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Connecting Europe Facility
Early Warning Intelligent System for Road Transportation Risks
2015-RO-TM-0435-W

MINISTRY OF TRANSPORT

2015-RO-TM-0435-W

EARLY WARNING INTELLIGENT SYSTEM FOR ROAD TRANSPORTATION RISKS

17 October 2018

Project description

The action is agreed with the **Innovation and Networks Executive Agency (INEA)** Department C - **Connecting Europe Facility (CEF).**

The action aim is to contribute to the implementation of the comprehensive network, horizontal priority: Telematic applications systems for road (ITS), and on the core network Corridors: ***Orient/East-Med, Rhine-Danube.***

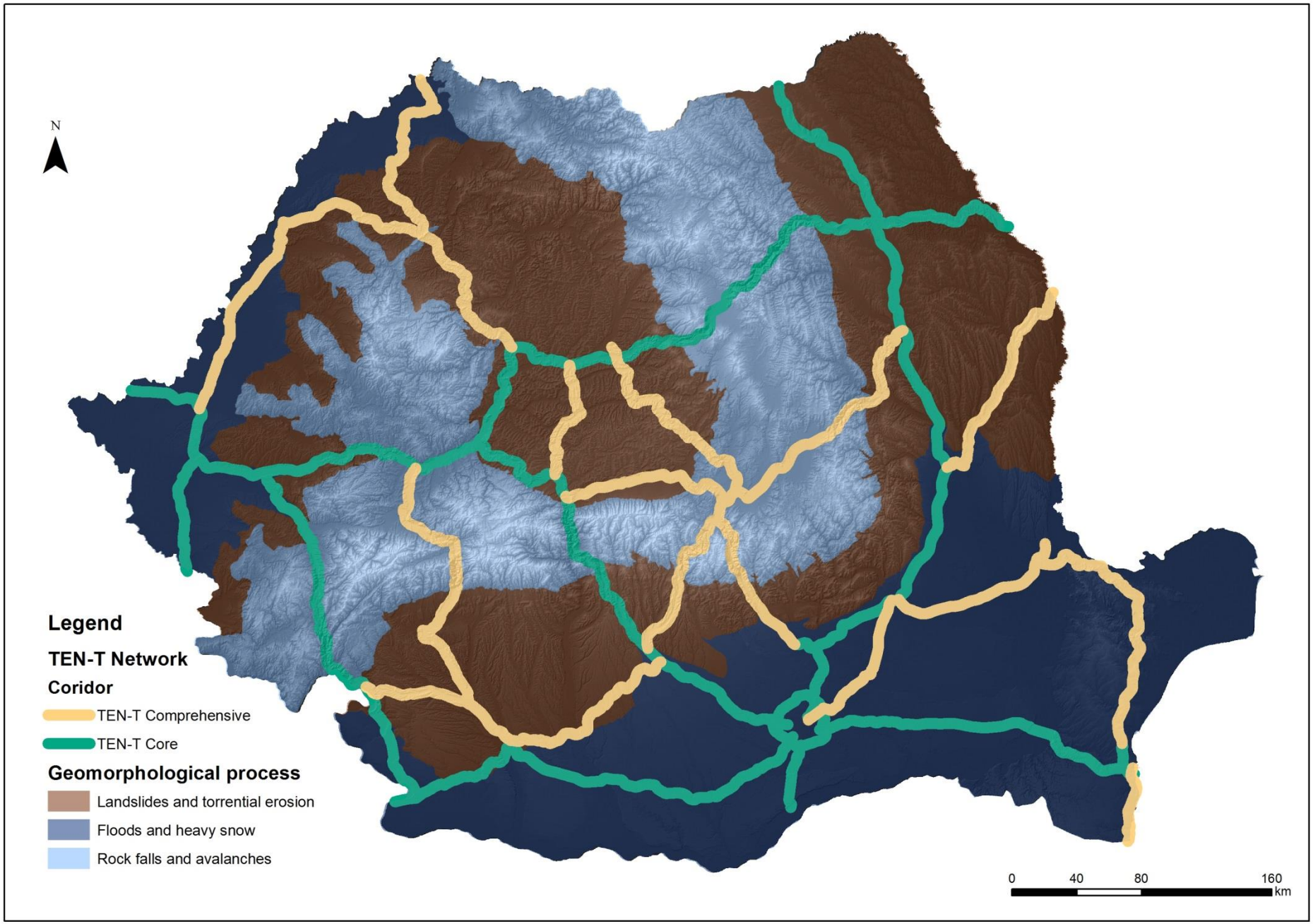
Scope and objectives

ITS (Intelligent Transport Systems) are being applied to facilitate mobility, make better use of existing infrastructure, improve safety and help mitigating negative environmental impacts. Deployment of ITS is also motivated by the increased difficulty of expanding transportation capacity through conventional infrastructure building.

Romanian TEN-T network is seriously affected by natural risks such as landslides, torrential erosion, rock falls, avalanches, floods and heavy snow. These natural hazards lead to numerous road accidents which cause important casualties and material losses every year.

The overall objective of the action is to improve traffic safety and reduce congestion of the Romanian road Core network by putting in place a compatible, accessible and interoperable intelligent transportation system (ITS) that will provide traffic and travel information services

Geomorphological and metorological risk



OBJECTIVE 1

The first specific objective ***is to contribute to the accessibility of interoperable accurate road and traffic safe-related*** data across the EU.

This objective will be met ***by identifying and characterising the list of risks that can affect road transportation***, through the identification of the corresponding data sources in line with and by making data available in a standardised format across Europe and in neighbouring countries through a national access point that will consist on an interoperable application module designed, set-up and made available via web and mobile.

OBJECTIVE 2

The second specific objective ***is to contribute to reducing the number of accidents, transport time and fuel consumption in the Romanian TEN-T Core network by providing real-time safety-related traffic information services to road users via well-functioning web and mobile applications.***

These services will cover information on a wide range of risks and will be easily accessed by the general public using various devices, including smartphones, tablets and laptops.

This objective will be met through the design and the implementation of a cloud-based back-end platform, a cloud-based web application and some mobile applications for the most popular Operating Systems which will provide real-time safety-related traffic information services to road users.

OBJECTIVE 2

A testing and validation process will be carried out so as to ensure that the web and mobile applications have been designed in compliance with the identified data sources and risks and implemented in line with the applications design.

The web and mobile applications will be fine-tuned on the basis of the user's feedback collected through dedicated forms as well as from the comments posted in the application stores.

A software development firm will be contracted via a public procurement procedure for the design, the development and fine-tune of the back-end platform, the web and the mobile applications.

OBJECTIVE 3

The third specific objective is to inform the road users, ITS service providers and road users about the results of this Action.

