KOCKS CONSULT GMBH

KOCKS INGENIEURE

TRAFFIC SAFETY AUDIT

10/2008

EUROPEAN UNION

REPUBLIC OF MOLDOVA

FEASIBILITY STUDY FOR THE REHABILITATION AND EXTENSION OF THE ROAD M3 CHISINAU – GIURGIULESTI/ROMANIAN BORDER

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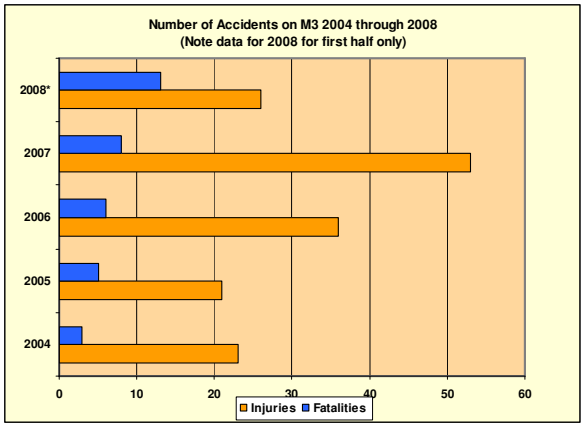

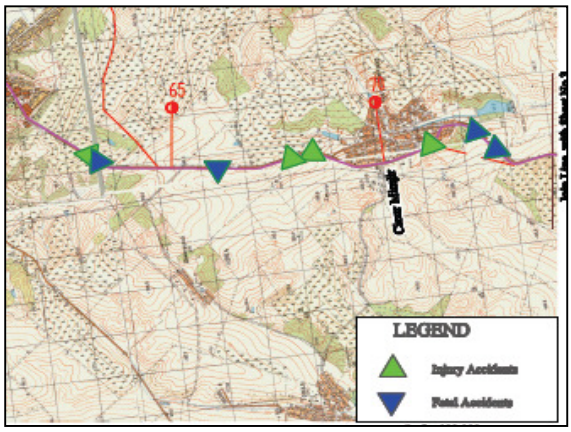

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1. INTRODUCTION

Traffic safety conditions in Moldova are characterized by a still low motorization index (vehicles available relative to population) and a high level of traffic accidents resulting in a high rate of fatalities. As presented in Table 1, the number of fatalities per 1000 registered vehicles is almost eight times higher in Moldova if compared to the situation in a Western European country like France:

Table 1. Fatalities per 1000 Registered Vehicle

Country	Registered vehicles	Population	Accidents/year (2007)	Fatalities	Fatalities/ 1000 Registered vehicles
France	37,150,988	63,392,000	81,272	4620	0,1
Moldova	586,015	3,581,100	2437	464	0,8

A study "*Joint OECD / ECMT Transport Research Centre, Working Group on Achieving Ambitious Road Safety Targets, Moldova Country Report on Road Safety Performance July 2006"* summarizes traffic safety issues on a national level for Moldova[1]:

- A high level of fatalities
- Drivers account for 25-30% of road fatalities, vehicle passengers for 25%, pedestrians for 40-45% and cyclists for 3-5%.
- The high level of fatalities in Moldavia is due largely to the lack of separation between road users, especially on high speed roads. This in turn is due to deficiencies in land use planning.
- Important infrastructure improvement is required to reduce this high fatality rate, with measures such as pedestrian crossings and central islands introduced in built-up areas.
- Excessive speeds are also responsible for the high number of fatalities.
- Since 1995, vehicle occupants constitute the user group with the biggest increase (+171%) in the number of fatalities. One reason for this is speeding and the non-utilisation of passive safety devices, such as seatbelts.
- A key issue is also the high rate of pedestrians killed, which is far above the European average: Collisions with pedestrians represent 46% of all accidents.

In the Republic of Moldova, traffic accident data are collected and recorded by the Road Police Division of the General Department of Public Police and Internal Affairs. Statistics are collected on accidents resulting in injury or fatalities. Non-injury accidents are not included in the statistics.

[1] The data used in the Joint OECD/ECMT study varies from the data provided by the site of the Ministry of the Informational Development of Moldova. Following the study, at the end of 2004 there were 649 910 registered vehicles in Moldova. The MID counted 586015 registered vehicles by the 01/09/2008.

