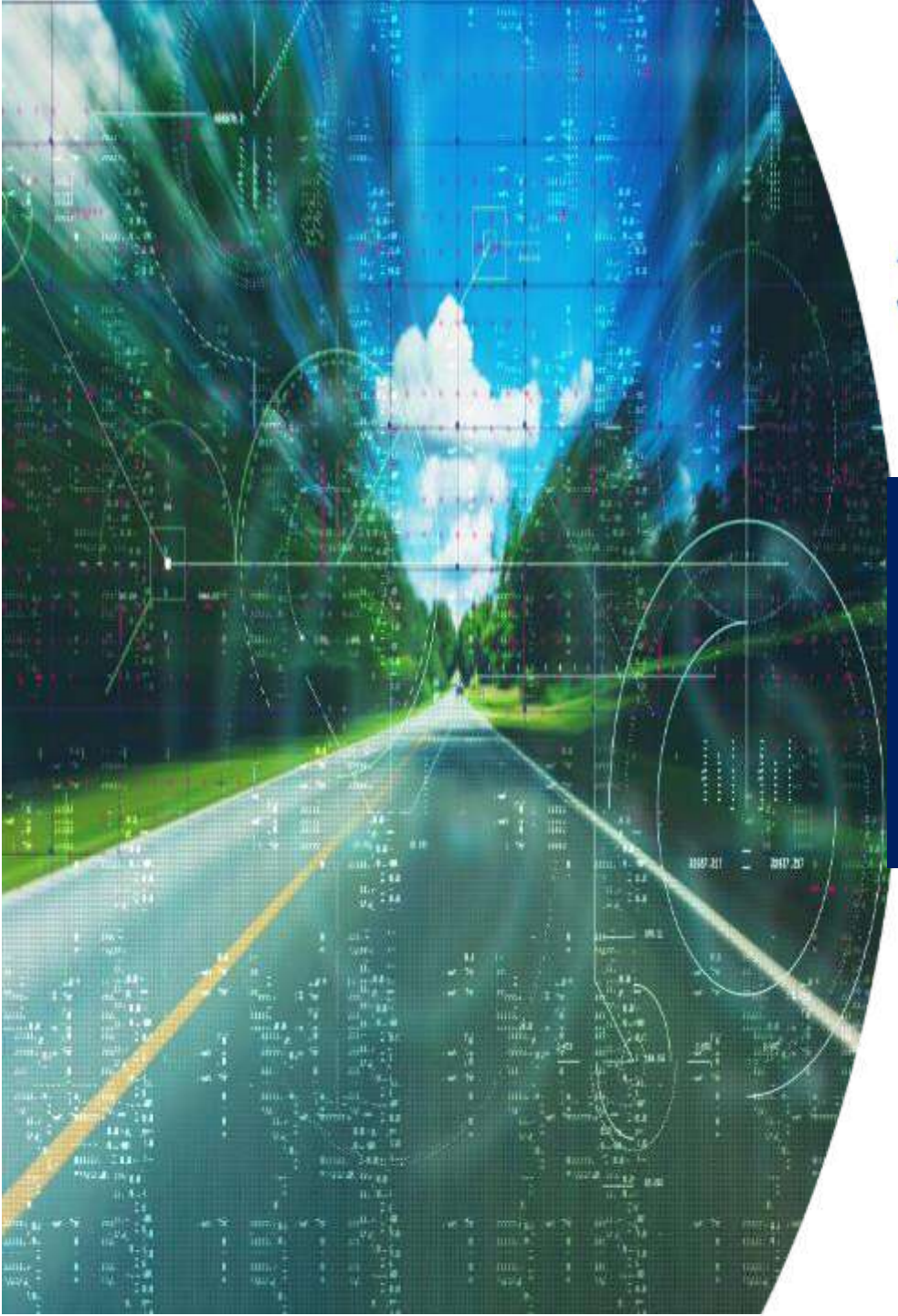

CEDR WG Road Safety

Network-wide Road Safety Assessment (Article 5) of RISM II

March 3, 2022

Study on a Methodology for Network-wide Road Safety Assessment

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Outline

1. RISM Study
2. In-built safety assessment methodology
3. Accident occurrence methodology
4. Integrated methodology
5. Next steps

