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Conférence Européenne des Directeurs des Routes
Conference of European Directors of Roads

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WHITE WILLOW
TRANSPORT INTELLIGENCE

Royal HaskoningDHV
Enhancing Society Together

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Introduction

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Introductions: People and places

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Shubham Soni

Yanja Dajsuren

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Presentation Overview

- The SAFEPATH project
- Systems analysis
- Empirical research
- Safety analysis
- Practitioners' Guide to Safe Smart Highways
- Final report

1. The SAFEPATH Project

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Yanja Dajsuren

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SAFEPATH

Identify, consider and gain a greater understanding of existing procedures to ***increase capacity*** of highways within National Road Authorities (NRAs), ***without compromising safety.***

Phased approach
allows early ***'quick wins'*** to be ***fed back*** into the ***delivery process***

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SAFEPATH

Systems Analysis

Empirical Research

Safety Analysis

Practitioners' Guide

Reporting & Dissemination

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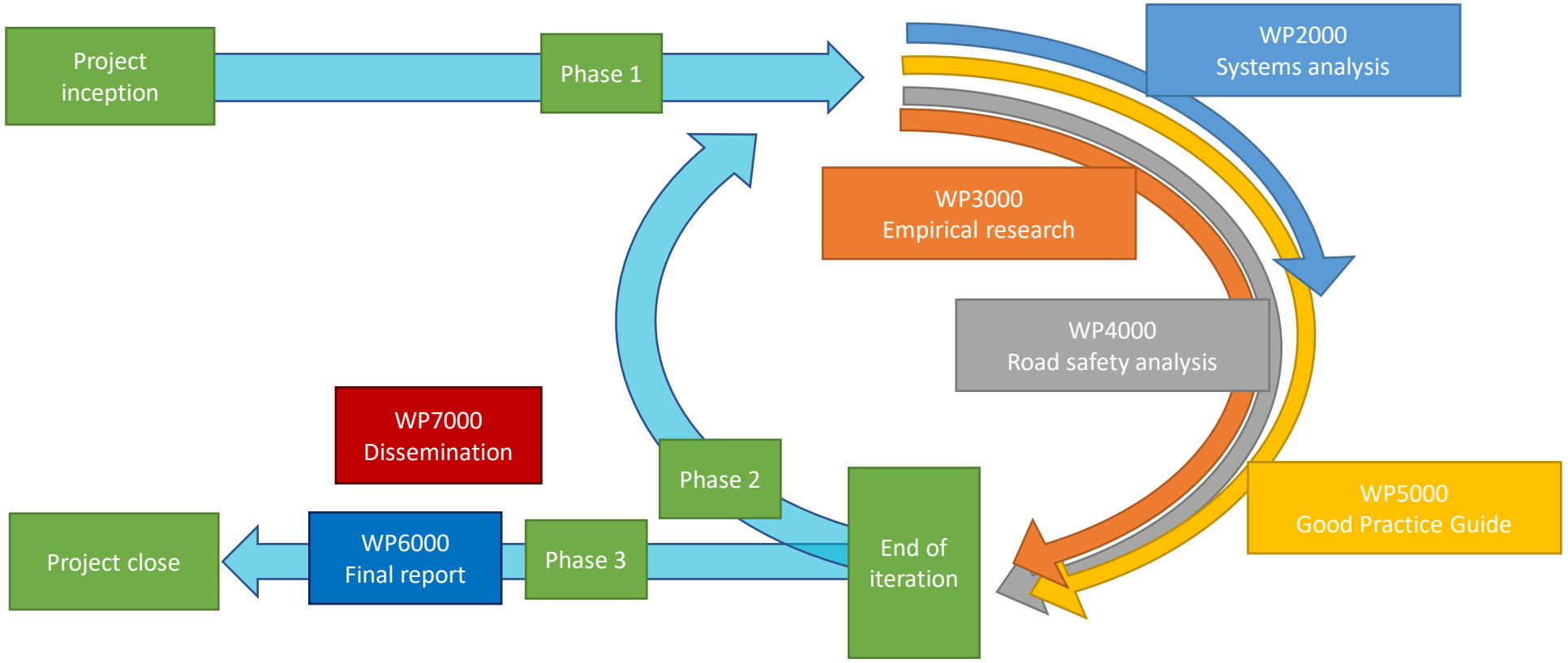
SAFEPATH phased approach