The Ministry of Internal Affairs communicated recently the following information:

- In 2007, 2,437 road accidents occurred in total, resulting in 464 fatalities and 2,984 injuries.
- 279 road accidents, which constitute 11.4% of the total, were due to unsatisfactory road conditions resulting in 62 people dead and 358 injured.
- Subsequent analysis identified 80 road sections with a high frequency of accidents. (244 road accidents, 102 fatalities 340 injuries).
- A major problem, needing an urgent solution, is the reduction of the road sections with a high frequency of road accidents. Therefore it is of urgency to develop measures to ensure the road safety of the public on these dangerous sections. In order to address the problem the Ministry of Internal Affairs together with the State Road Administration carried out the examination of the identified sections and proposed countermeasures.

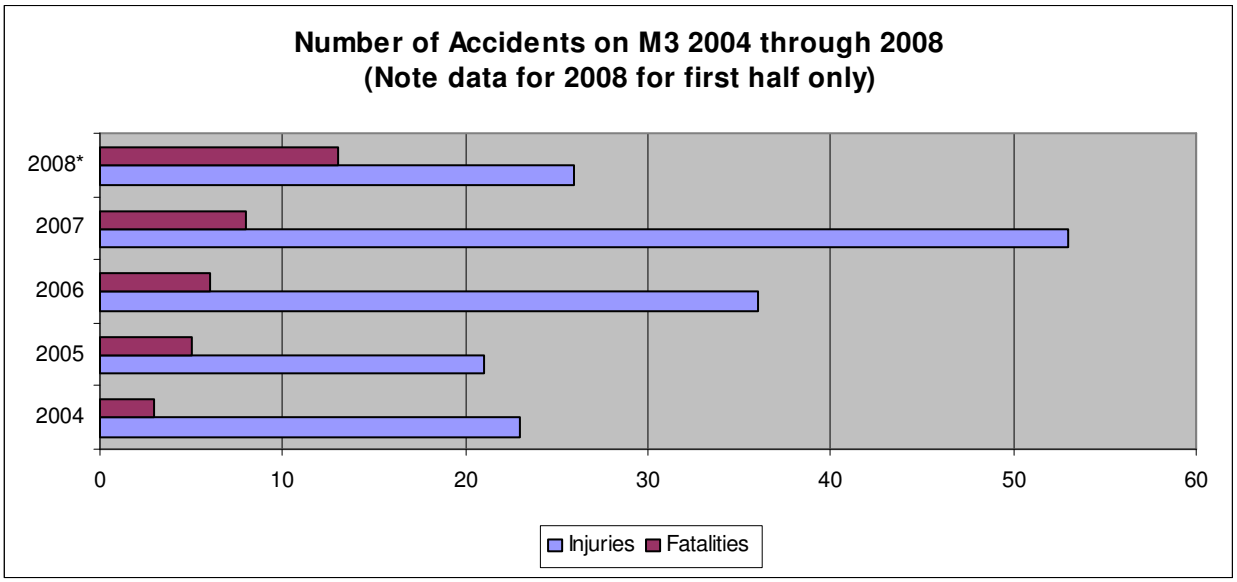
2. M3 CHISINAU TO GIURGIULESTI TRAFFIC ACCIDENT DATA

Traffic Accident Data for the study corridor was requested from the Road Police Division and received for the years 2004 through 2007. In addition, summarized data for the first half of 2008 was also obtained.

2.1. Corridor Specific Information

Between 1st of January.2004 and June 31st 2008 a total of 106 accidents (injury and fatalities) occurred along the study corridor. The recorded accidents resulted in 159 injuries and 35 fatalities. Figure 1 presents the number of injuries and fatalities by year. After a short decline between 2004 and 2005 absolute numbers of injuries as well as fatalities increased dramatically. Note that data for 2008 represents only first half of the year. Between 2004 and 2007 injury accidents increased by 130% and fatalities by 160%. The number of fatalities in the first half of 2008 (13) are almost as high as the total of 2006 and 2007 combined. It is also to note that traffic volume increased in the range of 3 to 5 percent annually). The maps in Annex 1 present the location of accidents on the M3 corridor.

