



Support for implementing measures for the South East Europe Core
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COLLECTION OF RESULTS AND EXAMPLES FROM THE RSI PILOTS IN THE SEETO REGION

Annex 4 to Road Safety Inspection Guideline

(FINAL)

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Collection of results and examples from the RSI pilots in the SEETO Region

1. Overview about the findings

The project team has conducted in the period from March to July 2009 seven Road Safety Inspections in the region. The pilots were done together with local engineers in every SEETO Participant. The following table contains the findings with the assessment of deficits.

| SEETO-Participant | Project data, characteristics | Assessment of deficits RSI pilots |
|-------------------|---|---|
| Montenegro | Interurban road in a mountainous area, Road M2, Length: about 1 km, 2-lane, one carriageway, Part of the European network (E 65/80) Date: 31/03/2009 | <ul style="list-style-type: none"> • Lack of super elevation with combination with problems regarding skid resistance, • Lack of safety guardrails, "windows" in the guardrail systems, no guardrails on bridges • Problems regarding road surface (rutting, potholes, drainage problems), • Problems with hard obstacles (fallen materials on the road, open manholes), • Bad sight conditions at intersections and missing signs, • Lack of sufficient rest areas, • Problems regarding marking and signing (some missing signs, marking in bad condition, missing delineators, missing edge lines, broken center lines suggestion, not sufficient coordination between horizontal and vertical signalization), • Bad sight conditions passing tunnels, driver can lose orientation |
| Serbia | Interurban road near Belgrade, Road M22, Length: about 2 km, 2-lane, 2 carriageways, part of the interchange "Orlovaca" Date: 07/04/2009 | <ul style="list-style-type: none"> • Unclear and unsafe situation for the interim solution for the interchanges, especially markings and signing, • too short and narrow weaving lane at first intersection, • unrecognizable and surprising change of cross section in a curvy situation (first left curve after first intersection), • unsafe exit at second intersection with a lane subtraction • Problems with directional signing causes confusion to the drivers • After the long straight section, curvy situation lack of chevron signs and delineators, as well as guardrails • Unprotected lamp posts and direction signs-need of additional guardrail sections • Insufficient speed limit at the area of first interchange. |
| Albania | Interurban road near Tirana, Road M22, | <ul style="list-style-type: none"> • Number of small intersection and accesses to the private properties in contradiction with the foreseen function and operation principle as a |

| | | |
|--|--|--|
| | <p>Length: about 2,6 km, 2-lane, one carriageways, connection to the Tirana International Airport Date: 12/05/2009</p> | <p>express connection to the airport</p> <ul style="list-style-type: none"> • Fixed hard obstacles near by road such as lamp post, billboards, etc. • Speed limit concept should be revised, • Unclear limit of urbanized area, • Some problems regarding signings (missing stop signs and missing chevron signs in curves) are recognized. Some correction of marking are necessary (phantom markings, correlation between marking and signing for forbidden overtaking) • No left turning lanes on small intersection with local roads. • Destroyed bridge joint can be dangerous esp. for powered two wheelers |
| former Yugoslav Republic of Macedonia | <p>Interurban road near Skopje, Road M 3, Length: about 2,0 km, 2-lane, one carriageways, Part of the European network (E 65) Date: 20/05/2009</p> | <ul style="list-style-type: none"> • Number of small and illegal intersection and accesses to the private properties is in the contradiction with the foreseen function and operation, • Bad sight conditions along the road and at access points (regular maintenance of the road), • Improving of the road signing and marking (including the intersection, for marking the usage of modern cold plastic materials with better retroreflection and better sustainability is recommended), • Problems regarding the pavement of the carriageway (rutting, pot holes) • Drainage system should be improved (re-profiling of ditches), • Few fixed hard obstacles near by road (directional signs and tree), • No left turning lanes on gasoline station (it should be checked). • Existing guardrail system is partly incomplete |
| Croatia | <p>Interurban road, Road D1, Length: about 1,0 km, 2-lane, one carriageways, Diversion link for motorway, partly through road character with pedestrian traffic Date: 26/05/2009</p> | <ul style="list-style-type: none"> • Number of small accesses to the private properties is in the contradiction with the foreseen function and operation (foreseen AADT is about 12000 pc/d), • Harmonization of speed limits, • Visibility at small intersections from secondary roads (to ensure give way), • Visibility and recognize ability of traffic signals, especially the repetition signal. • System of sidewalks incomplete, risks that pedestrian will use the carriageway for walking. |
| Kosovo | Interurban road | <ul style="list-style-type: none"> • Unclear and unsafe situation for the roundabout |

