Construction of the M-14 road section from Balti to Criva

General information

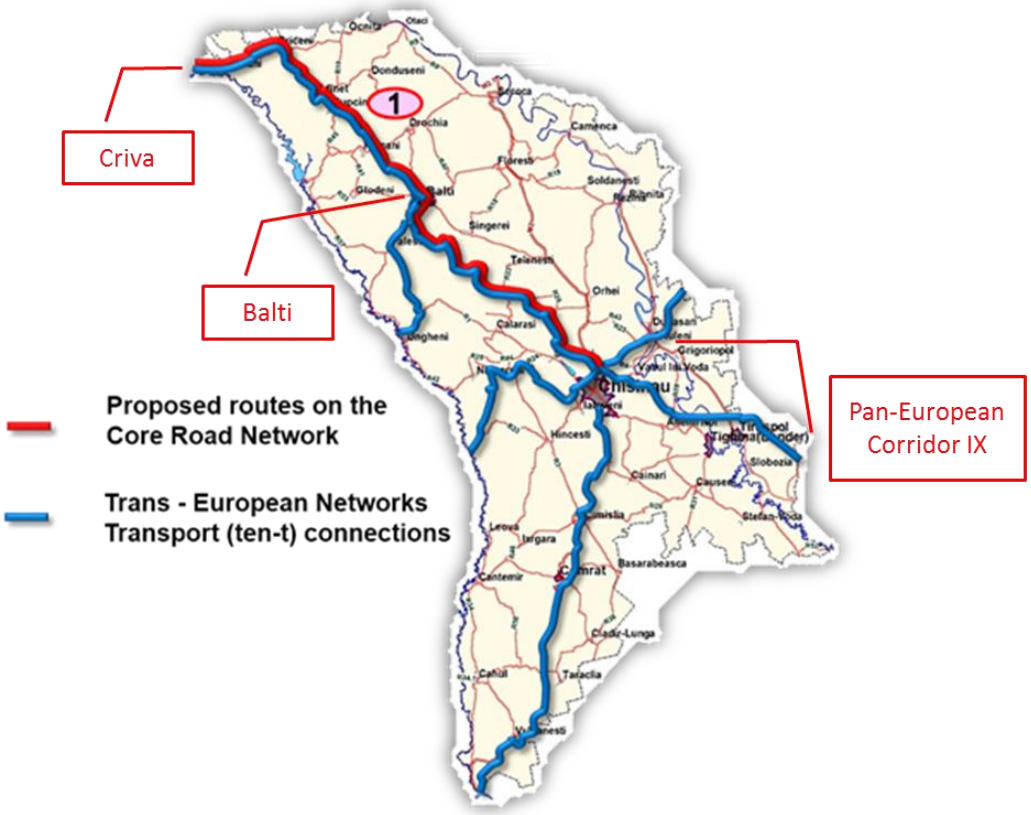
This project regards the rehabilitation of the **road M-14, from Balti to Criva** (i.e., 133 km). The road M-14 extends for 265 km from Criva to Chisinau[1] and is considered of major importance by the Government of Moldova and a backbone of the national road network.

Regarding **the relevance of the project**, the construction of the highway Balti-Criva is listed amongst the List of Priority Infrastructure Projects on the Eastern Partnership Regional Transport Network[2].

The M-14 crosses the country from the North-Western border with Ukraine's province of Chernivets'ka to South-Eastern border with Ukraine's province of Odes'ka[3] and passing through the capital city of Chisinau. In correspondence of Chisinau, the road M-14 intersects the Pan-European Corridor IX[4]. Figure 9-1 illustrates the localisation of the section from Balti to Criva. This section of the M-14 is classified as proposed Route 1 on the national core network.

The rehabilitation of the road M-14 would have a direct impact on the improvement of the road connection with Ukraine and contribute to the integration of Moldova into the transport system of the Eastern Europe.

Figure 9-1: Localisation of the section from Balti to Criva on the M-14



1 The second section of the M-14 extends from Balti to Chisinau (i.e., 132 km).
2 Endorsed at the meeting of EU and EaP Ministers on 9 October 2013.
3 And to the Black Sea ports.
4 Connecting Chisinau with Husi in Romania and to Ukraine.