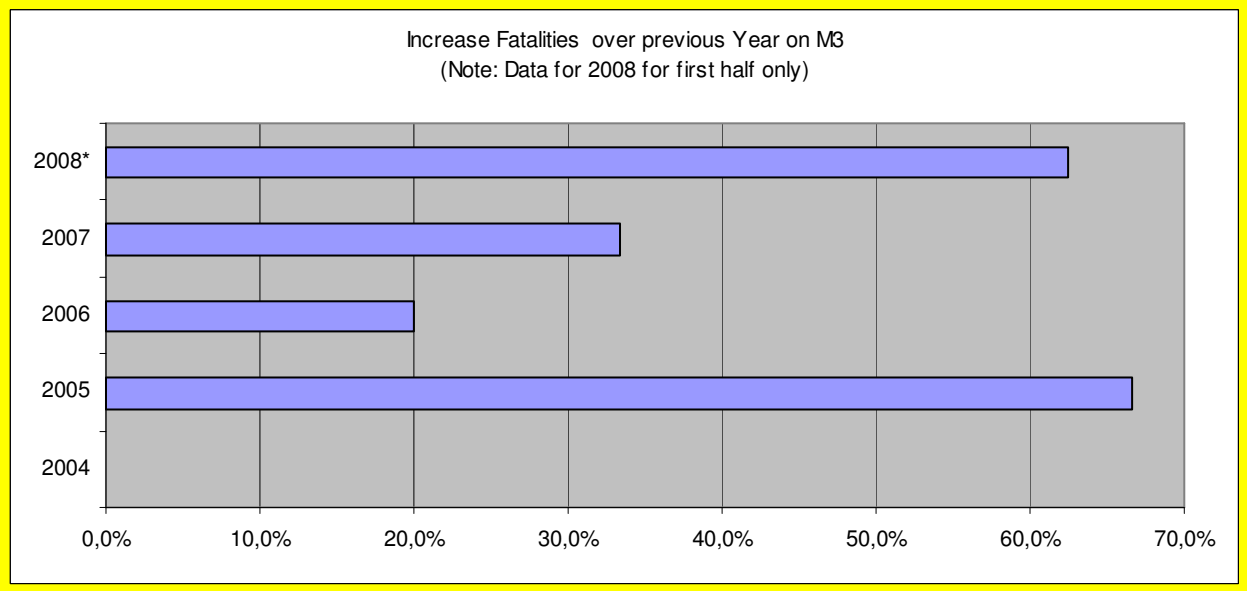
Figure 1. Number of accidents on M3 2004 through 2008



Source: Consultant, data Ministry of Internal Affairs

Noticeable is the continuous increase of fatalities relative to the previous years. Figure 2 presents the relative increase of fatalities over the previous year. In first half of 2008 7.4% of all fatalities in Moldova occurred on the M3 corridor.

Figure 2. Increase of Fatalities over Previous Year



Source: Consultant, data Ministry of Internal Affairs

The data received from the Road Police Division contained some data items regarding type and cause of the recorded accidents. Table 2 presents the type of accidents. From all accidents 56 % were vehicle with vehicle collisions, followed by a combined 31% of single vehicle accidents (inversion, obstacle, stationary vehicle), and approximately 11 % involving pedestrian and cyclists.

The majority of accidents were caused by speeding (45%) and drunk driving (14%). More than 10 percent involved Pedestrians and cyclists.

Table 2. Types of Accidents on M3

Type of accident	Number	Percent of Total
Collision	47	57.3%
Inversion (roll-over)	12	14.6%
Stationary vehicle	5	6.1%
Obstacle	9	11.0%
Pedestrian	2	2.4%
Cyclist	7	8.5%
Non-motorized vehicle	0	0.0%
Total	**82**	**100.00%**

Source: Consultant, data Ministry of Internal Affairs

2.2. Accident Patterns – Black Spots

The maps displayed in Annex I show the location of accidents along the M3 corridor. The analysis of the accident locations revealed 5 distinct "black spots" with a high frequency of accidents. The identified locations correspond with the locations identified by the Ministry of Internal Affairs. Table 3 lists the location together with possible causes, identified issues, and suggested improvements.

