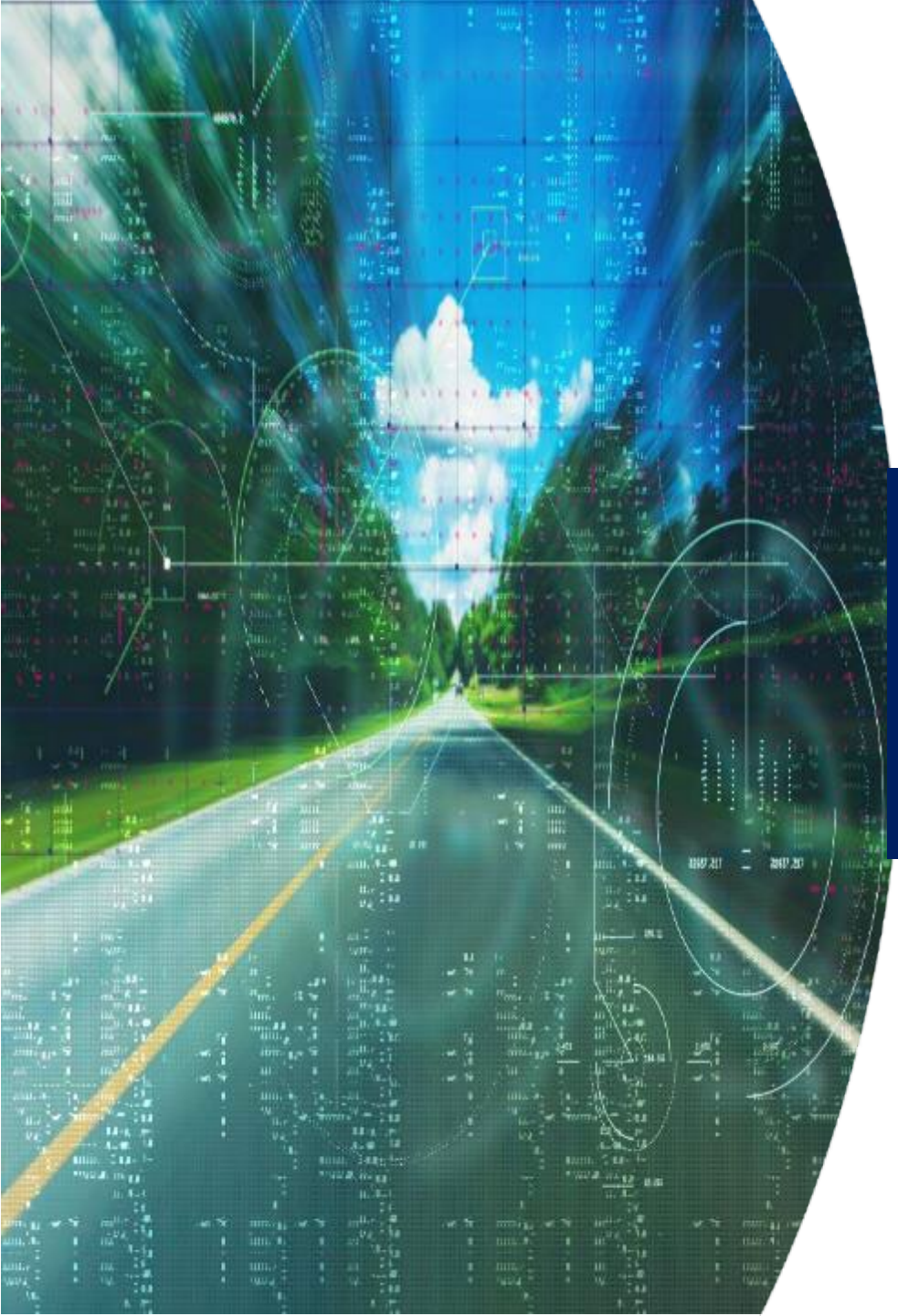

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9th International Conference
Road Safety Assessment – Challenges and Opportunities

January 25, 2023

The EU Methodology for Network Wide Road Safety Assessment

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Outline

1. RISM Directive
2. RISM Study
3. In-built safety assessment methodology
4. Crash occurrence methodology
5. Integrated methodology
6. Methodology advantages

DIRECTIVE (EU) 2019/1936 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 October 2019

amending Directive 2008/96/EC on road infrastructure safety management

Article 5: Network-wide road safety assessment

- Network-wide road safety assessments shall evaluate crash and impact severity risk, based on:
  - primarily, a visual examination, either on site or by electronic means, of the design characteristics of the road (in-built safety); and
  - an analysis of sections of the road network which have been in operation for more than three years and upon which a large number of serious crashess in proportion to the traffic flow have occurred.

