Digital imaging – more than just pictures

20th Annual Road Profiler User's Group Meeting
Austin, Texas
October 2008

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Collaborating with the road industry to turn **knowledge into practice**

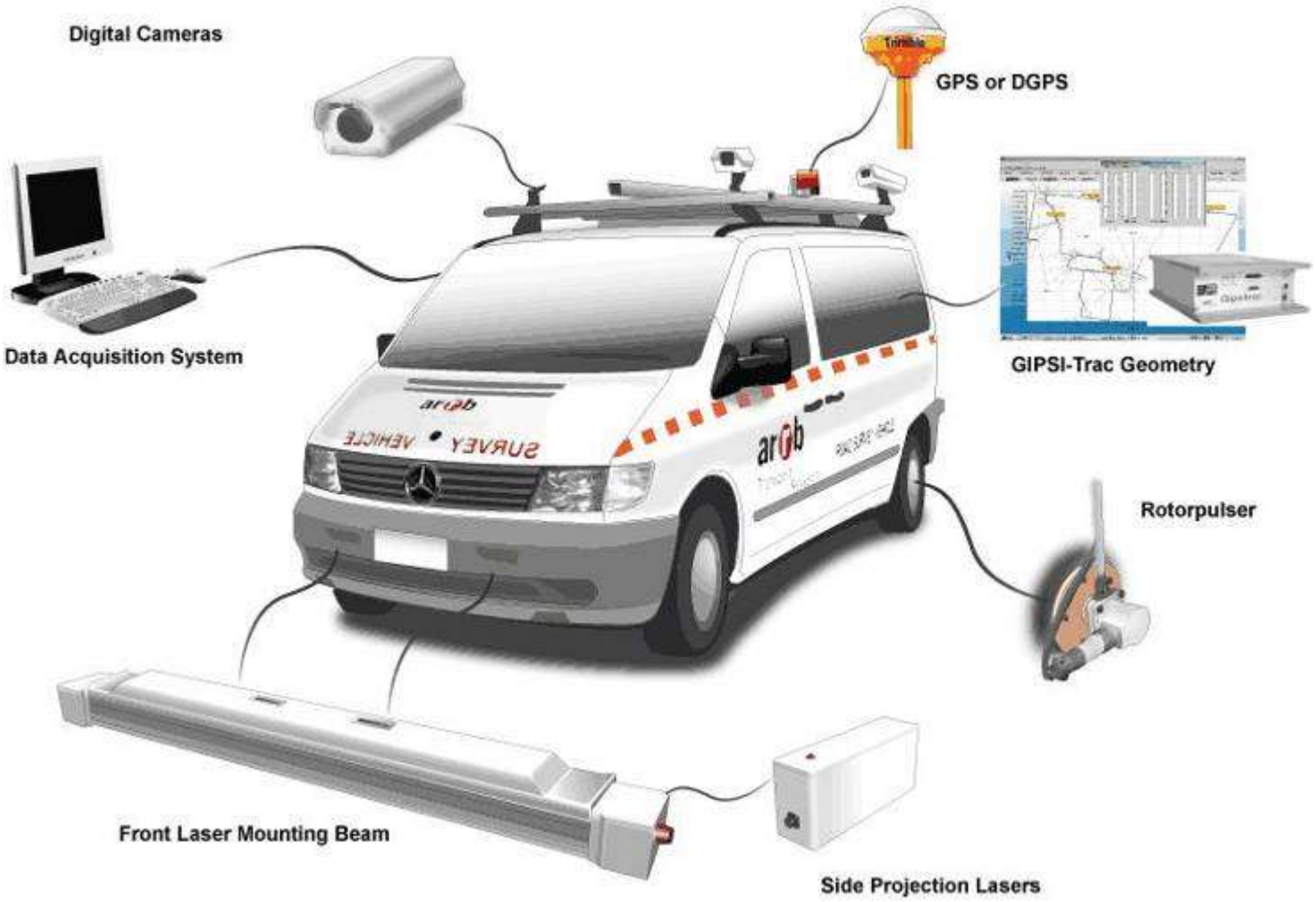
Overview

- digital imaging
- road safety
- AusRAP
- challenges
- other stuff

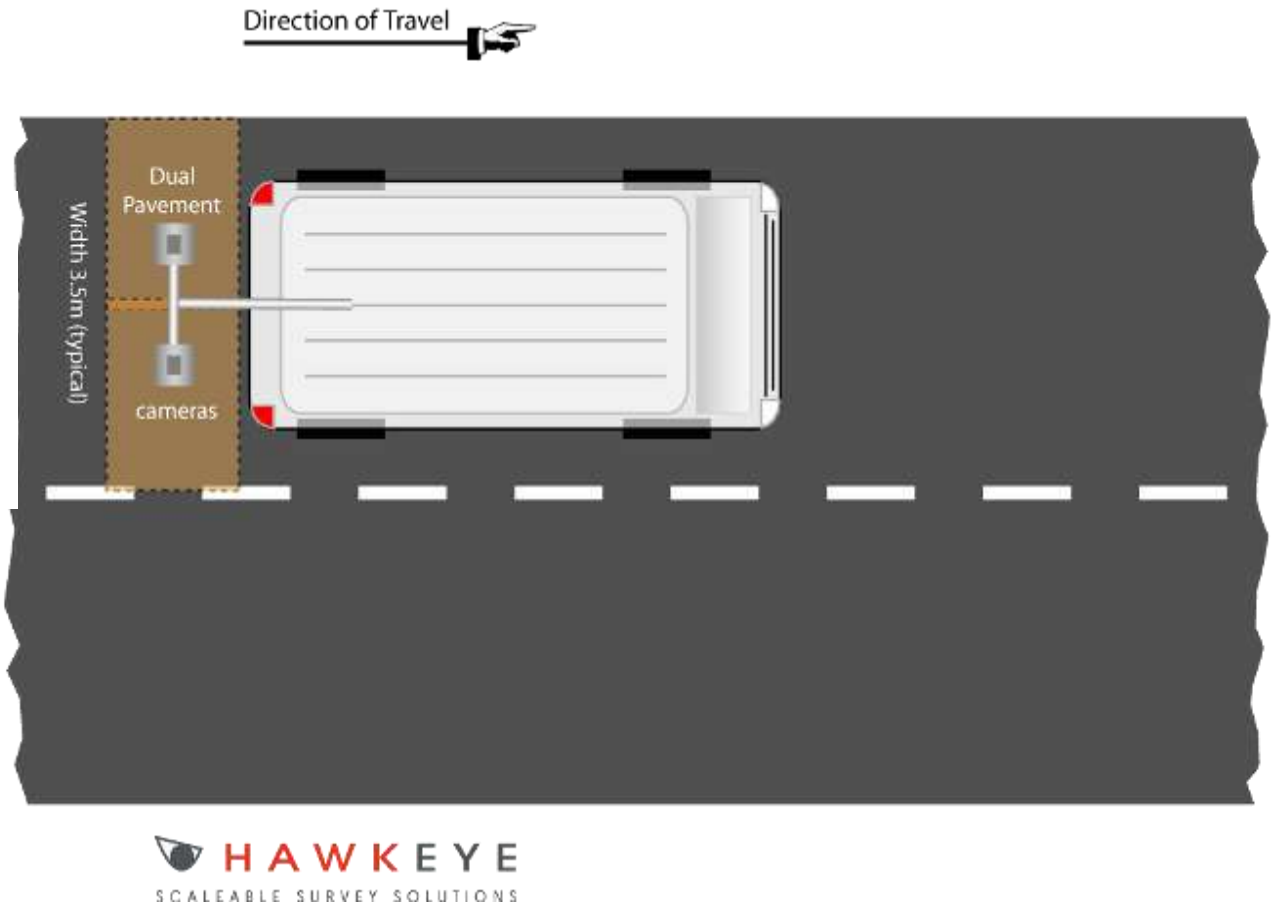
Acknowledgements

- Australian Automobile Association
- Joseph Affum
- Rob McInerney
- Greg Smith

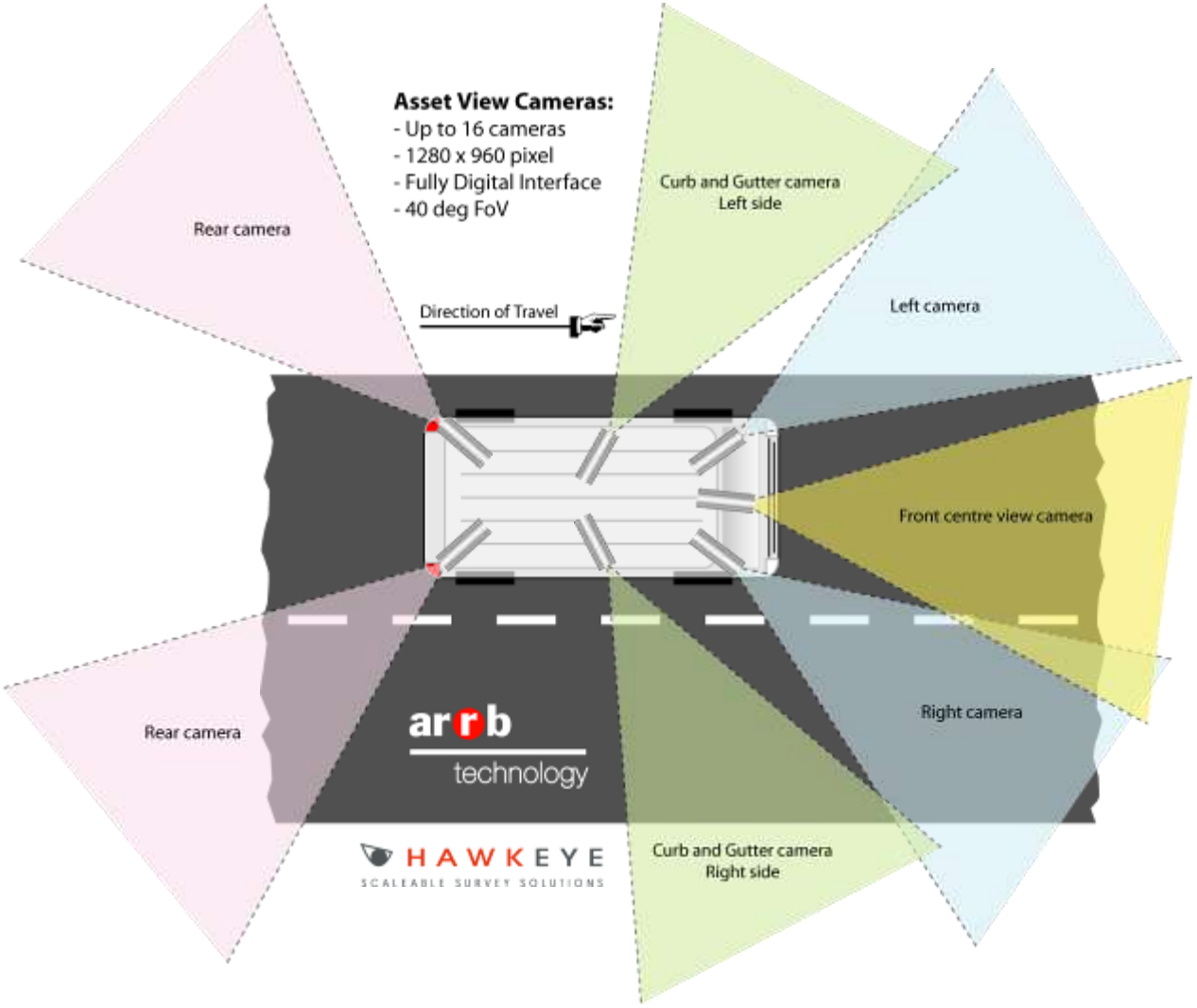
Automated data collection