Table 3. M3 Accident "Black Spots"

Location	From Km	To Km	Comment
Razeni	21	23	4 lane concrete section, in the vicinity of the Village of Razeni; horizontal curve **Issues:** high speed traffic in conflict with other road users, i.e. pedestrians, non-motorized vehicles, **Suggested improvements**: Improvement carriageway; speed enforcement, signage lighting
Access to Horesti and Tipala	27	29	4 lane concrete section, hilly terrain, intersection with **Issues:** high-speed traffic, steep curves, **Suggested improvements:** rehabilitation of carriageway including renewal the road markings, speed enforcement,
	75	78	2 lane section, normal visibility, horizontal curve section **Suggested improvements**: rehabilitation of carriageway including renewal the road markings, speed enforcement
Btw Chirsova and Congaz	100	115	2 lane section between the village of Chirsova and Congaz, straight alignment, high visibility; **Issues:** speed differential, high speed, mix of traffic modes, **Suggested improvements:** rehabilitate the carriageway, to renew the road marking and to ensure the lighting during night time
Vulcanesti	174	179	Vulcanesti; high concentration of accidents within town limits as well as western entry to town **Issues:** hilly terrain, steep grades, mix of traffic modes, speed differential, **Suggested improvements:** rehabilitation of carriageway including renewal the road markings, speed enforcement

Source: Consultant, Data Ministry of Internal Affairs

3. MEETING AT THE ROAD POLICE DEPARTMENT OF MOLDOVA – 03/09/2008

In order to identify general as well as specific safety improvements the study team met with representatives of the Moldova Road Police Department:

- Mr. Valentin Zubic, Police Chief of the RPD
- Mr. Dan Chirita, Statistics department RPD
- Mr. Sergey Capatina, Road Engineer at the RPD

The following main Safety issues were identified by Moldova Road Police Department:

- There is a dramatic increase of the number of accidents – 70% more than for the same period of 2007 ;

- About 5-6 dead every day in the accidents all over the country ;
- The main factor leading to the accidents is the excess of speed, often very much over the limits ;

- There is no sufficient police staff to survey the traffic and to limit the excesses on the roads; still a low culture of the local drivers, not respecting the road rules and the other

participants to the traffic. The road police staff has recently been reduced by 50% and the department has 150 vacant places at present ;

- It would be good to start implementing the modern traffic survey technologies in order to improve the safety on the roads and to replace as much as possible the human factor by these technologies ;

- The Department is working on some projects in this sense. Thus, it would be good to use the M3 road as a pilot road (project) in implementing some technologies of traffic survey ;

- About the statistics on the accidents: since the beginning of 2008, the Department is using a new methodology (and software) of getting information about the accidents. There is collected a detailed information about each accident : how many persons involved, their ages, how many adults, children, teenagers etc., the sex of the persons, their driving experience etc. ;

- A critical factor which leads to serious accidents are the trees on both sides of the roads, present on most of the Moldovan roads. In The Soviet period, it was basically a tradition to plant trees on the roadside and the consequences are dramatic today. Most of the accidents with 4 and more dead happened because the vehicles hit a tree on the roadside;

- The classification of the high accident risk sections: if there are 2 or more accidents/km/year, this section is considered as high risk. Also, if there was only one accident during a year and another one the next year, the section is also considered as a high risk one.

The following safety improvement was suggested by Road Police Department of Moldova for the M3 corridor:

- The implementation of modern traffic survey technologies which would transmit the images, the information directly to the control stations in Chisinau and to the respective police units in the districts;

- To supplement the police staff for the survey and monitoring of the dangerous and high risk sections;

- European standard road signing and marking. E. g. the indicators which show the 4 lane section is ending and there will be a 2 lane section, should be placed at 500, 300, 200 m etc from the point of strengthening;

- On the sections with trees planted on the roadside: to plan some crash barriers in order to avoid the impact with the trees. It should be done at least on the high risk sections first;

- Not to plant any tree on the new road sections (on the extensions);

- To make a meticulous examination of the soil in the land sliding risk sectors, to reconstruct and reinforce the road in these sectors and limit the future consequences of the road sliding, as it is possible.