| | | |
|---------------------------------------|--|--|
| <p>(under UNSCR 1244/1999)</p> | <p>section near by Pristina, Road M2, Length: 2,7 km, main arterial character, two divided carriageways, parallel service roads, incl. one roundabout, Part of the European network (E 65) Date: 22/06/2009</p> | <p>especially with the unsafe and unusual connection with the service roads (to many conflict points, incomplete signing, wrong marking, high entrance speed, merge problems, dangerous maneuvers by drivers with destination to the service roads),</p> <ul style="list-style-type: none"> • Dangerous solution for the access to the fuel station from the main carriageway, • Operation principle for the parallel service roads as two way roads cause safety problems especially at the connecting points, • Concept and regulation for legal speed especially for the service road is not clear, • Solution for a safe pedestrian traffic is unclear, one pedestrian bridge is existing but no connection for guiding the pedestrian to the bridge, • Missing passive safety installation for the underpass near intersection Lapo Selo • Incomplete signing |
| <p>Bosnia and Herzegovina</p> | <p>Interurban road section near by Banja Luka Road M16, Length: 0,7 km, main arterial character, two carriageways without median separation, some access to adjacent shopping centre etc., Part of the European network (E 661) Date: 07/07/2009</p> | <ul style="list-style-type: none"> • Unsafe cross section: Lack of separation of the directions can caused head on collisions and illegal "U" turns. • Speeding: Drivers behave like on a motorway (existing cross section as well as the number of accesses and speed limits are not in accordance). • Access control: Too many unsafe (and/or illegal) solutions of access roads in short distance with too short acceleration and deceleration lane. • Lack of directional signing: Can cause confusion to the drivers. • Some signs are missing and there are some of the problems with night visibility of the marking. • High risk of severe run off accidents: Unprotected bridge piles, deep ditches, illegal access to road need additional safety barrier protection. • Bad conditions of the road surface. • Crossing pedestrians. |

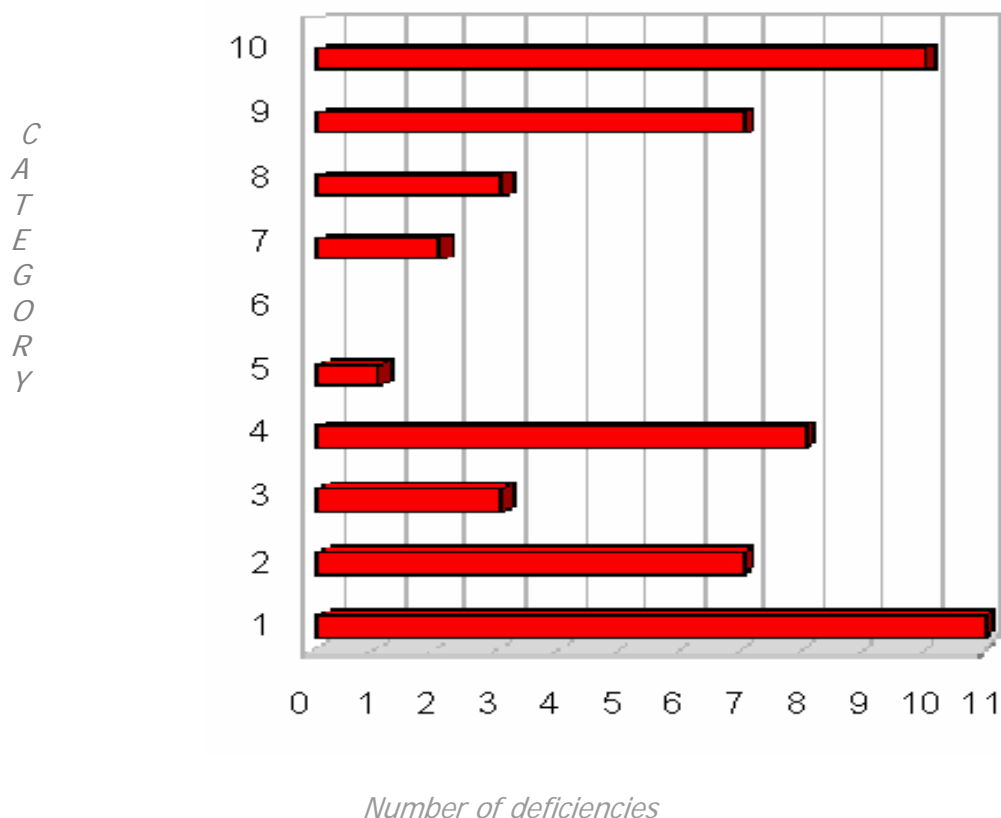
2. Conclusion and examples from the pilots

