

14th International Road Safety Conference

GAMBIT 2023

NEW DECADE - NEW ACTIVITIES - NEW TECHNOLOGIES

Gdańsk University of Technology, 29-31 May 2023



HONORARY PATRONAGE



MEDIA PATRONAGE



WORKSHOP ORGANIZERS



**XIV Międzynarodowe Konferencja
Bezpieczeństwa Ruchu Drogowego**

GAMBIT 2023

Nowa Dekada – Nowe Działania – Nowe Technologie

Politechnika Gdańska, 29-31 maj 2023

**ROAD SAFETY INSPECTION AS A TOOL OF A PROACTIVE
METHOD OF ROAD INFRASTRUCTURE SAFETY
MANAGEMENT**

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KIEĆ Mariusz



**Politechnika Krakowska
im. Tadeusza Kościuszki**

Part 1

EU directive framework

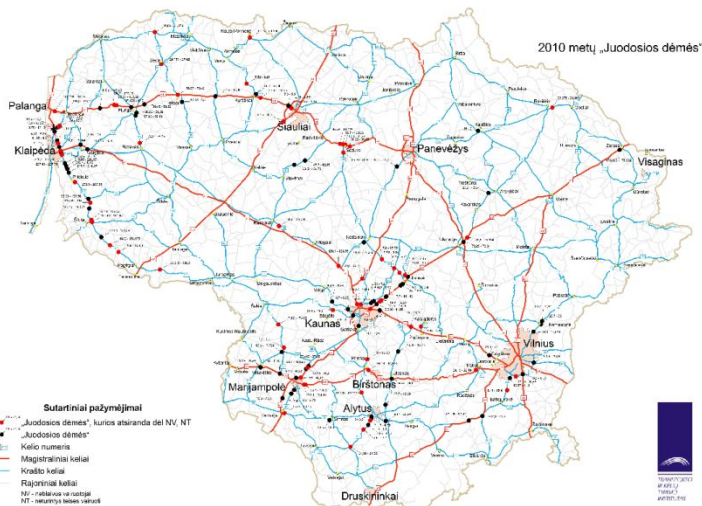
EU Directive RISM 2008/96/EC

- Network safety ranking has a high potential immediately after its implementation. Once **road sections with a high accident concentration** have been treated and remedial measures have been taken, **safety inspections as a preventive measure** should assume a more important role
- Regular inspections are an **essential tool for preventing possible dangers for all road users**, including vulnerable users, and also in case of **roadworks**

DIRECTIVE 2008/96/EC Road Network in Operation

Article 5

Management of the road network



Ranking of road section with high accident concentration (5.1)

Site visit (5.2)

Treatments
highest benefit-cost ratio
Priority Ranking (5.3)

Article 6

Safety Inspection



Identify road safety features to prevent accidents (6.1)

Inspections of road network & road works (6.2)

Sufficiently frequent to safeguard safety levels (6.3)

Treatments ?
benefit/cost ratio ? Priority ?

Network Safety Management

Crash Data

😊
Quantitative

☹️
Rare and casual events
Data quality
Reactive process

vs.