Study on a Methodology for Network-wide Road Assessment

In response to call for tenders: N° MOVE/C2/SER/2019-547

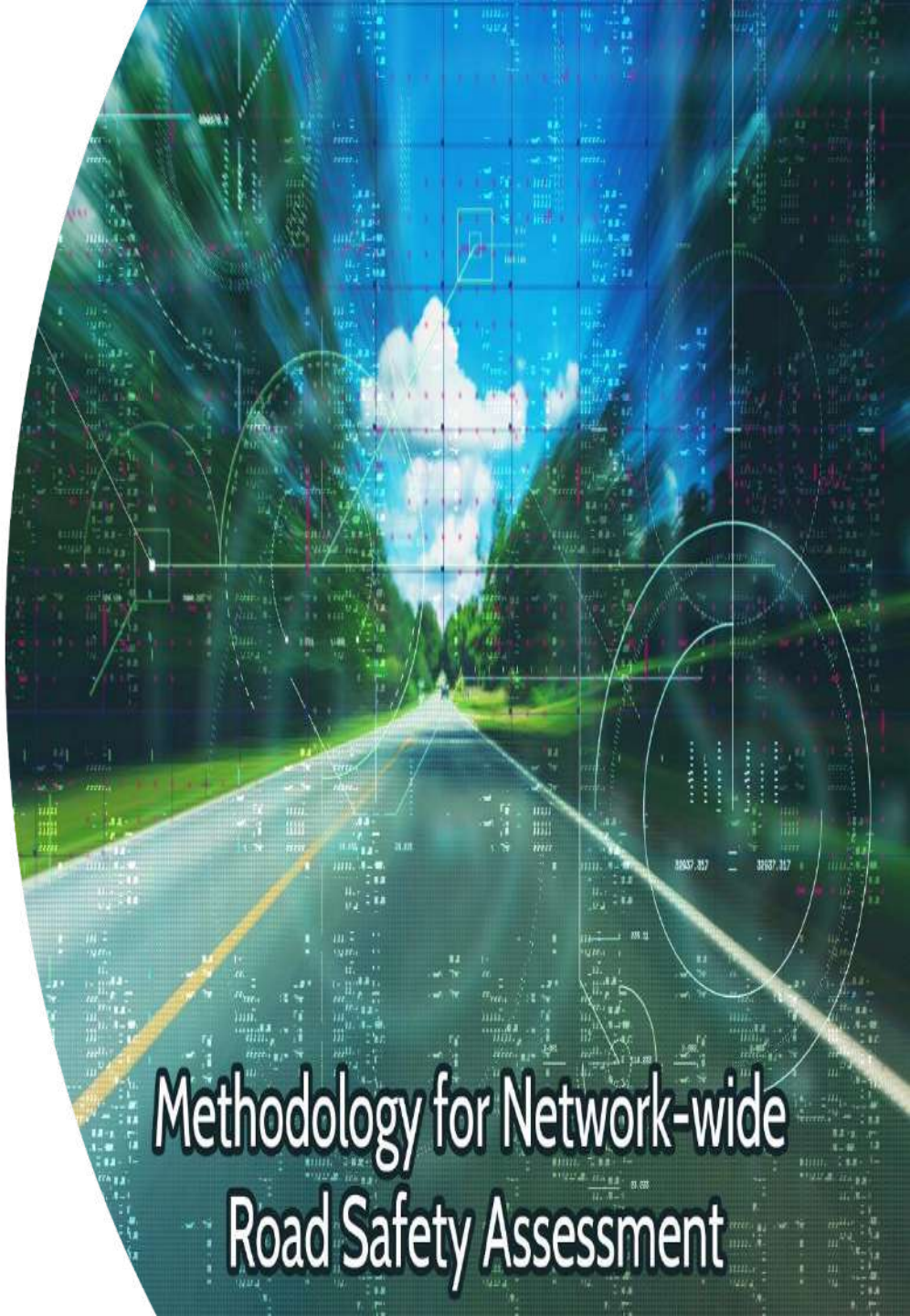
Project team

National Technical University of Athens (NTUA), Greece

University of Zagreb Faculty of Transport and Traffic Sciences (FPZ), Croatia

FRED Engineering s.r.l. (FRED), Italy

Project duration: September 2020-August 2023



2. In-built safety assessment methodology

Developing a methodology for the in-built safety assessment of roads

- Identification of appropriate road characteristics, i.e., a set of parameters, that affect network-level safety, for example:
  - barrier presence and safe roadside are important.
  - the presence of an uncovered barrier end does not affect network-level safety, although it's important for the specific site.
- Identification of a scientifically sound relationship between the set of parameters and safety outcomes.
- Achieve a balance between accuracy and level of detail, without being overly data-intensive and costly to use.
- Consider the needs of Member States (e.g., data availability, design standards).