- Based on the results of the assessment, Member States shall classify all sections of the road network in no fewer than three categories according to their level of safety.

- Member States shall complete this assessment by the end of 2024 and then, re-assess the roads every 5 years.

Study on a Methodology for Network-wide Road Assessment

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

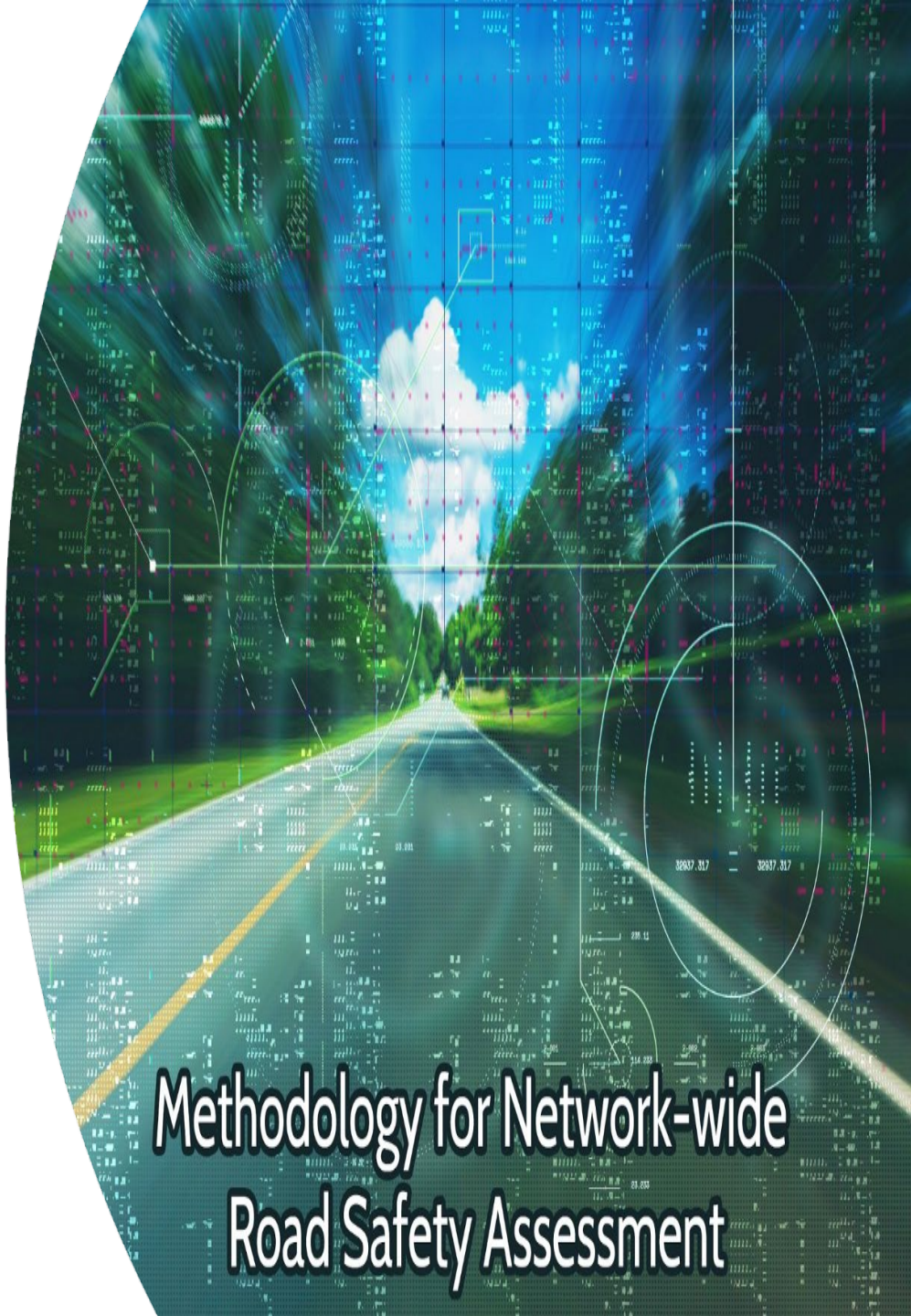
Project team

National Technical University of Athens (NTUA), Greece

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

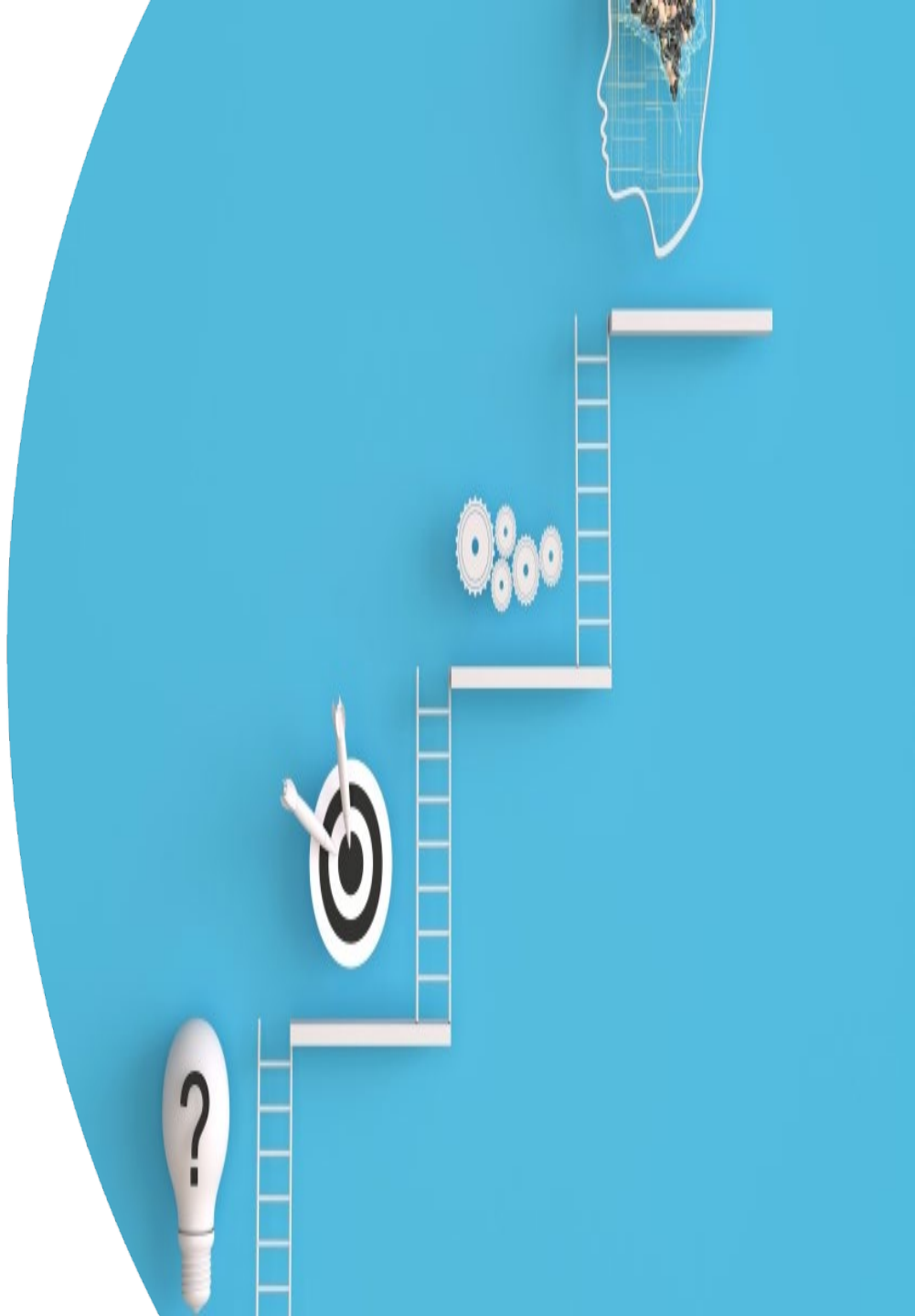
FRED Engineering s.r.l. (FRED), Italy

Project duration: September 2020-August 2023



Preliminary work for the methodology development

- The first step was to review and synthesize existing methodologies for the assessment of road infrastructure safety and understand the needs of Member States regarding the assessment of road infrastructure safety:
  - extensive review of the literature
  - questionnaire survey for Member States and relevant safety stakeholders
- The Network-Wide Assessment (NWA) methodology was developed during Feb. 2021 – Dec. 2022.
- Constant feedback was received by the Expert Group on Road Infrastructure Safety (EGRIS) Members and other EU-wide relevant stakeholders. EGRIS Members approved the NWA methodology on November 2022.



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.
- 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).

NWA-proactive methodology (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:

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

NWA-proactive methodology (2/2)

- Each road section is classified in one out of 3 classes based on the scoring:
  - High Risk (class 3)
  - Intermediate (class 2)
  - Low Risk (class 1)
- 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.

