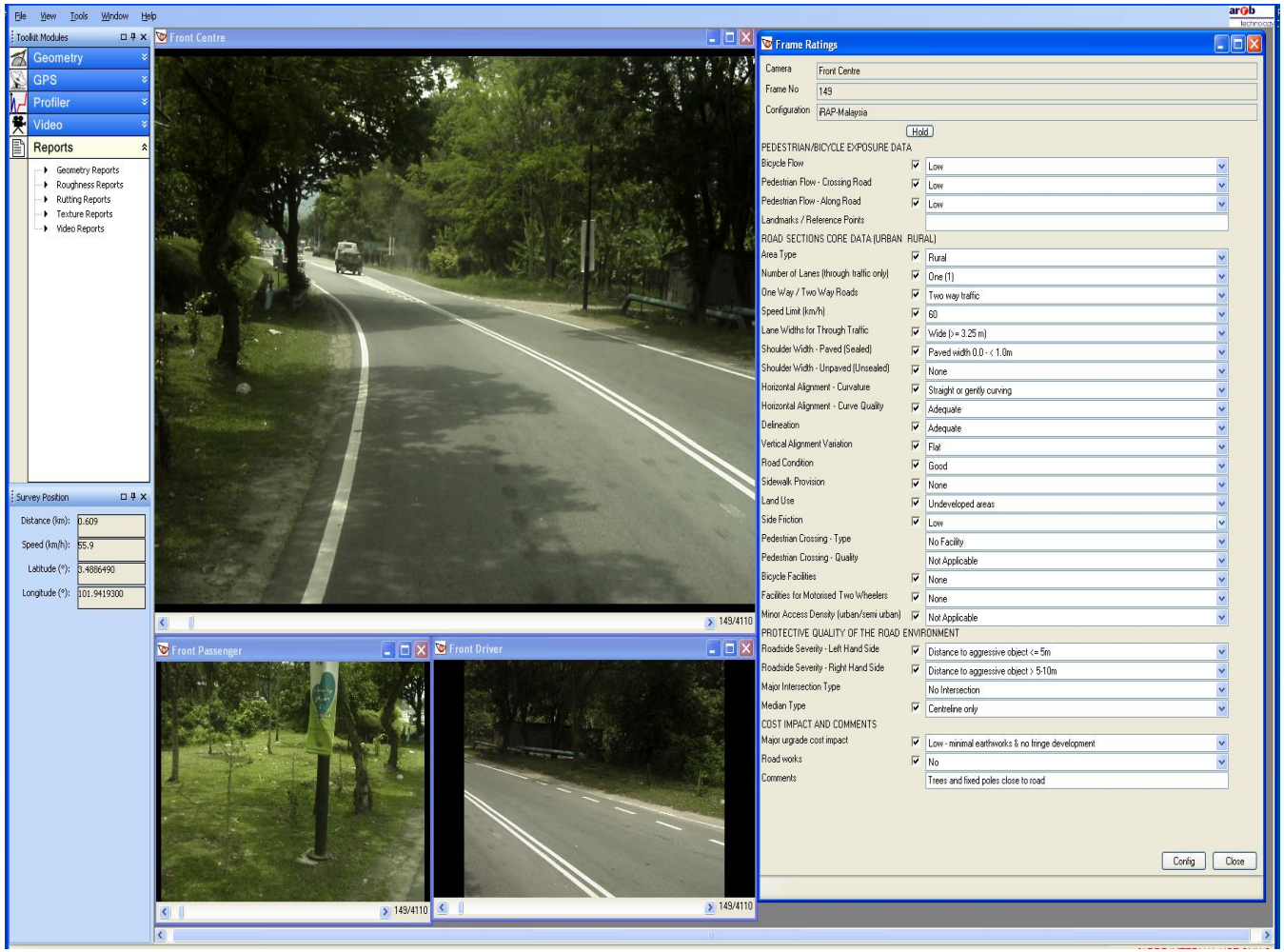
iRAP Malaysia Pilot Study



- Hawkeye Data Viewer
- Video images were analysed using a data rating form.
- 33 road attributes recorded.

★★★★★ road user ★★★★★ vehicle ★★★★★ road

iRAP Malaysia Pilot Study

Star Ratings

iRAP Malaysia Star Rating – Federal Roads (F1, F2, F3, F4, F5, F7, F8, F67, F76)

	Car Occupants		Motorcyclists		Bicyclists[1]		Pedestrians[1]	
Star Rating	Length (km)	%	Length (km)	%	Length (km)	%	Length (km)	%
★★★★★	0 km	0%	0 km	0%	0 km	0%	0 km	0%
★★★★	239 km	9%	186 km	7%	9 km	2%	0 km	0%
★★★	822 km	31%	905 km	35%	63 km	16%	476 km	48%
★★	1,127 km	43%	1,270 km	48%	261 km	65%	508 km	51%
★	433 km	17%	260 km	10%	66 km	16%	8 km	1%
	2,621 km	100%	2,621 km	100%	398 km	100%	992 km	100%
Not Rated					2223 km		1,629 km	

[1] *Note: Percentage values reflect the proportion of the network where bicycle or pedestrian demand exists. Where bicycle or pedestrian demand is zero the section has not been rated.*

