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ROMANIA - NATIONAL REPORT

STRATEGIC DIRECTION SESSION ST C
SAFETY OF THE ROAD SYSTEM

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ABSTRACT

This document describes the actual status of safety of the road system in Romania and highlights the specific topics, challenges and progresses registered during the last four years, which could be of interest to the world road community. After a short presentation of the Romanian public road network, this report, structured according PIARC Strategic Theme “C” in four chapters, is addressing safety aspects of road infrastructure, road operations and risk management. Finally, conclusions and main directions for future development trends and strategic approaches for putting existing knowledge into practice, in each of these safety domains, are presented.

1. THE ROMANIAN PUBLIC ROAD NETWORK. THE ROAD TRANSPORT SYSTEM

The Romanian transportation infrastructure consisting mainly of highways and railways, has a general orientation influenced by the Carpathian Mountains which are nevertheless crossed by ten railways and over twenty motorways, and by the southern location of Romania's capital city Bucharest, to which all the main traffic lines are converging. The modal distribution of the transport of freight and passenger travel in this country is shown in Table 1 from below:

Table1- Modal distribution of transport of goods and passengers in Romania

Transportation mode	Freight transport (%)	Passenger transport (%)
Road transport	87.3	65.5
Railroad transport	9.8	34.1
Sea transport	1.2	0.1
River transport	0.5	0.1
Air transport	0.1	0.2
Pipe transport	1.1	-

In the actual conditions of transition to a market economy which implies a higher mobility of freights and passengers, the road transport becomes a vital factor for the development and progress of our society. The Romanian public road network has a total length of 153,014 Km., of which 14,683 Km. are classified as national roads, 26,967 Km. are county roads, 31,166 Km. are communal roads and the reminder of 80,198 Km. being roads in the cities (streets). There are also 4,910 bridges located on the county road network with a total bridge length of 192,00Km. The Ministry of Transports, through the National Company for Roads and Motorways (CNADNR) administrates the national roads. The county and the communal roads are managed by the appropriate county or communal administrative bodies.

2. SAFER ROAD INFRASTRUCTURE

2.1. The actual status of safety of the road system

The national roads representing about 20% of the total public road network constitute the major road network of this country and carries over 65% of the total road traffic. From the total of 14,683 Km of national roads only 320 Km have a status of motorway, but the need for the construction of new motorways is evident in this country. Further on, 58.1 % from the national roads are classified as "principal", representing a total length of 8,156 Km from which more than half (4,508 Km) are classified as European (E) roads. If compared

with the road network of other European countries, since 1990 year, the Romanian road network, become subject to an important traffic growth, especially of the heavy traffic. Improving the safety of the road system, in order to achieve a safe and efficient movement of people and goods on the network, while effectively managing the risks associated with road transport operations is a constant objective of the Romanian Road Agency. As everywhere in the world, the building of new roads or the rehabilitation of the existing ones, in this country, besides of being responsible for business growth and progress of society, when improperly used by the motorists, they become very often a source of undesired impact on the environment, due to the air and noise pollution produced by the construction machinery and road traffic or due to the huge masses of displayed soils from cutting to fills. Aware of these problems, the National Highway Agency - CNADNR, parallel with the undertaking and rehabilitation projects is constantly initiating highway ecological programs, such as The Highway Environment Research and Management of its Ecological Systems (HERMES), these programs being in fact, pragmatic approaches to the problems of conservation of natural areas besides the highways, seeking their aesthetically improvement and in the same time the protection and the conservation of the genetic material its contains. Aware of the existing environmental problem and the new ones related with identifying and managing potential areas of risk affecting the road network and implicitly the road transport are becoming the great concern to the Romanian Highway Agency.

3. SAFER ROAD OPERATIONS

3.1. New concepts and developments for winter maintenance management system (WMMS)

In most European countries the cost of winter road maintenance is often about 50% of total budget of maintenance, due attention should be paid to optimize maintenance management and efficiency of these activities. This report presents the Romanian winter management systems for roads in the European context and also the maintenance technologies used in its specific operational traffic and climatic conditions. In this context the key components of these systems, are shortly described namely: the weather information systems, administrative systems, warning systems, equipment, intelligent traffic management systems and road user information. A useful structure of a WMMS developed in the frame of COST 353 Action is shown in Figure 1.