Parameters used for the in-built safety assessment of roads

The NWA-proactive methodology considers the following parameters for the assessment of motorways and primary roads:

#	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	Traffic operation centers and / or mechanisms to inform users for incidents
	PRIMARY ROADS
1	Lane width **
2	Roadside (clear zone width, obstacles, presence of barriers) **
3	Curvature
4	Density of property access points **
5	Junctions
6	Conflicts between pedestrians/ bicyclists and motorized traffic
7	Shoulder type and width **
8	Passing lanes **
9	Signs and markings

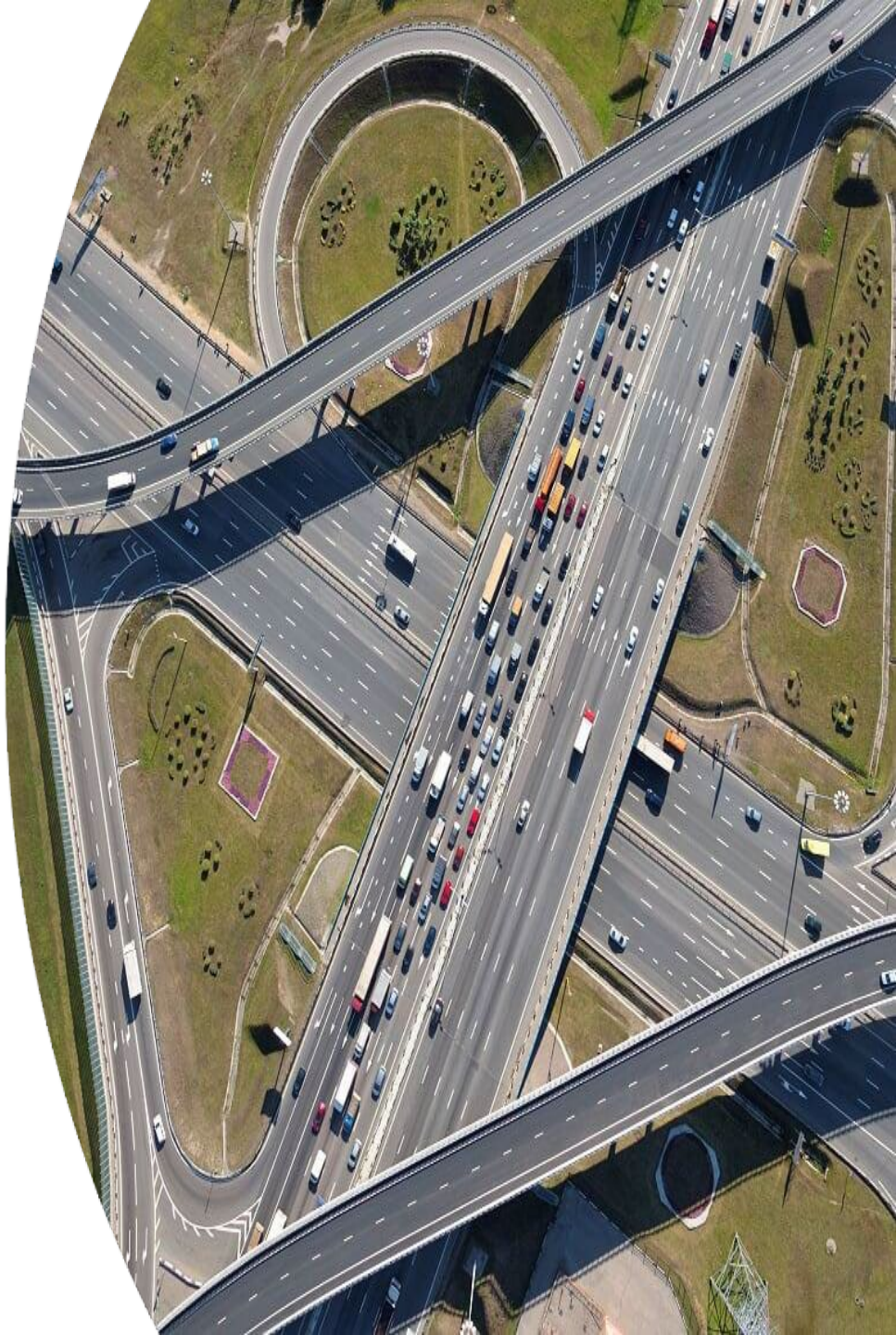
**Different assessment between urban and rural motorways*