★★★★★ road user ★★★★★ vehicle ★★★★★ road

iRAP Malaysia Pilot Study

Star Ratings

iRAP Malaysia Star Rating – Expressways (E1, E2, E8)*

	Car Occupants		Motorcyclists	
Star Rating	Length (km)	%	Length (km)	%
★★★★★	1.2 km	0.1%	0 km	0%
★★★★	924 km	87%	687 km	64%
★★★	130 km	12%	368 km	35%
★★	0 km	0%	1.6 km	0.2%
★	11 km	1%	10 km	1%
	1,066 km	100%	1,066 km	100%

** Note: Pedestrian and Bicycles are not permitted on Expressways*

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iRAP Malaysia Pilot Study

Top 8 Countermeasures for an investment program with a minimum BCR of 5

Countermeasure Type	Length or number of sites	KSIs Saved (20 years)	Present Value of Safety Benefit (20 years)	Estimated Initial Construction Cost	Estimated Cost to Build and Maintain (20 years)	Cost per KSI Saved (20 years)	Programme Benefit-Cost Ratio
Roadside safety - hazard removal	1,647 km	9,660	RM 2,849.0 million (USD 892.4 million)	RM 23.5 million (USD 7.4 million)	RM 23.5 million (USD 7.4 million)	RM 2,400 (USD 800)	121
Central hatching	13 km	40	RM 12.8 million (USD 4.0 million)	RM 0.2 million (USD 0.06 million)	RM 0.4 million (USD 0.1 million)	RM 8,200 (USD 2,600)	36
Motorcycle lanes	268 km	880	RM 258.1 million (USD 80.8 million)	RM 15.0 million (USD 4.7 million)	RM 16.8 million (USD 5.3 million)	RM 19,200 (USD 6,000)	15
Intersection upgrades	381 sites	2,000	RM 590.0 million (USD 184.8 million)	RM 34.5 million (USD 10.8 million)	RM 43.3 million (USD 13.6 million)	RM 21,700 (USD 6,800)	14
Additional lane	377 km	8,180	RM 2,412.7 million (USD 755.6 million)	RM 178.5 million (USD 55.9 million)	RM 178.5 million (USD 55.9 million)	RM 21,800 (USD 6,800)	14
Shoulder widening	270 km	1,370	RM 404.5 million (USD 126.7 million)	RM 34.0 million (USD 10.6 million)	RM 34.0 million (USD 10.6 million)	RM 24,800 (USD 7,800)	12
Improve delineation	126 km	420	RM 124.4 million (USD 39.0 million)	RM 2.6 million (USD 0.8 million)	RM 10.6 million (USD 3.3 million)	RM 25,100 (USD 7,900)	12
Pedestrian crossing	133 sites	340	RM 99.7 million (USD 31.2 million)	RM 12.6 million (USD 4.0 million)	RM 12.9 million (USD 4.1 million)	RM 38,300 (USD 12,000)	8

★★★★★ road user ★★★★★ vehicle ★★★★★ road

iRAP Activities after Pilot Study

YEAR	ACTIVITIES
2007	Pilot study over 3,700 km roads
2009 - 2010	Results presented to local stakeholders Implementation and evaluation of countermeasure
2011 - 2012	Consulting service to Philippines Appointment of MIROS as iRAP COE
2012 - 2013	Consulting services to Indonesia and local stakeholders
2014	Development of road survey tool
2015	Consulting services to Brunei and Papua New Guinea
2016	iRAP Malaysia Launched
2016	iRAP Malaysia Steering Committee Formed

iRAP proposed countermeasure:
Central hatching on rural primary roads

iRAP Malaysia launched by the Minister of Transport in Feb 2016

iRAP Malaysia
Centres of Excellence

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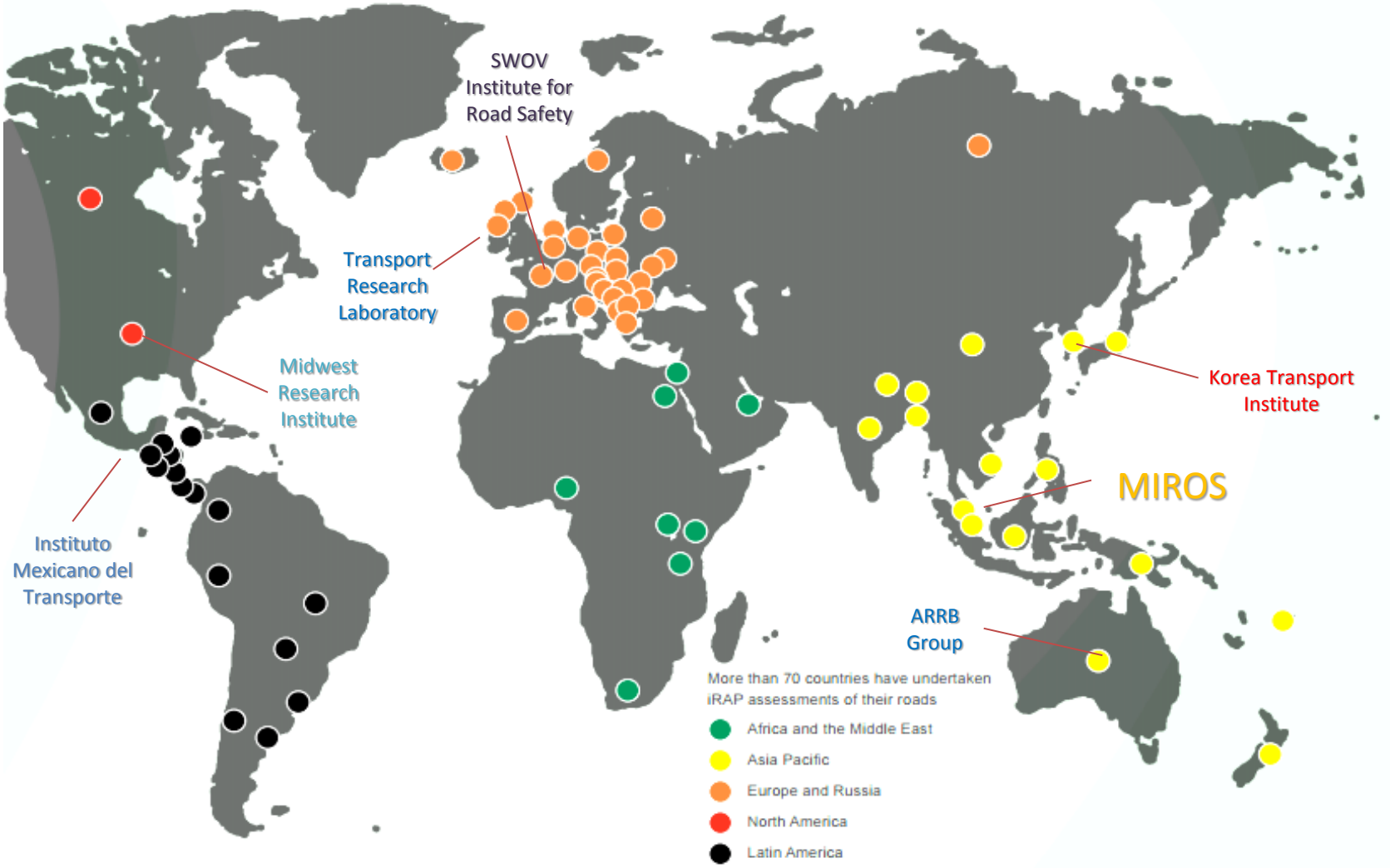
iRAP Centres of Excellence



