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Technical Assistance for the Elaboration, Quantification and Monitoring of Indicators for Sectoral Operational Program ”Transport” 2007-2013

Report on Activity 1

Setting the Baseline, Targets and Intermediate Values for SOPT Evaluation and Monitoring Indicators

Final Report
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NEA TRANSPORT RESEARCH AND TRAINING – PROGTRANS AG – AV TRANSPORT PLANNING SRL

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1. Introduction

In the Report on Activity 1 "Establishing the baseline values, targets and where appropriate, intermediate values for SOPT monitoring and evaluation indicators" the indicators for the base year, target year and if possible for intermediate years are established.

The methodology considered for establishing the values of indicators has been presented in detail in the revised version of the Inception Report. In this report the following are presented:

- The final list of indicators to be introduced in SMIS;
- The methodology for setting or estimating the values of indicators, as appropriate for each indicator.

2. The final list of SOPT indicators in SMIS

The final list of indicators to be included in SMIS was established based on the analysis of SOPT system of indicators, of their relevance and of the way in which they can be established and estimated in the current situation – issues that were presented in detail in the Inception Report and discussed with the Final Beneficiary during the working meetings.

The way in which each indicator was estimated is presented in detail in Chapter 3.

For railway projects the specific indicators of TEN-STAC report are presented in Annex 1. The indicators related to inland waterway projects are presented in Annex 2.

As specified in the methodology described in detail in the Inception Report, in TEN-STAC project all the projects on TEN-T corridors were analysed and 32 specific indicators were estimated for each project.

Some of the TEN-STAC indicators related to rail transport and inland waterways were considered in estimating the indicators for SOPT.

LIST OF INDICATORS – TO BE INTRODUCED IN SMIS

No.	SMIS Code	Indicator	UM	SMIS Code	Action category	Base line value	Base year	Cumulative indicative targets								
								2007	2008	2009	2010	2011	2012	2013	2014	2015
1	500	Length of new roads constructed	km	500	Motorways	0	2006						34.450	34.450	66.70	372.945
2	501	Length of new TEN-T roads constructed	km	500	Motorways	0	2006						34.450	34.450	66.70	372.945
3	502	Length of national roads rehabilitated	km	501	National roads	0	2006						164.052	164.052	291.149	302.796
4	503	Length of TEN-T national roads rehabilitated	km	501	National roads	0	2006						164.052	164.052	291.149	302.796
5	516	Length of new roads constructed	km	500	Motorways	0	2006									13.632
				501	National roads	0	2006							40.715	51.175	100.535
6	508	Length of TEN-T railway rehabilitated/ modernised	km	503	Railways	0	2006									209.185
7	512	Km of TEN-T navigable waters open for navigation (minimum depth 2.5 m)	km	504	Inland waterways	0	2006									200
8	523	New/modernised inter-modal terminals (number)	No.	507	Intermodal transport infrastructure	0	2006									1-2
9	504	Railway level crossings (number)	No.	503	Railways	0	2006								112	112
10	509	Ports rehabilitated	No.	504	Inland waterways	0	2006									1-2
11	510	Railway stations rehabilitated/ upgraded (number)	No.	503	Railways	0	2006						3	12	12	18

No.	SMIS Code	Indicator	UM	SMIS Code	Action category	Base line value	Base year	Cumulative indicative targets								
								2007	2008	2009	2010	2011	2012	2013	2014	2015
12	511	Railway bridges/tunnels rehabilitated (number)	No.	503	Railways	0	2006						4	17	17	98
13	514	Airports rehabilitated/ upgraded (number)	No.	506	Airports	0	2006									2
14	505	Km of linear villages protected	km	501	National roads	0	2006									36
15	520	Value of time savings for passengers and freight transported by rehabilitated railways	Mln. euro/ year	503	Railways	0	2006									86.925
16	521	Value of time savings for passengers and freight transported by new constructed and rehabilitated roads – road infrastructure	Mln. euro/ year	501	National roads	0	2006						67.85	83.02	266.20	810.48
17	518	Number of passengers shifted from road to rail	Mln. Passenger-km/year	503	Railways	0	2006									306.75
18	519	Volume of freight traffic shifted from road to rail (including inter-modal terminals)	Mln. tonne - km/year	503	Railways	0	2006									1,719
19	519	Volume of freight traffic shifted from road to inland	Mln. tonne	504	Inland waterways	0	2006									187.62

No.	SMIS Code	Indicator	UM	SMIS Code	Action category	Base line value	Base year	Cumulative indicative targets								
								2007	2008	2009	2010	2011	2012	2013	2014	2015
		waterways	-km/ year													
20	522	TEN-T projects realised - road infrastructure	%	508	Road infrastructure	0	2006									80%
21	522	TEN-T priority projects realised- Railways	%	503	Railways	0	2006									43.85%
22	513	Market share	%	503	Railways	15%	2006									15%
23	700	Environment protection projects	No.	509	Environment protection	0	2006									1
24	700	Studies, evaluations, institutional support	No.	700	Technical Assistance	0	2006					2	5	9	9	12
25	506	Reduction in serious accidents (serious accidents/ million passenger-km)	%	501	National roads	0	2003									-20%
26	507	Reduction in fatalities (fatalities/million passenger-km)	%	501	National roads	0	2003									-20%
27	705	Participant training days - MA	No.	700	Technical Assistance	0	2006					216	705	1,785	1,785	1,785
28	705	Participant training days - Beneficiaries	No.	700	Technical Assistance	0	2006					504	1,645	4,165	4,165	4,165
29	703	Committee meetings and relevant working groups (no.)	No.	700	Technical Assistance	0	2006	2	4	6	8	10	12	14	16	18
30	706	Total number of printed information materials or	No.	700	Technical Assistance	0	2006					7				15

No.	SMIS Code	Indicator	UM	SMIS Code	Action category	Base line value	Base year	Cumulative indicative targets								
								2007	2008	2009	2010	2011	2012	2013	2014	2015
		promotional items														
31	706	Number of communication and promotion events	No.	700	Technical Assistance	0	2006					12				16
32	706	Website hits	No.	700	Technical Assistance	0	2006					70,000				350,000
33	716	Level of awareness	%	700	Technical Assistance	0	2006				8%					15%
34		NOx emissions Total emissions	kt/year	500/ 501/ 502	Motorways/ National Roads/ Bypasses	5.763	2005									5.954
35		SO_2 emissions (kt) Total emissions	kt/year	500/ 501/ 502	Motorways/ National Roads/ Bypasses	0.014	2005									0.016
36		COV emissions (kt) Total emissions	kt/year	500/ 501/ 502	Motorways/ National Roads/ Bypasses	0.167	2005									0.200
37		Fine particulate emissions (kt) Total emissions	kt/year	500/ 501/ 502	Motorways/ National Roads/ Bypasses	0.209	2005									0.201

No.	SMIS Code	Indicator	UM	SMIS Code	Action category	Base line value	Base year	Cumulative indicative targets								
								2007	2008	2009	2010	2011	2012	2013	2014	2015
38		CO_2 equivalent emissions (kt) Total emissions	kt/year	500/ 501/ 502	Motorways/ National Roads/ Bypasses	568.465	2005									653.163
39		NOx emissions Evolution in the situation without project implementation	kt/year	503	Railways	-	2005									+0.190
40		Fine particulate emissions (kt) Evolution in the situation without project implementation	kt/year	503	Railways	-	2005									+0.016
41		Equivalent CO2 emissions (kt) Evolution in the situation without project implementation	kt/year	503	Railways	-	2005									-113.251
42		Total surface[1] occupied of protected areas [2]	ha	500	Motorways	0	2006									11.57
43		Total surface occupied of protected natural areas [2]	ha	503	Railways	0	2006									0.07

No.	SMIS Code	Indicator	UM	SMIS Code	Action category	Base line value	Base year	Cumulative indicative targets								
								2007	2008	2009	2010	2011	2012	2013	2014	2015
44		Number of protected areas[2] directly affected by SOPT projects	No.			0	2006									2

[1] The surface occupied by transport infrastructure in addition to the situation without project will be calculated.

[2] Categories of protected areas:

a) of national interest: scientific reserves, national parks, natural monuments, nature reserves, natural parks;
b) of international interest: natural sites of universal natural heritage, geoparks, wetlands of international importance, biosphere reserves;
c) sites of Community interest or "Natura 2000" sites of community importance, special areas of conservation, special protection areas for birds;
d) county or local interest: established only on public/private administrative-territorial units, as appropriate.

3. Establishing / estimation of SOPT indicators

The methodology for setting-up or estimating each indicator is presented below.

Indicators no. 1 and 2

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
1	500	Length of new constructed road	Km	500	Motorways
2	501	Length of new constructed TEN-T road	km	500	Motorways

As the new constructed roads are not located outside the TEN-T, the target and intermediate values for the two indicators mentioned above will be the same.

According to the methodology presented in the Inception Report the motorways sections considered are the following:

No	Motorway construction or bypass project		Intermediate and target values	
		2012	**2014**	**2015**
1	Construction of Nadlac-Arad motorway (design and execution)	0	0	38.000
2	Construction of Sibiu - Orăștie motorway (lot 1, lot 2, lot 3)	0	0	82.820
3	Construction of Lugoj-Deva motorway (3 lots)	0	0	99.000
4	Construction of Lugoj-Timisoara motorway	0	0	35.625
5	Construction of Arad-Timisoara motorway, including Arad bypass, as follows:			
	Construction of Arad-Timisoara motorway	0	32.250	32.250
	Construction of Arad bypass	12.250	12.250	12.250
6	Construction of Cernavoda-Constanta motorway	0	0	50.800
7	Construction of Constanta bypass	22.200	22.200	22.200
8	**TOTAL Km of new motorways completed - TEN-T**	**34.45**	**66.70**	**372.945**

**) Source: Financing applications*

The baseline value in year 2006 is "0" for both indicators and the target and intermediate values are taken from the table above.

The relatively high difference between the intermediate value for year 2014 and the target value for year 2015 is explained by the fact that most of the motorway construction projects are expected to be completed in year 2015.

Indicators no. 3 and 4

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
3	502	Length of national roads rehabilitated	km	501	National roads
4	503	Length of TEN-T national roads rehabilitated	km	501	National roads

The current national road rehabilitation program targets roads along the TEN-T corridors. Consequently, the value of the indicator 502/501 will be equal to the value of the indicator 503/501.

The table below shows the lengths of national road sections that will be rehabilitated and the completion deadlines.

National Road	**Section**	**Completion date**	**Length, km**
NR 1 H	Zalău - Aleșd	2012	69.334
NR 24 and NR 24B	GL/Vaslui Limit - Crasna / Crasna - Albita	2012	94.718
NR 6	Alexandria - Craiova	2014	127.097
NR 5	Bucharest– Adunații Copăceni (km 7+573 – km 19+220)	2015	11.647
Total			**302.796**

The baseline value for year 2006 is "0".

According to the above mentioned projects the final target is 302.796 km.

Indicator no. 5

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
5	516	Length of new roads constructed	km	500	Motorways
			km	501	National roads

The project portfolio for the construction of national roads includes construction of bypasses, as shown in the table below:

No.	Bypass	Deadline	The first year of operation	Length, km
1	Săcuieni Bypass	03/2013	2013	7.62
2	Carei Bypass	10/2013	2014	10.46
3	Alexandria Bypass	04/2013	2013	13.28
4	Caracal Bypass	04/2013	2013	10.350
5	Brașov Bypass – as motorway	2015	2015	13.632
6	Mihăileşti Bypass	10/2012	2013	3.18
7	Târgu Mureș Bypass	2015	2015	11.60
8	South Craiova Bypass	02/2013	2013	6.285
9	Tecuci Bypass	2015	2015	6.95
10	Bacău Bypass	2015	2015	30.81
Total				**114.167**

Thus, the target value for year 2015 is 114.167 km.
The intermediate value for year 2013 is 40.715 km.
The intermediate cumulative value for year 2014 is 51.175 km.

Indicator no. 6

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
6	508	Length of rehabilitated/ modernised railway TEN-T	km	503	Railways

Project portfolio for the rehabilitation/modernization of railways on TEN-T corridors includes the following projects:

- Rehabilitation of Border Curtici - Radna railway, length 41.185 km;

- Rehabilitation of Simeria – Coslariu railway, length 70 km;
- Rehabilitation of Coslariu – Sighisoara railway, length 98 km.

Thus, it is considered that the total length is 209.185 km for year 2015.

Indicator no. 7

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
7	512	Km of inland waterways open for navigation (minimum depth 2.5 m) - TEN-T	km	504	Waterways

Project location is in the Danube bed, in the sector between Calarasi (km 375) and Braila (km 175), therefore the indicator target for year 2015 is 200 km.

The baseline value for year 2006 is "0".

Indicator no. 8

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
8	523	New/modernised inter-modal terminals (number)	No.	507	Intermodal transport infrastructure

According to the programming documents and project portfolio the final target is 1-2 new or upgraded inter-modal terminals.

The baseline value for year 2006 is "0".

Indicator no. 9

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
9	504	Railway level crossings (number)	No.	503	Railways

According to the programming documents and Financing Application the final target is 112 railway level crossings. The completion of all the 112 railway level crossings is scheduled for year 2014.

The baseline value for year 2006 is "0".

Indicator no. 10

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
10	509	Ports rehabilitated	Nr.	504	Waterways

According to the programming documents and project portfolio the final target is 1-2.

The baseline value for year 2006 is "0".

Indicator no. 11

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
11	510	Railway stations rehabilitated/upgraded (number)	No.	503	Railways

According to the project portfolio the final target is 18 railway stations rehabilitated/ upgraded.

According to the FA – Financing applications and programming documents, the rehabilitation/ modernization of 9 railway stations will be completed in year 2013, and other 3 railway stations will be completed in year 2012.

The baseline value for year 2006 is "0".

Indicator no. 12

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
12	511	Railway bridges/tunnels rehabilitated (number)	No.	503	Railways

The information identified consists in the conclusions of the project.

"Technical Assistance for the preparation of the rehabilitation works for bridges, culverts and rail tunnels - LOT 1 - PHARE RO 2005-017 - 553.04.03.PHARE CES 2005 Project portfolio."

In a first stage 274 structures were identified and after reprioritisation 98 structures were selected, as shown in the table below.

SRCF	Bridges	Tunnels	Culverts	Total structures	EURO
BRASOV	1	3	2	6	10 266 000
BUCHAREST	7	0	0	7	17 991 200
CLUJ	6	2	9	17	25 162 250
CONSTANTA	4	0	2	6	47 644 450
CRAIOVA	8	0	7	15	21 396 550
GALATI	14	0	7	21	30 082 820
IASI	5	1	13	19	9 179 580
TIMISOARA	4	2	1	7	8 216 380
Total network	**49**	**8**	**41**	**98**	**169 939 230**

Thus, the target value of this indicator is considered 98. Based on the latest information from the portfolio of projects, 4 bridges/tunnels will be rehabilitated in year 2012 and 13 in year 2013. These intermediate values have been considered in SMIS list.

Indicator no. 13

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
13	514	Airports rehabilitated upgraded (number)	No.	506	Airports

According to the programming documents and project portfolio the final target is 2 rehabilitated/upgraded airports.

The baseline value for year 2006 is "0".

Indicator no. 14

No.	Cod SMIS	Indicator	UM	Cod SMIS	Action Category
14	505	Km of linear villages protected	km	501	National roads

According to the project portfolio the final target is 180 km of protected linear villages. Due to project delays it is estimated that 20% of the initial target could be achieved. Thus, the target value of the indicator for year 2015 is considered equal to 36 km of protected linear villages.

The baseline value for year 2006 is "0".

Indicator no. 15

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
15	520	Value of time savings for passengers and freight transport by rehabilitated railways	Mln. euro/year	503	Railways

As specified in the Inception Report, in order to estimate the time-saving benefits for all users of the rehabilitation projects and/or construction of new rail infrastructure, it is necessary to use a national transport model that must include the modal split module.