Source: Ministry of Transport and Road Infrastructure of Moldova (2016)

The **technical conditions** of the road M-14 were recognised poor for its entire length (Nathan et al., 2009). Field reconnaissance allowed to attribute such deterioration to (i) poor technical design corresponding to the former Soviet standards, (ii) lack of quality control during the construction works, (iii) poor quality of material used for the construction and (iv) lack of maintenance.

The condition of road pavement is also in state of degradation. The carriageway surface defects are: structural, potholes, cracks (i.e., isolated, longitudinal and crossing), roughness, local depressions and sectors with patching. The road shoulders are frequently damaged by water, because the drainage system fails. Pedestrians are required to walk on the road, increasing the risk of accidents as in some settlements there are no sidewalks. A lack of road signs and horizontal markings results in unsafe conditions.

The preliminary feasibility study of the section from Balti to Criva, developed by Nathan et al. (2009), identified a number of **rehabilitation measures**. Since additional land allocation was deemed not necessary, this rehabilitation project can be considered a brownfield intervention.

According to consulted stakeholders, this project should be considered in continuation with in the modernization programme of the national road network of Moldova. The EBRD is reported working closely with the Government to prepare the needed studies, in view of co-financing interventions.

Regarding the second section from Balti to Chisinau[5], a feasibility study and project documentation needs to be developed.

The **promoter** of this project is the Ministry of Transport and Road Infrastructure and the project is in line with a number of policy documents:

- the Ministerial Conference held in Luxembourg on 9 October 2013[6];
- Strategy of Transport and Logistics for 2013-2022 and Moldova 2020 National Development Strategy;
- the National Plan of Association Agreement between the Republic of Moldova and the EU[7];
- the Action Plan for the implementation of the Romania-EU Association Agreement 2014-2016 (approved by Government Decision on 25 June 2014);
- the Progress Report on EU Moldova Association Agenda of March 2016 (see Annex 10);
- the European Neighbourhood policy.

Technical description

The road section from Balti to Criva mainly traverses the country side and crosses settlements in the districts of Briceni, Edinet, and Rascani. The major part of the M-14 was built as a three-lane with width variable in the interval 7,5-12,7 meters[8] (see Figure 9-2). Embankment generally is of 18,74 meters.

5 This section is concrete paved with 2-3 lanes.

6 The partner countries agreed on priority connections in the EaP region and the M-14 was proposed as a part of TEN-T connection network.

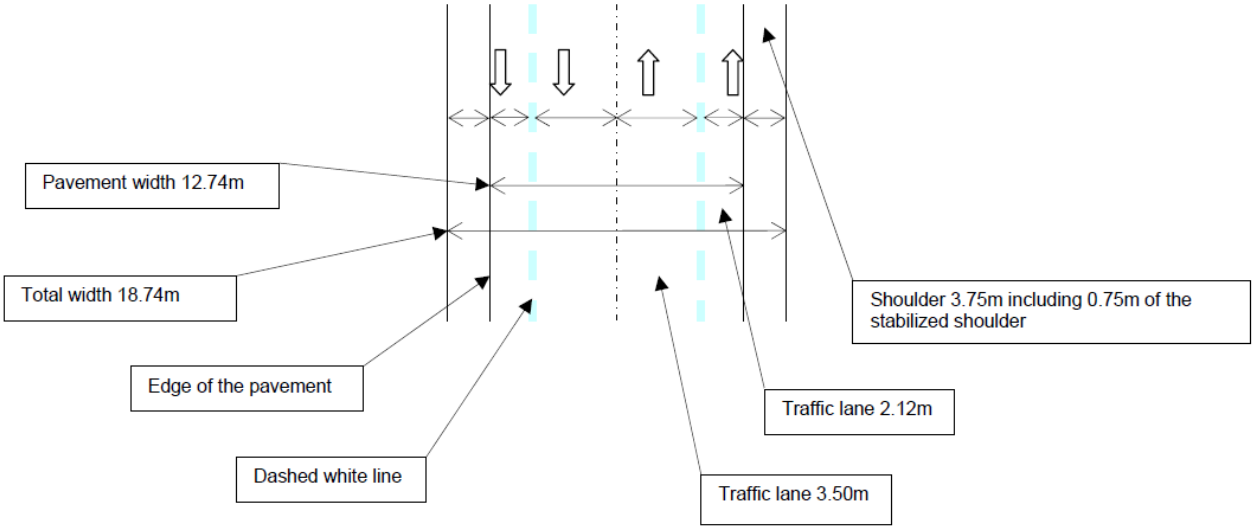
7 The government will continue implementing the existing contracts for the rehabilitation of the national roads, such as M3 Chisinau–Giurgiulesti–Romanian border, which makes connection of international port Giurgiulesti with Pan-European corridor IX and M14 road.