★★★★★ road user ★★★★★ vehicle ★★★★★ road

MIROS as iRAP Centre of Excellence

Provide training courses

- iRAP Coding
- iRAP Star Ratings
- iRAP Safer Roads Investment Plan

Engagement

- Public Works Dept., **Malaysia**.
- Department of Public Works & Highways, **Philippines**.
- Institute of Road Engineering, **Indonesia**.

Dept. of Public Works & Highways, Philippines

Public Works Dept. Malaysia

Institute of Road Engineering, Indonesia

MIROS as iRAP Centre of Excellence

Develop road survey tool

- To enable iRAP data
- collection
- To enable data viewing and coding

Partner

- Universiti Teknikal
- Melaka, Malaysia.

Road Attribute Data Logger & Inspection System (RADIS)

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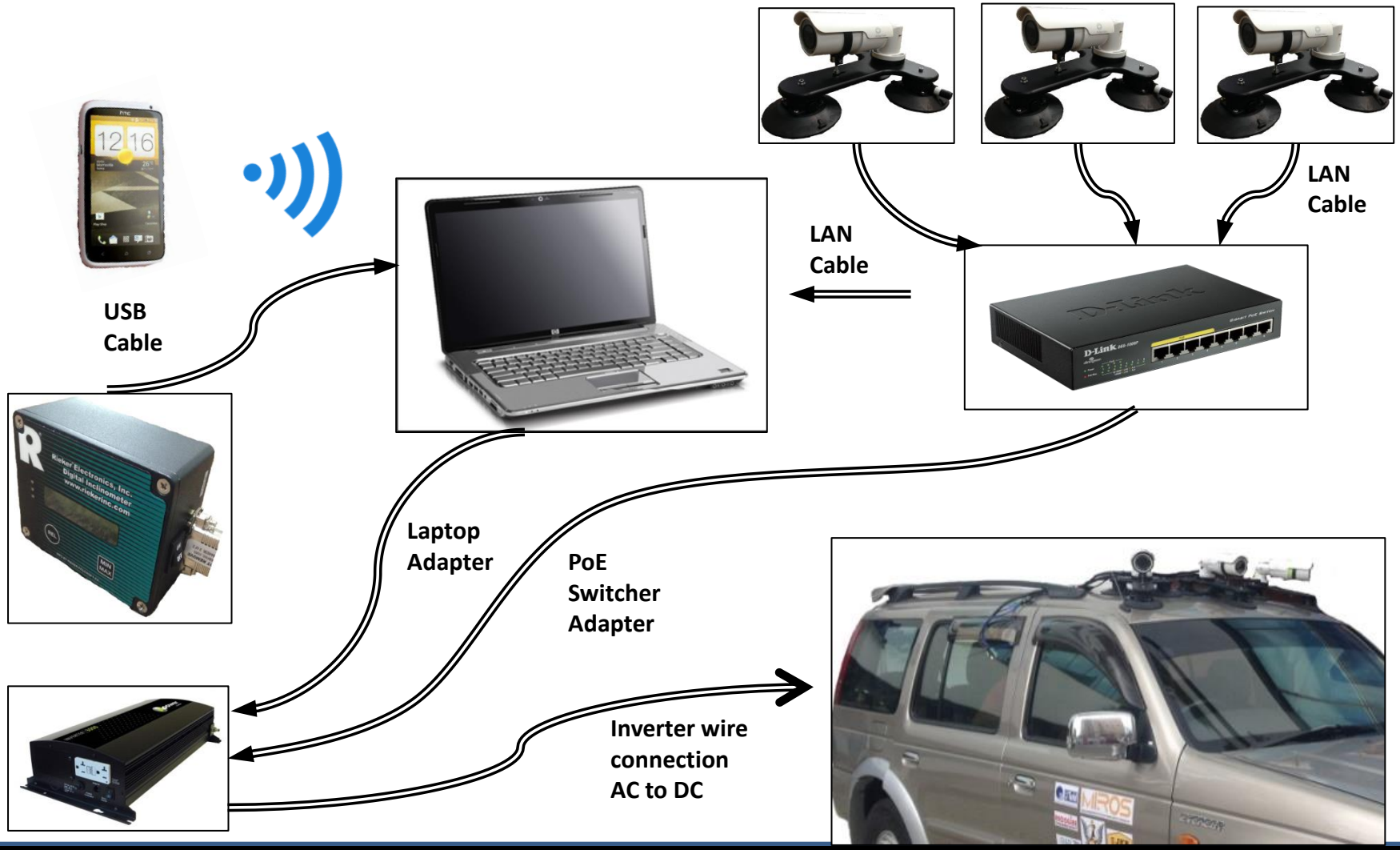

