TA to Connectivity in the Western Balkans

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Sub-Project

Code: CONNECTA-TRA-CRM-REG-01
Area: Connectivity Transport Reform Measures

Preparation of Road Safety Inspection and Audit Plans for core/comprehensive road network in Western Balkans (WB6) and Pilots

FINAL REPORT –
ROAD SAFETY INSPECTIONS

30 May 2018

MOTT MACDONALD CONNECTA CONSORTIUM

Issue and revision record

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3	30/05/2018	Stelios Efstathiadis (Task. Manager)	Jesper Mertner	Kostas Georgiou	RSI Final Report

Information Class: EU Standard

Contents

List of Abbreviations

ALB/AL	Albania
AO	Administrative Order
ARA	Albanian Roads Authority
AusRAP	Australian Road Assessment Programme
BiH	Bosnia and Herzegovina
CA	Contracting Authority
ChinaRAP	China Road Assessment Programme
CNC	Core Network Corridor
Connecta	Technical Assistance to Connectivity in the Western Balkans
Connecta	The MMD led Consortium implementing Connecta
CRM	Connectivity Reform Measures
CRMMP	Connectivity Reform Measures Management Plan
DG MOVE	Directorate-General for Mobility and Transport
DG NEAR	Directorate-General for Neighbourhood and Enlargement Negotiations
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EU	European Union
EUR	Euro (currency)
EuroRAP	The European Road Assessment Programme
FBiH	Federation of BiH (entity)
FR	Final Report
ICJ	International Court of Justice
IFI	International Financing Institution
IFICO	International Financing Institution Coordination Office
IPA	Instrument for Pre-accession Assistance
IPF	Infrastructure Project Facility
ITS	Intelligent Transport Systems
IR	Inception Report
iRAP	The International Road Assessment Programme
KE	Key Expert
KfW	Kreditanstalt fur Wiederaufbau (Bank)
KiwiRAP	Kiwi Road Assessment Programme
KoM	Kick-off-Meeting
KOS	Kosovo* (hereinafter referred to as Kosovo)
MAP	Multi Annual Plan
MED	Mediterranean (corridor)
MKD	the former Yugoslav Republic of Macedonia
MMD	Mott MacDonald
MNE/MON	Montenegro
MoTC/MoI/MoCTI	Ministry related to Transport and Infrastructure
MTI	Ministry of Transport and Infrastructure

* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

NIPAC	National IPA Coordinator
NKE	Non-Key Expert
OEM	Orient East Mediterranean (corridor)
PD	Preliminary Design
PDF	Project Description Form
PE	Public Enterprise
PERS/PE RoS	Public Enterprise Roads of Serbia
PM	Project Manager
REG	Regional
RFA	Request for Approval
RPS	Road Protection Score
RS	Republic of Srpska (entity of BiH)
RS	Road Safety
RSA	Road Safety Audit
RSI	Road Safety Inspection
RSWG	Road Safety Working Group
SEETIS	South East Europe Transport Information System
SEETO	South East Europe Transport Observatory
SNKE	Senior Non Key Expert
SRB/SER	Serbia
TA	Technical Assistance
TAIEX	Technical Assistance and Information Exchange instrument of the European Commission
TEN-T	Trans-European Network – Transport
TL	Team Leader
ToR	Terms of Reference
TRA	Transport
UNSCR	United Nations Security Council Resolutions
usRAP	United States Road Assessment Programme
ViDA	cloud-based software developed for iRAP
vWB	Western Balkan
WB6	Western Balkans 6 countries
WB (G)	World Bank (Group)

1 SYNOPSIS

Project (sub-project) Title:	**Preparation of Road Safety Inspection (RSI) and Audit (RSA) Plans for core/comprehensive network in Western Balkans (WB6) and Pilots** **Final report - Road Safety Inspection (RSI)**
Project Code:	CONNECTA-TRA-CRM-REG-01
Area:	Connectivity Transport Reform Measures in WB6
Contracting Authority:	European Commission - DG NEAR
Main Beneficiary/Monitoring:	SEETO
End Beneficiaries:	Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Kosovo (hereinafter referred to as Kosovo), Montenegro, and Serbia
Context:	Regional
Consultant:	Mott MacDonald Ltd. (UK) in Consortium with COWI A/S, WYG, CeS COWI, TRENECON, SYSTEMA
Administrative Order:	31 May 2017 (supplementary on 26 June 2017)
Mobilisation of NKEs:	05 June 2017 (Kick-off Meeting with SEETO at 13 June 2017)
Sub-Project Duration:	12 months
Anticipated completion:	04 June 2018
Responsible Transport KE:	Kostas Georgiou

1.1 Component 1- Purpose and Objectives

The South East Europe Region has a high road crash rate compared to EU countries with the 6 SEETO Regional Participants having almost 84 road deaths per million population in 2016 compared to the EU28 at just over 50 road deaths per million of population. In 2016, more than 1,500 were killed and almost 55,000 were injured in the SEETO Regional Participants according to MAP2018[1]. The road safety reform progress around the WB6 varies but is generally low. The EU Directive 2008/96/EC is not (or only partly) transposed in national legislations.

The Preparation of Road Safety Inspection (RSI) and Audit (RSA) Plans for core/comprehensive network in Western Balkans (WB6) and Pilots Project commenced with a Kick-off Meeting on the 13 June 2017 with an expected project duration of 12 months.

1.1.1 Project Purpose

The purpose of this TA is to prepare short-term plans (2018-2020) for road safety inspection and audit for the whole Core and Comprehensive Road Network in the Western Balkans. This consultancy will - as RSI/RSA pilots - also deliver a part (10% and 6 projects, respectively) of these overall plans in 2018.

The objective is to provide direct support to the Western Balkans' ministries responsible for transport and infrastructure and to road authorities for programming infrastructure maintenance and to assist the SEETO Secretariat in monitoring the implementation of relevant transport measures in the framework of Connectivity Agenda.

1.1.2 Objectives of TA

The specific objectives of this TA are to support the implementation of road safety measures under the CRMMP for 2016/2017:

- Prepare three-year RSI plan for the core and comprehensive network and pilot RSIs on high crash sections
- Help to ensure that road safety audits are carried out according to the Directive 2008/96/EC on all projects on the core and comprehensive network and undertake sample audits
- Support RPs in establishment of a national system for continuous road crash data collection (by 2018).

[1] SEETO Multi-Annual Development Plan, Multi-Annual Plan 2018, Common problems – Shared solutions

1.1.3 Activities of component

The four activities contained within this component are:

Activity 1 Map existing core and comprehensive road network in Western Balkans.

Activity 2 Compile a list of all Road Safety Inspections that have been implemented during the last 3 years (2014-2016), including those that followed the EuroRAP/iRAP inspection methodology. The list should include the recommendations of these inspections.

Activity 3 Prepare a three-year Plan (2018-2020) for road safety inspection for the core and comprehensive road network. This plan should recommend the use of two methods: i) traditional road safety inspection using SEETO's road safety inspection guidelines, and ii) EuroRAP road survey and star rating methodology. The Plan will include the required inspectors' inputs and an indicative cost to deliver it by consulting firms.

Activity 4 Undertake road safety inspections using SEETO's road safety inspection guidelines on 10% (about 550 km) of the core and comprehensive road network that is considered highest risk portion of the network based on fatal crash data. SEETO members will prepare a list of their high risk sections and the Consultant will then compile a list of about 550 km of these high risk roads by maintaining a reasonable distribution among all SEETO's members. The decision on the specific sections to be inspected will be taken jointly with SEETO and by also taking into account existing and foreseen TAs for RSI.

The present report is the three-year plan (2018/19-2020/21) for road safety inspection of the SEETO core and comprehensive road network.

2 Existing Core and Comprehensive road network in Western Balkans

The SEETO road network consists of Corridors and Routes, as follows:

Corridor Vc (400km):	CRO border/Bosanski Samac (BIH) – Sarajevo (BIH) – Doljani/CRO border
Corridor VIII (657km):	Tirane/ Durres/ Vlore (ALB) – Skopje (MKD) – Deve Bair/BG border
Corridor X (726km):	CRO border /Batrovci –Belgrade (SRB) – Skopje (MKD) – Bogorodica/GR border
Corridor X B (185km):	HU border/ Horgos—Novi Belgrade (SRB)
Corridor X C (110km):	Nis (SRB) —Gradina/BG border
Corridor X D (117km):	Veles (MKD) —Medzitlija/ GR border
Route 1 (147km):	CRO border/Neum Northwest – Neum (BIH) –Bar (MNE)
Route 2a (228km):	CRO border/Gradiska – Banja Luka (BIH) – Lasva (BIH)
Route 2b (395km):	Sarajevo (BIH) – Podgorica (MNE) – Vore (ALB)
Route 2c (125km):	Fier (ALB) —Kakavija/GR border
Route 3 (185km):	Sarajevo (BIH) —Uzice (SRB)
Route 4 (601km):	Romanian border/Vatin – Belgrade (SRB) – Podgorica (MNE) – Bar (MNE)
Route 5 (213km):	Cacak (SRB) – Krusevac (SRB) – Paracin (SRB) – Vrska Cuka/BG border
Route 6a (259km):	Ribarevina (MNE) – Ribarice (SRB) – Pristina (KOS) – Skopje (MKD)
Route 6b (205km):	Pristina (KOS) –Peje/Pec (KOS) – Kolasin (MNE)
Route 7 (314km):	Lezhe (ALB) – Pristina (KOS) – Doljevac (SRB)
Route 8 (78km):	Podmolje (MKD) – Bitola MKD)
Route 9a (305km):	Novi Sad (SRB) – Ruma (SRB) – Loznica (SRB)/Zvornik (BIH) – Tuzla (BiH) – Doboj (BiH) – Banja Luka (BiH)
Route 10 (142km):	Miladinovci (MKD) – Stip (MKD) – Novo Selo (MKD)

The total length of the SEETO comprehensive and core network is according to MAP2018[2] 5462 km of which the Core road network is 3,522 km and of the Comprehensive road network is 1,940 km long. On the entire network, approx. 2,198 km are Corridors and approx. 3,264 km are Routes.

The following map shows the Core and Comprehensive network of the Western Balkans (WB6).

[2] SEETO Multi-Annual Development Plan, Multi-Annual Plan 2018, Common problems – Shared solutions


Indicative Extension of the TEN-T Road
Comprehensive/Core Network to the Western Balkans
SEETO
SOUTH-EAST EUROPE TRANSPORT OBSERVATORY
Belgrade
Sarajevo
Podgorica
Pristina
Skopje
Tirana
Adriatic Sea
Ionian Sea
Legend
Core Network
Comprehensive Network
N
0 25 50 100 Km
November 2017

3 Road Safety Inspections implemented in the past

Information regarding the Road Safety Inspections that have been implemented during the last 3 years, including those that followed the EuroRAP/iRAP inspection methodology have been gathered.

The following Table incorporates all information that have been received from the regional member countries. Thus, the road sections that do not have RSI will be the starting point for the 3-year plan proposal.

	All sections	SEETO Network	Corridors /Routes	past 3years	
				RSI	iRAP
ALB	Muriqan(MNE border) - Koplik	Core	Route 1	Yes	
	Koplik - Skhoder	Core	Route 1		
	Skhoder - F. Kruje	Core	Route 1	Yes	
	F. Kruje - Lezhe	Core	Route 1		
	Hani i Hotit (MNE border) - Fush Kruje	Comprehensive	Route 2b		
	Fush Kruje - Vore	Comprehensive	Route 2b	Yes	
	Rrogozhine - Fier	Core	Route 2c	Yes	
	Fier - Tepelene	Core	Route 2c		
	Tepelene - Kakavia (GR border)	Core	Route 2c	Yes	
	Morine Vermice (KOS border) - Lezhe	Core	Route 7	Yes	
	Qaf Thane (MKD border) - Elbasan	Core	Corridor VIII	Yes	
	Elbasan - Tirane	Core	Corridor VIII	Yes	
	Tirane - Durres	Core	Corridor VIII		
	Durres - Vlore	Core	Corridor VIII		
	Fier - Vlore	Core	Corridor VIII		
BIH	Neum west - Neum South	Core	Route 1		
	Gradiska (CRO border) - Banja Luka - Jajce Jug	Core	Route 2a		
	Jajce Jug - Donji Vakuf	Core	Route 2a		
	Donji Vakuf - Lasva	Core	Route 2a		
	Sarajevo - Hum (MNE border)	Comprehensive	Route 2b		
	Sarajevo - Lapisnica	Comprehensive	Route 3		
	Lapisnica - Ljubogosta	Comprehensive	Route 3	Yes	
	Ljubogosta - Podromanija	Comprehensive	Route 3		
	Podromanija - Rogatica	Comprehensive	Route 3	Yes	
	Rogatica - Vardiste (SRB border)	Comprehensive	Route 3		
	Banja Luka - Doboj - Karakaj (SRB border)	Comprehensive	Route 9a		
	Bosanski Samac (CRO border) - Matuzici	Core	Corridor Vc		
	Matuzici - Ozimica	Core	Corridor Vc		
	Ozimica - Topcic Polje	Core	Corridor Vc		
	Topcic Polje - Sarajevo - Jablanica	Core	Corridor Vc		
	Jablanica - Potoci	Core	Corridor Vc		
	Potoci - Doljani (CRO border)	Core	Corridor Vc		