4. GENERAL SAFETY STRATEGIES

Roll-over Accidents at Bends
The apparent cause of these accidents is usually the driver entering the bend at excessive speed. The reason for this can be because the driver was willfully traveling at a high speed, was paying insufficient attention or because he misjudged the severity of the bend. Such misjudgments can be caused because of the bend's visual configuration, poor delineation or because it was unexpectedly sharp. Therefore for all bends below the desirable minimum standard, warning signs should be provided to give the driver an idea of the severity of the bend. This should ideally follow a standard whereby the most dangerous bends have the highest level of signing and marking.

Hazardous bend signs placed in front of the bend inform the driver of how the forward road alignment changes. Edging the signs with fluorescent strips will improve conspicuity. Advisory information can be written on the road or placed on speed limit signs. The information should inform the driver of how severe the hazard is and provide readily understandable advice on how to navigate the hazard safely.

Overtaking and Head-on Collisions
Another major problem occurs when drivers sometimes ignore the no-overtaking enforcement. Where head-on accidents are a problem, double white lines should be enhanced. Since line markings are widely ignored in Georgia, more physical deterrents to crossing the centre line are required. A variety of traffic engineering devices have been developed that could be used in similar circumstances, from rumple strips (profiled line marking) to heavy duty road studs.

Accidents at Entry and Exit of Villages and Municipalities
The differential between the speed limits inside and outside a village can be large. If drivers have been travelling along rural roads subject to the national speed limit for an appreciable distance, they may not recognize the need for greater care and lower speeds. They may be unaware of a lower speed limit or of their own speed and may respond late to the lower limit. In particular they may be unaware of the increased risk of an accident, especially with a vulnerable road user. Speeds observed through villages are often high compared to what is appropriate for the conditions.

Although village name signs together with speed limit signs have been conventionally used to mark the entry to a village these are largely ignored by the drivers. Other features within the village, respectively at the entrances, should be considered, if appropriate, to urge the driver to keep an appropriate speed. These may include reductions in road width, traffic islands and mini-roundabouts.

Rehabilitation and Enforcement
Unfortunately it is likely that accidents will increase as a result of the road rehabilitation improvements as it will be much easier for drivers to travel at greater speeds. From the engineering point only limited possibilities exist to oppose this tendency to higher speeds, and Police action to enforce speed limits is probably the only effective way to limit accidents.

5. GENERAL SAFETY FEATURES TO BE CONSIDERED IN THE DESIGN

However, following work items should be considered, where appropriate, in the detailed design phase of the project to enhance traffic safety:

- Install and replace delineation

- Install rumble strips
- Install crash barriers
- Replace deficient signing, as needed, using current standards
- Separate traffic modes, i.e. provision of sidewalks
- Install traffic islands and pedestrian refuges
- Restore sight distance at public road junctions and the inside of curves through low cost measures if they are available such as removal or relocation of signs and other obstructions, and cutting back of vegetation

Safety and Miscellaneous Design Items
In addition to the requirements on the road geometry, junction design, road furniture and markings, International Design Manuals include recommendations for safety and miscellaneous design items, which are considered in the design review of the project as follows:

- Safety Rest Areas and Scenic Overlook
- Bus Lay-Byes and Parking Bays/Lanes
- Public Utilities
- Safety Barriers
- Emergency Escape Ramps

Road Furniture and Markings
Adequate road furniture and markings in conformity with international standards and/or improved project standards are included in the design to provide for the road users suitable:

- Signalization
- Orientation
- Safety.

Road Markings and Marker Posts
For appropriate guidance during the day and especially at night or during adverse weather conditions (e.g. rain, fog) road markings are considered in the design.

6. GENERAL NOTES ON ROAD AND TRAFFIC SAFETY

Recent studies showed that the road/traffic safety situation all over South-East Europe and the Moldova Area is among of the worst in the world. A general problem is the poor driving skills (e.g. speeding, cutting curves, risky overtaking) associated with lack of discipline (e.g. neglecting traffic regulations) as well as inadequate technical condition of the vehicles (e.g. non functioning brakes).