★★★★★ road user ★★★★★ vehicle ★★★★★ road

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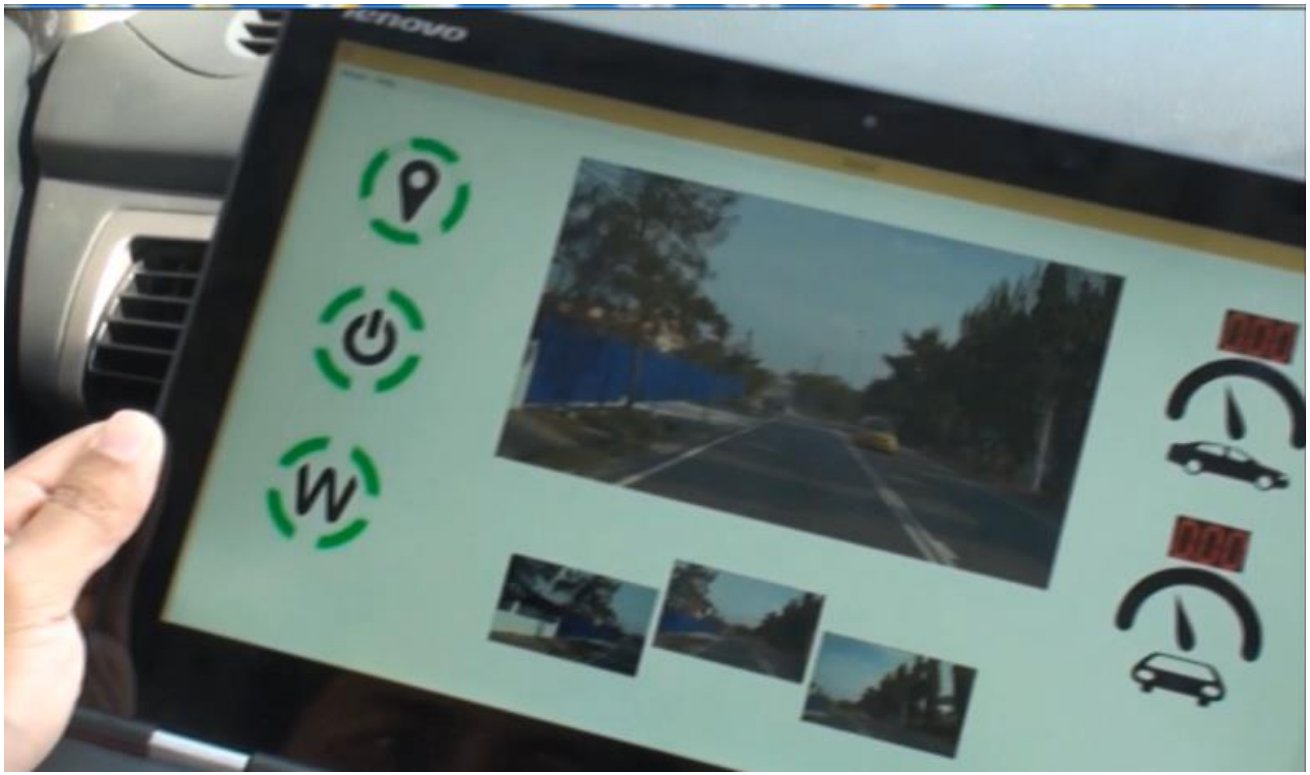

