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Group of Experts on Climate Change Impacts and Adaptation for Transport Networks and Nodes

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Climate Change and Transport Networks and Nodes: Presentations of initiatives at national and international levels

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

Submitted by the Government of Romania

I. Introduction

1. This document contains case study on early warning intelligent system for road transportation risks. The Group of Experts is invited to consider this case study and decide whether to include it in the Final Report.

II. Background

2. **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.

3. The overall objective of this action is to increase traffic safety and to reduce congestion on the Romanian TEN-T Core network by implementing a smart, compatible, accessible and interoperable transport system (ITS) which will offer real time traffic and trip information services in all European languages through web and mobile networks. This will allow all traffic users to access a robust database covering all identified risks (landslides, flood, rockfall, meteorological and risks, risks generated by traffic characteristics, road-related risks, accident risks) on that section of road.

4. The final result will be an **informatic platform** that will contain integrated (static and dynamic) information that can be used both by authorities involved in road transport management and safety and by public users with a smartphone and web applications.

5. The project is funded by the European Commission through the Connecting Europe Facility Program (CEF) through the Innovation and Networks Executive Agency (INEA).

The National Plan for Adaptation to Climate Change – The Romanian General Transport Master Plan

6. Starting 2016, Romania has a transport development strategy, in conjunction with European policy, called the General Transport Master Plan of Romania. This strategy foresees major investments for this area by 2030. Thus, the planning and ranking of investments included in GTMP also included the climate change component. It is foreseen that the achievement of the projects proposed by GTMP will achieve the reduction of greenhouse gas emissions.

III. Purpose of the study

7. **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 (Figure I).

8. In order to achieve the overall objective of the action, there are three specific objectives that will be met by carrying out twelve activities.

9. **The first specific objective** is to contribute to the accessibility of interoperable accurate road and traffic safe-related data across the EU. This objective was done by identifying and characterizing the list of risks that can affect road transportation, through the identification of the corresponding data sources and by making data available in a standardized format across Europe and in neighboring countries.

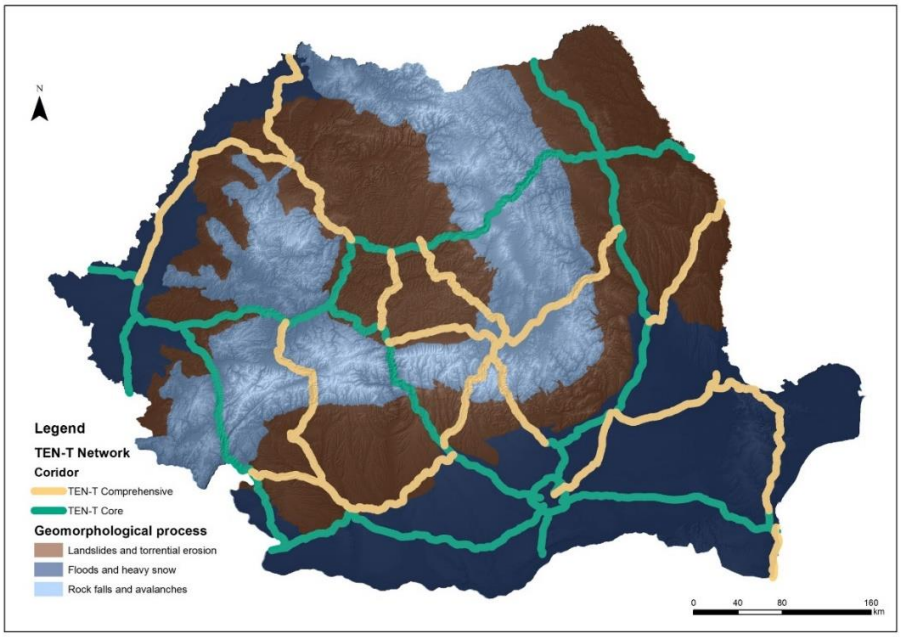
10. **The second specific objective** is to contribute to the reduction of the number of accidents, transport travel time and fuel consumption in the Romanian TEN-T Core network by providing real-time safety-related traffic information services to road users via well-functioning web and mobile applications. This objective will be met through the design and the implementation of a back-end platform, a web application and a mobile application.

11. **The third specific objective** is to inform the road users, ITS service providers and the management authorities about the results of this action. This objective will be met by designing and implementing an Information and Advertising Campaign.

IV. Scope of study and description of methodology

12. The total length of roads classified as TEN-T corridors in Romania is approximately 2500 km. Because data is collected and recorded for both ways, the total length to be traversed doubles - 5000 km.

