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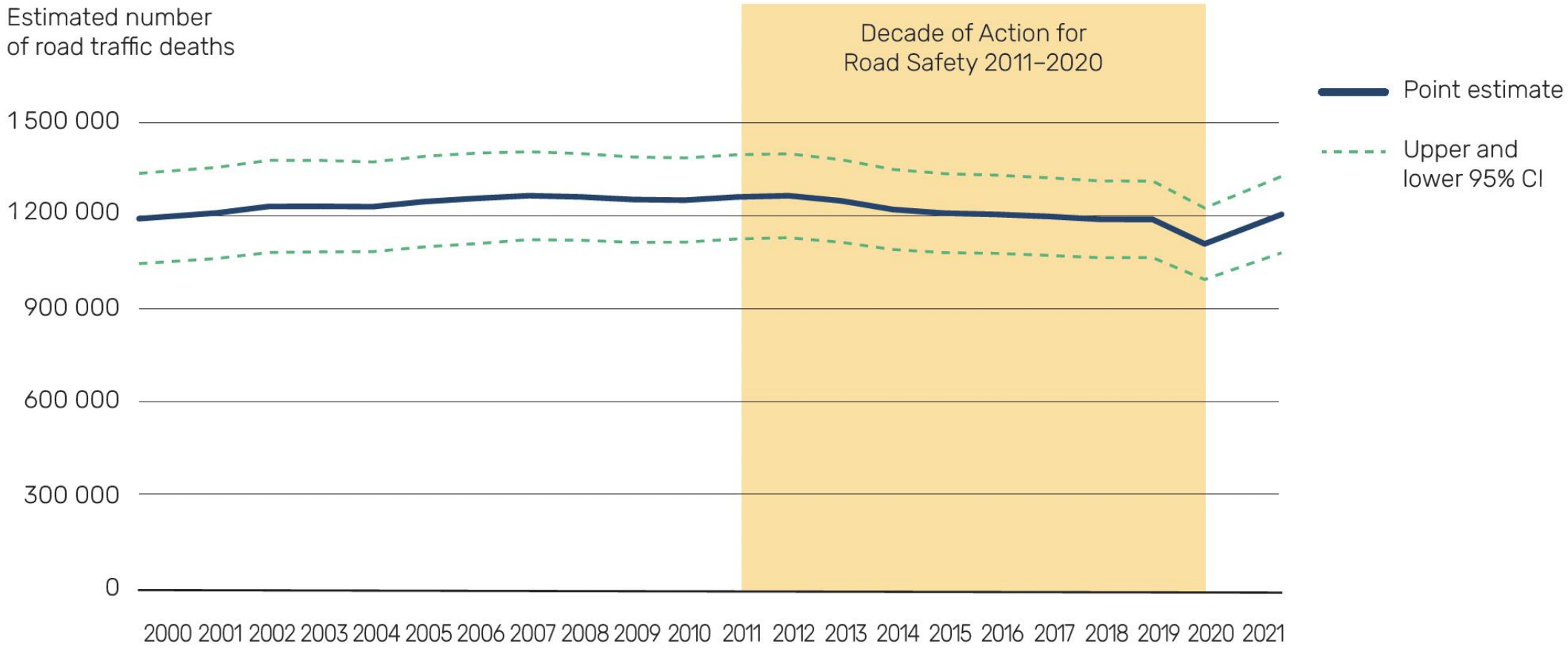
Developing KPIs and SPIs using Comprehensive Data for Progress Monitoring

Dr Johan Strandroth

Key Performance Indicators (KPI)
Safety Performance Indicators (SPI)
Road Safety Performance targets
Target Performance Indicators
Performance measures
…

“You cannot manage what you do not measure”

WHO estimated number of road traffic fatalities, 2000–2021



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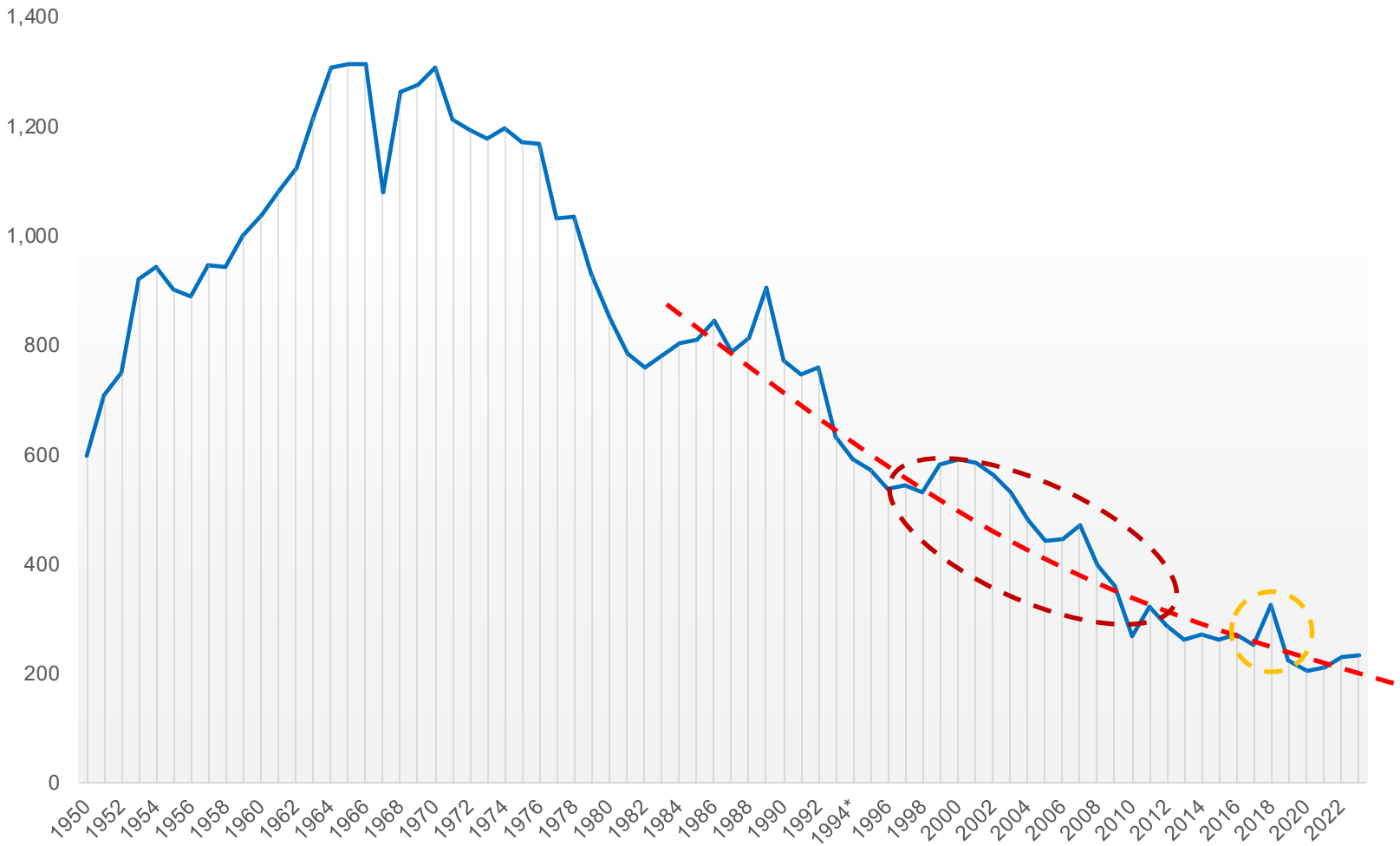
Are fatalities and injuries good indicators?

Trauma trends



Official crash statistics is incomplete

Crashes or injuries is subject to external factors and random fluctuations

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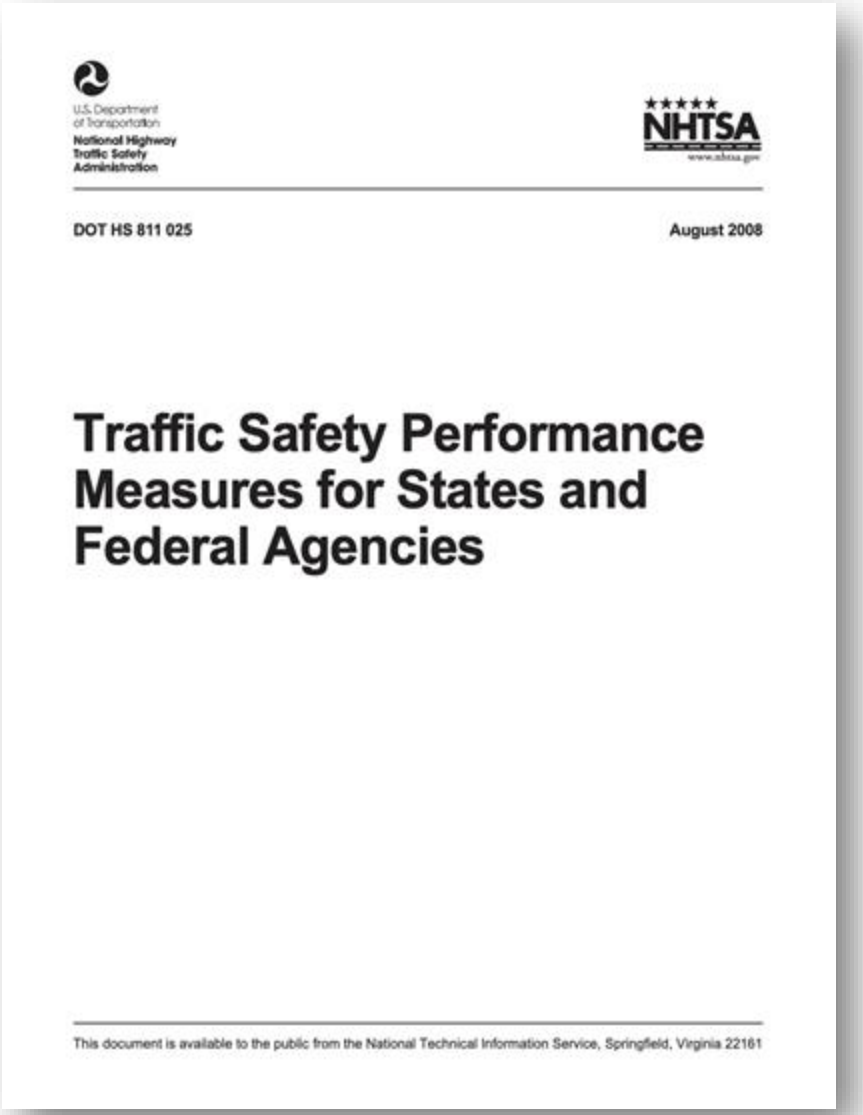
Performance Measures