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2. Systems analysis

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Shubham Soni

Yanja Dajsuren

Systems analysis approach

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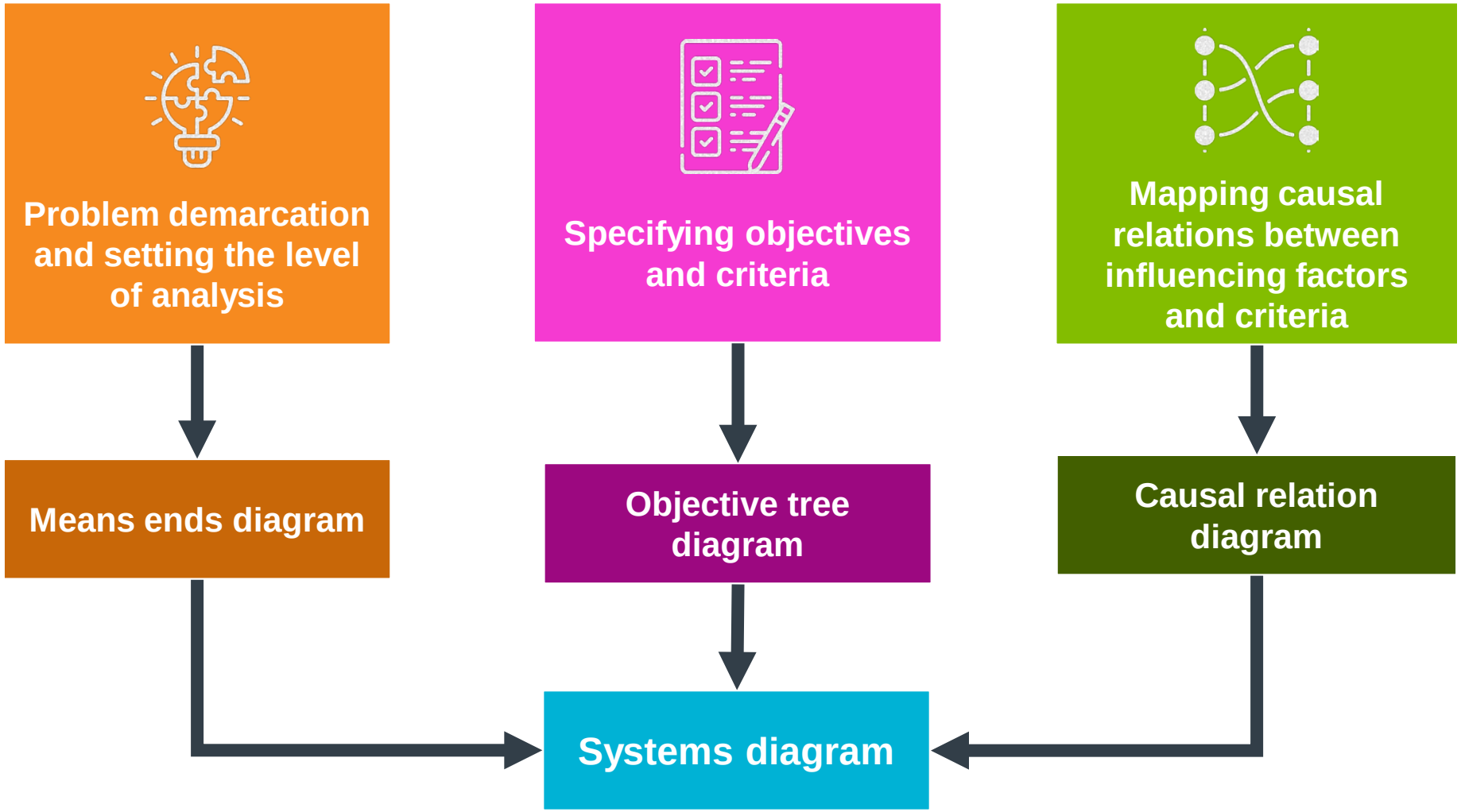
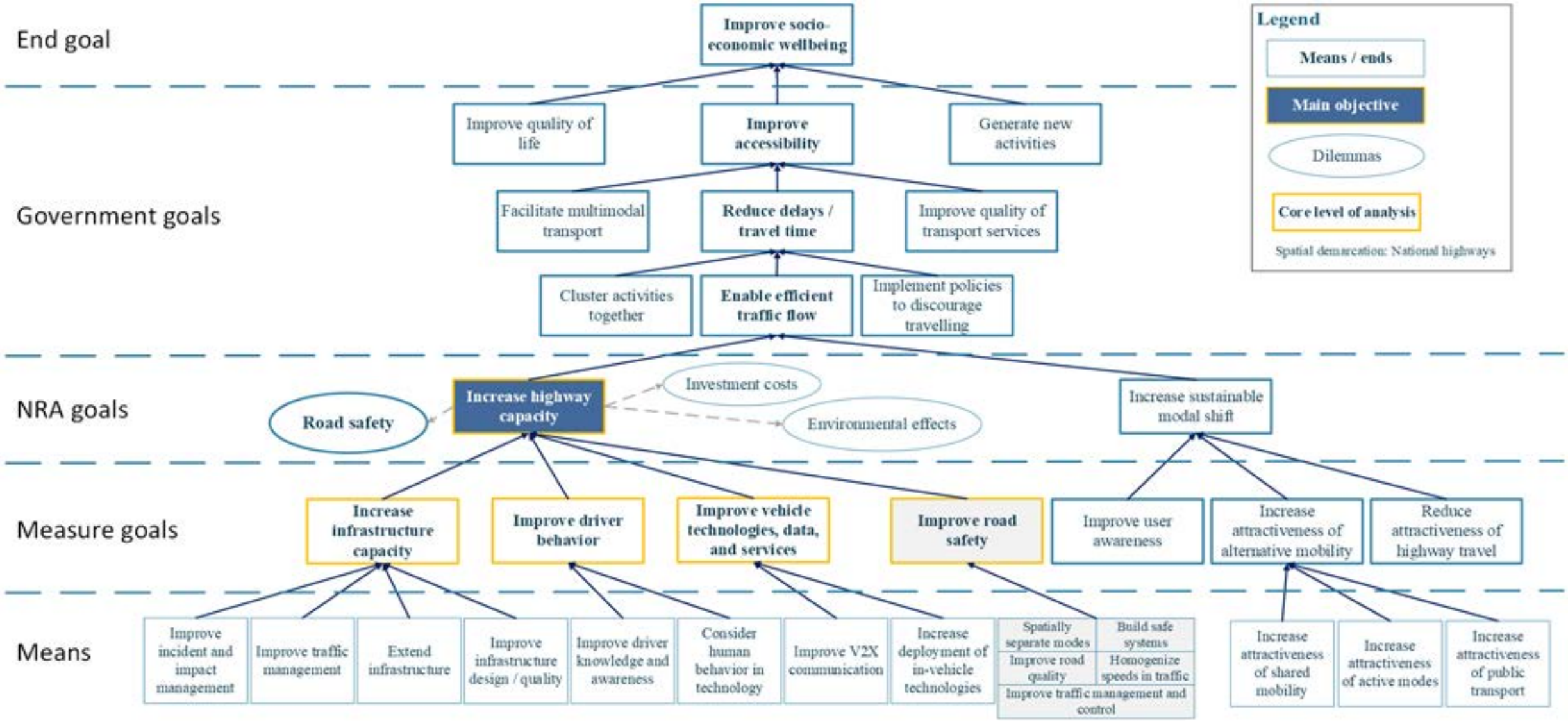
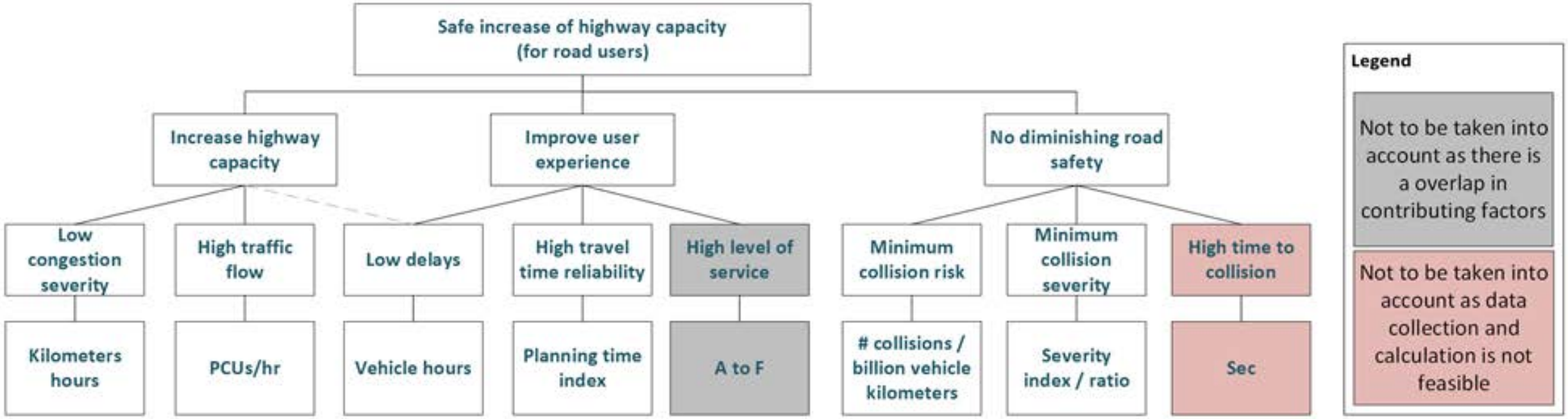
Systems analysis methodology



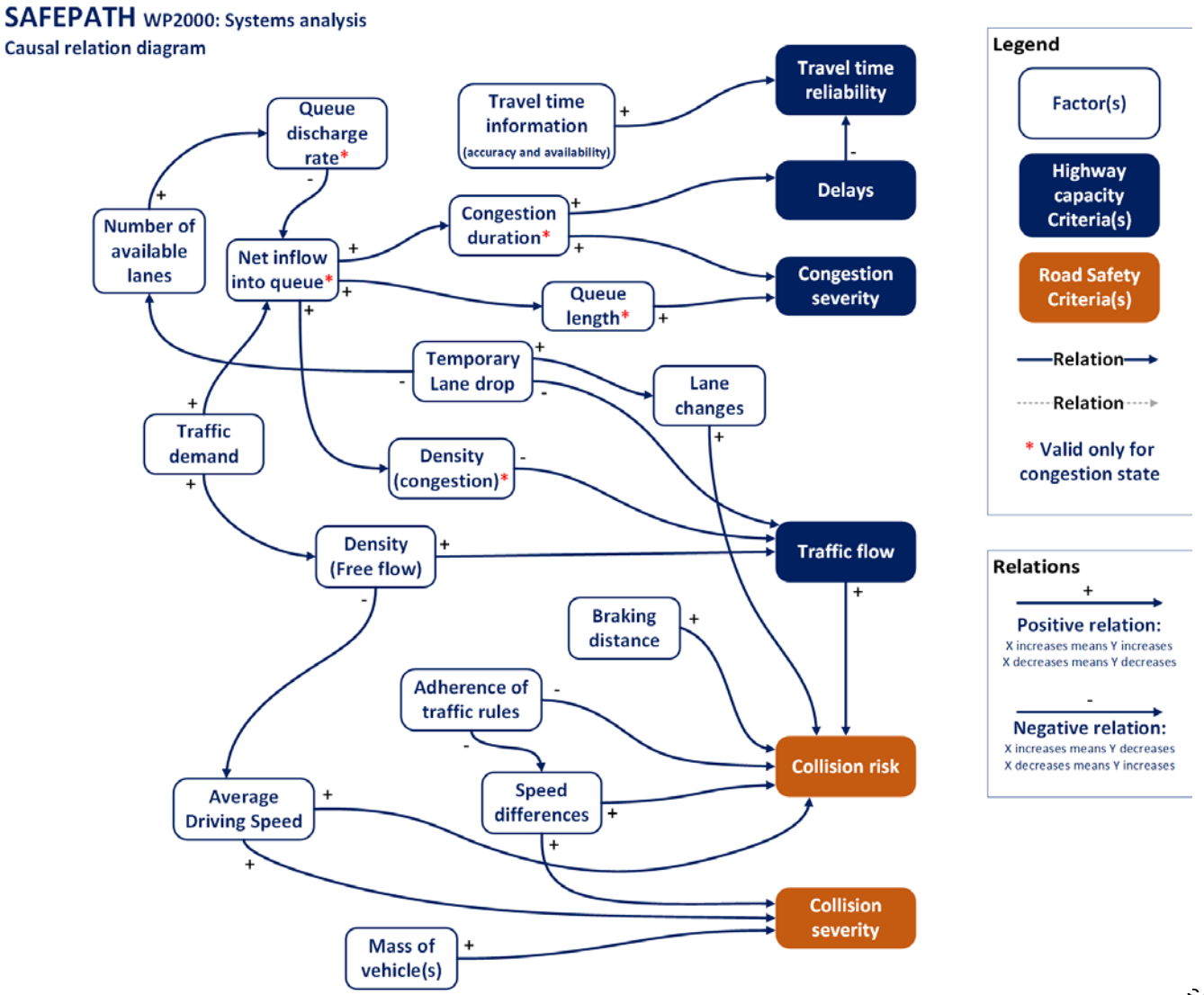
Step 1: Initial problem demarcation and setting the level of analysis