The improved alignment together with the new pavement and the much higher design speed of the upgraded M3 Road will provide a smooth road which may lead to the tendency of drivers using a too high speed. Unfortunately it is very likely that higher driving speed entail an increasing number of accidents due the above-mentioned general problem in the area:

In order to avoid and control potential problems in the operation of the upgraded road maximum attention has been paid to an adequate road and traffic safety. Road and traffic safety is based on the three ‘E’ which can be described as:

Engineering (e.g. standards for road/highway design and traffic engineering, control of quality in implementation, supervision of works for and maintenance of a good/safe road condition)

Education (e.g. education of pedestrians and motorists, training, public promotion)

Enforcement (e.g. laws and regulations, police, justice)

and is a complex process where dynamic, visual, geometrical, drainage and psychological requirements need to be optimized.

Engineering Design Component for Road and Traffic Safety
The main items of traffic safety which will be considered in the present engineering road/highway design can be summarized as follows.

Road Geometry
The requirements of the geometric design standard on road cross section (width of carriageway + shoulders), the horizontal & vertical alignment and the junctions will be described in detail as well as the route selection for the determined improvement alignment and the resulting engineering design for the upgrading of the M3 Road.

Road Furniture and Road Markings
Road furniture and road markings will be included in the designs and bidding documents respectively to provide for the road users suitable:

- Signalization
- Orientation
- Safety

Traffic Signs
For signalization danger warning and regulatory signs (e.g. speed limit, curve warning, give way) will be considered as well as standard 1.6m x 1.5m destination sign according to international practice. In order to provide an optimum signalization and orientation during darkness all road signs will be specified to be retro-reflective.

Road Markings
For appropriate guidance during the day and especially at night or during adverse weather conditions (e.g. rain, fog) road markings with surface reflectorisation and road studs should be used.

For the centerline and other markings, which are often crossed by vehicles (e.g. at lay-bys or junctions), thermoplastic material should be specified, which has a long service life and reduces maintenance requirements. All other markings, which are usually not crossed by vehicles, will be provided in ‘ordinary’ road marking paint due to economic reasons. All road markings will be specified with surface reflectorisation by the application of ballotini beads.

Kilometer and Guide Posts
The kilometer and guide posts should be upgraded. Therefore an improved type of guide post should be developed and used for the present Project.

Guard Rails

Galvanized steel guard rails will be considered at high embankments, at bridge approaches, etc. They will exclusively be installed with beveled/buried end sections, because these provide a higher safety than the ordinary end pieces.

Populated Areas

Speed Calming System (SCS)

As observed during the site inspection and as pointed out by town officials during our visit, a major concern is the high speed of vehicles entering or passing through sensitive areas. Consequently, an appropriate Speed Calming System (SCS) should be developed to increase the road safety.

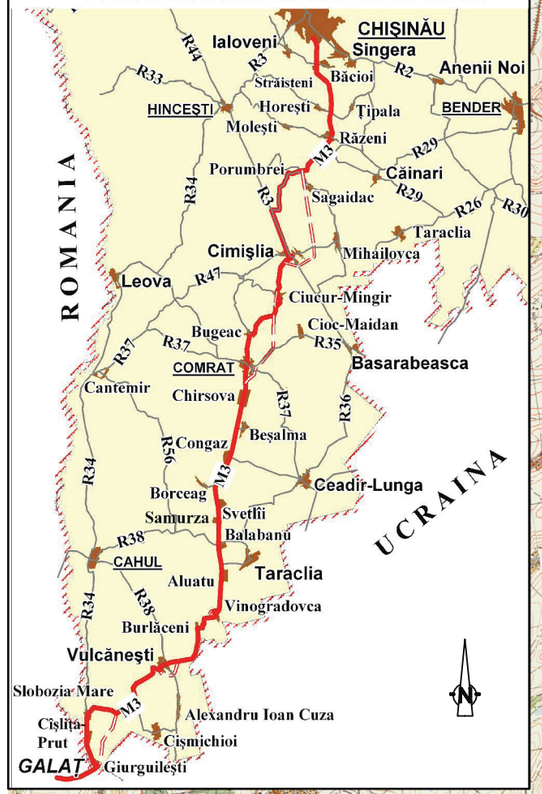
Pedestrian Walkways

Where the site conditions (space) allow, pedestrian walkways will be considered which are separated from the moving or stopping traffic (carriageway or parking bay/lanes) by a kerbstone for the best possible safety of pedestrians and their convenience as well.

