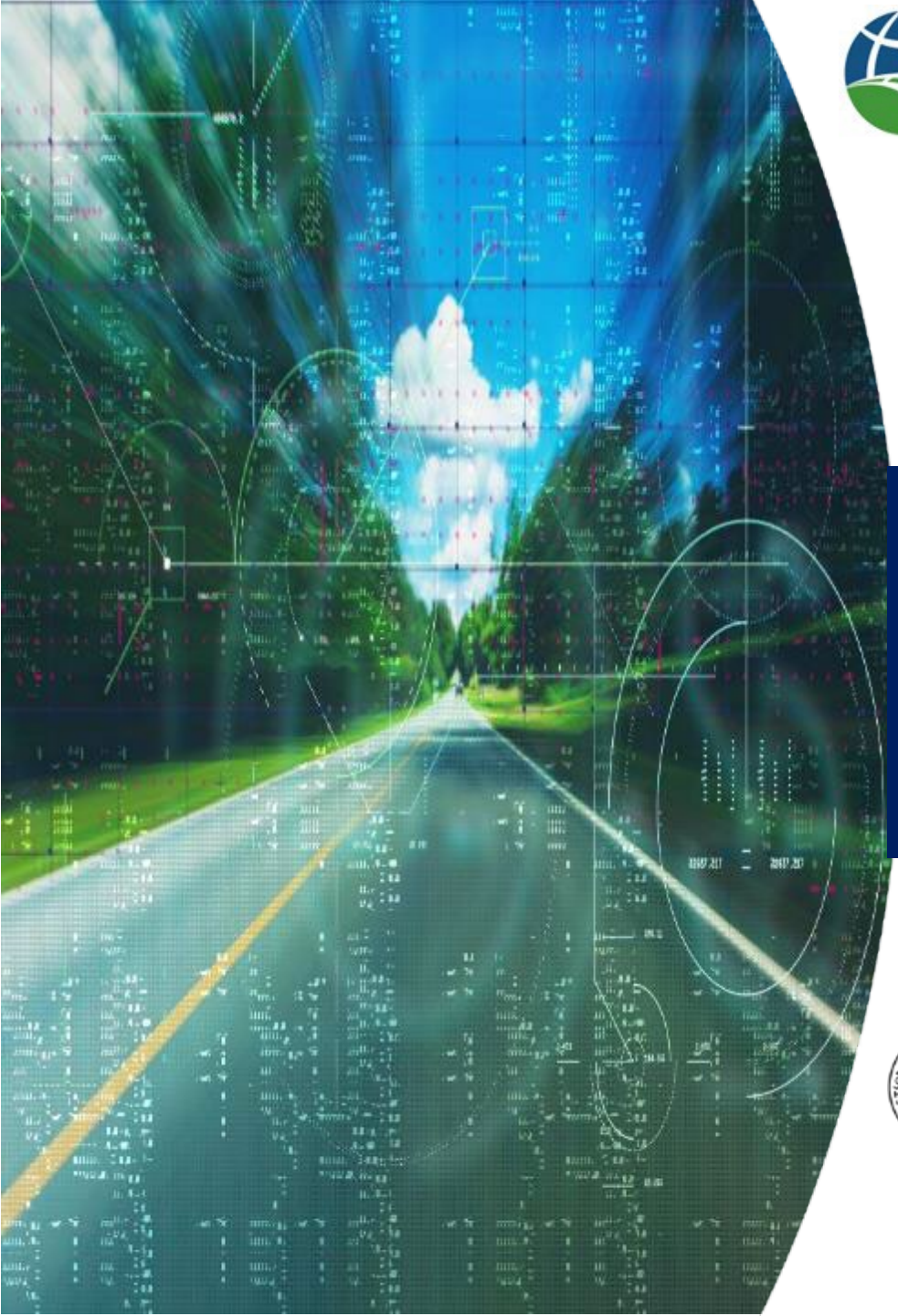

Vision Zero for the Balkans

May 15-16, 2023, Belgrade

Network Wide Road Safety Assessments to diagnose road safety risk

George Yannis, Professor

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Outline

1. RISM Directive
2. In-built safety assessment methodology
3. Crash occurrence methodology
4. Integrated Methodology
5. Pilot Studies
6. Conclusions

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 crashes 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.

Preliminary work for the methodology development

- Review and synthesis of existing methodologies for the assessment of road infrastructure safety.
- Understand the needs and limitations of Member States regarding the road safety assessment, through a questionnaire survey.
- These analyses set the ground for developing a Network-Wide Assessment (NWA) methodology (motorways and primary roads).
- The NWA methodology was developed during Feb. 2021 – Dec. 2022; then, it was approved by the EGRIS Members.
- During this time and on a regular basis, the process was presented to EGRIS Members and to the EC to for review.
- Feedback received through EGRIS, concerning both scientific and practical aspects, has been incorporated before and after the pilot studies and has been used to finalize the adopted methodology.