★★★★★ road user ★★★★★ vehicle ★★★★★ road

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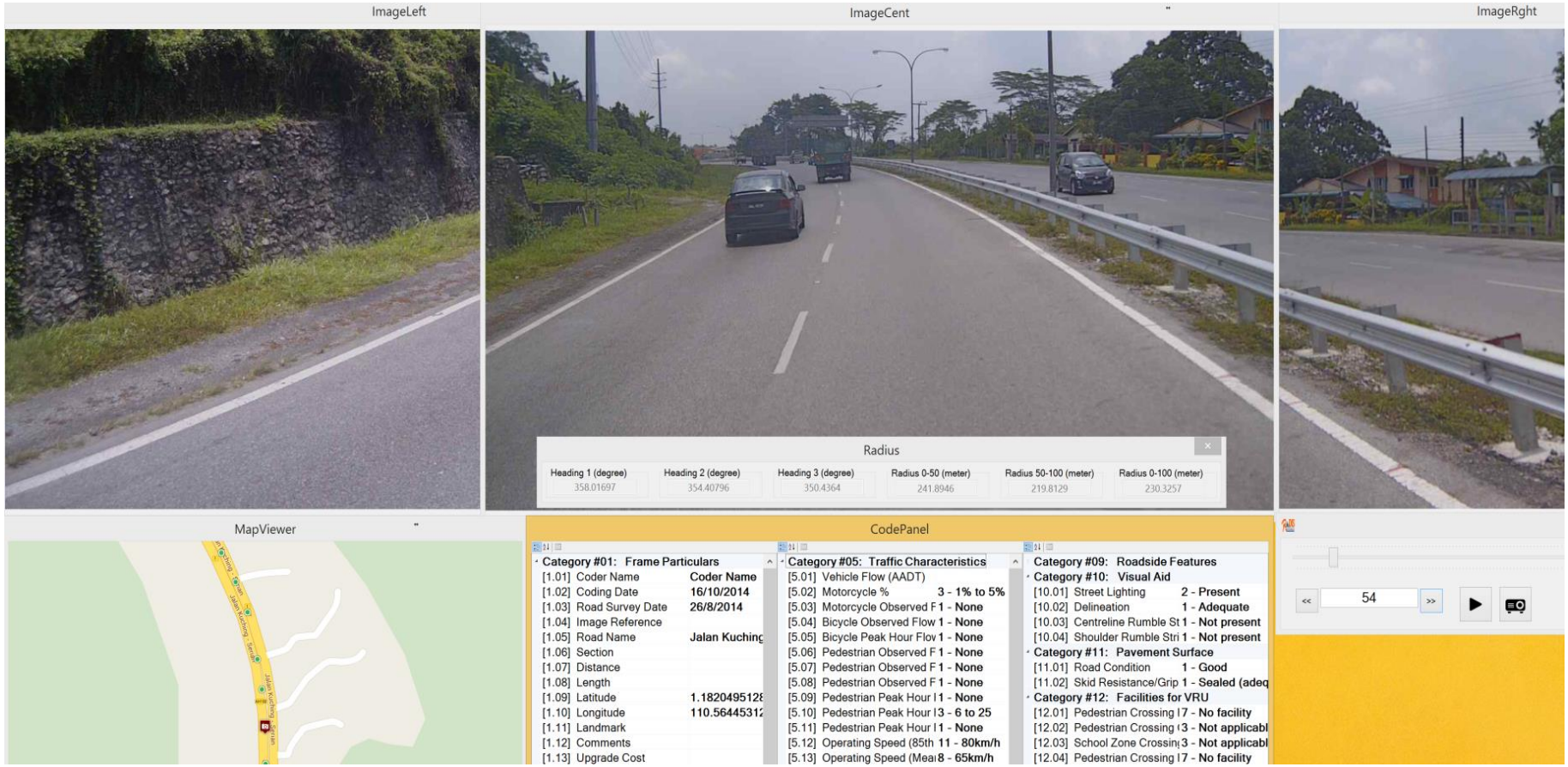

★★★★★ road user ★★★★★ vehicle ★★★★★ road

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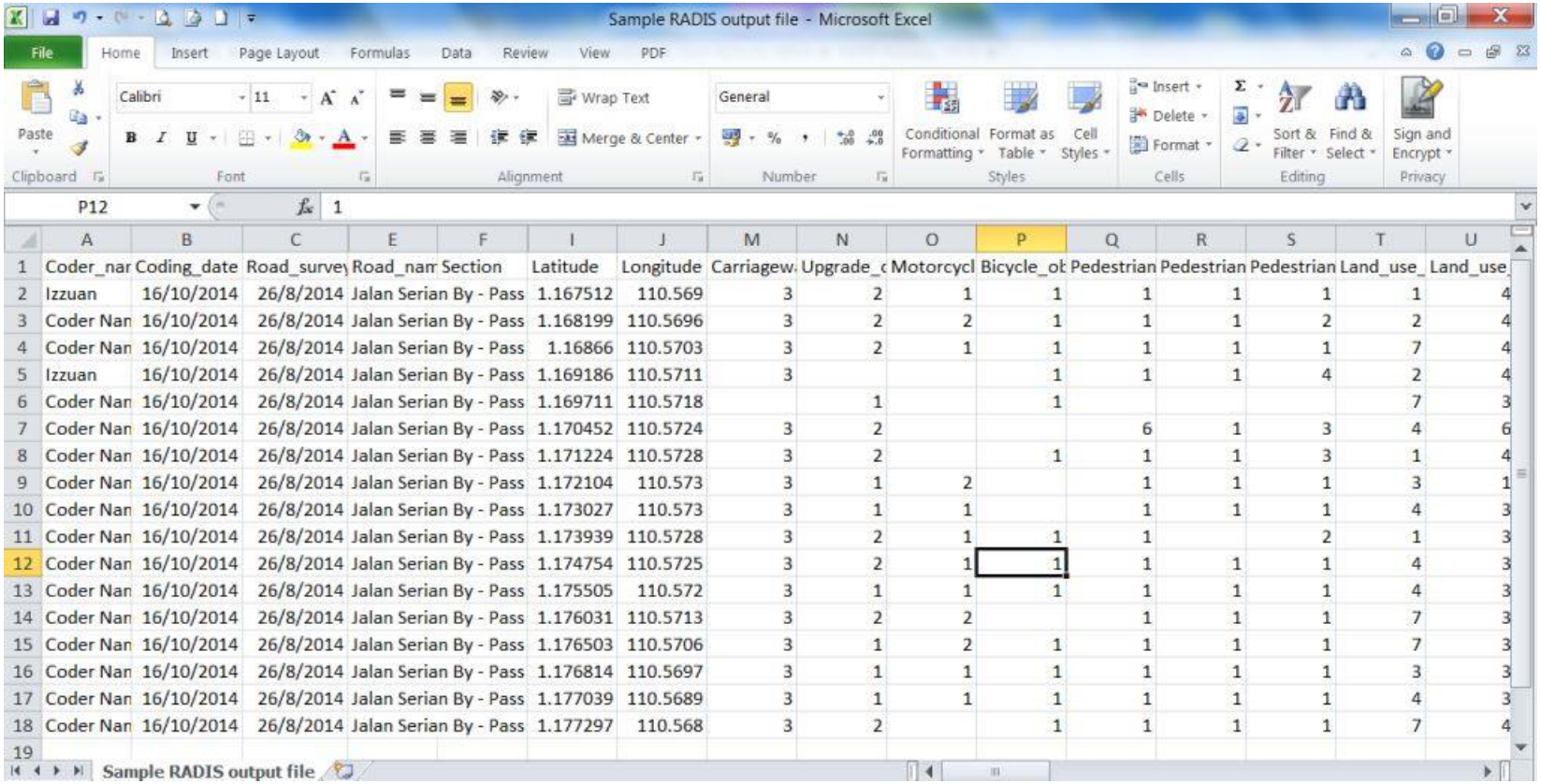
Data is converted into .csv file for further analysis