Safety Inspection

😊
Easy to conduct
Proactive process

☹️
Qualitative

Network Screening

Sites with potential for Road Safety Improvement Identification & Ranking

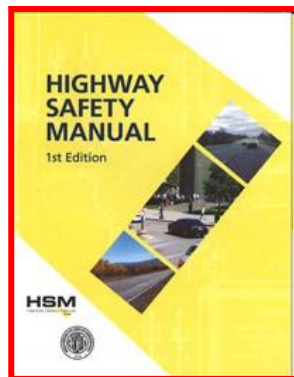
Sites Analysis
Problems Identification

Countermeasures Selection

Cost/Benefit Optimization

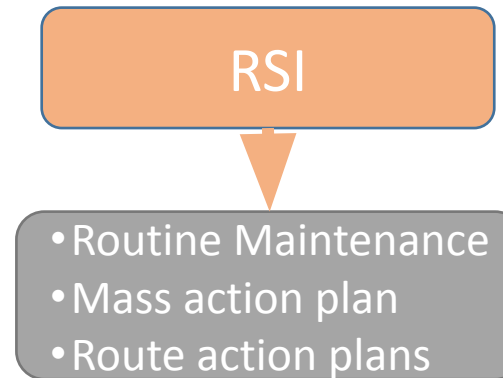
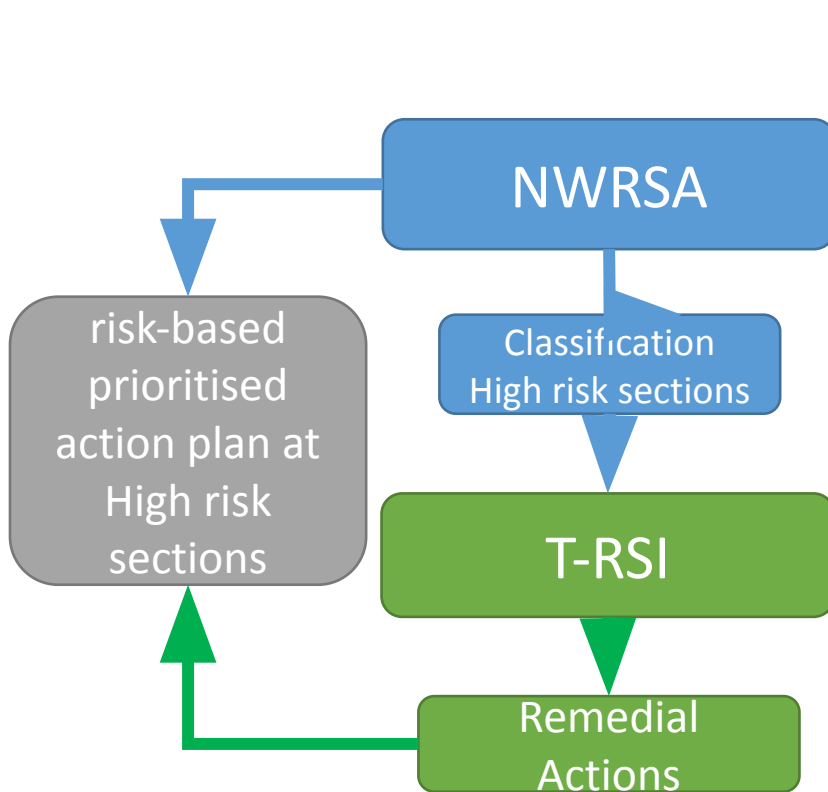
Cost ≤ Budget

Treatments



EU 2018 amended new DIRECTIVE RISM

Network Wide Road Safety Assessment (NWRSA)
Targeted Inspections (T-RSI) – Safety Inspections (RSI)



Questions:

- What is the target and time schedule for RSI (e.g. lower risk sections and maintenance needs 2 years after NWRSA)?
- Annex IIa identifies “indicative elements” for T-RSI. What are the safety issues to be considered in RSI?
- EU RISM requires Expert teams only for T-RSI. Do we need the same training and certification for T-RSI (e.g. theoretical) and RSI (e.g. practical) inspectors?

Comments: NWRSA is a new tool in RISM that will affect RSI procedures and results. We need to understand how NWRSA results and data can be of support to T-RSI and how RSI will complement NWRSA

Part 2

Safety Inspection Procedure

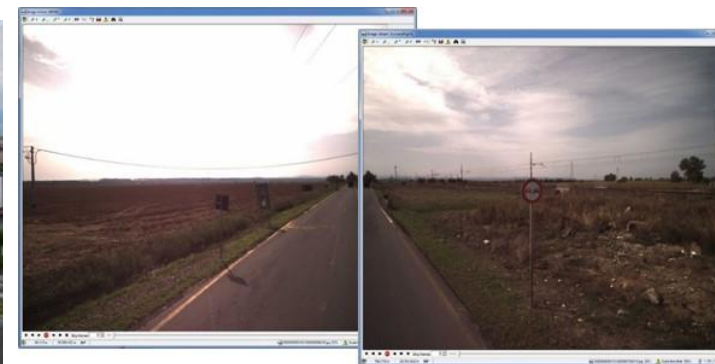
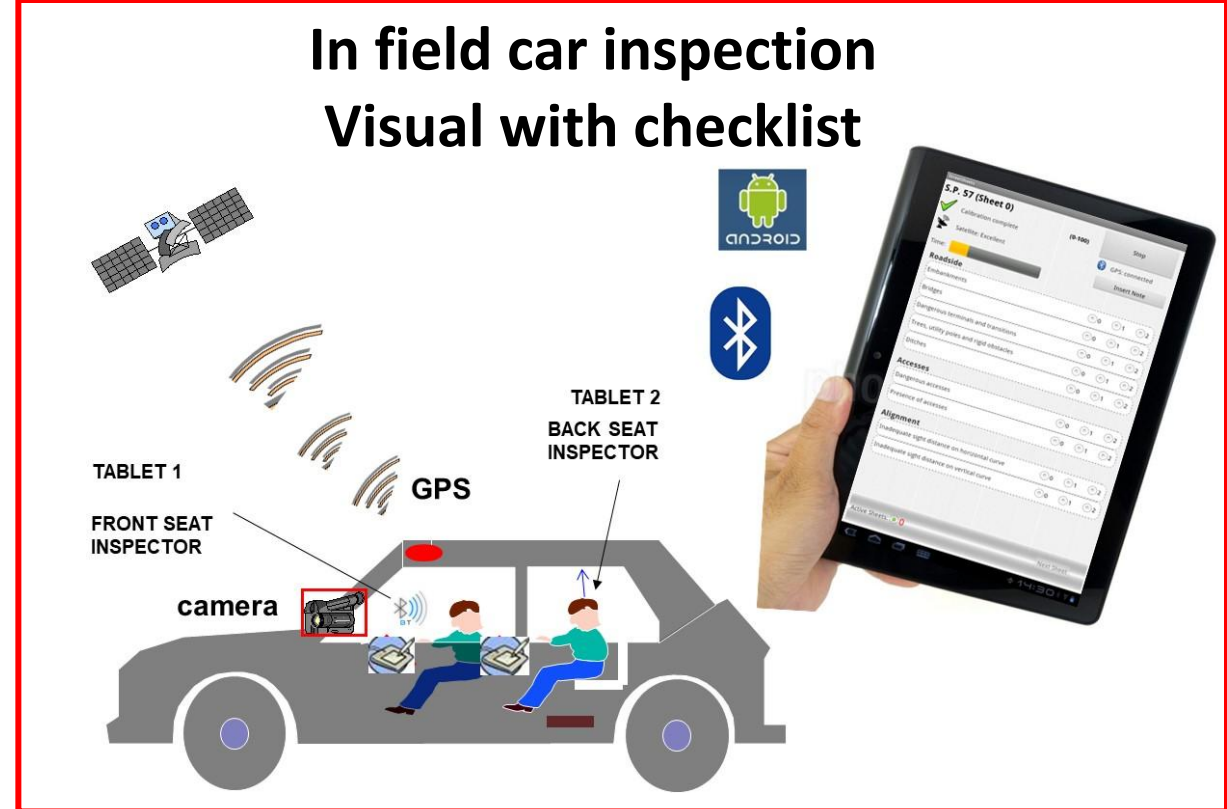
SAFETY INSPECTION Practice - Tools