As a general conclusion we can resume, that the problems are similar in the SEETO Region. In details we found out some differences, obviously were the results of the effort which was done in the last decade to improve the road safety and the infrastructure slightly varying.

In the following table the findings are sorted by the RSI manual categories:

| | MNG | SRB | ALB | MK | CRO | KS | BiH | Total |
|--|-----|-----|-----|----|-----|----|-----|-------|
| Most critical deficits | 8 | 8 | 7 | 8 | 5 | 6 | 8 | 50 |
| 1 Function, Operating elements | 0 | 1 | 3 | 2 | 2 | 1 | 2 | 11 |
| 2 Cross section | 2 | 1 | 0 | 1 | 0 | 1 | 2 | 7 |
| 3 Alignment | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 3 |
| 4 Intersections, Interchanges | 1 | 3 | 1 | 0 | 1 | 1 | 1 | 8 |
| 5 Traffic signals, ITS | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 6 Railway crossings | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 Service and rest areas | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |
| 8 Need of vulnerable road users, Public transport | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 3 |
| 9 Traffic signing, marking, lighting | 1 | 2 | 1 | 1 | 0 | 1 | 1 | 7 |
| 10 Civil engineering structures and Passive safety installations | 3 | 1 | 2 | 2 | 0 | 1 | 1 | 10 |

The dedicated graph is suitable to show clear the weak points (x-axes= number of deficiencies and y-axes = categories like in the table above):



The results can be subsuming that the most challenges were identified in the category of the “Road Function, Operation” and in the categories “Marking and Signing” as well as “Passive Safety Installations, Road Side Features”.

Taking into consideration, that it is possible to improve the passive safety installation and the gaps regarding marking and signing with so called “low cost measures” a fast progress on the way to more road safety is realistic.

The identified problems regarding the contradictions between the foreseen road function and existing situation are worrying because of the difficulties to improve this situation. The main reason for this situation are the lack of a consequent hierarchy of the network, a lack of sufficient legal regulation or/and lack of enforcement of existing laws and regulations as well as contradictions between urban planning and traffic planning.

In detail the findings and examples with proposals for improvements according to the RSI categories can be resuming as it follows. With some typical example the problem are illustrated.

- **Function**

In the pilots it was evident, that a lack of sufficient and sustainable functional performance is one of the main problems. There are big contradiction between what should be and the current situation. A typical problem is identified regarding the access control.

The main arterials as road sections of the core network near by big cities are very attractive for business and trading. In addition is there backwards often no sufficient secondary network for access. That leads to a situation that in addition to their origin function to guarantee the mobility for the long term traffic this road shall ensure access. The results are challenging problems not only for the road safety but also for the level of service.

Furthermore in the concept of the legal speed this special situation (high number of turning manoeuvres and pedestrians) is often not respected. For the driver it is partly not understandable if he is driving inside or outside the built up area. The existing speed limits in subsections with pedestrian traffic is sometimes dangerous (60 – 70 km/h) and can lead to serious consequence of accidents with pedestrians.