Therefore, considering the above mentioned and the fact that in Romania it is not available a national transport model that considers the distribution between transport modes, and also that the feasibility studies for railway rehabilitation projects are not completed, specific indicators of TEN-STAC project were considered, to which a correction factor of 0.75 was applied in order to estimate the target indicators for year 2015 (the time horizon of forecasts in TEN-STAC is the year 2020). This method was presented in the Inception Report and it was approved.

The specific indicators of TEN-STAC report are presented in Annex 1 for railway projects.

Thus we have:

Value of time saved for passenger transport by rehabilitated railways – TEN-STAC, in mln. euro/year	101.10
Value of time saved for freight transport by rehabilitated railways – TEN-STAC, in mln. euro/year	14.80
Total TEN-STAC, in mln./year	115.90
Value of time saved for passenger and freight transport by rehabilitated railways for year 2015, in mln. euro/year	115.90*0.75 = 86.925

The target value of the indicator for year 2015 is: 86.925 mln. Euro/year.

The baseline value for year 2006 is "0".

Indicator no. 16

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
16	521	Value of time savings for passengers and freight transported on the new constructed and rehabilitated roads – road infrastructure	Mln. Euro/year	501	National roads

The value of time savings for passengers and freight transport by new constructed and rehabilitated roads – road infrastructure was estimated in a first instance for the new motorway projects and bypasses in KAI 1.1.

The Final Beneficiary has been provided with the calculation model in Excel, which allows new the change, if necessary, of input data and the estimation of the indicators in a different context.

The model for estimating the value of time saved and reduction of traffic accidents

The road model calculates simultaneously the combined impacts of the implementation of all motorway projects implemented with the support of the Operational Programme:

- Traffic performance: movement of road vehicles, measured in vehicle-kilometres (vkm)
- Transport performance: movement of persons and goods, measured in passenger-kilometres (pkm) and tonne-kilometres (tkm)
- Transport time: passenger-hours (p-hr) and tonne-hours (t-hr)
- Transport time savings as the difference between the existing road and the new road; measured again in p-hr and t-hr
- Monetary value of transport time savings: measured in Euro
- Reduction of accident victims on the new motorway compared to the existing highway; measured in number of fatalities and number of seriously injured persons
- Monetary savings through reduced serious accidents: measured in Euro

This sequence of calculations enables to measure the main indicator of reduced travel time and its value; in addition to reduced accident impacts and the value of lives saved and serious injuries avoided.

The calculations cover the period 2005 to 2015 on an annual basis and an extension to the year 2020.

The starting point is the traffic volume in terms of vehicles using the present highway, broken down by vehicle type:

- Passenger cars, including vans and minibuses
- Buses
- Light trucks with two axles
- Medium trucks with 3 and 4 axles

- Heavy trucks with 5 axles and more (truck-trailer and tractor-semi-trailer combinations)

The traffic volumes are derived from the CESTRIN national traffic model calibrated for the year 2005. These traffic volumes provide a consistent data base that is preferable to the traffic counts from the various feasibility studies which relate to different base years.

Traffic forecasts are taken from the most recent ProgTrans World Transport Report 2010/2011 which is based on long-term time series of transport indicators in 40 countries including Romania. The forecasts take into account the slow-down of the world economy and of the national transport markets between 2008 and 2010 and the more modest growth expectations for the current decade. Growth indices with the base year 2007 have been established for passenger cars, buses and trucks (of all sizes combined).

The model allows for induced traffic on the motorway which is set to 10% with a buil-up phase of 3 years: 50 % in the first year, 80 % in the second year and 95 % in the third year.

In the absence of a national traffic model application for future years, the same growth indices are applied for all roads and the same traffic volumes are used for the existing highway and the future motorway. This is of course a shortcoming since in reality, a share of the traffic of the highway will remain there while the new motorway will attract traffic from other highways. On balance, the traffic attracted to the motorway may well exceed the original traffic volume on the highway, and the traffic situation on the national highways after the shift to the motorway is likely to improve. Insofar, the impact in terms of time savings calculated in this model is on the lower side and hence conservative. Once the national traffic model will be operational, the indicator estimation will certainly be more accurate.

The road model works with a number of parameters which have been estimated on the basis of various studies:

- <u>Occupancy rates and load factors</u>
  For passenger vehicles, assumptions of average number of passengers including car drivers have to be made, for freight vehicles the average load including empty trips.
  We have assumed the following average number of persons in a vehicle:
  - Passenger car 2.5
  - Van 2.0
  - Light bus 12.0
  - Heavy bus 25.0

  and for freight vehicles the following payloads in tonnes:

  - 2-axle truck 2.5
  - 3-4-axle truck 5.0
  - 5+-axle truck 10.0

- <u>Travel speed</u>
  The travel speed depends on the type of road and its conditions; the following values have been retained:

Road type	Condition	Speed (kmh)	
		Light vehicles	Heavy vehicles
National road	bad	50	40
	good	70	60
Expressway	good	90	70
Motorway	good	110	80

- <u>Value of time</u>
  The following average monetary values of time have been retained:
  - Car passenger 12.20 €/hour per person
  - Bus passenger 9.8 €/hour per person
  - Truck load 1.98 €/hour per freight tonne

- <u>Accident rates</u>
  Accident rates per 100 million vehicle-kilometres are estimated as shown in the table below:

Road type	Condition	fatalities	serious injuries
		per 100 million vkm	
National road	bad	7	14
	good	6	12
Expressway	good	4	10
Motorway	good	3	8

- The socio-economic value of a person killed in Romania is 350.000 Euro; the cost of a serious injury is 40.000 Euro.

The model is designed in a way to change the values of the above parameters if more reliable estimates are available.

Next the detailed calculation is presented, for project no. 1 considered, namely Nădlac – Arad Motorway. The indicator was estimated in the same way for all projects considered, then the values for each project were summed up in order to obtain the final indicator for SMIS.

- First of all we present the overall increase in traffic which is the basis of the traffic forecast for each segment of the highway.

  The general increase in traffic is considered as mentioned below:

General road traffic index	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020
Light trucks	95.0%	90.9%	100.0%	113.7%	110.3%	111.9%	115.0%	117.1%	119.1%	121.2%	123.2%	131.8%
Buses	97.2%	96.5%	100.0%	103.4%	105.1%	104.7%	103.3%	104.9%	106.4%	107.9%	109.4%	113.4%
Heavy trucks	85.0%	96.1%	100.0%	98.3%	85.1%	87.2%	91.1%	95.5%	100.1%	104.9%	110.1%	126.0%

Source: ProgTrans World Report 2010/2011, Basel 2010

Project no. 1: Nădlac – Arad Motorway

- *It is identified the project and it is filled in the first full year of project operation*

Project identification: 1 Nădlac-Arad Motorway **First full year of project operation:** 2015

- *The type of the existing/new road and its condition are identified*

			Light trucks	Heavy trucks				
Type of existing road	National road / bad condition	Average speed	50	40	km/ h	length	38	km
Type of new road	Motorway / good condition	Average speed	110	80	km/ h	length	38	km

In the model developed in Excel, the type of road and its condition can be selected, and the speeds for light and heavy trucks will be automatically selected.

- *Next, the road traffic is considered at AADT level - Annual Average Daily Traffic, by type of vehicle classification CNADNR/ CESTRIN for each section of the road for the base year*

Section number	**1**	**2**	**3**	
length [km]	38	0	0	
Traffic data, AADT				
Passenger car	5412			veh/day
Van				veh/day
Minibus				veh/day
Bus	134			veh/day
Truck				
2 axles	278			veh/day
3&4 axles	180			veh/day
5+ axles	816			veh/day

- *Next, the average traffic level of AADT level is calculated by type of vehicle starting from the base year and applying the coefficients of the traffic evolution that were previously established, given in the table on page 23. The results are shown in the table below.*

Total traffic by type of vehicle	Value	Unit	Obs.	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020
Induced traffic coefficient				1	1	1	1	1	1	1	1	1	1	1.05	1.1
Traffic values, Veh/day both ways															
Section 1															
Passenger car	1	veh/day		5,412	5,182	5,698	6,480	6,285	6,374	6,553	6,671	6,788	6,905	7,022	7,510
Van	1	veh/day													
Minibus	1	veh/day													
Bus	1	veh/day		134	133	138	143	145	144	142	145	147	149	151	156
Truck															
2 axles	1	veh/day		278	314	327	322	278	285	298	312	327	343	360	412
3&4 axles	1	veh/day		180	204	212	208	180	185	193	202	212	222	233	267
5+ axles	1	veh/day		816	923	960	944	817	837	875	917	961	1,008	1,057	1,210

- *Further, for each category of vehicle the average daily traffic is multiplied by 365 (number of days per year) and the length of the current road section, to calculate the traffic performance at annual level for each year separately, in million vehicles-kilometer (vkm).*

  For example for year 2005 for passenger cars:

  Traffic performance = 5,412 x 365 x 38 /1,000,000 = 75.064 mln. vkm

  Proceed similarly for each category of vehicle and year. The results are presented in the table below.

Annual traffic performance without project			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Passenger car	1,000,000	vkm	75.1	71.9	79.0	89.9	87.2	88.4	90.9	92.5	94.2	95.8	97.4	104.2
Van	1,000,000	vkm												
Minibus	1,000,000	vkm												
Bus	1,000,000	vkm	1.9	1.8	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.2
Truck														
2 axles	1,000,000	vkm	3.9	4.4	4.5	4.5	3.9	4.0	4.1	4.3	4.5	4.8	5.0	5.7
3&4 axles	1,000,000	vkm	2.5	2.8	2.9	2.9	2.5	2.6	2.7	2.8	2.9	3.1	3.2	3.7
5+ axles	1,000,000	vkm	11.3	12.8	13.3	13.1	11.3	11.6	12.1	12.7	13.3	14.0	14.7	16.8
Total	1,000,000	vkm	94.6	93.7	101.7	112.3	106.9	108.5	111.8	114.4	117.0	119.7	122.4	132.5

- *Next, calculate the transport performance by multiplying the number of vkm (vehicle-kilometers) with the occupancy rates for passenger cars and with the load factors motor for trucks.*

  Occupancy rates and load factors were previously presented, by category of vehicle, as input data.

  The results obtained are shown in the table below. For passenger vehicles the results are expressed in millions pkm - person-kilometers and for trucks in million tkm - tonne-kilometres.

Annual transport performance without project				**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Passenger car		1,000,000	pkm	187.7	179.7	197.6	224.7	217.9	221.0	227.2	231.3	235.4	239.4	243.5	260.4
Van		1,000,000	pkm												
Minibus		1,000,000	pkm												
Bus		1,000,000	pkm	46.5	46.2	47.8	49.5	50.2	50.1	49.4	50.2	50.9	51.6	52.3	54.2
Truck															
	2 axles	1,000,000	tkm	9.6	10.9	11.3	11.2	9.6	9.9	10.3	10.8	11.4	11.9	12.5	14.3
	3&4 axles	1,000,000	tkm	12.5	14.1	14.7	14.4	12.5	12.8	13.4	14.0	14.7	15.4	16.2	18.5
	5+ axles	1,000,000	tkm	113.2	128.0	133.2	130.9	113.3	116.1	121.3	127.2	133.3	139.8	146.6	167.8

For example, for passenger cars we have 75.0644 vkm x 2.5 persons / car = 187.7 pkm (in the table above it is presented a limited number of decimals, but in the model in Excel all decimals can be found).

- *Next, the total transport time is calculated by dividing the number of pkm and tkm with the specific speed for each vehicle for the situation without the project.*

The results obtained are shown in the table below. For passenger vehicles results are expressed in millions phr - person-hours, and for trucks in million thr - tonnes-hour.

Annual transport time without project			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Passenger car	1,000,000	phr	3.75	3.59	3.95	4.49	4.36	4.42	4.54	4.63	4.71	4.79	4.87	5.21
Van	1,000,000	phr												
Minibus	1,000,000	phr												
Bus	1,000,000	phr	1.16	1.15	1.20	1.24	1.26	1.25	1.24	1.25	1.27	1.29	1.31	1.36
Truck														
2 axles	1,000,000	thr	0.24	0.27	0.28	0.28	0.24	0.25	0.26	0.27	0.28	0.30	0.31	0.36
3&4 axles	1,000,000	thr	0.31	0.35	0.37	0.36	0.31	0.32	0.33	0.35	0.37	0.39	0.40	0.46
5+ axles	1,000,000	thr	2.83	3.20	3.33	3.27	2.83	2.90	3.03	3.18	3.33	3.49	3.66	4.19

For example, for passenger cars we have: 187.7 pkm/50 km/h = 3.75 phr (in the table above it is presented a limited number of decimals, but in the model in Excel all decimals can be found).

Similarly the number of phr and thr are calculated for all vehicle categories.

- *Next, the same calculations are performed for the situation with the project, starting with the project's first year of operation. In this case the first year of operation is 2015.*

The results obtained are shown in the tables below, according to the procedure detailed above.

Annual traffic performance with project			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Passenger car	1,000,000	vkm											102.3	114.6
Van	1,000,000	vkm												
Minibus	1,000,000	vkm												
Bus	1,000,000	vkm											2.2	2.4
Truck														
2 axles	1,000,000	vkm											5.2	6.3
3&4 axles	1,000,000	vkm											3.4	4.1
5+ axles	1,000,000	vkm											15.4	18.5
Total	1,000,000	vkm											128.5	145.8

Annual transport performance with project			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Passenger car	1,000,000	pkm											255.7	286.5
Van	1,000,000	pkm												
Minibus	1,000,000	pkm												
Bus	1,000,000	pkm											54.9	59.6
Truck														
2 axles	1,000,000	tkm											13.1	15.7
3&4 axles	1,000,000	tkm											17.0	20.4
5+ axles	1,000,000	tkm											153.9	184.6

It is mentioned that when estimating the total transport time the length and travel speed related to the new project are considered, as they are specified in the input data.

Annual transport time with project				**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Passenger car		1,000,000	phr											2.32	2.60
Van		1,000,000	phr												
Minibus		1,000,000	phr												
Bus		1,000,000	phr											0.69	0.75
Truck															
	2 axles	1,000,000	thr											0.16	0.20
	3&4 axles	1,000,000	thr											0.21	0.25
	5+ axles	1,000,000	thr											1.92	2.31

- *Next, the differences between the situation „with project" and the situation „without project" are estimated, starting with the project's first year of operation. The results are listed in the tables below.*

Annual traffic performance (difference with and without project)

				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020
Passenger car		1,000,000	vkm											4.9	10.4
Van		1,000,000	vkm												
Minibus		1,000,000	vkm												
Bus		1,000,000	vkm											0.1	0.2
Truck															
	2 axles	1,000,000	vkm											0.2	0.6
	3&4 axles	1,000,000	vkm											0.2	0.4
	5+ axles	1,000,000	vkm											0.7	1.7
Total		1,000,000	vkm											6.1	13.3

Annual transport time with project

				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020
Passenger car		1,000,000	pkm											12.2	26.0
Van		1,000,000	pkm												
Minibus		1,000,000	pkm												
Bus		1,000,000	pkm											2.6	5.4
Truck															
	2 axles	1,000,000	tkm											0.6	1.4
	3&4 axles	1,000,000	tkm											0.8	1.9
	5+ axles	1,000,000	tkm											7.3	16.8

Further it is presented the difference in transport time, that represents the total time saved, based on which the final value of time saved is calculated for passengers and freight transport on the new constructed and rehabilitated roads, also presented in the table below.