	All sections	SEETO Network	Corridors /Routes	past 3years	
				RSI	iRAP
MKD	Djeneral Jankovic (KOS border) - Skopje	Core	Route 6a		Yes
	Podmolje - Bitola	Comprehensive	Route 8		Yes
	Miladinovci - Stip - Novo Selo (BG border)	Comprehensive	Route 10		Yes
	Kafasan (ALB border) - Skopje	Core	Corridor VIII		Yes
	Skopje - Stracin	Core	Corridor VIII		Yes
	Stracin - Kriva Palanka	Core	Corridor VIII		Yes
	Kriva Palanka - Deve Bair (BG border)	Core	Corridor VIII		Yes
	Tabanovce (SRB border) - Skopje - Bogorodica (GR border)	Core	Corridor X		Yes
	Veles - Prilep	Comprehensive	Corridor Xd		Yes
	Prilep - Bitola	Comprehensive	Corridor Xd		Yes
	Bitola - Medzitlija (GR border)	Comprehensive	Corridor Xd		Yes
KOS*	Brnjak (SRB border) - Veternik	Comprehensive	Route 6a		
	Veternik - Lipljan	Core	Route 6a		
	Lipljan - Hani i Elezit (MKD border)	Core	Route 6a		
	Kuqishte (MNE border) - Kijeve/Kijevo	Comprehensive	Route 6b		
	Kijeve/Kijevo - Gjurgjice/Djurdjice	Comprehensive	Route 6b		
	Gjurgjice/Djurdjice - Fushe Kosove/Kosovo Polje	Comprehensive	Route 6b		
	Vermice/Vrbnica (ALB border) - Merdare (SRB border)	Core	Route 7		
MNE	Debeli Brijeg (CRO border) - Sukobin (ALB border)	Core	Route 1		
	Scepan Polje (BIH border) - Bozaj (ALB border)	Comprehensive	Route 2b		
	Dobrakovo (SRB border) - Mioska	Core	Route 4		
	Mioska - Podgorica	Core	Route 4		
	Podgorica - Bar	Core	Route 4		
	Ribarevine - Dracenovac (SRB border)	Comprehensive	Route 6a		
	Kolasin - Kula (KOS border)	Comprehensive	Route 6b		

	All sections	SEETO Network	Corridors /Routes	past 3years	
				RSI	iRAP
SRB	Uzice - Kotroman (BIH)	Comprehensive	Route 3		
	Vatin (RO border) - Belgrade - Orlovaca	Core	Route 4		
	Orlovaca-Stepojevac	Core	Route 4		
	Stepojevac-Celije	Core	Route 4		
	Celije - Knezevici	Core	Route 4		
	Knezevici - Kokin Brod	Core	Route 4	Yes	
	Kokin Brod - Gostun (MNE border)	Core	Route 4		
	Cacak/Preljina - Mrcajevci	Comprehensive	Route 5		
	Mrcajevci - Vrnjci	Comprehensive	Route 5		
	Vrnjci - Kamidzora	Comprehensive	Route 5		
	Kamidzora- Paracin - Vrska Cuka (BG border)	Comprehensive	Route 5		
	Spiljani (MNE border) - Brnjak (KOS border)	Comprehensive	Route 6a		
	Nis - Merosina	Core	Route 7	Yes	
	Merosina - Merdare (KOS border)	Core	Route 7		
	Novi Sad/Petrovaradin - Sremska Kamenica	Comprehensive	Route 9a		
	Sremska Kamenica - Irig	Comprehensive	Route 9a	Yes	
	Irig - Ruma	Comprehensive	Route 9a		
	Ruma - Klenak	Comprehensive	Route 9a	Yes	
	Klenak - Loznica - Mali Zvornik (BIH border)	Comprehensive	Route 9a		
	Batrovci (CRO border) - Kuzmin	Core	Corridor X		
	Kuzmin - Sremska Mitrovica	Core	Corridor X	Yes	
	Sremska Mitrovica - Beograd/Dobanovci	Core	Corridor X		
	Beograd/Dobanovci - Bubanj Potok	Core	Corridor X		
	Bubanj Potok - Mali Pozarevac	Core	Corridor X		
	Mali Pozarevac - Presevo (MKD border)	Core	Corridor X		
	Horgos (HU border) - Feketic	Core	Corridor Xb		
	Feketic-Sirig	Core	Corridor Xb		
	Sirig - Beograd/Dobanovci	Core	Corridor Xb		
	Nis - Gradina (BG border)	Core	Corridor Xc		

4 Three-Year Plan for Road Safety Inspections

4.1 Methodology scheme

A 3-year plan for road safety inspection of the SEETO Core and Comprehensive Road Network has been prepared. This way, until 2021 the total SEETO Core and Comprehensive Road Network will have been inspected according to the SEETO manual for Road Safety Inspections, which actually is in line with the EC 2008/96 Directive.

As an initial stage of road network assessment, the EuroRAP Risk Mapping procedure is proposed where reliable crash data are easily available. This can then be repeated following e.g. 3-5 years to see what are the results ad benefits. Risk mapping is a fast and low-cost process of evaluating road corridors based on reliable crash data, traffic volumes and mapping information. The EuroRAP Risk Mapping is proposed to be adopted only in the case that the required data are readily available and reliable.

In order to prepare the Plan for RSI, first the road safety inspections that have been implemented within the last 3 years will be taken into consideration and the relevant road sections will be excluded. Afterwards, the (pilot) Road Safety Inspections performed under Activity 4 of the Connecta project will be taken into account, as well. Thus, the three-year Plan will be established for the rest of road sections (that have not been inspected).

The approach for the Plan is recommended, as follows:

The road network under consideration should be surveyed according to the iRAP methodology in order to classify the road sections under one of the five risk rating categories. This procedure could be completed by the end of 2018.

The ‘traditional’ Road Safety Inspection using SEETO’s road safety inspection guidelines should be performed as follows:

- The 1st year for all 1-star road sections
- The 2nd year for all 2- and 3-star road sections
- The 3rd year for all 4- and 5-star road sections.

This 2-step approach has as scope to quickly proceed with the assessment of the most dangerous road sections. Performing ‘traditional’ RSI requires substantial resources, effort, time and budget. Furthermore, the execution of a large scale (in terms of road length) ‘traditional’ RSI would present outcomes after a considerable time period. Thus, implementing gradually the ‘traditional’ RSI to the Core and Comprehensive road network, according to the available budget, seems the most logical process. Therefore, in order to categorize at safety levels the road network, and give more importance and substance to the most dangerous sections, the initial assessment with the iRAP methodology is the quickest, least expensive and most acceptable process.

4.1.1 EuroRAP Road Risk Mapping

Risk Maps are colour-coded maps showing the risk of death and/or serious injury on individual road sections across a road network. This could as mentioned above be used by Regional Participants that have reliable and readily available crash data to compare the before and after situation. If data are not reliable and readily available the Regional Participant should follow the suggested process with iRAP screening and then traditional road safety inspections and not wait for crash data to be available.

Risk Maps are statistically designed to support national road safety strategies and add an extra layer of information alongside existing approaches. Using an international and common basis of measurement that can be used to assess priorities, Risk Mapping identifies the safest and most dangerous road sections within a region or country. Comparisons between countries enable benchmarking and progress to be tracked. Knowing where risk has been reduced and the measures that have worked are essential in building best practice and knowledge transfer.

Risk Mapping, by its very nature, relies on the use of historic crash and traffic flow data. As such, when published, some routes may already have had road safety improvements. Others may be more difficult to change and on these roads it is particularly important for road users to be aware that they face higher risks than they might expect. Risk Mapping should therefore be updated at regular intervals to ensure that they represent the most up-to-date picture.

Risk Maps based on crash rates show the combined influence of behaviour, road and vehicle. Rates per vehicle kilometre travelled can show the likelihood of a particular type of road-user (e.g. car driver, motorcyclist, lorry driver), on average, being involved in a road crash.

4.1.1.1 Road length

To identity road sections which demonstrate differences in general road standard performance, it is essential to assess lengths that minimise the impact of year-on-year variability in crash numbers and present a stable longer term estimate of crash risk.

While it is typical for fatal and serious crash rates to differ from road type group averages, variability is considerably greater for short sections. Where a section comprises a short length between junctions, crash rates may be unrepresentative of average rates, since crashes at junctions will form a disproportionately large contribution to the total in that length. This may be due to a proportionately higher influence from junction crashes at the ends of the short sections.

Sections less than 5kms tends to show greater year-on-year variability in crash numbers, were more likely to change risk rating from one period to another, and were therefore less reliable when compared over time. For motorways and dual and single carriageways these differences were significant up to section lengths of 10kms.

When assessing whether individual sections have fatal and serious crash rates that are above or below average, minimum thresholds of 10kms for motorways and dual carriageways and 5kms for single carriageways should be used as a starting point in assessing crash numbers. Where it is not possible to aggregate short sections, care must be taken when interpreting risk ratings.

4.1.1.2 Crash data

EuroRAP protocols focus on fatal and serious crashes. In addition to reflecting the key policy targets across Europe, such crashes reflect the ability of the road design to ‘contain’ the event and are likely to be reported more consistently than those falling in the ‘slight injuries’ and ‘damage only’ categories. They also represent the severity levels generally used in national targets and those that can have life-changing consequences.

EuroRAP Road Risk Mapping presents crashes at the severe end of the crash spectrum and provides adjustment factors to allow for differences between countries in reporting, standard crash definitions and elements such as the quality of medical care that may influence these issues. These factors are based on standard ratios between the number of fatal and serious crashes using values that are reviewed at frequent intervals as new evidence is presented.

Analysis has shown that when crash numbers are compared over time, the general relationship is strong, but the variation in frequency can become large when the numbers fall below 20 crashes per road section over three years.

4.1.1.3 Traffic flow

Traffic flow data is used as an exposure measure in expressions of fatal and serious crash risk in EuroRAP Road Risk Mapping.

4.1.1.4 Assessment period

A widely misunderstood aspect of road safety relates to the way in which crash numbers vary from year to year and can appear to show a trend that requires urgent attention, only for the trend to reverse a year later. Regression-to-mean, also sometimes called 'bias by selection', can complicate evaluations at sites with high crash numbers. Locations chosen for treatment following a year with particularly high numbers, often in practice will tend to reduce in the next year even if no treatment is applied. It is believed that the regression-to-mean effect can over-state the effect of a treatment by 5-30%, dependent on the assessment period.

A simple way of assessing regression-to-mean and changes in the environment is by using control sites chosen in exactly the same way as the treated sites, identified as having similar problems, but left untreated. In practice, it is difficult to find matched control sites and, if investigated, to justify not treating them.

The effect does, however, tend to be diminished if longer periods of time are selected.

Where crash numbers are insufficient to meet the criteria suggested of 20 per road section over three years, the data period could be extended. However, it should be noted that extending the period beyond three years will increase the likelihood of significant network changes over the period of investigation and therefore a thorough review of planned or potential large scale changes should be assessed at an early stage. Some variance over time may therefore not show up. In some circumstances lack of change in the colour banding of the same road section over time may be a good indicator of the robustness of the technique.

4.1.2 The iRAP Method

The protocols are developed by the International Road Assessment Programme (iRAP). iRAP is a registered charity dedicated to saving lives through safer roads. The programme is the umbrella organisation for EuroRAP, AusRAP, usRAP, KiwiRAP and ChinaRAP. Road Assessment Programmes (RAP) are now active in many countries worldwide.

iRAP provides tools for inspecting roads and developing Star Ratings, Safer Roads Investment Plans and Risk Maps.

The main objective of the iRAP method is the improvement of the road users' safety by proposing cost-effective investment plans. The method indicates that the severity of a road crash can be reduced through the intervention at the sequence of events happening during this crash. As it is known, an injury crash results from a chain of events, starting with an initial event, probably resulting from several factors, which leads to a dangerous situation. The basic idea is to intervene at any point of this chain, in order to reduce the kinetic energy of all road users who are involved in the crash to a tolerable level. Such an intervention may not only reduce the number of crashes but also the severity of injuries.

The initial step for the implementation of the RAP method is the inspection and record of the infrastructure elements of a road network, which relate to road safety. The record leads to the quantification of the safety that a road section provides to its users by awarding safety scores (Star Rating Scores). The Star Rating Scores express the safety capacity of a road section in a 5-Stars scale. This quantification aims to identifying the most appropriate countermeasures, which will increase the infrastructure's road safety score. The Safer Roads Investment Plan (SRIP) includes all the

countermeasures proved able to provide the greater safety capacity and maximize the benefit over spent cost of the planned investments. Thus, the SRIPs are considered as a valuable tool for the authorities, stakeholders and investors in order to decide for the most cost-effective and efficient road infrastructure investments.