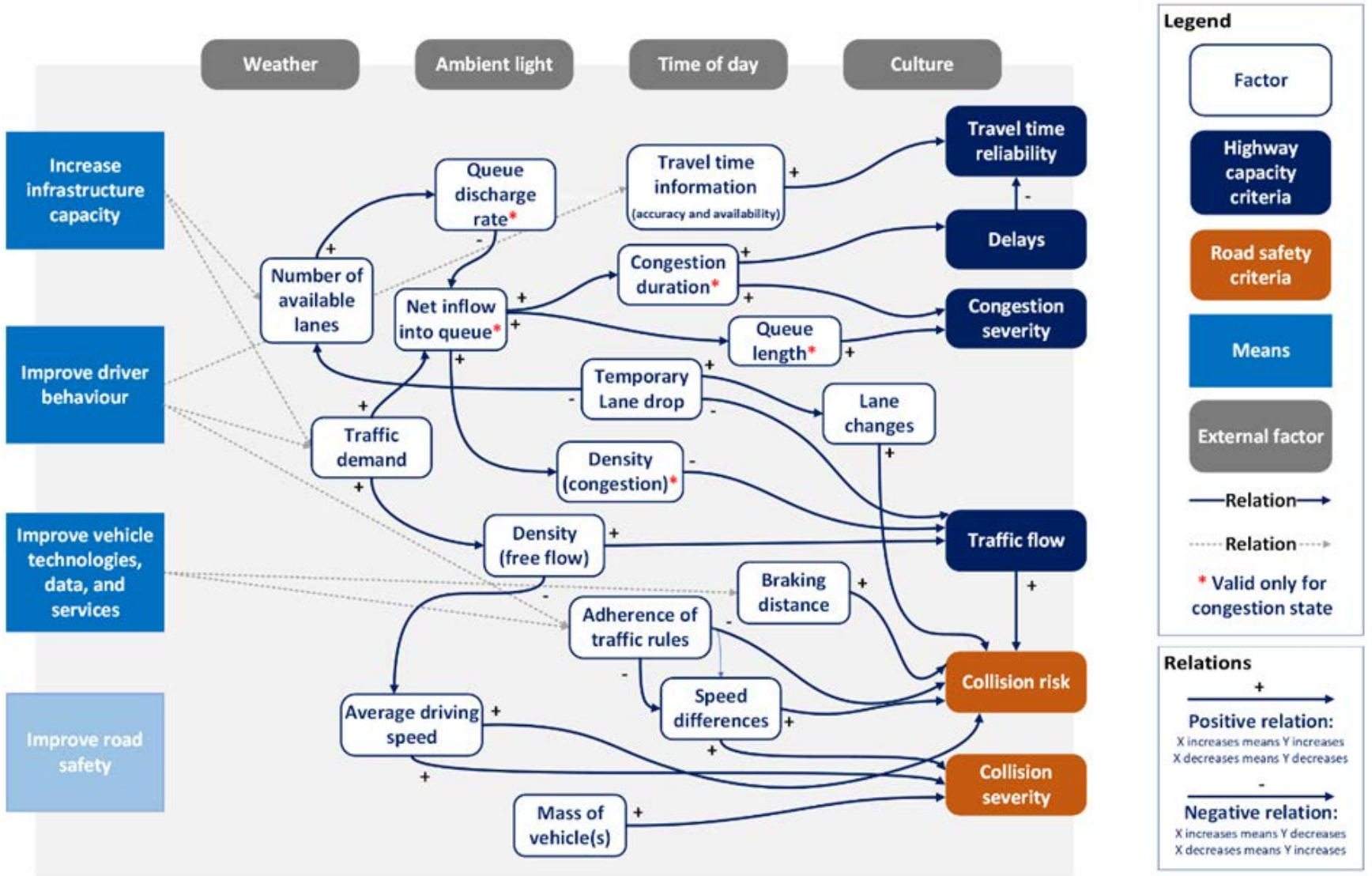
Step 2: Specifying objectives and criteria



Step 3: Mapping causal relations between factors and criteria



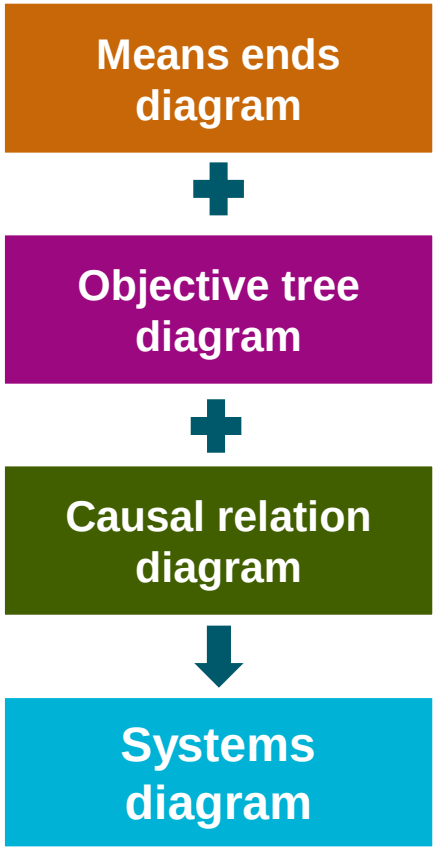
Step 4: Creating a systems diagram



There are four main elements in the systems diagram

1. Means
2. Criteria
3. External factors
4. Internal factors

Outcomes



Spectrum of the objectives and means from the strategic to the tactical level.

Identifies specific sub-objectives and criteria to define the main objective.

Various factors that influence the criteria identified in objective tree and the causal relationships between them.

Generated from all the findings from the first three steps along with findings on external factors to gain a full overview of the complete system.


Systems analysis outputs
Empirical research
Road safety analysis

3. Empirical research

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Shubham Soni

Yanja Dajsuren

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How can the highway capacity be increased without compromising traffic safety?

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Systems analysis output

Means of increasing highway capacity

Stakeholder engagement plan

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Systems analysis output

Means of increasing highway capacity

Stakeholder engagement plan

Extensive Literature review

Questionnaires

Brainstorming Workshops

Expert Interviews

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Systems analysis output

Means of increasing highway capacity

Stakeholder engagement plan

Extensive Literature review

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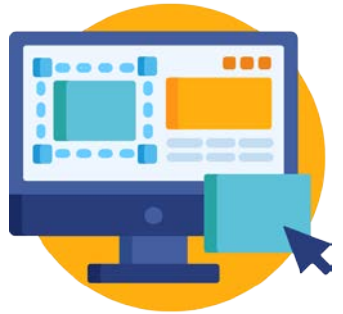

Collection of means and measures to increase highway capacity

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And making it accessible!