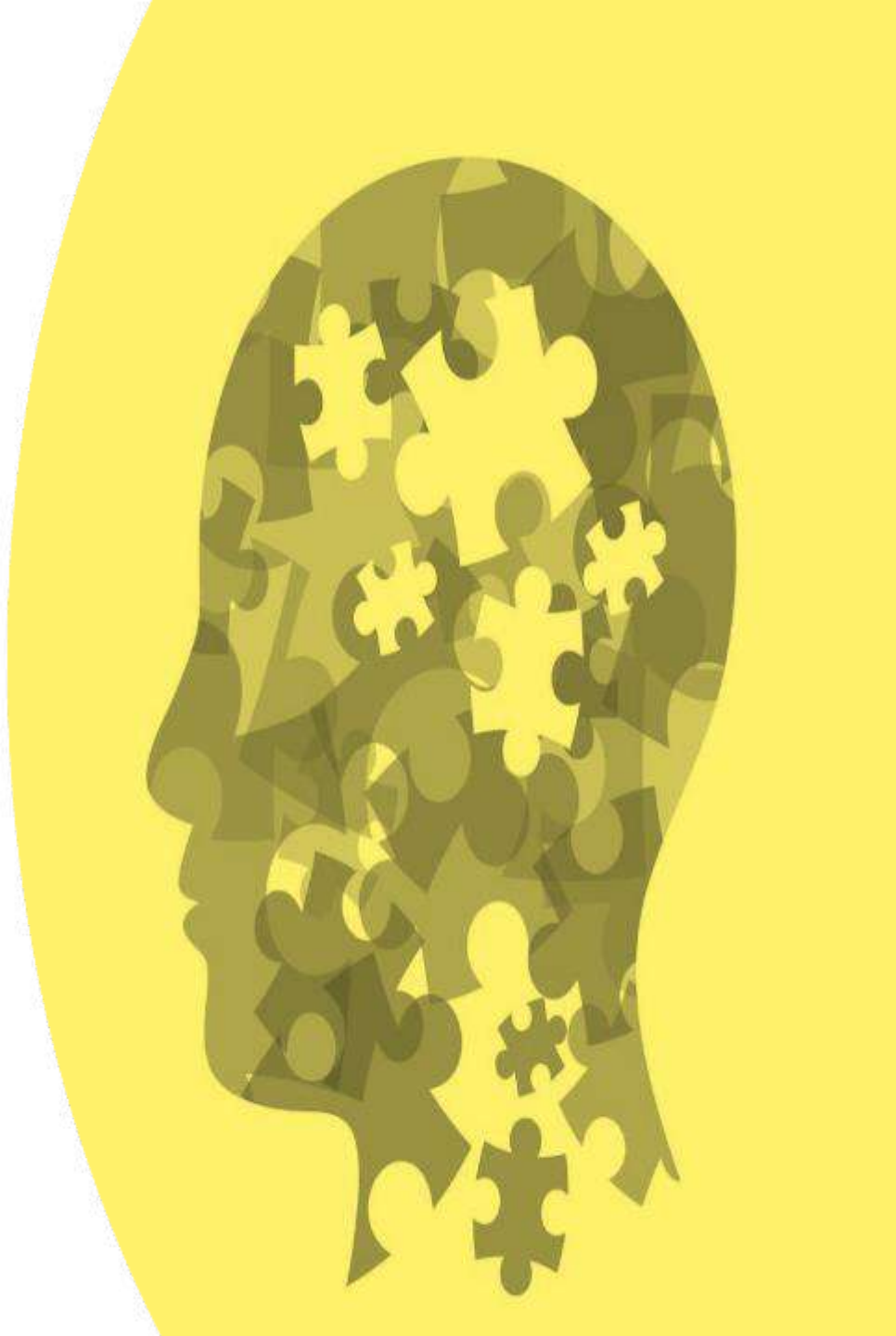
Proposed framework (1/2)

- Using a set of design and operational characteristics each one corresponding to a parameter, a road section is assessed. A perfectly safe road section is rated with a maximum score of 100 points. Reductions are applied for each identified unsafe condition.
- A CMF value lower than 1, or "Reduction Factor" (RF), is estimated per parameter to represent identified unsafe conditions. For safe conditions RF=1.
- The score for the road section i is estimated based on the formula:

$$Score_i = 100 \times RF_{1i} \times RF_{2i} \times \cdots \times RF_{ni}$$

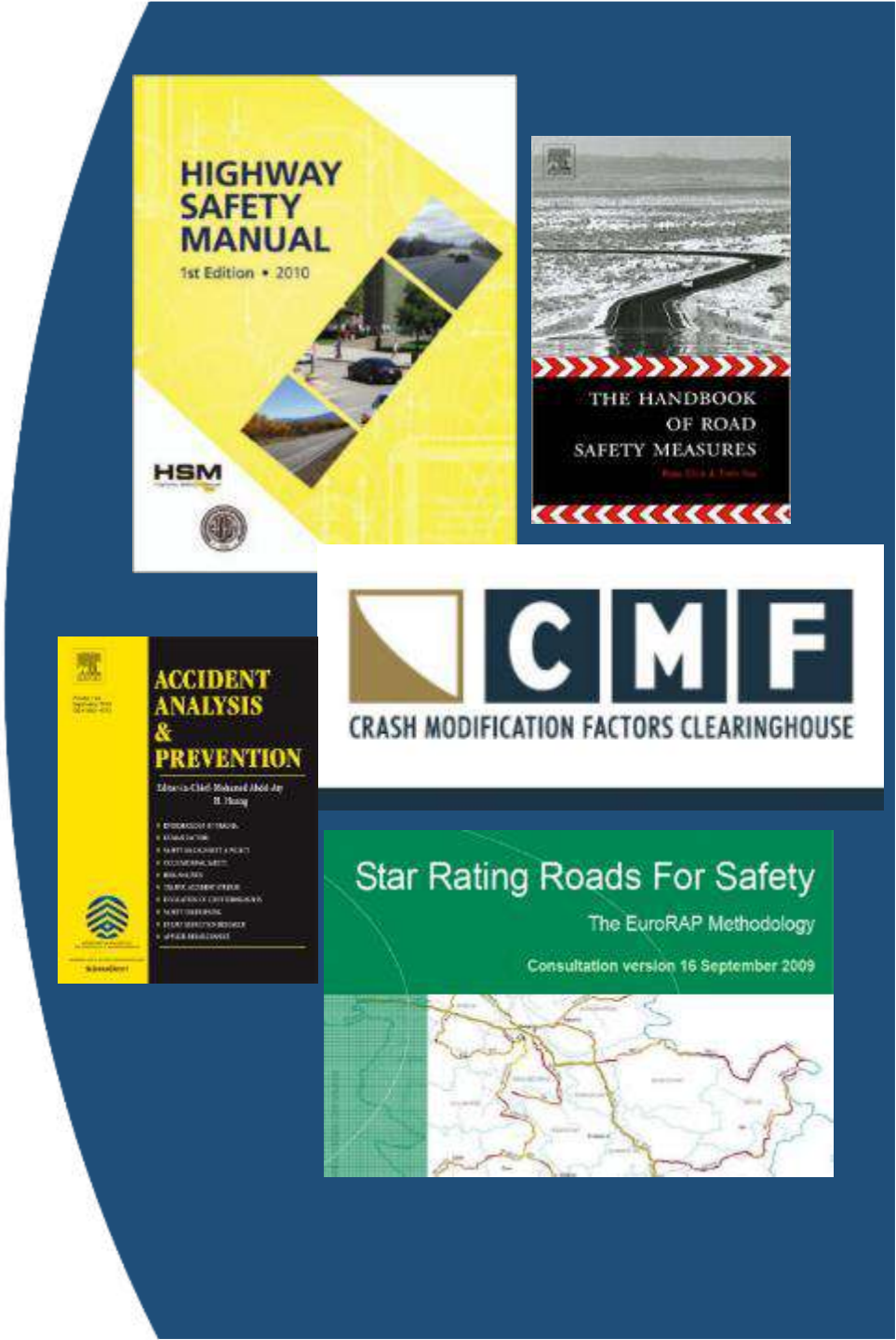
Proposed framework (2/2)

- Each road section is classified in one out of 3 classes based on the scoring:
  - High Risk (class 1)
  - Medium Risk (class 2)
  - Low Risk (class 3)
- Scoring and classification between motorways and primary roads is not comparable.
- Differentiation between rural and urban motorways is considered.
- A section is defined as a road stretch consisting of road segments and junctions.



Quantification of parameters' safety impact

- Identification of appropriate Crash Modification Factors (CMFs) based on international literature:
  - AASHTO Highway Safety Manual 2010, 2014
  - CMF Clearing House (individual studies)
  - PRACT Repository (individual studies)
  - The Handbook of Road Safety Measures, Elvik et al. (2009)
  - iRAP Factsheets (Star Rating Protocol)
- Reviewed studies include CMFs for all injury accidents at motorways and primary rural roads.
- Subsequent adjustments made, where appropriate, according to feedback from EGRIS



Parameters used for the in-built safety assessment of roads

Number	Parameter
	MOTORWAYS
1	Lane width *
2	Roadside (clear zone width, obstacles, presence of barriers)
3	Curvature *
4	Interchanges *
5	Conflicts between pedestrians/ bicyclists and motorized traffic
6	Quality of signs and markings
7	Presence of traffic operation center and mechanisms to inform users for incidents
8	*Lighting (TBD)*
	PRIMARY ROADS
1	Median separation
2	Lane width
3	Roadside (clear zone width, obstacles, presence of barriers)
4	Curvature
5	Density of property access points
6	Junctions
7	Conflicts between pedestrians/ bicyclists and motorized traffic
8	Shoulder type and width
9	Passing lanes
10	Quality of signs and markings
11	*Lighting (TBD)*