Annex I

Insert figures 1:100000 accident locations

PROJECT AREA M3 KEY MAP



LEGEND

- Injury Accidents
- Fatal Accidents

Scale :100 000

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Location of Accidents

Coala Nr.A3/Sheet No 1

Join Line with Sheet No 1

Join Line with Sheet No 3

Segaidul Nou

Segaidac

Sarie

Porumbrei

Costangalia

Iurievca

Valea Perjei

Gratiesti

Bostavnovca

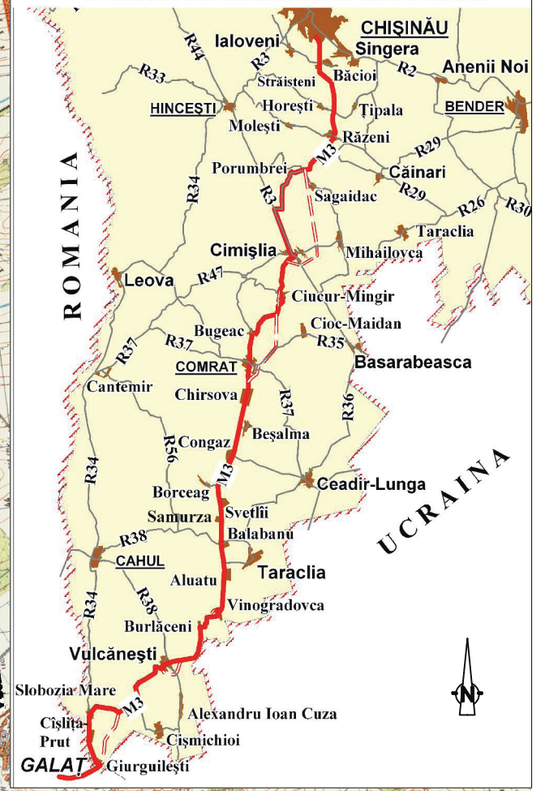
Cimislia

Bogdanovca Noua

Bogdanovca Veche

Ciucur Mingir

PROJECT AREA M3 KEY MAP



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- Fatal Accidents

Scale :100 000

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Location of Accidents

Coala Nr A3/Sheet No 2

PROJECT AREA M3 KEY MAP

Join Line with Sheet No 2

Join Line with Sheet No 4

BUGEAC

COMRAT

Chirsova

Congaz

Dezinges

LEGEND

- Injury Accidents
- Fatal Accidents

Scale :100 000

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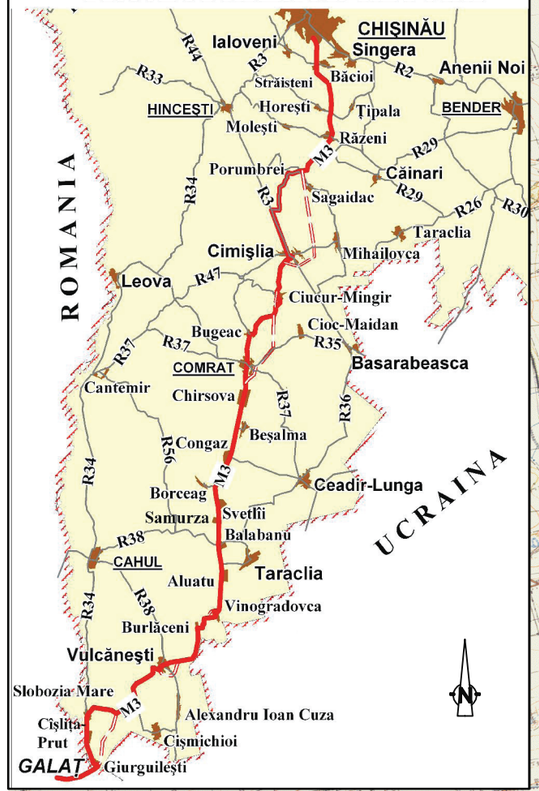
Location of Accidents