To improve that situation, a strict policy to avoid access on interurban roads and a reorganizing of existing facilities (separation with service road etc.) is necessary.

The following pictures are examples to illustrate the findings regarding “function”:



Figure 2.1. Interurban road near by a city – unorganized access situation



Figure 2.2. Express road with parallel service road but direct access from a petrol station to the main carriageway

Comments to example in figure 2.1.:

Problem: unorganized development of trading and business activities, the roadside is "occupied" as a big access area

Proposal for improvements: Reorganizing access from secondary access road network, reduction better closure of the access

Comments to example in figure 2.2.:

Problem: The two carriageway express road has parallel services roads, but the costumers of a petrol station have direct access to the main carriageway

Proposal for improvements: Closing the direct connection, improvements regarding the directional sign can lead costumers to the petrol station by using the well developed service road with a little delay

• **Cross section**

In some RSI problems regarding the cross section were found out. The main findings were lack of superelevation in curves, low long fall in section with turning direction of the cross fall, road surface in bad conditions (ruttings, lack of skid resistance) and in one situation to narrow lanes in an interchange subsection.

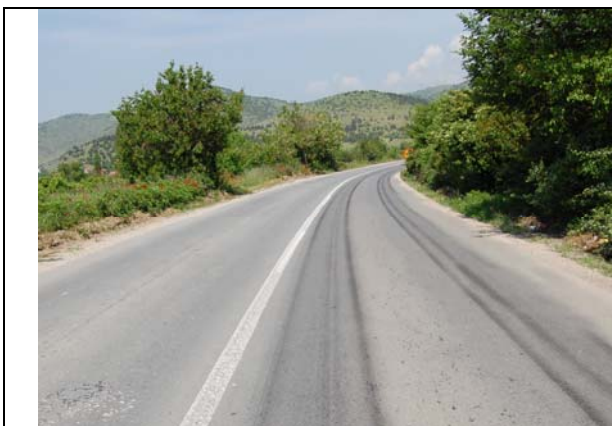


Figure 2.3. Ruttings and bleeding of asphalt



Figure 2.4. Weaving lane to narrow for large vehicles

Comments to example in figure 2.3.:

Problem: The lack of evenness in combination with rain and snowfall can lead to serious problems for the driver like aquaplaning. In addition very high risks for powered two wheelers.

Proposal for improvements: Resurfacing

Comments to example in figure 2.4.:

Problem: A two carriageway express road in a subsection of a split level junction. In a first construction step an interim solution was design with a insufficient lane width for the weaving lane (approx. 2,5 m)

Proposal for improvements: Change of the marking would make it possible to have 3 x 3,0 m wide lanes

• **Alignment**

In few RSI pilots problems regarding the alignment were identified. The identified issues are very common for such existing network. The typical deficiencies were identified as a lack of alignment consistency regarding the curve design and insufficient sight distances.



Figure 2.5. Curve sequence with small radii after a long stretched section is not visible



Figure 2.6. Lack of lateral clearance

Comments to example in figure 2.5.:

Problem: The curve sequence with small radii after a long stretched section is unexpected for a driver. There are not any measure to support the drivers perception like chevron sign, delinators etc. foreseen.

Proposal for improvements: Add sufficient warning signs, provide obstacle free zone in the outside of the curve (or guardrails) to reduce accident severity in the case of run offs.

Comments to example in figure 2.6.:

Problem: Lack of lateral clearance, problem with the stopping sight conditions

Proposal for improvements: Cutting the slope to ensure sight distance

• **Intersections, traffic lights, railway crossings**

In some cases were intersections also included in the RSI pilot sections. The most common problems are quite unorganized intersections with unsafe length of acceleration and deceleration lanes as well as lack of turning lanes, missing signs, missing sight conditions.

In one RSI a roundabout solution was included. The roundabout was quite new, unfortunately in some details the solution was insufficient (number of lanes, to low deflection, missing signs etc.)

Only in one pilot traffic lights were include (traffic light under construction). The RSI team made some suggestions to improve the visibility of the traffic signals.