8 This is a dangerous configuration. Drivers typically use the wide lane and when the speediest car wants to pass, the slower car moves to the narrow lane.

The existing pavement consists of: (i) sub-base (i.e., sand), (ii) base course (i.e., crushed stones) and (iii) wearing course (i.e., asphalt concrete).

The road crosses the Prut and Nistru rivers and does not intersect high hills and deep valleys. There are active landslides. Pluvial water overflows the carriageway along sections and pavement silting and degradation occurs. Design standards are those of former Soviet roads.

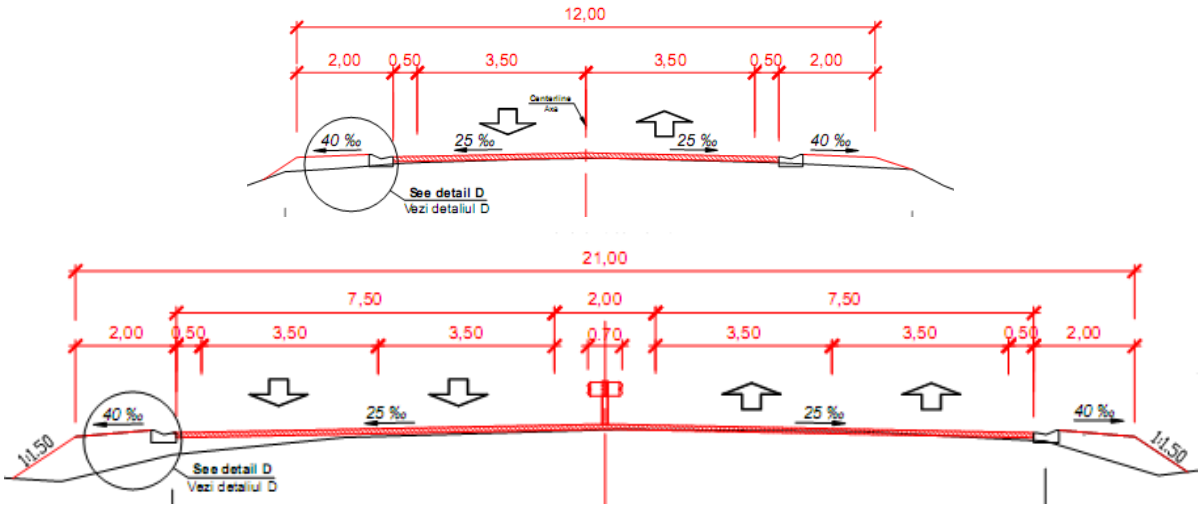
Figure 9-2: Existing transversal section of the M-14



Source: Nathan et al. (2009)

The project proposes to alter the existing road transversal section by reducing it to a **two-lane carriageway or widening to a four-lane carriageway** with strengthened shoulders (see Figure 9-3)[9].

Figure 9-3: Typical cross-section



Source: Ministry of Transport and Road Infrastructure of Moldova (2016)

The alignment of the road was maintained unchanged to avoid significant additional costs, land acquisition and resettlement.

[9] According to the consulted stakeholder, the section Balti–Edinet has been designed with four lanes of 3,5 m each, but this will be reviewed in the Technical-Economic Council of the Ministry to 3,75 m each lane.

The project identified the following **improvements** to address dangerous conditions:

- modification of pavement surface (i.e., new construction 9%, milling and pavement foundation strengthening 38% and surface levelling and overlay 53%);
- correction of longitudinal profiles due to visibility problems and introduction of deceleration lanes;
- redesign of narrow bridges creating lateral obstacles;
- deployment of water drainage channels, shoulder drainage channels and ditches of suitable slope;
- works on deformed embankments and shoulder consolidation to be performed after pavement construction (i.e., compacted layer of 1,5 m wide crushed limestone)[10];
- modification of horizontal radius of access roads and existing intersections. Additional improvements include: traffic signs, bollards and markings reparation of bus stops (rest platforms and parking places). Existing roundabouts and two-level interchange should be rearranged and new roundabouts constructed.