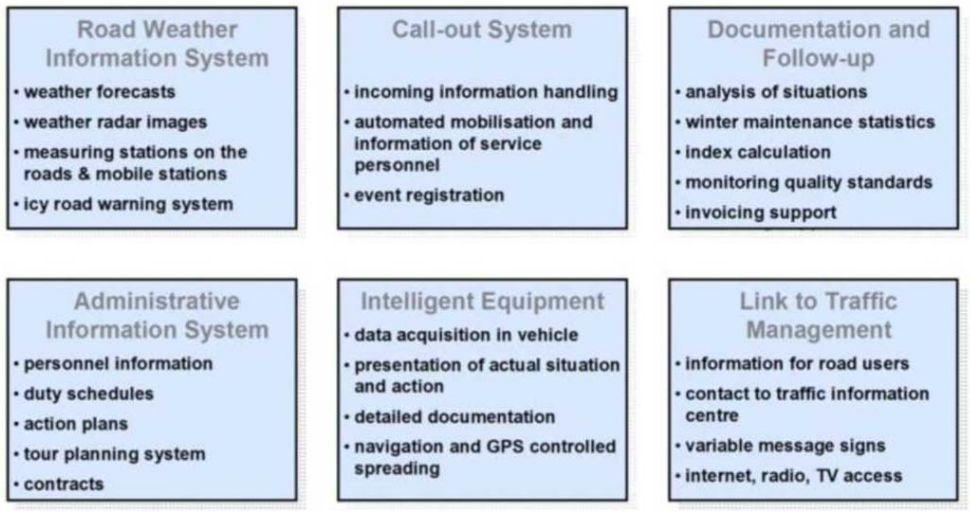


Figure 1 - The main structure of a Winter Maintenance Management System – WMMS [Cost 353]

3.2. Actual status of the Romanian WMMS and future development trends

In accordance with COST 353 recommendations, (Cost 353, 2008) in order to assess its efficiency, the main components of the WMMS have been divided into following groups: Road Weather Information Systems, Administrative System, Call-out System, Intelligent Equipment, Documentation and Follow-up and Traffic Management and Information, as described below. The following two aspects have been considered in this evaluation:

*Economical aspects***:** These systems, like all installations, generate implementation and maintenance costs that consist in the conservation and running of all the elements. The total cost will be the determining factor, and therefore its compound cost has been evaluated. Although this aspect is quantifiable by nature, several coefficients have to be attributed depending on costs in order to assign it the appropriate weight, bearing in mind at the same time the magnitude of the other aspects.

*Functional aspects***:** The efficiency, use or benefits of the system are analyzed, based on experience or surveys. The sectors capable of experiencing benefits being road users, administration and the environment. Conventional evaluation indexes have been assigned according to the degree of benefit, which will be assumed by weighting coefficients, equally conventional, according to the degree of importance, in order to reach the total value of this aspect.

In Romania, the integration of the winter maintenance activities within various serviceability levels is established according to the road category. Thus four levels of serviceability are established corresponding to four different classes of traffic, the ADT ranging from less than 500 to more than 16,000 physical vehicles per day. In case of road sectors classified as service level I. The maintenance centers, provided with radio-telephone stations, are located in such a way that each one covers a road section of approximately 50 km, so the minimum intervention time for the road crew should not exceed 30 minutes. Permanent information for drivers and pedestrians on road conditions is ensured constantly, 24 hours a day, including holidays. National Winter Commandments are established at the Ministry of Transport for national and European roads. For county and rural roads the emergency action is established by County Commandments, according to the transport requirements correlated at local and national level, thus ensuring the traffic continuity. With respect to the service level and also the intervention time during winter, road agencies are organizing the so-called Operation Centers and Informative Points with the necessary provisions.

3.2.1. Road weather information systems

In the frame of its strategic organization, in Romania this activity is managed by the National Company for Roads and Motorways - CNDNAR, which has 7 road and bridge Directorates, 44 national road operation centers, 275 winter operation centers and 85 auxiliary operation centers. For county roads, a similar organizational structure includes 41 regional councils and 260 winter operation centers. They are in charge of the organization of a service during the winter, to check the weather reports and make decisions in case of prognoses that can affect road conditions. They are also responsible for the duty organization of their own personnel and stockpiling of spreading material like grit or salt. Private companies are also involved in winter maintenance activities. Information regarding weather parameters for CNDNAR - Central Dispatcher Station - is provided by the National Institute for Meteorology and Hydrology (NIMH), on a contractual basis. Meteorological and hydrological forecasts for warnings are sent each time the occurrence of a dangerous phenomenon is foreseen. Road Weather Information Systems are located at representative points within the microclimate and can connect to the electricity and GIS networks. These RWIS stations measure the local road conditions and generate the