Safety – Accuracy - Equipment Cost – Productivity
Pros - Cons!

In field manual inspection



Automated data collection Virtual Inspection

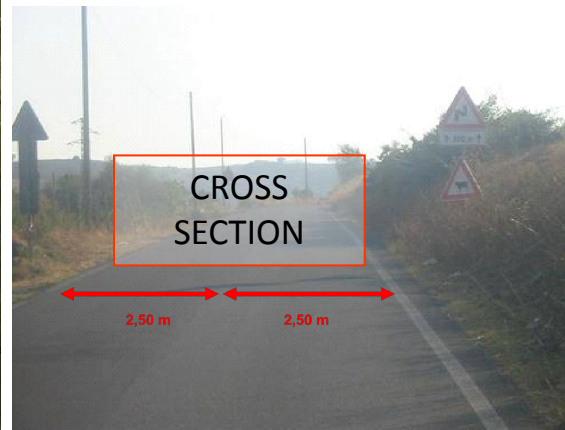


Front view



Rear view

Road Safety Inspection: safety issues



Module for the front-seat inspector

	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
PART A										
Roadside	L	H								
Embankments	X									
Bridges		X								
Dangerous terminals and transitions	X									
Trees, utility poles and rigid obstacles	-----									
Ditches	-----									
Alignment										
Inadequate sight distance on horizontal curve	-----									
Inadequate sight distance on vertical curve		X								
PART B										
Accesses										
Dangerous accesses										
Presence of accesses										

Running speed $\approx 36 \text{ km/h} = 10 \text{ m/s} \rightarrow 20 \text{ sec each } 200 \text{ m}$

PART A: recommended on site

PART B: best on site – eventually in office

Module for the back seat inspector

	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
PART A										
Cross section										
Lane width	■		■		■		■		■	
Shoulder width	■		■		■		■		■	
Pavement										
Friction	■	■	■	■	■	■	■	■	■	■
Unevenness	■		■		■		■		■	
Delineation										
Chevrons	■		■		■		■		■	
Guideposts and barrier reflectors	■		■		■		■		■	
PART B										
Signs										
Warning signs, regulation signs	■		■		■		■		■	
Markings										
Edge lines	■		■		■		■		■	
Center line	■		■		■		■		■	

In the Office

After in field Safety Inspection, Checklists are reviewed in the office by the Inspection Team (Review software)



Sheet 2 (200 - 400)

Roadside

Embankments	✓ <input checked="" type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2
Bridges	✓ <input checked="" type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2
Dangerous terminals and transitions	✓ <input type="radio"/> 0	<input checked="" type="radio"/> 1	<input type="radio"/> 2
Trees, utility poles and rigid obstacles	✓ <input type="radio"/> 0	<input checked="" type="radio"/> 1	<input type="radio"/> 2
Ditches	✓ <input type="radio"/> 0	<input checked="" type="radio"/> 1	<input type="radio"/> 2

Accesses

Dangerous accesses	✓ <input checked="" type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2
Presence of accesses	✓ <input checked="" type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2

Alignment

Inadequate sight distance on horizontal curve	✓ <input type="radio"/> 0	<input checked="" type="radio"/> 1	<input type="radio"/> 2
Inadequate sight distance on vertical curve	✓ <input checked="" type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2