This objective will be met by designing and implementing an Information and Advertising Campaign.

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Example situation

On December 1st 2015, on the DN7 national road (Olt Valley, Core Network) it was a minor accident (without casualties).

The accident led to block traffic in both directions.

The accident was caused by falling rocks which broke away from the slopes (2200 m3). In order to increase the road safety, the National Company of Motorways and National Roads in Romania (CNAIR).

Thus, several hundreds of vehicles including dozens of cargo transport truck were blocked on the Olt Valley.

After several hours of waiting and an assessment of CNAIR specialists, it was decided to redirect the traffic on an alternative route.

Three scenarios

The case study was developed for a charged truck on the Nădlac (Romania - Hungary border) - port of Constanta on the Black Sea route. The analyzed vehicle has 40 tones mass, 5 axes, emission class Euro 5 and has green pollution permits.

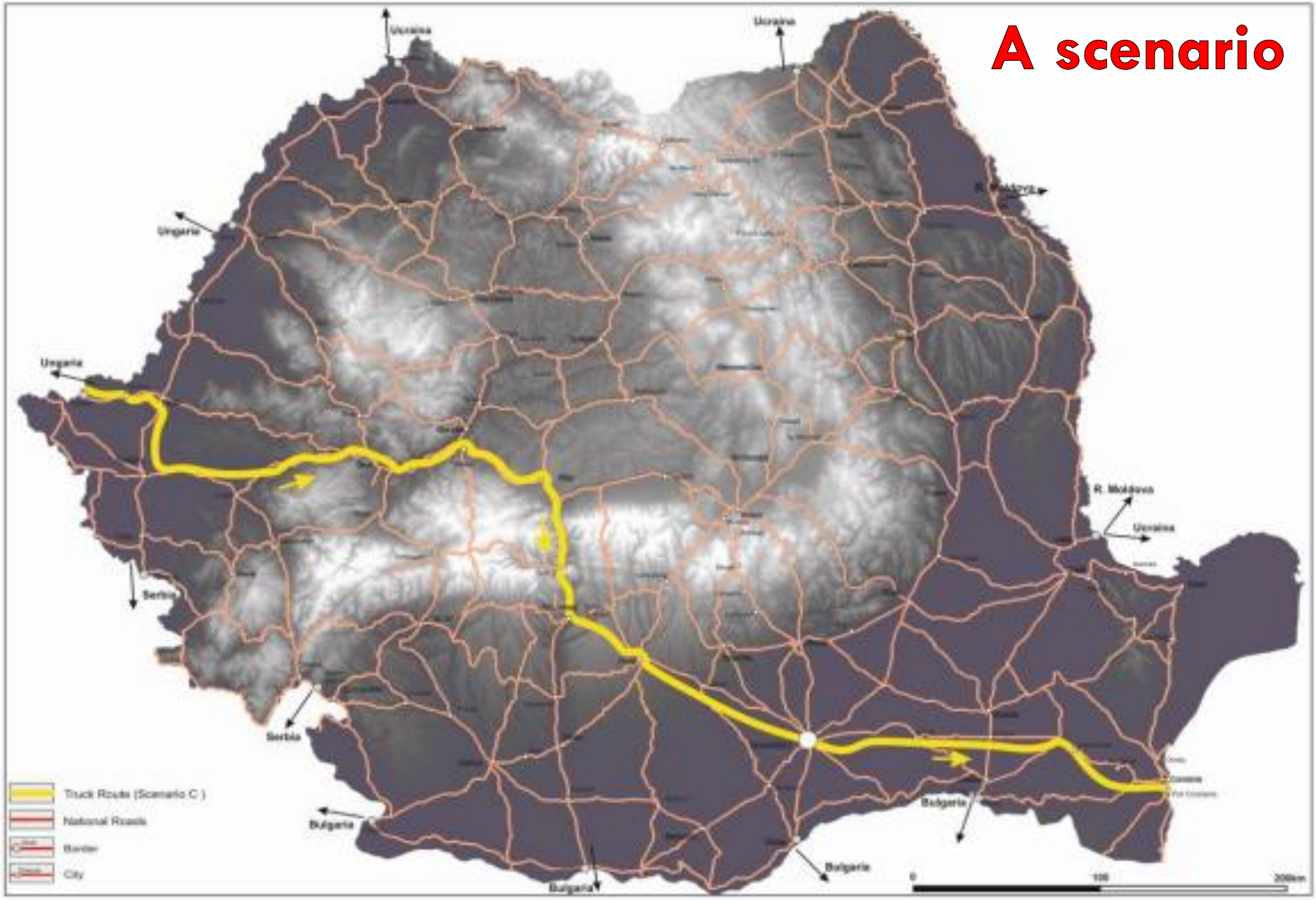
Three scenarios were simulated:

A scenario – Transport by truck to a normal situation

B scenario – Truck transport without the benefit of accident alert along its route (Scenario without the project) – present situation

C scenario – Truck transport with the benefit of alert along its route (project scenario) – results from CEF projects.

A scenario



Auto route in a normal situation

A scenario

In a ***normal situation*** (without route incident), the truck route linking Nadlac to Constanta it is 834 km: Nădlac – Arad – Timișoara – Lugoj – Deva – Sibiu – Rm.Vâlcea – Pitești – București – Constanța.

For ***A scenario*** were determined the following parameters:

Emissions

Route length (km)	Journey time	Fuel Consumption (litres)	Average consumption (litres)	Total Fuel Cost (Euro)	CO2 (kg)	NOx (g)	N2O (g)	CH4 (g)
834	15h 38'	321	38.5	319.6	849	3352	49	1.92