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

- Using a set of road characteristics each one corresponding to a parameter, a road section is assessed. A perfectly safe road section is rated with 100 points (max). 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: $Score_i = 100 \times RF_{1i} \times RF_{2i} \times \cdots \times RF_{ni}$
- Sections are classified as:
  - High Risk (class 3)
  - Intermediate Risk (class 2)
  - Low Risk (class 1)

Parameters used for the in-built safety assessment of roads

Based on the feedback from EGRIS Members as well the existing safety literature, 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

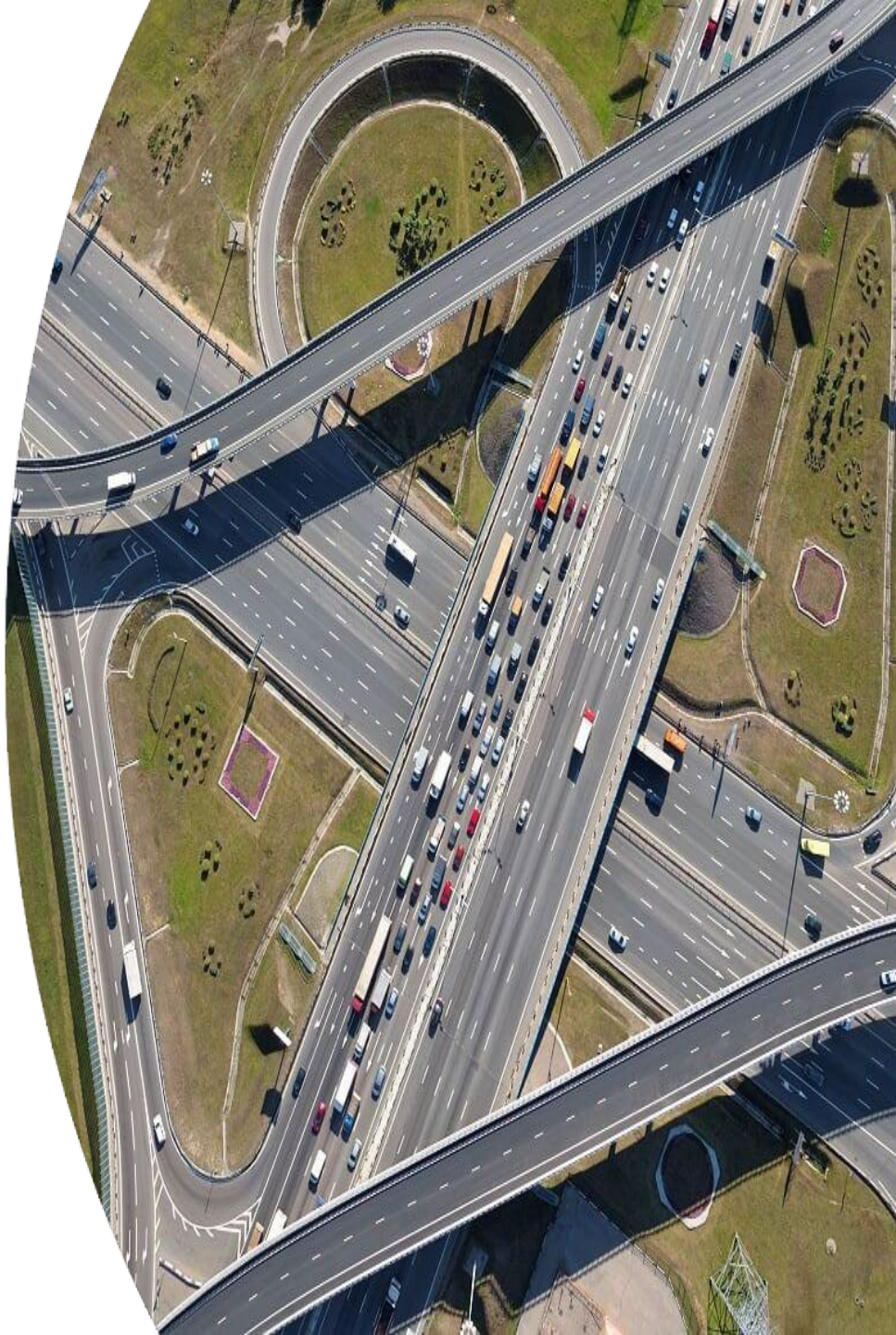
**Different assessment between urban and rural motorways*