3. Accident occurrence analysis methodology

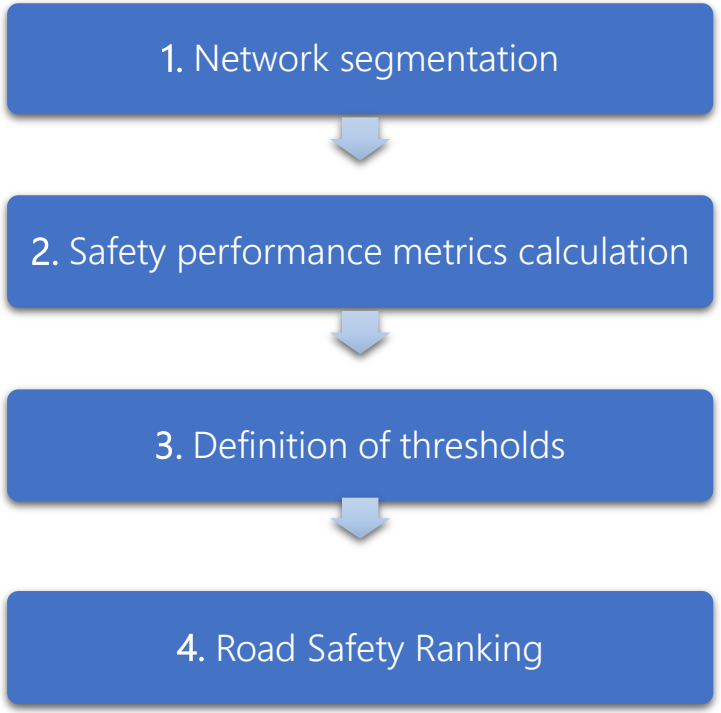
Developing a methodology for accident occurrence analysis

- Across Member States, it was found that different accident occurrence methods are used.
- They vary in terms of safety performance metric (e.g., accident rate), safety ranking, type of accidents used for the analysis, etc.
- Modular approach: combination of possible methods for each step allowing flexibility to Member States to implement the method that is more compatible to
  - existing data
  - available budget
  - previous experience

Proposed framework (1/4)

Network segmentation

- Section lengths have been proposed per road type.
- The sections are homogeneous.
- Three approaches are proposed to deal with junctions:
  - 1st approach: midpoint of the junction as the section limit
  - 2nd and 3rd approaches: boundary of the area of influence of the junction as limit of the section



Proposed framework (2/4)

Safety performance metric calculation

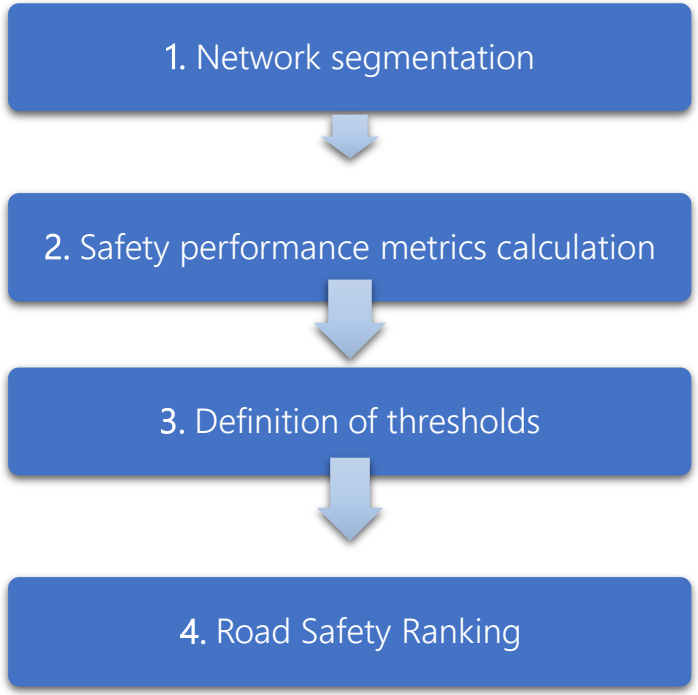
- Accident data should be available for at least three years to implement the methodology.
- The number of fatalities and injuries are considered.
- Depending on traffic volume data availability, it is proposed to use accident rates (accidents per million vehicle km).
- Alternatively, the proposed safety performance metric is the accident density (accidents per km).
- Future:
  - common definition AIS → accidents with serious injuries (MAIS 3+) and fatalities
  - Use of accident rates

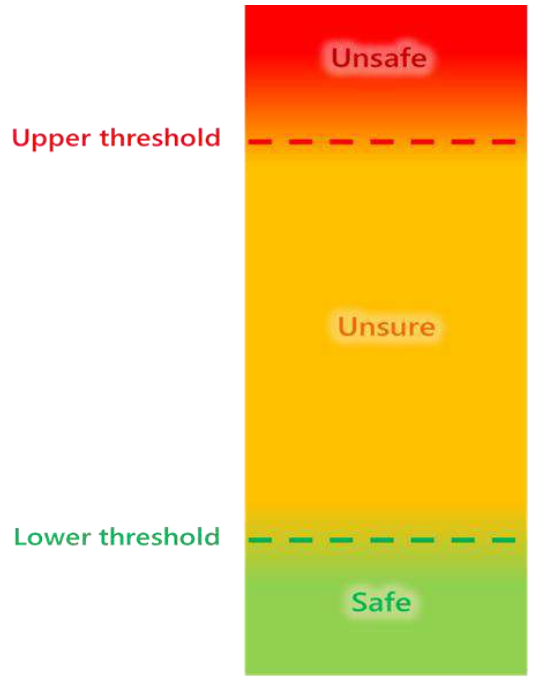
Proposed framework (3/4)