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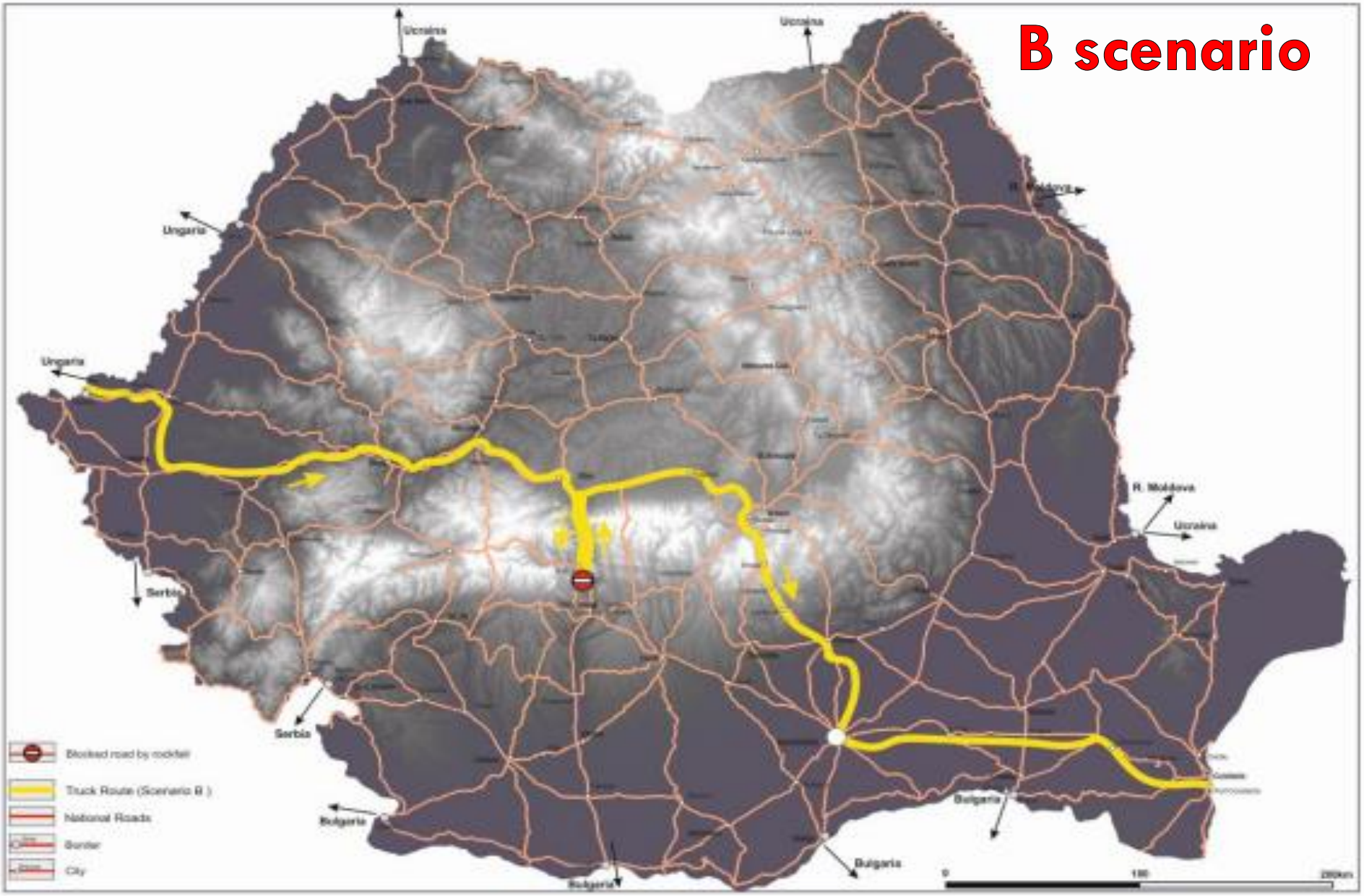
- Accident image 2



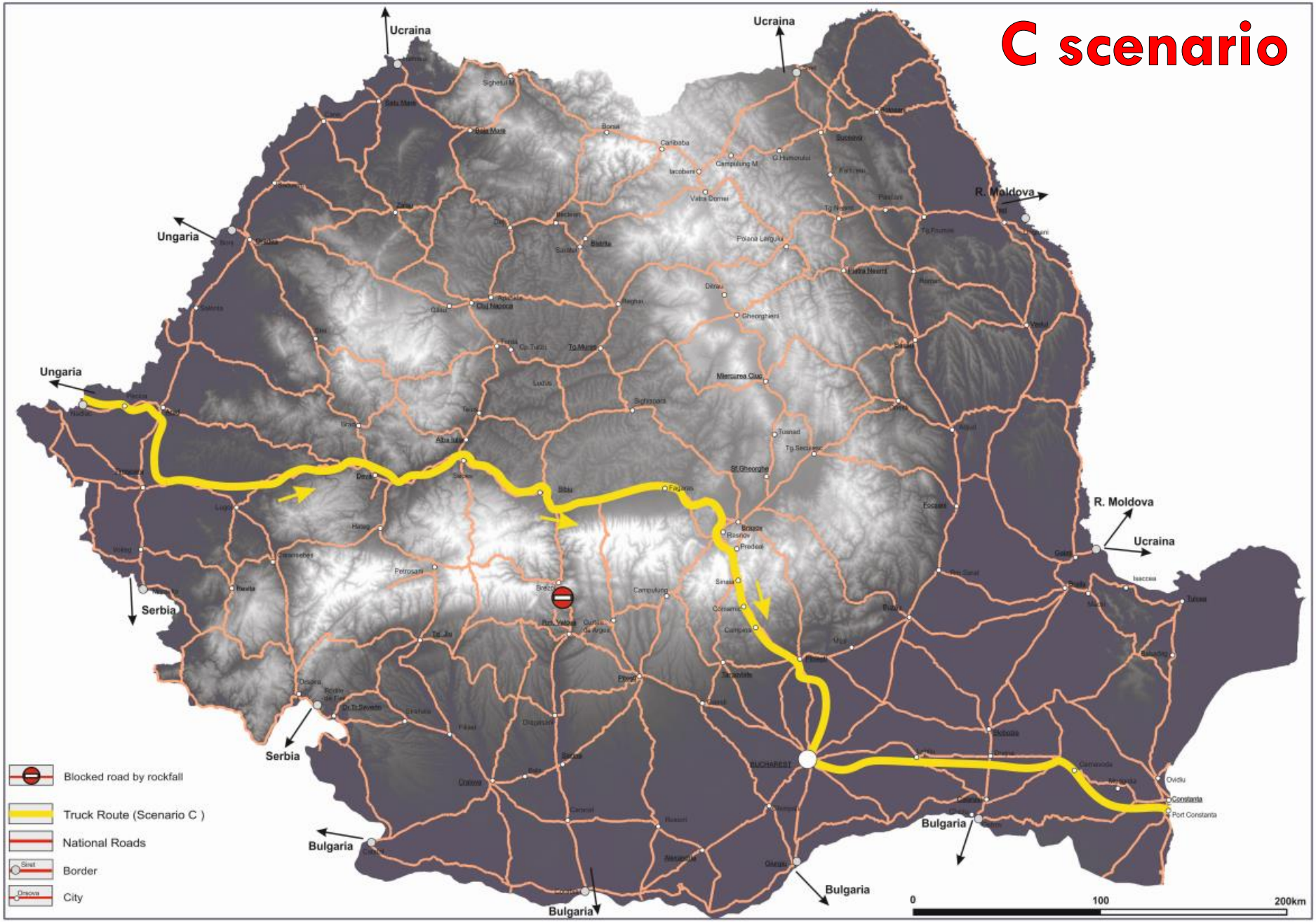
Truck transport without the benefit of accident alert along its route (Scenario without the project)

B scenario

In the event that ***an incident occurs on the truck route*** (Nadlac to Constanta Port), the route is rerouting after arriving at the incident and analyzing the situation. In this scenario, the route is: Nădlac – Arad – Timișoara – Lugoj – Deva – Sibiu – Brezoi – incident location – Brezoi – Sibiu – Brașov – Predeal – Câmpina – Ploiești – București – Cernavodă – Constanța. The route length has 979 km, 145 km 14 more than the A scenario.