In order to estimate the time saved per year, the total annual time saved by type of vehicle is multiplied with the value of time presented as input data. For example, for passenger cars we have: 2.545505 mln phr x 12.2 Euro/person = 31.055162 mln Euro (in table with 1 decimal 31.1 million Euro)

Annual transport time (difference with and without project)			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Passenger car	1,000,000	phr											-2.5	-2.6
Van	1,000,000	phr												
Minibus	1,000,000	phr												
Bus	1,000,000	phr											-0.6	-0.6
Truck														
2 axles	1,000,000	thr											-0.1	-0.2
3&4 axles	1,000,000	thr											-0.2	-0.2
5+ axles	1,000,000	thr											-1.7	-1.9

Value of annual transport time saved (million €)			**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2020**
Passenger car	1,000,000	Euro											31.1	31.8
Van	1,000,000	Euro												
Minibus	1,000,000	Euro												
Bus	1,000,000	Euro											6.1	6.0
Truck														
2 axles	1,000,000	Euro											0.3	0.3
3&4 axles	1,000,000	Euro											0.4	0.4
5+ axles	1,000,000	Euro											3.4	3.7
Passenger transport	1,000,000	Euro											37.1	37.7
Freight transport	1,000,000	Euro											4.1	4.5
Total value of annual transport time saved	**1.000,000**	**Euro**											**41.3**	**42.2**

Thus, the estimated value of annual time saved for Nădlac – Arad is EUR 41.3 million for year 2015.

The indicators at project level for all the projects considered for the KAI 1.1 were estimated in the same way. The calculation procedure for all projects is implemented in Excel and has been provided to the Final Beneficiary to be used as a tool for updating the indicator value if necessary.
This tool provided to the Final Beneficiary was also used for:

1) Estimating the result indicators for rehabilitated roads;
2) Estimating the result indicators for the construction of bypasses.

Finally, the values of the indicator "value of time saved for passenger and freight transport by new constructed and rehabilitated roads" estimated for the KAI 1.1 are presented in the table below.

Year	2010	2011	2012	2013	2014	2015
Cumulative value of time saved, in mln. euro - Motorways	0	19.3	19.5	19.7	158.2	628.1

Bypasses

The projects considered in order to estimate the value of time saved for bypasses are presented in the table below:

No.	Bypass	Length, km	Year of commissioning
1	**Săcuieni**	7.620	2013
2	**Carei**	10.460	2014
3	**Alexandria**	13.280	2013
4.	**Caracal**	10.350	2013
5	**Brasov**	13.632	2015
6	**Mihăileşti**	3.180	2013
7	**Tg. Mures**	11.600	2015
8	**South Craiova**	6.285	2013
9.	**Tecuci**	6.950	2015
10	**Bacau**	30.810	2015

Considering the traffic forecast for each bypass and the specific speeds for the situations "without project" and "with project" the value of time saved has been estimated in a similar way to the one described above.

Information on the traffic forecast for year 2015 by types of vehicles was obtained from the existing traffic studies at CNADNR.

Thus, the following results were obtained:

The value of time saved, cumulatively - Bypasses

Year	2010	2011	2012	2013	2014	2015
Value of time saved, cumulatively, in mln. euro - Bypasses	**0**	**0**	**0**	**14.97**	**18.43**	**74.72**

The above values for the indicator "value of time saved for passengers and transported goods by new constructed and rehabilitated roads" are considered in the SMIS list.

National Roads rehabilitated

The projects considered in order to estimate the value of time saved for national roads to be rehabilitated are presented in the table below:

National road	Description section	Deadline	Length, km
NR 1 H	Zalau - Aleşd	2012	69.334
NR 24 to NR 24B	Limit GL / City - Krasna / Krasna - Albita	2012	94.718
NR 6	Bucharest - Craiova	2014	127.097
NR 5	Bucharest - Adunatii Copăceni (km 7+573 - km 19+220)	2015	11.647

Considering the traffic forecast for each bypass and the specific speeds for the situations "without project" and "with the project" the value of time saved has been estimated in a similar way to the one described above.

Information on the traffic forecast for 2015 by types of vehicles were obtained from the Financing Application for each project, which also includes excerpts from the traffic study.

Thus, the following results were obtained:

The value of time saved, cumulatively - rehabilitation of National Roads

Year	2010	2011	2012	2013	2014	2015
Value of time savings, cumulatively, in mln. euro, NR	**0**	**0**	**48.350**	**48.350**	**89.577**	**107.664**

Thus, by summing-up the estimated values for each category of intervention and time horizon we obtain the final values of the indicator, which are presented in the table below:

Year	2010	2011	2012	2013	2014	2015
Value of time savings, cumulatively, in mln. euro	**0**	**0**	**67.85**	**83.02**	**266.20**	**810.48**

The above values for the indicator "value of time savings for passengers and freight transported by new constructed and rehabilitated roads" are considered in the list of indicators.

Recommendations:

This tool can be used also until a National Transport Model will be developed for Romania - that includes all transport modes for passengers and freight and that could be also used for the global estimation of the indicators related to transport infrastructure projects.

Indicator no. 17

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
17	518	Number of passengers shifted from road to rail	Mln. Passenger-km/year	503	Railways

As mentioned in the methodology presented in the Inception Report, this indicator measures how the railway projects help balancing the use of transport modes for passenger transport. As known, promoting the use of railway and balancing the use of transport modes is a major political objective of EU transport policy.

Since this indicator can only be estimated with a national transport model, and this is not available in Romania, in this case the indicator was taken from the list of indicators of TEN-STAC project, in which 32 indicators for all projects on TEN-T axis in Europe were estimated.

As in TEN-STAC the base year is 2000 and forecast year is 2020, a correction factor of 0.75 was applied to TEN-STAC indicator in order to estimate the indicator for the SOPT in year 2015.

Thus, the TEN-STAC related indicator for the rail rehabilitation projects in Romania is 409 mln. passenger-km per year. The considered value for year 2015 is 409 x 0.75 = 306.75 mln. passenger-km per year.

Indicator no. 18

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
18	519	Volume of freight traffic shifted from road to rail (including inter-modal terminals)	Mln. tonne-km/year	503	Railways

As mentioned in the methodology in the Inception Report, this indicator measures how the rail projects help balancing transport modes used for transport freight. As known, promoting the use of railway and balancing the use of transport modes is a major objective of EU transport policy.

Since this indicator can only be estimated with a national transport model and this is not available in Romania, the indicator was taken from the list of indicators of TEN-STAC project, in which 32 indicators for all projects on TEN-T axis in Europe were estimated.

As in TEN-STAC the base year is 2000 and forecast year is 2020, a correction factor of 0.75 was applied to TEN-STAC indicator in order to estimate the SOPT indicator in year 2015.

Thus, the TEN-STAC related indicator for the rail rehabilitation projects in Romania is 2,292 mln. tonne-km per year. The considered value for year 2015 is 2,292 x 0.75 = 1,719 mln. tonne-km per year.

Indicator no. 19

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
19	519	Volume of freight traffic shifted from road to inland waterways	Mln tonne-km/year	504	Waterways

As mentioned in the methodology in the Inception Report, this indicator measures how the projects related to inland navigation help rebalancing the use of transport modes used for freight transport. As it is known, promoting the use of inland navigation and balancing the use of transport modes is a major political objective of EU transport policy.

Since this indicator can only be estimated with a national transport model and this is not available in Romania, in this case the indicator was taken from the list of indicators of TEN-STAC project, in which 32 indicators for all projects on TEN-T axis in Europe were estimated.

As in TEN-STAC the base year is 2000 and forecast year is 2020, a correction factor of 0.75 was applied to TEN-STAC indicator in order to estimate the indicator for the SOPT in year 2015.

Since out of 450 km initially set 200 km will be done on the sector Calarasi - Braila, another correction coefficient equal to 200/(450+200), so equal to 0.308 will be applied.

Thus, the TEN-STAC related indicator for the inland navigation projects in Romania is 813 mln. tonne-km per year. The considered value for year 2015 is 813 x 0.75 x 0.308 = 187.62 mln. tonne-km per year.

Indicator no. 20

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
20	522	TEN-T projects realised - road infrastructure	%	508	Road Infrastructure

According to the portfolio of projects and project implementation projections the target value is set at 80% for year 2015.

The value for the base year 2006 is equal to "0".

Indicator no. 21

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
21	522	TEN-T priority projects realised- railways (%)	%	503	Railways

According to the portfolio of projects and their implementation projections, the length of rehabilitated railway is 209.185 km - indicator no. 6, page 13. Since the total length of the priority project is 476.95 km, the target value of the indicator no. 21 is:

100 * 209.185/476.95 = 43.85% for year 2015.

The baseline value for year 2006 is "0".

Indicator no. 22

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
22	513	Market share	%	503	Railways

According to the current forecasts the target value for the market share of the railways is 15% in year 2015.

Indicator no. 23

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
23	700	Environment protection projects	No.	509	Environment protection

According to the project portfolio indicator target for studies, analyses, reports, strategies - environmental protection is equal to 1.

Indicator no. 24

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
24	700	Studies, evaluations, institutional support	Number of	700	Technical Assistance

According to the Annual Procurement Program for year 2011 of MTI, the following studies, evaluations and institutional support projects are currently foreseen:

1. Technical assistance for institutional support in the activities related to verification of reimbursement requests and checks at the location of SOP Transport Beneficiaries;

2. Technical Assistance for the elaboration of a General Transport Master Plan;
3. Technical Assistance to support the Managing Authority for SOPT in the activity of evaluation and selection of SOPT applications;
4. Institutional Support for the elaboration and implementation of the General Transport Master Plan;
5. Technical assistance for the Danube projects;
6. Technical assistance for the elaboration of SOPT 2014 - 2020;
7. Technical assistance for institutional support for CNADNR;
8. Technical assistance for institutional support for CN CFR SA.

On-going projects expected to be completed in 2011:

1. Consultancy to support the Managing Authority for SOPT in the activity of monitoring SOPT project implementation.
2. Technical Assistance for the elaboration, quantification and monitoring of the indicators for the Sectoral Operational Program "Transport" 2007-2013.

Two evaluation projects are foreseen in MEP until the end of the programming period.

Thus, from the analysis of the estimated studies, evaluations and institutional support the following values of this indicator were established:

Implementation	2010	2011	2012	2013	2014	2015
Studies, analyses, reports, strategies	-	2	5	9	9	12

<u>Indicators no. 25 and 26</u>

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
25	506	Reduction in serious accidents (serious accidents/ million passenger-km)	%	501	National Roads
26	507	Reduction in fatalities (fatalities/million passenger-km)	%	501	National Roads

According to the national forecasts, the target for both indicators was set at -20%.

<u>Indicators no. 27 and 28</u>

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
27	705	Participant training days - MA	No.	700	Technical Assistance
28	705	Participant training days - beneficiaries	No.	700	Technical

					Assistance

According to the project portfolio the total number of participant training days was identified and distributed as follows: 30% for MA and 70% for the Beneficiaries. These values are set both for the target value and for intermediate values, as specified in the table below.

	2011	2012	2013	2014	2015
MA	216	705	1,785	1,785	1,785
Beneficiaries	504	1,645	4,165	4,165	4,165
Total	**720**	**2,350**	**5,950**	**5,950**	**5,950**

Indicator no. 29

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
29	703	Committee meetings and relevant working groups (no.)	No.	700	Technical Assistance

According to the discussions with GDFFA representatives, two meetings are organised every year, so the target for 2015 is 18.

Intermediate values are listed below:

Implementation	2007	2008	2009	2010	2011	2012	2013	2014	2015
Committee meetings and relevant working groups (no.)	2	4	6	8	10	12	14	16	18

Indicator no. 30

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
30	706	Total number of printed information materials or promotional items	No.	700	Technical Assistance

According to the information received from MA until now the following have been done:

- 2007:
    - 1 edition prints (brochure);
    - 1 edition promotional items (pen, map).
- 2008:
    - 1 edition prints (brochure);
    - 1 edition promotional items (pen, map, poster).
- 2011:
    - 1 edition prints (brochure);

- 1 edition promotional items (pen, map, banner).

And the following will be done:

- 2011: 1 edition promotional items (agenda, calendar)
- 2012 - 2015: 1 edition of printed materials and 1 edition of promotional materials each year.

Thus, the intermediate value for 2011 is 7 editions of printed materials or promotional items, and the target for 2015 is 15 editions of printed materials or promotional items.

The indicator values for years 2011 and 2015, as presented above, were considered in the list of indicators.

Indicator no. 31

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
31	706	Number of communication and promotion events	No.	700	Technical Assistance

According to the information received from MA until now, the following events were organised:

- 2007:
  - A press conference to launch the SOPT;
- 2008
  - A national conference to promote SOPT.
- 2011:
  - A press conference - completion of SOPT promotion campaign.

And will be organised:

- 2011: 8 regional conferences and a national one.
- 2012 - 2015: at least one promotional event each year.

Thus, the intermediate value for communication and promotion events for year 2011 is 12 and the target for year 2015 for communication and promotion events is 16.

Indicator values for 2011 and 2015, as considered above, were considered in the list of indicators.

Indicator no. 32

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
32	706	Website hits	No.	700	Technical Assistance

Based on the current dynamics of SOPT website hits, a total of 70,000 website hits is foreseen as target for year 2011 and the target for year 2015 is a total of 350,000 website hits.

The indicator values for 2011 and 2015, as presented above, were considered in the list of indicators.

Indicator no. 33

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
33	716	Level of awareness	%	700	Technical Assistance

According to the surveys conducted until now the public awareness of SOPT was 8% in September 2010. The target value for 2015 was set at 15%.

The indicator values for 2010 and 2015, as estimated above, were considered in the list of indicators.

<u>Environmental indicators - emissions road transport mode</u>

The methodology used to estimate the emissions is detailed in the Inception Report. Next, the input data and the calculations will be presented in detailed.

The emissions were estimated for the base year 2005 and for the 2015. For year 2015 in the situations "with the project" and "without project" were considered in order to estimate the effect of implementing the projects.

The following projects were considered:

1) Motorways

As described before, the following projects are considered:

No	Highway construction project or Bypass construction at motorway level
1	Construction of Nadlac-Arad motorway (design and execution)
2	Construction of Orăștie -Sibiu motorway (lot 1, lot 2, lot 3)
3	Construction of Lugoj-Deva motorway (3 lots)
4	Construction of Timisoara - Lugoj motorway
5	Construction of Arad-Timisoara motorway, including Arad bypass, as follows:
	Construction of Arad-Timisoara motorway
	Construction of Arad bypass
6	Construction of Cernavoda-Constanta motorway
7	Construction of Constanta bypass

2) Rehabilitation of national roads

As described above, the following projects are considered:

National road	Description section	Deadline	Length, km
NR 1 H	Zalau - Aleşd	2012	69.334
NR 24 to NR 24B	GL limit / Vaslui - Crasna / Crasna - Albita	2012	94.718
NR 6	Alexandria - Craiova	2014	127.097
NR 5	Bucharest - Adunatii Copăceni (km 7+573 - km 19+220)	2015	11.647
Total			**302.796**

3) Bypasses

As described above, the following projects are considered:

No.	Bypass	Deadline	The first year of operation	Length, km
1	Săcuieni Bypass	03/2013	2013	7.62
2	Carei Bypass	10/2013	2014	10.46
3	Alexandria Bypass	04/2013	2013	13.28
4	Caracal Bypass	04/2013	2013	10.350
5	Brasov Bypass - motorway	2015	2015	13.632
6	Mihăileşti Bypass	10/2012	2013	3.18
7	Targu Mures Bypass	2015	2015	11.60
8	South Craiova Bypass	02/2013	2013	6.285
9.	Tecuci Bypass	2015	2015	6.95
10	Bacau Bypass	2015	2015	30.81
Total				**114.167**

Estimation of emissions for motorways

Input data:

Traffic performance in million vehicle-km for each project as estimated for the indicator no. 16 was considered as follows:

	Nădlac -Arad	Orastie - Sibiu	Lugoj - Deva	Timișoara - Lugoj	Arad - Timișoara	Arad bypass	Cernavoda - Constanta	Constanta bypass	TOTAL
2005									
Passenger cars	75.10	226.40	98.70	63.60	132.60	9.70	198.70	57.60	862.40
Trucks	13.80	104.30	28.60	27.60	37.70	2.70	38.40	1.80	254.90
2015 without project									
Passenger cars	97.40	293.80	128.10	82.60	163.40	12.50	257.80	74.70	1110.30
Trucks	17.90	135.00	37.00	35.70	41.40	3.40	49.80	2.30	322.50
2015 with project									
Passenger cars	102.30	261.70	128.10	82.60	152.70	10.80	257.80	80.70	1076.70
trucks	18.80	120.30	37.00	35.70	38.70	3.00	49.80	2.40	305.70

The following categories of vehicles were considered to estimate emissions:

- Passenger cars
- Trucks (3 & 4 axles, with 5 and over 5 axles)

Since there is no statistics in Romania regarding the number of cars fueled with gasoline and diesel, it was considered that in the current situation all the passenger cars are powered by gasoline.