- Number of traffic fatalities
- Number of serious injuries in traffic crashes
- Number of unrestrained passenger vehicle occupant fatalities, all seat positions
- Number of fatalities in crashes involving a driver or motorcycle operator with a BAC of .08 and above
- Number of speeding-related fatalities
- Number of motorcyclist fatalities
- Number of unhelmeted motorcyclist fatalities
- Number of drivers aged 20 or younger involved in fatal crashes
- Number of pedestrian fatalities


U.S. Department of Transportation
National Highway Traffic Safety Administration

NHTSA

DOT HS 811 025

August 2008

Traffic Safety Performance Measures for States and Federal Agencies

This document is available to the public from the National Technical Information Service, Springfield, Virginia 22161

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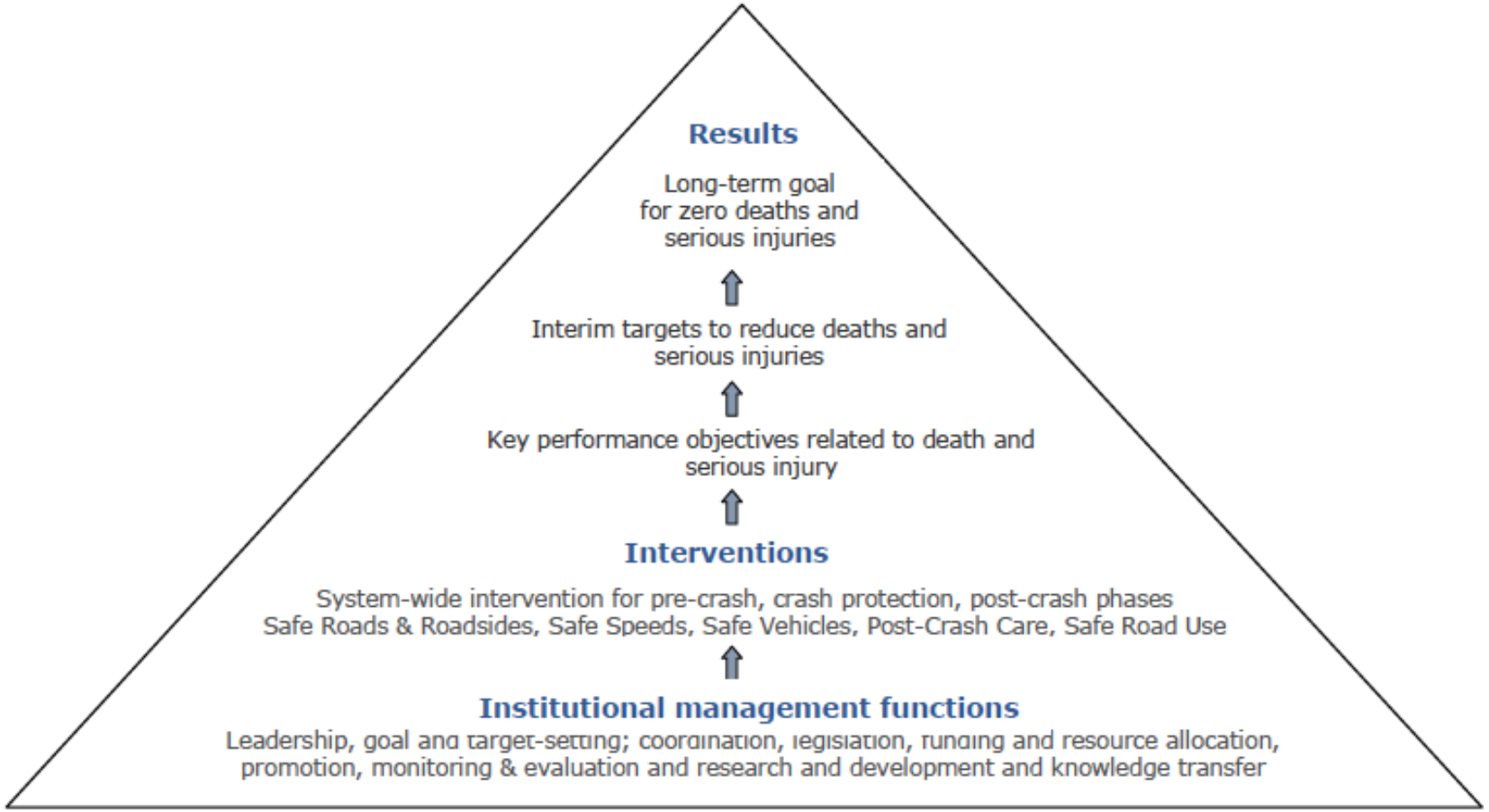
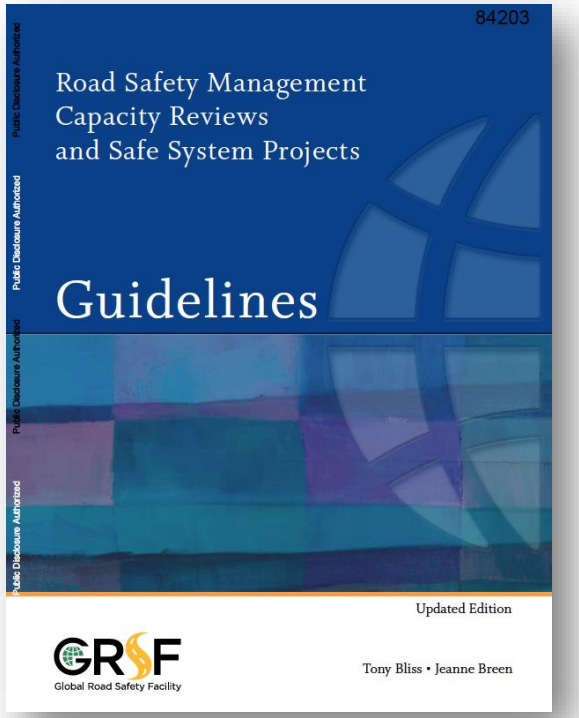
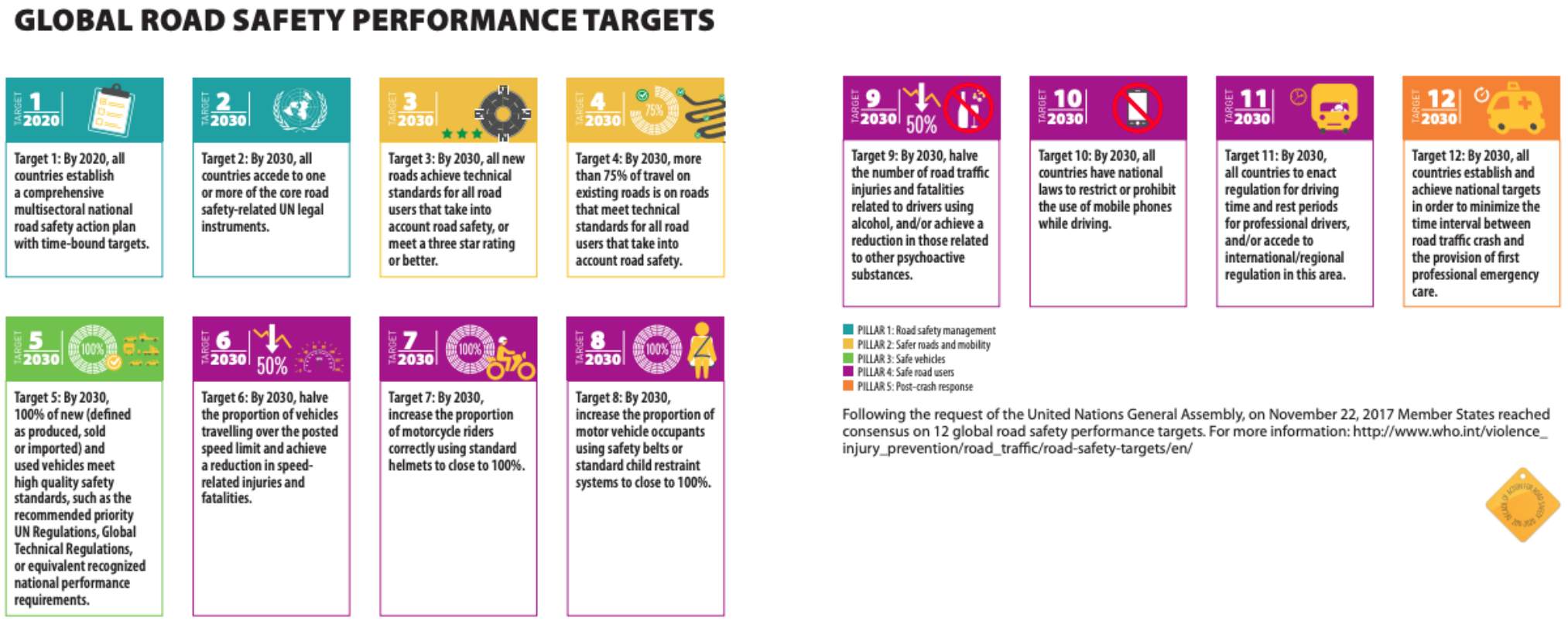
Management by objectives: Target hierarchy





Source: Road Safety Management Capacity Reviews and Safe System Projects, World Bank. 2013.