4.1.2.1 Measuring the road infrastructure safety

The assessment of road safety requires Road Safety Inspections of the road network sections and the assignment of a safety score to them. The inspection is conducted by visual observation and record of the road infrastructure elements which are related (directly or not) to road safety and have a proven influence on the likelihood of a crash or its severity. The RAP uses two types of inspection; the drive-through and the video-based inspection. During the first one, the record of the infrastructure's elements is performed manually, with the help of specialized software, while during the second, a specially equipped vehicle is used, so as the recorded video to be used for a virtual drive-through of the network and an automated identification of the infrastructure's elements.

Following the RSI, the Road Protection Score (RPS) is calculated. The RPS is a unit-less indicator, which depicts the infrastructure's safety capacity for each road user type and it is calculated for 100m road segments. Road user types considered are car occupants, motorcyclists, bicyclists and pedestrians, who may be involved in road crashes. For each road user type and for every 100m road segmentation the respective RPS is calculated as follows:

$$RPS_{n,u}=\sum_{c} RPS_{n,u,c}=\sum_{c} L_{n,u,c} * S_{n,u,c} * OS_{n,u,c} * EFI_{n,u,c} * MT_{n,u,c}$$

where "n" is the number of 100m road segment, "u" the type of road user and "c" the crash type that the road user type "u" may be involved in. The following variables are taken into consideration:

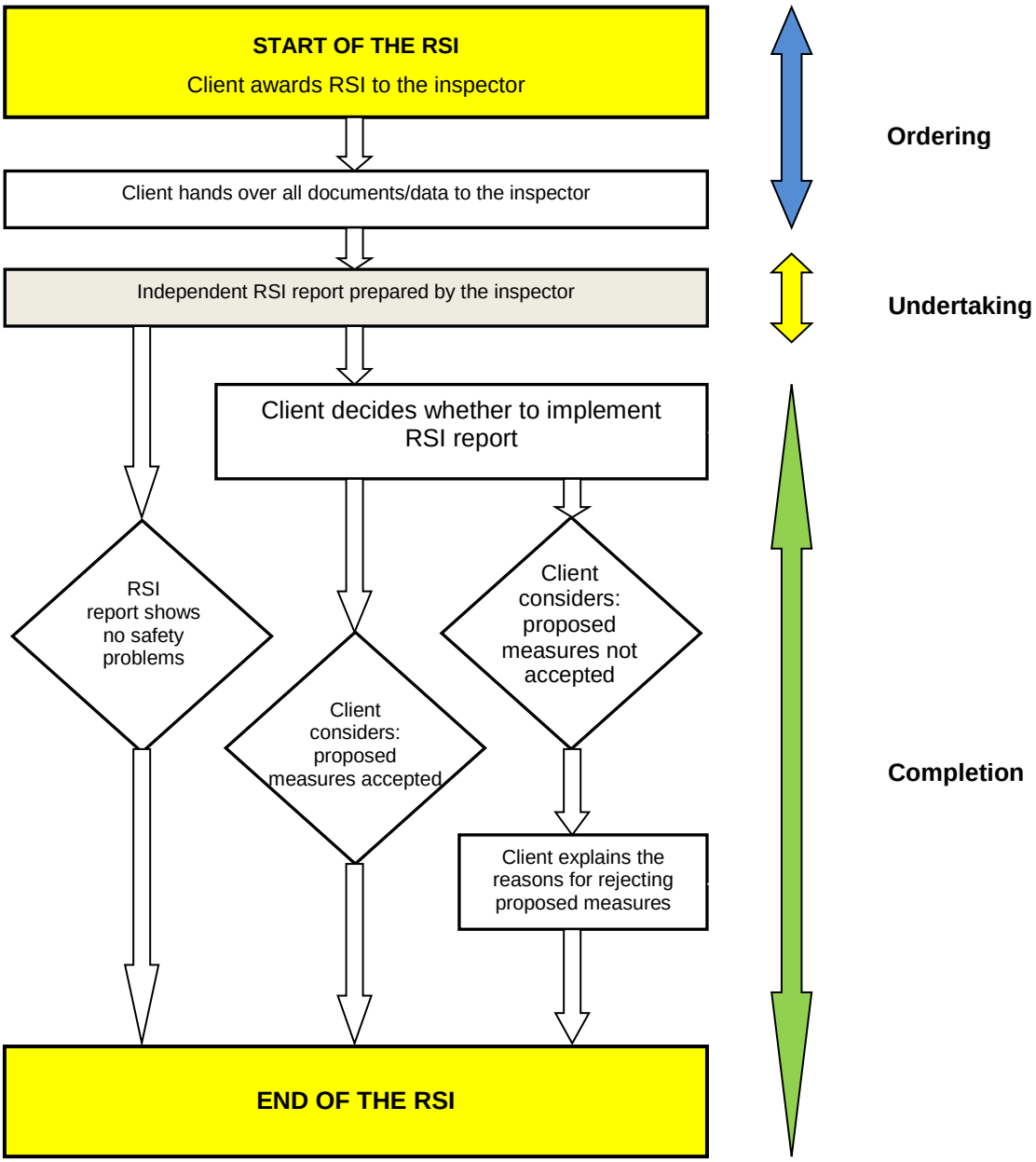
- L: the Likelihood that the "i" crash may be initiated
- S: the Severity of the "i" crash
- OS: the degree to which risk changes with the Operating Speed for the specific "i" crash type
- EFL: the degree to which a person's risk of being involved in the "i" type of crash is a function of another person's use of the road (External Flow Influence)
- MT: the potential that an errant vehicle will cross a median (Median Traversability).

4.1.2.2 The Star Rating process

The aim of the Star Rating process is the award of the "n" 100m road segments with Stars, depicting the safety offered to each of the "u" road users' types. The Star Rating system uses the typical international practice of recognising the best performing category as 5-star and the worst as 1-star (5 stars scale), so that a 5-star road means that the probability of a crash occurrence, which may lead to death or serious injury is very low. The Star Rate is determined by assigning each RPS calculated to the Star Rating bands. The thresholds of each band are different for each road user and were set following significant sensitivity testing to determine how RPS varies with changes in road infrastructure elements. The assignment procedure leads to the development of a risk-worm chart, which depicts the variation of the RPS score in relation to the position (distance from the beginning) on the road under consideration. The final output of the Star Rating is the Star Rating Maps, in which the "n" road sections are shown with different colour, depending on their Star award (5-star green and 1-star black).

4.1.3 The ‘traditional’ RSI

The ‘traditional’ RSI is performed according to the SEETO guidelines for Road Safety Inspections. The inspection process is presented at the following figure.



The following steps outline the procedure of the inspector’s work:

- STEP 1 Preparatory work in the office
- STEP 2 On-site field study
- STEP 3 RSI report
- STEP 4 Remedial measures and follow-up.

4.1.3.1 The partners in the RSI process and their roles

The client (usually the road authority or private road operating company) and the inspector (or team of Inspectors) participate in the inspection process.

Order the RSI: Usually, the decision to order an inspection is taken by the client (road authority). However, it may be regulated by a Ministry decision or by law as well as by the financing donor.

Selecting the team: The client commissions the inspector, who can either be an individual or a team. A list of potential inspectors compiled by the client can be helpful for the selection process. It is important to consider including members with experience regarding all aspects of facility maintenance including signage, traffic lighting control, vegetation, snow removal, etc. It may be useful to include a police officer who is experienced in road safety and crash investigation.

4.1.3.2 Preparatory work in the office

Background information about the road, the function of the road, the standard of the road and traffic volumes should be obtained as a first step. Information from local residents might prove useful and can be obtained through face-to-face discussions or a questionnaire. The list below provides information about the sort of questions that should be asked and the answers recorded during the preparatory work:

- Road function
- Traffic situation
- Road standards.

The RSI team should have the necessary equipment to perform their tasks.

4.1.3.3 Field Study

When an intersection is included in the road to be inspected it is necessary to inspect part of the intersecting road as well (at least the approaches), both by vehicle and on foot. Site inspections should be undertaken over a range of traffic and environmental conditions likely to be encountered. Both night-time and daytime inspections are essential to appreciate the situation. It may also be necessary to view the location at other times of the day (e.g. when school finishes, during peak hours or the weekly market). The core part of the RSI is to identify deficiencies on the road that may cause crashes or could have an influence on the severity of crashes.

4.1.3.4 RSI findings and report

The RSI team or expert notes in the report the problems detected and provides recommendation on inventions and measures that will reduce or remove the road safety problem. The RSI team may also do an assessment of the risk, e.g. High, Medium or Low.

4.1.3.5 Completion of the RSI

Upon receipt of the report, the client must consider the indicated problems and proposals and make a decision on how or if the proposed measures will be implemented. A ‘Completion meeting’ should be organised in order to finalise the ‘Response to the inspection report’.

4.1.3.6 Follow-up and evaluation

For the foreseen periodic RSI of the core network it is very important that sufficient and an effective way for serious follow up is identified.

In addition, it could be helpful to conduct some studies at a later time to evaluate the effects of the remedial measures. The road authority could organise such. Behavioural studies should be carried out in the same way and in the same locations as during the investigation. Traffic volumes and speeds should be checked, as well as the traffic environment.

4.2 Requirements - Qualifications

There are specific requirements for the realization of this 3-year plan, in terms of capacity/capability and resources.

4.2.1 EuroRAP road risk mapping requirements

Members may only use the RAP Road Risk Mapping protocol if they have a licence to do so. The licence gives access to the detailed specifications for data collation and analysis, ensuring consistency of output in form and style. The licence also appoints the Member as principal manager and communications outlet within a territory and gives access to the EuroRAP name and logo for the communication of results. The organisation has specific standards and procedures that should be followed. More detailed information may be found at the official EuroRAP site (www.eurorap.net).

Additionally, it is obligatory that risk maps produced to be Quality Assured. This, again, is a procedure according to specific standards.

In terms of performance, it is envisaged that (on average) a country's road network may be risk mapped within one month of an accredited consultant.

4.2.2 iRAP requirements

An iRAP may be performed only by a certified supplier of iRAP. The organisation has specific standards and procedures that should be followed. Furthermore, there are specific procedures for someone to be accredited by iRAP. More detailed information may be found at the official site of iRAP (www.irap.org).

Additionally, it is obligatory that all road sections assessed according to iRAP methodology, to be Quality Assured. This, again, is a procedure according to specific standards.

Finally, there is the availability of uploading all iRAP assessed road section to a cloud-based software (named ViDA), where various analyses may be performed. In order to achieve this, specific training needs to be obtained.

In terms of performance, it is envisaged that an average of 30 km road length may be completed within one working day of the iRAP Team (based on international experience).

4.2.3 Traditional RSI

The team performing 'traditional' RSI (based on the SEETO Road Safety Inspection manual) should be comprised, ideally, by 3 persons (team leader and 2 members).

The RSI team should be comprised by experienced road safety engineers, with more than 10 years of experience on the field. The team leader should be a certified road safety inspector and/or auditor.

In terms of performance, it is envisaged that an average of 10 km road length may be completed within one working day of the RSI Team (based on international experience, but also experience that Connecta RSI team gained during pilots in the context of this sub-project). This comprises both field work and reporting.

4.3 The 3-year plan proposal

The following Table incorporates all information that has been received by the WB6 Regional Participants member countries. It also contains the RSI conducted by Connecta as "pilots" (approximately 580 km of the network).