*** 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.
- 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 (1/2)

The preliminary steps prior to the methodology implementation:

1. Ensure that at least 3 years of reliable crash data is available
   - Crashes with slight and severe injuries and fatalities are used
   - Crashes involve all road users (e.g., car drivers, cyclists, etc.)
2. Road type identification
3. High-level data collection
   - Used for the network segmentation task
   - Presence of horizontal curves, presence and type of junctions, nc lanes

NWA-reactive methodology (2/2)

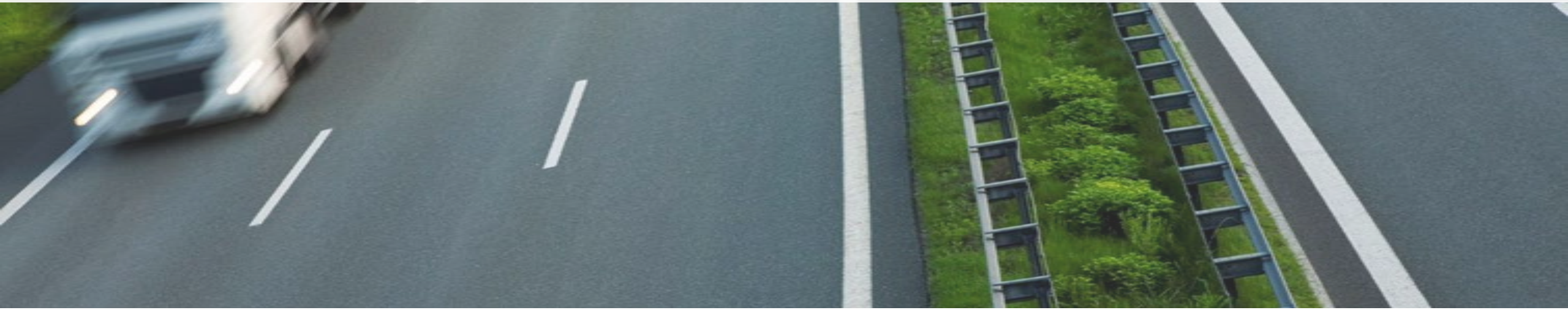
1. Network segmentation
   - Homogenous sections or junctions
2. Calculate safety performance metrics for each section
   - Crash Rate (if traffic volume data are available)
   - Crash Density
3. Definition of thresholds
   - Comparison group: safety performance of roads with similar characteristics. Known as the Reference Population
4. Classify the section/junction