Part 3

International applicability

Case study

RSI in Italy and Poland

Two Lane Rural Roads



University of Catania - Italy



Cracow University of
Technology - Poland

International Transferability



Road safety inspection in Poland

Characteristics of roads and surroundings		Description of site	
Name of the road/street		Name of segment.....	
Total road kilometers		Number of sheet	
Location from km to km			
kilometres	km	km	km
hectometre ascending	0 2 4 6 8	0 2 4 6 8	0 2 4 6 8
hectometre descending	8 6 4 2 0	8 6 4 2 0	8 6 4 2 0
Defects			
Inadequate course of the road			
Sight distance on straights and curves			
Sight distance at intersections and driveways			
Geometry of intersections and interchanges			
Incorrect type of intersection or junction			
Priority opposed to the geometry			
Incorrect geometry			
Railway crossings			
Lack of sight distance			
Lacks and errors in marking and signing			
Number and width of lanes			
Inadequate width			
Lack of additional lanes			
1x4 cross-section			
Sidewalks and bike paths			
Incorrect location of pedestrian/cyclist crossing			
Lack of protection for pedestrian/cyclist crossing			
Incorrect geometrical parameters			
Lack of sidewalks and bike paths			
Obstacles, limitation of sight distance			
Shoulders			
Incorrect width			
Lack of shoulder			
Bad technical condition			
Road drainage			
Lack of runoff water sites			

Three classes of severity
A small
B medium
C large & very large
 (updated)

Characteristics of roads and surroundings		Description of site	
Name of the road/street		Name of segment.....	
Total road kilometers		Number of sheet	
Location from km to km			
kilometres	km	km	km
hectometre ascending	0 2 4 6 8	0 2 4 6 8	0 2 4 6 8
hectometre descending	8 6 4 2 0	8 6 4 2 0	8 6 4 2 0
Defects			
Vegetation			
Limitation of sight distance			
Bed condition			
Close to the edge of roadway			
Signs			
Lack of signs			
Unnecessary signs			
Signs destroyed or damage			
Incorrect location of the signs			
Traffic signals			
Bed visibility and legibility			
Markings			
Unreadable marking			
Errors in markings			
Barriers and protective devices			
Beck of barriers			
Damaged barriers			
Incorrect ending			
Speed limits			
Lack of speed limit			
Unjustified speed limit			
Speed limit instead of other means			
Public transport			
Lack of bus bays			
Bad location			
Parking			
Incorrect location			
Inappropriate traffic management			
Road access			
Incorrect driveway			

Harmonization of IASP and Polish procedures

		0.2	0.4	0.6	0.8	1.0
PART A						
Roadside						
I1	Embankments (P22, P23, P44, P45)	█	█	█	█	█
I2	Bridges (P44, P45)	█	█	█	█	█
I3	Dangerous terminals and transitions (P46)	█	█	█	█	█
I4	Trees, utility poles and rigid obstacles (P59, P27)	█	█	█	█	█
I5	Ditches	█	█	█	█	█
Alignment						
I6	Inadequate sight distance on horizontal curve (P2, P16, P26, P28, P34, P60)	█	█	█	█	█
I7	Inadequate sight distance on vertical curve (P2, P16, P26, P28, P34, P60)	█	█	█	█	█
I8a	Geometric design consistency for horizontal curves (P1)	█	█	█	█	█
I8b	Geometric design consistency for horizontal tangent (P1)	█	█	█	█	█
I9	Geometric design consistency for vertical alignment (P1)	█	█	█	█	█
PART B						
Accesses						
I10	Dangerous access (P54)	█	█	█	█	█
I11	Presence of an access (P55)	█	█	█	█	█
Vegetation						
I12	Bad conditions of vegetation (P35)	█	█	█	█	█
I13	Vegetation close to the edge of roadway (P36)	█	█	█	█	█



I: Italian/Polish items



P: only Polish item (new)

Through a TAXONOMIC approach, it has been observed that many fields in the Polish checklist may be matched with similar IASP fields, while issues, that hadn't any correspondence, have been added in a new common checklist.

Harmonization of the two guidelines

In terms of equivalent Risk factor



Three scores of severity:

- 0** No problem
- 1** low severity
- 2** high severity



4(5) scores:

- No problem
- A** small
- B** medium
- C** large
- D** very large

updated

3(4) scores:

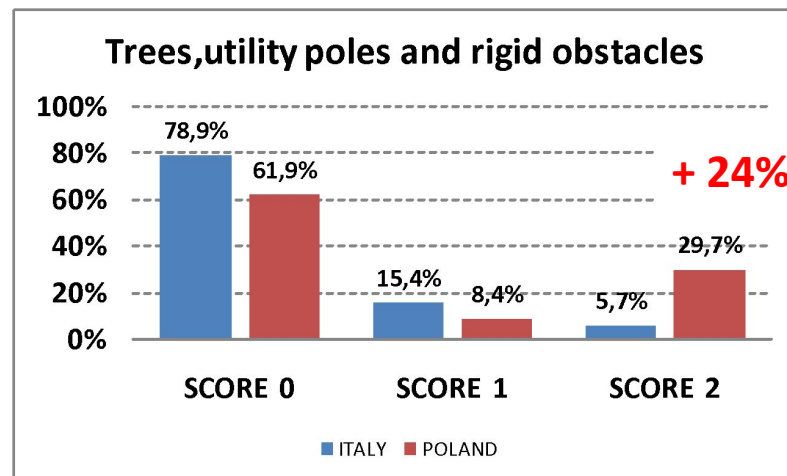
- No problem
- A** small
- B** medium
- C** large & very large