	All sections	SEETO Network	Corridors / Routes	past RSI	past/ current iRAP	Connecta pilot RSI	Missing RSI
ALB	Muriqan(MNE border) - Koplik	Core	Route 1	✓			
	Koplik - Skhoder	Core	Route 1			✓	
	Skhoder - F. Kruje	Core	Route 1	✓			
	F. Kruje - Lezhe	Core	Route 1			✓	
	Hani i Hotit (MNE border) - Fush Kruje	Comprehensive	Route 2b				✓
	Fush Kruje - Vore	Comprehensive	Route 2b	✓			
	Rrogozhine - Fier	Core	Route 2c	✓			
	Fier - Tepelene	Core	Route 2c				✓
	Tepelene - Kakavia (GR border)	Core	Route 2c	✓			
	Morine Vermice (KOS border) - Lezhe	Core	Route 7	✓			
	Qaf Thane (MKD border) - Elbasan	Core	Corridor VIII	✓			
	Elbasan - Tirane	Core	Corridor VIII	✓			
	Tirane - Durres	Core	Corridor VIII			✓	
	Durres - Vlore	Core	Corridor VIII				✓
	Fier - Vlore	Core	Corridor VIII			✓	
BIH	Neum west - Neum South	Core	Route 1				✓
	Gradiska (CRO border) - Banja Luka - Jajce Jug	Core	Route 2a				✓
	Jajce Jug - Donji Vakuf	Core	Route 2a			✓	
	Donji Vakuf - Lasva	Core	Route 2a				✓
	Sarajevo - Hum (MNE border)	Comprehensive	Route 2b				✓
	Sarajevo - Lapisnica	Comprehensive	Route 3				✓
	Lapisnica - Ljubogosta	Comprehensive	Route 3	✓			
	Ljubogosta - Podromanija	Comprehensive	Route 3				✓
	Podromanija - Rogatica	Comprehensive	Route 3	✓			
	Rogatica - Vardiste (SRB border)	Comprehensive	Route 3				✓
	Banja Luka - Doboj - Karakaj (SRB border)	Comprehensive	Route 9a				✓
	Bosanski Samac (CRO border) - Matuzici	Core	Corridor Vc				✓
	Matuzici - Ozimica	Core	Corridor Vc			✓	
	Ozimica - Topcic Polje	Core	Corridor Vc			✓	
	Topcic Polje - Sarajevo - Jablanica	Core	Corridor Vc				✓
	Jablanica - Potoci	Core	Corridor Vc			✓	
	Potoci - Doljani (CRO border)	Core	Corridor Vc				✓
MKD	Djeneral Jankovic (KOS border) - Skopje	Core	Route 6a		✓		✓
	Podmolje - Bitola	Comprehensive	Route 8		✓		✓
	Miladinovci - Stip - Novo Selo (BG border)	Comprehensive	Route 10		✓		✓
	Kafasan (ALB border) - Skopje	Core	Corridor VIII		✓		✓
	Skopje - Stracin	Core	Corridor VIII		✓		✓
	Stracin - Kriva Palanka	Core	Corridor VIII		✓	✓	
	Kriva Palanka - Deve Bair (BG border)	Core	Corridor VIII		✓		✓
	Tabanovce (SRB border) - Skopje - Bogorodica (GR border)	Core	Corridor X		✓		✓
	Veles - Prilep	Comprehensive	Corridor Xd		✓		✓
	Prilep - Bitola	Comprehensive	Corridor Xd		✓	✓	
	Bitola - Medzitlija (GR border)	Comprehensive	Corridor Xd		✓		✓

	All sections	SEETO Network	Corridors / Routes	past RSI	past/ current iRAP	Connecta pilot RSI	Missing RSI
KOS*	Brnjak (SRB border) - Veternik	Comprehensive	Route 6a				✓
	Veternik - Lipljan	Core	Route 6a			✓	
	Lipljan - Hani i Elezit (MKD border)	Core	Route 6a				✓
	Kuqishte (MNE border) - Kijeve/Kijevo	Comprehensive	Route 6b				✓
	Kijeve/Kijevo - Gjurgjice/Djurdjice	Comprehensive	Route 6b			✓	
	Gjurgjice/Djurdjice - Fushe Kosove/Kosovo Polje	Comprehensive	Route 6b			✓	
	Vermice/Vrbnica (ALB border) - Merdare (SRB border)	Core	Route 7				✓
MNE	Debeli Brijeg (CRO border) - Sukobin (ALB border)	Core	Route 1				✓
	Scepan Polje (BIH border) - Bozaj (ALB border)	Comprehensive	Route 2b				✓
	Dobrakovo (SRB border) - Mioska	Core	Route 4				✓
	Mioska - Podgorica	Core	Route 4			✓	
	Podgorica - Bar	Core	Route 4				✓
	Ribarevine - Dracenovac (SRB border)	Comprehensive	Route 6a				✓
	Kolasin - Kula (KOS border)	Comprehensive	Route 6b				✓
SRB	Uzice - Kotroman (BIH)	Comprehensive	Route 3				✓
	Vatin (RO border) - Belgrade - Orlovaca	Core	Route 4				✓
	Orlovaca-Stepojevac	Core	Route 4			✓	
	Stepojevac-Celije	Core	Route 4			✓	
	Celije - Knezevici	Core	Route 4				✓
	Knezevici - Kokin Brod	Core	Route 4	✓			
	Kokin Brod - Gostun (MNE border)	Core	Route 4				✓
	Cacak/Preljina - Mrcajevci	Comprehensive	Route 5			✓	
	Mrcajevci - Vrnjci	Comprehensive	Route 5				✓
	Vrnjci - Kamidzora	Comprehensive	Route 5			✓	
	Kamidzora- Paracin - Vrska Cuka (BG border)	Comprehensive	Route 5				✓
	Spiljani (MNE border) - Brnjak (KOS border)	Comprehensive	Route 6a				✓
	Nis - Merosina	Core	Route 7	✓			
	Merosina - Merdare (KOS border)	Core	Route 7				✓
	Novi Sad/Petrovaradin - Sremska Kamenica	Comprehensive	Route 9a			✓	
	Sremska Kamenica - Irig	Comprehensive	Route 9a	✓			
	Irig - Ruma	Comprehensive	Route 9a				✓
	Ruma - Klenak	Comprehensive	Route 9a	✓			
	Klenak - Loznica - Mali Zvornik (BIH border)	Comprehensive	Route 9a				✓
	Batrovci (CRO border) - Kuzmin	Core	Corridor X				✓
	Kuzmin - Sremska Mitrovica	Core	Corridor X	✓			
	Sremska Mitrovica - Beograd/Dobanovci	Core	Corridor X				✓
	Beograd/Dobanovci - Bubanj Potok	Core	Corridor X			✓	
	Bubanj Potok - Mali Pozarevac	Core	Corridor X			✓	
	Mali Pozarevac - Presevo (MKD border)	Core	Corridor X				✓
	Horgos (HU border) - Feketic	Core	Corridor Xb				✓
	Feketic-Sirig	Core	Corridor Xb			✓	
	Sirig - Beograd/Dobanovci	Core	Corridor Xb				✓
	Nis - Gradina (BG border)	Core	Corridor Xc				✓

The previous table shows (last column) the road sections that have not been inspected during the last three years (either with 'traditional' RSI or with EuroRAP/iRAP methodology) and not included in the Connecta pilot RSI.

It is suggested that for the remaining road sections (road network that has not been inspected during the last three years and not included at Connecta pilot RSI – column 'missing RSI' of previous table) the following methodological approach to be followed:

1. Prepare iRAP maps, according to the star rating methodology.

2. Perform detailed road safety inspections for the road sections that have the worst performance according to the iRAP star rating methodology as described in section 4.1.

It is estimated that if a RP performs RSI for the 20% of the country's core and comprehensive road network, within 5 years the whole network will have been inspected. If funds are short, the iRAP may be performed and the RSI will focus only at the less performed road sections.

4.3.1 Cost estimations

In order to estimate the cost of the proposed assessments, the following assumptions have been taken under consideration.

For EuroRAP Road Risk Mapping implementation, an accredited consultant would require (if data is readily available) a team work of data and map processing.

Taken into account all cost items involved, it is estimated that the total cost per km of length included at the Risk Map is between 20€ and 30€. The total cost incorporates all associated required costs (i.e. QA, mapping according to standards, etc.).

For iRAP implementation, a licenced team leader along with two junior members are required. Furthermore, an accredited iRAP system needs to be involved. Lastly, according to the iRAP protocol a Quality Assurance procedure needs to be followed.

In terms of resources required, adapting the assumption that for iRAP implementation, overall and as an average, in terms of performance, the iRAP team may complete 30 km of road length within a working day, the average cost per km may be estimated. This assumption of performance, integrates the time and cost for survey planning, field tasks, elements coding, data uploading to ViDA, and reporting.

Taken into account all cost items involved, it is estimated that the total cost per km of length assessed is between 100€ and 120€. The total cost incorporates all associated required costs (i.e. iRAP system, labour, reporting, etc.).

For the 'traditional' RSI, three road safety experts (one team leader and two team members) need to be involved. Since considerable time is on field, travel and accommodation costs are also involved.

In terms of resources required, having in mind that approximately 10 km of road length may be inspected at a working day of the 'traditional' RSI team, as an average estimation and overall of a road network, the average required budget per road length in km may be estimated. This estimation includes the costs and time spent by the 'traditional' RSI team for meetings, planning, inspecting and reporting, as well as of travel and accommodation, etc.

Taken into account all cost items involved, it is estimated that the total cost per km of length inspected is at the range of 300€ to 350€. The total cost incorporates all associated necessary costs (i.e. equipment, labour, per diems, reporting, etc.).

The above indicative cost ranges are based on the hypothesis of inspections to be conducted by private contractor (as per ToR) and with a team of international (at least the leader) and local experts.

4.3.2 Albania

EuroRAP Road Risk Mapping for the whole core and comprehensive Albania network is anticipated to cost between 17,000€ and 26,000€.

The following table presents the road sections that either have not been inspected in the last 3 years or were not inspected as part of the Connecta pilot RSI.

Road sections	SEETO Network	Corridors/Routes	iRAP min	iRAP max	'traditional' RSI min	'traditional' RSI max
Hani i Hotit (MNE border) - Fush Kruje	Comprehensive	Route 2b			32.100	37.450
Fier - Tepelene	Core	Route 2c			24.600	28.700
Durres - Vlore	Core	Corridor VIII			35.700	41.650

The total length of the above mentioned road sections is approximately 310 km. Since it is relatively small length, it is recommended to skip the initial phase of iRAP survey and rating, and proceed with 'traditional' road safety inspections.

Thus, it is proposed to implement RSI of approx. 100km per year, for the next 3 years.

The anticipated cost is between 92,500€ and 108,000€.

4.3.3 Bosnia and Herzegovina

EuroRAP Road Risk Mapping for the whole core and comprehensive Bosnia and Herzegovina network is anticipated to cost between 21,000€ and 32,000€.

The following table presents the road sections that either have not been inspected in the last 3 years or were not inspected as part of the Connecta pilot RSI.

Road sections	SEETO Network	Corridors/Routes	iRAP min	iRAP max	'traditional' RSI min	'traditional' RSI max
Neum west - Neum South	Core	Route 1	500	600	1.500	1.750
Gradiska (CRO border) - Banja Luka - Jajce Jug	Core	Route 2a	12.700	15.240	38.100	44.450
Donji Vakuf - Lasva	Core	Route 2a	6.800	8.160	20.400	23.800
Sarajevo - Hum (MNE border)	Comprehensive	Route 2b	9.700	11.640	29.100	33.950
Sarajevo - Lapisnica	Comprehensive	Route 3	250	300	750	875
Ljubogosta - Podromanija	Comprehensive	Route 3	2.750	3.300	8.250	9.625
Rogatica - Vardiste (SRB border)	Comprehensive	Route 3	6.560	7.872	19.680	22.960
Banja Luka - Doboj - Karakaj (SRB border)	Comprehensive	Route 9a	19.800	23.760	59.400	69.300
Bosanski Samac (CRO border) - Matuzici	Core	Corridor Vc	8.000	9.600	24.000	28.000
Topcic Polje - Sarajevo - Jablanica	Core	Corridor Vc	16.820	20.184	50.460	58.870
Potoci - Doljani (CRO border)	Core	Corridor Vc	6.200	7.440	18.600	21.700

The total length of the above mentioned road sections is approximately 900 km.

According to the recommended approach, iRAP methodology is recommended for these road sections. This task could be fulfilled until the end of 2018.

According to the iRAP output, the 1-star ranking road sections are recommended to be 'traditionally' road safety inspected within 2019. The 2- and 3- star ranking road sections should follow and implement 'traditional' RSI until April 2021. Finally, for the 4- and 5- star ranking road sections is recommended to implement 'traditional' RSI until end 2021. It is noted that, the exact percentage of 1-star (or 2-star and so on) ranking road length over the total network could be known before iRAP is implemented, thus assumptions are applied.

The total anticipated cost is 90,000€ - 108,000€ for iRAP and from 270,000€ to 315,000€ for 'traditional' RSI.

4.3.4 The former Yugoslav Republic of Macedonia

EuroRAP Road Risk Mapping for the whole core and comprehensive former Yugoslav Republic of Macedonia network is anticipated to cost between 16,500€ and 25,000€.

In MKD, a project that implements iRAP methodology for all Core and Comprehensive Road Network is ongoing. The results are expected soon. Therefore, there is no need for further iRAP implementation.

The following table presents the road sections that either have not been inspected in the last 3 years or were not inspected as part of the Connecta pilot RSI.

	SEETO Network		iRAP		'traditional' RSI	
Road sections		**Corridors/Routes**	**min**	**max**	**min**	**max**
Djeneral Jankovic (KOS border) - Skopje	Core	Route 6a	1.600	1.920	4.800	5.600
Podmolje - Bitola	Comprehensive	Route 8	7.800	9.360	23.400	27.300
Miladinovci - Stip - Novo Selo (BG border)	Comprehensive	Route 10	14.200	17.040	42.600	49.700
Kafasan (ALB border) - Skopje	Core	Corridor VIII	19.000	22.800	57.000	66.500
Skopje - Stracin	Core	Corridor VIII	6.200	7.440	18.600	21.700
Kriva Palanka - Deve Bair (BG border)	Core	Corridor VIII	1.600	1.920	4.800	5.600
Tabanovce (SRB border) - Skopje - Bogorodica (GR border)	Core	Corridor X	18.100	21.720	54.300	63.350
Veles - Prilep	Comprehensive	Corridor Xd	6.100	7.320	18.300	21.350
Bitola - Medzitlija (GR border)	Comprehensive	Corridor Xd	1.400	1.680	4.200	4.900

The total length of the above mentioned road sections is approximately 760 km.