According to information obtained from the Ministry of Transport and Road Infrastructure, the most recent **estimation of the costs** to develop rehabilitation works is summarised in Table 9-1 (cost breakdown by relevant category is not available). Figure 9-4 shows the localisation of the sub-sections.

Table 9-1: Estimated cost and characteristics of the sections of the M-14

Sub-section	Length [km]	Costs [€ million]	Number of lanes
Criva-Briceni	38,1	31,9	2
Briceni-Edinet	27,0	23,5	2
Edinet-Riscani	39,0	42,4	4
Riscani-Balti	29,2	35,8	4
Total	**133,3**	**133,6**	

Source: Elaboration from presentation of Ministry of Transport and Road Infrastructure of Moldova (2015)

Figure 9-4: Sub-sections of the road section from Balti to Criva

Source: Ministry of Transport and Road Infrastructure of Moldova (2016)

[10] According to field observations and road conditions works have been identified in the following sections: (i) 664km-671km between Edinet and Cupcini, due to rather complicated geotechnical conditions, (ii) 648km-649km where the embankment was built in a soaked region close to the river stream and high groundwater level, (iii) 628 km within a district of Briceni where is a large scale landslide near the town of Briceni (triggered after heavy rains and excessive precipitation in 1996) and (iv) 623km the embankment is deformed and counterweight beams were deemed suitable to halt the deformation processes.

Project implementation

The following Table 9-2 shows the **level of maturity achieved**, according to the project identification form made available from concerned stakeholder (Ministry of transport and Road Infrastructure, 2016).

Table 9-2: Status of project implementation

Available studies and documents	Ready and approved	Being worked on	Not started yet
Pre-feasibility study	X		
Conceptual design	X		
Feasibility study and CBA	X		
EIA study (if needed)			X
Valid spatial planning documents	X		
Land property resolved	X		
Preliminary design	X		
Main design/detailed design		X	
Tender documentation			X
Construction and other permits		X	
Construction contract signed			X

Source: Elaboration from Ministry of transport and Road Infrastructure of Moldova (2016)

A more detailed information on the project implementation is not available.

Transport demand

Two sources of information have been screened to report on transport demand analysis of the road section from Balti to Criva, namely (i) the preliminary feasibility study of Moldova roads rehabilitation programme of Nathan et al. (2009) and the Transport and Logistic Strategy of Moldova developed by Kocks et al. (2012)[11].

The annual traffic volumes elaborated in Nathan et al. (2009) were estimated starting from daily traffic counts at different locations along the section under study. The **largest volumes** were identified in the sectors close to the cities of **Balti and Edinet** and the lowest in the sections between Briceni and Criva (i.e., close to border with Ukraine).

In the section immediately North of Balti, cars were reported as being 50% of the vehicles and trucks 21%. In the rest of the road, the share of cars increased to 65%-70%, while trucks reduced significantly in the interval 6%-11%. Public transport (i.e., minibuses) was reported as displaying a relatively large share (i.e., from 23% South of Edinet, to 30% north of Balti)[12].

The forecasts were elaborated for **three scenarios of growth of the national GDP**, over the period 2010-2031[13] (see Table 9-3). Elasticities of freights and passengers transport demand to GDP were obtained relying on Land Transport Infrastructure Strategy 2008-2017 of Moldova (2007). Elasticities were assumed equal to 1,65 for passenger cars and 1,61 for freight vehicles, respectively and over the period 2009-2019. After 2020, the values of the elasticity were reduced to 1,40 for passenger cars and to 1,20 for freight vehicles to 2030.

[11] Both studies have been developed for the Government of Moldova.

[12] This study analysed the traffic volumes only on this section of the M-14. The study does not provide with demand volumes at country level.

[13] GDP estimation were inferred analysing data of 2008 of the International Monetary Fund, the EBRD, the United Nations and JP Morgan. The median growth scenario was considered as the most likely case.

Table 9-3: GDP and traffic (passengers and freight) growth forecasts [% annual] (Nathan et al., 2009)

GDP growth scenario	Low	Median	High
2010-2011	2,0	3,0	4,5
2012-2019	2,5	4,0	5,0
2020-2031	2,0	3,0	4,0
Passengers traffic			
2010-2011	3,3	5,0	7,4
2012-2019	4,1	6,6	8,3
2020-2031	2,8	4,2	5,6
Freight traffic			
2010-2011	2,4	3,6	5,4
2012-2019	3,0	4,8	6,0
2020-2031	2,4	3,6	4,8

Source: Nathan et al. (2009)

Table 9-4 illustrates on traffic forecasts in **a median growth scenario** and by sections of the M-14. On average, the road traffic was expected to grow by 7,0% per year in the interval 2009-2015 and 6,6% per year in the interval 2015-2025, respectively.