	A	B	C	E	F	I	J	M	N	O	P	Q	R	S	T	U
1	Coder_nar	Coding_date	Road_survey	Road_nam	Section	Latitude	Longitude	Carriagew	Upgrade_c	Motorcycl	Bicycle_ot	Pedestrian	Pedestrian	Pedestrian	Land_use_	Land_use_
2	Izzuan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.167512	110.569	3	2	1	1	1	1	1	1	4
3	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.168199	110.5696	3	2	2	1	1	1	2	2	4
4	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.16866	110.5703	3	2	1	1	1	1	1	7	4
5	Izzuan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.169186	110.5711	3			1	1	1	4	2	4
6	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.169711	110.5718		1		1				7	3
7	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.170452	110.5724	3	2			6	1	3	4	6
8	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.171224	110.5728	3	2		1	1	1	3	1	4
9	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.172104	110.573	3	1	2		1	1	1	3	1
10	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.173027	110.573	3	1	1		1	1	1	4	3
11	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.173939	110.5728	3	2	1	1	1		2	1	3
12	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.174754	110.5725	3	2	1	1	1	1	1	4	3
13	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.175505	110.572	3	1	1	1	1	1	1	4	3
14	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.176031	110.5713	3	2	2		1	1	1	7	3
15	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.176503	110.5706	3	1	2	1	1	1	1	7	3
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17	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.177039	110.5689	3	1	1	1	1	1	1	4	3
18	Coder Nan	16/10/2014	26/8/2014	Jalan Serian By - Pass		1.177297	110.568	3	2		1	1	1	1	7	4
19																

MIROS as iRAP Centre of Excellence

Provide consultation services

- iRAP data coding
- iRAP Star Rating
- iRAP Safer Roads Investment Plans

Clients

- iRAP **Philippines**: Coding and Quality Assurance
- iRAP **Brunei**: Data coding
- iRAP **Papua New Guinea**: Star Rating and Safer Roads Investment Plans

Road Assessment on Papua New Guinea

- A total of 3,800 km of roads spanning across 18 provinces were assessed.
- More than 50 road attributes were coded.
- More than 90 countermeasure programmes were proposed.

Sustainability of iRAP Malaysia

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Launch of iRAP Malaysia

iRAP Malaysia Steering Committee

- A steering committee reporting to the Cabinet Committee on Road Safety was formed in 2016.
- As a form of institutionalizing the programme whereby all related ministries are engaged.
- Aim to achieve 75% travel to occur on 3-Star and above roads by 2020.

Steering Committee Members

Chair
Ministry of Transport Secretary-General

Members
- DG of MIROS
- DG of Malaysian Highway Authority
- DG of Public Works Department
- DG of Road Safety Department
- DG of Local Government Department
- Highway Planning Division, MOW
- Land & Logistics Division, MOT
- Policy & Inspectorate Division, MUHLG
- Independent iRAP Expert Individuals

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Steering Committee Terms of Reference

Determine Road Selection Criteria

Outcome

MyRAP & ASEANRAP
Establish new programmes under ASEAN Road Safety Centre

Coordinate Engagement of Local Stakeholders

Report to:

1. **Minister of respective Ministries.**
2. **Cabinet Committee on Road Safety.**

TARGET
75% travel on 3-star and above roads by 2020 (as envisioned by developed countries)

Monitor & Propose Road Improvement Plans

Establish funding mechanism for programme sustainability

Outcome

Road Improvements:
1. Short term (*quick-wins*)
2. Medium & long terms (high impact projects)