By building a online database of projects and measures which includes:

- Impact of measure on highway capacity and road safety
- Measure details and implementation method
- References to original documents / websites for more details
- Insights into challenges and public acceptance
- Insights into costs and effect on environment

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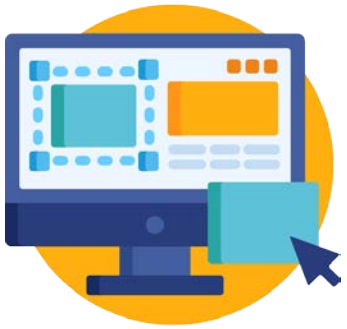
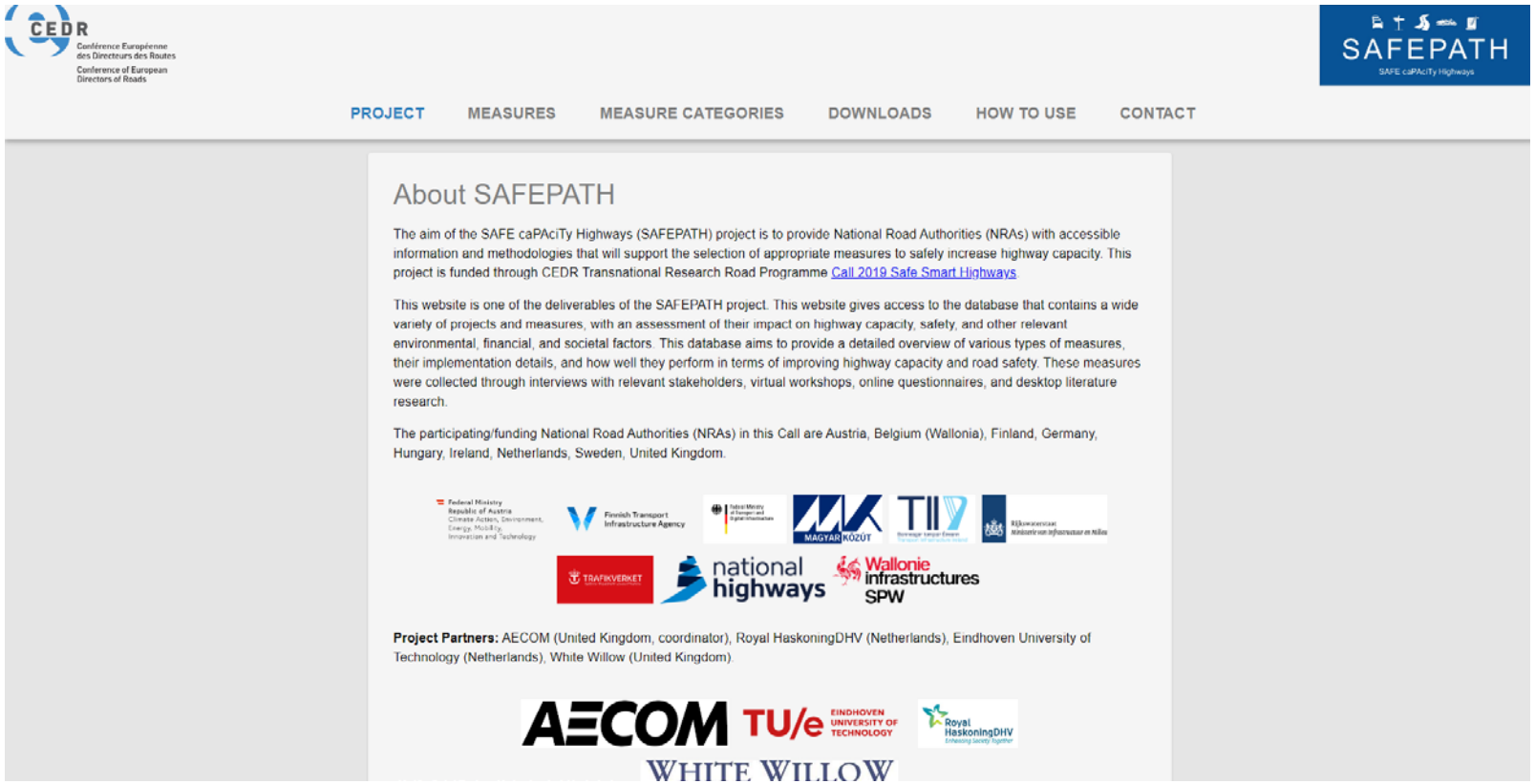


Online database: https://project-safepath.azurewebsites.net/



With 150+ measures

Easily Accessible

Comprehensive

Easy to use

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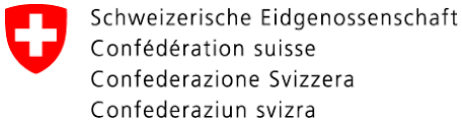
Contributions to the database by many stakeholders



4. Safety analysis

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Shubham Soni

Yanja Dajsuren

Aim and Objectives

Aim:

Investigate the safety aspects and ***provide safety insights*** to the NRAs, which will help guide them to suitable road safety solutions on highways.

Objectives:

- **Identify**, **analyse** and **compare** various safety KPIs, measures and their safety performance, pre- and post- implementation.
- **Report on road safety analysis** and solution performance and how primary collision types may be affected.

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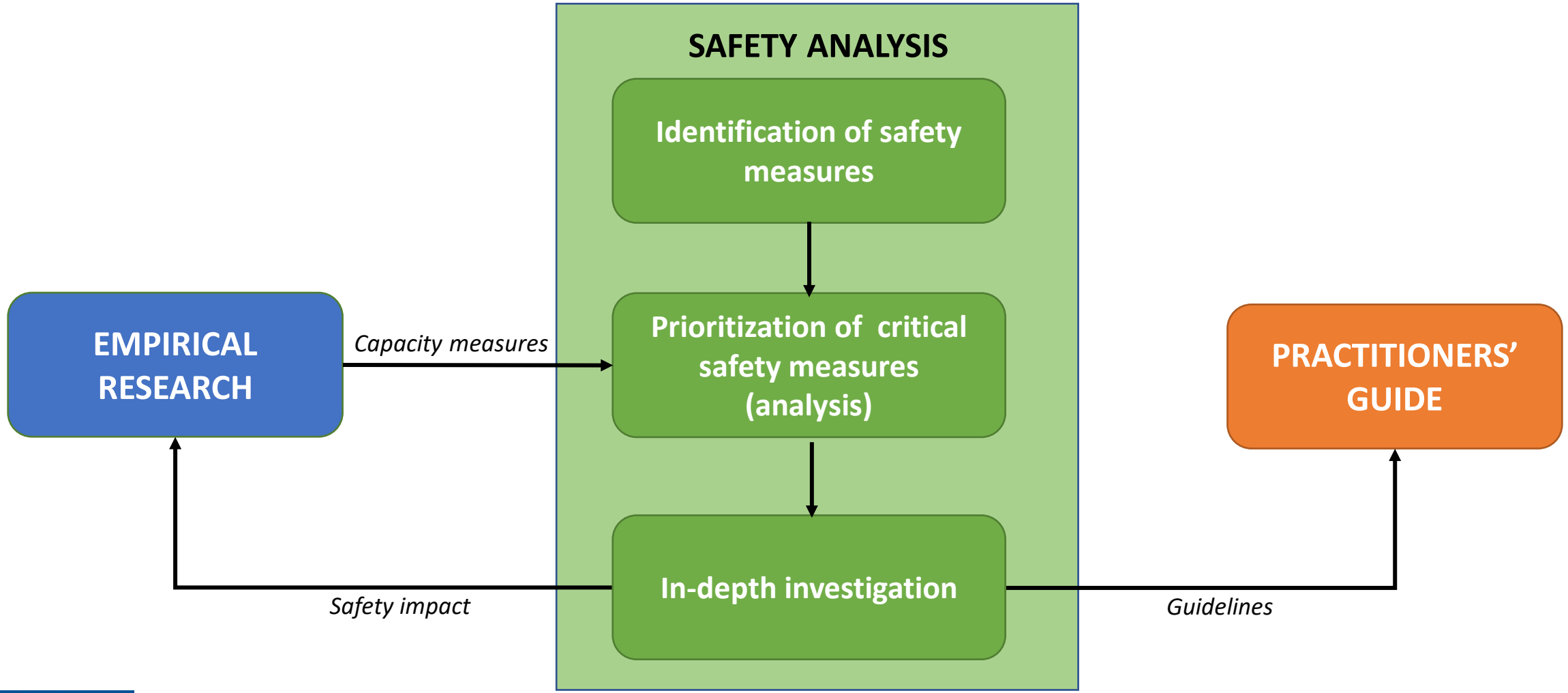
Safety Analysis Context