Railway crossing feature were not inspected in any SEETO Participant.



Figure 2.7. “Canalized” junction without marking and signing



Figure 2.8. Regulation of the traffic with traffic light – bad visibility regarding the signals

Comments to example in figure 2.7.:

Problem: In one road section we found an canalized junction which was obviously constructed some years ago. In the current situation was there not any marking to show the left turning lane and almost all signs were missing.

Proposal for improvements: It should be checked if this junction is still in use. If so, the situation should be improved with a proper marking and signing.

Comments to example in figure 2.8.:

Problem: From the secondary leg of a junction the traffic lights (under construction) are hardly recognizable (esp. when the operation will start). One signal is hid by signs, the second is installed on the opposite site of the road.

Proposal for improvements: It should be checked if it is possible to have overhead signals for better visibility.

- **Public and private services, service and rest areas**

Regarding this issue the typical problem in the region is at one hand the lack of sufficient rest place (esp. for trucks) and unsafe solution of access to petrol stations along interurban road sections (pls. see topic function).

- **Vulnerable road user needs**

Only in few pilots the inspected road section was in an area with pedestrian traffic. If there was pedestrian traffic common problems were identified like a lack of footpath connection or crossing facilities.



Figure 2.9. Bus-stop with lay-by, lack of crossing facility and connecting footpath



Figure 2.10. Modern pedestrian bridge crossing an express road with adjacent service roads, but lack of connection to guide the pedestrians

Comments to example in figure 2.9.:

Problem: Good designed bus lay bys with shelter, but no regular pedestrian crossing as well as no sufficient footpath connection to the adjacent built up area.

Proposal for improvements: Marked pedestrian crossing or traffic island as crossing help should be installed, improvements of footpath connection to avoid that pedestrians are forced to use the carriageway.

Comments to example in figure 2.10.:

Problem: Modern pedestrian bridge crossing an express road with adjacent service roads, but lack of connecting footpaths to guide the pedestrians to that facility.

Proposal for improvements: Parallel footpaths to connect the bridge with the adjacent built up area.

• Traffic signing, marking and lighting

In almost all pilots problem regarding the signing and marking were identified like as:

- Missing regulating signs
- Missing directional signing or misguiding signing
- Marking with bad performance especially at night.

This is quite surprising because in the legal and technical regulations are mainly precise.



Figure 2.13. Insufficient directional signing solution, misleading marking



Figure 2.14. Marking in bad condition, old "phantom" marking

Comments to example in figure 2.13.:

Problem: The directional signing does not show the real situation of the three lanes and the complex situation (only 250 m after this interchange is the next one). Also the marking is mixed (broken line with solid line).

Proposal for improvements: Improvement of directional signing, clarify marking

Comments to example in figure 2.14.:

Problem: The marking is in the darkness not sufficient and the old "phantom" marking could misguide the driver. is mixed (broken line with solid line).

Proposal for improvements: Renewing of the marking in sufficient quality of for a European TEN roads.

• Roadside features and passive safety installations

Considering the challenging situation regarding the road function the passive safety installation are together with the signing and marking the most common problem.

As the typical deficiencies were identified:

- o Lack of passive safety installations at dangerous spots,
- o Insufficient technical solutions (like usage of wrong connection bolts and welded connection of beams, dangerous end construction etc.) and lack of maintenance after crashes,
- o Lack of coordination between sufficient safety barrier solution along road sections and adjacent bridges,
- o Obstacles along the road.



Figure 2.15. Missing guardrail for an overpass bridge pile



Figure 2.16. Missing guardrail at the bridge section

Comments to example in figure 2.15.:

Problem: Missing guardrail for an overpass bridge pile along a express road. This is not only a problem of the result for the car which could hit this facility. It could be also a critical situation for the structure in the case of a hit by a big truck (is the structure stable enough).

Proposal for improvements: Installing of a sufficient safety barrier

Comments to example in figure 2.16.:

Problem: Missing guardrail at a viaduct and in the adjacent road section.

Proposal for improvements: Installing of a sufficient safety barrier.