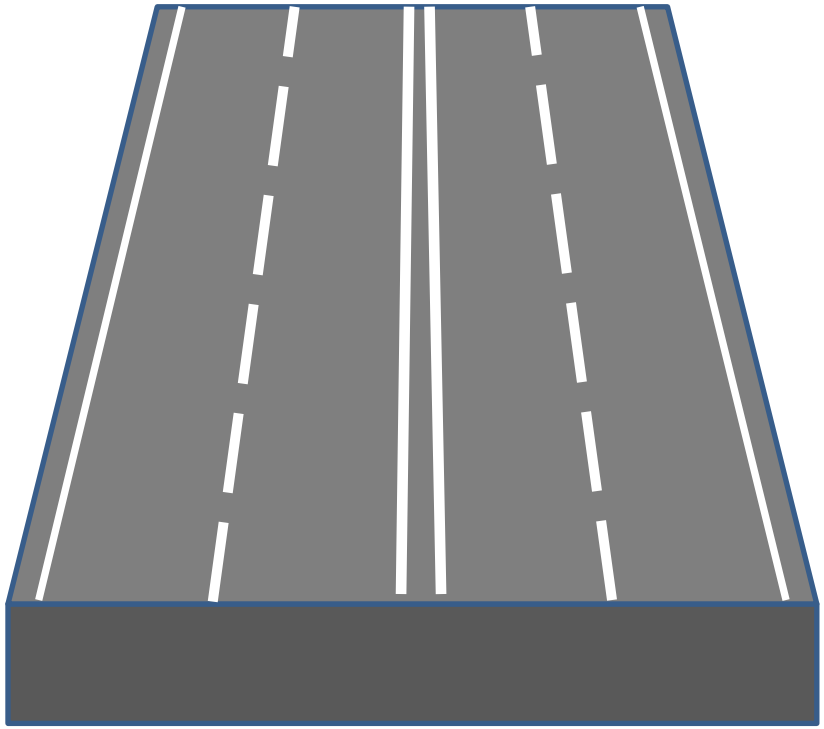
★★★★★ road user ★★★★★ vehicle ★★★★★ road

iRAP Malaysia Action Plans

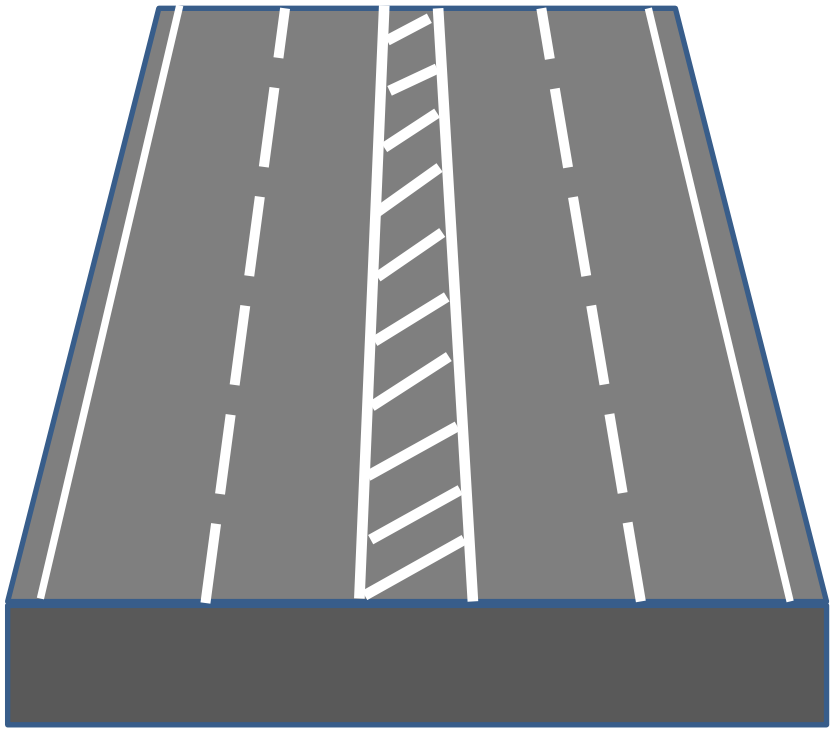
Assessing roads selected based on criteria	• **Steering Committee** • **MIROS**
Produce star ratings and **high impact road improvement plans** (*quick-wins*)	• **MIROS** • **Road authorities**
Implement road improvement plans within 6 months of after proposals had been approved	• **Road authorities (JKR, LLM, KPKT)** • **Steering committee**
Star rating review after improvement had been carried out	• **MIROS**
Dissemination of findings to public (e.g. logistic companies)	• **JKJR, MIROS** • **Road authorities (JKR, LLM, KPKT)** • **Steering committee**

Road Improvement Projects

Median Treatment – central hatching



(a) Double line



(b) Central hatching

- **Perceptual countermeasure to speeding**
- **Narrowed lane effect**
- **Significant speed reduction by 3 km/h**

