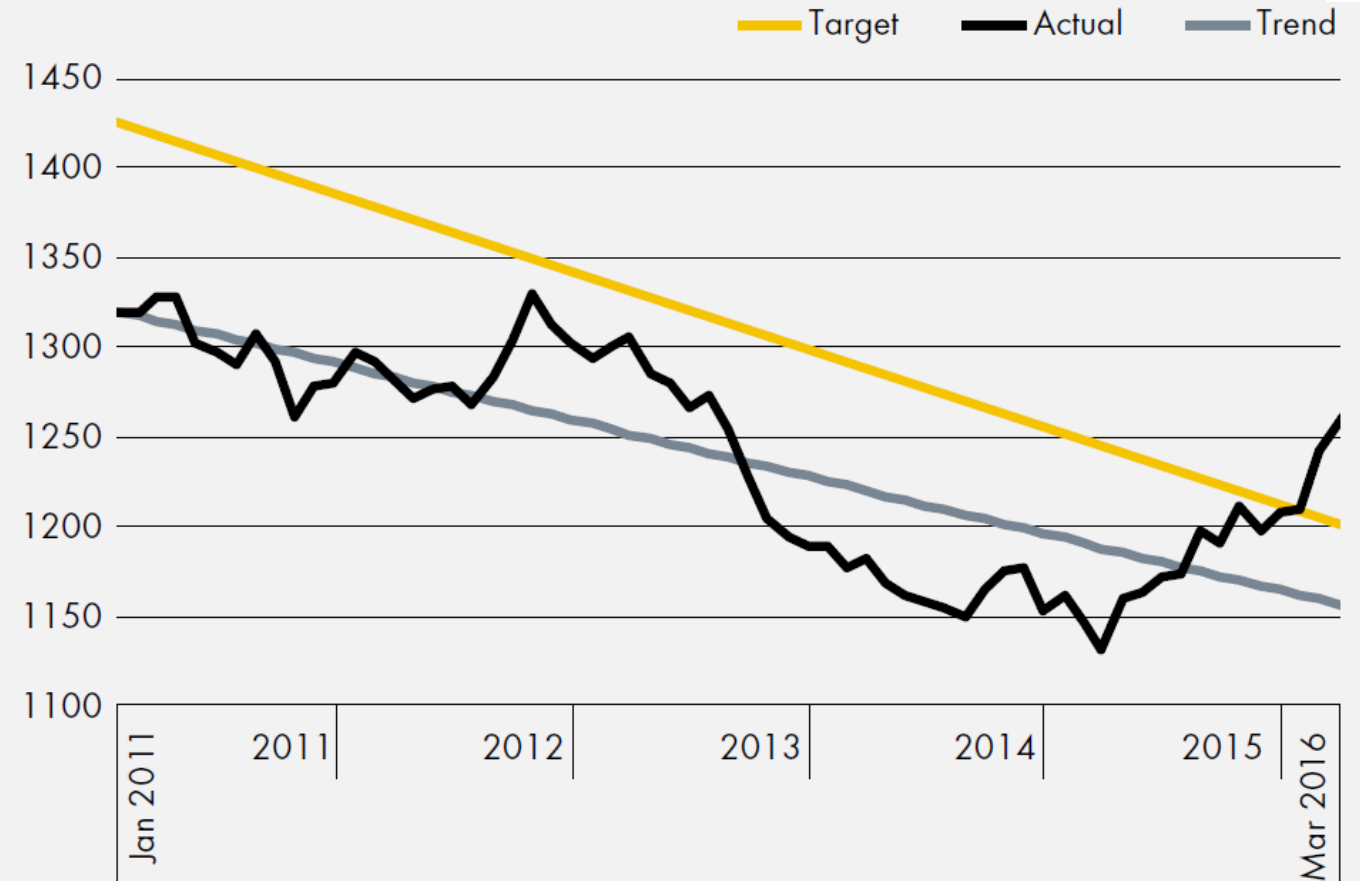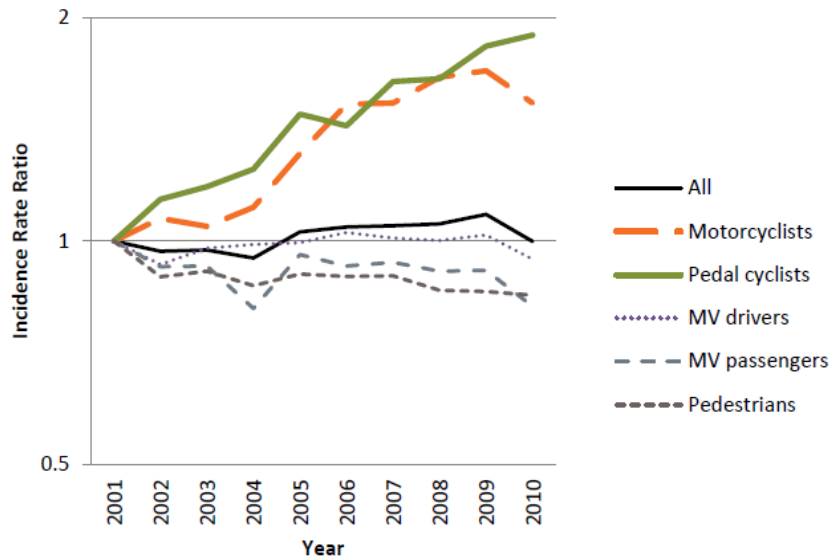# Measuring the progress of Safe System implementation