*** Different assessment between (primary) divided and undivided rural roads*

3. Crash occurrence analysis methodology

Developing a methodology for crash occurrence analysis

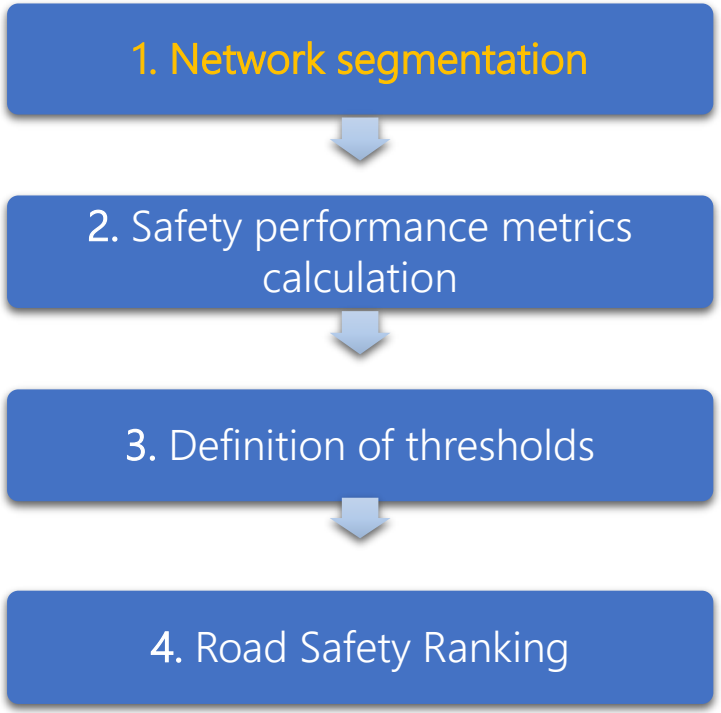
- Across Member States, it was found that different crash occurrence methods are used.
- They vary in terms of safety performance metric (e.g., crash rate), safety ranking, type of crashes used for the analysis, etc.
- To accommodate the needs of Member States a modular approach was used: combination 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



NWA-reactive methodology (1/4)

1. Network segmentation

- Max section lengths have been defined per road type.
- The sections are homogeneous: hor. curve, no. lanes
- Three approaches exist 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



NWA-reactive methodology (2/4)

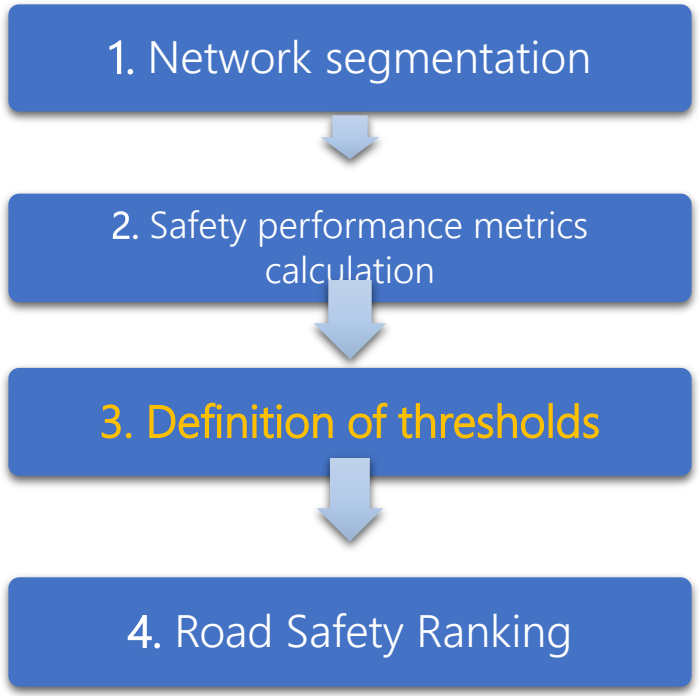
2. Safety performance metric calculation

- Crash data should be available for at least 3 years to implement the methodology.
- The number of crashes with fatalities and injuries across all modes are considered.
  - *Future: common definition AIS → crashes with serious injuries (MAIS 3+) and fatalities*
- For each section, the lower and upper number of expected crashes is estimated based on the Poisson method using the number of occurred crashes.
- Crash Rate (if traffic data are available) and crash Density are estimated per section using the lower and upper number of expected crashes.

NWA-reactive methodology (3/4)

3. Definition of critical thresholds

- The safety performance of a section is compared against the safety performance of the Reference Population to which the section belongs to.
- The Reference Population is the set of roads across a Member State with same characteristics, e.g., all urban motorways.
- Crash Rate (if traffic data are available) and Crash Density are estimated for each Reference Population group.