Pavement view camera

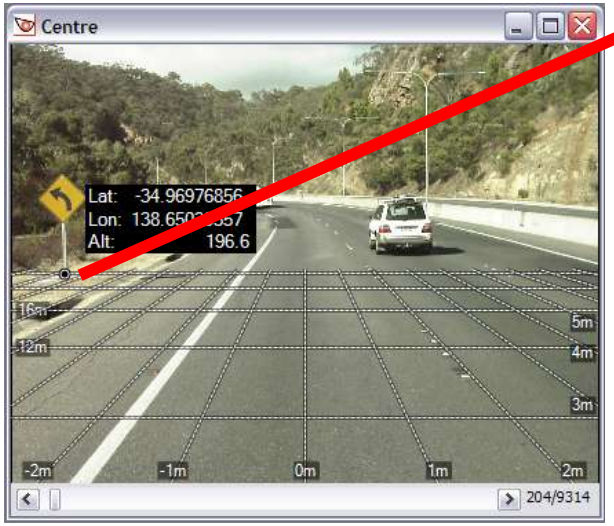


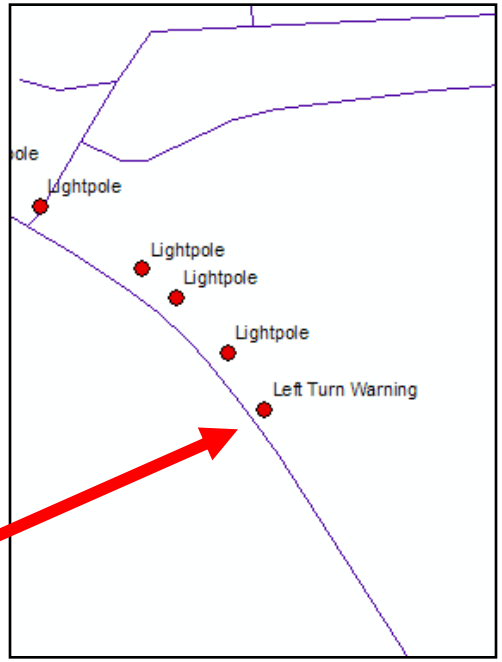
Digital imaging systems



What are images usually used for?

- pavement condition
- asset management (identification)





Other applications ……

- roadside vegetation
- project and maintenance planning
- quality control
- risk assessment
- road safety

The world road safety problem

- 1.2 million killed every year
- 50 million seriously injured

How safe are our roads?

Australia:

- > 1,600 deaths
- > 22,000 seriously injured

USA (2007):

- > 41,500 deaths

How safe are our roads?