GLOBAL ROAD SAFETY PERFORMANCE TARGETS



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UN Voluntary Target Performance indicators

Target	Indicators	Number of countries				
			Income levels[a]			
		All N=(170)	**High** (N=51)	**Upper middle** (N=43)	**Lower middle** (N=46)	**Low** (N=27)
Target 1 By 2020, all countries establish a comprehensive multisectoral national road safety action plan with time-bound targets.	Published national action plan that provides for regularly updated, time-bound targets for reductions in fatalities and injuries	17	9	5	3	0
	Presence of national lead agency to coordinate, monitor, evaluate and implement multisectoral national road safety action plan	117	34	31	33	17
Target 2 By 2030, all countries accede to one or more of the core road safety-related UN legal instruments.	Ratification or accession, and adhesion, to one or more core road safety-related UN legal instruments (out of seven)	128 (only 16 MS have 7)	50	33	31	14

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Purpose of Key Performance Indicators (KPI)

“The indicator needs to be meaningful, in that it can be used to inform or direct beneficial activity”

Matt Pickard, The Association of Directors of Environment, Economy, Planning and Transport, UK

- Understand the relationship between operation and FSI reduction
- Trigger actions, create accountability
- Show what success looks like
- Identify change in things that matters, focus on transformational changes

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KPI and SPI development

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KPI development – consensus based (UK example)

Criteria for selecting indicators	Mean scores (Range)	Ranking
Relationship with KSIs	4.7 (1)	1
Accuracy/reliability of data	4.3 (2)	2
Collection possible at different levels (nationally and locally)	4.1 (2)	3
Relevance nationally	4 (3)	4
Legal requirement	3.9 (3)	5
Need to cover all five pillars of safe system	3.9 (4)	6
Cost of collection	3.7 (2)	7
Relationship with the Highway Code	3.5 (3)	8

Table 1: How UK experts and stakeholders rated criteria for selecting performance indicators

Source: Results of project questionnaire issued by PACTS

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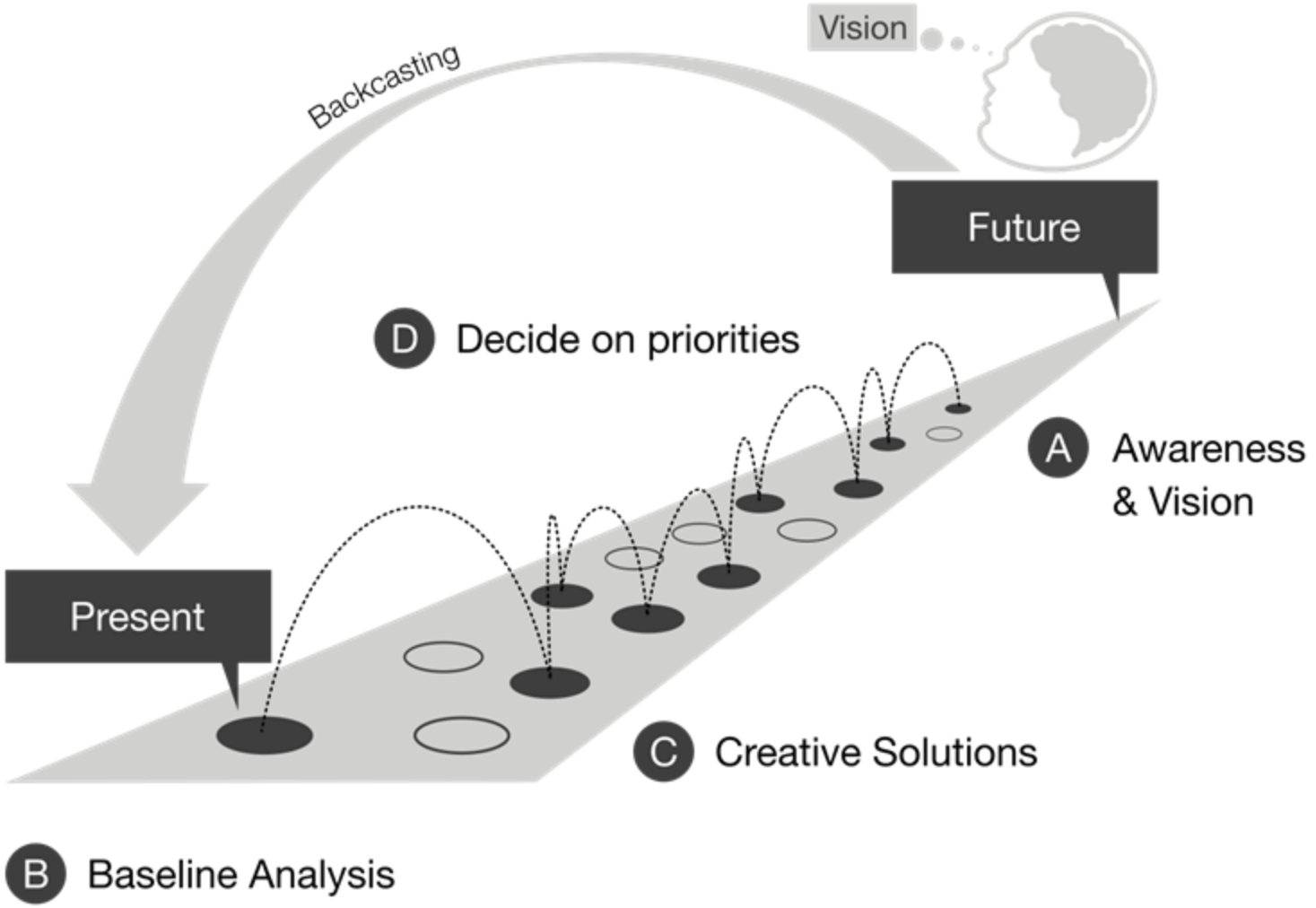
Vision Zero planning – back-casting



Adapted from The Natural Step, 1991

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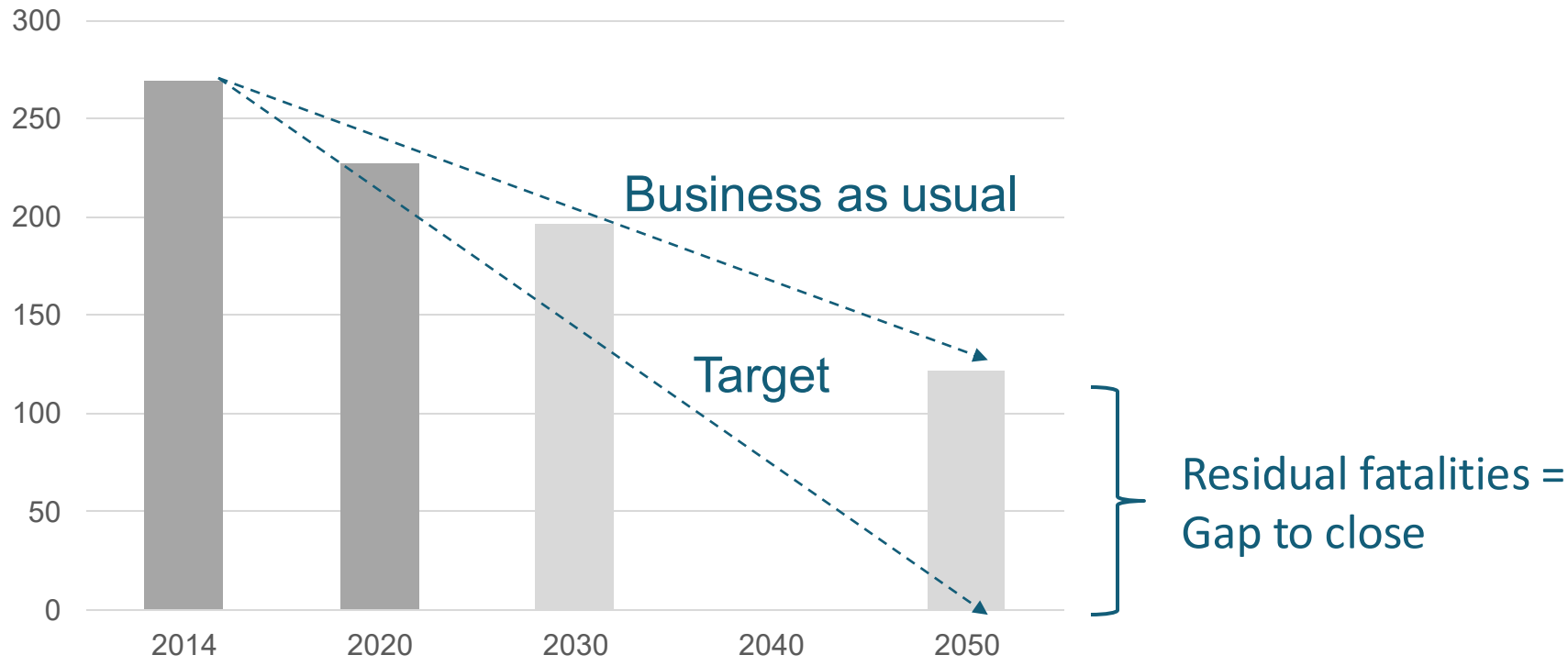
Baseline analysis

Where are we going and where do we start?



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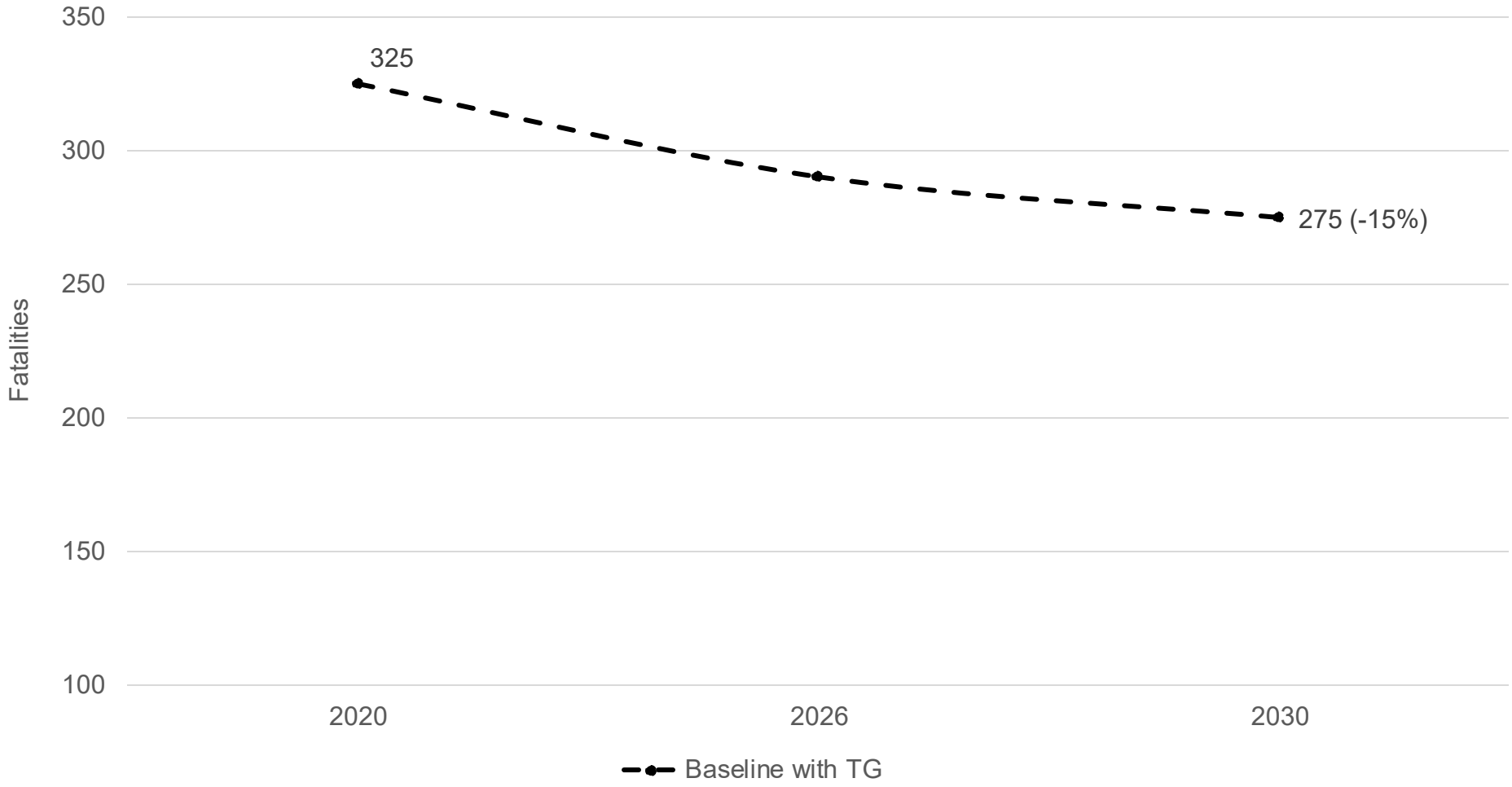
Baseline analysis