NWA-reactive methodology (4/4)

4. Road Safety Ranking

- Based on the Crash Rate (or Density) value for the reference population (CRRF) and the lower & upper thresholds for the section's Crash Rate (CR-lower, CR-upper, respectively), a section is classified as:

Class 3: High Risk section

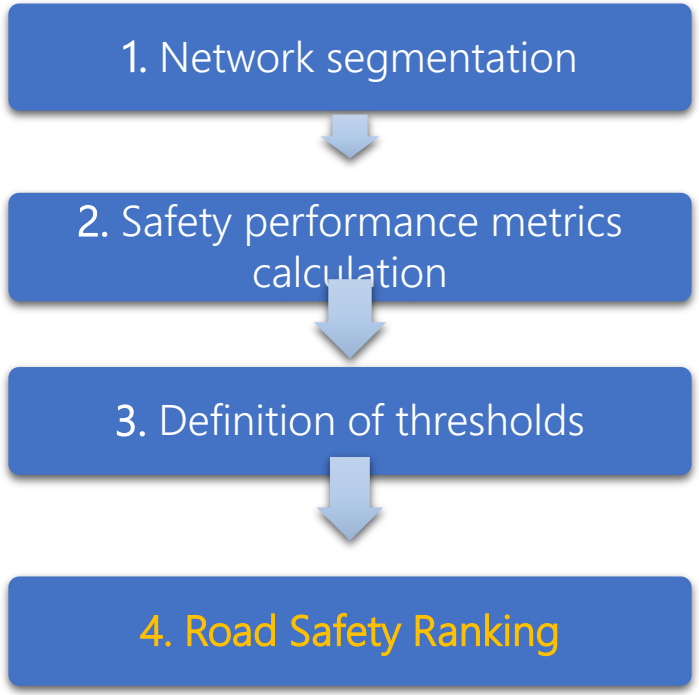
when CRRF < CR-lower < CR-upper

Class 2: Unsure section

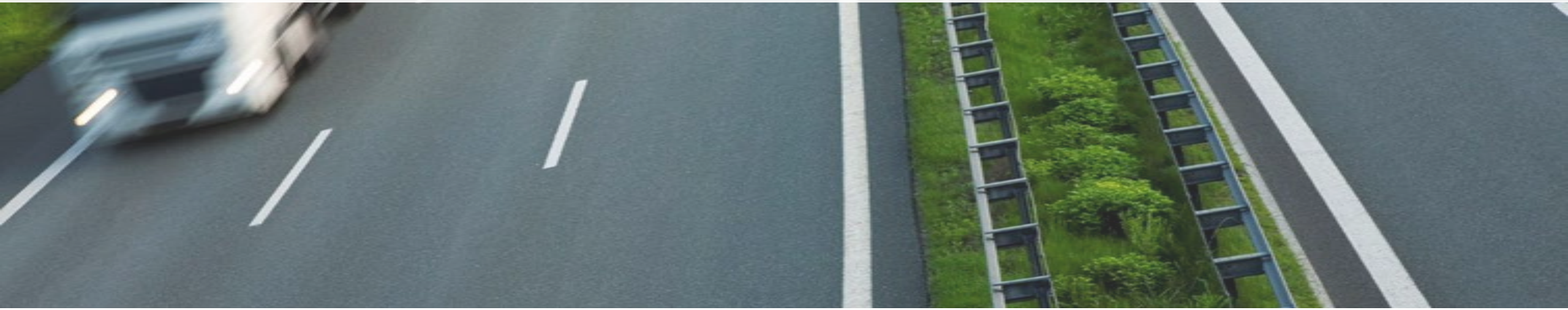
when CR-lower ≤ CRRF ≤ CR-upper

Class 1: Low Risk section

when CRRF > AR-upper > CR-lower



4. Integration of the proactive and reactive methodologies



NWA-integrated Framework (1/3)

- The objective of the integrated methodology is to combine the proactive and reactive methodologies.
- The integrated methodology determines the final safety ranking of a road section, and in turn, of the network.
- When developing the NWA-integrated methodology two main aspects had 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 set of rules to combine the NWA-proactive and the NWA-reactive outcomes.

NWA-integrated Framework (2/3)

- A 5-class ranking system is used to combine the results of the proactive (3 classes) and reactive (2 classes + unsure + no data) methodologies.

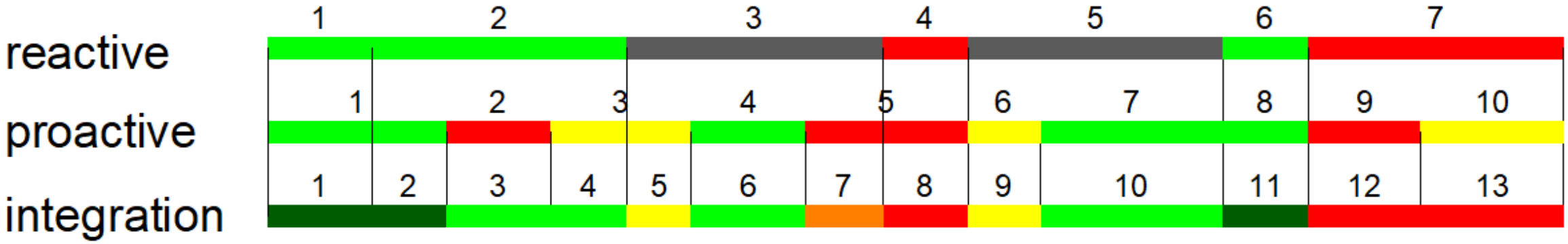
Very High Priority (class 5)	High Priority (class 4)	Intermediate Priority (class 3)	Low Priority (class 2)	Very Low Priority (class 1)