Table 9-4: Traffic forecasts in median growth scenario by sections of the M-14 [total number of vehicles/day]

Section	Length [km]	2009	2015	2025
Criva-Briceni	38,1	2.049	2.900	4.800
Briceni-Edinet	27,0	4.869	6.900	11.450
Edinet-Riscani	39,0	5.203	7.400	12.250
Riscani-Balti	29,2	4.518	6.400	10.650

Source: Nathan et al. (2009)

The traffic forecasts of Kocks et al. (2012) are more comprehensive relying on a **modelling exercise** developed upon updated values of socio-economic drivers and covering all the road network[14]. The GDP forecasts again assumed three scenarios of growth and are summarised in Table 9-5. Demand elasticity for passenger cars has been assumed equal to 1,2 until 2022 and 1,1 afterwards. Regarding freight vehicles elasticity, it has been assumed equal to 1,1 unit 2022 and 1,0 afterwards.

Table 9-5: GDP and traffic (passengers and freight) growth forecasts [% annual] (Kocks et al., 2012)

GDP growth scenario	Low	Median	High
2011-2016	3,6	4,6	5,6
2016-2020	3,7	4,7	5,7
2020-2025	2,8	3,8	4,8
2025-2033	2,5	3,0	3,5
Passengers traffic			
2011-2016	5,5	4,4	6,6
2016-2020	5,7	4,5	6,8
2020-2025	4,2	3,4	5,1
2025-2033	3,3	2,6	4,0
Freight traffic			
2011-2016	5,1	4,0	6,1
2016-2020	5,2	4,2	6,2
2020-2025	3,8	3,1	4,6

[14] Automatic traffic counts have been carried out for the years from 2009 to 2011. Regarding the M14, automatic counts refer to the section Riscani-Balti. Some manual traffic counts are reported for 2011 on specific points.

2025-2033	3,0	2,4	3,6

Source: Kocks et al. (2012)

Table 9-6 summarises on traffic forecasts by sections of the M-14. On average, the road traffic was expected to grow by 7,0% per year in the interval 2012-2022 and 3,8% per year in the interval 2022-2032, respectively.

Table 9-6: Traffic forecasts by section of the M-14 [total number of vehicles/day]

Section	Length [km]	2012	2022	2032
Criva-Briceni	38,1	1.400	2.350	3.267
Briceni-Edinet	27,0	3.067	5.150	7.167
Edinet-Riscani	39,0	3.500	6.100	8.400
Riscani-Balti	29,2	5.200	8.850	12.100

Source: Elaboration from Kocks et al. (2012)

Comparing the two sources of information above, Kocks at al. (2012) appears as being more conservative. While assumptions on GDP growth are relatively similar, the values of elasticity of transport demand and growth rates over the long-term period are lower (i.e., 3,8% against 6,6%).

In general, road traffic volumes of Moldova both observed and forecasted are low in absolute values. The section from Balti to Criva shows a relatively high volume compared to the country level. In this respect, it is worth remarking that the city of **Balti displays a high rate of attraction**. Balti is the second urban area in Moldova in terms of value of the industrial activity and average monthly income, after Chisinau[15]. Another observation from the modelling exercise is that the major origin-destination pair in Moldova is the exchange between the capital Chisinau and Balti along the M-14.

Financial analysis

The roads of Moldova are not tolled. For this reason, a financial profitability analysis was not carried out.

Regarding financing sources, (i) the EU support is not envisaged, (ii) according to concerned stakeholders, the EBRD is reported working with the Government to prepare the needed studies and (iii) the Ministry of Finance of Moldova has been consulted by the Ministry of Transport. Information on the spending schedule for the M-14 from Chisinau to Criva (i.e., 265 km) is presented in Table 9-7 (Ministry of Transport and Infrastructure, 2016).