Includes already funded and committed initiative and programs in infrastructure, vehicle safety, enforcement and policies for road user behaviour.



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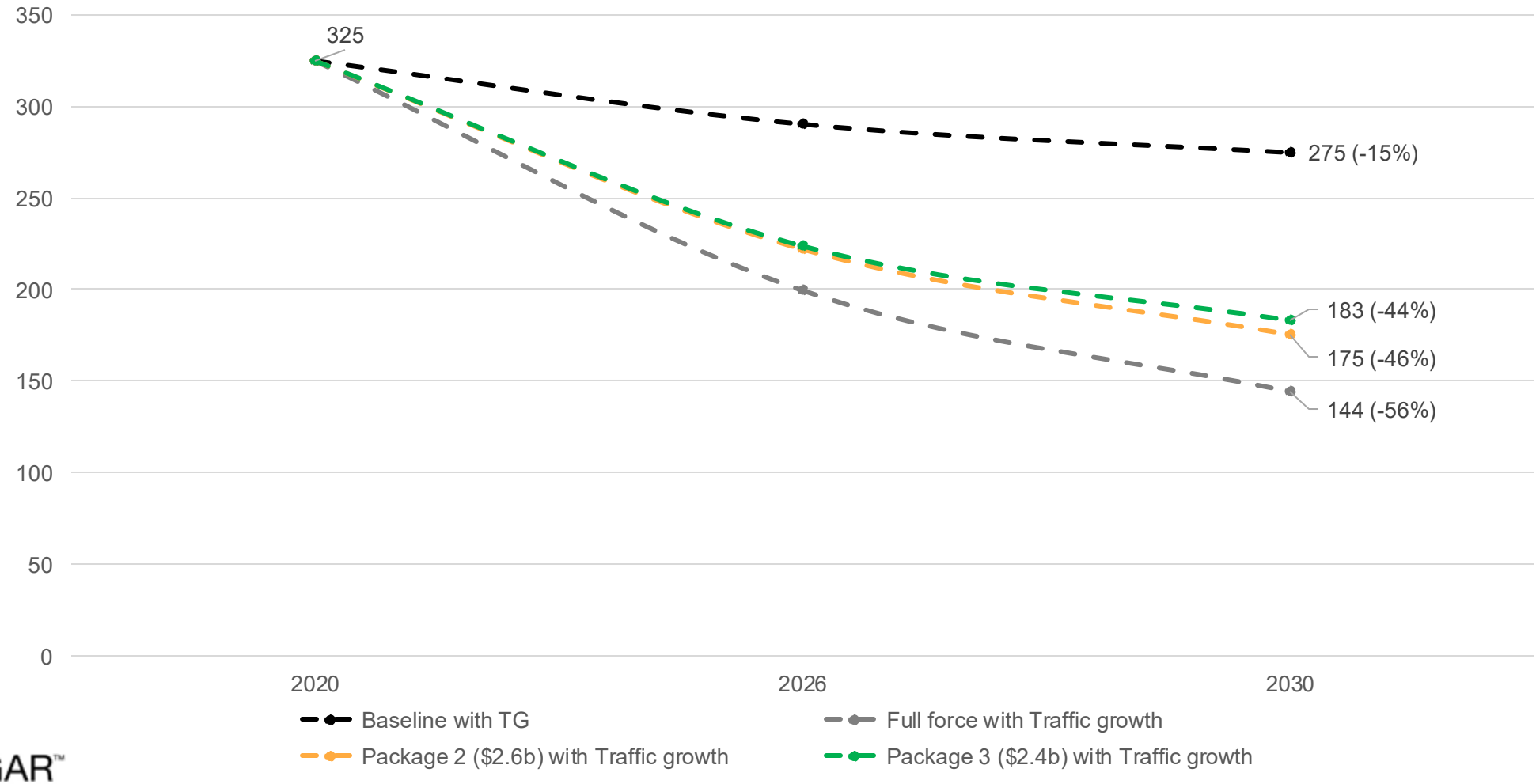
Estimated benefits of additional interventions



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Additional interventions and estimated lives saved

Programs	Countermeasures	Fatalities saved to 2030
High Speed, High movement, transformative	Full barrier, high speed divided rural roads (100-200 km left of untreated undivided rural and urban)	4.8
	Full barrier, high speed divided urban routes (100-200 km left of untreated undivided rural and urban)	3.6
	Full barrier, high speed high volume, undivided high movement roads (158 km)	1.5
	Full barrier on high speed medium-high volume, undivided, high movement roads (282 km)	3.0
Cost effective, route and intersection	Cost-effective treatment on high speed, non-low volume, mid movement roads (2,000 km)	6.2
	Cost-effective treatments on high speed, sealed low movement and LGA roads (10% of 70,000 km)	0.8
	Cost-effective treatments on high speed, low-mid volume, high movement roads (1,800 km)	1.7
	Cost effective intersection treatments (3,000)	1.9
	Cost-effective treatments on high speed, low volume, high movement roads (1,000 km)	0.4
	Cost-effective treatments on high speed, low volume, mid movement roads (10,000 km)	4.8
Intersections, transformative and innovative	Intersection transformative treatments, rural (300)	2.6
	Intersection transformative treatments, urban (300)	2.1
	80 to 50 at signalised intersections	2.6
	70 to 50 on signalised intersections	2.2
	60 to 50 on signalised intersections	0.9
Place making	Safer travel in 50 km/h local streets – speed calming in rural & urban areas, remove car parking and reduce car use	1.4
	Default 40 km/h local roads and streets	3.2
	20 km/h at Civic Hubs and City Streets - vehicle occupants	0.0
	20 km/h at Civic Hubs and City Streets - peds & cyclists	0.0
	Superblocks (10 km/h with pedestrian priority) in City Places	0.0
Speed	60 to 50 on urban collectors	1.9
	100 to 80 on M3 rural undivided	16
	Default 80 on sealed council roads	11
	Default 80 on unsealed council roads	1.2
	Mobile Speed Camera increase, urban	20
	Mobile Speed Camera increase, rural	32
Impaired driving	Increase in RDT	20
	Increase in RBT	5.2
	Zero BAC for all commercial drivers driving light vehicles	2.2
	Zero BAC for fully licensed drivers aged 21 to 26 years	4.5
	Zero BAC for all motorcycle riders	4.1
	Zero BAC for high-level (repeat) offenders	1.7

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Performance Indicator empirically derived from a Road Safety Strategy

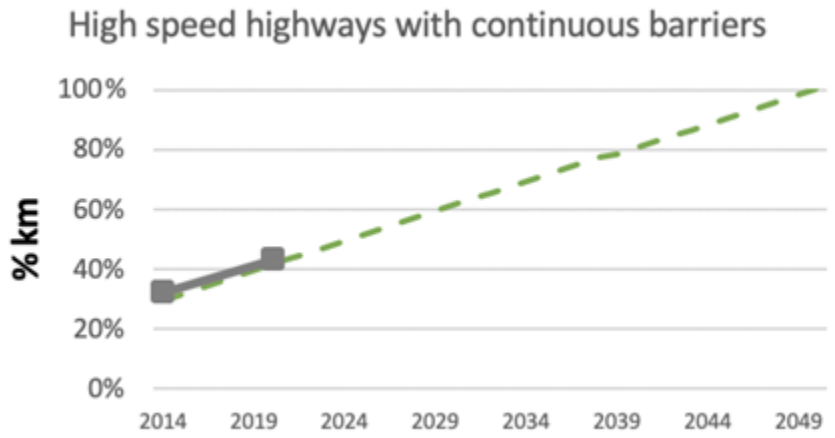
Countermeasure
(Targets over time to achieve FSI targets)

Action Plan
(Project KPI)

System state
(SPI)

CM type	Intervention	2025	2030	2050
Route treatments	Full barrier on high speed rural, high movement roads, undivided roads.	500 km	1,000 km	4,400 km (100%)

Project	Project Targets
Top 20 High Risk Rural Road Projects	6 Delivered in 2022-23 9 Delivered in 2023-24 5 Delivered in 2024-250