- The NWA-reactive (when data is available and it can be completed) is prioritized over the NWA-proactive:

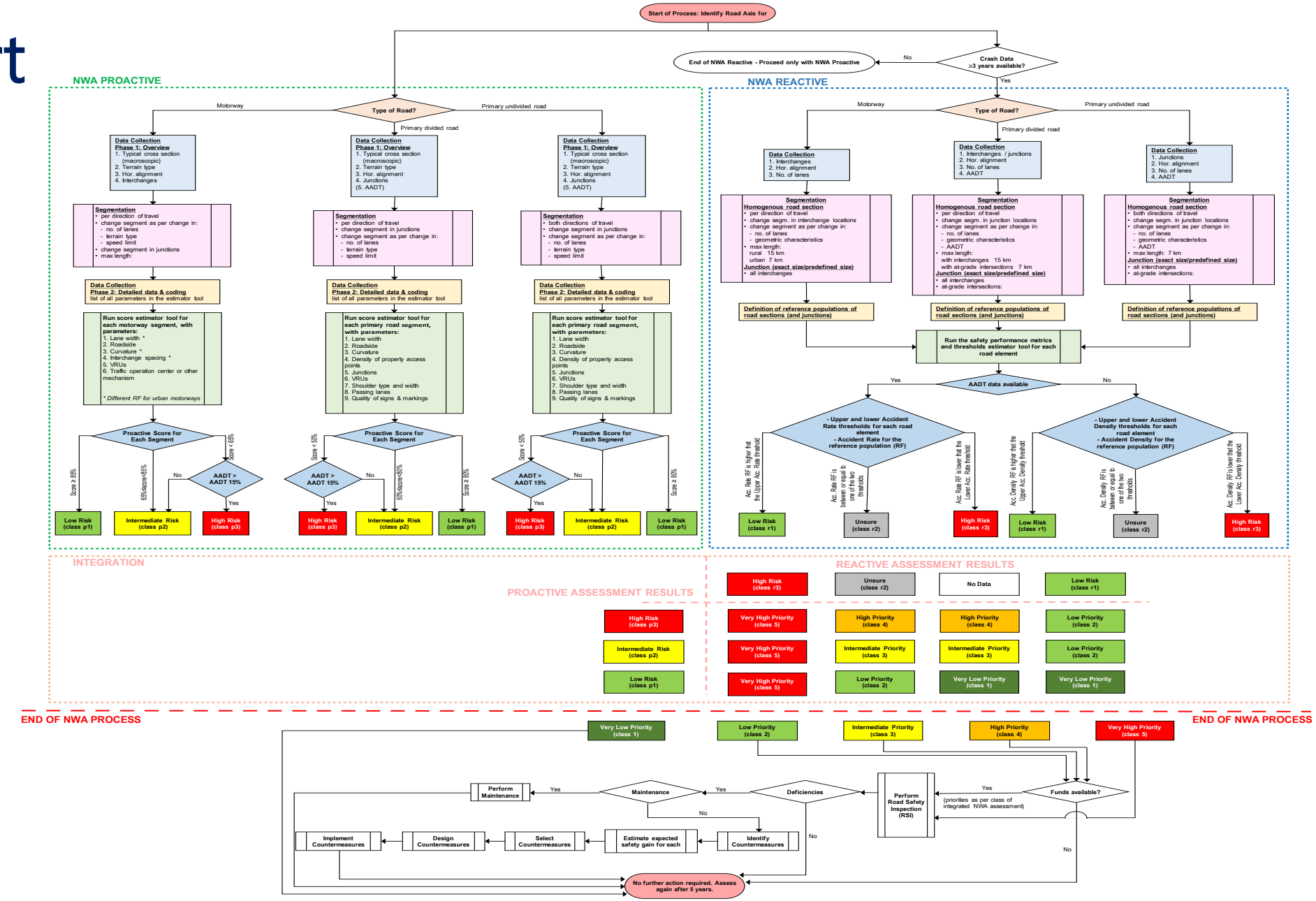
PROACTIVE ASSESSMENT RESULTS \ REACTIVE ASSESSMENT RESULTS	High Risk (class r3)	Unsure (class r2)	No Data	Low Risk (class r1)
High Risk (class p3)	Very High Priority (class 5)	High Priority (class 4)	High Priority (class 4)	Low Priority (class 2)
Intermediate Risk (class p2)	Very High Priority (class 5)	Intermediate Priority (class 3)	Intermediate Priority (class 3)	Low Priority (class 2)
Low Risk (class p1)	Very High Priority (class 5)	Low Priority (class 2)	Very Low Priority (class 1)	Very Low Priority (class 1)

NWA-integrated Framework (3/3)

- The NWA-proactive and NWA-reactive methodologies use different segmentation approach.
- The following graph illustrates how the final ranking of the network is performed.