For each time horizon it was considered the total traffic performance by type of vehicle traffic found in the table above.

The following travel speeds were considered for highways:

Type of road	Status (condition)	Speed (kmh)	
		Light vehicles	Heavy vehicles
National Roads	bad	50	40
Highway	good	110	80

The following travel speeds were considered for national roads rehabilitated and detours:

Type of road	Status (condition)	Speed (kmh)	
		Light vehicles	Heavy vehicles
National Roads	bad	50	40
Rehabilitated roads and Bypasses	good	80	70

<u>Indicator no. 34</u>

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
34		NOx emissions [1] Total emissions	kt /year	500/501/502	Motorways/National Roads/Bypasses

The calculation method for motorways is presented below.

First the emission factors for NOx were estimated, as follows:

Passenger cars:

FE_NOx = (0.525-0.01*V +0.0000936*POWER (V,2))/1 , where:

V = the speed. For the base year V = 50 km/h; for year 2015 V = 110 km/h.

We obtain:

[1] NO_x emissions (NO_2 and NO cumulated) are considered

FE_NOx 2005 and 2015 without project = 0.2590 g/km

FE_NOx 2015 with the project = 0.5576 g/km

Trucks:

FE_NOx = (1 /(((- 0.000001 * (POWER (V,2)) +0.026687*V +0.00067 * V))))

V = the speed. For the base year V = 40 km/h; for year 2015 V = 80 km/h.

We obtain:

FE_NOx 2005 and 2015 without project = 19.2727 g/km

FE_NOx 2015 with project = 13.5342 g/km

The emissions are obtained for each scenario considered by multiplying the emission factors for each time horizon and scenario with traffic performance.

Similarly, the emissions are calculated for bypasses and rehabilitated national roads, using as input data the specific speeds mentioned above.

Thus, we finally obtain the following cumulative results for all three categories of action:

	NOx, tonnes per year	**NOx, kt per year**
Base year 2005	5,763	5.763
Year 2015 target		
Without project	8,283	8.283
With project	5,954	5.954
The difference with the project - without project	**-2,329**	**-2.329**

It is noticed that NOx emissions are reduced, in total, with 2.329 kt per year in 2015 in the situation with project compared to the situation without project.

<u>Indicator no. 35</u>

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
35		SO_2 emissions (kt) Total emissions	kt/year	500/501/502	Motorways/ National Roads/ Bypasses

The calculation method for motorways is presented below.

To estimate SO_2 and CO_2 emissions it is necessary to estimate before the specific fuel consumption CC, in g/km.

Passenger cars:

CC=(191+1.17*V)/(1+0.129*V-0.000723*POWER(V,2)), where:

V = speed. For the base year V = 50 km/h for year 2015 V = 110 km/h.

We obtain:

CC 2005 and 2015 without project = 44.2180 g/km

CC 2015 with Project = 49.6298 g/km

Trucks:

For trucks different formulas are applied depending on the speed, according to CORINAIR, as follows:

CC = 276.5968+721.6679*EXP(-1*0.036759*V)+20235.47*EXP(-1*0.804496*V)

V = speed. For the base year V = 40 km/h; for year 2015 V = 80 km/h.

We obtain:

CC 2005 and 2015 without project = 442.4669 g/km

CC 2015 with project = 314.7208 g/km

Estimation of SO2 emissions

For passenger cars, emission factors for SO_2 are calculated using the formula:

FE_SO2 = 2*0.00004*CC

Thus, we obtain:

FE_SO2 2005 and 2015 without project = 0.00354 g/km

FE_SO2 2015 with project = 0.00397 g/km

For trucks, SO_2 emission factors are calculated using the formula:

FE_SO2=2*0.00004*CC

Thus, we obtain:

FE_SO2 2005 and 2015 without project = 0.03540 g/km

FE_SO2 2015 with project = 0.02518 g/km

Total emissions for each scenario considered are obtained by multiplying the emission factors for each time horizon and scenario with the traffic performance.

The emissions for bypasses and rehabilitated national roads are similarly calculated, using as input data the specific speeds mentioned above.

Thus, we finally obtain the following cumulative results for all three categories of action:

	SO_2 tonnes per year	**SO_2, kt per year**
Base year 2005	14	0.014
Target Year 2015		
Without project	22	0.022
With project	16	0.016
Difference with project-without project	**-6**	**-0.006**

It is noticed that SO_2 emissions are reduced, in total, with 0.006 kt per year in 2015 in the situation with projects compared to the situation without projects.

<u>Indicator no. 36</u>

No	SMIS Code	Indicator	UM	SMIS Code	Action Category
36		COV emissions (kt) Total emissions	kt/year	500/501/502	Motorways/National Roads/Bypasses

Further, the calculation method for motorways is presented:

COV emissions are estimated only for passenger cars, because COV are emitted only by vehicles on gasoline.

COV emission factors are estimated with the formulas presented below:

FE_COV=(1.35-0.00677*V)/(1+0.178*V-0.00127*POWER(V,2)), where:

V = speed. For the base year V = 50 km / h; for year 2015 V = 110 km/h.

We obtain:

FE_COV 2005 and 2015 without project = 0.1504 g/km

FE_COV 2015 with project = 0.1161 g/km

Total emissions for each scenario considered are obtained by multiplying the emission factors for each time horizon and scenario with the traffic performance.

The emissions for bypasses and rehabilitated national roads are similarly calculated, using as input data the specific speeds mentioned above.

Thus, we finally obtain the following cumulative results for all three categories of action:

	COV, tons per year	COV kt per year
Base year 2005	167	0.167
Target Year 2015		
Without project	270	0.270
With project	200	0.200
Difference with project-without project	**-70**	**-0.070**

It is noticed that COV emissions are reduced, in total, with 0.070 kt per year in 2015 in the situation with projects compared to the situation without project.

Indicator no. 37

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
37		Fine particulate emissions (kt) [2] Total emissions	kt/year	500/501/502	Motorways/National Roads/Bypasses

The calculation method for motorways is presented below.

Fine particle emissions were estimated for trucks. Emissions of fine particles are generated only by diesel-powered vehicles.

First emission factors (FE) were estimated for PM - fine particles, as follows:

Trucks:

FE_PM =0.458629+1.753999*EXP(-1*0.047259*V)+4.55682*EXP(-1*0.32909*V)

V = speed. For the base year V = 40 km/h; for year 2015 V = 80 km/h.

[2] Estimated for heavy trucks

We obtain:

FE_PM 2005 and 2015 without project = 0.7235 g/km

FE_PM 2015 with project = 0.4986 g/km

Total emissions for each scenario considered are obtained by multiplying the emission factors for each time horizon and scenario with the traffic performance.

The emissions for bypasses and rehabilitated national roads are similarly calculated, using as input data the specific speeds mentioned above.

Thus, we finally obtain the following cumulative results for all three categories of action:

	PM, tonnes per year	PM, kt per year
Base year 2005	209	0.209
Target Year 2015		
Without project	302	0.302
With project	201	0.201
Difference with project-without project	**-101**	**-0.101**

It is noticed that COV emissions are reduced, in total, with 0.101 kt per year in 2015 in the situation with projects compared to the situation without projects.

Indicator no. 38

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
38		CO_2 equivalent emissions (kt) Total emissions	kt/year	500/501/502	Motorways/National Roads/Bypasses

Further, the calculation method for motorways is presented:

CO_2 emissions are estimated based on the traffic performance by type of vehicle and CC - specific fuel consumption.

For passenger cars FE_CO2 is estimated using the formula:

FE_CO2=44.011*(CC/(12.011+1.008*1.8+0))

For trucks, FE_CO2 it is estimated using the same formula. in which CC is now the specific fuel consumption for trucks.

CC - specific fuel consumption for cars and trucks was estimated above in the estimation of SO_2 emissions

For passenger cars we obtain:

FE_CO2 2005 and 2015 without project = 140.76 g / km

FE_CO2 2015 with project = 157.99 g / km

and for trucks:

FE_CO2 2005 and 2015 without project = 1408.52 g / km

FE_CO2 2015 with project = 1001.86 g / km

Total emissions for each scenario considered are obtained by multiplying the emission factors for each time horizon and scenario with the traffic performance.

The emissions for bypasses and rehabilitated national roads are similarly calculated, using as input data the specific speeds previously mentioned.

Thus, we finally obtain the following cumulative results for all three categories of action:

	CO_2 tonnes per year	**CO_2 kt per year**
Base year 2005	568,465	568.465
Target Year 2015		
Without project	859,103	859.103
With project	653,163	653.163
Difference with project-without project	**-205,940**	**-205.940**

It is noticed that CO_2 emissions are reduced, in total, with 205.940 kt per year in 2015 in the situation with projects compared to the situation without projects.

Indicator no. 39

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
39		NOx emissions [3] Evolution in the situation without project implementation	kt/year	503	Railways

As specified in the Inception Report, it is necessary to use a national transport model, which must include the modal split module, in order to estimate the emissions for all users in the case of rehabilitation projects and/or construction of new rail infrastructure.

[3] NO_x emissions (NO_2 and NO cumulated) are considered.

Therefore, considering the above mentioned and the fact that in Romania it is not available a national transport model that considers the distribution between transport modes, and also that the feasibility studies for railway rehabilitation projects are not completed, specific indicators of TEN-STAC project were considered, to which a correction factor of 0.75 was applied in order to estimate the target indicators for year 2015 (the time horizon of forecasts in TEN-STAC is the year 2020). This method was presented in the Inception Report and it was approved.

Thus, we have an increase in NOx emissions of 253 tonnes per year in TEN-STAC 2020, so the corresponding indicator for SOPT is 253 * 0.75 = 189.75 tonnes so 0.190 kt increase of NOx emissions in 2015.

Therefore, the target indicator for 2015 is +0.190 kt / year.

A slight increase for year 2015 can be noticed, due to NOx emissions generated by diesel locomotives.

Baseline value for year 2005 is not known and cannot be estimated.

<u>Indicator no. 40</u>

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
40		Fine particulate emissions (kt) Evolution in the situation without project implementation	kt / year	503	Railways

As mentioned for the indicator no. 40, in this case it was also considered the specific indicator from TEN-STAC project, to which a correction factor of 0.75 was applied in order to estimate the target value for 2015 (the time horizon of forecasts in TEN STAC is 2020). This method was presented in the Inception Report and was approved.

Thus, we have an increase in fine particle emissions of 22 tons per year in TEN-STAC in the year 2020, so the corresponding indicator for SOPT is 22 * 0.75 = 16.5 tons so 0.016 kt increase of emissions of fine particles in year2015.

Therefore, the target value of the indicator for year 2015 is +0.016 kt / year.

A slight increase for 2015 is noticed, due to emissions of particles generated by diesel locomotives.

The baseline value for year 2005 is not known and cannot be estimated.

Indicator no. 41

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
41		Equivalent CO_2 emissions (kt) Evolution in the situation without project implementation	kt/year	503	Railways

As mentioned for the indicator no. 40, in this case it was also considered the specific indicator from TEN-STAC project, to which a correction factor of 0.75 was applied in order to estimate the target value for 2015 (the time horizon of forecasts in TEN STAC is 2020). This method was presented in the Inception Report and approved.

Thus, we have a decrease of CO2 emissions by 151,002 tonnes per year in TEN-STAC in 2020 compared to the situation without project implementation, so the corresponding indicator for the SOPT is: 151,002 * 0.75 = 113,251.5 tonnes so 113.251 kt decrease of CO_2 emissions in year 2015. Thus, the target value of the indicator for 2015 is -113.251 kt/year.

The baseline value for year 2005 is not known and cannot be estimated.

No indicators 42, 43, 44

The following indicators have been revised and their final version is presented below:

No.	SMIS Code	Indicator	UM	SMIS Code	Action Category
42		Total surface[1] occupied of protected areas [2]	ha	500	Motorways
43		Total surface[1] occupied of protected natural areas [2]	ha	503	Railways
44		Number of protected natural areas[2] directly affected by SOPT projects	No.		

[1] The area occupied by transport infrastructure in addition to the situation without project will be calculated

[2] Categories of protected natural areas:

a) of national interest: scientific reserves, national parks, natural monuments, nature reserves, natural parks;

b) of international interest: natural sites of universal natural heritage, geoparks, wetlands of international importance, biosphere reserves;

c) sites of Community interest or "Natura 2000" sites of community importance, special areas of conservation, special protection areas for birds;

d) of county or local interest: established only on public/private administrative-territorial units, as appropriate.

Out of the motorway projects, the only project that will occupy a certain area of the protected area is Lugoj - Deva motorway. The total surface of the protected area occupied will be 11.57 ha.

Out of the railway projects, the only project that crosses a protected area is the rehabilitation of Sighisoara - Coslariu railway. The total surface of the protected area occupied will be 700 m^2, so 0.07 ha.

The total number of protected areas directly affected is equal to 2.

In the next section it is presented the specific analysis based on which the names and the significance of these indicators were established.

Identification of environmental indicators for biodiversity relevant at SOPT level

According to the European and international practice, the first step in proposing indicators for monitoring the impact on biodiversity is the use of selection criteria for relevant and applicable indicators whose values can be validated.

The most common selection criteria used (OECD) are:

- Relevance and utility of the indicator in correlation with the objective set
- Viability of data and analytical methods
- Measurability

An indicator of environmental impact should:

- Provide a representative picture of environmental conditions, pressure on the environment and society reaction/response
- Be simple, easy to interpret and be possible to monitor its evolution
- Be responsive to environmental changes and related activities
- Provide a basis for international comparisons
- Be relevant at national level or applicable at regional level in the field of interest
- Have a threshold or benchmark against which it can be compared so that users can assess the significance of associated values.

An environmental indicator should:

- be grounded in scientific and technical terms;
- be based on international standards and international consensus about its validity;
- be possible to be linked to economic models, forecasting and information systems.

The data required to support the indicator should be:

- readily available or available at a reasonable cost;
- adequately documented and highly qualitative
- updated at regular intervals according to specific procedures.

Based on this concept and in relation to the requirements of specific legislation in Romania, we proceeded to the identification of the relevant indicators to monitor the effects of SOPT projects on biodiversity in general and on protected areas in particular.

The process started with the analysis of indicators which are reported by each EU country to the European Environment Agency and/or the EC in monitoring the implementation of European directives.

1. Description of the current situation

Considering that it should be possible to compare an environmental impact indicator with a baseline, we present hereunder the current situation of the data available at national level.

In Romania, in order to ensure protection and conservation of natural site assets, special measures are taken to establish a differentiated system of protection, conservation and use, according to the following categories of protected natural areas:

a) of national interest: scientific reserves, national parks, natural monuments, nature reserves, natural parks;

b) of international interest: natural sites of universal natural heritage, geoparks, wetlands of international importance, biosphere reserves;

c) sites of Community interest or "Natura 2000" sites of community importance, special areas of conservation, special protection areas for birds;

d) county or local interest: established only on public/private administrative-territorial units, as appropriate.

According to the data provided by the environment protection agencies, the categories and number of protected areas that form the national network of protected areas are the following:

scientific reserves - 77;
national parks - 13;
monuments of nature - 230;
nature reserves - 661;
natural parks - 15 (Danube Delta);
biosphere reserves - 3;
wetlands of international importance - 5;
special protection areas for birds - 108;
sites of community importance - 273.

The protected natural areas of national interest are declared in accordance with L*aw no. 5/2000 on National Planning, Section III, protected areas, G.D. no. 2151/2004 on the creation of protected natural area regime for new zones; G.D. no. 1581/2005 on the creation of new protected natural area; G.D.no. 1143/2007 on the creation of new protected natural areas.*

The national park is a protected natural area administered especially for ecosystem protection and recreation, while the natural park is set up especially for the conservation of landscapes.