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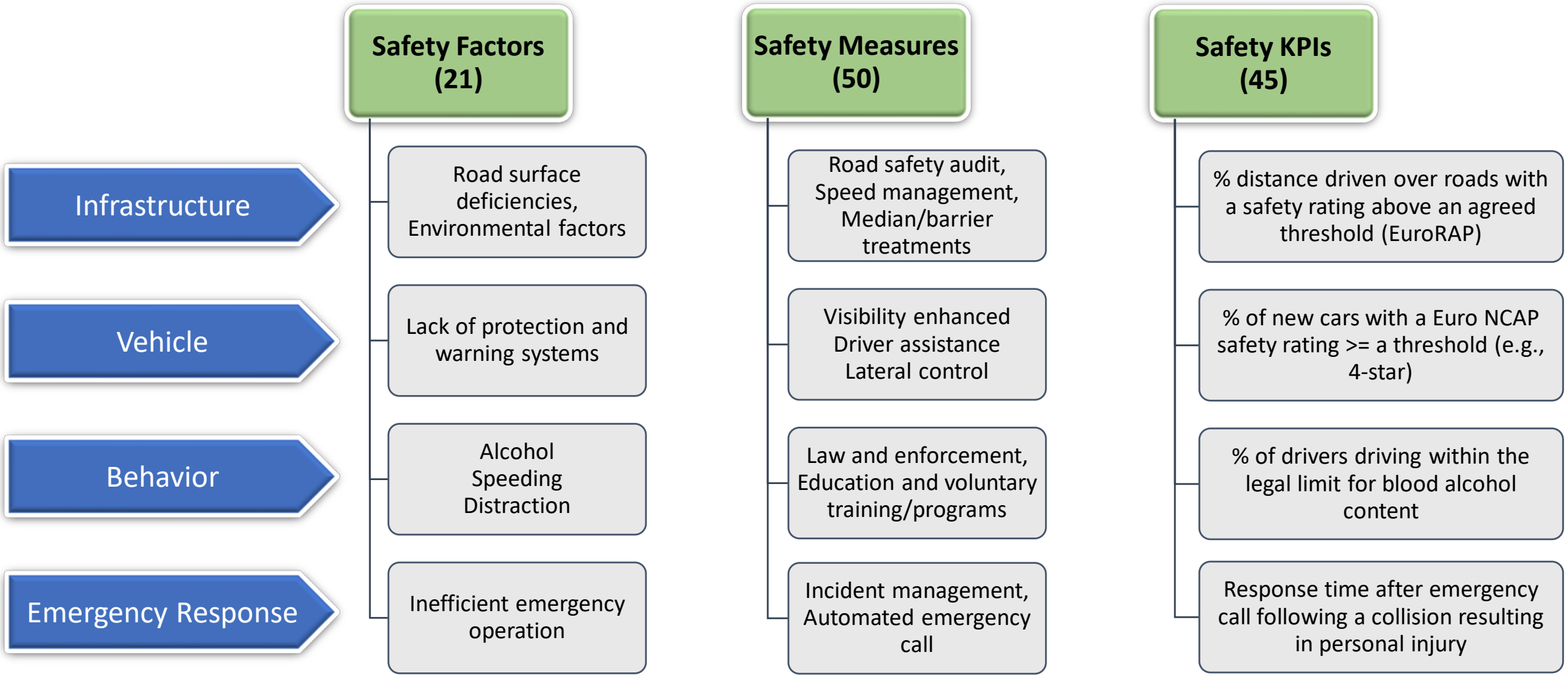
Vision Zero Compliant Safety Aspects



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Infrastructure Safety Measures

Physical infrastructure

- Road safety audit and inspection (RISM[*1])
- Speed cameras
- Shoulder & roadside treatments
- HGV traffic restrictions

Evidence

Pre-post analysis
Real time data & simulation data

Digital infrastructure

- Dynamic speed display signs
- Variable message signs (VMS)
- Signage installation and improvement
- Dynamic increase of lanes and section control
- e-call (Incident management)

Evidence

Pre-post analysis:
Modeling, simulation,
On-going pilots

Connected and Automated driving

- C-ITS services (Day 1, Day 1.5)
- V2I
  I2X (everything)
- e.g., road hazard warning, emergency warning

Traditional/current measures → Evolving measures

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Road infrastructure safety management – EU *Directive 2008/96/EC*

Safety Impact Analysis

- **SAFEPATH Impact Indicator Tool** (IIT) aims to support users on the analysis of safety impact of capacity measures.
- Developed using Microsoft Excel and can be used via running the file SAFEPATH-IIT.xlsx.

The tool:

- contains the **capacity measures** with an overview of their impact on highway safety, and other factors,
- enables easy access to the information collected during **road safety analysis** research.
- facilitates users by giving **indications** on safety impact of the capacity measures.

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Impact of Capacity Measures on Risk Factors

Capacity measure / Risk factor	Regulations for Incident and Impact Management	Cloud data management	V2V communication	Speed Cameras	Speeding Intervention Matrix	Driver motivation	Dynamic Speed Display Signs	Dynamic speed limits (DSLs)	Variable Speed Limits (VSL)	Data for Traffic Management	Pro-Active Incident Management	Appropriate Speed saves All People	Road work: Speed management	Guidelines on Roadworks Safety	Accident prediction and analysis	Traffic signaling	Spee enfor
Traffic flow	increase		increase	increase	increase		increase	increase	increase		increase	increase	increase	increase	increase	increase	inc
Lane changes			decrease			decrease											
Braking distance			decrease									decrease	decrease				
Speed differences			decrease	decrease			decrease	decrease	decrease			decrease	decrease			decrease	
Average driving speed				decrease	decrease				decrease			decrease	decrease			decrease	
Adherence of traffic rules			increase	increase	increase	increase	increase	increase	increase			increase	increase			increase	inc
Road Surface - Inadequate Friction																	
Risk due to Workzone length														increase			
Alignment deficiencies - Low Curve																	
Cross-section deficiencies - Number of Lanes																	
Shoulder and roadside deficiencies - Absence of paved shoulders / Narrow Shoulders																	
Inadequate visibility - Risks resulting from the blind spot issue																	
Poor Visibility – Darkness (cars only)			decrease														
Inadequate post-crash services	decrease	decrease									decrease				decrease		
Passenger car – injury mechanism - risk of injury																	
Large mass of vehicle(s)																	

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Impact of Capacity Measures on Risk Factors

A	B	C	D
Capacity measures	*Potential collision risk*	*Possible collision severity*	*Safety performance*
Variable Speed Limits (VSL)	Decreased	Decreased	Probably effective
Traffic information	Decreased		Probably effective
Speed Cameras	Decreased	Decreased	Probably effective
Dynamic Speed Display Signs	Decreased	Decreased	Probably effective
Truck platooning	Unclear	Unclear	Unclear
Green Light Optimized Speed Advisory (GLOSA)	Unclear	Unclear	Unclear
Emergency services warning	Decreased	Decreased	Probably effective
Emergency cut through barrier	Decreased	Decreased	Probably effective

SAFEPATH-IIT Tutorial | UserInput | SafetyImpactResults | ImpactOfCMsOnRiskFactors

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In-depth Investigation

Measure type: Road infrastructure safety management (RISM)

- Road safety impact assessment (RIA)
- Road safety audit (RSA)
- Road safety inspection (RSI)
- High risk sites (HRS)
- Road assessment Program (RAP)
- In-depth accident analysis

Support road authorities in prevention and mitigation of road accidents.