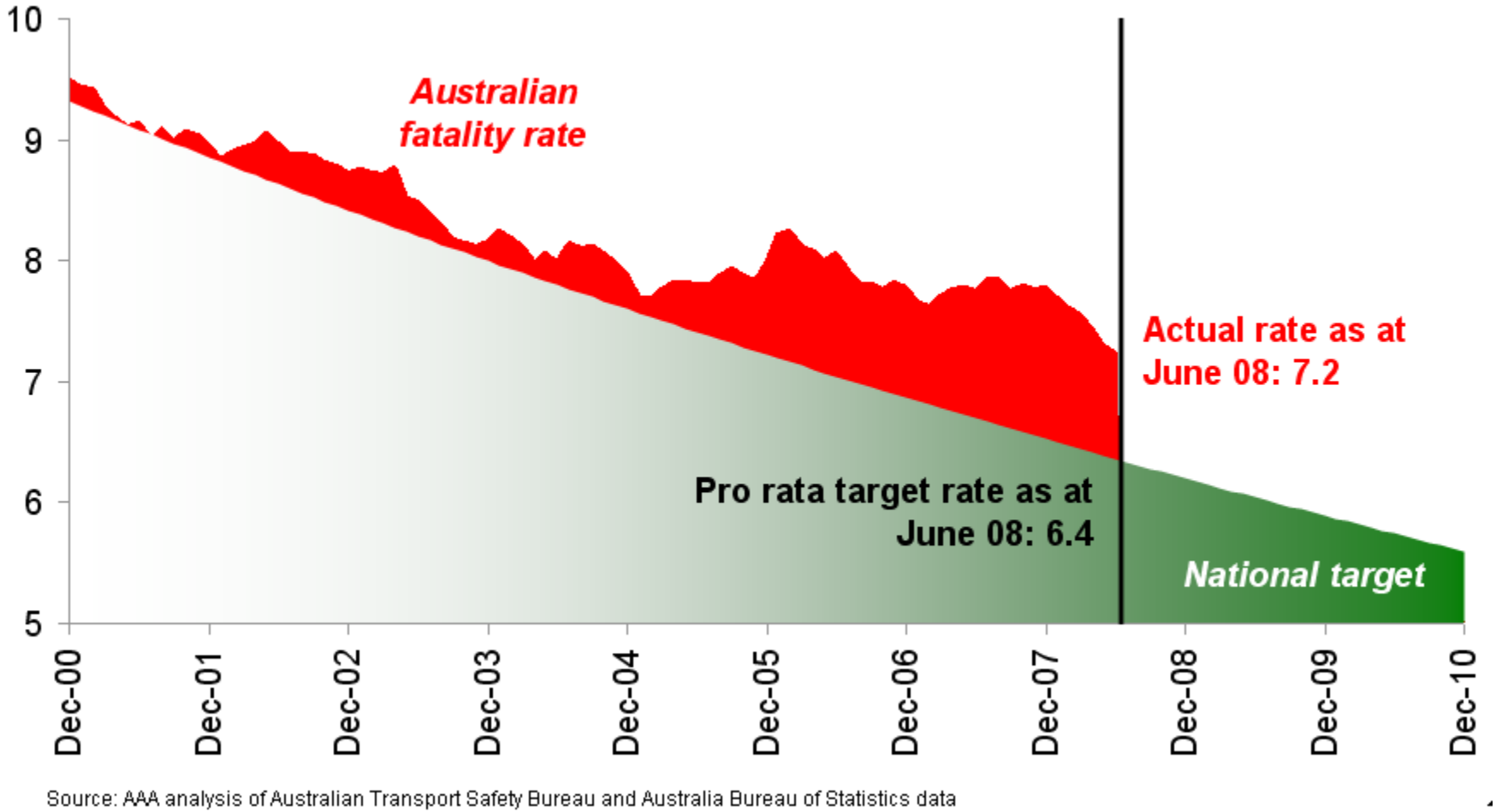
- public perception varies greatly
- is the safety of a road just about potholes?

ROAD SURVEY VEHICLE

Time and unforeseen occurrence…

National Strategy

Deaths per 100,000 population



Source: AAA analysis of Australian Transport Safety Bureau and Australia Bureau of Statistics data

How to save lives

A safe road system

Safer drivers in safer cars on safer roads

AusRAP background

- AusRAP – Australian road assessment program
- sister program to ANCAP (Australian new car assessment program)
- based on EuroRAP
  - risk mapping of casualty crashes
  - road protection score based on engineering features (star ratings)

Risk Maps
(casualty crashes per km, 2000-04)

How does AusRAP star rate roads?

- star-ratings measure the safety that is *built-in* to the road
- they enable sections of road that are likely to be risky to be identified before a crash occurs
  - in NZ in 2004, 54% of fatal crashes occurred where there had been no other injury crashes in the previous 4 years
- measures *likelihood* and *severity*
- method developed with ARRB Consulting

Road protection score (RPS)

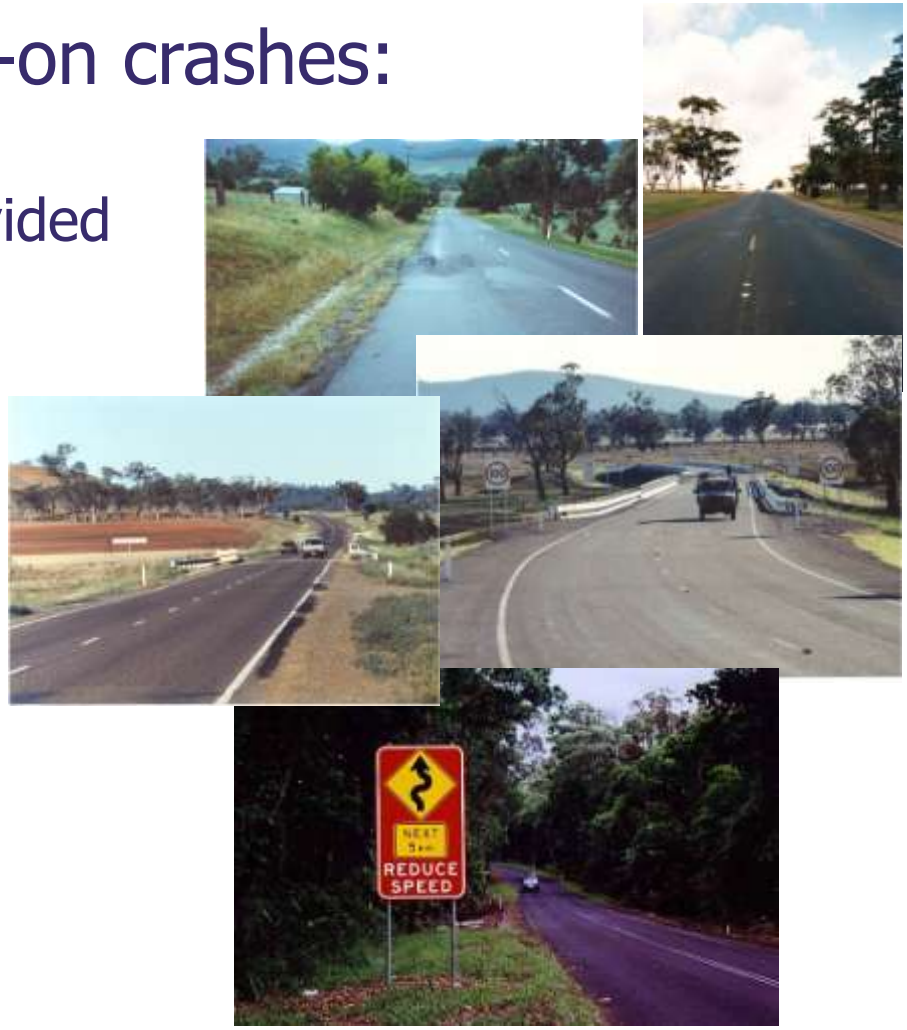
- focuses on 3 main crash types
  - run-off road
  - head-on
  - intersection related crash problems

- limited to rural open road sections > 90 km/h
- risk as it relates to the individual – no exposure

What elements are assessed?

For run-off road and head-on crashes:

- road type: divided or undivided
- lane width
- sealed shoulder width
- horizontal alignment
- terrain
- delineation
- roadsides
- traffic speeds
- overtaking provision



What elements are assessed?