According to the iRAP output, the 1-star ranking road sections are recommended to be 'traditionally' road safety inspected until the half of 2019. The 2- and 3- star ranking road sections should follow and implement 'traditional' RSI until end 2020. Finally, for the 4- and 5- star ranking road sections is recommended to implement 'traditional' RSI until end 2021. It is noted that, the exact portion of 1-star (or 2-star and so on) ranking road length over the total network is not known yet, therefore assumptions are applied.

The anticipated total cost is between 228,000€ and 266,000€.

4.3.5 Kosovo

EuroRAP Road Risk Mapping for the whole core and comprehensive Kosovo network is anticipated to cost between 7,500€ and 11,000€.

The following table presents the road sections that either have not been inspected in the last 3 years or were not inspected as part of the Connecta pilot RSI.

	SEETO		iRAP		'traditional' RSI	
Road sections	**Network**	**Corridors/Routes**	**min**	**max**	**min**	**max**
Brnjak (SRB border) - Veternik	Comprehensive	Route 6a			21.600	25.200
Lipljan - Hani i Elezit (MKD border)	Core	Route 6a			16.800	19.600
Kuqishte (MNE border) - Kijeve/Kijevo	Comprehensive	Route 6b			20.100	23.450
Vermice/Vrbnica (ALB border) - Merdare (SRB border)	Core	Route 7			37.500	43.750

The total length of the above mentioned road sections is approximately 320 km. Since it is relatively small length, it is recommended to skip the initial phase of iRAP survey and rating, and proceed with 'traditional' road safety inspections.

Thus, it is proposed to implement 'traditional' RSI of around 110 km per year, for the next 3 years.

The anticipated total cost is estimated from 96,000€ up to 112,000€.

4.3.6 Montenegro

EuroRAP Road Risk Mapping for the whole core and comprehensive Montenegro network is anticipated to cost between 13,000€ and 19,000€.

The following table presents the road sections that either have not been inspected in the last 3 years or were not inspected as part of the Connecta pilot RSI.

Road sections	SEETO Network	Corridors/Routes	iRAP		'traditional' RSI	
			min	max	min	max
Debeli Brijeg (CRO border) - Sukobin (ALB border)	Core	Route 1	12.200	14.640	36.600	42.700
Scepan Polje (BIH border) - Bozaj (ALB border)	Comprehensive	Route 2b	15.400	18.480	46.200	53.900
Dobrakovo (SRB border) - Mioska	Core	Route 4	8.100	9.720	24.300	28.350
Podgorica - Bar	Core	Route 4	5.000	6.000	15.000	17.500
Ribarevine - Dracenovac (SRB border)	Comprehensive	Route 6a	7.940	9.528	23.820	27.790
Kolasin - Kula (KOS border)	Comprehensive	Route 6b	9.900	11.880	29.700	34.650

The total length of the above mentioned road sections is approximately 590 km.

According to the recommended approach, iRAP methodology is recommended for these road sections. This task could be fulfilled until the end of 2018.

According to the iRAP output, the 1-star ranking road sections are recommended to be 'traditionally' road safety inspected within 2019. The 2- and 3- star ranking road sections should follow and implement 'traditional' RSI until April 2021. Finally, for the 4- and 5- star ranking road sections is recommended to implement 'traditional' RSI until end 2021. For the yearly allocation of resources, assumptions are utilised, since it's not known what the road length per star category would be.

The total estimated cost is approx. 58,500€ - 70,000€ for iRAP and 175,500€ - 205,000€ for 'traditional' RSI.

4.3.7 Serbia

EuroRAP Road Risk Mapping for the whole Serbia core and comprehensive road network is anticipated to cost between 34,500€ and 52,000€.

The following table presents the road sections that either have not been inspected in the last 3 years or were not inspected as part of the Connecta pilot RSI.

Road sections	SEETO Network	Corridors/Routes	iRAP		'traditional' RSI	
			min	max	min	max
Uzice - Kotroman (BIH)	Comprehensive	Route 3	5.400	6.480	16.200	18.900
Vatin (RO border) - Belgrade - Orlovaca	Core	Route 4	11.700	14.040	35.100	40.950
Celije - Knezevici	Core	Route 4	14.600	17.520	43.800	51.100
Kokin Brod - Gostun (MNE border)	Core	Route 4	7.000	8.400	21.000	24.500
Mrcajevci - Vrnjci	Comprehensive	Route 5	4.400	5.280	13.200	15.400
Kamidzora- Paracin - Vrska Cuka (BG border)	Comprehensive	Route 5	13.600	16.320	40.800	47.600
Spiljani (MNE border) - Brnjak (KOS border)	Comprehensive	Route 6a	2.800	3.360	8.400	9.800
Merosina - Merdare (KOS border)	Core	Route 7	7.100	8.520	21.300	24.850
Irig - Ruma	Comprehensive	Route 9a	900	1.080	2.700	3.150
Klenak - Loznica - Mali Zvornik (BIH border)	Comprehensive	Route 9a	8.000	9.600	24.000	28.000
Batrovci (CRO border) - Kuzmin	Core	Corridor X	3.410	4.092	10.230	11.935
Sremska Mitrovica - Beograd/Dobanovci	Core	Corridor X	4.760	5.712	14.280	16.660
Mali Pozarevac - Presevo (MKD border)	Core	Corridor X	35.000	42.000	105.000	122.500
Horgos (HU border) - Feketic	Core	Corridor Xb	7.200	8.640	21.600	25.200
Sirig - Beograd/Dobanovci	Core	Corridor Xb	9.090	10.908	27.270	31.815
Nis - Gradina (BG border)	Core	Corridor Xc	11.000	13.200	33.000	38.500

The total length of the above mentioned road sections is approximately 1,450 km.

According to the recommended approach, iRAP methodology is recommended for these road sections. This task could be fulfilled until the end of 2018.

According to the iRAP output, the 1-star ranking road sections are recommended to be 'traditionally' road safety inspected within 2019. The 2- and 3- star ranking road sections should follow and implement 'traditional' RSI until April 2021. Finally, for the 4- and 5- star ranking road sections is recommended to implement 'traditional' RSI until end 2021. The yearly allocation of 'traditional' RSI may only be estimated at best possible assumption.

The total anticipated cost is approximately 146,000€ - 175,000€ for iRAP and 438,000€ - 511,000€ for 'traditional' RSI.

4.3.8 Yearly allocation of resources

Based on the previous sections, the following table summarises the required financial resources on a yearly basis, **expressed in Euro** currency for complementing inspections in SEETO core/comprehensive road network. The necessary **budget is indicative** according to average cost values per road length and per methodology followed.

		Year 1	Year 2	Year 3	Year 4	Total
ALB	EuroRAP	21.500				21.500
	iRAP					0
	'traditional' RSI	33.000	33.000	34.000		100.000
BiH	EuroRAP	26.500				26.500
	iRAP	99.000				99.000
	'traditional' RSI		135.000	100.000	58.000	293.000
MKD	EuroRAP	9.000				9.000
	iRAP					0
	'traditional' RSI	34.000	35.000	35.000		104.000
KOS[1]	EuroRAP	21.000				21.000
	iRAP					0
	'traditional' RSI	110.000	85.000	52.000		247.000
MNE	EuroRAP	16.000				16.000
	iRAP	64.500				64.500
	'traditional' RSI		95.000	65.000	30.000	190.000
SRB	EuroRAP	43.500				43.500
	iRAP	160.500				160.500
	'traditional' RSI		210.000	165.000	99.000	474.000

Total	EuroRAP	137.500	0	0	0	137.500
	iRAP	324.000	0	0	0	324.000
	'traditional' RSI	177.000	593.000	451.000	187.000	1.408.000

This is in fact an up to 3.5 year plan (in contrast to ToR for a 3 year plan), taken into account the date of this report and the relevant sub-project completion date, as well as the time required for iRAP implementation.

Hence, it was necessary to extend it till end of 2021, for some RPs with extensive network and inspection needs.

5 Pilot Road Safety Inspections

5.1 The selection – planning process

Pilot road safety inspections have been carried out by the team (Activity 4, according to ToR) using SEETO's road safety inspection guidelines on 10% (about 550 km, as per ToR, but finally actually 580 km) of the core and comprehensive road network that is considered highest risk portion of the network based on fatal crash data.

SEETO members prepared a list of their high risk sections and the team compiled a list of about 550 km of these high risk roads by maintaining a reasonable distribution among all SEETO's members.

Initially the High Risk Road Sections from all WB6 countries were assessed. The information received was not comparable and should not be, because all countries have different characteristics and different problems. The crashes occurring on these roads is only an indication. Normally, it is not possible to compare between different roads from various countries, if their traffic characteristics, volumes, design, etc. are not known. Furthermore, the total length either of the TEN-T road network or of the high risk road sections are not the same in all countries.

As some RPs might not be able to deliver specific crash information for these road sections, and more importantly the exchange of information (either with meetings or information exchange) at the initial stage would create more problems (time delays and having a second round of comparing information between the WB6 countries), a proposal was developed by the team for SEETO and the Road Safety WG to consider.

The area coverage, the population, the total number of road crashes, the total number of road fatalities, the total number of road injuries, the relevant figures from WHO, the under-reporting of road safety statistics, etc. of each country, were taken into consideration along with the team's engineering judgement, and initially the total road section length of each country to be inspected as part of Connecta project was formed.

Apart from statistics, it was aimed to include a representative sample of each country's road network. In order to introduce RSI capacity building within each country and have sound information for the plan to be developed later, it was proposed to have more than one road section within each country and not less than a total of 40km for each SEETO RP. The only exception to this rationale was Montenegro, where it was proposed to inspect only one road ("Podgorica- Mioska") instead of two road sections (namely "Lipci - ljuta" and "Ribarevine - Berane"), because it was considered a much more important road. Furthermore, it was intended not to underestimate the smaller countries.

Furthermore, since it seems that according to statistics, ALB and BiH face proportionally bigger road safety problems, and SRB is the best performing country (according to WHO) in terms of fatality rate per 100,000 population, we decreased the share of SRB and increased a bit the road length inspection in ALB and BiH. Since there was a need for a fair sample from each country, the final proposed RSI road length per country was the following:

- ALB: 110km
- BiH: 125km
- MKD: 60km
- KOS: 50km
- MNE: 50km
- SRB: 155km

The following Table presents the rationale for the determination of the length per country.

country	area	population (2017 est.wiki)	length acc. Pop	accidents (2013)	accidents (2014)	fatalities (2013)	fatalities (2014)	injured (2014)	injured % total (2014)	fatalities WHO estimated (2013)	fatalities WHO estimated (2013) %total	Length fatalities WHO estimated (2013) % total	accidents % total (2014)	fatalities % total (2014)	area % total	length acc. Area	pop %total	average (1) (km)	length acc. Fatalities	length acc. Injured	average (2) (km)	fatality rate per 100.000 pop. (WHO)	**proposed length approx. (km)**
ALB	28.750	2.877.000	88	2.075	1.914	295	264	2.353	5%	478	22,1%	111	2%	19%	13%	72	16%	81	104	27	66	15,1	**110**
BiH	51.197	3.531.000	107	37.725	36.225	334	297	10.067	21%	676	31,3%	156	37%	21%	23%	129	20%	130	117	117	117	17,7	**125**
MKD	25.710	2.069.000	63	11.000	3.853	198	130	6.056	13%	198	9,2%	46	4%	9%	12%	65	11%	56	51	70	61	9,4	**60**
KOS*	10.908	1.859.000	57	19.929	16.301	118	111	9.713	20%				16%	8%	5%	27	10%	78	44	113	78		**50**
MNE	13.810	679.000	21	5.264	5.531	74	56	1.278	3%	74	3,4%	17	6%	4%	6%	35	4%	18	22	15	18	11,9	**50**
SRB	88.360	7.058.000	215	37.140	35.152	650	536	17.953	38%	735	34,0%	170	36%	38%	40%	222	39%	197	211	208	210	7,7	**155**

Additionally, all road sections delivered by WB6 were assessed. The selection included the most important road sections, as well as some less busy roads. An attempt was also made to be close to the proper road length per country.

In the following Table, the proposed Road Sections to be included for pilot RSI of Connecta, are highlighted with green colour. Lastly, it should be mentioned that in order to be in line with the incoming information of High Risk roads, only full road length was proposed and not sections out of the information received (since it would not be possible to justify which segment to select).