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Why measure progress towards Safe System?

- Is the direction right?

- Is what we do right?

- Which areas need more action?

Why measure progress towards Safe System?

- Can we tell which actions are more aligned with Safe System objectives?

- What about prioritisation of limited budgets?

How to do our best with what we've got?

Measuring progress towards Safe System

- **Strategic level objectives:**
  - Review progress vs. the 30% FSI reduction in 2011-2020 National Road Safety Strategy
  - Objective-driven KPIs, e.g. % of VKTs on high-speed roads with median barriers

- **Program level** – strategic objectives, estimating FSI reductions, business cases

- **Network/mass-action and route level** – risk and FSI reduction estimation, strategic objectives, tools

- **Project and design level:**
  - Alignment with program and Safe System objectives
  - Estimate FSI reduction benefits
  - Precision tools needed

So, what are the tools?

Measuring progress towards Safe System

| Levels \ Tools	Strategic review	ANRAM, AusRAP, KiwiRAP	Crash reduction factors	Safe System Assessment Framework	X-KEMM-X
Strategic					
Program					
Network / mass-action Route					
Project					
Design					

Safe System Assessment Framework

Measuring progress: Safe System Assessment Framework

- NRSS: "all new projects to consider Safe System principles"

- 10 years of Safe System – need to better understand risks and solutions

- Austroads objectives were to help agencies to:

  1. Methodically consider Safe System objectives in road infrastructure projects

  2. Assess how closely road design and operation align with the Safe System objectives

  3. Clarify which elements need to be modified to achieve closer alignment with Safe System objectives

Safe System Assessment Framework
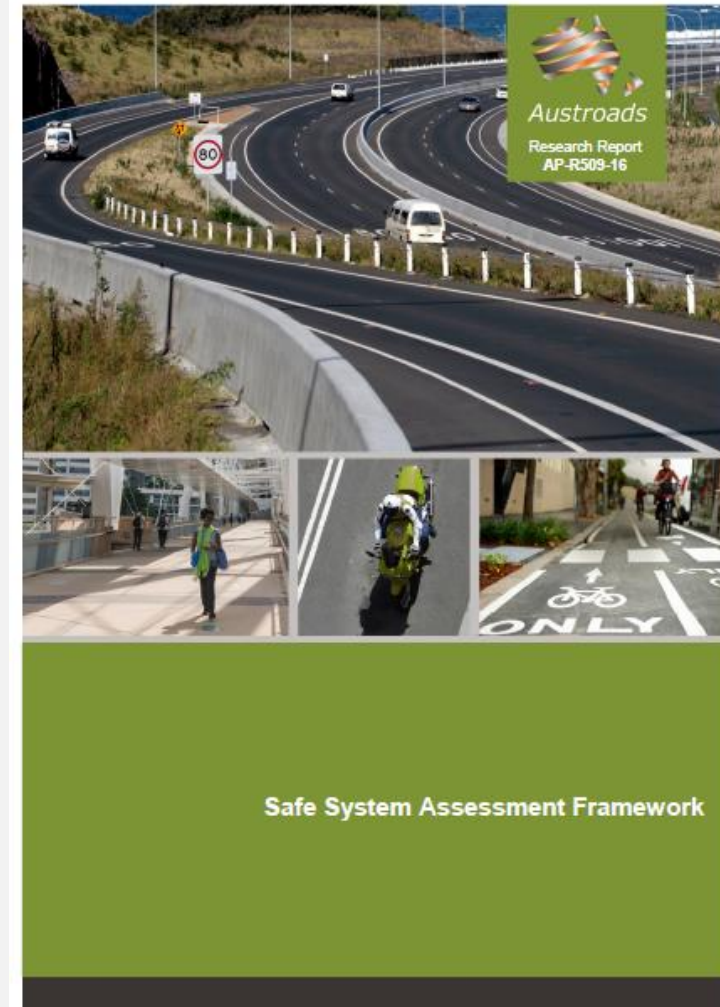
Safe System Assessment Framework

- Includes all pillars of the Safe System

- Breaks down the problem into base elements:
  - Most common FSI crash types
  - Risk elements – exposure, likelihood, severity

- A way to measure Safe System alignment

- A way to identify improvements – treatment hierarchy

So what's this all about?