Quantitative, systematic process for studying roadway crashes and characteristics (AASHTO, 2010).

Benefits:

- HRS results in 18% reduction in casualties
- Regular use of RAP shown reduction of accidents in high-risk sites (Spain, Britain, and Sweden)

Example

- Country: Poland
- Method: pre-post implementation
- Results:
  - road safety impact assessment: 10 – 25%
  - road safety audit: 5 – 20%
  - infrastructure inspection: 1 – 20%.

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Ref: Management of road infrastructure safety, Luca Persia et al., 6th Transport Research Arena April 18-21, 2016
https://www.itf-oecd.org/irtad-members

Commentary on Critical Safety Measures

Road infrastructure safety management (RISM)

Main barriers to the implementation

- Lack of resources/tools
- Absence of recommendations
- No regulation
- Data not available

Recommendations to NRAs:

- Road safety data must be gathered, collated and analyzed (e.g., Crash Analysis System (CAS), KiwiRAP and SafetyNET, by the New Zealand Transport Agency)
- Legislation to conform to good practice based on sound evidence of effectiveness – EU 2008/96/EC
- Road safety training courses - The Netherlands, Belgium and USA
- Clear and comprehensive guidelines for conducting Road safety audits and inspections – UK and Ireland

Ref: Management of road infrastructure safety, Luca Persia et al., 6th Transport Research Arena April 18-21, 2016
https://www.itf-oecd.org/irtad-members

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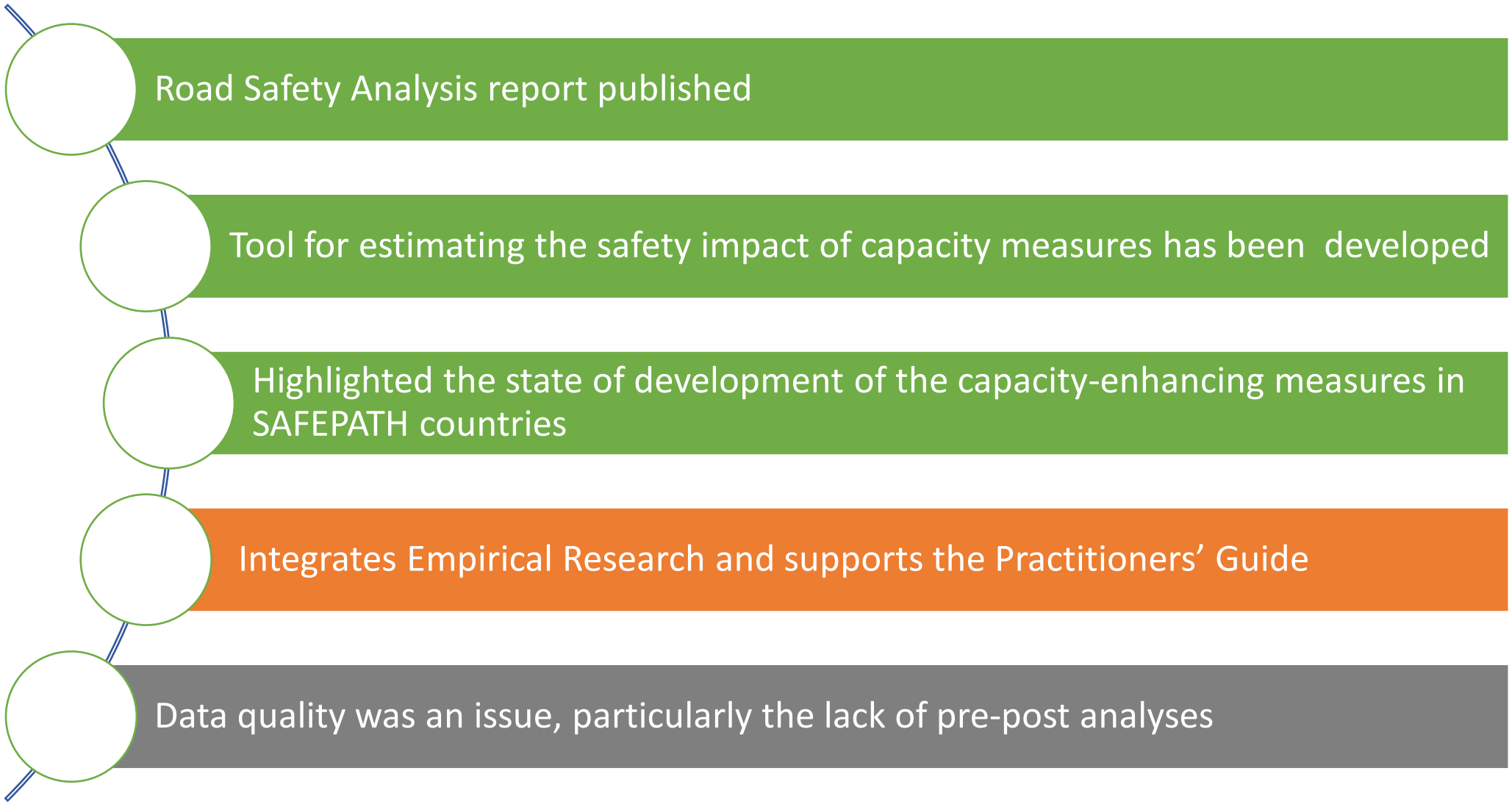
Summary of Safety Analysis



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5. Practitioners' Guide to Safe Smart Highways

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Shubham Soni

Yanja Dajsuren

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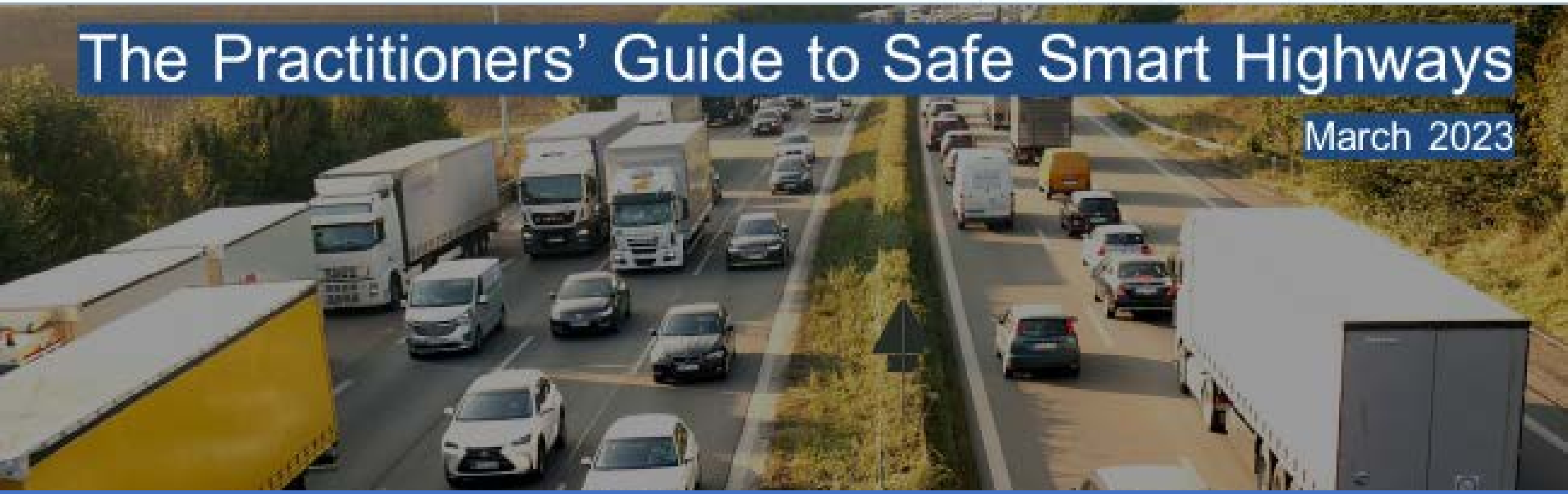
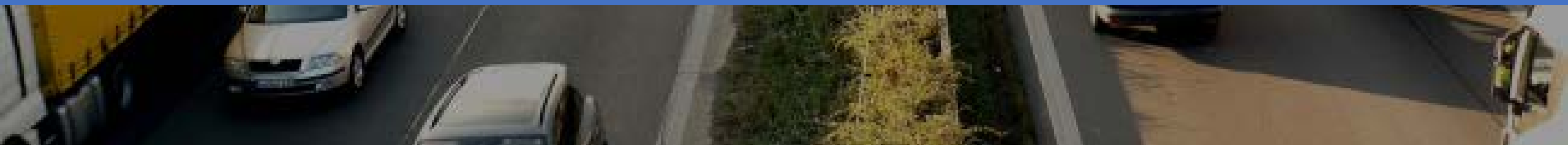
Introduction | Option | ...to increase basic capacity | ...to increase up-time | ...to increase compliance | Evidence and key resources | Contacts