Country	Corridor/ Route/Node	Name of the Project (sections)	Section_Start Node	Section_End Node	Type of road	SEETO Network/ Core/Comprehensive	Section length (km)	**RSI Proposed Length**
ALB	E762 dhe SH1	Shkoder - Koplik	Road Start Tuzit	Start of By Pass Koplik	Secondary Intercity (Kat C, according the Albanian Code)	Comprehensive	13	**13,0**
ALB	E 851	Milot - Rreshen	Road Intersection Laç -Lezhe to Nation Road	Intersection of Nation Road to road Burrel - Peshkopi	Secondary Intercity (Kat C, according the Albanian Code)	Core	10,6	
ALB	E 762	F. Kruje - Lezhe	Overpassing F. Kruje	Roundabout in Lezha exit	Main Intercity (partially for Thumane - Milot) and secondary (the remaining part)	Core	35,9	**35,9**
ALB	SH 2	Tirane - Durres	Overpassing Kamez	Interchange of By Pass Shkozet	Main intersity	Core	30	**30,0**
ALB	SH 3 dhe E 86	Pogradec - Bilisht	Road Intersection to Reshit Çollaku Road	Entry in Bilisht city	Secondary intercity	Comprehensive	65	
ALB	E 853	Fier - Vlore	Intersection to Aulona Road	Intersection to road Sinan Ferhati	Main intercity (Levan - Vlore) and secondary for (Fier- Levan)	Comprehensive	33,6	**33,6**
ALB:							**Sub-total:**	**112,5**
BiH	Route 2a	E-661 (Gradiška - Banja Luka)	0+000	32+000	Motorway	Core	32	
BiH	Route 2b	M-18 (Dobro polje-Miljevina)	0+000	18+809	The Main Road	Comprehensive	18,809	**18,8**
BiH	Route 2b	M-18 (Brod na Drini 3-granica RS	0+000	20+715	The Main Road	Comprehensive	20,715	**20,7**

Country	Corridor/ Route/Node	Name of the Project (sections)	Section_Start Node	Section_End Node	Type of road	SEETO Network/ Core/Comprehensive	Section length (km)	**RSI Proposed Length**
		(Šćepan polje))						
BiH	Route 3	M-19 (Podromanija-Sumbulovac)	0+000	21+559	The Main Road	Comprehensive	21,559	**21,6**
BiH	Route 9a	M-4 (Donje Caparde-Karakaj 1)	0+000	15+350	The Main Road	Comprehensive	15,35	
BiH	Route 2a	E-661 (M 5 : Jajce Jug - Donji Vakuf)	0+000	33+000	The Main Road	Core	33	
BiH	Corridor Vc	E-73 (M 17: Karuše - Ozimica)	0+000	29+485	The Main Road	Core	29,5	
BiH	Corridor Vc	E-73 (M 17: Ozimica - Topčić Polje)	0+000	23+993	The Main Road	Core	24	**24,0**
BiH	Corridor Vc	E-73 (M 17: Jablanica - Potoci)	0+000	36+312	The Main Road	Core	36,3	**36,3**
BiH:							**Sub-total:**	**121,4**
MKD	0	0	Gostivar	Kicevo	0	0	48	
MKD	0	0	Bitola	Prilep	0	0	42	**42,0**
MKD	0	0	Gradsko	Prilep	0	0	53,5	
MKD	0	0	Bitola	Resen	0	0	32	
MKD	0	0	Stracin	Kriva Palanka	0	0	27	**27,0**
MKD	0	0	Strumica	Border with Bulgaria	0	Not in CCRN	21,5	
MKD:							**Sub-total:**	**69,0**

Country	Corridor/ Route/Node	Name of the Project (sections)	Section_Start Node	Section_End Node	Type of road	SEETO Network/ Core/Comprehensive	Section length (km)	**RSI Proposed Length**
KOS	N9	0	Prishtine/N-2 and N-9 Interchange	Fushe Kosove	National/ the main road	National road	6	
KOS	R6b	0	Fushe Kosove	Gjurgjice/ R7-R6b Interchange	National/ the main road	Core	28	**28,0**
KOS	R6b	0	Gjurgjice/ R7-R6b Interchange	Kijeve	National/ the main road	Comprehensive	11	**11,0**
KOS	R6a	0	Prishtine	Mitrovice	National/ the main road	Comprehensive	35	
KOS	R6a	0	Veternik/ N-2 and N-25.2 interchange	Lipjan/N-2 and N-25 roundabout	National/ the main road	Core	7,6	**7,6**
KOS:							**Sub-total:**	**46,6**
MNE	Route 4	Podgorica-Mioska	PG	Mioska	National	Belgrade 8 SRB)-Podgorica(MNE)	54	**54,0**
MNE	Route1	Lipci - ljuta	Lipci	Ljuta	National	Neum (Cro) - Debeli Brijeg-Bar	21,3	
MNE	Route 2b	Nikšić - Danilovgrad	Nikšić	Danilovgrad	National	Sarajevo (Bih) - Podgorica (MNE)	37,5	
MNE	Route 6b	Ribarevine - Berane	Ribarevine	Berane	National	Peje (Kos) - Kolasin (MNE)	28,7	
MNE:							**Sub-total:**	**54,0**
SRB	Route 4	IB22	9	61	2way	Comprehensive	22,1	**22,1**
SRB	Route 9	IB21	97	98	motoput	Comprehensive	7,8	**7,8**
SRB	Corridor X	A1	11	12	Autoput	Core	20,6	**20,6**
SRB	Corridor X	A1	9	11	Autoput	Core	29,5	**29,5**
SRB	Route 4	IB22	61	62	2way	Comprehensive	22,1	**22,1**
SRB	Corridor Xb	A1	37	38	Autoput	Core	22,1	**22,1**

Country	Corridor/ Route/Node	Name of the Project (sections)	Section_Start Node	Section_End Node	Type of road	SEETO Network/ Core/Comprehensive	Section length (km)	**RSI Proposed Length**
SRB	Route 5	IB23	77	78	2way	Comprehensive	20,8	**20,8**
SRB	Route 5	IB22	75	76	2way	Comprehensive	12,3	**12,3**
SRB:							**Sub-total:**	**157,1**
							TOTAL:	**560,6**

The proposed road sections were a reasonable distribution among SEETO's members, taking into consideration the individual characteristics, needs, statistics and road safety situation of the 6 RPs, and were agreed by SEETO and RSWG members.

After SEETO approval, the RSI team drafted a mission plan and started to contact the RSWG members from each relevant country and set meetings.

During the meetings, apart from the data / information request the participation of local experts was invited to the field tasks. The latter (although not required by ToR) was part of the Connecta input to the country's capacity building of RSI.

The RSI field tasks were performed according to the following time schedule:

- 3-7 September, 8-9 November, 4-8 December SRB
- 10-19 September, 11-14 December BiH
- 25-29 September ALB
- 2-7 October MNE
- 5-8 November KOS
- 19-23 November MKD.

The final selected road sections as well as the initial time plan had to be modified.

This was due to issues regarding inspections to be carried out by Inspectors not licensed raised by the Republic of Srpska of the Bosnia and Herzegovina, during the September 19th meeting at Banja Luka. These issues had as a consequence to reject the planned RSI at Republic of Srpska and re-allocate to the Federation of Bosnia and Herzegovina the not-performed RSI length (following SEETO SC decision and no objection by DG NEAR). Therefore, the following 2 road sections substituted the originally selected RSI road sections that were located at the Republic of Srpska.

Corridor / Route	Name of the Project (sections)	Section_ Start Node	Section_ End Node	Type of road	SEETO Core/ Comprehensive	RSI Section length (km)
Route 2a	E-661 (M 5 : Jajce Jug - Donji Vakuf)	0+000	33+000	The Main Road	Core	33
Corridor Vc	E-73 (M 17: Karuše - Ozimica)	0+000	29+485	The Main Road	Core	29,5

Furthermore, some additional road sections (precisely two from Macedonia around 18 km long) were requested to be included in the pilot RSI. Connecta did that, despite that were considered extra from what was initially decided.

These two sections are presented at the next table.

Corridor / Route	Name of the Project (sections)	Section_ Start Node	Section_ End Node	Type of road	SEETO Core/ Comprehensive	RSI Section length (km)
R-106	Prilep - Drenovo	Prilep	Drenovo			8,5
R-106	Drenovo - Rosoman - connection A1	Drenovo	Rosoman			9,9

After implementing the field tasks, the road length per section was precisely defined. So, small dissimilarities were identified between the declared lengths and the real ones.

Thus, the road sections that have been inspected in the field have a total length of 580 km (30 km more than the indicated in ToR).

5.2 General findings

Pilot road safety inspections have been carried out by the team **using SEETO's road safety inspection manual** on approximately 580 km of the core and comprehensive road network that is considered highest risk portion of the network based on fatal crash data (based on information provided by each RP).

Below are presented, in brief, the most important or/and frequent RSI findings along the road sections inspected in WB6. Much more details on findings and proposed remedial measures are included in the specific pilot RSI reports (separately for each road section).

5.2.1 Assessment of the deficits

The most critical deficits in respect of road safety are (of course, depending on each separate road section):

- Co-existence of long distance travel and local trips - increased speed conflicts and demand for overtaking.
- Many accesses (houses and commercial businesses next to the road). Especially accesses with allowed left turns (especially from the main carriageway) contribute to many conflicts and increased risk of crashes.
- Conflicts between vehicles and pedestrians. Activities around the road generate demand for pedestrian movement by the road and crossing the road at places with speed limit and operation speed more than 50 kph.
- Unpaved areas near the road which have unregulated / unchanneled exits and entries to the main carriageway. Vehicles need to decelerate before exiting or accelerate after entering the traffic on the road. Manoeuvres interrupt other drivers, create traffic conflicts and could result to road crashes.
- The absence of adequate pedestrian facilities at urban segments, near bus stops, etc. could force pedestrians to use the carriageway for walking along the road. It could increase risk and cause crashes involving pedestrians.

- Parked vehicles (legal or illegal) in the settlements reduce sight distance, reduce space for pedestrians, take driver's attention away and could make confused traffic situations and cause road crashes.
- Legal and illegal advertising signs (billboards), placed in the safety zone of the road, taking driver's attention away. Some advertisment billboards reduce sight distance, especially near the intersections. This could increase risk of road crashes near advertisment billboards.
- Not adequate pedestrian facilities on urban subsections, near bus stops, near houses and commercial plots, could force pedestrians to use carriageway for walking along the road. It could increase risk and cause road crashes with pedestrians.
- Insufficient space and not appropriate design of bus stops, with missing information signs in advance, could create unexpected situations in the traffic and cause crashes. It could make bus deceleration and acceleration difficult and unsafe.
- Damaged, not maintained or not safe guardrails with unsafe ends, gaps and unsafe connections.
- Road safety barriers are missing at some places where guardrails are needed to protect vehicles from hitting hard objects or from running off the road at dangerous places (i.e. high slopes).
- Guardrails installed to protect culverts or hard objects near the road with inadequate length. These short guardrails cannot protect hard objects and would not keep vehicle which run off the road.
- Unsafe barrier ends (terminals).
- Sharp curves without chevron signs to inform and advice drivers
- Street lighting not adequate in some villages, at schools and bus stops.

5.2.2 Proposals and Recommendations

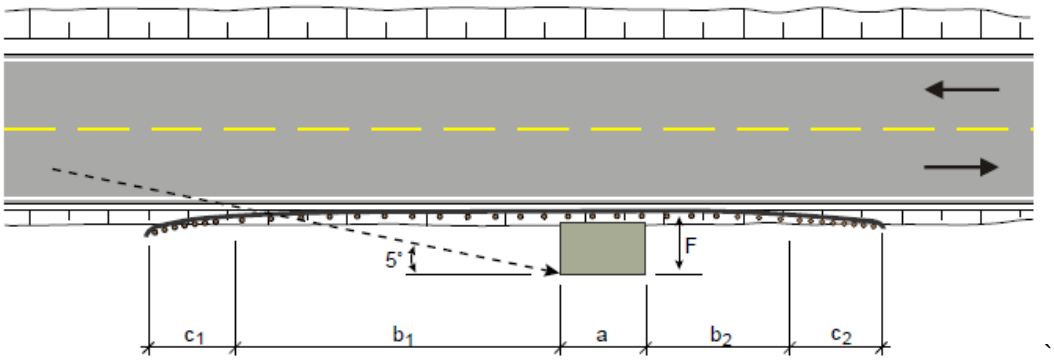
Among the deficiencies, there are some that could greatly be improved with some low cost implementation measures. Some general, initial remedies of the RSI team are described at the following.

5.2.2.1 Improve the guardrail system

Add guardrails where needed, repair guardrails, improve connection, extend guardrails or change the end of the guardrails.

The guardrail system should have proper length in order to be an appropriate restraint system for users. Guardrails will not work in the system if the elements do not have the required length. It could also create too many guardrail beginnings that may be problematic with regard to road safety.

Recommendation is based on the EN 1317-4 (or EN 1317-7 new end terminal treatment). In order to protect errant vehicles to exit the road and to secure safe stops, end terminals should be constructed based on the mentioned EN standards.



The required length of the guardrail, relevant to the object to be protected

Example of transition between concrete barrier and guardrail

5.2.2.2 Unsafe guardrail ends

Recommendation is based on the EN 1317-7 new end terminal treatment. In order to protect errant vehicles to stop safely, end terminals should be constructed based on the mentioned EN standards.