corresponding warning to the road users. Such RWIS stations cover an average road length of 36 km.
During the winter maintenance period (15th of November - 15th of March), the following types of measurements are envisaged every 24 hours, such as air and road surface temperature, humidity, amount and type of precipitation, snow depth, wind speed and direction, solar radiation, etc.
At a national level, at the National Dispatcher Station, an information system processes the specific data provided by the RWIS's, the National Meteorological Institute, daily patrol groups along the roads, local authorities, police teams and " in traffic " road users. The processed information is then disseminated through a network of computers to the various areas of the country and to the public via radio, TV, telephones, etc. Generally, the stations are placed at the coldest points on roads and bridges. The determination of the location of new stations takes place through thermal mapping and the experience of the intervention crews and drivers of snow ploughs.
Here follows the main conclusions resulted from a comparative analysis of the existing WMMS systems practiced today in various European countries, including Romania. As you could see from Figure 2, most European countries including Romania , have already invested in RWIS extensively and see now more needs in administration and organization fields.

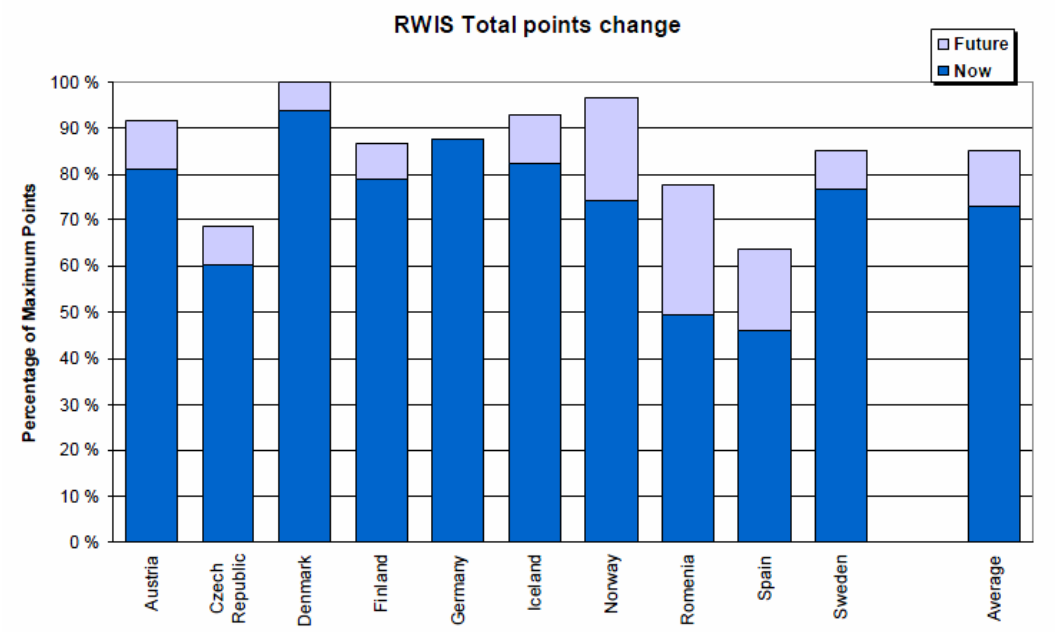


Figure 2. Road weather information system changes in future resource allocations by countries [Cost 353]

3.2.2. Administrative system
The administrative part of the WMMS combines all information and procedures needed by operators and decision makers, and must support and assist operators and supervisors to manage all activities**.**The documentation of winter maintenance activities is based on achievements or reports made by the drivers. All trucks have a plan document consisting of initiation, process and finalization of the route.

3.2.3.Call-out-system

The drivers can be reached by phone or they are at the service station for the next 12 hours. To call out private contractors there are several readiness models. When the truck reaches the service station an onboard transmitter is registered in order to determine the beginning of the service. The evaluation of the existing systems makes clear that satisfaction with the callout system is not so high at the moment. On average, the systems only rated a 36 % of maximum points. However, a clear increase in this area is expected in the future.