Emissions

Route length (km)	Journey time	Fuel Consumption (litres)	Average consumption (litres)	Total Fuel Cost (Euro)	CO2 (kg)	NOx (g)	N2O (g)	CH4 (g)
979	19h 09'	387.7	39.6	386.0	1023	4050.6	57.6	2.27



Truck transport with the benefit of alert along its route (project scenario)

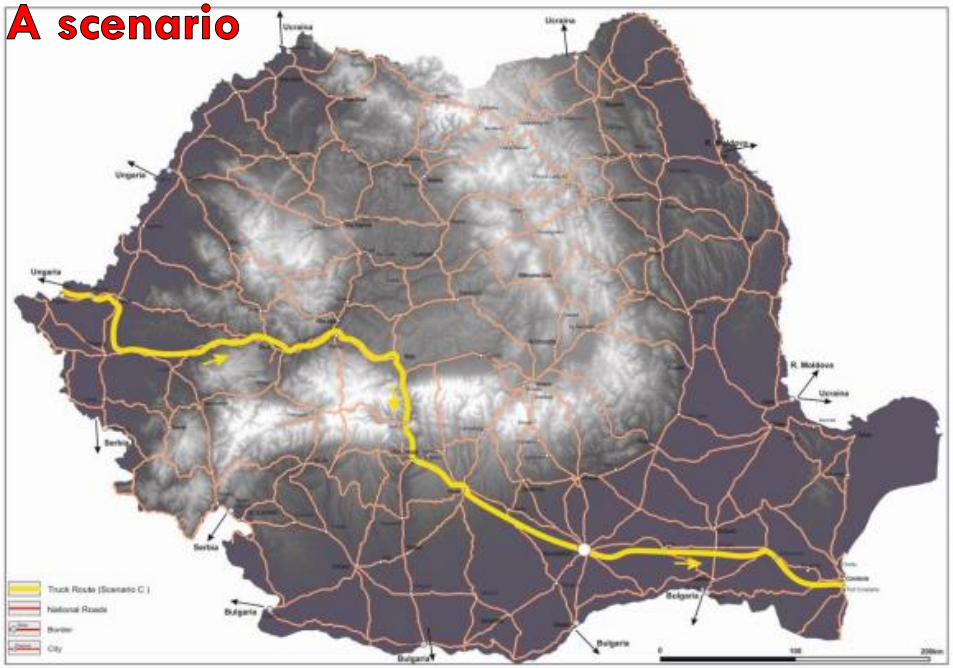
C scenario

In the chase that the ***truck driver is alerted by the application***, the route is redirected before arriving at accident. Thus, the route will be as follows: Nădlac – Arad – Timișoara – Lugoj – Deva – Sibiu - Brașov – Predeal – Câmpina – Ploiești – București – Cernavodă – Constanța. The route has 870 km. In this case, it will be 109 km less then B Scenario and just 36 km more than A Scenario.

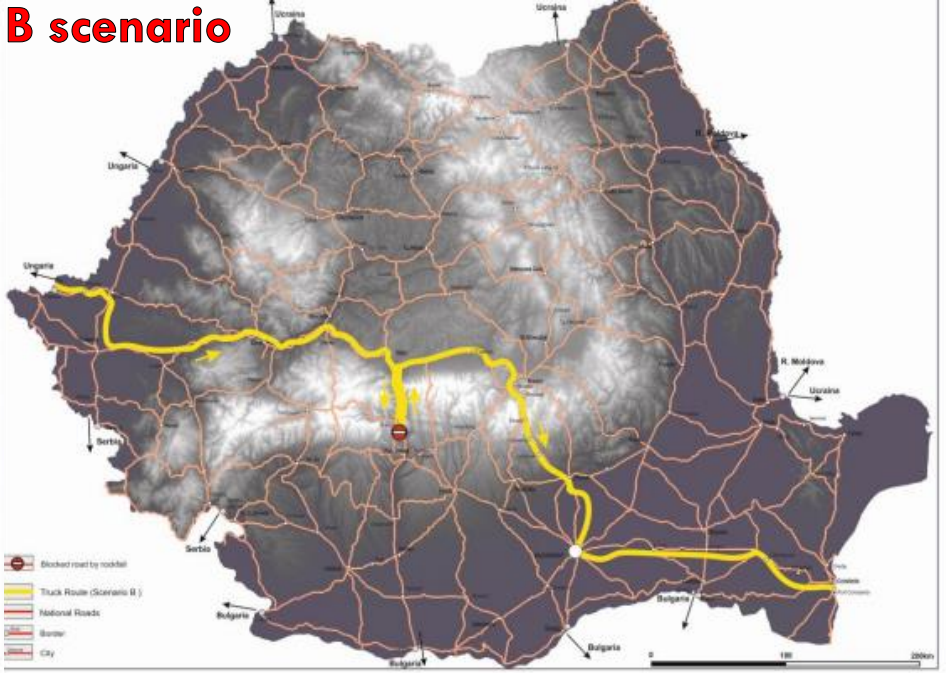
Emissions

Route length (km)	Journey time	Fuel Consumption (litres)	Average consumption (litres)	Total Fuel Cost (Euro)	CO2 (kg)	NOx (g)	N2O (g)	CH4 (g)
870	16h 28	335	38.5	333.5	884	3522.7	51	2