Natural Parks in Romania in year 2009

No.	**Name of the natural park**	**County**	**Area (ha)**
1	Apuseni	Alba, Bihor, Cluj	76,022.34
2	Iron Gates	Caras Severin, Mehedinti	128,196.22
3	Grădiştea Muncelului - Cioclovina	Hunedoara	38,116.34
4	Bucegi	Arges, Brasov, Dambovita	32,597.8
5	Small Pond of Braila	Braila	20,460.12
6	Vinatori Neamt	German	30,840.87
7	Mures Floodplain	Arad, Timis	17,428
8	Lower Prut Floodplain	Galati	1,169.45
9	Comana	Giurgiu	24,962.86
10	Haţegului Country Dinosaurs Geopark	Hunedoara	100,486.72
11	Maramures Mountains	Maramures	133,418.96
12	Mehedinti Plateau Geopark	Mehedinti	106,491.61
13	Putna - Vrancea	Vrancea	38,190.01
14	Upper Mureş Defile	Mures	9,156
15	Danube Delta	Constanta, Tulcea	58,000
Total surface			**1.337.537.3**

National Parks in Romania in year 2009

No.	Name of national park	County	Area (Ha)
1	Domogled - Cerna Valley	Caras Severin, Mehedinti, Gorj	61,190.03
2	Semenic - Caras Gorges	Caras Severin	36,219.39
3	Nera Gorges - Beusnita	Caras Severin	36,706.99
4	Retezat	Hunedoara	38,117.06
5	Piatra Craiului	Arges, Brasov	14,781.33
6	Cozia	Glen	16,720.65
7	Bicaz Gorges - Hasmas	Harghita, Neamt	6,933.23
8	Ceahlău	German	7,739.05
9	Călimani	Bistrita - Nasaud, Harghita, Mures, Suceava	23,915.37
10	Rodna	Bistrita - Nasaud, Maramures, Suceava	47,207
11	Macin Mountains	Tulcea	11,114.15
12	Buila - Vânturariţa	Glen	4,490.5
13	Jiu Defile	Gorj, Hunedoara	13,782
Total surface			**318,917**

Natura 2000 network is a structure of nature protection, protection that does not necessarily mean "limitations and restrictions”. Nature 2000 allows both preservation and further development of biodiversity in Romania.

The total area of Natura 2000 in Romania represents **17.84%** of the country out of which the sites of community importance (under the Habitats Directive - SCI) represent **13.21%** of the country and the special protection areas for Birds (Special Protection Areas - SPA) represent **11.89%** of the country.

It should be mentioned that some Natura 2000 sites overlap other types of protected areas (at national or local level) so it is difficult to calculate the percentage of the total area of the country representing the declared protected natural areas and Natura 2000 sites.

For each protected area and Natura 2000 site the environmental protection authorities have digital maps with their boundaries so they can identify for each project based on Stereo 70 coordinates, the position of the site in relation to protected areas.

Maps with Natura 2000 sites can be found on the website: http://natura2000.eea.europa.eu/#

The objectives of protection, conservation and management regime of the categories of protected natural areas are established in their management plans.

Since the ecological systems are functional systems with complex organization, in general the level of structural changes are not noticeable from one year to another (unless major environmental accidents and on short term occur). Subsequently, by removing the disruptive factor, the natural environment can be restored.

Due to fact that the integrated monitoring system which includes also the monitoring of biological diversity is not implemented, there is no evidence which would allow a real analysis of its real condition, except for some wild species, which are subject to certain programs and projects research of university structures, museums, research institutes, as well as specialized non-governmental organizations.

At the moment the vast majority of protected areas do not have approved management plans, the elaboration process is in progress (financed through SOP Environment), so there is not a situation at the level of each protected area and even less at the national level of the surfaces of protected areas that are currently occupied by transport infrastructure or that have this destination according to spatial and urban planning. Moreover, the limits of the areas where priority habitats are present that constitute the reason for protecting these protected areas, that is, areas with severe restrictions in terms of land use change are unknown.

The analysis of Natura 2000 site maps, online, showed that the vast majority of sites are crossed by the transport infrastructure (road, rail, water), on the surface of these sites there are settlements, industrial zones, agricultural zones, etc. We mention once more that in Natura 2000 sites human activities are not prohibited, therefore, any project which is properly evaluated in terms of environmental impact and in particular on the habitats and species for which the site was declared can be achieved with the implementation of mitigation measures or, where appropriate, compensatory measures will be proposed.

2. Indicators for monitoring the SOPT impact on biodiversity

In the approval process for transport infrastructure projects, the procedure for environmental impact assessment includes also the appropriate assessment procedure of the effects on protected areas and Natura 2000 sites, according to MO 19/2010.

Following the analysis of the project in relation with the location proposed for its implementation, the environmental authorities decide whether it is necessary or not to elaborate the appropriate assessment study.

For each project, the designer and the impact evaluator propose the monitoring of certain indicators that emphasize the evolution of the environmental factors and of the status of protected areas both during the project implementation and during operation.

These indicators are different from one project to another because the project characteristics are different, and also the sites/protected areas, which leads to the complexity of the methodology for monitoring the impact of a plan at national level.

Identifying relevant indicators started with checking the indicators related to transport infrastructure that are reported to the European Environment Agency. These will be supplemented with other indicators that we consider can be monitored based on the data/information from appropriate assessment studies and EIA reports prepared for each project.

To ensure the consistency of the presentation, for each indicator proposed guidance will be given on how to collect the data needed to calculate the values of the indicators and the methodology for collecting and aggregating the values of indicators at SOPT level.

The values of indicators are calculated by taking into account the projects listed on the site MA SOPT approved on 11 March 2011, data on the impact on biodiversity is collected from the regulatory acts issued by the competent authorities for environmental protection for these projects.

Indicators:

1. Types of protected areas affected by transport infrastructure projects

No.	Type of protected area	Number of transport infrastructure projects					
		Road		Railways		Waterways	
		New Route	Rehabilitation of existing road	New Route	Rehabilitation of existing route	New Route	Rehabilitation of existing route
1.	scientific reserves	0	0	0	0	0	0
2.	national parks	0	0	0	0	0	0
3.	nature monuments	0	0	0	0	0	0
4.	nature reserves, parks	0	0	0	0	0	0
5.	natural sites of universal natural heritage	0	0	0	0	0	0
6.	wetlands of international importance	0	0	0	0	0	0
7.	Biosphere Reserves	0	0	0	0	0	0
8.	Geoparks	0	0	0	0	0	0
9.	SCI	0	0	0	0	1	0
10.	SPA	1	0	0	0	0	0
11.	Areas of county or local interest	0	0	0	0	0	0
	TOTAL	1	0	0	0	1	0

These refer to those projects for which the environmental protection authority has decided they have impact on the protected areas.

Data in the project proposal stage is collected from the beneficiary of the projects through the environmental permit analysis, decision screening stage, the EIA report, Natura 2000 statement and the appropriate assessment study.

In the implementation phase of the project data will be collected from environmental factors monitoring reports prepared by the constructor and delivered by the beneficiary to MA SOPT.

Data aggregation at SOPT level will be done by cumulating data from each project.

2. *Number of protected areas directly affected by SOPT projects*

Transport infrastructure projects		Number of protected areas directly affected											
		scientific reserves	national parks	monuments	nature reserves, parks	natural sites of universal natural heritage	wetlands of international importance	biosphere reserves	geoparks	SCI	SPA	Areas of county or local	**Total**
Road	New	0	0	0	0	0	0	0	0	0	1	0	**1**
	Rehabi litation	0	0	0	0	0	0	0	0	0	0	0	**0**
CS	New	0	0	0	0	0	0	0	0	0	0	0	**0**
	Rehabi litation	0	0	0	0	0	0	0	0	1	0	0	**1**
Water ways	New	0	0	0	0	0	0	0	0	0	0	0	**0**
	Rehabil itation	0	0	0	0	0	0	0	0	0	0	0	**0**
Total		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**2**

Data in the project proposal stage is collected from the beneficiary of the projects through the environmental permit analysis, decision of the screening stage, the EIA report, Natura 2000 statement and the appropriate assessment study.

In the implementation phase of the project data will be collected from the monitoring of environmental factors reports prepared by the constructor and delivered by the beneficiary to MA SOPT.

Data aggregation at SOPT will be done by cumulating data from each project.

3. *Surface of the protected area which will change the land use and % of the total area*

Transport infrastructure projects		Area %	Affected surface in protected areas											
			scientific reserves	national parks	monuments	nature reserves, parks	natural sites of universal natural heritage	wetlands of international importance	biosphere reserves	geoparks	SCI	SPA	Areas of county or local	**Total**
Road	New	**Ha**	0	0	0	0	0	0	0	0	0	11.57	0	11.57
		%	0	0	0	0	0	0	0	0	0	0.02	0	0.02
	Rehabilitation	**Ha**	0	0	0	0	0	0	0	0	0	0	0	0
		%	0	0	0	0	0	0	0	0	0	0	0	0
Rail	New	**Ha**	0	0	0	0	0	0	0	0	0	0	0	0
		%	0	0	0	0	0	0	0	0	0	0	0	0
	Rehabilitation	**Ha**	0	0	0	0	0	0	0	0	0.07	0	0	0.07
		%	0	0	0	0	0	0	0	0	0.00008	0	0	0.00008
IWW	New	**Ha**	0	0	0	0	0	0	0	0	0	0	0	0
		%	0	0	0	0	0	0	0	0	0	0	0	0
	Rehabilitation	**Ha**	0	0	0	0	0	0	0	0	0	0	0	0
		%	0	0	0	0	0	0	0	0	0	0	0	0
Total		**Ha**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		%	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.07008**	**11.59**	**0**	**11.6608**

Data in the project proposal stage is collected from the beneficiary of the projects through the environmental permit analysis, decision of the screening stage, the EIA report, Natura 2000 statement and the appropriate assessment study.

In the implementation phase of the project data will be collected from the monitoring of environmental factors reports prepared by the constructor and delivered by the beneficiary to MA SOPT.

Data aggregation at SOPT will be done by cumulating data from each project.

4. Number / type of habitats and / or protected species affected

Transport infrastructure projects		Number of protected habitats and/or species affected					
		Priority Habitats	Protected Habitats	Endangered Species	Protected species	Areas of nesting/ feeding/ shelter for protected species	Other relevant issues
Road	New	0	0	0	0	0	0
	Rehabilitation	0	0	0	0	0	0
Railways	New	0	0	0	0	0	0
	Rehabilitation	0	0	0	0	0	0
Waterways	New	0	0	0	0	0	0
	Rehabilitation	0	0	0	0	0	0
Total		**0**	**0**	**0**	**0**	**0**	**0**

Data in the project proposal stage is collected from the beneficiary of the projects through the environmental permit analysis, decision of the screening stage, the EIA report, Natura 2000 statement and the appropriate assessment study.

In the implementation phase of the project data will be collected from the monitoring of environmental factors reports prepared by the constructor and delivered by the beneficiary to MA SOPT.

Data aggregation at SOPT will be done by cumulating data from each project.

5. Number and types of habitats fragmented by transport infrastructure projects and their surface

Transport infrastructure projects		Number of habitats fragmented						
		Priority Habitats	Protected habitats	Endangered Species	Protected species	Areas of nesting/ feeding/ shelter for protected species	Surface habitat / species affected by fragmentation (ha)	Other relevant issues
Road	New	0	0	0	0	0	0	0
	Rehabilitation	0	0	0	0	0	0	0
Railways	New	0	0	0	0	0	0	0
	Rehabilitation	0	0	0	0	0	0	0
Waterways	New	0	0	0	0	0	0	0
	Rehabilitation	0	0	0	0	0	0	0
Total		**0**	**0**	**0**	**0**	**0**	**0**	**0**

Data in the project proposal stage is collected from the beneficiary of the projects through the environmental permit analysis, decision of the screening stage, the EIA report, Natura 2000 statement and the appropriate assessment study.

In the implementation phase of the project data will be collected from the monitoring of environmental factors reports prepared by the constructor and delivered by the beneficiary to MA SOPT.

Data aggregation at SOPT will be done by cumulating data from each project.

6. The type of impact on biodiversity identified for transport infrastructure projects

No.	Impact	Number of transport infrastructure projects					
		Road		Railways		Waterways	
		New route	Rehabilitation of existing route	New route	Rehabilitation of existing road	New route	Rehabilitation of existing route
1	On short-term (execution)		2	0	8	0	2
2	On medium term	7	1	0	0	0	0
3	On long term	0	0	0	0	0	0

Data in the project proposal stage is collected from the beneficiary of the projects through the environmental permit analysis, decision screening stage, the EIA report, Natura 2000 statement and the appropriate assessment study.

In the implementation phase of the project data will be collected from the monitoring of environmental factors reports prepared by the constructor and delivered by the beneficiary to MA SOPT.

Data aggregation at SOPT will be done by cumulating data from each project.

*7. Cumulative effects of transport infrastructure projects on Natura 2000 **

No.			Number of transport infrastructure projects					
			Road		Railways		Waterways	
			New route	Rehabilitation of existing route	New route	Rehabilitation of existing route	New route	Rehabilitation of existing route
1	Road	New route	1	0	0	0	0	0
2		Rehabilitation	0	0	0	0	0	0
3	Railways	New route	0	0	0	0	0	0
4.		Rehabilitation	0	0	1	0	0	0
5.	Waterways	New route	0	0	0	0	0	0
6.		Rehabilitation	0	0	0	0	0	0
Total			1	0	1	0	0	0

* Separate statements for SCI and SPA will be produced.

Data in the project proposal stage is collected from the beneficiary of the projects through the environmental permit analysis, decision screening stage, the EIA report, Natura 2000 statement and the appropriate assessment study.

In the implementation phase of the project data will be collected from the monitoring of environmental factors reports prepared by the constructor and delivered by the beneficiary to MA SOPT.

Data aggregation at SOPT will be done by done by cumulating data from each project.

8. Number of transport infrastructure projects proposed to be realised in the vicinity of Natura 2000 sites

No.	Impact	Number of transport infrastructure projects					
		Road		Railways		Waterways	
		New route	Rehabilitation of existing route	New route	Rehabilitation of existing route	New route	Rehabilitation of the existing route or other interventions
1	SCI	1	0	0	3	0	1
2	SPA	1	0	0	0	0	1
	Total	1*	0	0	3	0	1*

* The same project is proposed in the vicinity of SCI and SPA

9. Number of transport infrastructure projects for which compensatory measures were necessary

No.	Impact	Number of transport infrastructure projects					
		Road		Railways		Waterways	
		New Route	Rehabilitation of existing road	New Route	Rehabilitation of existing road	New Route	Rehabilitation of existing road
1	SCI	0	0	0	0	0	0
2	SPA	0	0	0	0	0	0
	Total	0	0	0	0	0	0

Imposing countervailing measures is made through the environmental permit. Aggregation at SOPT level is done by aggregating the number of projects for which the environmental authorities have imposed compensatory measures.

Taking into account the characteristics of transport infrastructure projects, the current state of the infrastructure and the importance of promoting an infrastructure that can support inter-modal transport, it is necessary to be able to quantify the number of projects, which can have cumulative effects on biodiversity. Each EIA report or appropriate assessment has a chapter dedicated to the analysis of the cumulative impact of that project with other projects or activities from the project location. For each protected area the legislation provides a detailed analysis of the cumulative impact.

10. Number of transport infrastructure projects for which positive effects on protected areas have been identified

No.	Positive effects	Number of transport infrastructure projects					
		Road		Railways		Waterways	
		New Route	Rehabilitation of existing route	New Route	Rehabilitation of existing route	New Route	Rehabilitation of the existing route or other interventions
1	SCI	0	0	0	0	0	1
2	SPA	0	0	0	0	0	1

Considering that some projects propose the relocation of existing routes or the transport relocation from existing transport routes passing through Natura 2000 sites, with positive effects on habitats and species, it is important to highlight their number.