   Class 3: High Risk section

   Class 2: Unsure section

   Class 1: Low Risk section

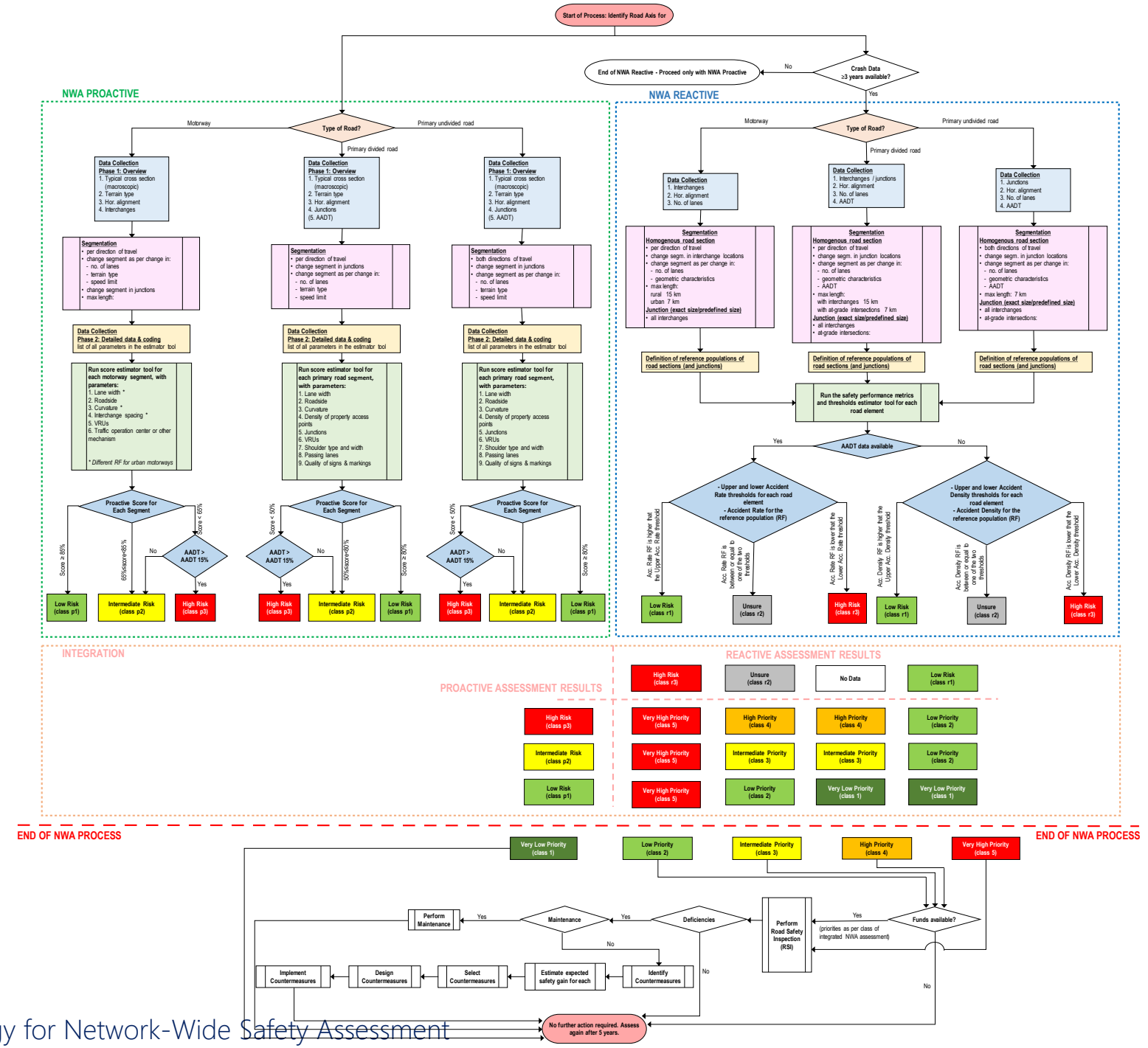
4. Integration of the proactive and reactive methodologies



NWA Integrated Methodology

- 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.

Overview of the NWA Integrated Methodology



NWA - Integrated Methodology Classes

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

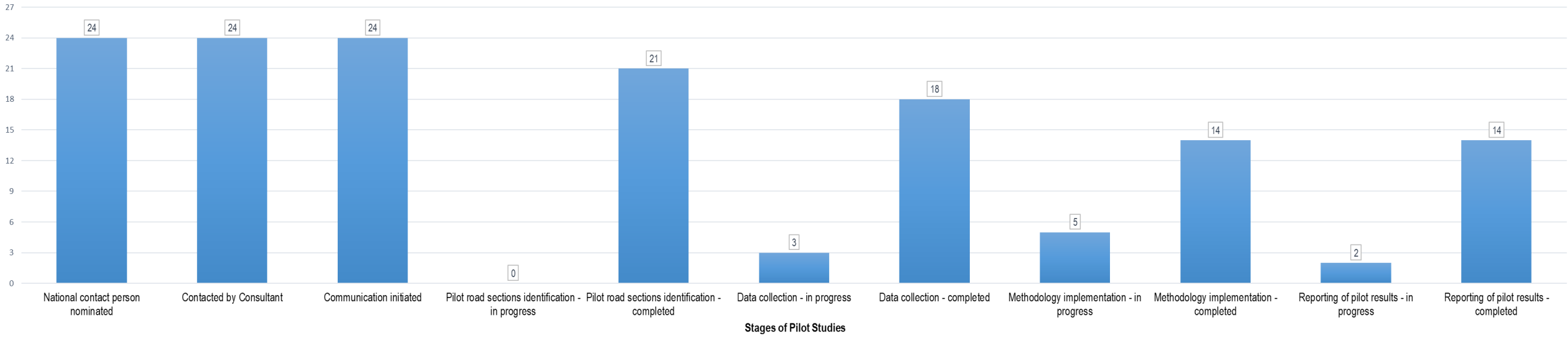
Very High Priority (class 5)	High Priority (class 4)	Intermediate Priority (class 3)	Low Priority (class 2)	Very Low Priority (class 1)

- 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)

5. Pilot Studies

Overview of the pilot studies



Road type	Total axes	Total KM	Member States
Urban motorway	2	43	CY, PT
Rural motorway	9	521	AT, CY, EL, ES, FI, FR, HR, IT, LT, RO
Primary divided road	3	156	EL, ES, FR, IT, LT
Primary undivided road	9	324	CY, ES, FI, FR, IE

Pilot studies results

6. Conclusions

Conclusions (1/2)

The EU NWA methodology is an important contribution to road safety assessment as it combines reactive and proactive assessments. Additional assets that make it user-friendly and reliable are:

1. Data requirements & data collection process

   Limited amount of data are needed, and these data can be easily retrieved and coded (e.g., Google Maps).