Coala Nr A3/Sheet No 3

PROJECT AREA M3 KEY MAP



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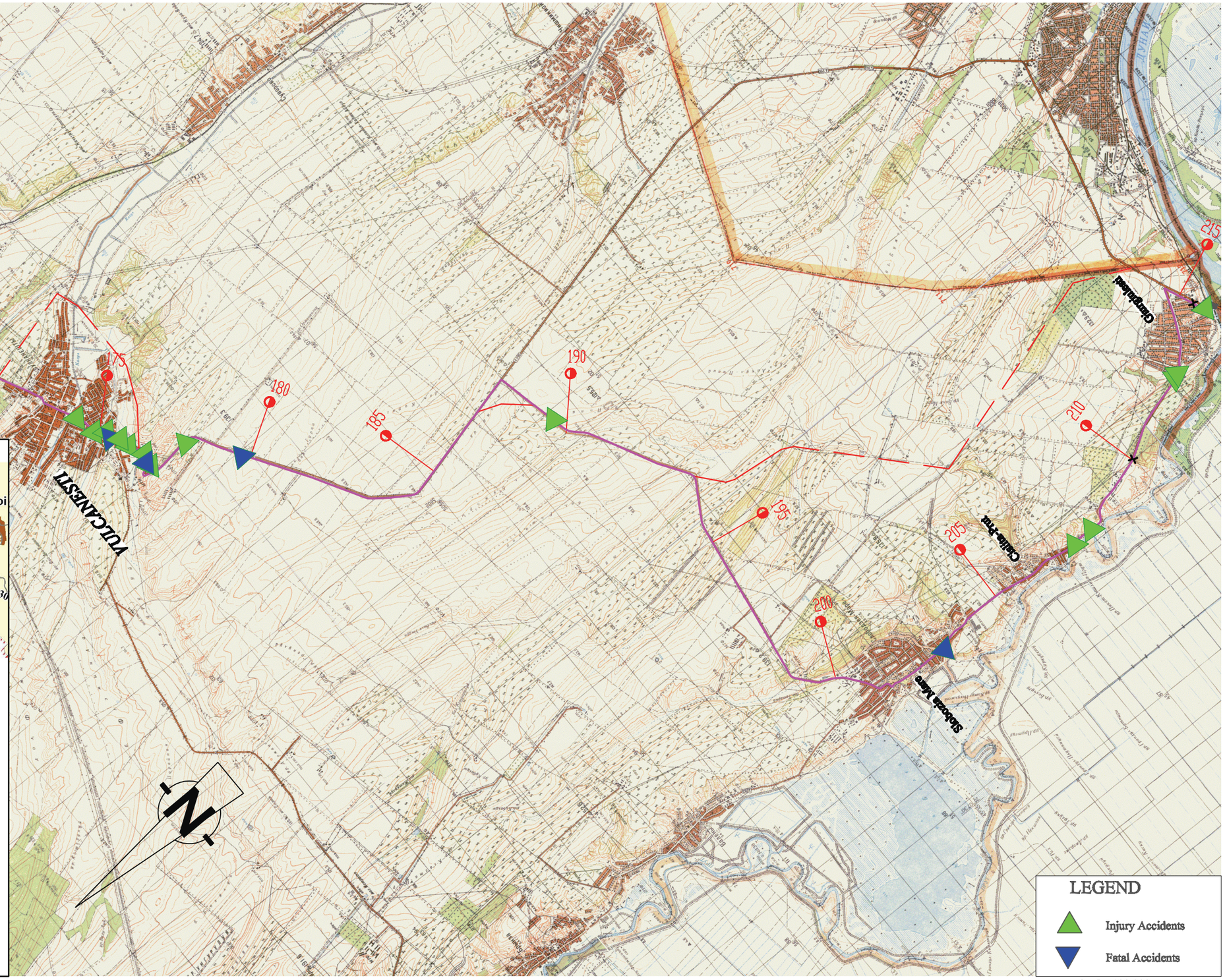
Location of Accidents

Coala Nr A3/Sheet No 4

Join Line with Sheet No 4



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Location of Accidents

Coala Nr A3/Sheet No 5