Figure I
Geomorphological and metorological risk in Romania



13. The activities in the action contributes to the first specific objective of the Action by determining the data sources that contain information regarding the risks identified in the first activity.

14. A total of 48 categories of events or conditions were identified. Among the classes of events or risk generating conditions regarding the road traffic, one can mention: meteorological risks, hydrological risks, geomorphological risks (generated by the morphology / road characteristics or generated by the state of the road or traffic characteristics). For 22 of them, information from the relevant institutions can be obtained based on agreements concluded within the project. For the rest of 26 events categories or risk generating conditions, it was necessary to collect the information directly from the field by the project team (Figure).

15. Two types of road transportation data were taken into account: static and dynamic road data.

16. *Static data* were collected from the field and integrated into an innovative geo-database that can be accessed via an interactive map. Over 5000 km of roads and motorways were detailed mapped in the field and were transposed in GIS environment/geo-database. Over 100 hours of video were recorded in the field campaign. In this activity, over 5500 road features and environment characteristics were mapped and transposed in GIS and 10 road critical areas were identified and analysed.

17. *Dynamic data* have been identified and their source has been established. In this activity, in order to receive real-time dynamic data, collaboration agreements have been signed with three institutions: National Company for Road Infrastructure Administration (CNAIR), National Meteorological Administration (ANM), General Inspectorate for Emergency Situations (IGSU), the institutions have already provided specific data (which confirms the functionality of the protocols). At the same time, based on these protocols, was created the framework for real time dynamic data delivery.

18. In accordance with the signed protocols, CNAIR will provide data regarding closed roads, road sectors under construction and congested road sectors. ANM will provide data on weather conditions on TEN-T Core road network (in particular weather code warnings, nowcasting Warnings) and IGSU will provide data regarding real time major accidents and other associated risks (fire, floods, geological processes).

19. Both static and dynamic data will compose the integrated geo-database as a final result of the Action, data-base that is an international compatible. Also, the geo-database will be compatible with other similar applications in order to have a positive impact on reducing the number of accidents and decreasing pollution on the TEN-T Core network in Romania.

20. The geo-database integrates relevant data from field survey and identified data sources and is developed in an international standard format.

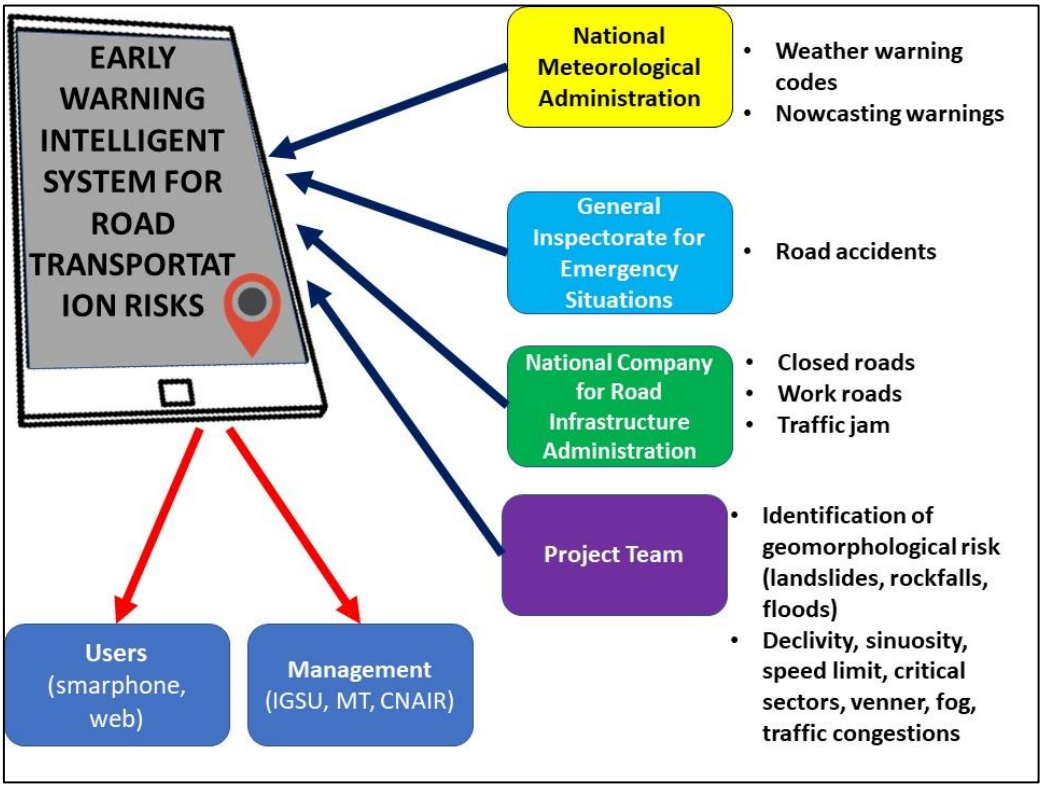
21. In conclusion, the static geo-database was created (and can be accessed) and a legal framework with the institution mentioned was established for real-time data transfer.