Definition of critical thresholds

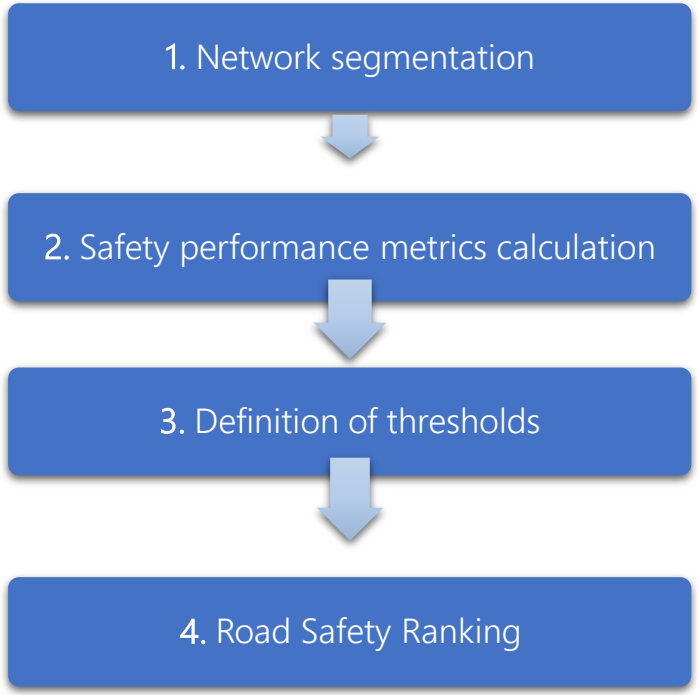
1. If traffic data are available:
   - **Threshold:** Critical accident rate (Quality Control method)
   - Specific threshold for each section/junction

2. If traffic data are not available (i.e., use of accident density):
   - **Threshold:** Critical value (Poisson method)
   - Specific threshold for each reference population (e.g., divided rural roads)
   - Based on the confidence level, two thresholds are defined:
     - Upper
     - Lower





Proposed framework (4/4)



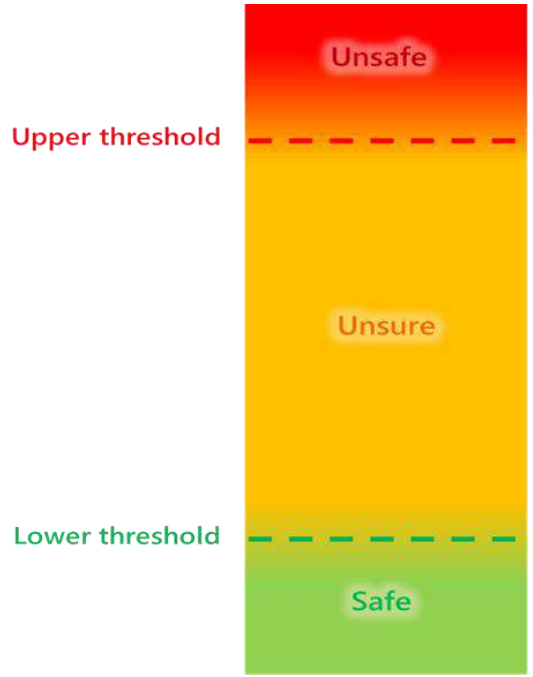
- Based on the two upper and lower threshold values, the accident rate and accident density thresholds are determined:

  Unsafe section: value of the metric exceeding the upper threshold

  Unsure section: value of the metric between the two thresholds. It is not clear if a section is "safe"/"unsafe".

  Safe section: value of the metric below the lower threshold

- **Output**: a classification for accident density and a classification for accident rate



4. Integration of the proactive and reactive methodologies

Integrated methodology - Overview

- The objective of the integrated methodology is to combine the proactive and reactive methodologies.
- The integrated methodology will determine the final safety ranking of a road section, and in turn, of the network.
- Two main things needed to be determined:
  - The number of safety classes to be considered
    - *According to the RISM Directive they have to be at least three classes*
  - A rule to determine whether the proactive or the reactive methodology should be prioritized over the other.

Integration of proactive and reactive methodologies (1/2)

The integrated approach is proposed to apply a 3-class ranking system similarly to the number of ranking classes in the proactive and reactive methodologies.