3.2.4. Intelligent equipment and documentation

The data on the equipment will be read in and transferred to a computer program. The data of the ice warning stations are transferred to the service stations. They give information concerning air and surface temperature, dew point, moisture, wind, precipitation, air pressure and the quantity of residual salt on the surface. The evaluation of the existing system clearly indicates that the satisfaction with the components of the intelligent equipment is not very high at the moment. But in future a clear increase in this area is expected. Since the satisfaction with intelligent equipment components is estimated higher in future than now, and the importance of these components for a WMMS will be greater, the experts foresee a high potential for them.

3.2.5. Traffic management and information

The government and also private broadcasting stations inform about the forecasted and current weather and the local conditions during their news bulletins or via RDS. Weather information is also available on Internet. Information concerning winter road conditions should be given as early as possible to drivers. This information is given on the following aspects:

• road sectors on which traffic flow is difficult due to road works, by observing the appropriate signaling and indicating the by-pass alternatives by means of radio, TV, press and telephone;
• roads with snow cover, areas with blizzards and meteorological forecasts;
• in case of an emergency, the road and traffic conditions are transmitted every hour by national and local radio and TV or by special broadcasts. Some road signs indicate a speed limit when there is a danger of slippery roads. The road agency also uses classical and variable message signs. Information concerning weather, road conditions, traffic jams or surface temperature is given to the drivers.

4. MANAGING OPERATIONAL RISK IN ROAD OPERATIONS

4.1. Background

Romania is exposed to a variety of hazards resulting from the interaction of natural factors with the demographic, social and anthropogenic ones, also with infrastructure elements such as buildings, roads, railways. This interaction is increasing due to the trend of population concentration in large urban areas and expansion of residential areas within the unsuitable land exposed to floods or landslides. Climate change, linked to global warming trends, generates uncertainty concerning the intensity and frequency of hazards, but also to the emergence of new phenomena such as tornadoes or desertification. Due to the modern industrial practices, which largely depend on the status of critical infrastructure combined with the effect of population growth in densely inhabited, this country is becoming increasingly vulnerable to these risks. Unfortunately, there are few systematic studies and accurate data on risk management, which will allow us to know how much more reasonable, how, when, where and why certain events and disasters may affect significantly the technical state of road and users safety. Also there are few records and

studies on the assessment of costs that they involved the right approach and solve these problems. To answer these questions, and to prevent or reduce the risks caused by these events, natural disasters like typhoons, tornadoes, floods, drought, natural fires, earthquakes and man-made ones, their effects over roads were identified and analyzed. In this respect the recent contributions of the researchers involved in the Technical Committee C3 PIARC; have brought a significant progress in the developing of risk assessment methodologies. These methodologies were later associated with the development of effective decision-making processes to prevent or to reduce existing risk and some of them are now under study for future implementation.

4.2. General situation of hazards and risks factors in Romania

Climate change, linked to global warming trends, generates uncertainty concerning the intensity and frequency of hazards, but also to the emergence of new phenomena such as tornadoes or desertification. For the last two decades is evident an increase in precipitation, flood frequency and extreme temperatures.

Hydrological hazards
Floods are natural hazards with a pronounced impact on network settlements, communication routes and land along the existing 4.000 rivers in Romania. .Statistically, the land affected by floods is around 3.5 million hectares, the largest areas within being located along the Danube and main rivers of the Romanian Plain, such as Siret, Buzau, Ialomita, Arges and Olt River. In mountainous and hilly area, where river beds have sharp slopes, floods are accompanied by intense processes of erosion on the banks causing landslides that may affect the valleys. Human activities and deforestation in different sectors of Carpathian Mountains are leading also to an increase of the erosion, transport and deposition of silt.

Landslides hazards

Landslides are natural hazards (see Fig.3) that are closely related to floods. Severe soil erosion, landslides and mud flow affect 30-40% from the agricultural lands. Landslides, triggered by heavy rains and earthquakes, are affecting the localities settled on the hillsides, and floods are a major risk factor for the network of localities, communication routes and land along the main river artery.

Fig. 3 - Landslides aspects affecting road network

Seismic hazards

Romania presents a high seismic risk, hazards of this type having the greatest impact on the population. The risk is aggravated by the large number of tall and old buildings, most of them located in Bucharest and in large cities. The risk comes from the seismic region of Vrancea, where the occurring earthquakes are characterized by releasing of large quantities of energy, causing the greatest damage to people. According to specialized

studies in this area, earthquakes with a magnitude of 7 on the Richter scale have an average return of 32 years. The strongest earthquake with epicenter in Vrancea, occurred in the year 1802 having a magnitude of 7.5. - 7.8 on the Richter scale, which corresponds to intensity IX+, on the Mercalli scale.