V. Application architecture

22. The application will have two modules:

- *one for the general public*
- *another for the management of the institutions involved* (National Meteorological Administration, General Inspectorate for Emergency Situations, National Company for Road Infrastructure Administration, Ministry of Transport).

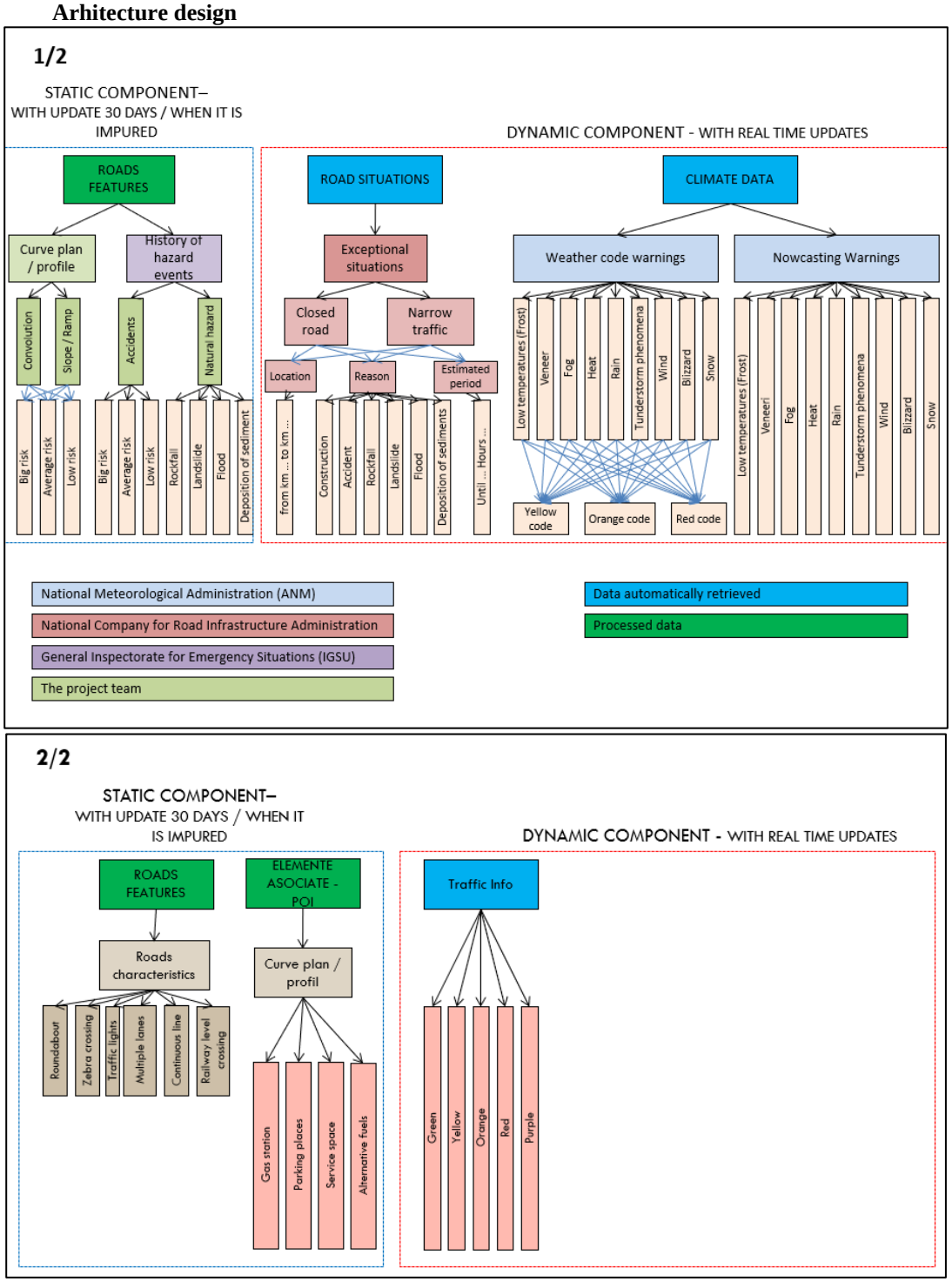
Figure II
The design of the application



23. The information from the application will be both dynamic (which will be automatically retrieved and updated in real time) and static (referring to the infrastructure features - which will update at 30 days or when required).