Table 9-7: Spending schedule of M-14 from Balti to Criva

Item	2016	2017	2018	2019	2020	2021
Project preparation	0,5	0,5	-	-	-	-
Investment	-	-	64,75	64,75	64,75	64,75

Source: Elaboration from Ministry of transport and Road Infrastructure (2016)

Economic analysis

The economic analysis has been developed in Nathan et al. (2009), elaborating through the Highway Development and Management model (i.e., HDM-4). Inputs for the application of the HDM-4 model included:

- traffic volumes per vehicle type in the median economic growth scenario;

[15] According to Kocks et al. (2012), in 2009 the industrial activity of Balti counted for a 12%, while Chisinau 57%. The average monthly income was reported approximately equal to €190, while in Chisinau € 225.

- vehicle operating costs: elaborating on traffic counts representative vehicle models were identified to estimate the unit operating costs (i.e., capital, fuel, lubricants, tyres and driver for trucks). Economic values were obtained by converting financial inputs;
- value of travel time savings: the mean value was assumed equal to € 1,60 per hour[16] and then adjusted by a shadow price factor of 0,80 to become € 1,30 per hour for working time and € 0,48 for non-working time[17];
- investment costs: estimations were developed including all required items (i.e., materials, personnel, equipment, transport, mobilisation and demobilisation)[18].

  Allowances were also included for geotechnical remediation works, environmental mitigation and contingencies. The costs for supervisory engineering, field engineering, and quality assurance/quality control were estimated to be 8% of the total construction cost. The financial capital costs for the project were converted to economic values by using a factor equal to 0,80. Table 9-8 summarises on the estimated investment cost inputs.

Table 9-8: Estimated investment costs of M-14

Section	Length [km]	Cost category			
		Financial (US Dollar 2009)	Financial (€ 2009)	Economic (€ 2009)	per km (€ 2009)
Criva-Briceni	38,1	42.578.284	30.413.060	24.330.431	638.594
Briceni-Edinet	27,0	21.662.982	15.473.559	12.378.852	458.476
Edinet-Cupcini	13,0	13.901.784	9.929.846	7.943.871	611.067
Cupcini-Riscani	26,0	25.793.307	18.423.791	14.739.036	566.886
Riscani-Balti	29,2	33.466.400	23.904.571	19.123.664	654.920
Total	**133,3**	**137.402.757**	**98.144.826**	**78.515.854**	**589.016**

Source: Elaboration from Nathan et al. (2009)

- routine and periodic maintenance costs. The financial maintenance costs were converted to economic values by using a factor equal to 0,80. Table 9-9 summarises on the estimated maintenance cost inputs.

Table 9-9: Estimated maintenance costs of M-14

Item	Unit of measurement	Value
Overlay 40 mm asphalt concrete	€/m^2	10
Edge repairs (with overlay)	€/m^2	20
Patching improved (with project)	€/m^2	40
Patching basic (without project)	€/m^2	30
Crack sealing	€/m^2	10
Regular miscellaneous maintenance	€/km	1.000

Source: Elaboration from Nathan et al. (2009)

The **ENPV** of the project was estimated equal to **€ 9,56 million** and the **EIRR** equal to **14,0%**[19].

[16] According to data of the Central Bank of Moldova on average wage Levels per month in 2009.
[17] Values of travel time savings were adjusted over time to reflect variation of GDP per capita and wage increase.
[18] The estimates were developed in Moldovan Lei, then converted to US Dollar of 2009.
[19] The analysis assumed that the works of section from Briceni to Criva would have started in 2011 and 2012. An exchange rate of 1 € equal to 1,40 US Dollar were assumed to convert, where necessary.

The economic analysis does not include welfare changes for safety and environmental conditions improvement. However, given the objective of this project, benefits could be envisaged in terms of (i) improved safety levels and (ii) reduction of vehicles emissions.

Assumptions on the residual value are not mentioned. The sensitivity and risk analyses are not reported in this preliminary feasibility study.

Eventually, it is worth considering that an updated economic analysis has not been carried out developing the appraisal on the demand volumes estimated in Kocks (2012). Comparing traffic forecasts of Nathan et al. (2009) with the demand volumes of Kocks et al. (2012), one can observe that the recent forecasts are more conservative. Table 9-10 summarises on the data available.