Technological hazards

Technological hazards can be caused by errors in the design of industry facilities. Transport of dangerous substances is another issue that may cause accidents with human casualties and environmental pollution. There are situations in which accidents technology, such as dam break or explosion of plants may be caused by natural factors, such as floods and earthquakes, producing a succession of extreme events. Considering the provisions of the European Directive 96/82 EC Seveso II concerning the management of major accidents involving dangerous substances, in Romania, have been identified 333 objects that are covered by the directive, from which 245 having considered as sources of serious danger, most of which being chemical or petrochemical ones.

Chemical industry hazards

Events or accidents that occur due to the leakage of radioactive substances are most dangerous to humans and the environment. From this point of view, Romania has one nuclear power station in Cernavoda. Outher risk sources are the reactors located in Bucharest-Magurele, the Pitesti-Mioveni or Drobeta Turnu-Severin Until now, Romania was affected only by the nuclear accident at Chernobyl from April 1986. This accident has affected particularly the north-east of the country, where an increase in the rate of people with thyroid cancer and children born with birth defects is still recording.

Hydro construction

Partial surrender or destruction of dikes and dams can produce strong and floods with devastating effects. Romania has 1.600 dikes having a length of 9.920 km done, and 1.353 dams for accumulation of water with a total volume of 13.8 billion m^3. Most of these dams present a high risk for floods, due to the old outdated technologies used during their construction. In order to prevent such undesired events, all locations downstream of major dams such as those of the Arges, Bistrita, Somes and Lotru rivers, have been equipped with modern alarm systems and with the necessary equipment for prompt intervention and mitigation the effects of floods.

4.3. Potential risks affecting safety of the Romanian road network

The common risk for a road transport authority includes anything in relation to infrastructure, personnel and finance concerning physical and natural risks, accidents and engineering failures. Risks affecting a public road network can be categorized function of a number of aspects involved such as: causes, impact, interests etc. In order to address and to properly manage the various potential risks and to mitigate their threats on the population, Romania developed recently a series of National Strategies for emergency situations, as follows :

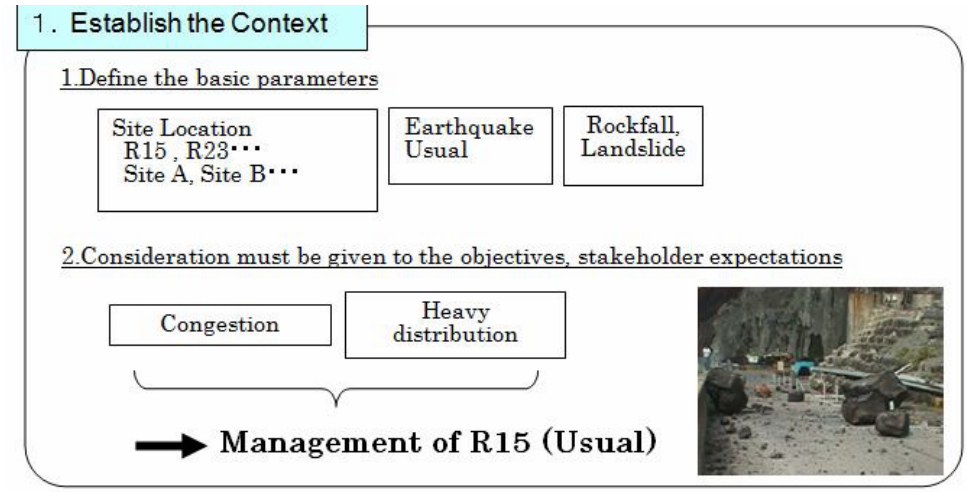
- National Strategy for communication and public information in case of emergency situations
- National Strategy for risk management in case of floods
- Romanian National Strategy concerning the climate changes
- National strategy the management of road traffic safety
- National strategy for the management of emergency situations on the public roads

The institutional structure is the National System of Management of Emergencies, established as a network of organizations, bodies and skill in emergency management, set up by level or area of competence, which has the infrastructure and resources required to perform in the field. National System of Management of Emergencies, subject to

Government Emergency Ordinance no. 21/2004, is composed of permanent activity structures and structures with temporary work.