The Practitioners' Guide to Safe Smart Highways

March 2023



1. Practitioners' Guide to Safe Smart Highways



Practitioners' Guide

Principles:

- *Meet DoRN requirements*
- *Meet stakeholder needs*
- *Based on evidence*

Other considerations:

- *Expecting primarily digital access*
- *Not expected to be read cover to cover*
- *Considers things NRAs can control*
- *Make guide practical for it to be useful*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SAFEPATH
Introduction
Option
...to increase
...to increase
...to increase
Evidence and
Contacts
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Evidenc
SAFE caPAciTy Highways
...to increase basic capacity
...to increase up-time
...to increase compliance
Evidence and key resources
Contacts

Practitioners' Guide

Guide takes the form of a slide deck, downloadable from the website:

https://project-safepath.azurewebsites.net/

- *Preliminary material*
  - *Foreword and introduction*
  - *How to use the Guide*
  - *What is your objective? (i.e. identify priorities)*
  - *Summary of units used*
- *Implementation Checklist*
- *Tables summarising all options*
- *Options to increase basic capacity*
- *Options to increase Up-time*
- *Options to increase road user compliance*
- *Evidence and key resources*

6. Final report


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Andy Graham


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Shubham Soni


Yanja Dajsuren

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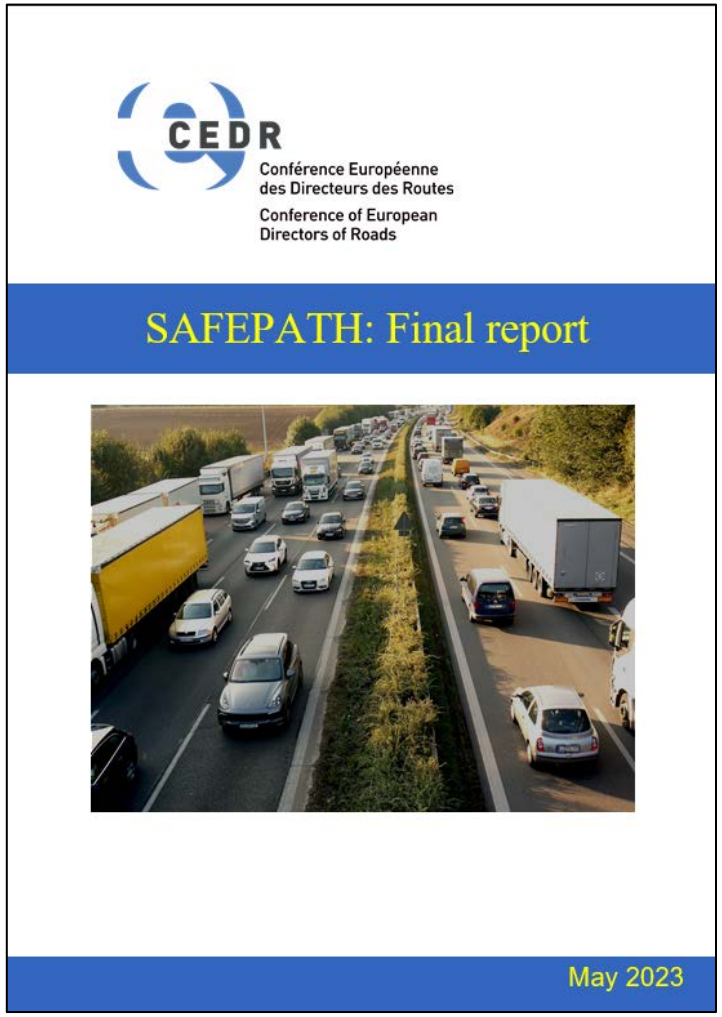
Format / structure



Executive summary

1. Definition of the issue
   - 1.1. Scope of the project
   - 1.2. Methodology of the project
2. Review of the project
   - 2.1. Project outcomes compared to original objectives
   - 2.2. Project actions
   - 2.3. Uptake of project outputs
   - 2.4. Summaries of work packages
   - 2.5. Impact analysis
   - 2.6. How the research is applicable now and in the future
   - 2.7. Recommended future work
     - 2.7.1. Further dissemination of the Guide
     - 2.7.2. Remaining knowledge gaps
3. Conclusions – including lessons learned

Add CEDR website reference for source of report

Knowledge sharing journey and legacy

- High ambition to engage end-users for knowledge-gathering
- But it was difficult!
- Very little knowledge received at first…
- …which only highlighted the need!

- SAFEPATH worked hard to build engagement momentum.
- Dissemination workshops – strong interest
- The Practitioners' Guide, website, and SAFEPATH-IIT provide a strong legacy.

Top lessons learned

What went well:

- ✓Agile approach worked well
- ✓Great project team communication
- ✓Adapted to personnel change
- ✓Always focused on objectives
- ✓Constructive feedback
- ✓Sharing interim Guide at 12 months
- ✓Use of contingency
- ✓Enthusiasm!
- ✓Advisory group was valuable

What could be better:

- ✓Better familiarisation with stakeholders
- ✓Broader NRA input (UK-NL-DE focused)
- ✓Clear definitions (e.g. model)
- ✓Face to Face meeting at the start
- ✓Chat instead of email
- ✓Slow access to contingency fund
- ✓Include end-of-project event in scope