Safety issue		Polish risk category																	
		Embankments	Bridges	Dangerous terminals and transitions	Trees, utility poles and rigid obstacles	Ditches	Inadequate sight distance on horizontal curve	Inadequate sight distance on vertical curve	Dangerous accesses	Presence of accesses	Lane width	Shoulder width	Friction	Unevenness	Chevron	Guideposts and barrier reflectors	Edge lanes	Center lines	Warning signs, regulation signs
IASP severity score	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	B	B	A	A	A	A	A	C	C	A	A	A	A	A	A	A	A	A
	2	C	D	B	B	B	B	B	D	D	B	B	B	B	B	B	B	B	B



Results

RSI in Italy and Poland with IASP procedure

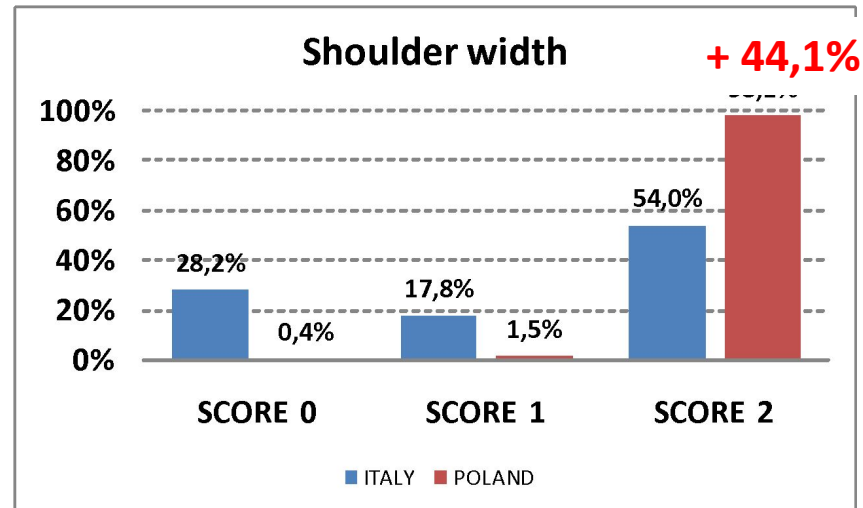


Roadside: Tree hazard
Score: HIGH



Results

SI in Italy and Poland with IASP procedure

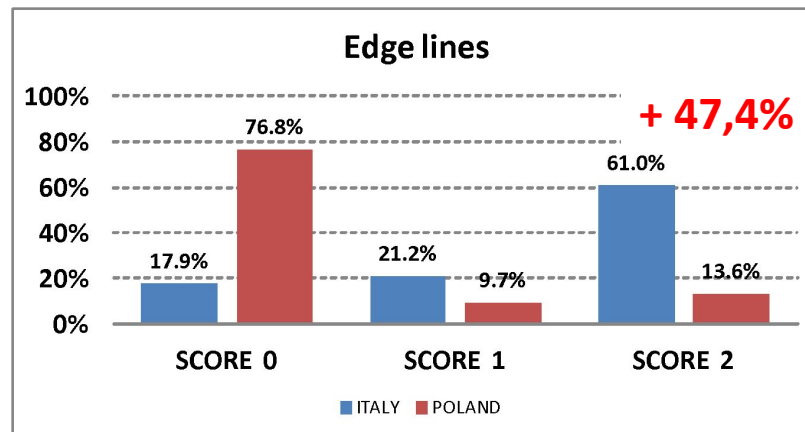
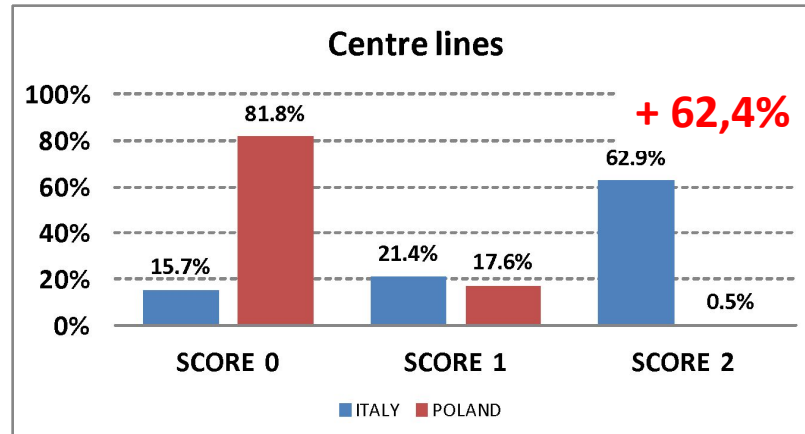