For intersection crashes:

- intersection type
- volume of traffic on side road (or railway)
- traffic speeds
- alignment of side roads (or railway)
- sight distances
- right and left turn provision

Road protection score (RPS)

- star-ratings are based on a RPS
- a risk 'score' is assigned to each of the road's design elements that influence safety
- e.g. the risk on road with narrow lanes (<2.8m) is 1.5 [50% higher than wide lanes (3.6m)]
- RPS combines these scores to form a star-rating

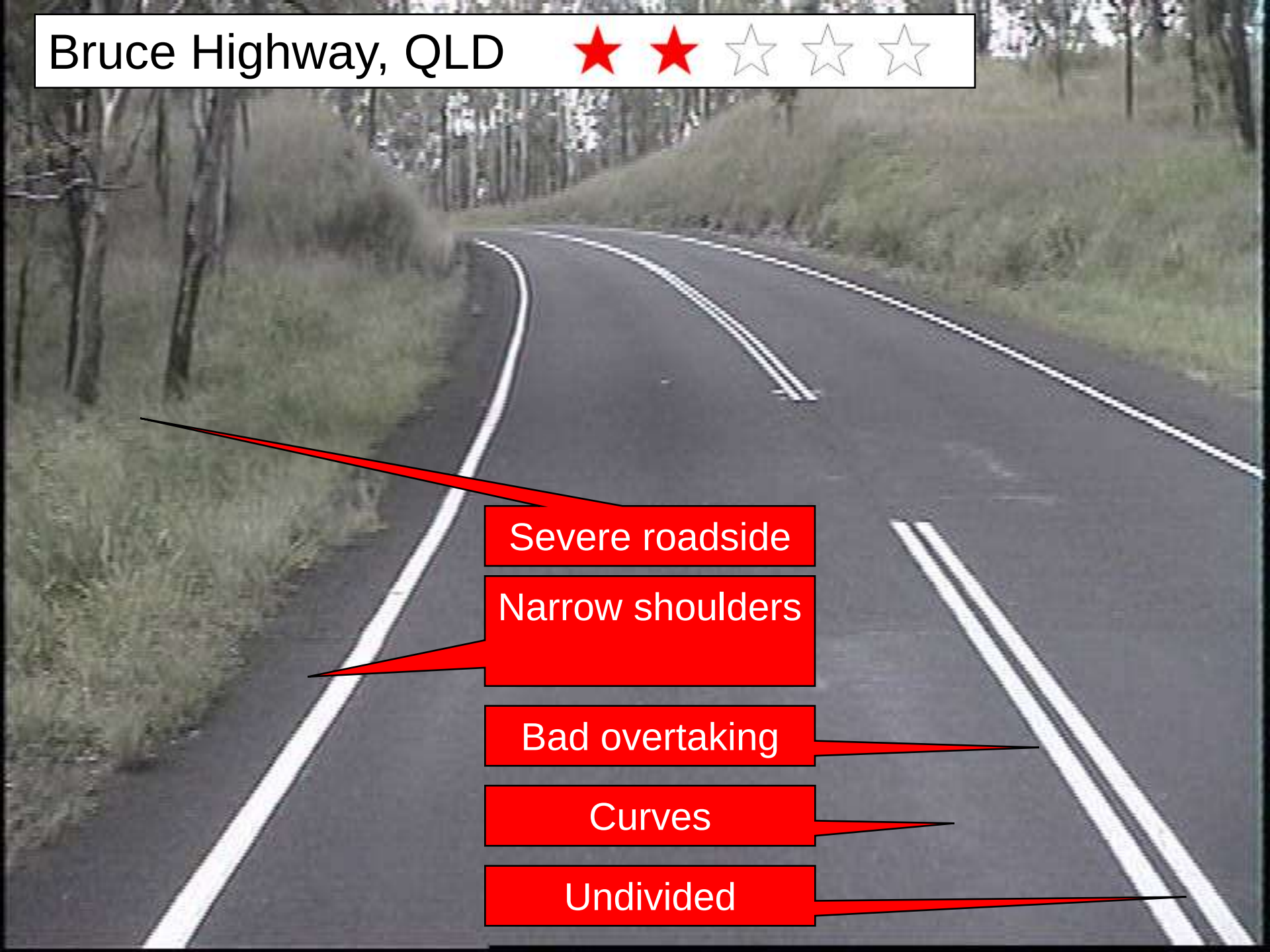
Lane width	Risk score
>3.6	1
3.2-2.6	1.04
2.8-3.2	1.15
<2.8	1.5

Rating method

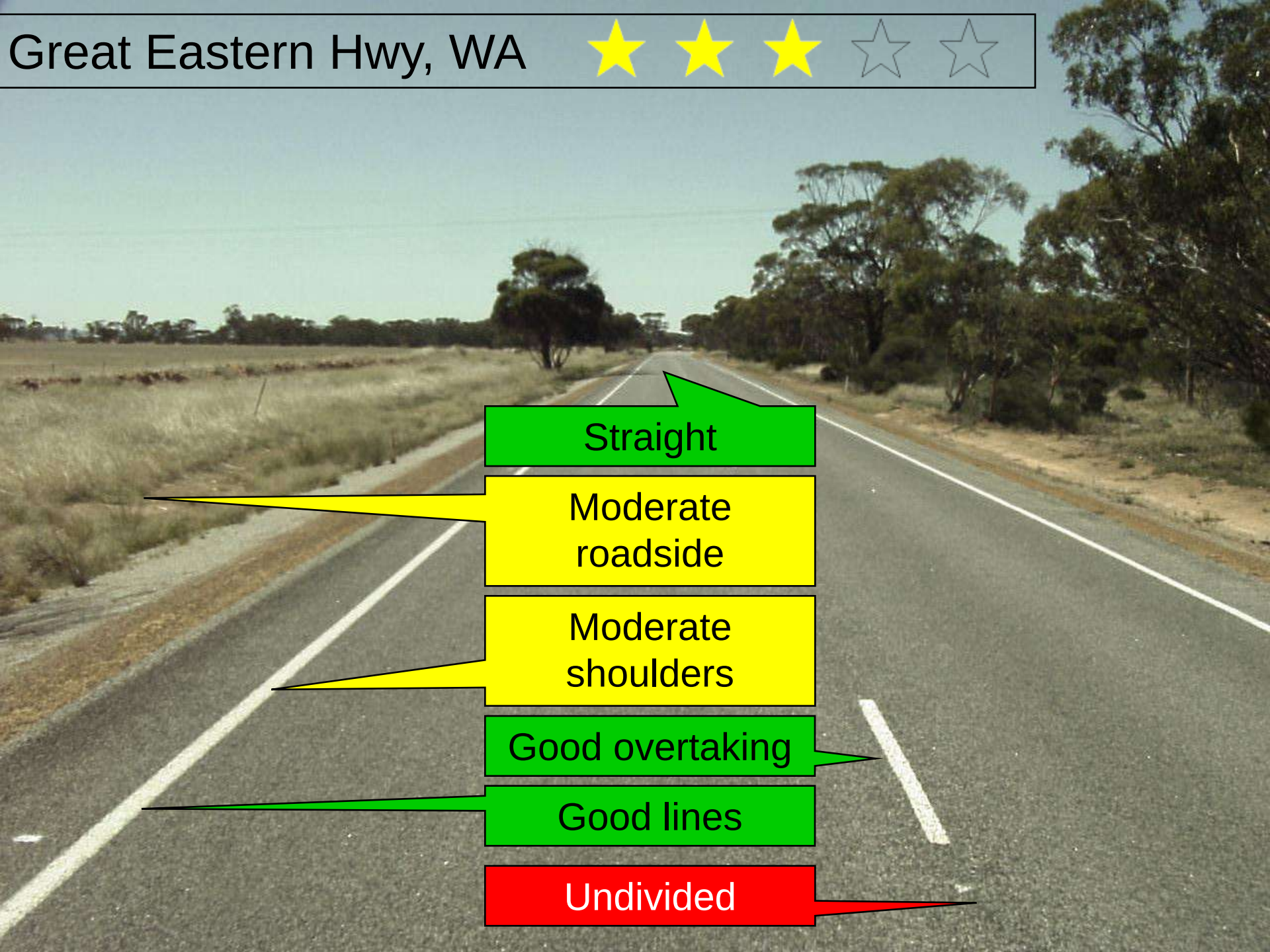
- digital imaging used to rate roads
- safer, quicker, more cost efficient with a QA process