For clarification, this indicator will be accompanied by an explanation of the type of positive impact of the projects (tunnels, viaducts, relocation of routes outside sites, etc.).

ANNEX 1 Indicators set for TEN-T 22 –TEN-STAC project

P22 Railway line Athenia-Sofia-Budapest-Wien-Praha- Nürnberg/Dresden

Short description of the project

The proposed improvements in this corridor are described elaborately in 0. A short description of the planned infrastructure projects can be found in the following table.

Project #	Project name	Proposed final agregated sections		Sub-sections (30.09.2003 list + last DG TREN precisions)	Subsection stard date	Subsection end date
P22	Railway line Athina-Sofia-Budapest-Wien-Praha-Nürnberg/Dresden	P22.1	Railway line Greek/Bulgarian border-Kulata-Sofia-Vidin/Calafat	P22 BG Kulata – Vidin/Calafat	2010	2015
		P22.2	Railway line Curtici-Brasov (towards Bucuresti and Constanta)	P22 RO Curtici - Brazov	2005	2010
		P22.3	Railway line Budapest-Wien , cross-border section	P22 A Budapest – Sopron – Wien	2004	2010
				P22 HU Budapest – Sopron – Wien	2004	2010
		P22.4	Railway line Brno-Praha-Nürnberg , with NürnbergPraha as cross-border section.	P22 CZ Brno-Praha-Czech Border	2003	2015
				P22 D CZ Border Schirnding – Marktredwitz – Nurnberg	2012	2015

These improvements correspond with priority project number 6 indicated by the High Level Group. The projects consist of the upgrading of existing railway lines and partly the construction of new railway lines along a major railway axis from the Black-sea ports and the ports of Athens and Thessaloniki to Central Europe. The railway line is a mixed passenger/ freight line. The Eastern part has two branches; one in the direction of Romania and one in the direction of Greece.

The aim is to increase capacity, reduce journey times and transport costs. On a more strategic level the railway line furthers regional and port development by providing improved hinterland connections for the ports in Romania and Greece. The railway line will form one of the backbones of the rail network of Eastern Europe.

Project fiche P22

Project	Description			
P22 Railway line Athina – Sofia – Budapest – Wien – Praha – Nürnberg/ Dresden	The project is the backbone of the railway network of Eastern Europe, connecting the ports of Athens, Thessaloniki and Constanta to the enlarged Union. The selected sections will complete an axis on which future Member States have already invested through the ISPA programme and will achieve thus a connectivity of networks on the basis of common standards (TER and ERMTS, double track, electrified, with maximum speed from 160 to 200 km/ h). This line will foster traffic and trade within a big part of Europe. It will also provide the Greek network with an important hinterland.			
Sections of the Project	Objectives	Description	Start date	End date
P22.1 Railway line Greek/ Bulgarian border – Kulata – Sofia – Vidin/ Calafat	This project is part of Pan-European Transport Corridors and it provides the land railway connection of Greece with the EU Member States of Central and Western Europe. From year 2007, the railway line will connect 4 Member States: Greece, Bulgaria, Romania and Hungary. Besides, the construction of the Danube Bridge at Vidin/ Calafat, which will be completed in year 2007, will eliminate the main bottleneck along the corridor and together with the modernisation of the railway line, will create conditions for uninterrupted rail transport between Greece, Bulgaria, Romania and Hungary and Western Europe. There will be also a reduction of waiting time at the border crossing.	The project includes construction of new double track and reconstruction of existing single-track section for speed up to 160 km/h along the Vidin – Sofia – Kulata railway line. The approximate total length is expected to be 420 km (now 480 km). In particular the upgrade of existing single-track sections is needed for 130 km, the upgrade for tunnels is needed for 5 km and for bridges for other 5 km. The construction of new double track sections is needed for 250 km, 25 km of tunnels and 5 km of bridges. All the design and construction works will be in full compliance with Directive 2001/16/EC on the interoperability of trans-European conventional rail system and Directive 96/48/EC on the interoperability of the trans European high-speed rail system. In particular the design and interoperability standards will be TER and ERMTS.	2010	2020
P22.2 Railway line Curtici – Brasov (towards Bucuresti and Constanta)	The objectives of this project are mainly the increase in traffic safety and the reduction in the travel duration that will be of 78 minutes in passengers' traffic and of 120 minutes in freight traffic.	The line will be rehabilitated on its total length of 481 km and it is located in the centre of Romania, in the Transylvania region. This project involves 2 tunnels with a total length of 1448 m. The expected capacity is 148 trains/ day. The design and interoperability standards will be in compliance with EU and UN/ECE standards. In particular they will be AGTC and AGC parameters for railways.	2005	2010
P22.3 Railway line Budapest – Wien, cross-border section	The objective of this section is mainly to contribute to face the high international traffic and its high potential for future increase. Besides, the time at the border will be reduced of several minutes.	The project includes a section of 67 km to be upgraded between Hegyeshalom and Budapest (completion of works already achieved in 1997) and a section of 70 km between Wien – Wampersdorf – Hungarian/ Austrian border (Sopron). It will be added the 2nd track between Wien and Sopron. Design and interoperability standards will be	2004	2010

		compliant with EU and UN/ECE standards.		
P22.4 Railway line Brno – Praha – Nürnberg, with Nürnberg – Praha as cross-border section.	The main objective of the project is to contribute to the improvement of accessibility and transport safety along the corridor.	The project involves the electrification of the line Nurnberg – Marktredwitz – border D/ CZ together with the line Marktredwitz – Reichenbach. There are numerous tunnels involved between Hersbruck and Pegnitz. The expected capacity between Nurnberg – Marktredwitz – Hof is 145 trains per day and direction. The Nurnberg – Marktredwitz line will be 2 tracks and the Marktredwitz – border D/ CZ line will be 1 track. Design and interoperability standards will be compliant with EU and UN/ECE standards.	Not sched uled	Not schedu led

Impact on the level of traffic flows

The impact at the level of traffic flows is identified at infrastructure level as follows:

- Rail passenger flows P22, total interregional,
- Rail passenger flows P22, international,
- Rail freight flows P22, total interregional.
- Rail freight flows P22, international.

The impact at the level of traffic flows is illustrated by the figures hereunder.

Rail passenger flows P22, total interregional

Rail passenger flows P22, international

Rail freight flows P22, total interregional

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Rail freight flows P22, international

Estimated aggregated impacts of the high priority project

In the following table, the impact variables are presented for all subsections of the high priority project. The methodology of the impact variables is described in D6 Chapter 3.6.

Impact variables P22: Railway line Athina-Sofia-Budapest-Wien-Praha-Nürnberg/Dresden

Objective	Indicator	P22.1	P22.2	P22.3	P22.4	P22 Total
ECONOMIC IMPACTS IN THE TRANSPORT SECTOR						
IMPROVEMENT OF ROAD LEVEL SERVICE	(1) Changes in time costs caused by road congestion (mln. € / year)	-10.6 (-2.1)	-0.7 (-0.6)	-0.6 (-1.1)	-2.2 (-1.6)	**-14.2** (-5.4)
REDUCTION OF TRAVEL TIME	(2a) Changes in monetary value of the reduction of passenger travel time (mln. € / year)	-42.6 (-40)	-101.1 (-94.4)	-12.7 (-14.3)	-45.3 (-50.6)	**-201.7** (-199.2)
	(2b) Changes in passenger travel time (mln hour / year)	-7.8 (-7.8)	-18.8 (-18.5)	-1.2 (-1.4)	-4.6 (-5.3)	**-32.5** (-33)
	(3) Changes in monetary value of the reduction of freight travel time (mln. € / year)	-11.2 (-11.1)	-14.8 (-14.8)	-1.4 (-2.7)	-8.4 (-11.8)	**-35.8** (-40.3)
ENVIRONMENTAL SUSTAINABILITY						
GLOBAL WARMING	(4a) Change (in monetary value) of the transport contribution to global warming (1000 € / year)	754 (-3430)	-3549 (-3208)	-248 (-159)	-4342 (-2929)	**-7385** (-9726)
	(4b) Change of the transport contribution to global warming (1000 kg CO2 / year)	32087 (-145945)	-151002 (-136519)	-10533 (-6749)	-184746 (-124622)	**-314194** (-413835)
ATMOSPHERIC POLLUTION	(5a) Change (in monetary value) of the NOX transport emission (1000 € / year)	-1152 (-262)	-177 (683)	58 (360)	-726 (41)	**-1997** (822)
	(5b) Change of the NOX transport emission (1000 kg NOx / year)	-131 (-72)	253 (626)	95 (194)	-43 (78)	**174** (826)
	(6a) Change (in monetary value) of particulates' emissions of transport (1000 € / year)	14 (-1)	103 (172)	54 (90)	25 (100)	**196** (361)
	(6b) Change of particulates' emissions of transport (1000 kg particulates / year)	4 (1)	22 (38)	7 (11)	7 (10)	**39** (59)
TRANSPORT SAFETY	(7) Variation on monetary value of accidents (mln. € / year)	-18.2 (-5.4)	-6.7 (-8.8)	-7.4 (-2.4)	-47.3 (-10.7)	**-79.7** (-27.3)

Objective	Indicator	P22.1	P22.2	P22.3	P22.4	P22 Total
FINANCIAL AND ECONOMIC FEASIBILITY						
INVESTMENT COST	(8) Total project costs (mln. €)	2400	1455	1510	510	**5875**
ECONOMIC FEASIBILITY	(9) Ratio 2020 monetary benefits / project total cost (%)	3.5 (2.6)	8.7 (8.3)	1.5 (1.3)	21.2 (15.2)	**5.8** (4.8)
GENERAL TRANSPORT RELEVANCE						
TOTAL TRAFFIC VOLUME ON THE PROJECT	(10) Total passenger traffic on the project section (mln. passengers / year)	1.4 (1.4)	4.1 (4)	1.2 (1.3)	2.5 (2.9)	**9.1** (9.7)
	(11a) Maximum freight traffic on the project section (mln. ton / year)	9.7 (10.3)	27.4 (27.5)	16.0 (18.4)	41.9 (40.5)	**41.9** (40.5)
	(11b) Average freight traffic on the project section (mln. ton / year)	5.2 (5.5)	15.6 (15.8)	0.6 (0.9)	12.3 (12.6)	**33.7** (34.8)
	(11c) Total freight traffic on the project section (bln. ton km /year)	5.7 (0.8)	15.4 (2.5)	11.3 (4)	19.2 (6.8)	**51.7** (14)
INTERMODALITY	(12) Quantitative appraisal of the project's contribution for an intermodal transport system (mln. ton)	2.6 (3.5)	3.1 (3.3)	1.2 (0.5)	2.1 (1.6)	**9.0** (8.9)
CREATION OF EUROPEAN VALUE ADDED						
DEVELOPMENT OF INTERNATIONAL PASSENGER TRAFFIC	(13) Share of international passenger traffic on total traffic on the project (%)	17.3 (17.3)	36.2 (34.7)	22.6 (33.3)	31.0 (28.4)	- -
	(14) Volume of international passenger traffic on the project (mln. passengers / year)	0.2 (0.2)	1.5 (1.4)	0.3 (0.4)	0.8 (0.8)	**2.8** (2.9)
DEVELOPMENT OF INTERNATIONAL FREIGHT TRAFFIC	(15) Share of international freight traffic on total traffic on the project (%)	38.8 (37.9)	60.5 (60.7)	54.4 (70.7)	71.7 (71.9)	- -
	(16) Volume of international freight traffic on the project (mln. tons / year)	2.0 (2.1)	9.4 (9.6)	0.3 (0.6)	8.8 (9)	**20.6** (21.4)
INTEROPERABILITY	(17) Reduction of passengers waiting time at borders for international traffic (-)	N/a	N/a	N/a	N/a	-
	(18) Reduction of freight waiting time at borders for international traffic (-)	N/a	N/a	N/a	N/a	-
	(19) Length of networks becoming interoperable because of the project (-)	N/a	N/a	N/a	N/a	-
IMPROVEMENT OF ACCESSIBILITY						

Objective	Indicator	P22.1	P22.2	P22.3	P22.4	P22 Total
PASSENGER ACCESSIBILITY	(20) Variation of the STAC centrality index for passenger transport (%)	0.01 (0)	0.03 (0.02)	0.00 (0)	0.14 (0.03)	- -
FREIGHT ACCESSIBILITY	(21) Variation of the STAC centrality index for freight transport (%)	0.00 (0.04)	0.04 (0.07)	0.00 (0.04)	0.01 (0.04)	- -

Objective	Indicator	P22.1	P22.2	P22.3	P22.4	P22 Total
PERIPHERAL ACCESSIBILITY	(22) Variation of the STAC centrality index for passenger transport in regions identified as peripheral (%)	0.01 (0.02)	0.03 (0.05)	0.00 (0)	0.03 (0.02)	- -
	(23) Variation of the STAC centrality index for freight transport in regions identified as peripheral (%)	0.00 (0)	0.02 (0)	0.00 (0)	0.00 (0)	- -
ENVIRONMENTAL SUSTAINABILITY						
MODAL REBALANCING	(24) Volume of road freight traffic shifted to rail, IWW or sea transport (mln. t·km / year)	439 (2053)	2292 (2322)	534 (265)	2442 (1757)	**5707** (6397)
	(25) Volume of road and air passenger traffic shifted to rail (mln. passenger·km / year)	-29 (141)	409 (633)	59 (124)	545 (233)	**984** (1131)
LEVEL OF CONCERN :TRAFFIC TRANSFER	(26) Transfer of traffic from infrastructure lying in sensitive zones to the projected infrastructure % of road traffic transferred from sensitive areas	4.7% (-1.4%)	-0.1% (-0.7%)	2.7% (-0.1%)	17.8% (-0.4%)	- -
LEVEL OF CONCERN: DISTANCE	(27) Percentage of the length of the project lying in a sensitive area (% length)	9.0%	0.0%	37.0%	27.0%	-
LEVEL OF CONCERN: EMISSIONS	(28a) Changes of inhabitants' level of concern caused by emissions of NOx (% NOx)	-0.7% (-1.5%)	-2.3% (-2.4%)	-1.2% (-0.2%)	-1.0% (-0.5%)	- -
	(28b) Changes of inhabitants' level of concern caused by emissions of particulates (% particulates)	-0.7% (-1.7%)	-2.7% (-2.6%)	-1.5% (-0.1%)	-1.5% (-0.5%)	- -
LEVEL OF CONCERN: PROXIMITY	(29) Synthetic appreciation of the proximity of the project from specially protected areas (SPAs) or densely populated areas (Proximity of the project from SPA (km))	38.0%	0.0%	6.0%	7.0%	-
MATURITY AND COHERENCE OF THE PROJECT						
DEVELOPMENT OF THE PROJECT	(30) Appraisal of the project planning status (-)	0	1	1	1	-
INSTITUTIONAL SOUNDNESS	(31) Qualitative appraisal of the project's compliance with national plans (-)	2	2	5	4	-
COHERENCE OF THE PROJECT	(32) Qualitative appraisal of the project's coherence with main international traffic corridors (-)	2	2	2	2	-

Impact on passenger volumes and modal shift

- Passenger transport volumes vary on average between 1.4 mln passenger for P22.3 (Railway line Budapest – Wien, cross-border section) and 4.1 mln for P22.2 (Railway line Curtici – Brasov, towards Bucuresti and Constanta).
- The project is forecasted to result in a decrease of road passenger transport performance by 984 mln pkm per year.

Impact on freight volumes and modal shift

- The total transport volumes amount are between 0.6-15.6 mln ton. The share of international transport in total transport is 50-60% ;
- The project will result in an increase in the transported rail freight tonnage in the corridor of 9.0 mln ton at the expense of (primarily) road freight transport;

Impact on infrastructure network use

The detailed analysis carried out by the consortium has revealed the following impacts on infrastructure use:

- The growth of rail passenger traffic flows can be observed all along the project corridor, in particular on the border crossing sections between Romania and Hungary. Apart from the links on the project an increase in rail passenger flows can be expected for München – Nürnberg and Constanta – Bukuresti – Brasov.
- Road passenger flows are expected to decrease, particularly along Bucuresti/ Brasov – Sibiu – Arad – Szeged – Budapest.
- The freight traffic flows are growing also along the project corridor, even up to the Baltics in the North and Western France, South Germany in Bavaria and to the Netherlands. However, rerouting effects are also observed.