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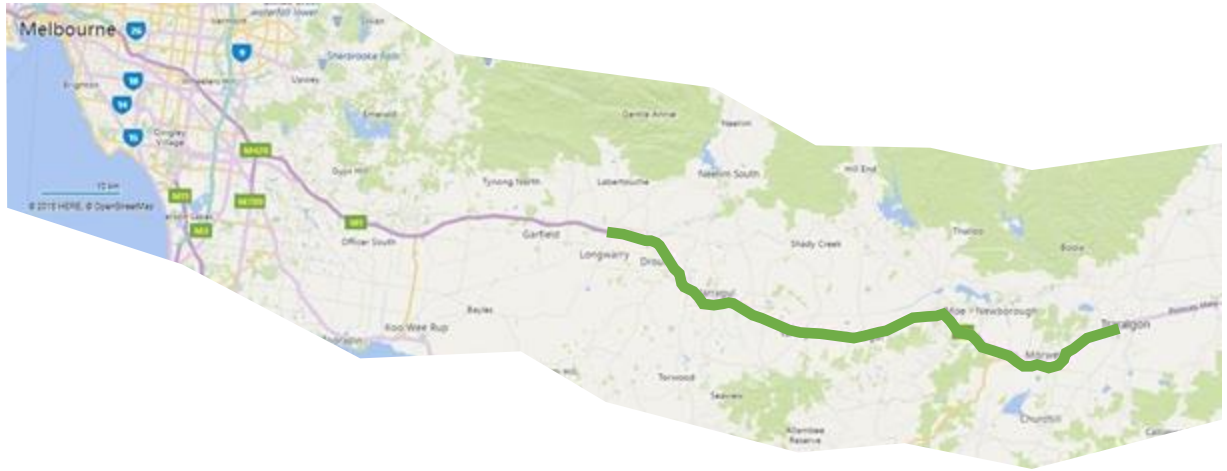
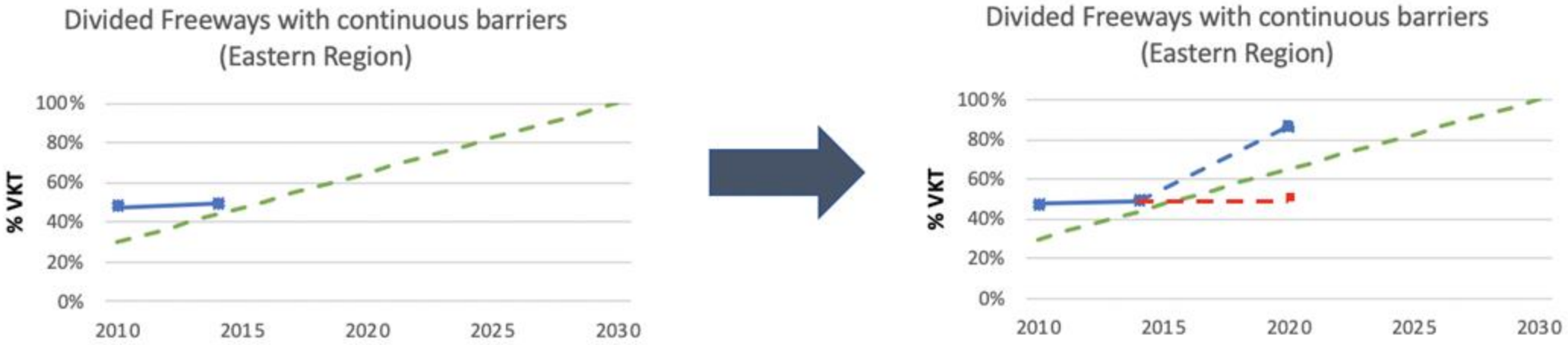
Output Indicators on a regional/project level





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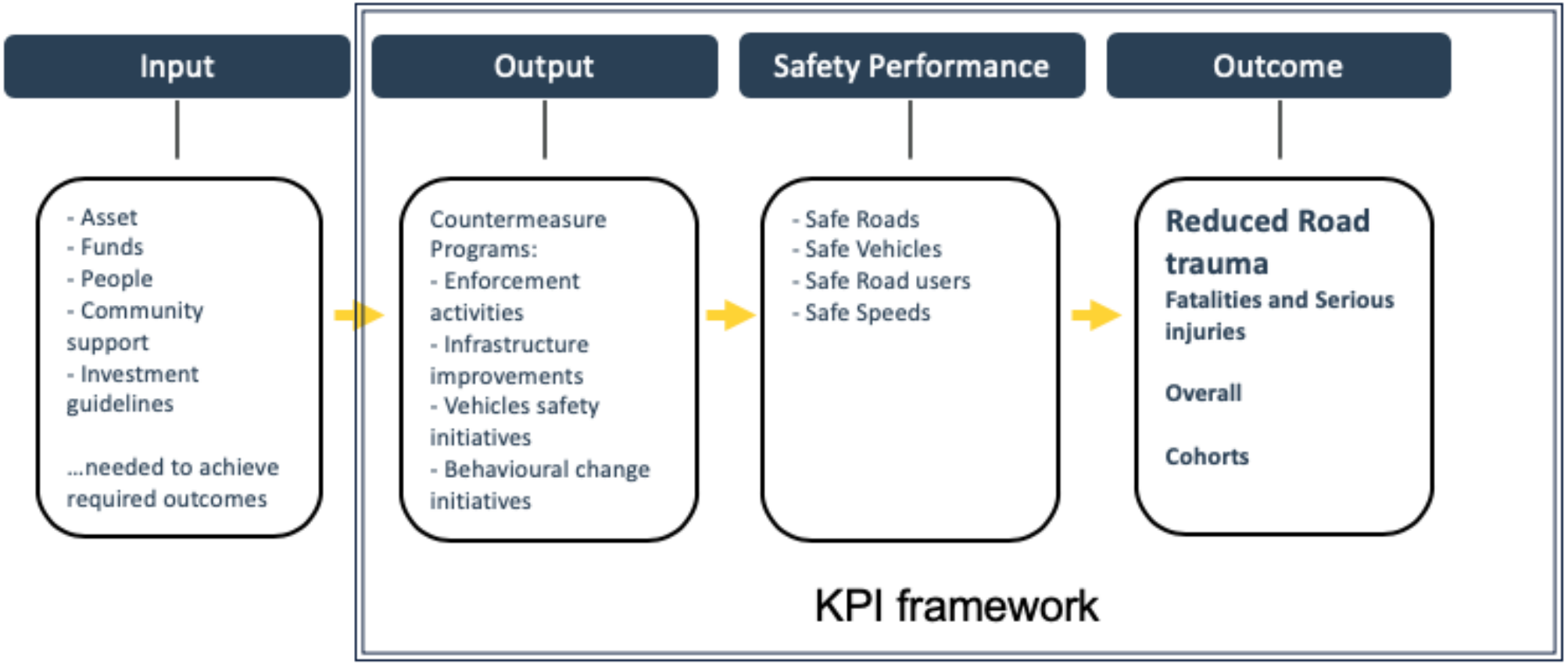

- **Output Indicators** – delivery of programs, projects and services that impact on the Safety Performance Indicators
- **Safety Performance Indicators** – scientifically supported long-term goals that include system components, that should, when combined, virtually eliminate harm
- **Outcome indicators** – the measures of achievement in the primary goal, eliminating deaths and serious injuries

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Outcome indicators

Outcome Indicators	Fatalities Average 2017-2019	Serious injuries Average 2016-2018	MAIS3+ Average 2015-16 to 2017-18	Development
Fatalities (average 2017-2019)	**246**	-	-	
Serious Injuries (average 2016-2018)	-	**6,511**	-	
MAIS3+ (average 2015-16 to 2017-18)	-	-	**1,358**	
People who are at higher risk of being injured				
Unprotected road users – cyclists, pedestrians, motorcyclists	89 (33%)	2052 (33%)	509 (37%)	
People who are more vulnerable – older people (75+), children (0-17), young drivers (18-25)	74 (30%)	3763 (58%)	646 (48%)	
People travelling in older vehicles	152 (62%)	3763 (58%)	646 (48%)	
People travelling on remote and rural roads	134 (55%)	1804 (28%)	449 (33%)	

Cohorts				
People who engage in higher risk behaviours				
Any road user affected by drugs or alcohol	88 (36%)	N/A	N/A	
People who frequently drive or ride over the speed limit	63 (25%)	288 (4%)	62 (25%)	
Distracted road users	16 (6%)	321 (5%)	59 (4%)	
People who use the roads for work or at work	39 (15%)	598 (9%)	117 (9%)	
Fatigue drivers	11%	-	4-26%	

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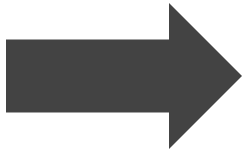
Setting SPI targets, long term and near term

Countermeasure description	Target 2050
Transformation of high speed, high movement roads	100%
Cost effective treatments on arterial and local roads	100%
Innovative and transformative intersection treatments	100%
Urban place making	100%
Off-road bike routes	100%
Safer travel speeds (CMS19, 21-23)	100%
Speed enforcement - mobile speed camera increase	100%
RDT (100% increase to 2030) and RBT (4.5m)	100%
Zero BAC and night driving restrictions for high risk groups	100%



Safety Performance Indicators

Safety Performance Indicators	Current level	Strategy target 2030	Method and data
Safe roads and streets			
% VKT on safe arterial roads (4/5 star or equivalent)	40%	60%	
% VKT on safe divided roads (5-star or 4-star with median-barrier)	90%	100%	
% VKT on safe high movement arterial roads (M1/M2 with 5-star or 4-star with median-barrier))	10%	50%	
% length with safe lower movement arterial roads (M3 roads with safe speed)	10%	40%	
% length with safe local rural roads (local roads with safe speed)	10%	40%	
% km of 40 km/h speed limit or below in urban streets	10%	100%	
% safe intersections	37%	TBC	
Vehicles			
% 5-star cars in new car sales[1]	93% (81%[1])	95%	
% vehicles older than 15 years	19%	TBC	
% 5-star cars in Victorian government fleet	97%	100%	
Speed			
% of drivers/riders compliant with speed limit on high movement arterial roads (M1/M2)	77%	TBC	
% of drivers/riders compliant with speed limit on mid movement arterial roads (M3)	73%	TBC	
Mean speed on high movement arterial roads (110 km/h)	103 km/h	TBC	
Mean speed on mid movement arterial roads (100 km/h)	97 km/h	TBC	
Non-impaired drivers			
% sober drivers	99.89%	99.95%	
% non-drug drivers	97.9%	99.5%	
% non-fatigue drivers	63%	75%	
Seat belt and protective gear			
% seat belt wear in light vehicles	97%	99%	
% seat belt wear in heavy vehicles	90%	97.5%	
% riders always wearing full protective gear	37%	75%	
Corporate responsibility			
Indicator requires development	TBC	TBC	

[1] Rating date stamp maximum 5 years

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Setting KPI targets

Value based approach

Non-impaired drivers	Current level	Target 2030	Method and Data
% sober drivers	99.89%	99.95%	
% non-drug drivers	97.9%	99.5%	
% non-fatigue drivers	63%	75%	

Target 2030:

1. For sober driving, aim to halve the number of alcohol impaired drivers each decade to 2050.
2. That would result in moving from a level of sober drivers of 99.89% to a level of 99.95% to 2030.
3. Aligning with the strong focus on preventing drug driving, the target has been set a bit more ambitious by aiming for a 75% reduction of drug driving resulting in a target of 99.5% of non-drug use drivers in 2030.
4. For fatigue, a linear improvement approach to 2050 is taken aiming for 75% non-fatigue drivers in 2030.