A. Roads with no accident data (i.e., roads with no/low accident data availability or low accident data quality)

- Rely on the proactive score

B. Roads with sufficient accident data:

- Reactive score = Unsafe → Road Safety Inspection
- Reactive score = Safe → Use proactive score to prioritize Road Safety Inspection
- Reactive score = Unsure → Rely on the proactive score

		Reactive methodology			
		Safe (class 3)	**Unsure** (class 2)	**Unsafe** (class 1)	Not applicable *(e.g. no/ unreliable accident data)*
Proactive methodology	**Safe** (class 3)	3	3	1	3
	Intermediate (class 2)	2	2	1	2
	Unsafe (class 1)	2	1	1	1

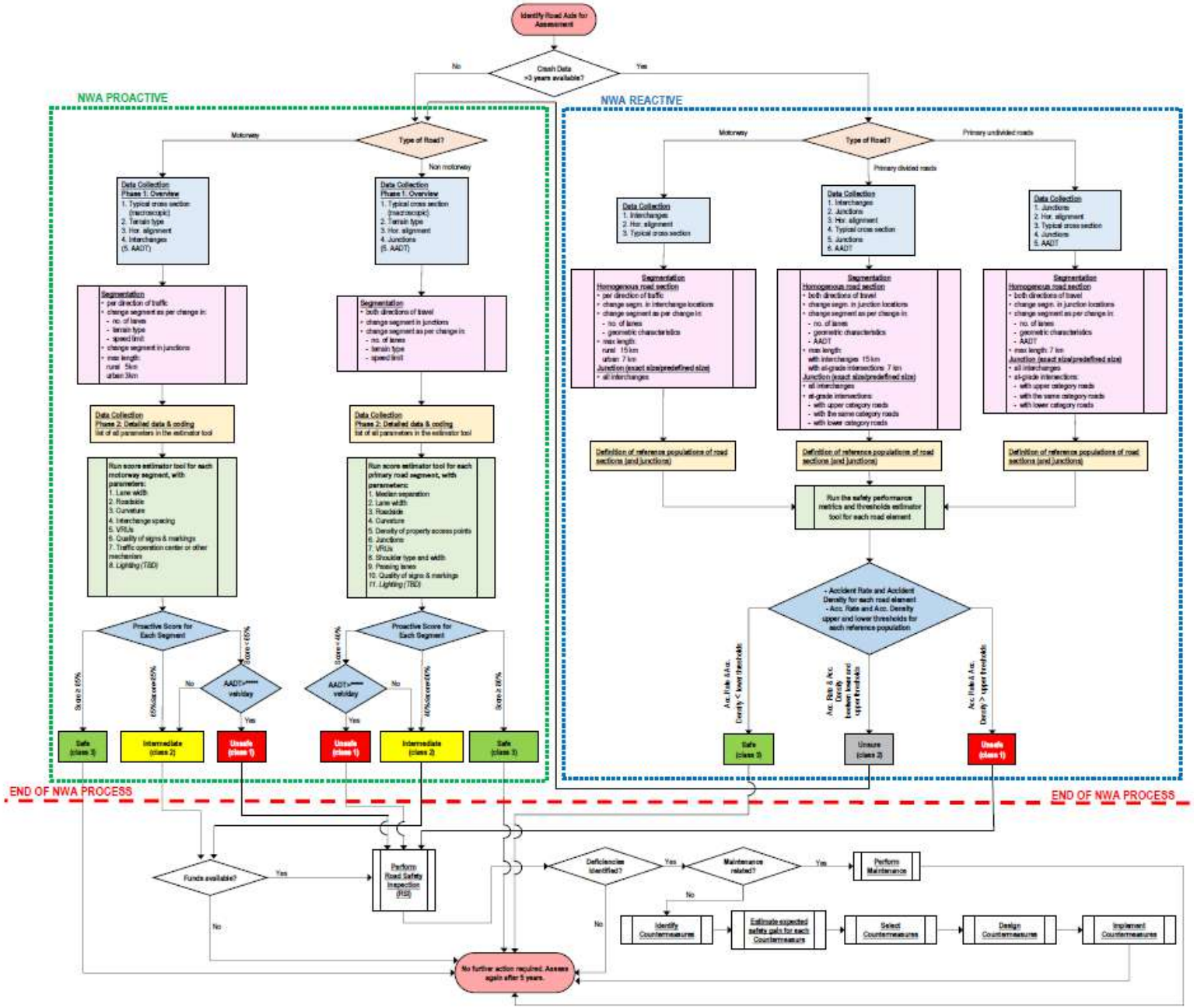
Integration of proactive and reactive methodologies (2/2)

- The right column describes cases with no accident data, where the use of proactive methodology is the only way to assess safety.
- Consensus between the two methodologies: when a section is "Safe" or "Unsafe" based on both methodologies, then it corresponds to Classes 3 and 1, respectively.
- A prioritization rule is needed when the two methodologies produce different results:
  - Sections found "Unsafe" based on the reactive methodology, belong in Class 1 regardless of the proactive assessment score.
  - Sections found "Safe" based on the reactive methodology, yet the proactive approach indicates safety deficiencies (Unsafe/intermediate), then they are classified in Class 2 and are in second priority for detailed inspection.
- When the reactive approach is "unsure", the proactive is used.