Impact on freight transport performance – shift to rail

- Total transport shift to rail freight of the P22 scenario is 5,7 bill. ton-km.

Impact on emissions

The overall impact on emission is quantified from the impact at the network level and the differences between the all project scenario and the reference 2 scenario are as follows:

- CO_2: net decrease with 314 thousand tonnes,
- NO_x: net increase with 0.2 thousand tonnes,
- PM-10: net increase with 0.04 thousand tonnes.

The relatively small increase of NO_x and particulates is explained by the further use of diesel locomotives, which show a high emission rate of these emissions.

Annex 2 Indicators set for TEN-T 18 – TEN-STAC project

P18 Rhine/Meuse-Main-Danube inland waterway route

Short description of the project

The proposed improvements in this corridor are described elaborately in 0. A short description of the planned infrastructure projects can be found in the following table.

Project #	Project name	Proposed final agregated sections		Sub-sections (30.09.2003 list + last DG TREN precisions)	Subsection stard date	Subsection end date
P18	Rhine/Meuse-Main-Danube inland waterway route	P18.1	Rhine-Meuse with the lock of Lanaye as cross-border section	P18 B Lock of Lanaye	2006	2010
				P18 NL Rhine - Meuse	2005	2019
		P18.2	Vilshofen-Straubing	P18 D Vilshofen – Straubing	2008	2013
		P18.3	Wien-Bratislava cross-border section	P18 A Wien - Bratislava	2006	2015
		P18.4	Palkovicovo-Mohàcs	P18 HU Palkovicovo–Mohàcs	2007	2014
		P18.5	Bottlenecks in Romania and Bulgaria .	P18 RO Romania	2002	2011
				P18 BG Bulgaria	2004	2011
		P18.6	Inland waterway Seine - Scheldt	Inland waterway Seine - Scheldt	n.a.	2020

These improvements are the projects combined in the High Level Group priority project number 2 and list 4 project number 4. They involve improvements of the Seine-Meuse-Scheldt waterway network in Western Europe and projects aimed at the improvement of the Danube network in central-eastern Europe. Connecting these two waterway areas is the main waterway along which inland water transport takes place, namely the river Rhine.

Generally most projects aim to increase the draught (eliminating bottlenecks) of the waterways in order to increase the capacity allowing larger vessels to operate on these networks. This will reduce transport cost per ton and waiting times and consequentially improve the competitiveness of inland water transport. This in turn is expected to result is a significant modal shift to inland waterways.

Project fiche P18

Project	Description			
P18 Rhine/Meuse – Main Danube inland waterway route	The project will improve the competitiveness of the waterway in relation to other means of transport on this multimodal route crossing Europe from east to west, in order to encourage the transfer of freight transport from road to inland waterway. Removing bottlenecks on the Rhine-Main-Danube corridor will improve its navigability, favouring the transfer of freight traffic on an increasingly congested route from road to waterways. The mentioned corridor is a major freight route connecting the North Sea (port of Rotterdam) to the Black Sea (in particular the port of Constanta). It will integrate the networks of a number of candidate countries into the European Union. It will also be instrumental in the economic and social cohesion of the acceding countries by creating jobs.			
Sections of the Project	Objectives	Description	Start date	End date
P18.1 Rhine – Meuse with the lock of Lanaye as cross border section	An objective is to increase the importance in the waterway traffic between Netherlands, Belgium and Germany. Currently the Meuse route is a bottleneck. Another fundamental objective is to promote the modal shift. Thanks to this intervention up to 50% of the growth in road traffic can be transferred to Meuse route, being up to 8,300 trucks every 24 h.	The Meuseroute project is situated between Nijmegen and Maastricht/ Belgian border. It connects to the lock of Lanaye, Belgium, where also an enlargement of the lock complex to class Vb is foreseen. The works on the Meuse route in Netherlands consist in an upgrading of the inland Waterway between Nijmegen and Maastricht/ Belgian border from class Va to class Vb, and increasing of draught from 3.0 meters to 3.5 meters. Making the waterway available for container vessels stacked 4 containers high between Nijmegen and Born Container terminal. Heightening of the bridges over the Weurt lock (Nijmegen) by 2.5 meters has to be done, in order to increase the availability of the locks during high waters at the River Waal. All lock complexes are to be upgraded towards a length of 210 meters, width 16 meters and draught 3.5 meters at least, in order to accommodate class Vb vessels, thus the following works have to be done: the building of a new lock at Heumen (Maas-Waal-canal) in order to make two-way traffic from River Maas to the canal possible, the rebuilding of the old locks at Sambeek and Belfeld, in order to increase draught and width of the locks, building a new class Vb lock at Heel, enlarging locks at Maasbracht and Born from class Va lock to class Vb lock, building a new lock near Maastricht, being the entrance to the Juliana canal. The width of the Juliana canal must be enlarged with about 25 meters over a stretch of about 10 kilometres. Smaller adjustments to the River Maas must be made at Neer, Steijl and Venlo to improve navigability. The Maas route is at the moment a class Va waterway with depth, heights and width restrictions. Thanks to the upgrading it will become navigable for class Vb vessels instead of class Va. A further growth of goods, up to 50 % is therefore	2005	2019

		possible on this waterway. Up to 50 % of the growth of truck traffic, expected on the A2 motorway, can be transferred to the Meuseroute waterway after upgrading, thus creating less congestion on the motorway. Regarding the lock of Lanaye, a new lock will be built and the end of the works is expected to be in 2010. The new construction will improve the interconnection between the Wallon Region and the Rhine – Main – Danube through the Netherlands.		
P18.2 Vishofen – Straubing	The objective of this section is to eliminate the "strategic bottleneck" and to improve the shipping conditions. The promotion of the waterway transport has to be considered and the interventions on this section will contribute to shift in 2015 114,000 tonnes from road to waterborne transport.	This section is a part of the transnational axis between Rotterdam and the Black Sea. The length of the section to be upgraded is about 70 km. According to forecast a freight volume of 114000 t will be shifted to waterway transport in 2015. In total, a cargo volume of approximately 11 Mt is predicted by 2015. The percentage of border crossing transport in 2015 is predicted at 97,3%.	2008	2013
P18.3 Wien – Bratislava cross border section	In context with the intention to shift transport from road to more ecological inland waterways, the upgrade of the Danube river will be in accordance with European transport policy. No new construction of infrastructure will be necessary; the project leads to an improvement of the environmental balance and transport safety. Furthermore the growing together of an economic area of European importance will be accelerated.	The project consists in an upgrade of the section between Wien and Bratislava for a length of 47 km to eliminate bottlenecks in the Danube inland waterway. The existing facilities have an unsatisfying waterway depth (draught < 2m). It has to be increased to 2.7 m in order to reach the LNRL Level (Low Navigation and Regulation Level = water level that corresponds to the flow available for 94% of the duration of the navigable season). The width of the navigable section has to be 100 m - 120 m. The tonnes-kilometres/ year to be shifted from road to waterborne transport are about 1.25 billions tonnes-kilometres/ year on the Austrian section.	2006	2015
P18.4 Palkovico – Mohacs	This section will contribute to shift transport from road to waterways. (After completion of the works approximately a quantity of 100 000 tons will be shifted to waterborne transport exclusively from the volume of Hungarian exports and imports simultaneously additional growth will be initiated by the shift of an even greater volume coming from the volume of the transit passing through Hungary).	The length of this section is 358 km. Bottlenecks on the Danube waterway along those km have to be eliminated, by the upgrading of some parts of the section. From the Slovak - Hungarian section (Palkovicovo - 1,811.0 km) to 1,708.2 km is required an upgrading for draught to 2.70 m (lowest recorded draught at dry seasons is 1.70 m) and an upgrading for height under bridges to 9.10 m (current height under bridge is 7.75 m). The section from 1,708.0 km to Budapest at 1,652.0 km - lowest recorded draught is 1.70 m and has to be upgraded as well as between the km 1632-1433 where lowest recorded draught 2.00 metres. No new sections have to be built. Basically there are no tunnels and bridges involved by these works. The improvements are aimed at ensuring a proper fairway for inland waterways transport.	2007	2014

P18.5 Bottlenecks in Romania & Bulgaria	The interventions included in the project of this section will improve the navigation safety on the Danube. The conditions for permanent navigation will be ensured even when the river levels are low. The time for transit crossing of Bulgarian – Romanian section of the river will significantly decrease as well as the operational costs. The development of cartographic and information systems will establish a Bathymetric map and it will be used by all the countries as a tool for communication and for joint social and economic cohesion projects development.	This project includes some interventions on the Romanian and Bulgarian territory aim to improve the inland waterways navigability. The Romanian sector of the Danube frames within km 1075, at the entrance into the country, and the point where Sulina Arm issues into the Black Sea. On the sector between km 1075 and km 863, the river has a dammed flow regimen, due to the construction of the Hydrotechnical and Navigation Systems Portile de Fier (Iron Gates) I and II. Downstream km 863, the river has a natural flow regimen. On the river sector between km 863 and km 175, due to the variable flow regimen, to the drift and accumulation of alluviums, and to the existence of a great number of secondary arms, in certain areas, during the low water periods, there occur navigation bottlenecks, due to the low depths of 1-1.5 m, much lower than the recommended minimal depths, of 2.5 m. Such phenomena occur in periods of 60 to 150 days/ year. Downstream km 175, there is Danube's river-sea sector. On the sector between km 63 and km 0, Sulina Channel, the bank protections executed during the period 1954-1965 could not cope with the traffic volume (especially sea vessels traffic) and with the size of the ships that navigate in that area. Hence, a massive erosion and destruction of banks has occurred, and the effect of this phenomenon is the frequent flooding of the neighbouring localities, and the negative impact on Danube's Delta. In the main ports of Danube's Romanian sector, it is also necessary to create a system for disposal of residues, wastewater and waste from ships, so as to prevent water pollution by ships. In order to eliminate the navigation hindrances, the following works are necessary. In the sector between km 845.5 and km 375, there are necessary hydrotechnical works for assuring natural dredging of alluviums and, consequently, depths over 2.5 m during the low water periods. In the sector between km 375 and km 175, there are necessary works for closing secondary arms and for calibrating the riverbed, with a view to increase the water volume on the main channel of the Danube during the low water periods and, consequently, to assure the minimal navigation depths. In the sector between km 175 and km 63, there are necessary works for riverbed calibration, fairway stabilisation and cutting-off of Danube's riverbed in Tulcea area. In the sector km 63 – km 0 – Sulina Channel, there are necessary works for banks' protection, water and alluvium streams' control, and reduction of water discharges. The bank protection works are necessary on a length of approx. 100 km. Works' execution started in 1984. Until 2003, the works have been completed on 32 km. Besides the above-mentioned works, in order to improve the river transport on Danube's Romanian sector, the	1982	2011

		following works are also necessary: The repair and improvement of the port infrastructure in the Romanian ports; The works' completion at the Danube – Black Sea Canal (slopes and electrical installations); The system for disposal of waste and wastewater. Concerning the Bulgarian sector, the project envisages fairway improvements of the sections from rkm 530 to rkm 520 and rkm 576 to rkm 560 of the Danube river to ensure international navigation safety. The following conditions for navigation have to be guaranteed: Depth of 2.50 m under "0" conditional water level for the relevant river sections, which will ensure minimum 3.50 m draw depth at low water navigation level and width of the navigation route 180 m. Currently no facilities exist. The project completion will improve the navigation safety on the Danube. The conditions for permanent navigation will be ensured even when the river levels are low. The time for transit crossing of Bulgarian-Romanian section of the river will significantly decrease. The transport costs will decrease with 0.030 EURO for t/ km.		
P18.6 Inland waterway Seine – Scheldt	The improvement of the Seine - Scheldt river link will connect the Parisian Region and Seine basin with the entire Benelux inland waterway network. This link forms part of a vital transport route in a highly - developed economic and industrial region, connecting in particular the ports of Le Havre, Rouen, Dunkirk, Antwerp and Rotterdam.	The project is formed by a Belgian and a French part. The works will improve the navigability of the Seine Scheldt river link. In Belgium the distance covered is 80 km while in France is 105 km. Currently, the navigability on the French part of the section is at the lower end of international standards, with access restricted to vessels of no more than 400 to 750 tonnes on some stretches. The project comprises the construction of a channel with large gauge of about hundred kilometres, which will allow the conveying of loadings, which can reach 4,400 tonnes. The route selected departs from valleys and from the inhabited areas, thus limiting the impact of the project on the natural inheritance. Belgium also plans to improve navigability on the Scheldt north to give access to vessels up to 4,400 tonnes. The works will therefore ensure continuity between the inland waterways basins of the North of France and Benelux. The project will assist transit traffic and alleviate land - based transport congestion and it will have a beneficial effect on the adjacent regions, where transport platforms could be developed. Numerous jobs could be created, about 8,000 units over 5 years.		2020

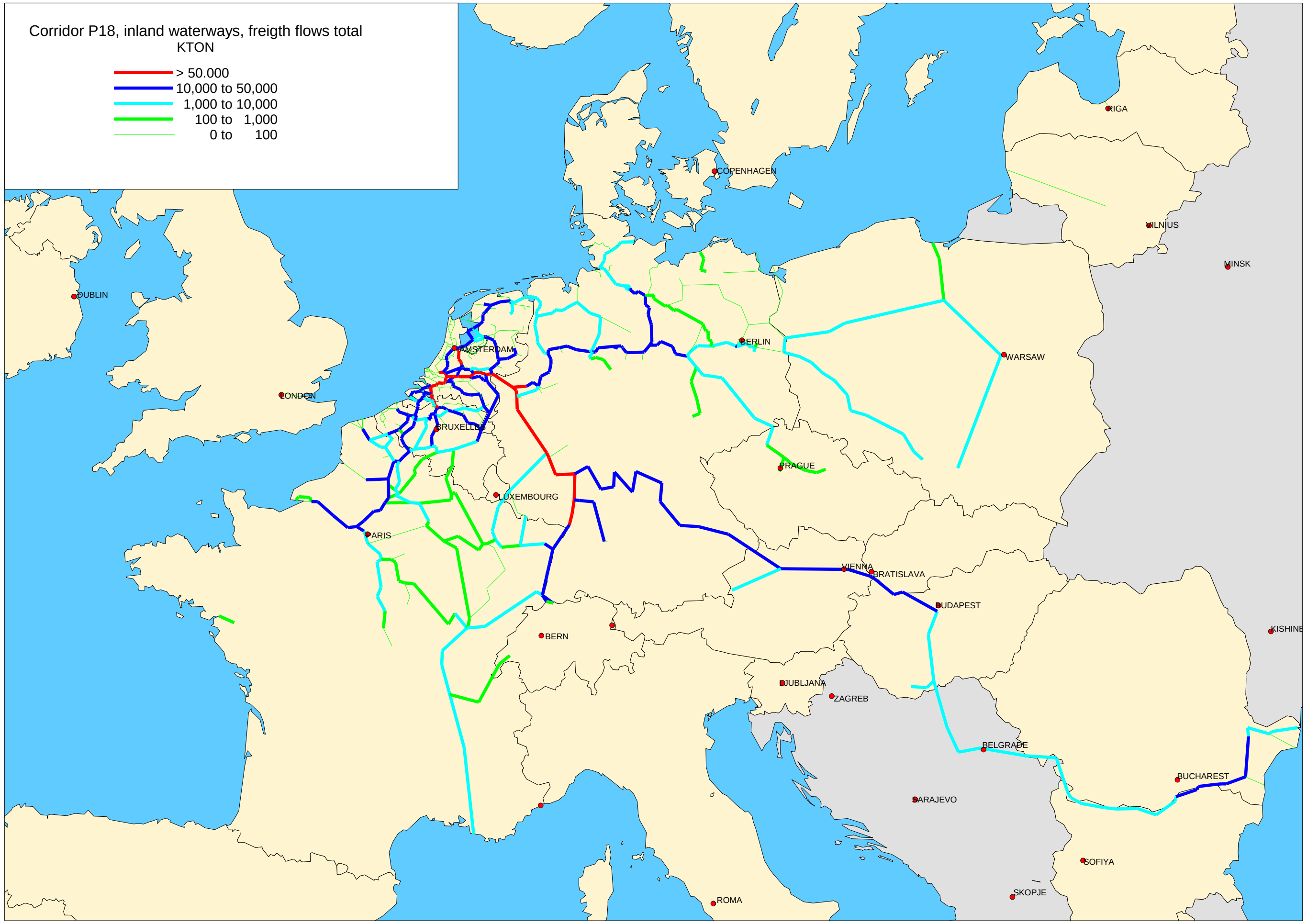
Impact on the level of traffic flows

The impact at the level of traffic flows is identified at infrastructure level as follows:

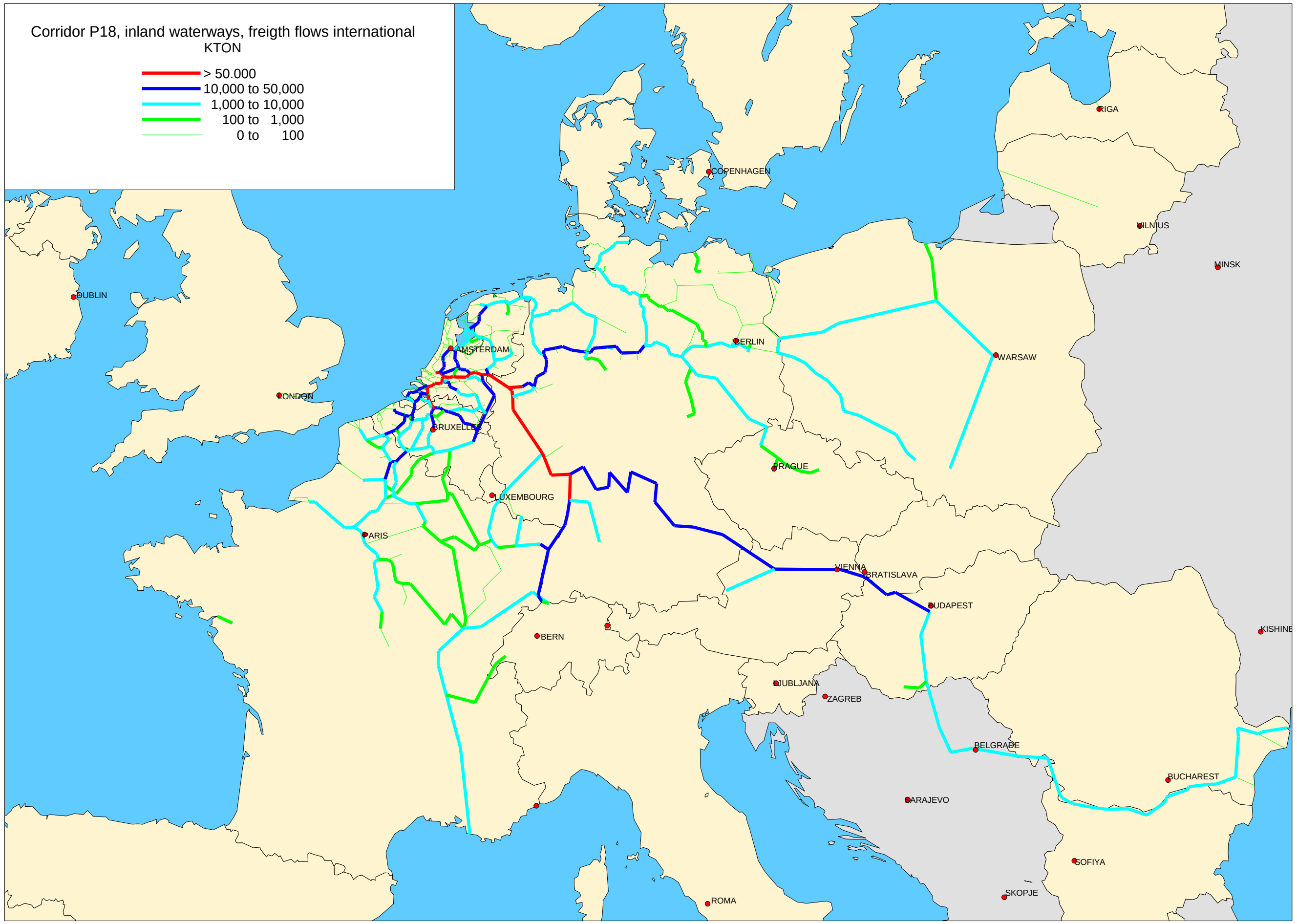
- Inland waterways freight flows P18 total interregional,
- Inland waterways freight flows P18 international.

The impact at the level of traffic flows is illustrated by the figures hereunder.

Inland waterways freight flows P18, total interregional



Inland waterways freight flows P18, international



Estimated aggregated impacts of the high priority project

In the following table, the impact variables are presented for all subsections of the high priority project. The methodology of the impact variables is described in D6 Chapter 3.6.

Impact variables P18: Rhine/Meuse-Main-Danube inland waterway route

Objective	Indicator	P18.1	P18.2	P18.3	P18.4	P18.5	P18.6	P18 Total
ECONOMIC IMPACTS IN THE TRANSPORT SECTOR								
IMPROVEMENT OF ROAD LEVEL SERVICE	(1) Changes in time costs caused by road congestion (mln. € / year)	-1.8 (-33.8)	-0.2 (-0.9)	-0.4 (-2.3)	-0.3 (-2.2)	-0.5 (-2.1)	0.0 (-0.1)	**-3.1** (-41.5)
REDUCTION OF TRAVEL TIME	(2a) Changes in monetary value of the reduction of passenger travel time (mln. € / year)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	**0.0** (0)
	(2b) Changes in passenger travel time (mln hour / year)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	**0.0** (0)
	(3) Changes in monetary value of the reduction of freight travel time (mln. € / year)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	**0.0** (0)
ENVIRONMENTAL SUSTAINABILITY								
GLOBAL WARMING	(4a) Change (in monetary value) of the transport contribution to global warming (1000 € / year)	-16514 (-147632)	-48318 (-17031)	10325 (-43129)	4058 (-36453)	2093 (-34767)	96702 (-40633)	**48346** (-319645)
	(4b) Change of the transport contribution to global warming (1000 kg CO2 / year)	-702695 (-6282242)	-2056068 (-724717)	439375 (-1835255)	172683 (-1551191)	89033 (-1479439)	4114979 (-1729060)	**2057307** (-13601902.8)
ATMOSPHERIC POLLUTION	(5a) Change (in monetary value) of the NOX transport emission (1000 € / year)	-5373 (-322654)	-1733 (-16722)	40844 (-59548)	16741 (-51623)	13382 (-45858)	119788 (-305)	**183648** (-496710)
	(5b) Change of the NOX transport emission (1000 kg NOx / year)	-121	306	5187	3283	3212	18955	**30823**

Objective	Indicator	P18.1	P18.2	P18.3	P18.4	P18.5	P18.6	P18 Total
		(-33530)	(-2662)	(-8624)	(-7398)	(-6766)	(-8624)	(-67603.8)
	(6a) Change (in monetary value) of particulates' emissions of transport (1000 € / year)	134	495	4396	3667	3236	14837	**26765**
		(-36508)	(-3771)	(-7679)	(-6229)	(-5636)	(-709)	(-60531.5)
	(6b) Change of particulates' emissions of transport (1000 kg particulates / year)	-1	27	269	198	193	845	**1531**
		(-1692)	(-140)	(-429)	(-367)	(-342)	(-481)	(-3452)
TRANSPORT SAFETY	(7) Variation on monetary value of accidents (mln. € / year)	-4.3	-0.2	-1.2	-0.9	-3.7	-1.8	**-12.1**
		(-6.6)	(-2.1)	(-2.7)	(-2.3)	(-2.5)	(-1.7)	(-17.9)
FINANCIAL AND ECONOMIC FEASIBILITY								
INVESTMENT COST	(8) Total project costs (mln. €)	498	128	180	250	777	2710	**4543**
ECONOMIC FEASIBILITY	(9) Ratio 2020 monetary benefits / project total cost (%)	5.6	39.0	-30.0	-9.3	-1.9	-8.5	**-5.4**
		(109.9)	(31.7)	(64.1)	(39.6)	(11.7)	(1.6)	(20.6)
GENERAL TRANSPORT RELEVANCE								
TOTAL TRAFFIC VOLUME ON THE PROJECT	(10) Total passenger traffic on the project section (mln. passengers / year)	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
		(0)	(0)	(0)	(0)	(0)	(0)	(0)
	(11a) Maximum freight traffic on the project section (mln. ton / year)	28.5	16.0	15.0	12.1	14.4	18.7	**28.5**
		(30.6)	(16.4)	(15.3)	(12.4)	(14.5)	(17.8)	(30.6)
	(11b) Average freight traffic on the project section (mln. ton / year)	28.5	16.0	15.0	12.1	10.3	18.7	**100.6**
		(30.6)	(16.4)	(15.3)	(12.4)	(10.4)	(17.8)	(102.9)

Objective	Indicator	P18.1	P18.2	P18.3	P18.4	P18.5	P18.6	P18 Total
	(11c) Total freight traffic on the project section (bln. ton km /year)	4.8 (4.8)	6.4 (6.6)	4.2 (4.3)	3.6 (3.6)	5.4 (5.5)	7.9 (7.4)	**32.3** (32.1)
INTERMODALITY	(12) Quantitative appraisal of the project's contribution for an intermodal transport system (mln. ton)	1.4 (1.5)	1.7 (1.9)	0.6 (0.6)	0.7 (0.8)	3.2 (3.3)	10.9 (9.8)	**18.5** (18)
CREATION OF EUROPEAN VALUE ADDED								
DEVELOPMENT OF INTERNATIONAL PASSENGER TRAFFIC	(13) Share of international passenger traffic on total traffic on the project (%)	N/a (N/a)	N/a (N/a)	N/a (N/a)	N/a (N/a)	N/a (N/a)	N/a (N/a)	**-** -
	(14) Volume of international passenger traffic on the project (mln. passengers / year)	N/a (N/a)	N/a (N/a)	N/a (N/a)	N/a (N/a)	N/a (N/a)	N/a (N/a)	**0.0** (0)
DEVELOPMENT OF INTERNATIONAL FREIGHT TRAFFIC	(15) Share of international freight traffic on total traffic on the project (%)	78.3 (79.8)	99.6 (99.7)	91.3 (90.9)	99.0 (98.8)	84.7 (85.3)	72.9 (71.2)	**-** -
	(16) Volume of international freight traffic on the project (mln. tons / year)	22.3 (24.4)	15.9 (16.3)	13.7 (13.9)	12.0 (12.2)	8.7 (8.9)	13.7 (12.7)	**86.3** (88.4)
INTEROPERABILITY	(17) Reduction of passengers waiting time at borders for international traffic (-)	N/a	N/a	N/a	N/a	N/a	N/a	**-**
	(18) Reduction of freight waiting time at borders for international traffic (-)	yes	N/a	No	0.6	Yes	0.3	**-**
	(19) Length of networks becoming interoperable because of the project (-)	N/a	N/a	N/a	N/a	N/a	N/a	**-**
IMPROVEMENT OF ACCESSIBILITY								
PASSENGER ACCESSIBILITY	(20) Variation of the STAC centrality index for passenger transport (%)	0.00	0.00	0.00	0.00	0.00	0.00	**-**

Objective	Indicator	P18.1	P18.2	P18.3	P18.4	P18.5	P18.6	P18 Total
		(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	-
FREIGHT ACCESSIBILITY	(21) Variation of the STAC centrality index for freight transport (%)	0.00	0.00	0.00	0.00	0.00	0.00	-
		(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	-
PERIPHERAL ACCESSIBILITY	(22) Variation of the STAC centrality index for passenger transport in regions identified as peripheral (%)	0.00	0.00	0.00	0.00	0.00	0.00	-
		(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	-
	(23) Variation of the STAC centrality index for freight transport in regions identified as peripheral (%)	0.00	0.00	0.00	0.00	0.00	0.00	-
		(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	-
ENVIRONMENTAL SUSTAINABILITY								
MODAL REBALANCING	(24) Volume of road freight traffic shifted to rail, IWW or sea transport (mln. t·km / year)	266	1131	430	556	813	2803	**5999**
		(248)	(328)	(229)	(241)	(737)	(2003)	(3786)
	(25) Volume of road and air passenger traffic shifted to rail (mln. passenger·km / year)	-67	3	16	14	67	39	**72**
		(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)	(0)
LEVEL OF CONCERN :TRAFFIC TRANSFER	(26) Transfer of traffic from infrastructure lying in sensitive zones to the projected infrastructure	-1.9%	-1.7%	-0.6%	-7.3%	-8.6%	-1.8%	-
	% of road traffic transferred from sensitive areas	(-2.5%)	(-14.3%)	(-2.5%)	(-2.3%)	(-1.4%)	(-2.4%)	-
LEVEL OF CONCERN: DISTANCE	(27) Percentage of the length of the project lying in a sensitive area (% length)	N/a	N/a	N/a	N/a	N/a	N/a	-
LEVEL OF CONCERN: EMISSIONS	(28a) Changes of inhabitants' level of concern caused by emissions of NOx (% NOx)	-0.5%	-1.4%	-1.8%	-2.1%	-2.9%	-2.6%	-
		(-3.4%)	(-3.9%)	(-1.2%)	(-2.2%)	(-1.4%)	(-2.9%)	-
	(28b) Changes of inhabitants' level of concern caused by emissions of particulates	-0.2%	-1.3%	-1.7%	-2.0%	-3.0%	-3.1%	-

Objective	Indicator	P18.1	P18.2	P18.3	P18.4	P18.5	P18.6	P18 Total
	(% particulates)	(-3.3%)	(-3.8%)	(-1.2%)	(-2.3%)	(-1.6%)	(-3.4%)	-
LEVEL OF CONCERN: PROXIMITY	(29) Synthetic appreciation of the proximity of the project from specially protected areas (SPAs) or densely populated areas (Proximity of the project from SPA (km))	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-
MATURITY AND COHERENCE OF THE PROJECT								
DEVELOPMENT OF THE PROJECT	(30) Appraisal of the project planning status (-)	1	2	1	1	4	1	-
INSTITUTIONAL SOUNDNESS	(31) Qualitative appraisal of the project's compliance with national plans (-)	3	5	4	5	1	3	-
COHERENCE OF THE PROJECT	(32) Qualitative appraisal of the project's coherence with main international traffic corridors (-)	N/a	N/a	N/a	N/a	N/a	N/a	-

Impact on freight volumes and modal shift

- Freight transport volumes in this project vary between 10 mln (P18.5) and 29 mln ton (P18.1). The share of international transport in total freight transport varies between 70-95%.
- The combination of all these inland waterways projects is expected to result in a large shift in freight transport of all grouped projects considered in this chapter. The total shift in freight volumes is 18.5 mln tonnes per year to inland waterways, primarily at the expense of road freight transport but also, to a smaller extent, at the expense of rail freight transport.

Impact on infrastructure network use

The detailed analysis carried out by the consortium has revealed the following impacts on infrastructure use:

- The main changes on the traffic flows are the decrease of both road and rail traffic flows along the inland waterways project sub-sections. It is interesting to observe that also the traffic on the Rhine increase because this river connects both the Danube and the Seine /Meuse operating areas.

Impact on emissions

The overall impact on emission is quantified from the impact at the network level and the differences between the all project run and the reference 2 scenario are as follows:

- CO2: net increase with 2.057 thousand tonnes,
- NOx: net increase with 30 thousand tonnes,
- PM-10: net increase of 1.530 tonnes, because particulates emissions are much higher for inland waterways than for the other modes.