Setting KPI targets
Analytical approach

Safety Performance Indicators	Current level	Strategy target 2030	Method and data
Safe roads and streets			
% VKT on safe arterial roads (4/5 star or equivalent)	40%	60%	◉
% VKT on safe divided roads (5-star or 4-star with median-barrier)	90%	100%	◉
% VKT on safe high movement arterial roads (M1/M2 with 5-star or 4-star with median-barrier))	10%	50%	◉
% length with safe lower movement arterial roads (M3 roads with safe speed)	10%	40%	◉
% length with safe local rural roads (local roads with safe speed)	10%	40%	◉

Investment Logic:
The most optimal pathway to 2050 in terms of lives saved would be to complete the transformation into a safe road network in the time leading up to 2040, i.e. the period in the near and mid-term future when we have not reached significant fleet penetration of safer vehicles.

A natural approach is to target transformation on the highest risk and high-volume roads and in parallel apply speed management and mass action on low volume arterial and local roads.

Target setting:
- The target of 100% safe divided roads relates to the initiative in the action plan to finalise the instalment of barrier treatment on these roads to 2030.
- For high-speed undivided roads the ambition is to achieve around 50% of VKT on safe roads which would require transformation of around 500 km or high-volume roads.
- As for lower movement arterial roads and local roads, the ambition is to achieve targeted area wide mass-action and speed management to achieve 40% in 2030 with a scaling up post 2030.

Summing up the Roads SPI targets results in an overall target for the key SPI to 60% VKT on safe arterial roads by 2030.

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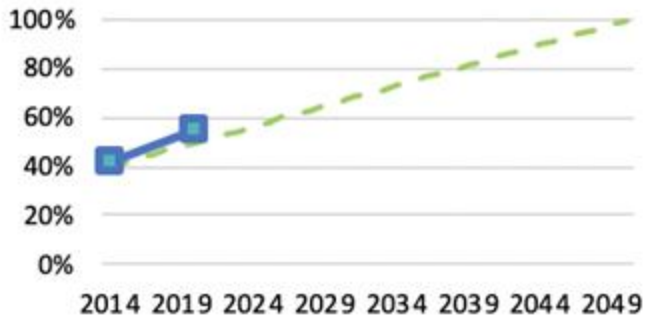
KPI Dashboard – Road's example

PROPORTION OF VKT ON ROADS WITH ACCEPTABLE SAFETY STANDARD



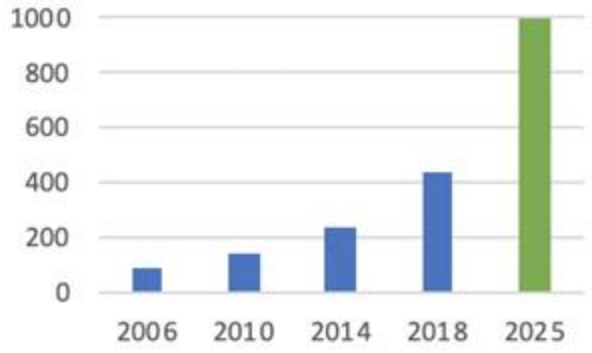
2050 Targets

100%	100%	100%	100%
VKT on roads with acceptable safety standards	VKT on high speed roads with continuous barriers	KM of undivided low movement arterials with acceptable speed limits	Number of intersections with acceptable speed limits per type

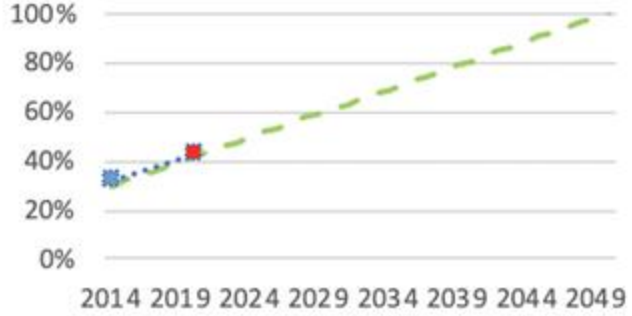
2025 Targets

65%	100%	45%	45%
VKT on roads with acceptable safety standards	VKT on high speed roads with continuous barriers	KM of undivided low movement arterials with acceptable speed limits	Number of intersections with acceptable speed limits per type

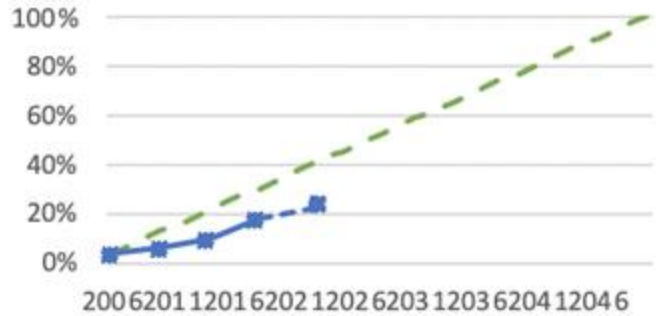
PROPORTION OF INTERSECTIONS WITH ACCEPTABLE SPEED LIMITS PER TYPE



PROPORTION OF VKT ON HIGH SPEED ROADS WITH CONTINUOUS BARRIERS



KM OF UNDIVIDED LOW MOVEMENT ARERIALS WITH ACCEPTABLE SPEED LIMITS



iRAP Safety Insights Explorer

Country
All

Region
All

Income Level
All

Road Safety Observatory
All

Land Use
All

Area Type
All

Vehicle Flow
All

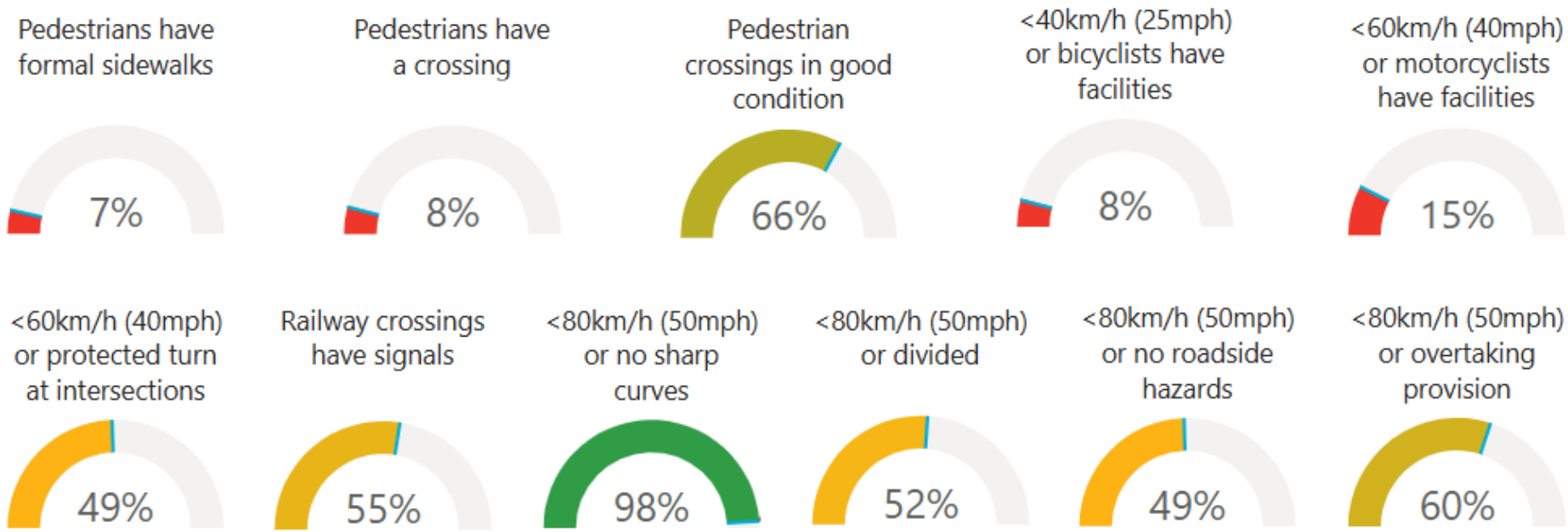
Carriageway
All

Clear Filters

Length	Countries
590184	88

Road length rated 3-Star or better

Infrastructure safety key performance indicators (KPI)



iRAP FIA FOUNDATION TAC DECADE OF ACTION FOR ROAD SAFETY 2021 - 2030

Challenges/limitations with KPIs

- System complexity
- Conflicts between accuracy and being pragmatic
- ‘Gaming targets’

EXAMPLE: Swedish Performance Indicator framework

Outcome indicators

Indicator	Description	Starting point (average 2017–2019)	2022	Target 2030
Number of fatalities	Number of fatalities in road traffic accidents	266	227	133
Number of seriously injured	Number of seriously injured in road traffic accidents	Will be computed in 2023		Reduce by 25 %
Number of seriously injured in pedestrian falls	Number of seriously injured in pedestrian falls (not included in the definition of a road traffic accident)	Will be computed in 2023		Reduce by 25 %
Number of suicides in the road transport sector	Number of suicides in the road transport sector, including the number jumping off bridges (not included in the definition of a road traffic accident)	52	Not established	Reduce
Number of seriously injured in single-bicycle accidents	Number of seriously injured in single-bicycle accidents	Will be computed in 2023		Reduce by 25 %

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EXAMPLE: Swedish Performance Indicator framework

System indicators				
Indicator	**Description**	**Starting point 2020**	**2022**	**Necessary level 2030**
Safer roads, national road network	Share of traffic volume on roads with median barriers, national roads with speed limits 90–120 km/h	85 %	86 %	96 %
Safer roads, national road network	Share of traffic volume on roads with median barriers, national roads with speed limits 80–120 km/h	64 %	65 %	70 %
Safer intersections, national road network	Share of annual average daily traffic with *very good* or *good* road safety classifications	–	74 %	85 %
Safer intersections, national road network	Share of annual average daily traffic with *very good*, *good* or *fair* road safety classifications	–	91 %	99 %