		Reactive methodology			
		Safe (class 3)	**Unsure** (class 2)	**Unsafe** (class 1)	Not applicable *(e.g. no/ unreliable accident data)*
Proactive methodology	**Safe** (class 3)	3	3	1	3
	Intermediate (class 2)	2	2	1	2
	Unsafe (class 1)	2	1	1	1

NWA Flowchart

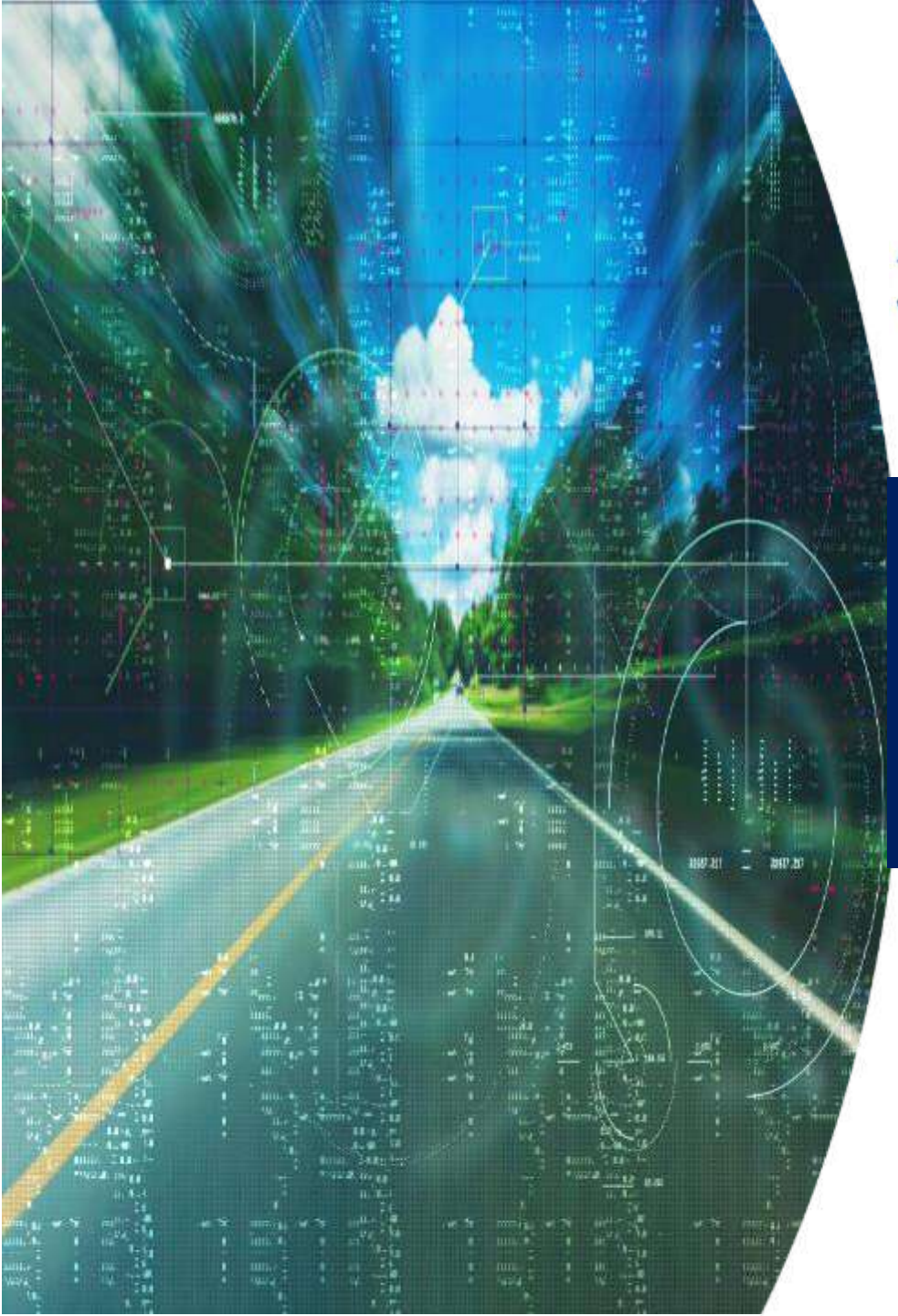
- Flow chart presenting the steps for conducting NWA in motorways and primary rural roads.
- A document with guidelines will be developed to guide authorities step-by-step.



5. Next steps

Ongoing Study Activities

- Currently, a **revised** version of the NWA methodology is being developed, to address comments from EGRIS.
- **Guidance document** and **assessment excel tool** are developed in parallel.
- The developed methodology will be **pilot tested** in all Member States.
- The pilot studies are expected to result in **technical improvements of the methodology** but also assist in better shaping the guidelines for its implementation
- The methodology will be **finalized** after the completion of the pilot studies (summer of 2023).



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