24. The system will also allow a better collaboration and intervention of public authorities by offering a management tool that will be accessed through the applications. Also, this tool application will offer to the public authorities, information regarding the road risks occurrence in order to plan the future actions and interventions.

Figure III
Arhitecture design



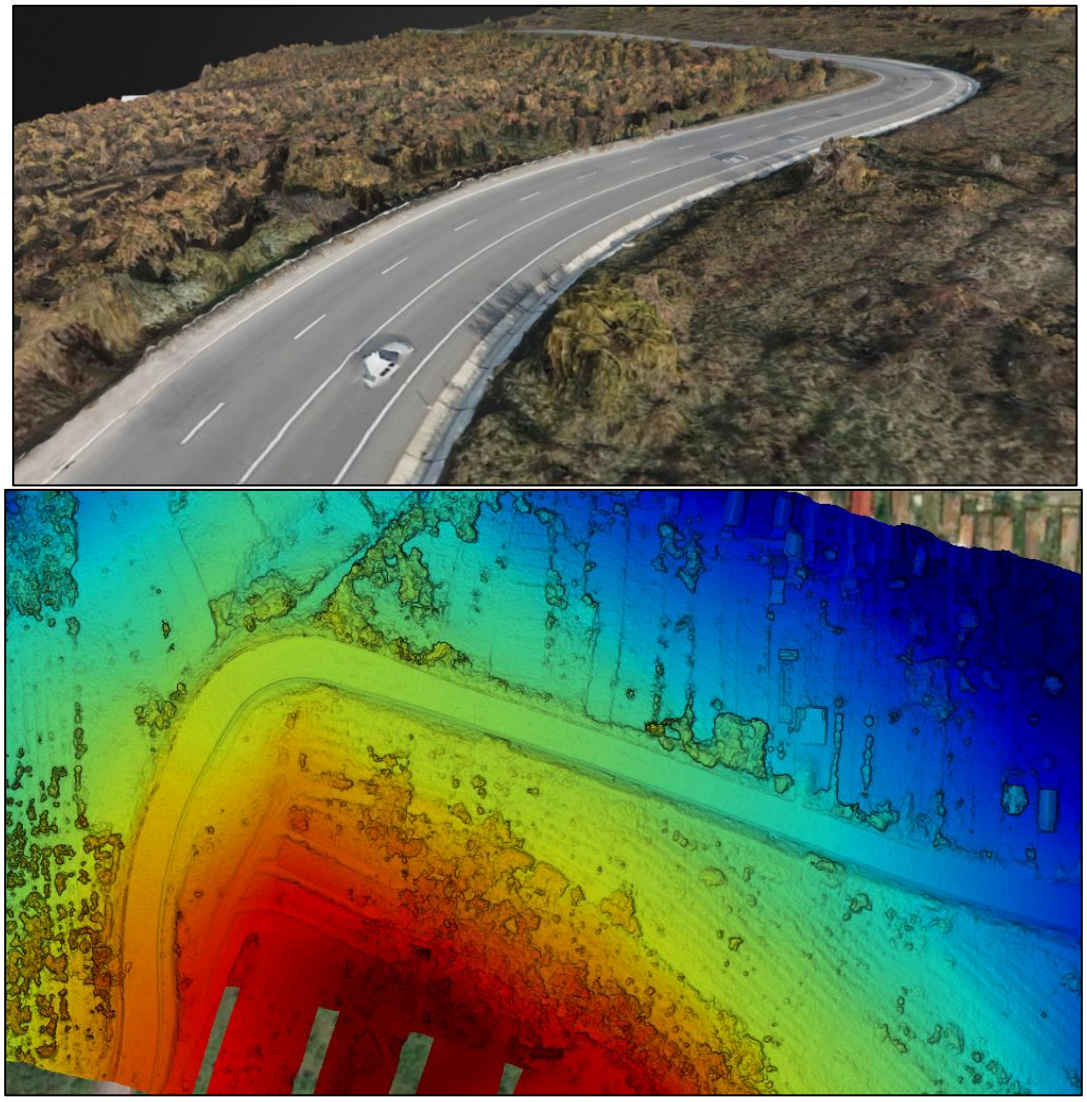
VI. Conclusions and way forward

25. ***To accomplish the first specific goal***, the first two activities were completed. Field work aimed at collecting and validating geomorphological and technical information. *Laboratory activity* focused on the analysis of collected information and was based mainly on the use of Geographic Information Systems (GIS), spatial analysis techniques and statistical and multicriterial analyzes. The identified risks range from events with minor effects (such as temporary or small-scale construction to major events such as exceptional weather conditions and natural hazards).