The ends of the guardrails have to be rounded

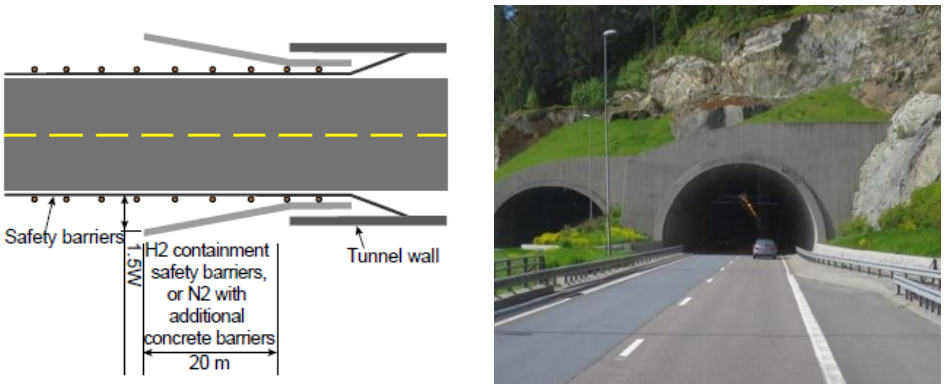
Tangent energy-absorbing terminals

Example of a proper energy absorbing terminals

Example of barrier ends at intersection/access

5.2.2.3 Tunnel entrances

A recommended solution which could efficiently solve the problem with tunnel portals is installation of tunnel portal safety barriers or crash cushions. The barriers cover the beginning and end of the head front of tunnels portals. For bidirectional tunnels and tunnels regularly operated for bidirectional flows, transitions should be designed for safety in both traffic directions. Guardrails can finish on the portal so vehicles are protected from the head front of the portal. An example of possible implementation tunnel portal safety barriers could be like in this case (picture below).



Example of the placement of safety barriers before parallel tunnel portals

5.2.2.4 Pedestrian crossing with proper lighting

General recommendation for pedestrian crossing lighting should be enhanced with additional lighting poles at the intersection zones and in the areas where pedestrian movement is expected.

Proposed measures, in accordance with the standards, include placement of adequate lighting that allows the lighting both of the crossing itself and the accesses, to ensure that drivers on the main road notice pedestrians in time.

Good example of lighting of pedestrian crossing which makes positive silhouette of a pedestrian

5.2.2.5 Agriculture access roads

In order to protect users on the main road, pavement on the access roads from agriculture fields should be made of asphalt, concrete or gravel. Satisfactory length for the pavement on the access road is min 15-20 m. Access from the agricultural roads should be gravel, because this material helps previously accumulated dirt from wheels of the agricultural vehicle to be stripped before they access to the state road.

This measure reduces bringing mud to the road and therefore the risk of vehicle encountering mud and, consequently skidding and loss of control of the vehicle.

Agricultural access road from ribbed concrete (expensive but most efficient solution, example from Serbia)

5.2.2.6 Additional signage for curves

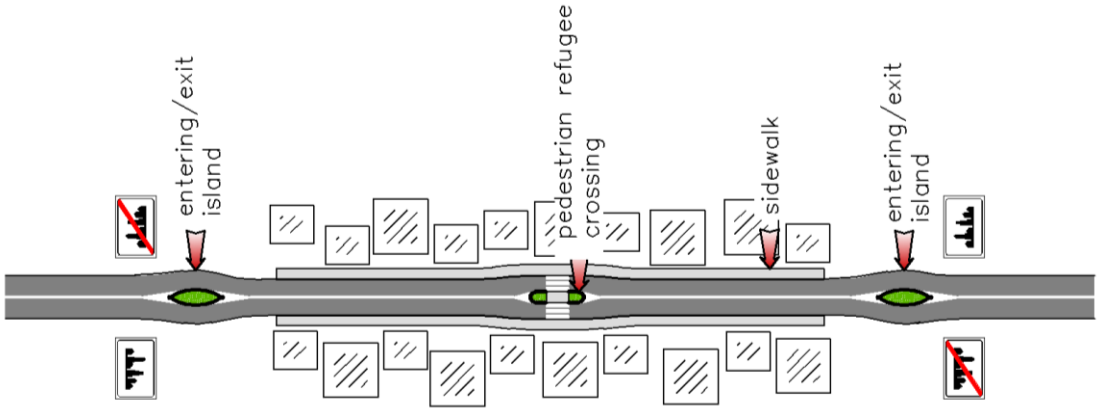
Adding of chevron signs before and along the sharp curves is recommended. The number of chevron signs should be calculated based on the length and radii of the curve as well as a principle that at each point in time the driver should see at least three chevron signs. It is recommended that, depending on the radii of the curve, distances between two chevron signs should be 8-15 m for curve radii of 60 m, 15-25 m for curve radii of 150 m and 25 m for curves with larger radii.

Proper installation of chevrons in curves

It is also recommended to install chevron signs with fluorescent base.

5.2.2.7 Built-up Area Gates and Speed Management

Considering that the speed limit outside of settlements is more than 50 kph (i.e. 80 kph) and in settlements 50 km/h, it is necessary for the infrastructure to be adapted so that the drivers are forced to reduce the speed when entering in the settlement. The following figure shows one of the possible solutions to the problem.

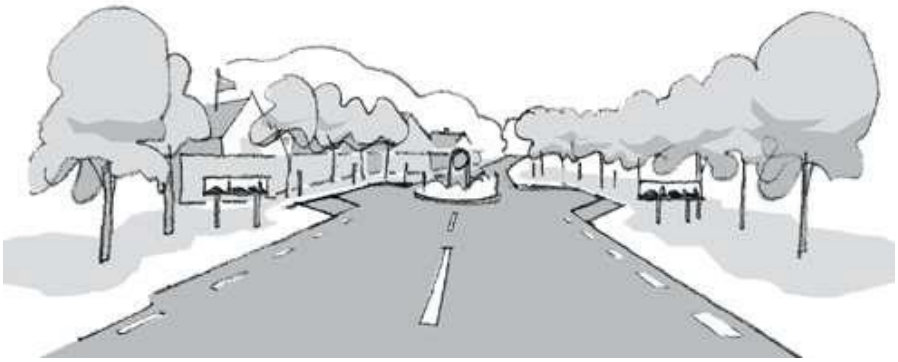


Adapted infrastructure (gates) for entry into the settlement

The need to change the driving behaviour when entering built-up areas should be emphasized by some infrastructure elements in order to indicate very clearly that driving conditions are changed. The typical signs, according to the current traffic code, are not enough according to the RSI Team. The recommendation of RSI Team is to have median islands (as gates) at all built-up areas' limits.

At the entrance of built-up areas, an island accompanied with the relevant signage creates a 'threshold' effect to show drivers that they are 'entering' an urban area and that there is a change in road type and

its function, which requires lower speeds, attention to vulnerable road users (pedestrians, etc.) and unanticipated movements.



Example - entering/exiting island to/from built-up areas

Good example of "gate" in Hungary

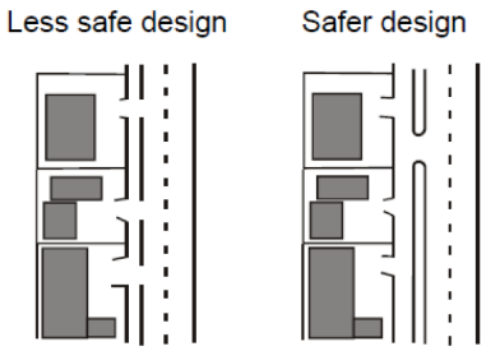
Good example with additional signage for "gate" in Austria

The gates should where relevant and at least at schools and bus stops be supplemented with speed management schemes.

5.2.2.8 Access control

One of the big problems seen on most of the inspected roads are many and often unregulated accesses. It is recommended to regulate accesses e.g. by:

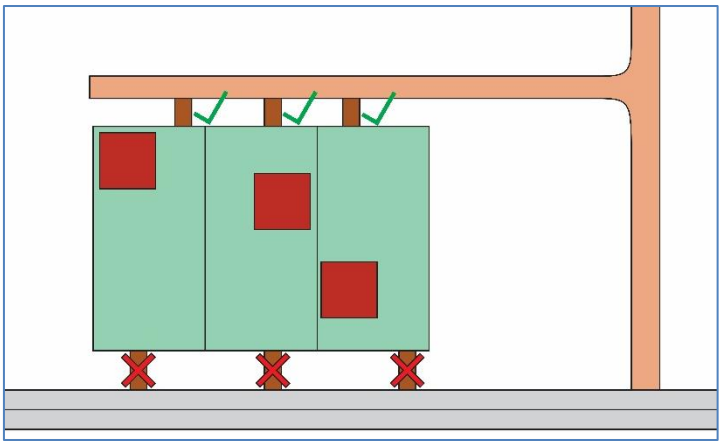
- Close illegal accesses if it is possible,
- Connect more neighbouring accesses with a service road, if it is possible. The service road should be directed to the main road with deceleration and acceleration lanes, or
- Do designs and improvements of regular individual accesses, in case it is possible.



A high number of accesses gives higher risk of crashes

As a recommendation for solving the problem of access control at the inspected section, the following solutions are recommended:

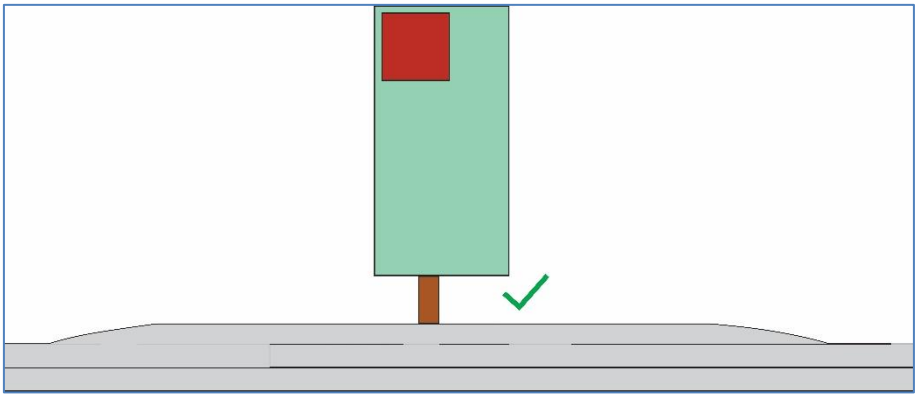
- Solution 1. Reconsider closing accesses on the road and redirecting them to an existing service (collecting) road and connect them to the main road (or to secondary road first and then to the main road) with a road junction. This solution is ideal if feasible. Thus, a feasibility study is primarily required.



Solution 1- Close accesses and redirect vehicles to regular intersection

Image 1a. Visualisation example of solution 1 (It is a planning problem and may be solved in close cooperation with local communities, planners and designers)

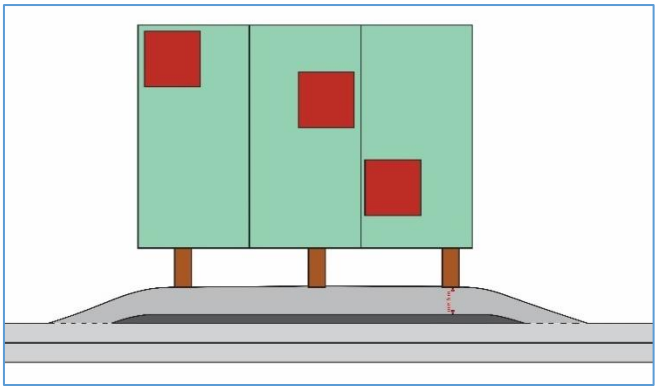
- Solution 2. Rearrange and improve regulation of the accesses, constructing acceleration and deceleration lanes in order to ensure safe entering and exiting to the road. This is feasible only when the relevant property has the available 'face' on the main road.



Solution 2- Rearrange the accesses

Image 2a. Visualisation example of solution 2

- Solution 3. Merge and/or construct a traffic island to allow entrance and exit to the road at controlled places. Available width from carrageway to the nearest property should be at least 4 m. This is the best solution when the Road Authority has the right-of-way for the available roadside area.

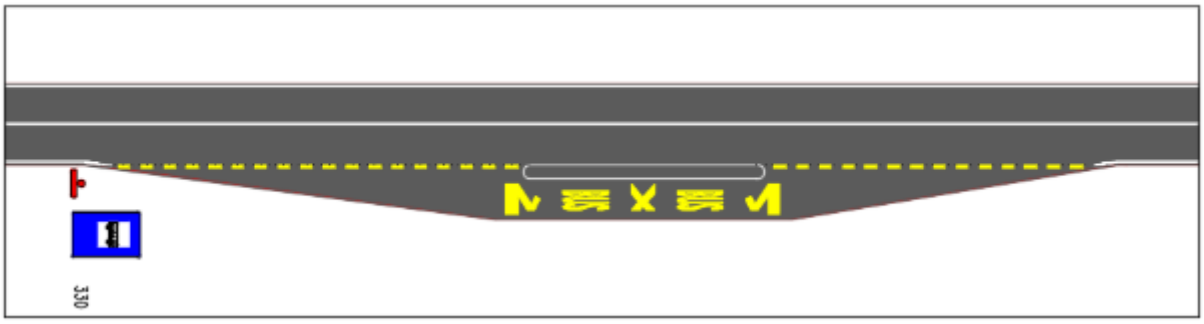


Solution 3- Merge and/or construction of a traffic island

Image 3a. Visualisation example of solution 3

5.2.2.9 Bus stops

It is recommended that bus stops (especially outside settlements) should incorporate an island separating (forcing) the stopped bus from through traffic, bus stop sign at the bus stop and at some meters ahead (according to speed limit) for informing drivers following a bus that should expect its speed decrease, lighting, etc.