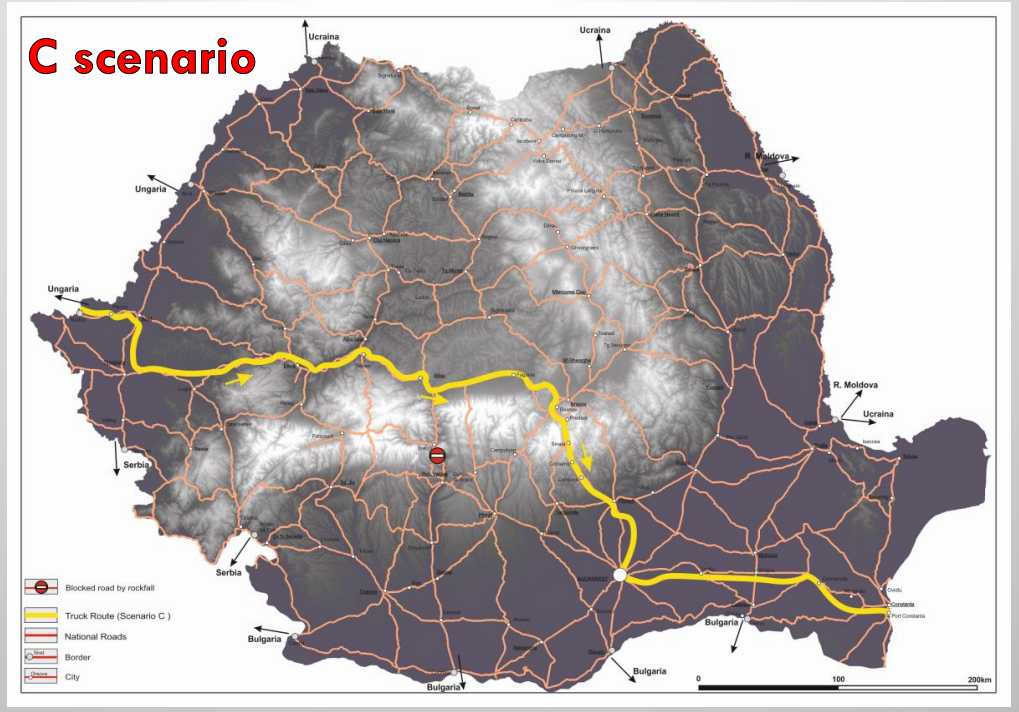
A scenario



B scenario



C scenario



A scenario

Route length (km)	Journey time	Fuel Consumption (litres)	Average consumption (litres)	Total Fuel Cost (Euro)	CO2 (kg)	NOx (g)	N2O (g)	CH4 (g)
834	15h 38'	321	38.5	319.6	849	3352	49	1.92

B scenario

Route length (km)	Journey time	Fuel Consumption (litres)	Average consumption (litres)	Total Fuel Cost (Euro)	CO2 (kg)	NOx (g)	N2O (g)	CH4 (g)
979	19h 09'	387.7	39.6	386.0	1023	4050.6	57.6	2.27

C scenario

Route length (km)	Journey time	Fuel Consumption (litres)	Average consumption (litres)	Total Fuel Cost (Euro)	CO2 (kg)	NOx (g)	N2O (g)	CH4 (g)
870	16h 28	335	38.5	333.5	884	3522.7	51	2

B scenario vs. C scenario

	Route length (km)	Journey time	Fuel Consumption (litres)	Average consumption (litres)	Total Fuel Cost (Euro)	CO2 (kg)	NOx (g)	N2O (g)	CH4 (g)
Diference between Scenario B and Scenario C	**109**	**2h 41'**	**52.7**	**1.1**	**52.5**	**139**	**527.9**	**6.6**	**0.27**
Procent (%)	11.1	14.0	13.6	2.8	13.6	13.6	13.0	11.5	11.9

National Meteorological Administration

- Coduri meteorologice
- Avertizări nowcasting

General Inspectorate for Emergency Situations

- Accidente rutiere

National Company for Road Infrastructure Administration

- Drumuri cu circulație inchisa
- Drumuri cu circulatie ingreunata
- Drumuri in lucru

Project Team

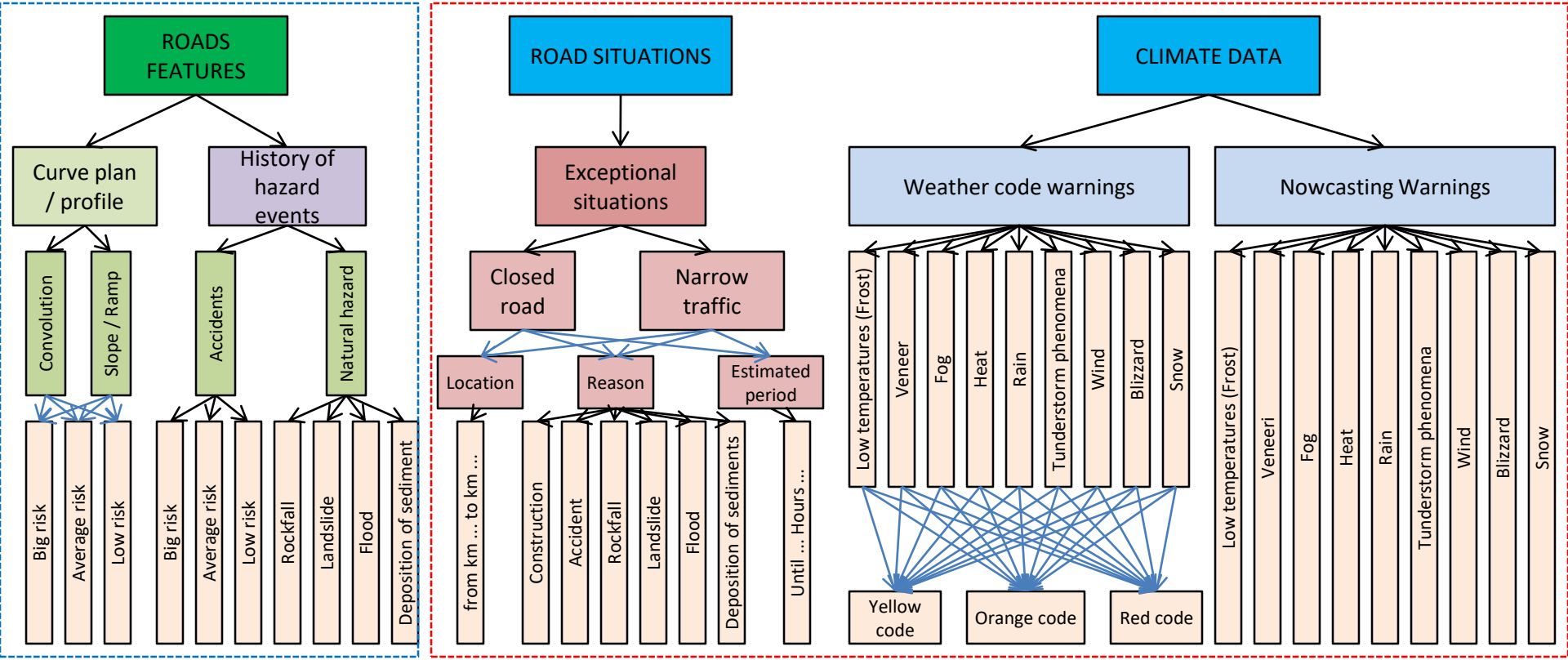
- Identificarea riscurilor geomorfologice (alunecari, inzapeziri, inundatii)
- Puncte de interes (benzinării, parcari)