Inadequate shoulder
width
Score: High



Results

SI in Italy and Poland with IASP procedure



No lane marking
Score: High

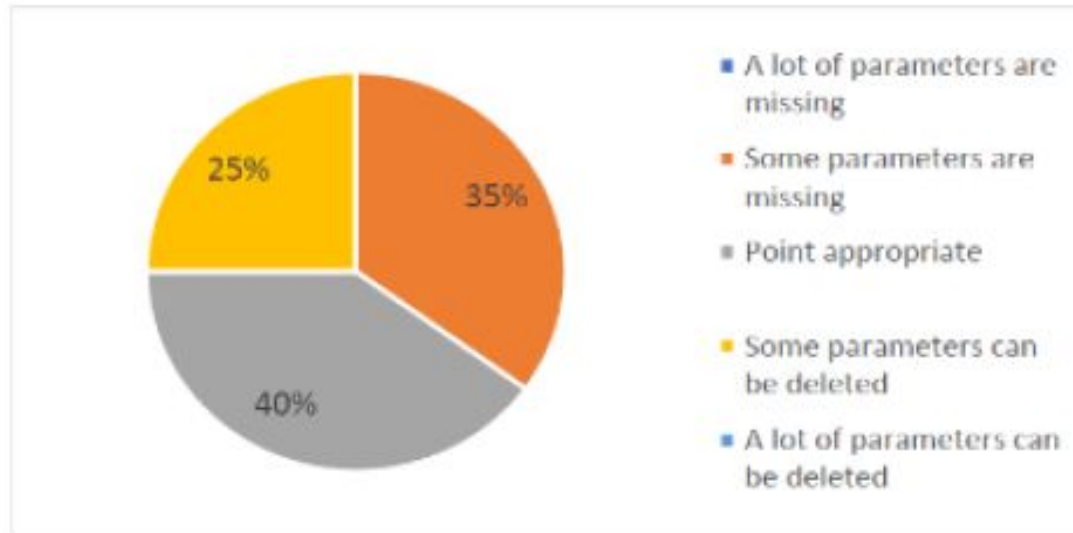
Case study in Poland

- The results showed the transferability of the RSI procedure in Poland.
- It is possible to apply the RSI method and equipment to carry out Safety Inspections complying with the Polish guidelines (limited adjustments are required).
- To ensure efficiency of the Safety Inspections, it is suggested to limit the number of issues and severity classes of Polish checklist.
- Even if limited to the experimental sample, comparison between Italy and Poland showed roadside hazard (i.e. lateral obstacle, reduced shoulder width) as the main safety issue in Polish two lane rural roads.

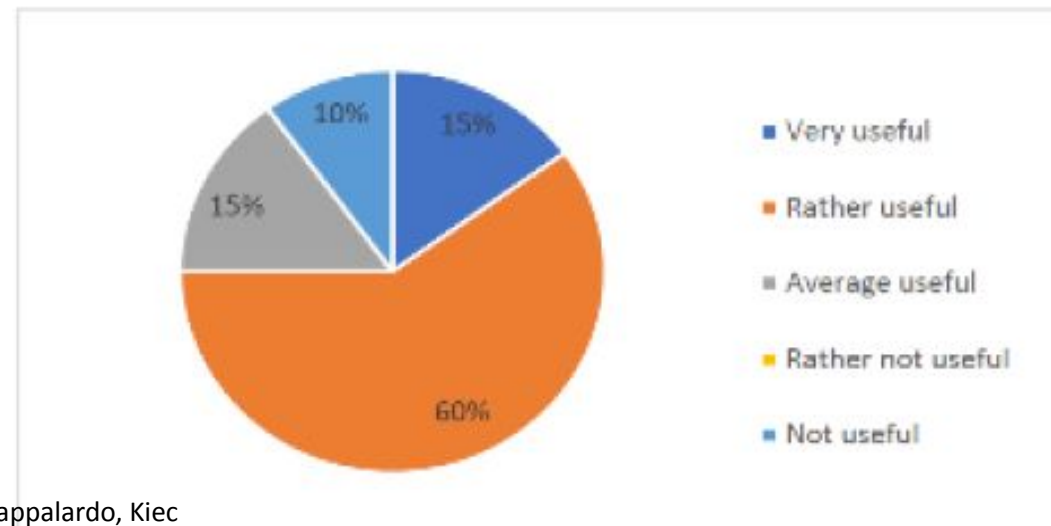


Questionnaire: 35 certified inspectors in Hungary

Question n°.4 - How complete do you feel about the method in terms of the parameters tested?



Question n°.5 - How useful do you think the method is?