26. Data sources are represented on the one hand by the institutions that produce and manage these data sets and on the other hand they are collected by the project implementation team.

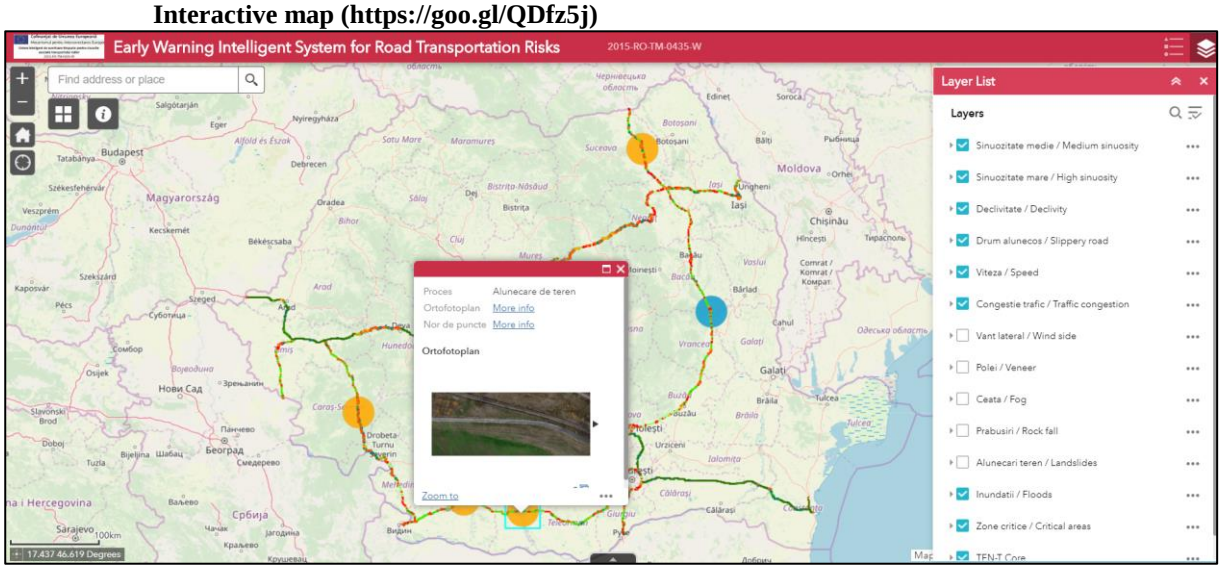
27. For detailed mapping and orthophotoplans, a drone was used to obtain high-resolution images with very good details and very current information (such data being unavailable and impossible to obtain by other means). The creation of numerical altimetric models and the elaboration of very detailed and current situation plans (including aerophotography) will be used to validate the information identified on the field (Figure).

Figure IV
3D image (Digital Elevation Model) of the road risk sector Using drone imagines (done by project team)



28. The information obtained in stage I (Activity I and II) is transposed into a geo-database that can be accessed through a GIS interactive map, facilitating access to accurate and current data of the TEN-T Core network from Romania (Figure). This geo-database that was created is directly related to the field stage, the entire database depending on the accuracy and accuracy of the information identified and mapped in the field stage. The project result from the first phase was transposed in a interactive map in the aim to be useful for road management and other users. Geo-spatial databases contain raster information (images), vectors, and a large quantity of films about roads: sinuosity, declivity, slippery roads, speed, traffic congestion, wind side, veneer, fog, rock fall, landslide, floods, critical areas.

Figure V
Interactive map (https://goo.gl/QDfz5j)



29. At this stage, we obtained validation letters from the most important institutions in the field, with which we have a signed protocol (National Meteorological Administration, National Company for Road Infrastructure Administration, National Union of Road Transports from Romania, The General Emergency Situations Inspectorate).

30. In a future stage, it is desirable to implement a project using the same methodology in neighboring, cross-border, interoperable countries.

31. The activities implemented contribute to the achievement of the objective of the action by creating the first Romanian GIS geo-database containing the most important road network related risks. The geo-database is developed in an international standard format. The result of the first phase of the action (Activity No. 1 and No. 2) has been transposed into an interactive map, accessible to both authorities and the public. Also, the results of the implemented activities are an important pillar for the action to be continued in Large Infrastructure Operational Programme (LIOP). The Ministry of Transport confirms that the expected benefits of the action will be fully achieved (although later than originally envisaged) as the project will continue.