Users
(smarphone, web)

Management
(IGSU, MT, CNAIR)

STATIC COMPONENT–
WITH UPDATE 30 DAYS / WHEN IT IS IMPURED

DYNAMIC COMPONENT - WITH REAL TIME UPDATES



National Meteorological Administration (ANM)

National Company for Road Infrastructure Administration

General Inspectorate for Emergency Situations (IGSU)

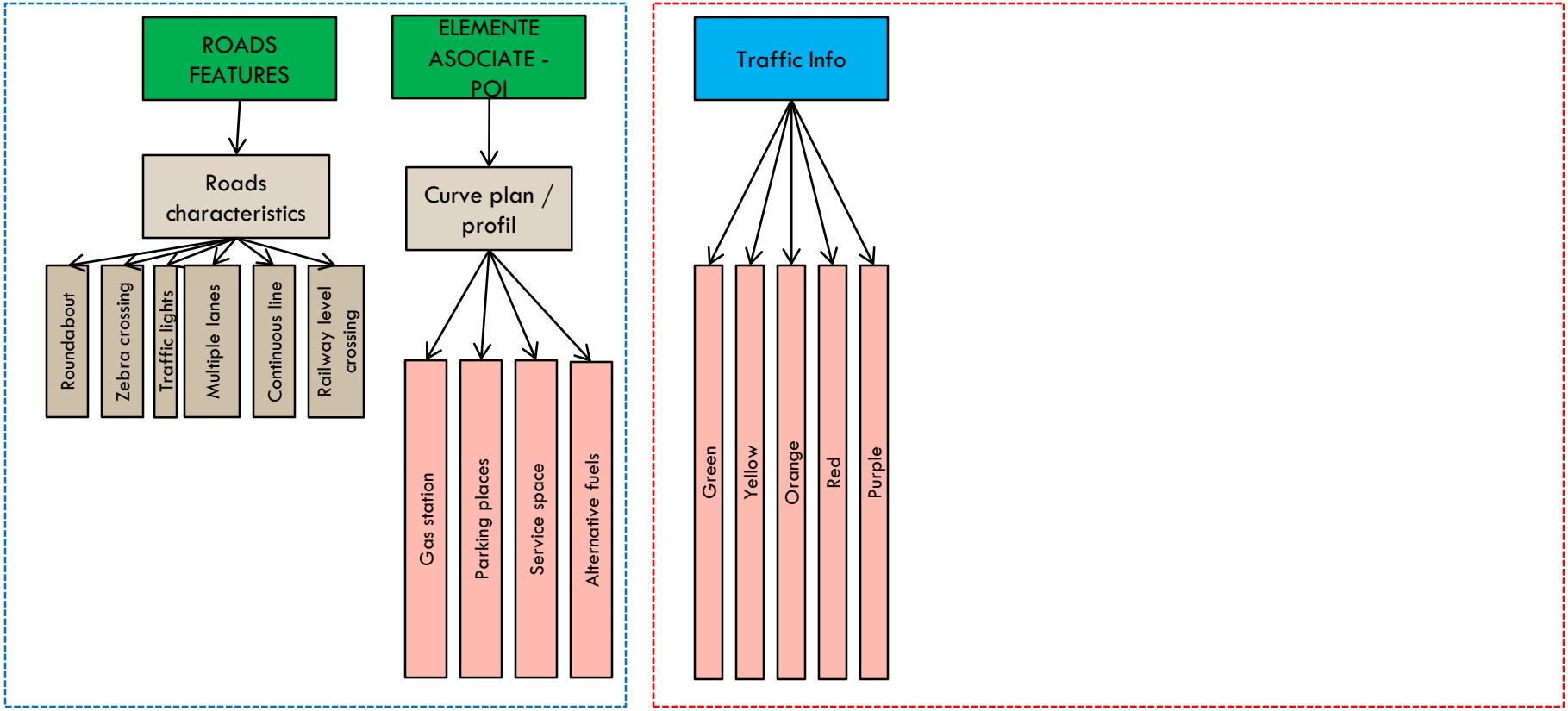
The project team

Data automatically retrieved

Processed data

STATIC COMPONENT–
WITH UPDATE 30 DAYS / WHEN IT IS IMPURED

DYNAMIC COMPONENT - WITH REAL TIME UPDATES



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Activity 2 - Identification of the data sources

Nr. crt.	Data / information source	Total number of event categories or risk generating conditions provided	The share (%)
-1-	-2-	-3-	-4-
1.	ANM[1] - National Meteorological Administration	9	18,7
2.	CNAIR[2] - National Company for Road Infrastructure Administration	7	14,6
3.	IGPR[3] - The General Inspectorate of Romanian Police	4	8,3
4.	IGSU[4] - General Inspectorate for Emergency Situations	2	4,2
5.	**PT[5] = Project team**	**26**	**54,2**
		48	100

Agreements concluded

No. crt.	Data / information source	providing data / information method	Protocol
-1-	-2-	-3-	-4-
1.	ANM[1] - National Meteorological Administration	- File Transfer Protocol (FTP)	signed
2.	CNAIR[2] - National Company for Road Infrastructure Administration	- WEB services, - File Transfer Protocol (FTP) - Application Programming Interface (API) - other available means	signed
3.	IGPR[3] - The General Inspectorate of Romanian Police		Under discution
4.	IGSU[4] - General Inspectorate for Emergency Situations	- WEB services, - File Transfer Protocol (FTP) - Application Programming Interface (API) - other available means	signed
5.	IP[5] = Project team	- GIS data	n/a

3. Collection / acquisition of data / information

No. crt.	Event classes or risk generating conditions	Categories of events or conditions generating risk	data / information source
-1-	-2-	-3-	-4-
1.	Meteorological risks	- low temperature (frost) - veneer - fog - heat - precipitations - hunderstorm phenomena - wind - blizzard - snow	ANM[1] ANM[1] ANM[1] ANM[1] ANM[1] ANM[1] ANM[1] ANM[1] ANM[1]
2.	Hydrological risks	- sectors exposed to floods	EP[5]

3. Collection / acquisition of data / information

3.	Geomorphological risks	- landslide - rockfall - deposition of sediments	CNAIR[2], PT [5] CNAIR[2], PT [5] CNAIR[2], PT [5]
4.	Morphology / road features related risks	- slippery road - sinuous road (succession of curves)- curve - slope / ramp - narrow road - multiple lanes in each direction - rail crossing	PT [5] PT [5] PT [5] PT [5] PT [5] PT [5] PT [5]
5.	Road-related risks	- road work - bumpy road - state marks	CNAIR[2], EP[5] PT [5] PT [5]