Cairo University - Egypt

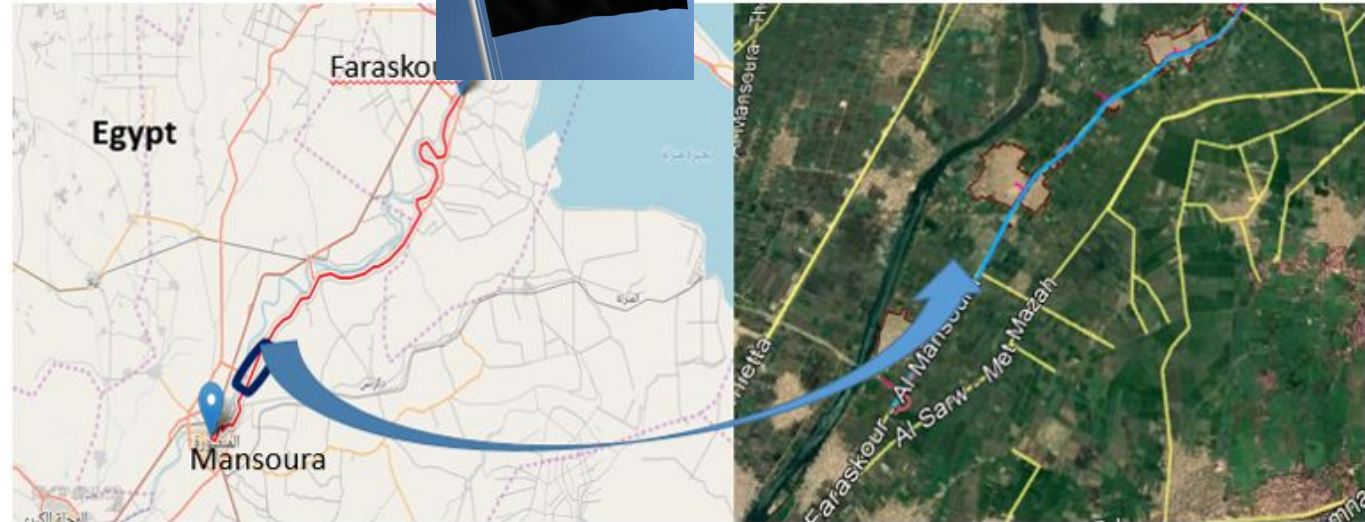
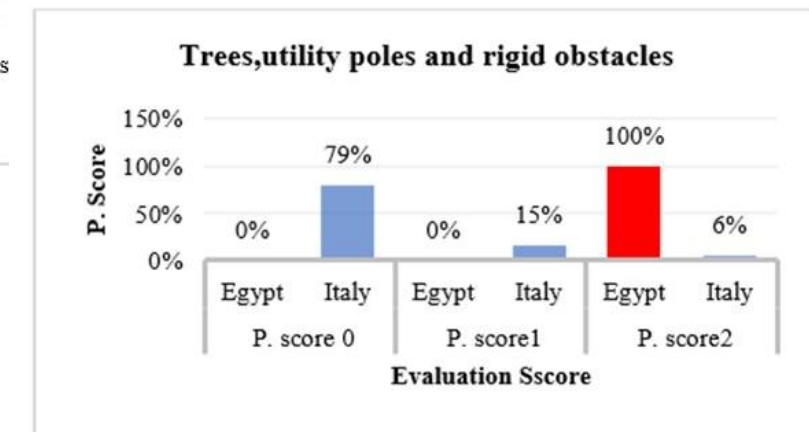
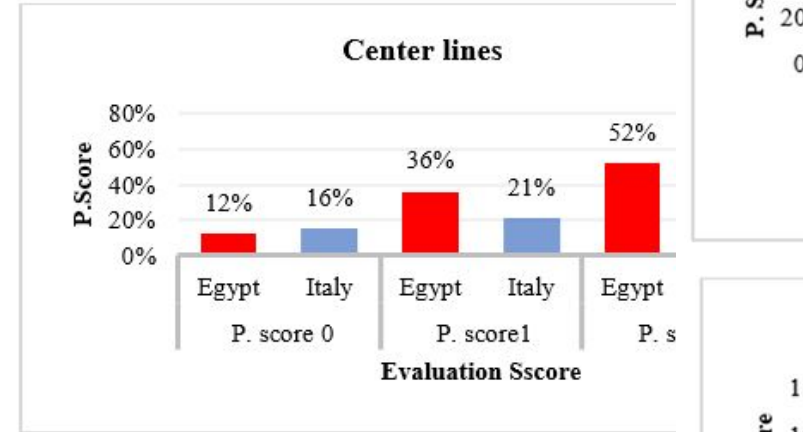
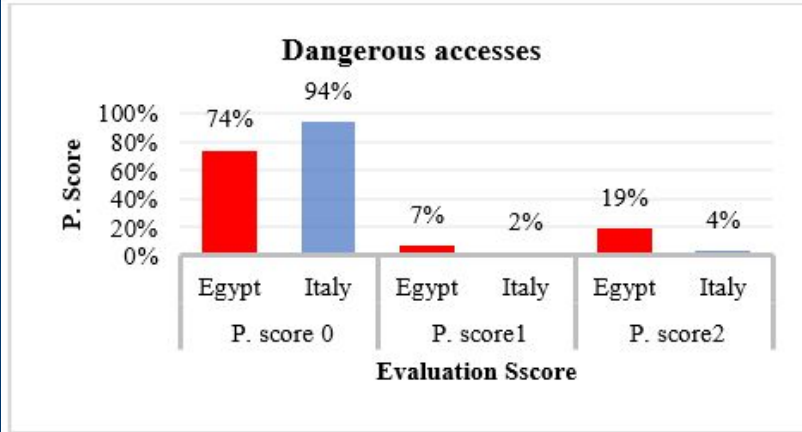
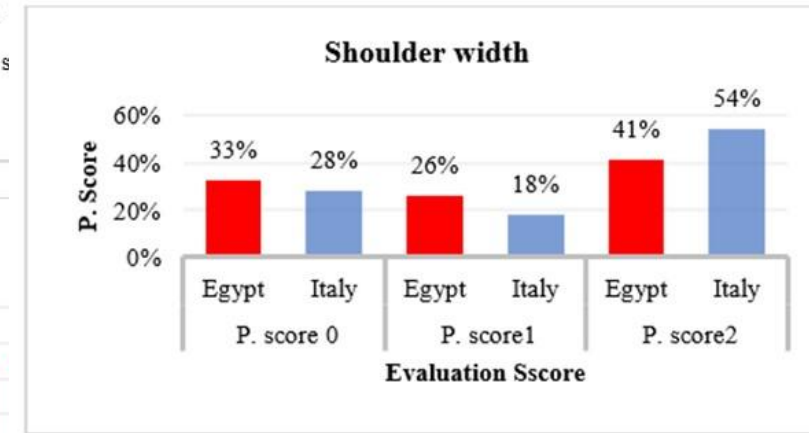
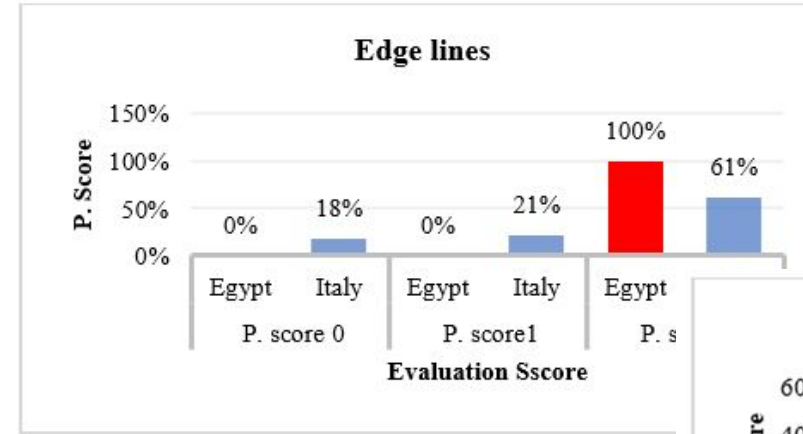
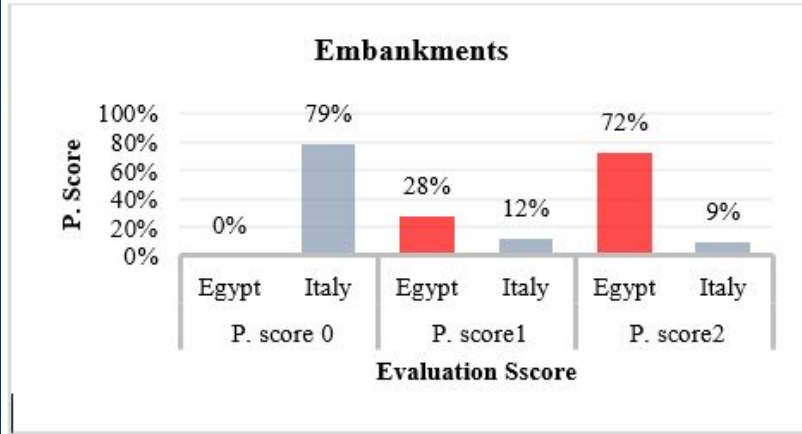
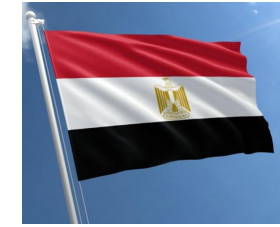


Figure 5: Case Study- Faraskour-Mansoura Road



Figure 6: Road Section Safety Issues



SI procedure: Conclusions & next steps

- The proposed **RSI operative procedure** is able to improve the effectiveness and reliability of the methodology
- The procedure has proved to be **effective to identify** and **to rank the** most relevant safety issues
- Applicability in **two lane rural roads**, where accident data generally do not give enough information for the safety analysis, makes the procedure very attractive
- The **RSI operative manual** allows to transfer to other road agencies the acquired knowledge and to obtain a greater objectivity in the inspection process

Next

- Safety inspections are only the first **step** of a more complex **safety evaluation process** which must provide quantitative evaluations for the Network Wide Road Safety Management (i.e ranking, B/C, Prioritization)