Assess objectives

- Purpose
- Scale
- Depth

Project context

- Project objectives
- Road function
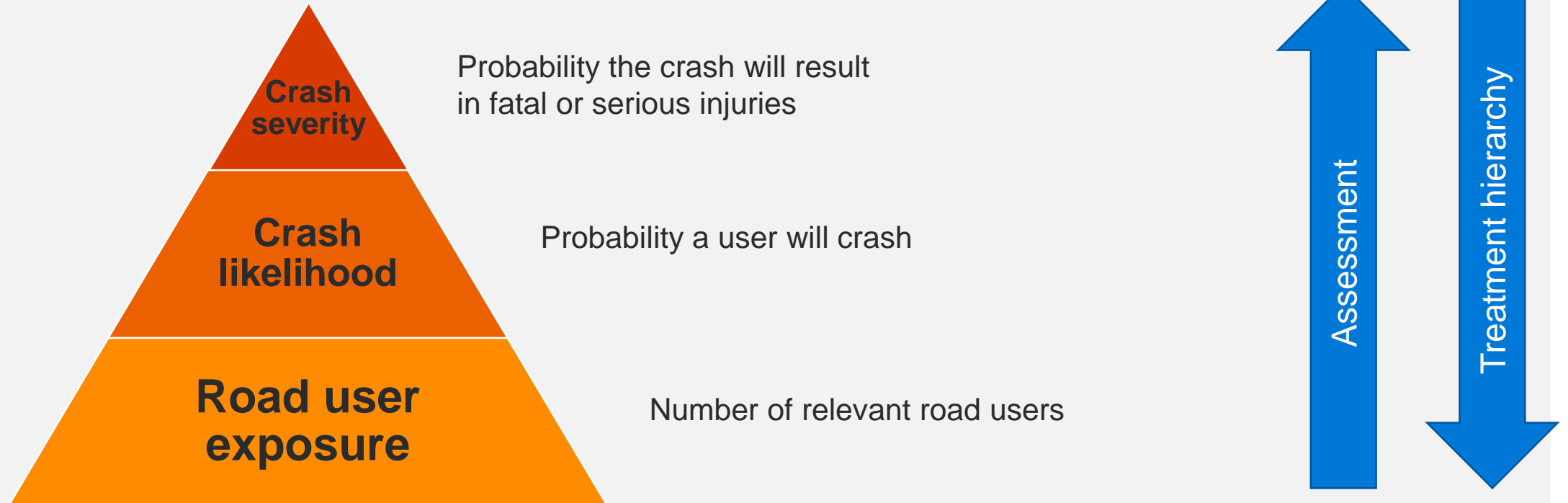- Speed environment
- Road users
- Vehicles

Safe System Matrix

- Exposure, likelihood, severity
- Other Safe System pillars

Treatment hierarchy

- Primary / transformational
- Supporting
- Other considerations

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Logical model for Safe System implementation

Safe System matrix

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Table 4.2: Safe System assessment framework for infrastructure projects

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Exposure	AADT; length of road segment	AADT; length of road segment	AADT for each approach; intersection size	AADT; length of road segment	AADT; pedestrian numbers; crossing width; length of road segment	AADT; cyclist numbers; pedestrians	AADT; motorcycle numbers; length of road segment
Likelihood	Speed; geometry; shoulders; barriers; hazard offset; guidance and delineation	Geometry; separation; guidance and delineation; speed	Type of control; speed; design, visibility; conflict points	Speed; sight distance; number of lanes; surface friction	Design of facilities; separation; number of conflicting directions; speed	Design of facilities; separation; speed	Design of facilities; separation; speed
Severity	Speed; roadside features and design (e.g. flexible barriers)	Speed	Impact angles; speed	Speed	Speed	Speed	Speed