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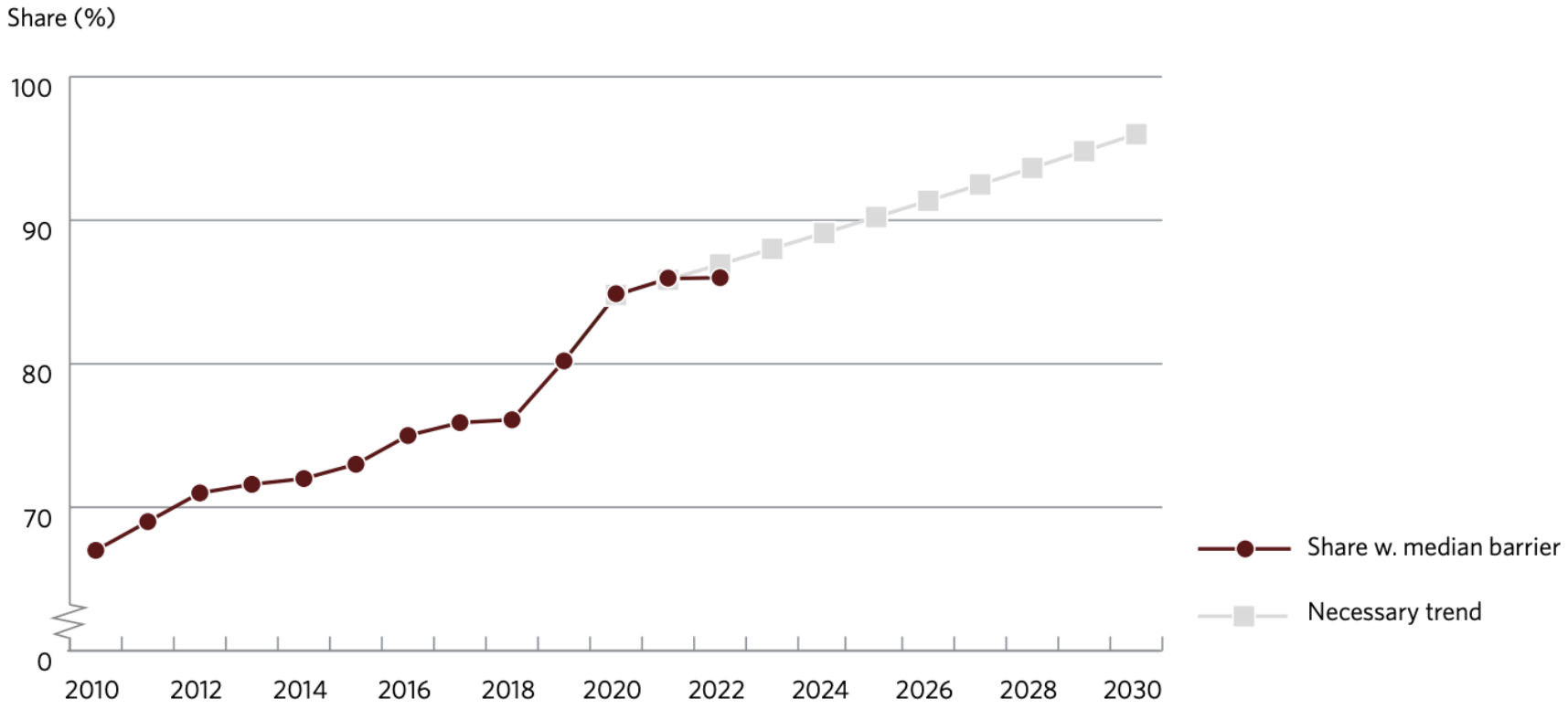
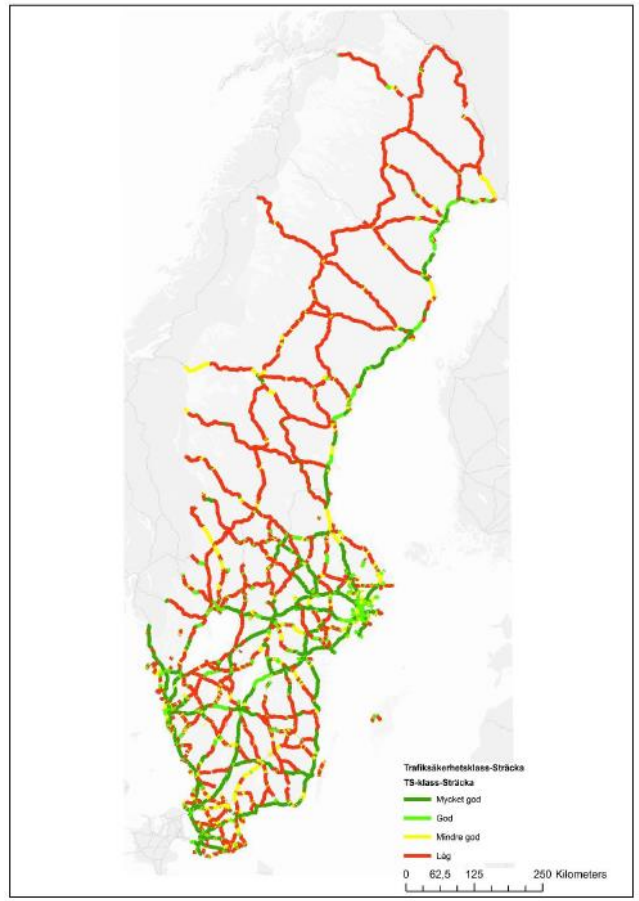
Performance Indicator for roads

Match speed limits to road quality and to road user vulnerability





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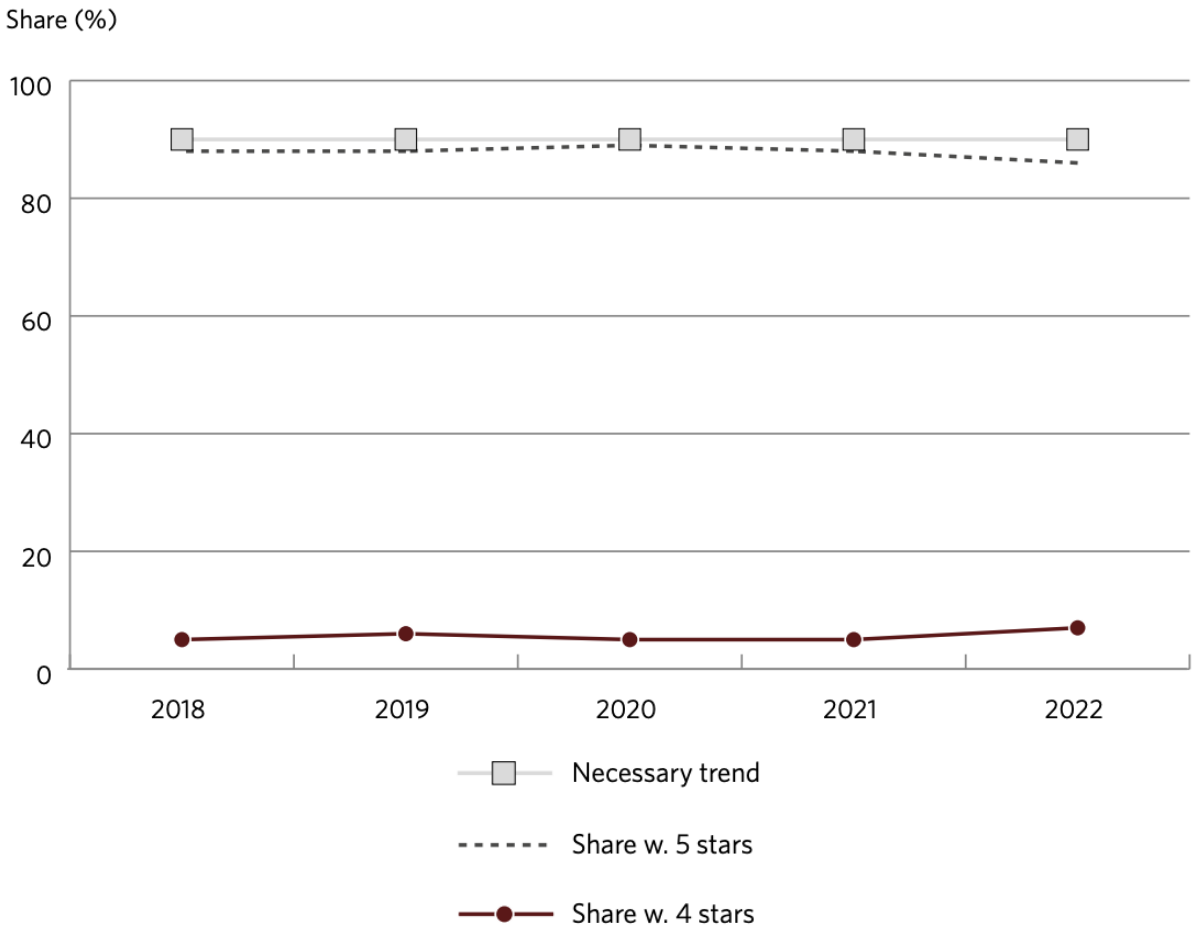
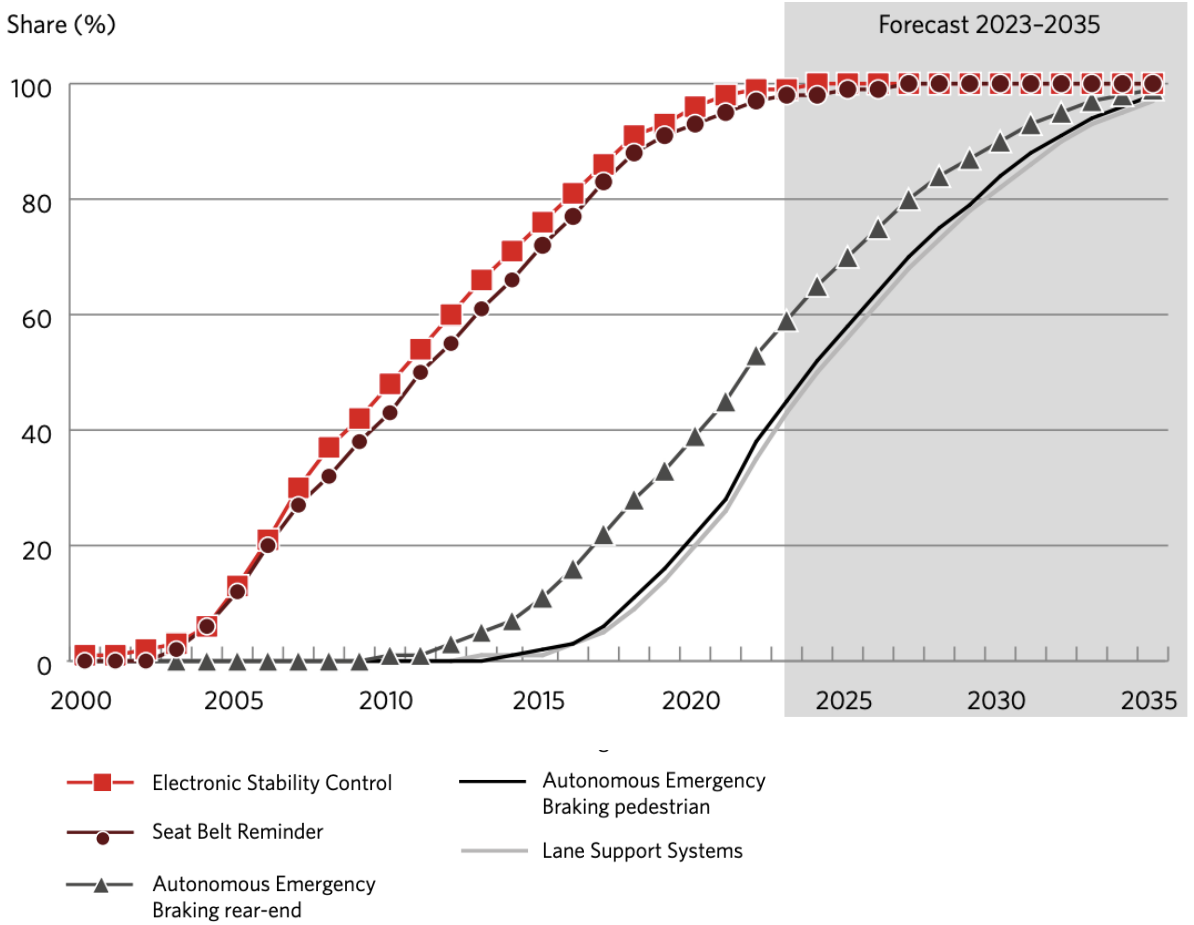
Performance Indicator for vehicles