7. Dissemination

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Shubham Soni

Yanja Dajsuren

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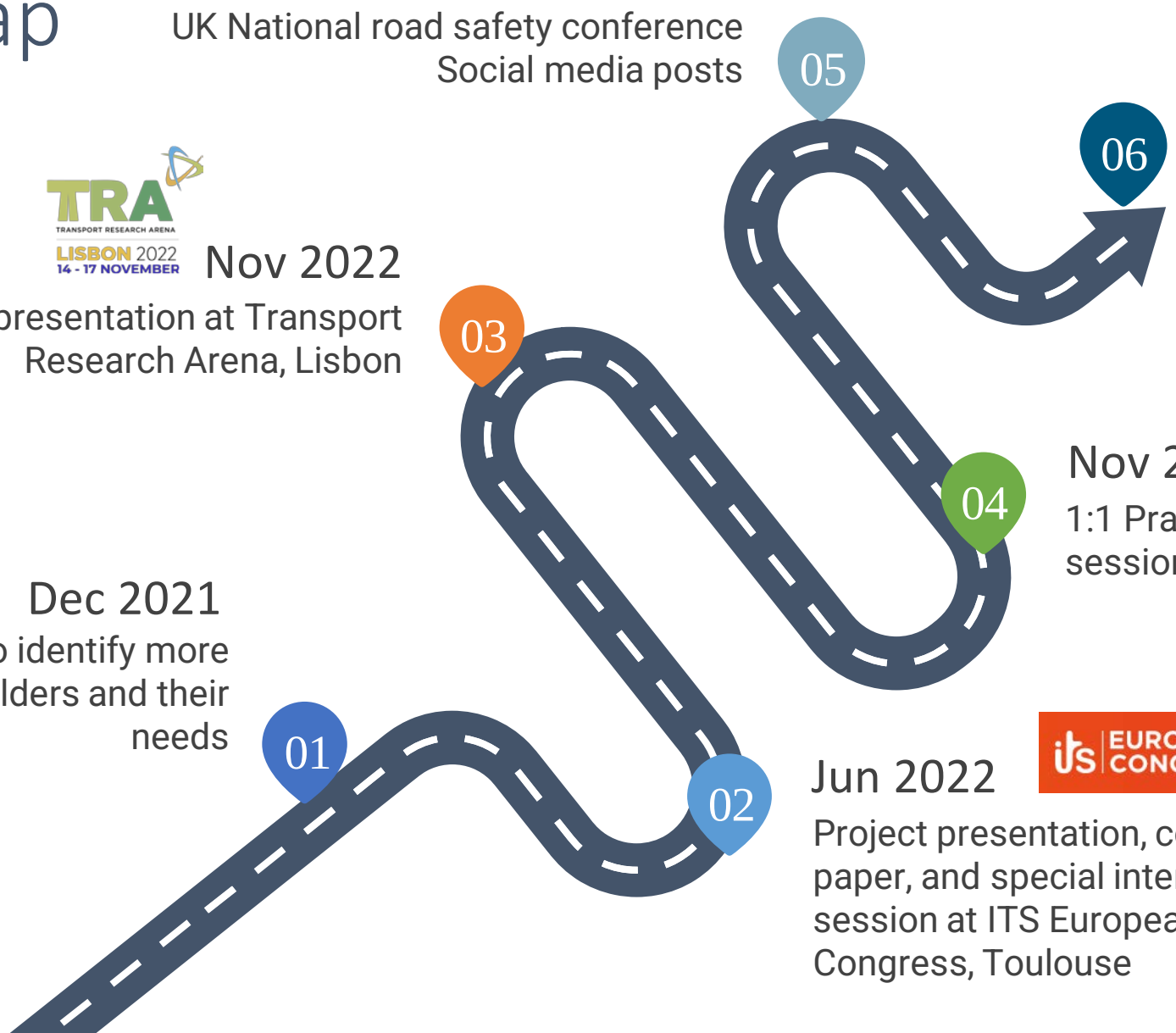
Dissemination Roadmap



01

Dec 2021

LinkedIn survey to identify more possible stakeholders and their needs

02

Jun 2022

Project presentation, conference paper, and special interest session at ITS European Congress, Toulouse

03

Nov 2022

Poster presentation at Transport Research Arena, Lisbon

04

Nov 2022

1:1 Practitioners' Guide session with National Highways

05

Nov 2022

UK National road safety conference
Social media posts

06

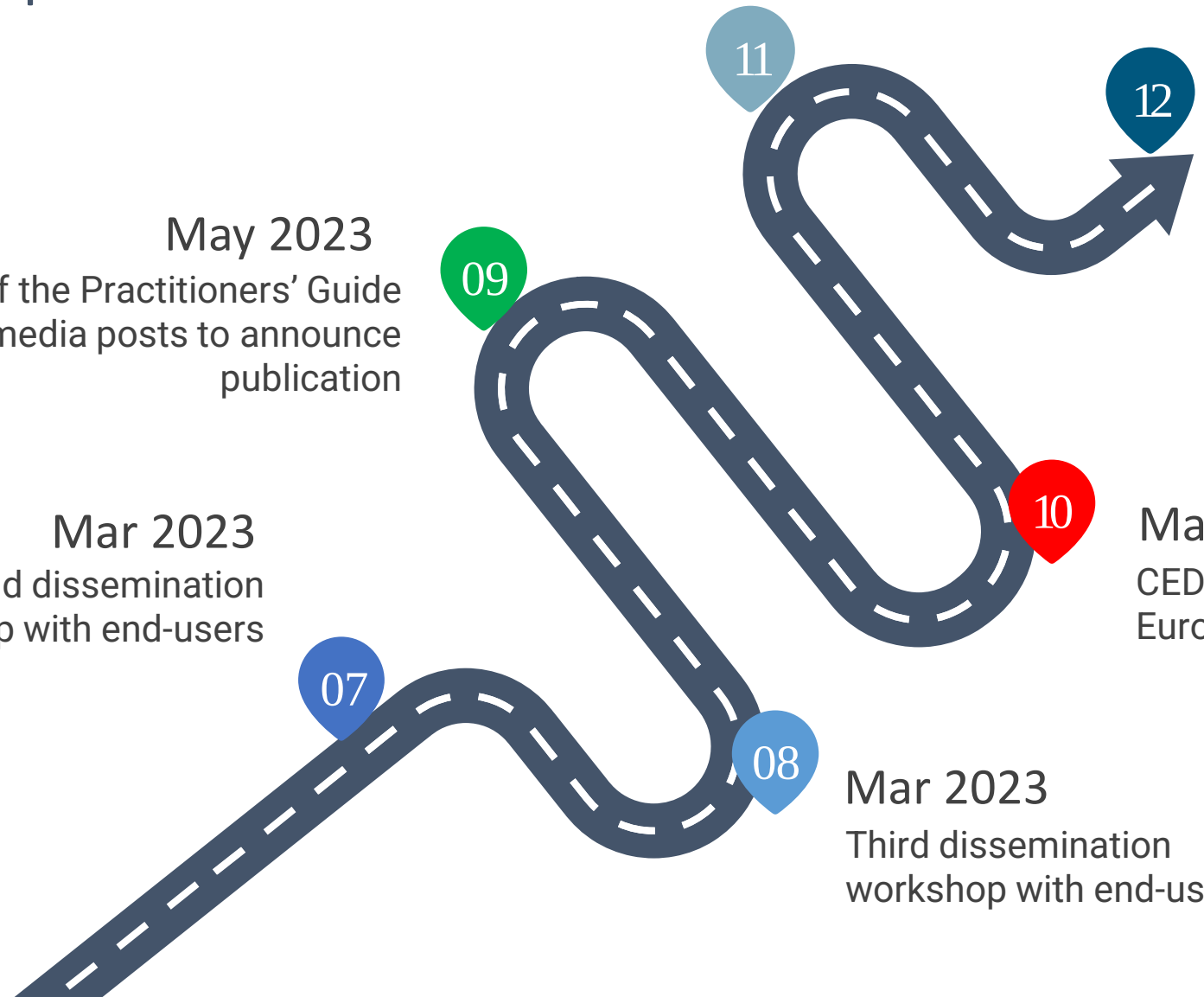
Mar 2023

First dissemination workshop with end-users

Dissemination Roadmap

May 2023

CEDR Conference, Namur, Belgium



Jul 2024

Transport Research Arena, Dublin

May 2023

Publication of the Practitioners' Guide
Social media posts to announce publication

May 2023

CEDR stand content for European ITS Congress, Lisbon

Mar 2023

Second dissemination workshop with end-users

Mar 2023

Third dissemination workshop with end-users

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9. Advisory Group

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Shubham Soni

Yanja Dajsuren

8. Advisory Group - Success

Dank u wel !

Thank You !

Danke

Merci !

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Advisory Group

Contribution

- Reality check
- Steve's Golden Rules
- Good contributions
- Wide perspective
  - Sector
  - Interest
  - Geographic
  - Diversity of group

Support

- Influential @ ITS Congress 2022
- Practitioners' Guide context
- Dissemination

- Met 4 times
- A model we will continue….

An independent view – not contractual control but "have you thought about…"

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9. Final thoughts

Dave Cowell

Scott Stephenson

Andy Graham

Shubham Bhusari

Shubham Soni

Yanja Dajsuren

Final thoughts…

We have prepared:

- Wide range of tools / measures
- Some measures not so clear
- Lots of ideas in the Guide
- The Guide is easily accessible

We have shown:

- You can increase capacity without building roads
- Capacity is over the year, not just an hour

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Questions

- What is your next steps to increase capacity on your roads?
- What do you need to know to take this step?

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Day 1 - Close

DINNER – “**L’ESPIÈGLERIE**”, RUE DES TANNERIES 13, 5000 NAMUR
@19:00

DAY 2 – START @ 9:00AM / WORKSHOP