Star rating bands

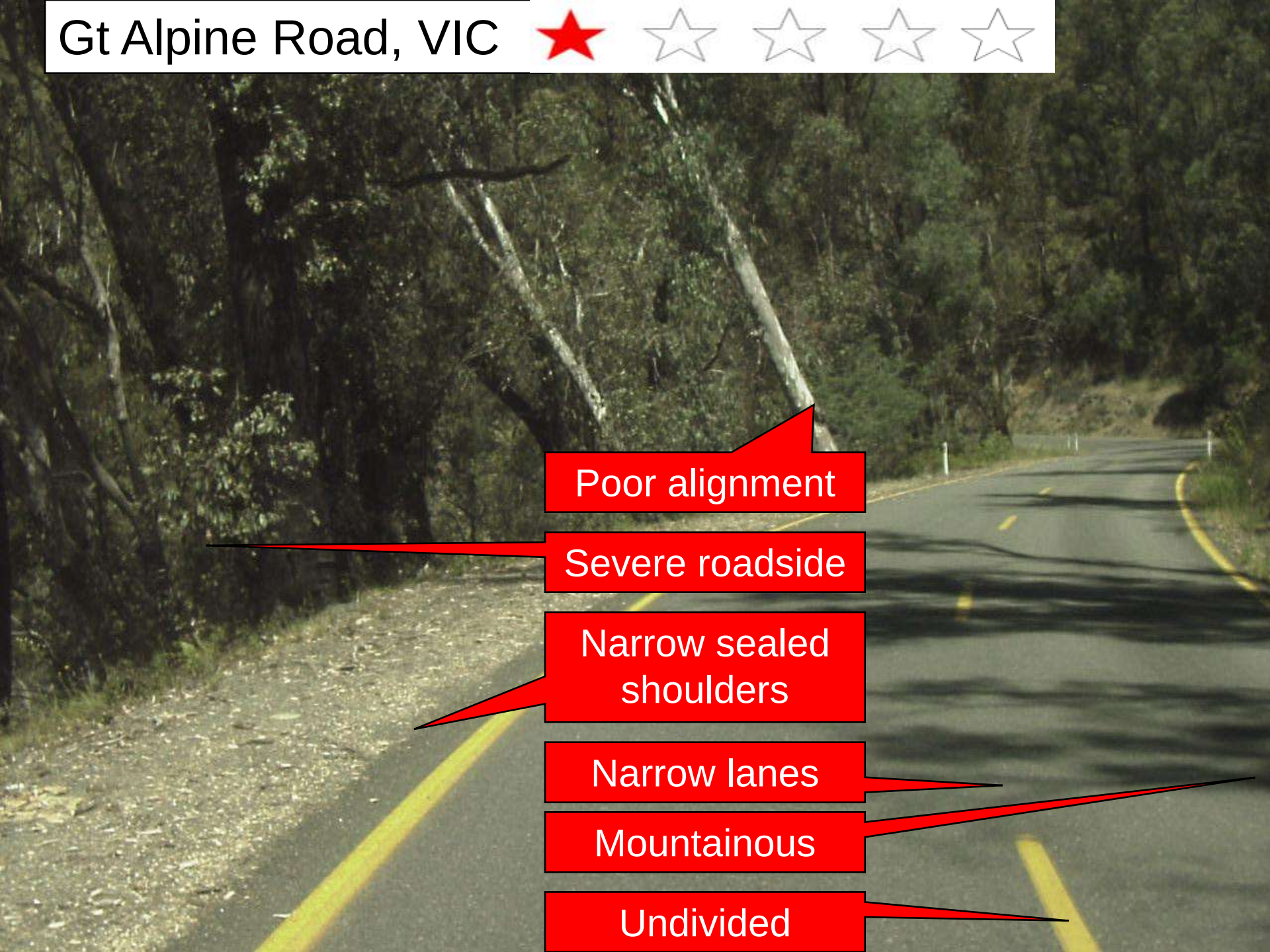
Rating Scale	RPS	Typical Features
5 star * * * * *	**0 to 1.05**	A divided straight road with good delineation, wide lanes and sealed shoulders, favourable roadside conditions and grade separated intersections. No undivided roads can achieve a 5-star rating
4 star * * * *	**>1.05 to 4**	A divided road with minor deficiencies in some road features OR An undivided straight road with good engineering & roadside conditions
3 star * * *	**>4 to 10**	A divided road with major deficiencies in some road features and at-grade intersections at regular intervals OR An undivided road with minor deficiencies in some road features
2 star * *	**>10 to 25**	A divided road that has with many major deficiencies and regular at-grade intersections An undivided road that has major deficiencies in some road features and/or a high frequency of intersections
1 star *	**>25**	A divided road in mountainous terrain that has poor features and roadside conditions and more than three 4-leg at-grade major intersections per 5km length. An undivided road in mountainous terrain that has very poor features.

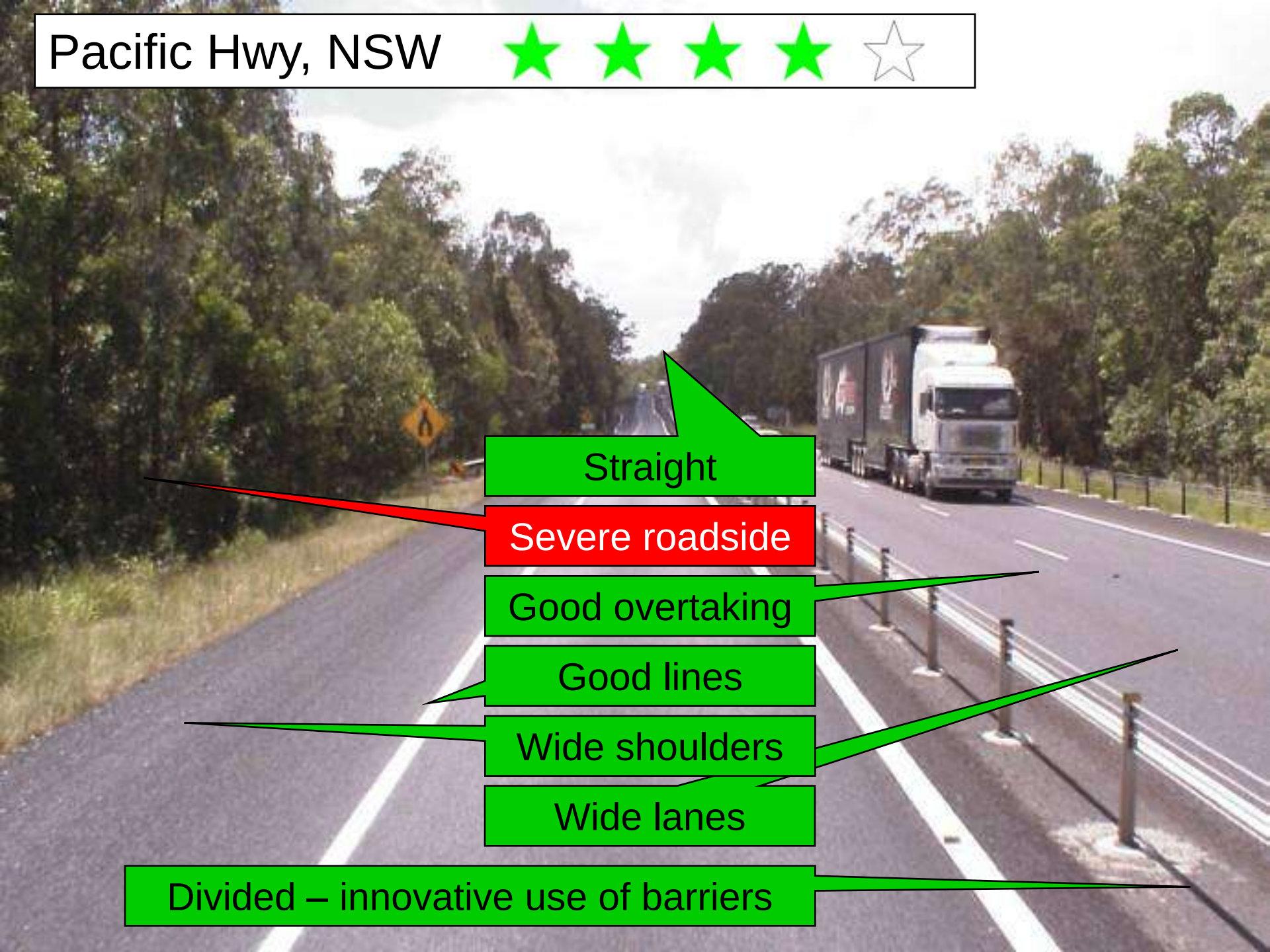

Bruce Highway, QLD
Severe roadside
Narrow shoulders
Bad overtaking
Curves
Undivided