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EXAMPLE: Swedish Performance Indicator framework

Use indicators

Indicator	Description	Starting point 2020	2022	Necessary level 2030
Compliance with speed limits, national road network	Share of traffic within speed limits	49 %	53,9 %	80 %
Compliance with speed limits, municipal road network	Share of traffic within speed limits	67 %	63 % (2021)	80 %
Sober drivers	Share of traffic volume with sober drivers	Ej fastställt	-	99,9 %
Seat belt use	Share of passenger car occupants observed using a seat belt	97,9 %	95,7 % (2021)	99,5 %
Helmet use, cyclists	Share of cyclists observed wearing a helmet	47 %	46 % (2021)	80 %
Helmet use, moped riders	Share of moped riders observed wearing a helmet	98 %	98 % (2021)	100 %

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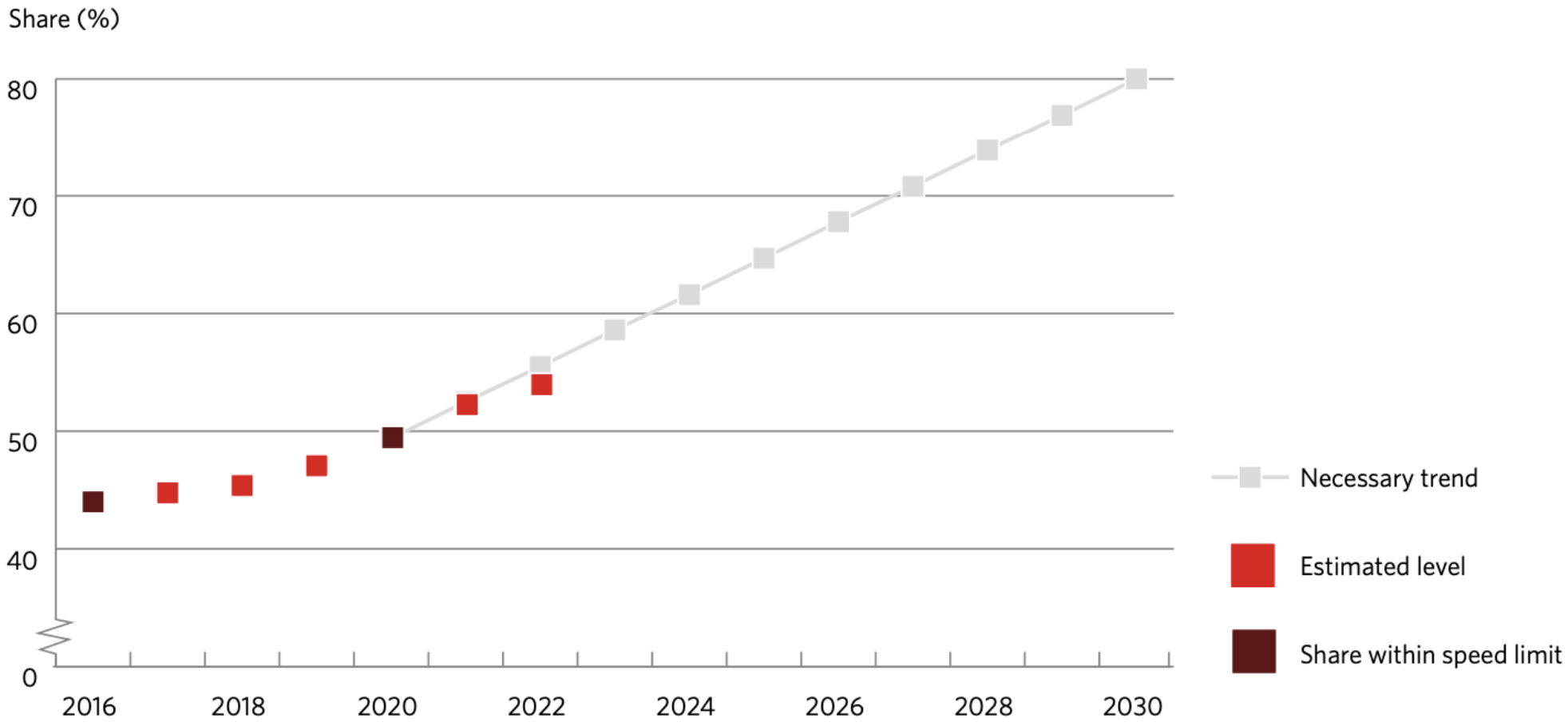
Performance indicator for speed



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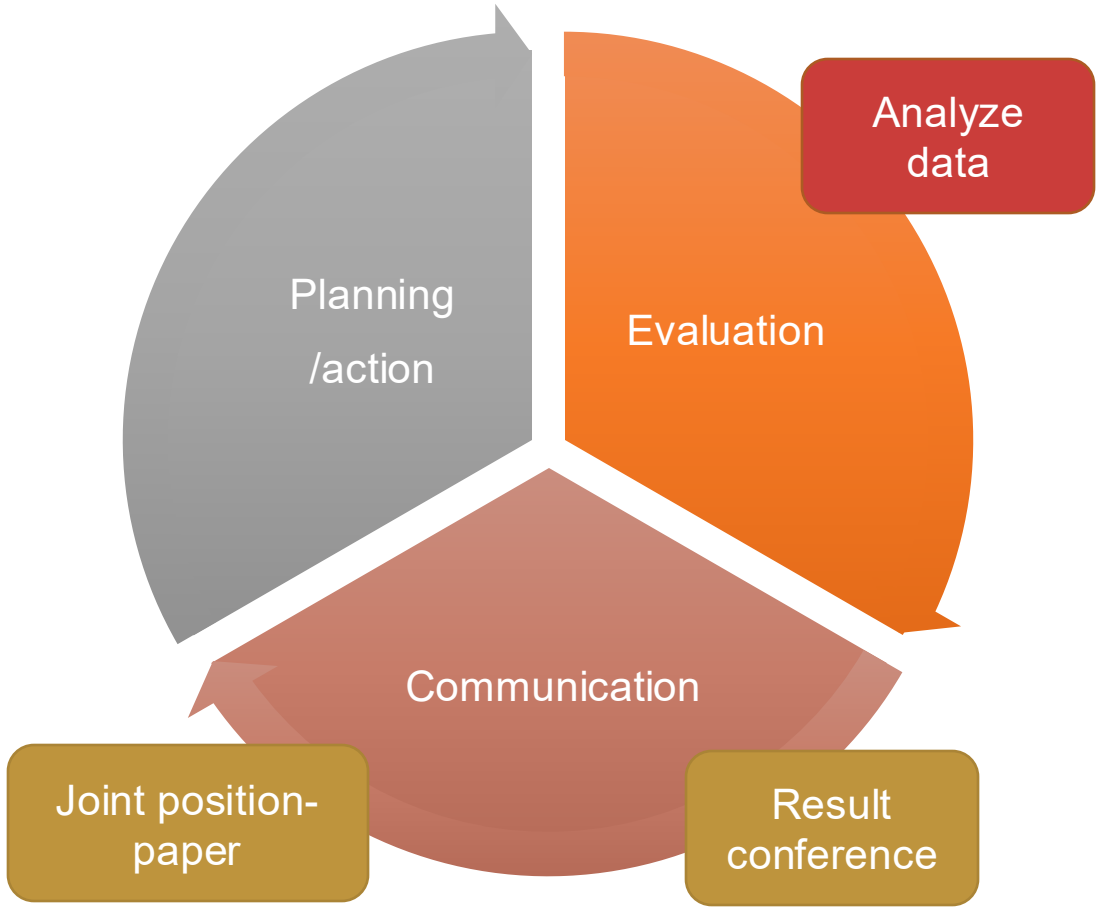
Annual result conferences



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Thanks!

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