Example of safe bus stop – should be provided with safe facilities for crossing pedestrians

5.3 RSI reporting

The approx. 580 km SEETO network inspected (as pilots), have been classified in RPs and sections for reporting purposes. Target was to deliver one report for each separate road section inspected.

The result is 24 separate (and standalone) RSI pilot reports for the 6 RPs of SEETO.

The pilot RSI reports have been submitted to each RP, according to the following table. The submission status below is at the end of March.

		Corridor	Name	Section_Start Node	Section_End Node	Submission Date (2018)
ALB	1	E762 SH1	Shkoder-Koplik	Road Start Tuzit	Start of By Pass Koplik	23/4
ALB	2	E 762	F. Kruje - Lezhe	Overpassing F. Kruje	r/a in Lezha exit	26/4
ALB	3	SH 2	Tirane - Durres	Overpassing Kamez	I/C of By Pass Shkozet	24/4
ALB	4	E 853	Fier - Vlore	I/C to Aulona Road	I/C to rd Sinan Ferhati	26/4
BiH	1	Route 2a	E-661 (M5)	Jajce Jug	Donji Vakuf	31/3
BiH	2	Corridor Vc	E-73 (M 17)	Karuše	Ozimica	28/2
BiH	3	Corridor Vc	E-73 (M 17)	Ozimica	Topčić Polje	28/2
BiH	4	Corridor Vc	E-73 (M 17)	Jablanica	Potoci	30/3
MKD	1	A3		Bitola	Prilep	29/1
MKD	2	A2		Stracin	Kriva Palanka	31/1
MKD	3	R-106		Prilep	Drenovo	16/4
MKD	4	R-106		Drenovo	Rosoman	16/4
KOS	1	R6b		Fushe Kosove	Gjurgjice/ R7-R6b I/C	10/4
KOS	2	R6b		Gjurgjice/ R7-R6b I/C	Kijeve	29/3
KOS	3	R6a		Veternik/N-2 N-25.2 I/C	Lipjan/N-2 & N-25 r/a	10/4
MNE	1	Route 4		Podgorica	Mioska	31/1
SRB	1	Route 4	IB22	Orlovaca	Stepojevac	10/4
SRB	2	Route 4	IB22	Stepojevac	Celije	26/3
SRB	3	Route 5	IB23	Vrnjci(Ugljarevo)	Kamidzora	26/3
SRB	4	Route 5	IB22	Preljina	Mrcajevci	14/2
SRB	5	Route 9	IB21	Petrovaradin	Sremska Kamenica	26/3
SRB	6	Corridor X	A1	Bubanj Potok	Mali Pozarevac	30/3
SRB	7	Corridor X	A1	Beograd (Dobanovci)	Bubanj Potok	13/4
SRB	8	Corridor Xb	A1	Feketic	Sirig	23/3

All RSI pilot reports were submitted by middle of April.

6 Summary and Conclusions

Following the completion of the missions to undertake pilot RSIs in each of the regional participants, the opinion from each participant is that the missions were very valuable in raising awareness of the inspection process and its benefits.

The RSI reports produced as part of this assignment will also be a useful tool for participants to give some guidance on methodology, types of safety hazards, etc.

The Road Safety Inspections carried out in the WB6 countries showed overall lack of maintenance leading to many of the road safety problems.

In the RSI's carried out, there were many common issues shared within all RPs. This includes the overall lack of maintenance which require urgent action. Crash barriers (missing, inadequate, damaged, etc.), property accesses and high operating speed vehicles passing through villages are the most commonly hazards identified at all countries.

Consistent use of unsafe barrier terminals, short barrier lengths, missing barriers, gaps in barrier and outdated bridge parapet implementation were common issues identified in all inspections. Commercial and residence accesses, especially at the single carriageway roads (the non-motorway), are safety hazards that need urgent confrontation. Junctions and interchanges are usually with many problems, outdated design and missing elements. Roads passing through built-up areas or areas with concentrated pedestrian movements do not have adequate infrastructure elements for vulnerable road users.

The following Table presents the allocated costs per route/corridor and section.

Corridors / Routes	SEETO Network	All sections	Country	EuroRAP Risk Map	iRAP	traditional RSI	EuroRAP Risk Map Total (€)	iRAP Total (€)	traditional RSI Total (€)
Corridor Vc	Core	Bosanski Samac (CRO border) - Matuzici	BIH	2.000	8.800	26.000	10.000	34.122	100.815
	Core	Matuzici - Ozimica	BIH	738	-	-			
	Core	Ozimica - Topcic Polje	BIH	600	-	-			
	Core	Topcic Polje - Sarajevo - Jablanica	BIH	4.205	18.502	54.665			
	Core	Jablanica - Potoci	BIH	908	-	-			
	Core	Potoci - Doljani (CRO border)	BIH	1.550	6.820	20.150			
Corridor VIII	Core	Qaf Thane (MKD border) - Elbasan	ALB	2.025	-	-	14.590	-	125.775
	Core	Elbasan - Tirane	ALB	625	-	-			
	Core	Tirane - Durres	ALB	750	-	-			
	Core	Durres - Vlore	ALB	2.975	-	38.675			
	Core	Fier - Vlore	ALB	840	-	-			
	Core	Kafasan (ALB border) - Skopje	MKD	4.750	-	61.750			
	Core	Skopje - Stracin	MKD	1.550	-	20.150			
	Core	Stracin - Kriva Palanka	MKD	675	-	-			
	Core	Kriva Palanka - Deve Bair (BG border)	MKD	400	-	5.200			
Corridor X	Core	Tabanovce (SRB border) - Skopje - Bogorodica (GR border)	MKD	4.525	-	58.825	17.103	47.487	199.128
	Core	Batrovci (CRO border) - Kuzmin	SRB	853	3.751	11.083			
	Core	Kuzmin - Sremska Mitrovica	SRB	533					
	Core	Sremska Mitrovica - Beograd/Dobanovci	SRB	1.190	5.236	15.470			
	Core	Beograd/Dobanovci - Bubanj Potok	SRB	738	-	-			
	Core	Bubanj Potok - Mali Pozarevac	SRB	515	-	-			
	Core	Mali Pozarevac - Presevo (MKD border)	SRB	8.750	38.500	113.750			
Corridor Xb	Core	Horgos (HU border) - Feketic	SRB	1.800	7.920	23.400	4.625	17.919	52.943
	Core	Feketic-Sirig	SRB	553	-	-			
	Core	Sirig - Beograd/Dobanovci	SRB	2.273	9.999	29.543			
Corridor Xc	Core	Nis - Gradina (BG border)	SRB	2.750	12.100	35.750	2.750	12.100	35.750
Corridor Xd	Comprehensive	Veles - Prilep	MKD	1.525	-	19.825	2.925	-	24.375
	Comprehensive	Prilep - Bitola	MKD	1.050	-	-			
	Comprehensive	Bitola - Medzitlija (GR border)	MKD	350	-	4.550			

Corridors / Routes	SEETO Network	All sections	Country	EuroRAP Risk Map	iRAP	traditional RSI	EuroRAP Risk Map Total (€)	iRAP Total (€)	traditional RSI Total (€)
Route 1	Core	Muriqan(MNE border) - Koplik	ALB	800	-	-	12.690	35.420	104.650
	Core	Koplik - Skhoder	ALB	325	-	-			
	Core	Skhoder - F. Kruje	ALB	1.793	-	-			
	Core	F. Kruje - Lezhe	ALB	898	-	-			
	Core	Neum west - Neum South	BIH	125	550	1.625			
	Core	Debeli Brijeg (CRO border) - Sukobin (ALB border)	MNE	3.050	13.420	39.650			
Route 2a	Core	Gradiska (CRO border) - Banja Luka - Jajce Jug	BIH	3.175	13.970	41.275			
	Core	Jajce Jug - Donji Vakuf	BIH	825	-	-			
	Core	Donji Vakuf - Lasva	BIH	1.700	7.480	22.100			
Route 2b	Comprehensive	Hani i Hotit (MNE border) - Fush Kruje	ALB	2.675	-	34.775	9.300	27.610	116.350
	Comprehensive	Fush Kruje - Vore	ALB	350	-	-			
	Comprehensive	Sarajevo - Hum (MNE border)	BIH	2.425	10.670	31.525			
	Comprehensive	Scepan Polje (BIH border) - Bozaj (ALB border)	MNE	3.850	16.940	50.050			
Route 2c	Core	Rrogozhine - Fier	ALB	1.125	-	-	4.625	0	26.650
	Core	Fier - Tepelene	ALB	2.050	-	26.650			
	Core	Tepelene - Kakavia (GR border)	ALB	1.450	-	-			
Route 3	Comprehensive	Sarajevo - Lapisnica	BIH	63	275	813	4.625	16.456	48.620
	Comprehensive	Lapisnica - Ljubogosta	BIH	170	-	-			
	Comprehensive	Ljubogosta - Podromanija	BIH	688	3.025	8.938			
	Comprehensive	Podromanija - Rogatica	BIH	715	-	-			
	Comprehensive	Rogatica - Vardiste (SRB border)	BIH	1.640	7.216	21.320			
	Comprehensive	Uzice - Kotroman (BIH)	SRB	1.350	5.940	17.550			
Route 4	Core	Dobrakovo (SRB border) - Mioska	MNE	2.025	8.910	26.325	15.030	51.040	150.800
	Core	Mioska - Podgorica	MNE	1.350	-	-			
	Core	Podgorica - Bar	MNE	1.250	5.500	16.250			
	Core	Vatin (RO border) - Belgrade - Orlovaca	SRB	2.925	12.870	38.025			
	Core	Orlovaca-Stepojevac	SRB	553	-	-			
	Core	Stepojevac-Celije	SRB	553	-	-			
	Core	Celije - Knezevici	SRB	3.650	16.060	47.450			
	Core	Knezevici - Kokin Brod	SRB	975	-	-			
	Core	Kokin Brod - Gostun (MNE border)	SRB	1.750	7.700	22.750			
Route 5	Comprehensive	Cacak/Preljina - Mrcajevci	SRB	308	-	-	5.328	19.800	58.500
	Comprehensive	Mrcajevci - Vrnjci	SRB	1.100	4.840	14.300			
	Comprehensive	Vrnjci - Kamidzora	SRB	520	-	-			
	Comprehensive	Kamidzora- Paracin - Vrska Cuka (BG border)	SRB	3.400	14.960	44.200			

Corridors / Routes	SEETO Network	All sections	Country	EuroRAP Risk Map	iRAP	traditional RSI	EuroRAP Risk Map Total (€)	iRAP Total (€)	traditional RSI Total (€)
Route 6a	Core	Djeneral Jankovic (KOS border) - Skopje	MKD	400	-	5.200	6.475	11.814	81.705
	Comprehensive	Brnjak (SRB border) - Veternik	KOS	1.800	-	23.400			
	Core	Veternik - Lipljan	KOS	190	-	-			
	Core	Lipljan - Hani i Elezit (MKD border)	KOS	1.400	-	18.200			
	Comprehensive	Ribarevine - Dracenovac (SRB border)	MNE	1.985	8.734	25.805			
	Comprehensive	Spiljani (MNE border) - Brnjak (KOS border)	SRB	700	3.080	9.100			
Route 6b	Comprehensive	Kuqishte (MNE border) - Kijeve/Kijevo	KOS	1.675	-	21.775	5.125	10.890	53.950
	Comprehensive	Kijeve/Kijevo - Gjurgjice/Djurdjice	KOS	275	-	-			
	Comprehensive	Gjurgjice/Djurdjice - Fushe Kosove/Kosovo Polje	KOS	700	-	-			
	Comprehensive	Kolasin - Kula (KOS border)	MNE	2.475	10.890	32.175			
Route 7	Core	Morine Vermice (KOS border) - Lezhe	ALB	2.775	-	-	7.850	7.810	63.700
	Core	Vermice/Vrbnica (ALB border) - Merdare (SRB border)	KOS	3.125	-	40.625			
	Core	Nis - Merosina	SRB	175	-	-			
	Core	Merosina - Merdare (KOS border)	SRB	1.775	7.810	23.075			
Route 8	Comprehensive	Podmolje - Bitola	MKD	1.950		25.350	1.950	0	25.350
Route 9a	Comprehensive	Banja Luka - Doboj - Karakaj (SRB border)	BIH	4.950	21.780	64.350	8.598	31.570	93.275
	Comprehensive	Novi Sad/Petrovaradin - Sremska Kamenica	SRB	195	-	-			
	Comprehensive	Sremska Kamenica - Irig	SRB	353	-	-			
	Comprehensive	Irig - Ruma	SRB	225	990	2.925			
	Comprehensive	Ruma - Klenak	SRB	875	-	-			
	Comprehensive	Klenak - Loznica - Mali Zvornik (BIH border)	SRB	2.000	8.800	26.000			
Route 10	Comprehensive	Miladinovci - Stip - Novo Selo (BG border)	MKD	3.550	-	46.150	3.550	0	46.150
			Total:	**137.138**	**324.038**	**1.408.485**	**137.138**	**324.038**	**1.408.485**