Great Eastern Hwy, WA



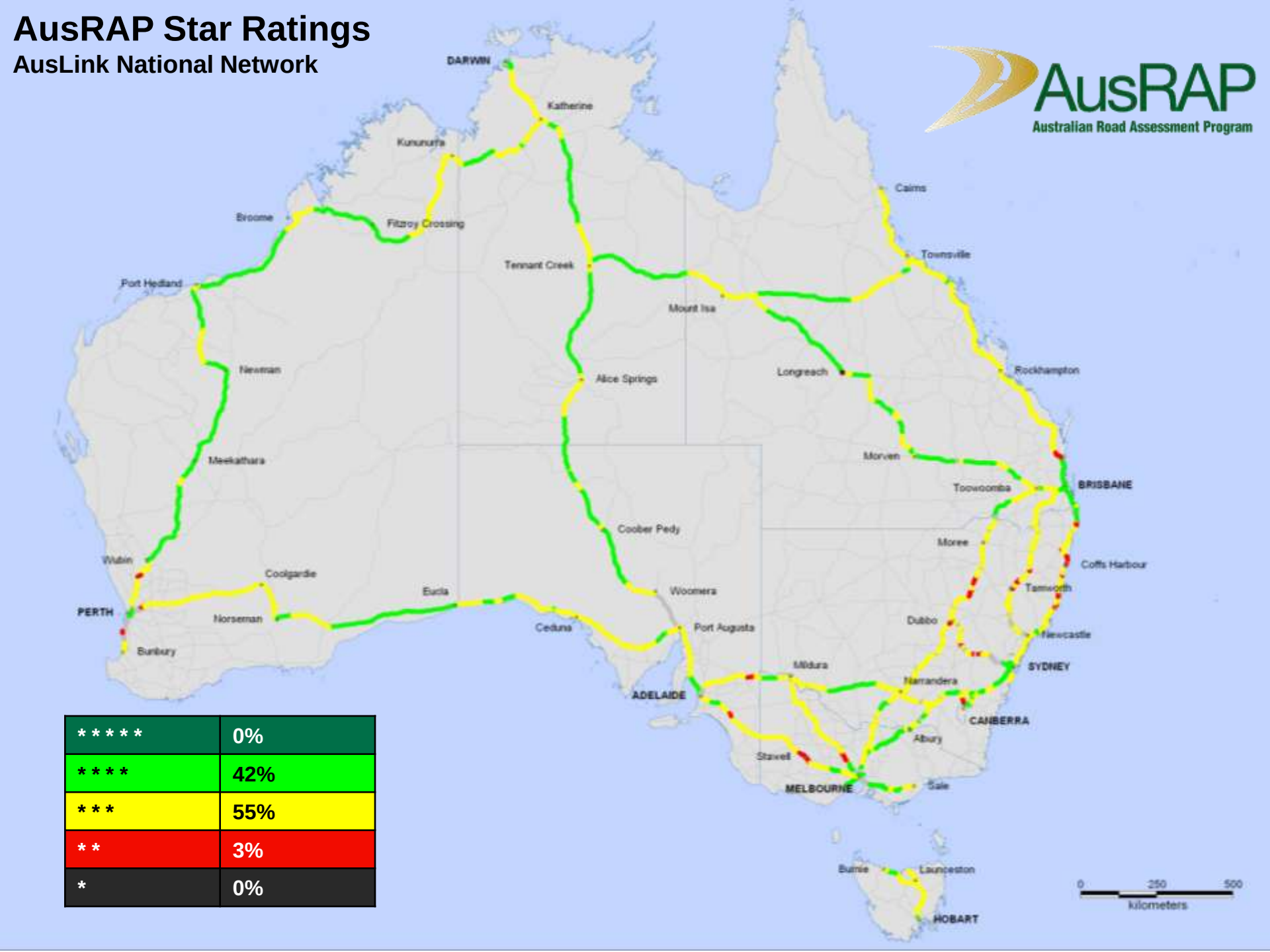
Gt Alpine Road, VIC




Pacific Hwy, NSW
Straight
Severe roadside
Good overtaking
Good lines
Wide shoulders
Wide lanes
Divided – innovative use of barriers

AusRAP Star Ratings

AusLink National Network



* * * * *	0%
* * * *	42%
* * *	55%
* *	3%
*	0%

star ratings for
Victoria's country highways

RACV

Star Rating		Percentage
★★★★★	(safest)	0%
★★★★		15%
★★★		57%
★★		27.5%
★		0.5%
	not rated	(unsafe or below 90km/h)

Total kilometres rated = 6,847 kilometres

Note: These star ratings are based on road data collected in 2004, 2005 and 2006.

Who benefit?

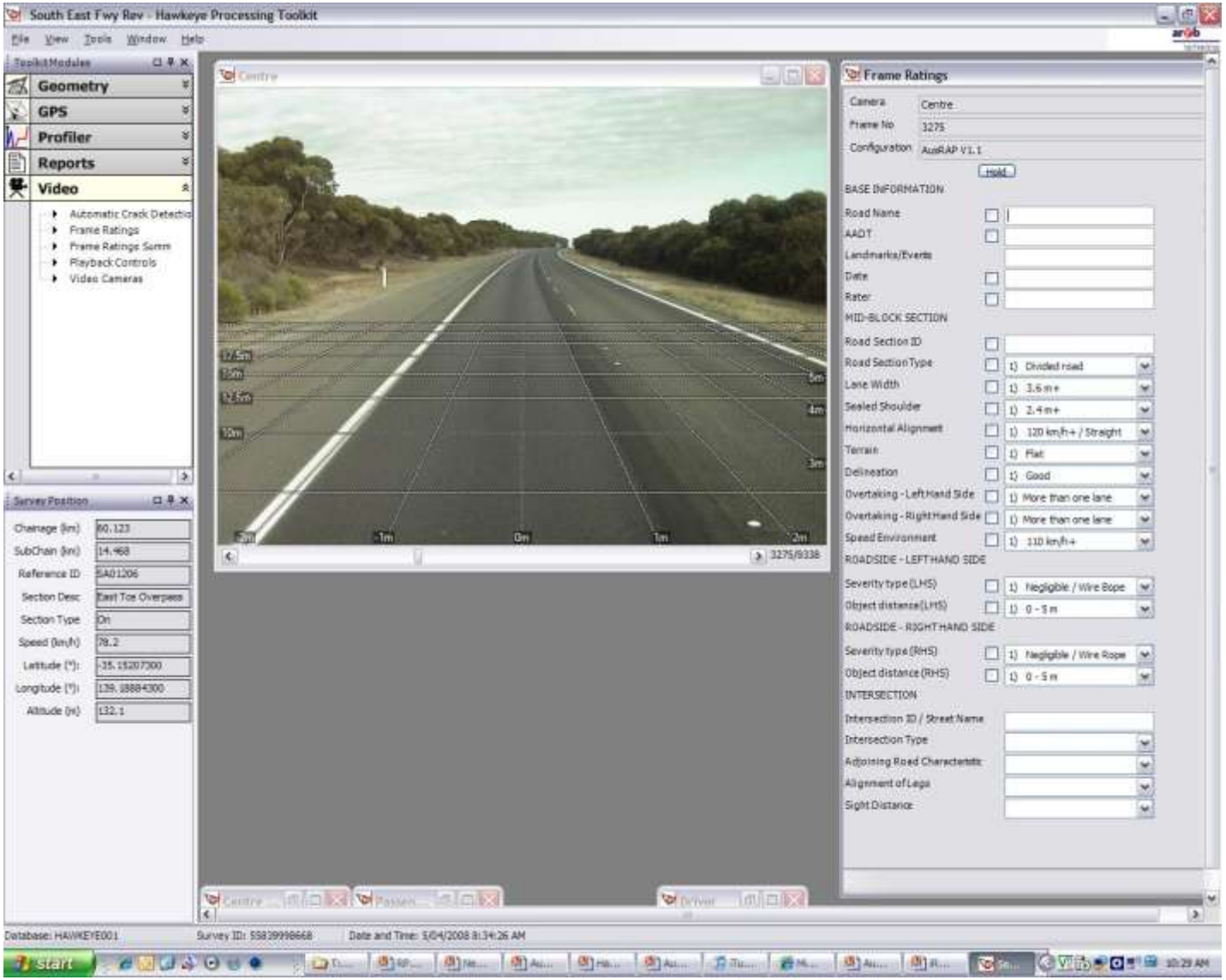
- Road users:
  - raised awareness of risk
  - adapt driving and better understand need for laws
  - want to see safer roads