2. Optimum use of resources

   The collected data is always used and determined the final outcome of the NWA methodology.

Conclusions (2/2)

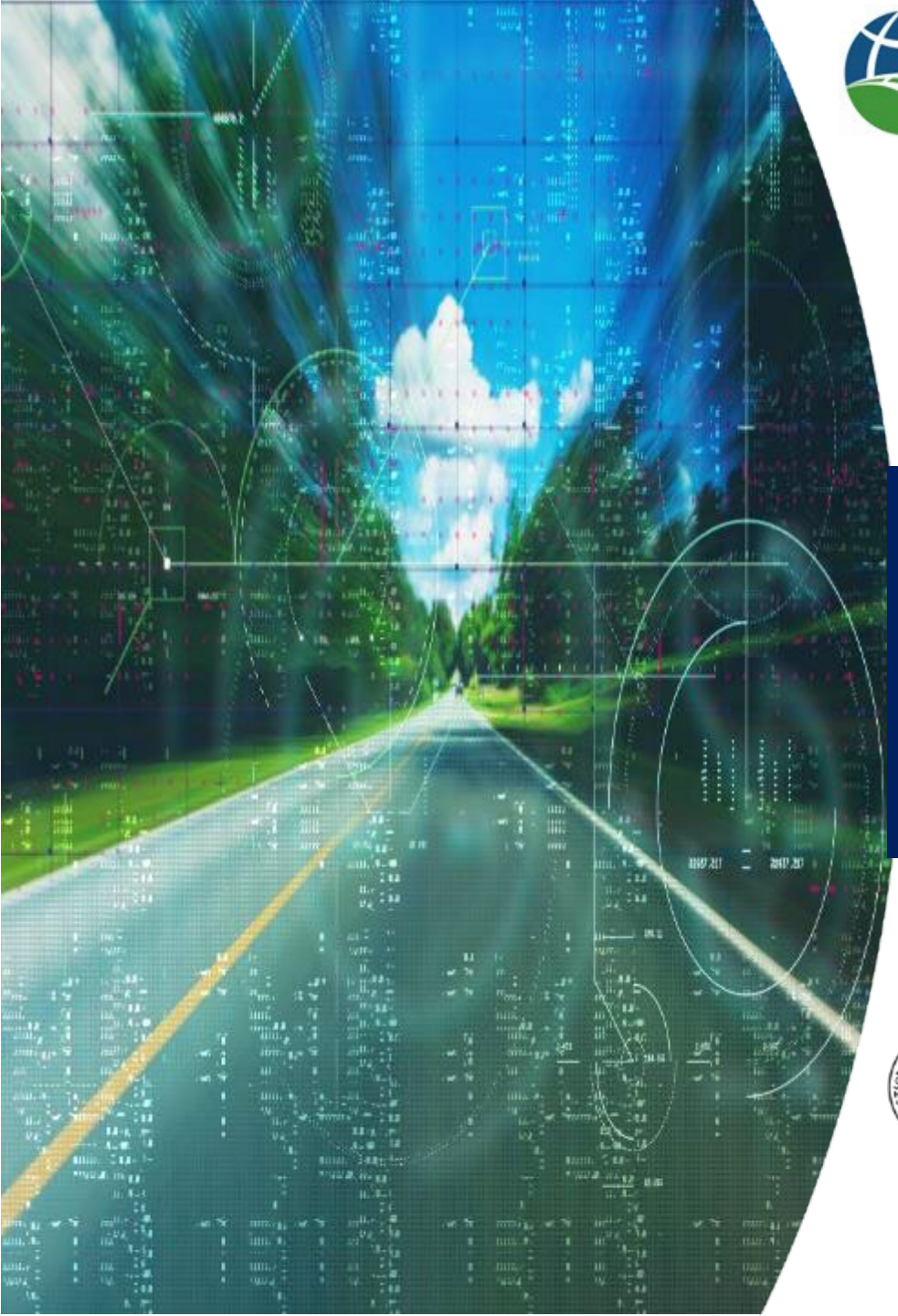
3. Transparency

Road safety assessment models are based on existing research and are presented and justified in a fully transparent way. The user has access to the formulas both through the Deliverables and the Assessment tools.

4. Assessment tools

The assessment tools (proactive & reactive methodology) are in Excel format and are fully transparent, can be used by anyone at anytime. The formulas can be adjusted to local conditions.

Access to the Study Deliverables & Guidelines.



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