4.4. Risk management strategies in the road sector.

Due to the modern industrial practices, which largely depend on the status of critical infrastructure combined with the effect of population growth in densely inhabited, this country is becoming increasingly vulnerable to these risks. In the context of overall management, the Road Administration needs to consider, permanently, a minimum of requirements that will ensure an effective management of risks associated with these disasters. Unfortunately, there are few systematic studies and accurate data on risk management, which will allow us to know how much more reasonable, how, when, where and why certain events and disasters may affect significantly the technical state of road and users safety. Also there are few records and studies on the assessment of costs that they involved the right approach and solve these problems. To answer these questions, and to prevent or reduce the risks caused by these events, natural disasters like typhoons, tornadoes, floods, drought, natural fires, earthquakes and man-made ones, their effects over roads were identified and analyzed. In this respect the recent contributions of the researchers involved in the Technical Committee C3 PIARC (Komata,2007; Okahara,2008) , have brought a significant progress in the developing of risk assessment methodologies. The PIARC C-3 set is actually a particular database file which is presented in the form of Inventory file of risk and their corresponding technological Annexes includes useful technologies for risk management, applicable to each specific phase of road cycle management, namely: planning, design, implementation, maintenance and reconstruction. By their composition and the recommendations provided, these files have assisted concretely and effective decision makers from our country , in choosing risk management strategies including the assessment of the costs necessary for implementing these strategies into practice.
Here follows a significant example of application of the PIARC risk management tool to a specific Romanian case (Boboc & others, 2009), concerning a landslide evaluation risk on the National Road NR 10



2. Identify the Risk

Number	No.1	No.2	No.3
Name	R15 Site A Rockfall	R15 Site B Rockfall	R15 Site B Landslide
Described	・・・	・・・	・・・
Status Emerging Live Parked	Emerging	Live	・・・

9 (inspection) Appendix 2

3. Analyse Risks

Rating the Likelihood

	Threat	Opportunity
No.1	Rating 5	Rating1
No.2	Rating 1	Rating 4
・・・		

15 (disaster history survey)

16 (topographic survey)

Rating the Consequence

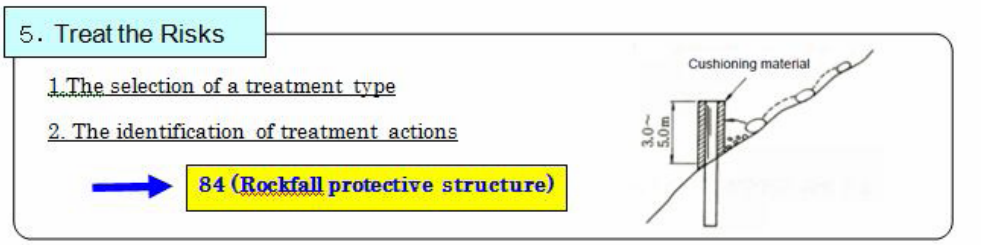
	Threat	Opportunity
No.1	Rating 100	Rating -10
No.2	Rating 10	Rating -70
・・・		

17 (topographical survey)

18 (foundation survey)

4. Evaluating the Risks

		No.1	No.2	・・・	・・・
Threat	Risk Score	500	10		
	Risk Category	Extreme	High		
	Risk Ranking	1	2		
Opportunity	Risk Score	-10	-280		
	Risk Category	Low	Very high		
	Risk Ranking	2	1		



5.CONCLUSIONS

In order to adapt and to implement the PIARC TC-3 Guide on Risk Management to the public road network of Romania, the following program has been undertaken during the last four years:

- Stage of development assessment (state-of-art), national and international studies for prevention, technologies and management of natural or man-made disasters related with roads, selection and proposal of assimilation and implementation of the best technology.
- Translation on Romanian language of documentation and presentation of the 115 PIARCTC-3 Guides and their adaptation to specific conditions of roads in this country, developing a user guide with representative examples, the multiplication and their distribution at various operational and decision levels (ministries, local and national road administrations, prefectures, etc.)
- Initiation at national and regional level of technical research activities with the objective of systematic investigation on different sectors of the public road network and developing risk maps for all public roads in Romania, using as reference material the set of files PIARC Guide.
- Participation and increasing technical activities undertaken by the National Committee APDP C3 within PIARC International Committee during 2008-2011, through the organization in 2009, an International Seminar Committee PIARC TCC3, in Iasi, Romania.

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