Additional Safe System components	
Pillar	**Prompts**
Road user	Are road users likely to be alert and compliant? Are there factors that might influence this?
	What are the expected compliance and enforcement levels (alcohol/drugs, speed, road rules, and driving hours)? What is the likelihood of driver fatigue? Can enforcement of these issues be conducted safety?
	Are there special road uses (e.g. entertainment precincts, elderly, children, on-road activities, motorcyclist route), distraction by environmental factors (e.g. commerce, tourism), or risk-taking behaviours?
Vehicle	What level of alignment is there with the ideal of safer vehicles?
	Are there factors which might attract large numbers of unsafe vehicles? Is the percentage of heavy vehicles too high for the proposed/existing road design? Is this route used by recreational motorcyclists?
	Are there enforcement resources in the area to detect non-roadworthy, overloaded or unregistered vehicles and thus remove them from the network? Can enforcement of these issues be conducted safety?
	Has vehicle breakdown been catered for?
Post-crash care	Are there issues that might influence safe and efficient post-crash care in the event of a severe injury (e.g. congestion, access stopping space)?
	Do emergency and medical services operate as efficiently and rapidly as possible?
	Are other road users and emergency response teams protected during a crash event? Are drivers provided the correct information to address travelling speeds on the approach and adjacent to the incident? Is there reliable information available via radio, VMS etc.
	Is there provision for e-safety (i.e. safety systems based on modern information and communication technologies, C-ITS)?

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist	
Exposure	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	
Likelihood	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	
Severity	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	$/_4$	
Product	$/_{64}$	$/_{64}$	$/_{64}$	$/_{64}$	$/_{64}$	$/_{64}$	$/_{64}$	$/_{\mathbf{448}}$

Additional Safe System components		
Pillar	**Prompts**	**Comments**
Road user	Are road users likely to be alert and compliant? Are there factors that might influence this? What are the expected compliance and enforcement levels (alcohol/drugs, speed, road rules, and driving hours)? What is the likelihood of driver fatigue? Can enforcement of these issues be conducted safety? Are there special road uses (e.g. entertainment precincts, elderly, children, on-road activities, motorcyclist route), distraction by environmental factors (e.g. commerce, tourism), or risk-taking behaviours?	
Vehicle	What level of alignment is there with the ideal of safer vehicles? Are there factors which might attract large numbers of unsafe vehicles? Is the percentage of heavy vehicles too high for the proposed/existing road design? Is this route used by recreational motorcyclists? Are there enforcement resources in the area to detect non-roadworthy, overloaded or unregistered vehicles and thus remove them from the network? Can enforcement of these issues be conducted safety? Has vehicle breakdown been catered for?	
Post-crash care	Are there issues that might influence safe and efficient post-crash care in the event of a severe injury (e.g. congestion, access stopping space)? Do emergency and medical services operate as efficiently and rapidly as possible? Are other road users and emergency response teams protected during a crash event? Are drivers provided the correct information to address travelling speeds on the approach and adjacent to the incident? Is there reliable information available via radio, VMS etc. Is there provision for e-safety (i.e. safety systems based on modern information and communication technologies, C-ITS)?	

Table 4.4: Safe System matrix scoring system

Road user exposure	Crash likelihood	Crash severity
0 = there is no exposure to a certain crash type. This might mean there is no side flow or intersecting roads, no cyclists, no pedestrians, or motorcyclists).	0 = there is only minimal chance that a given crash type can occur for an individual road user given the infrastructure in place. Only extreme behaviour or substantial vehicle failure could lead to a crash. This may mean, for example, that two traffic streams do not cross at grade, or that pedestrians do not cross the road.	0 = should a crash occur, there is only minimal chance that it will result in a fatality or serious injury to the relevant road user involved. This might mean that kinetic energies transferred during the crash are low enough not to cause a fatal or serious injury (FSI), or that excessive kinetic energies are effectively redirected/dissipated before being transferred to the road user. Users may refer to Safe System-critical impact speeds for different crash types, while considering impact angles, and types of roadside hazards/barriers present.
1 = volumes of vehicles that may be involved in a particular crash type are particularly low, and therefore exposure is low.	1 = it is highly unlikely that a given crash type will occur.	1 = should a crash occur, it is highly unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies must be

Treatment hierarchy

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Hierarchy	Treatment	Influence (E = exposure L = likelihood S = severity)
Safe System options ('primary' or 'transformational' treatments)	• Flexible roadside and median barriers (or equally/better performing future equivalent)	S
	• Very high quality compacted roadside surface, very gentle to flat side slopes and exceptionally wide run-off areas	S
	• Very low speed environment/speed limit.	L, S
Supporting treatments which move towards better Safe System alignment (compatible with future implementation of Safe System options)	• Wide run-off areas, with well-maintained shallow drainage and gentle side slopes	S
	• Wide sealed shoulders with audio-tactile edgeline	L
	• Lower speed limit.	L, S
Supporting treatments (does not affect future implementation of Safe System options)	• Non-flexible safety barrier	S
	• Consistent design along the route (i.e. no out-of-context curves)	L
	• Consistent delineation for route	L
	• Skid resistance improvement	L
	• Improved superelevation	L
	• Audio-tactile centreline	L
	• Audio-tactile edgeline	L
	• Vehicle activated signs.	L
Other considerations	• Speed enforcement	L, S
	• Rest area provision	L
	• Lane marking compatible with in-vehicle lane-keeping technology.	L