3. Collection / acquisition of data / information

6.	Traffic characteristics related risks	- traffic lights	PT [5]
		- zebra crossing	PT [5]
		- roundabout	PT [5]
		- continuous line	PT [5]
		- speed limitation	PT [5]
		- crowded road	PT [5]
		- animal warning	PT [5]
		- warning related to pedestrians	PT [5]
		- warning related to bicycles	PT [5]
		- speed limitation	PT [5]
		- accident	CNAIR[2], IGPR[3], IGSU[4]
		- locality	EP[5]
		- road closed to traffic	CNAIR[2], IGPR[3]
		- Alternative circulation on a single band	CNAIR[2], IGPR[3]
		- high-frequency road accidents	PT[5], IGPR[3], IGSU[4]

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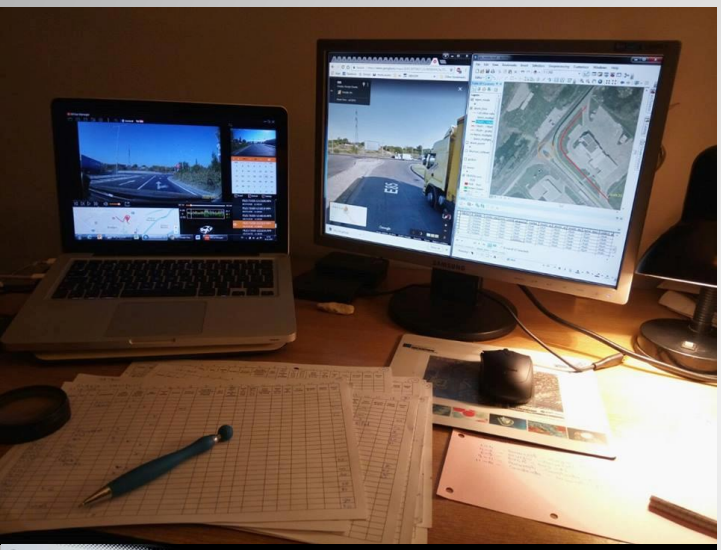
Progress on obtaining data



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0	Polyline M	DN6	423,2	423,4	BETON ASFALTIC	188,458224
1	Polyline M	DN6	332,4	332,6	BETON ASFALTIC	194,558766
2	Polyline M	DN6	192	192,2	BETON ASFALTIC	202,418103
3	Polyline M	DN6	349,6	349,8	BETON ASFALTIC	199,943536
4	Polyline M	DN6	212,4	212,6	BETON ASFALTIC	195,027096

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Ora	observatii	limita viteza	parcare	Linie continuă	Sens giratoriu	Trecere de pietoni	Curbă	Drum sinuos (succesiune de curbe)	Drum alunecos	Drum cu denivelări	Căderi de pietre	Alunecări de teren
57.21		80.00							start			
57.52		40.00										
58.19				da		da1						
58.42		40.00				da1						
8.00.20				da								
0.58			P tir									
1.05			S servicii									
1.36		70.00		da								
2.03			P tir	da								
2.34		70.00										
2.40		50.00		da	da							
4.03		70.00										
6.11		70.00		da								
6.55		70.00										
7.45				da								
8.20												punctual
9.05		50.00		da	da							
10.02									start			
10.14						da1						
10.20							da					

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Aerial image capturing






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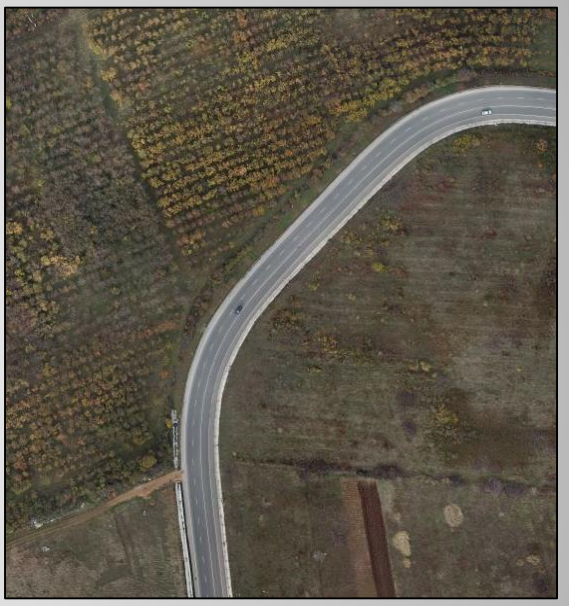
Aerial image capturing (into problematic road sectors)



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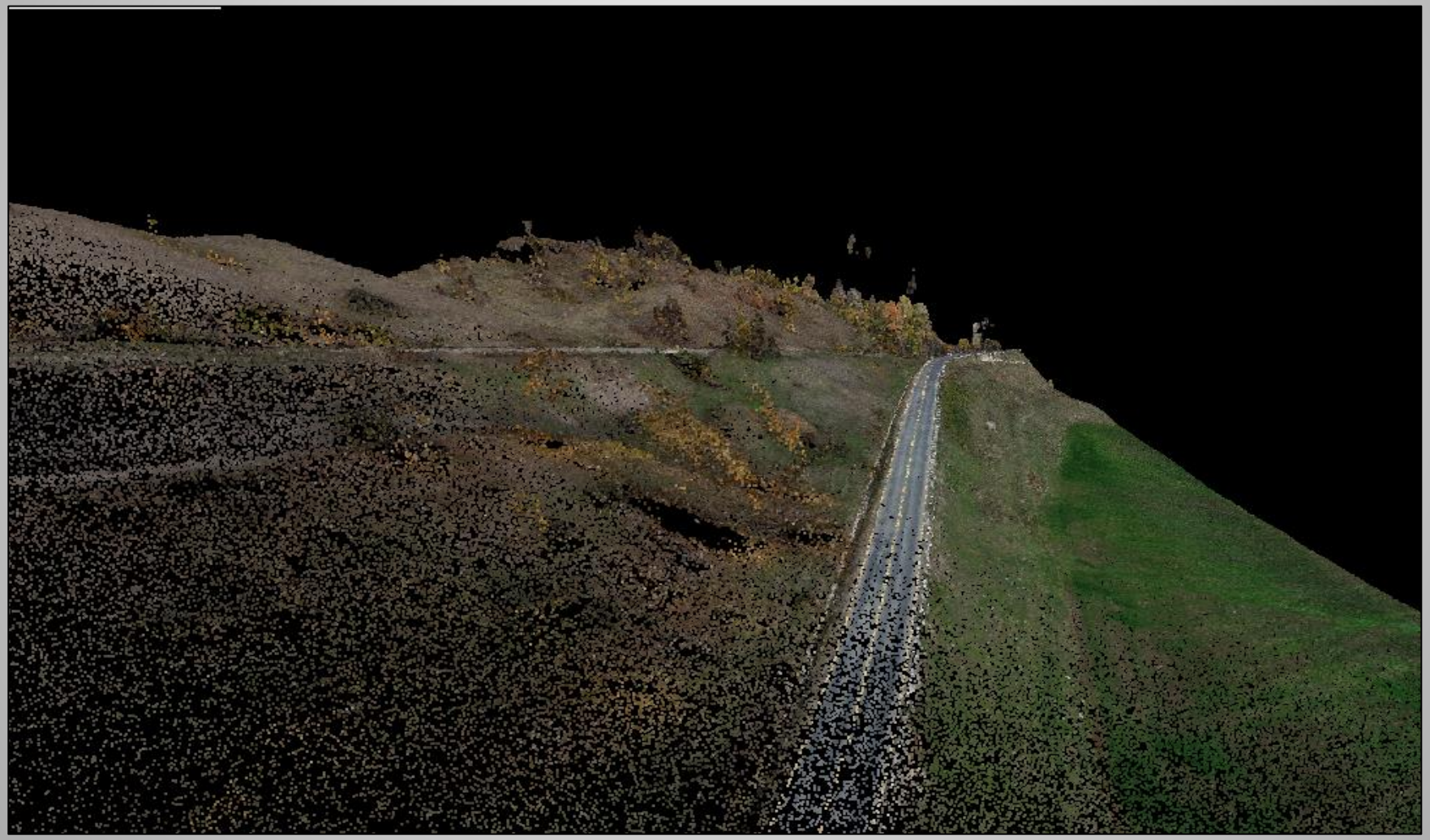
Point cloud obtained (on the road sector with landslides)