Table 9-10: Traffic forecasts by sections of the M-14 [total number of vehicles/day]

Section	Preliminary feasibility study (2009)			Transport and Logistics Strategy (2012)		
	2009	2015	2025	2012	2022	2032
Criva-Briceni	2.049	2.900	4.800	1.400	2.350	3.267
Briceni-Edinet	4.869	6.900	11.450	3.067	5.150	7.167
Edinet-Riscani	5.203	7.400	12.250	3.500	6.100	8.400
Riscani-Balti	4.518	6.400	10.650	5.200	8.850	12.100

Source: Nathan et al. (2009) and Kocks et al. (2012)

Environmental analysis

According to the available information, the EIA has not been carried out yet. Preliminary field reconnaissance activities addressed the impact on the environment (Nathan et al., 2009) and concluded that the alignment of the M14 corridor is not adjacent to any identified protected areas. The performance of works was not expected to have significant negative impact. Also, the impact of the road traffic would be low, because of the limited demand volume.

The most significant conclusions from the preliminary reconnaissance conducted regarded:

- **fisheries and aquatic ecology**: all streams, rivers, and wetlands of Moldova are negatively affected by sedimentation and chemical runoff associated with the agriculture activities. Temporary negative environmental impacts to the fisheries or aquatic resources were expected, but short-term and reversible;
- **wetlands**: 10 potential wetland areas were observed along the M14. Mitigation measures to limit the negative impact would include delineation of wetland boundaries;
- **forests**: approximately 1,97 km of forest is exposed to works. No negative environmental impact to forests or protection strips were anticipated;
- **rare and endangered species**: no threatened and endangered species of birds, amphibians, or reptiles were identified;
- **animal migration**: portions of the M14 road cross three avian migratory zones, located: (i) between Balti and Recea, (ii) in Cupcini and (iii) between Hlina and Criva. Rehabilitation works would not affect feeding or nesting habitats;
- **soil erosion and siltation**: impacts need to be controlled through the application of design measures and during construction;
- **local flooding**: 27 culverts and 2 bridges were identified either undersized for the original design or not providing adequate flow volume for high flood water due to structural damage or being clogged with debris;
- **stream channel regime changes**: the Balti-Criva section crosses 29 water courses. Local input from public consultation were necessary to ensure that risks could be minimized;

- **landslides**: the M14 crosses a zone of landslides around Balti. Road construction activities could be a trigger and require mitigation measures;
- **air pollution**: during the construction, impacts will be temporary and of short duration and mitigated through specifications. Estimations of emissions during operation were not carried out during field reconnaissance;
- **noise**: impacts were considered significant because of the nearness of the surrounding buildings. Mitigation included enforcing slower speeds in populated areas. Specific estimations on emissions during operation were not carried out during field reconnaissance.

Safety levels

As anticipated, the technical conditions of road M14 were reported poor for its entire length. The road condition has significantly deteriorated for a number of reasons through time. This situation has been recognised as being negatively affecting road safety levels. Pedestrians walk on the road, increasing the risk of accidents, and a lack of road signs and horizontal markings also results in a generally unsafe traffic condition.

Specific accident data of the road M14 road was collected from national Police authorities. However, it is not possible to clearly identify black spots from the database because the accidents were only registered proportionally along the roads. Table 9-11 presents a summary of the causes of the registered accidents in 2008.

Table 9-11: Causes of registered accidents on M-14 in 2008

Reason	Accidents	Fatalities	Casualties
Advanced fatigue, falling asleep while driving	3	0	6
Driving under the influence of alcohol, falling asleep while driving	2	1	3
Excessive speed	24	9	27
Failure to take precaution when chancing lane/direction, U-turn	1	0	1
Inadequate speed considering visual range, road condition, traffic	3	2	1
Not giving right of way to other vehicles	4	0	4
Not giving right of way to pedestrians	5	0	5
Other caused generated by road traffic	1	1	0
Other traffic violations committed by drivers	1	0	1
Pedestrian crossing in unassigned places	2	1	1
Reckless driving	1	3	3
Technical malfunctions of automotive lighting-signalling system	1	0	1
Unauthorised overtaking	1	3	0
Unsatisfactory road conditions	5	1	5
Total	**54**	**21**	**58**

Source: Elaboration from Nathan et al. (2009)

Eventually, the layout of junctions and intersections should be addressed with attention. Geometrical standards correspond to those used in Western countries 40 or more years ago. Basically, an intersection consists of a few thousand square meters of bitumen without adequate signage, drainage, traffic islands or striping.