- Governments, authorities, planners and engineers:
  - overall performance of a particular road can be compared to others
  - rising road standards can be tracked
  - assisting in decision-making about road investments
  - makes the business case for road improvements

The AusRAP project (2006)

- focused on AusLink road network (20,000 km)
- required sourcing of local video data from SRAs
- manually rated
- issue with calibration of images
- quality control important due to subjective nature of rating

Rating form


South East Fwy Rev - Hawkeye Processing Toolkit
File View Tools Window Help
Toolkit Modules
Geometry
GPS
Profiler
Reports
Video
Automatic Crack Detectio
Frame Ratings
Frame Ratings Summ
Playback Controls
Video Cameras
Survey Position
Chainage (km) 60.123
SubChain (km) 14.468
Reference ID 5A01206
Section Desc East Toe Overpass
Section Type On
Speed (km/h) 78.2
Latitude (°) -35.15207300
Longitude (°) 139.18884300
Altitude (m) 132.1
Centre
3275/9338
Frame Ratings
Camera Centre
Frame No 3275
Configuration AusRAP V1.1
Hold
BASE INFORMATION
Road Name
AADT
Landmarks/Events
Date
Rater
MID-BLOCK SECTION
Road Section ID
Road Section Type 1) Divided road
Lane Width 1) 3.6 m+
Sealed Shoulder 1) 2.4 m+
Horizontal Alignment 1) 120 km/h+ / Straight
Terrain 1) Flat
Delineation 1) Good
Overtaking - Left Hand Side 1) More than one lane
Overtaking - Right Hand Side 1) More than one lane
Speed Environment 1) 110 km/h+
ROADSIDE - LEFT HAND SIDE
Severity type (LHS) 1) Negligible / Wire Rope
Object distance (LHS) 1) 0 - 5 m
ROADSIDE - RIGHT HAND SIDE
Severity type (RHS) 1) Negligible / Wire Rope
Object distance (RHS) 1) 0 - 5 m
INTERSECTION
Intersection ID / Street Name
Intersection Type
Adjoining Road Characteristic
Alignment of Legs
Sight Distance
Database: HAWKEYE001
Survey ID: 558299998668
Date and Time: 5/04/2008 8:34:26 AM
start
10:29 AM

Improving objectivity – horizontal alignment

- indicates whether road is straight or curved
- rating relates to the safe speed a vehicle can negotiate curve

> 120 km/h

100 < limit < 120 km/h

70 < limit < 100 km/h

< 70 km/h

Improving objectivity – horizontal alignment

- subjectivity removed by using outputs from inertial system
- automated measure of curve speed

Prevention is the best cure

AusRAP
Australian Road Assessment Program

- road safety remains a major public health problem in Australia and around the world
- safer roads **will** save lives
- visit www.ausrap.org for more information and reports

AAA Foundation for Traffic Safety

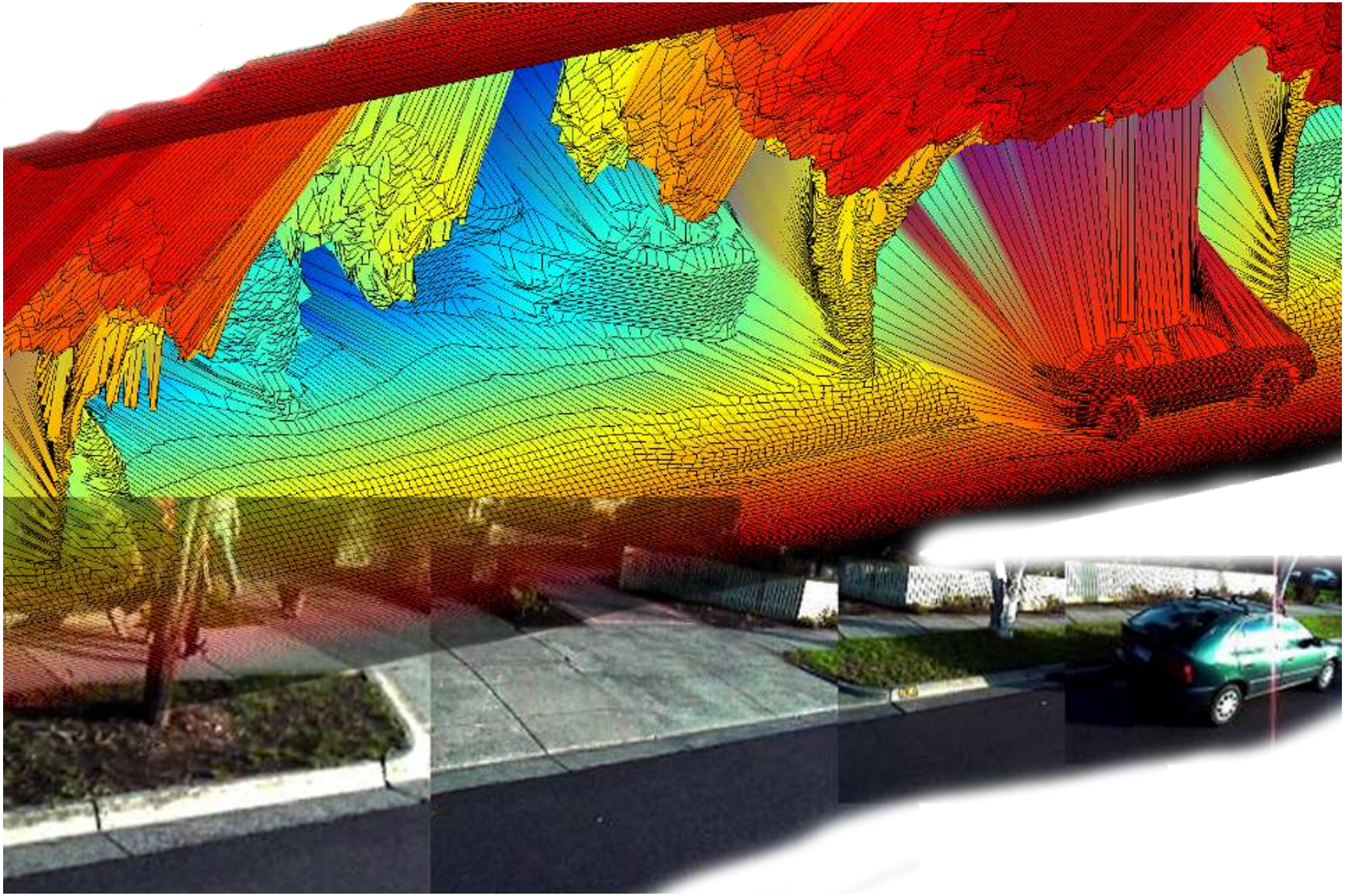
usRAP
UNITED STATES ROAD ASSESSMENT PROGRAM
A program of the AAA Foundation for Traffic Safety