Median Treatment – central hatching

Median Treatment – central hatching

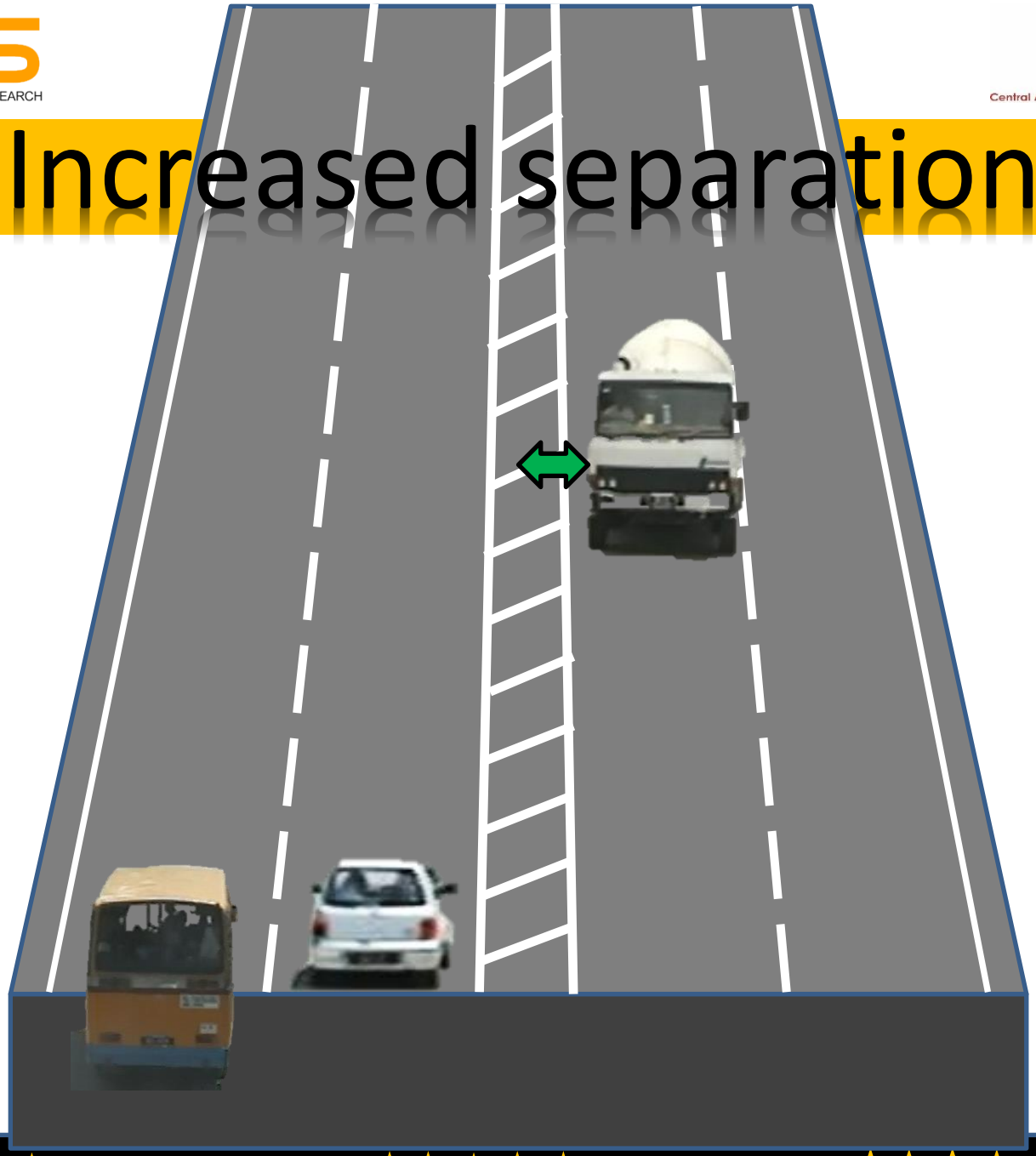
Lane line conflict

Increased separation

Centreline conflict

★★★★ road user ★★★★ vehicle ★★★★ road

Increased separation



Roadside Treatment – hazards removal

Roadside Treatment – hazards removal

Roadside Treatment – hazards removal

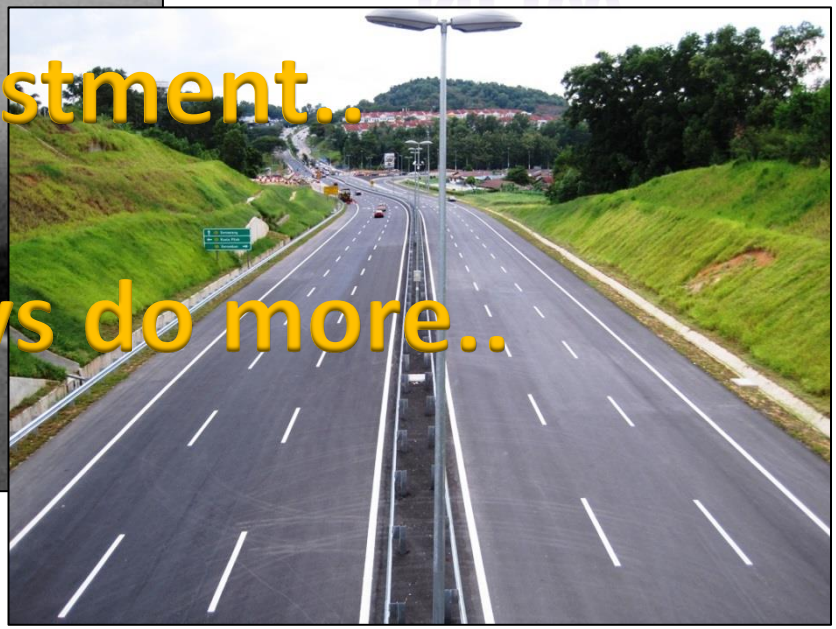
Roadside Treatment – hazards removal

Roadside Treatment – hazards removal

★★★★★ road user ★★★★★ vehicle ★★★★★ road

Safer Roads

NOW..



Safer Roads and iRAP in Malaysia:

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THANK YOU

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