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3D modelling (on the road sector with landslides)

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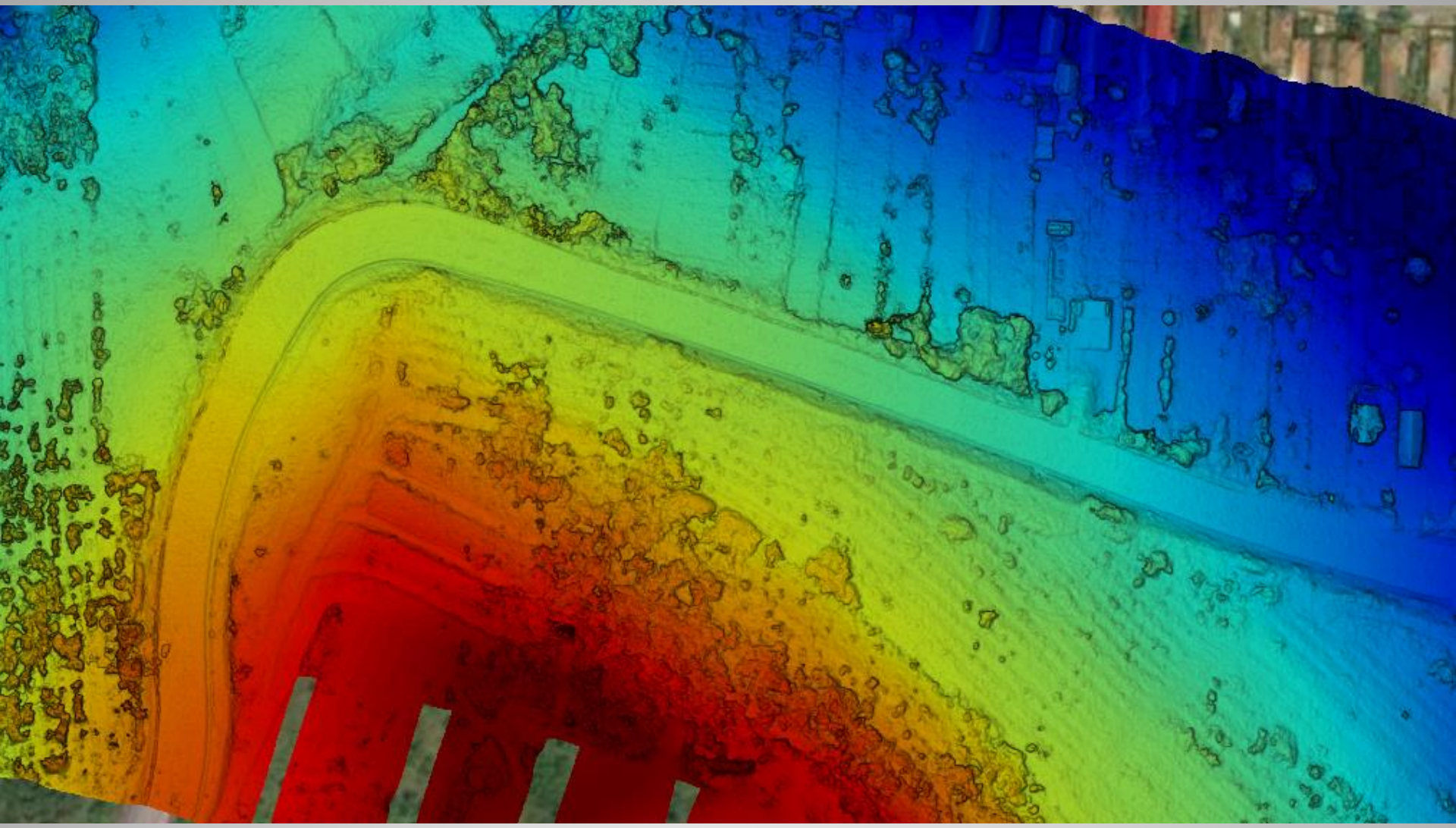
Mapping

In order to identify the road network characteristics and for obtaining a good positioning of the elements, photographs were taken and GPS measurements were made.



Very detailed Digital Elevation Model (into problematic road sector)

Aerial ortophoto created by project team (into problematic road sector)

Aerial ortophoto created by project team (into problematic road sector)

Means of verification / Milestones

- **M1 Start of the Road transportation sizing – 01.08.2017**
- **M2 – Completion of the Road transportation sizing - 31.03.2018**
- **M3 – 01.11.2017 – Start of the identification of the data sources**
- **M4 – Data sources identified – 30.04.2018**
- **M5 – Public tender launched – 15.11.2018**
- **M6 – Start of the back-end platform and applications arhitecture design**
- **M7 – Completion of the back-end platform and applications arhitecture design**
- **M8 – Back-end platform deployed on the chosen cloud environment**
- **M9 – Web application developed**

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Our vision – crossborder early warning system

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Thank you

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