Other stuff (that may be of interest)

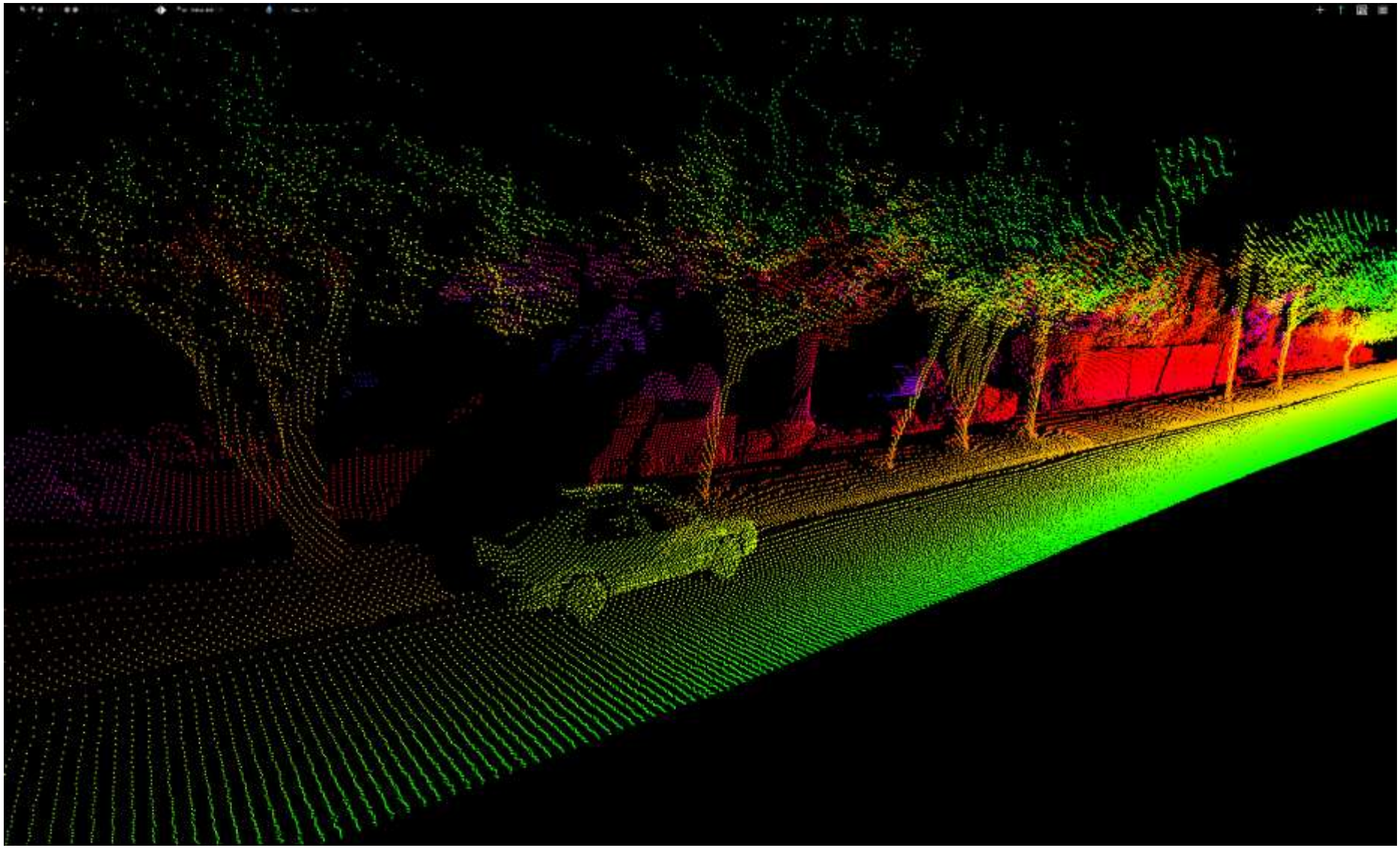
- SICK laser scanner

Assets and hazards - location and identification

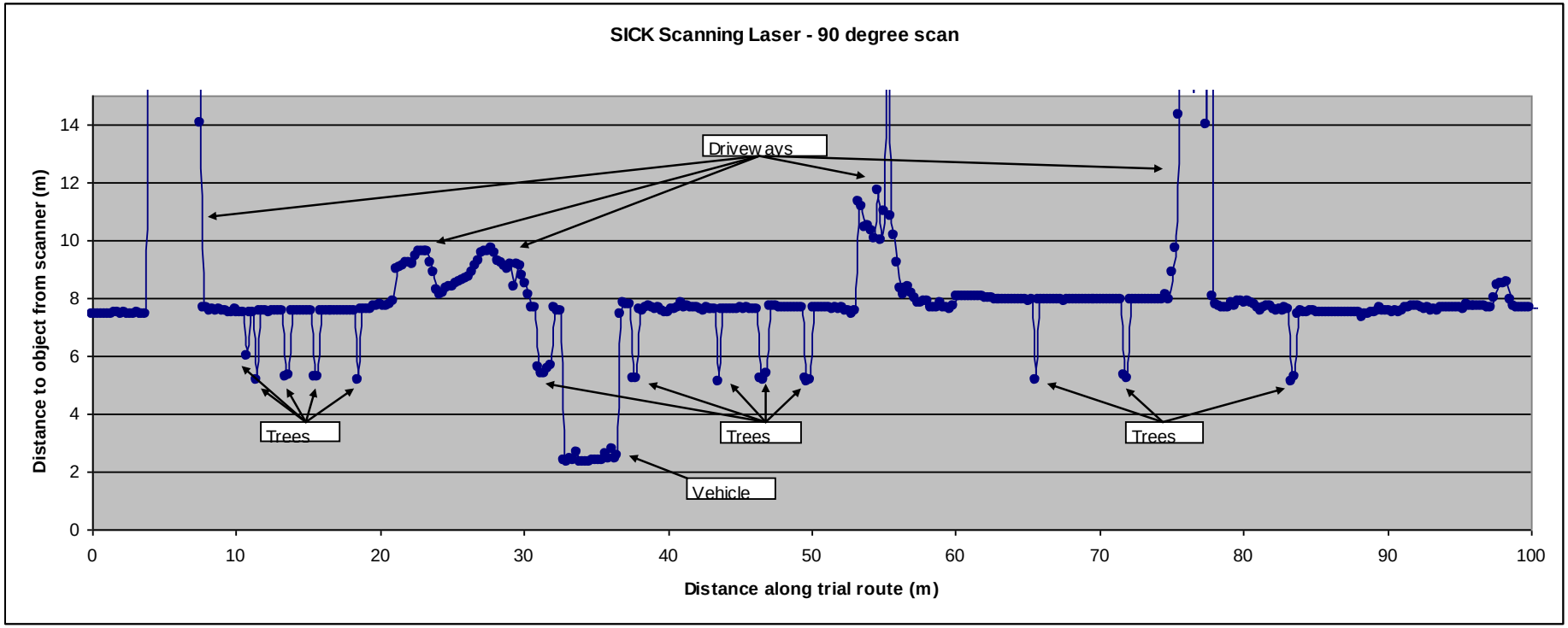
Cool images



Point cloud export



Identifying features and hazards



Other stuff (that may be of interest)

iRAP project aims

- drive safety upgrading where large numbers are killed and seriously injured
- global methodology to generate effective and economic countermeasure programmes
- implement performance tracking methodologies for funding bodies to assess outcomes
- provide the training, manuals and web tools to build and sustain national capability
- visit www.irap.net for more information and reports

iRAP Malaysia – from box to vehicle

iRAP in Costa Rica

Costa Rica – Nicaragua border

One final thing…..

Thanks for listening

Questions?

email: richard.wix@arrb.com.au