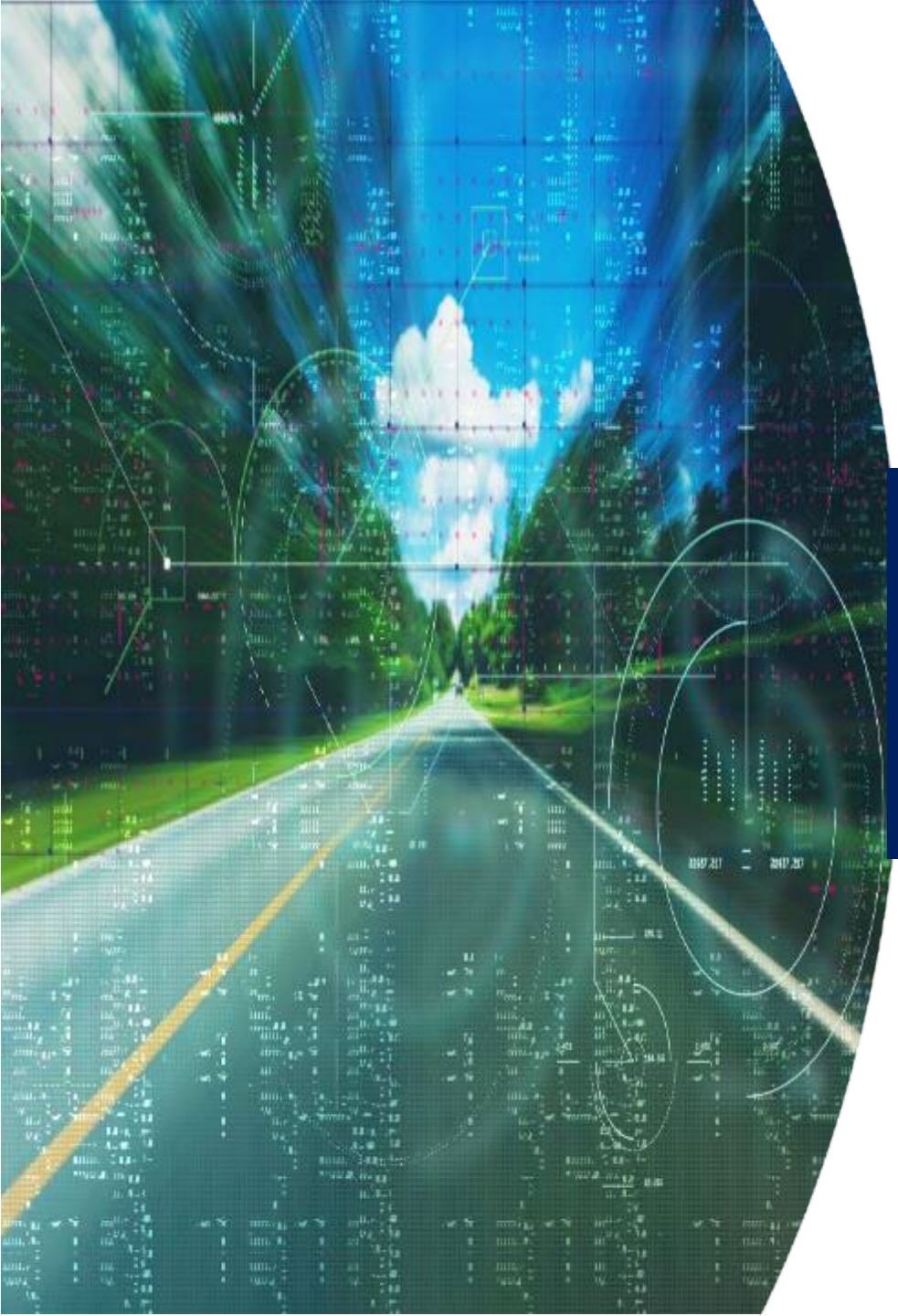


NWA flowchart



EU NWA Methodology Advantages

1. Fully aligned to DIR.2019/1936/EU
2. Low data needs
3. Ease of application
4. Low cost
5. Transparent assessment models
6. Flexibility and versatility



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