WP 6: "ADB and Green Transport"

Deliverable 6.1
"External costs of transport in ADB area: lessons learnt"

Release date, period:	03.10.2013, Period 04
Responsible organization:	PP10 UNI LUB: Institute of Traffic and Transport Ljubljana PP3 AUTh: Aristotle University of Thessaloniki
Version:	Final version

Note:

The Deliverable 6.1 " External costs of transport in ADB area: lessons learnt" refers to the output 6.1.1 "Survey of external costs calculation methods used in SEE area and country" of the AF and integrates the reports that were delivered independently by the partners involved in the activity. It encompasses five individual taks as described in the next page.

Progress of Activity 6.1 "External costs of transport in ADB area: lessons learnt"

WP6 "ADB and Green Transport" focuses on the calculation of external costs of intermodal transport in ADB area and also on measures for internalising these costs. Responsible partner for the whole work package is Aristotle University of Thessaloniki (ERDF PP3 AUTh).

The first activity of WP6, Activity 6.1: "External costs of transport in ADB area: lessons learnt" provides a general assessment of the environmental impact and externalities of freight transport in relation to the peculiarities and special needs of ADB area. Responsible partner for Activity 6.1 has been ERDF PP10 Uni Lub while ERDF PP3 AUTh and all partners have been main contributors to the processes and tasks of the activity. After discussions and exchange of ideas among the involved partners a workplan was made and Activity 6.1 was divided into five sub activities:

1) Review of external cost calculation (Responsible partner: ERDF PP10 Uni Lub)

2) Survey of external cost calculation approaches applied in projects and initiatives in ADB area (Responsible partner: ERDF PP10 Uni Lub)

3) Compliance of methodologies with the main EU guidelines and with "on-line" manuals for external cost calculation (Responsible partner: ERDF PP11 PBN)

4) Development of a common methodology (Responsible partner: ERDF PP10 Uni Lub)

5) Finalisation of output (Responsible partner: ERDF PP3 AUTh).

The allocation of responsibilities of partners involved in WP6 was thoroughly presented by AUTh at Belgrade meeting and was approved.

Concerning the elaboration of the first and second sub activity, Uni Lub PP10 designed at first a questionnaire on external cost calculation and AUTh PP3 sent comments and suggestions on it. A new version of the questionnaire was created and distributed to partners. All ADB countries sent back their answers, except from Croatia and Italy. PP10 Uni Lub made an overview of recent and on-going projects dealing with external cost calculation and also an analysis of issues related to external costs in SEE area at country level, based on the completed questionnaires. Special emphasis was also given on environmental aspects of legislation on freight transport, environmental management systems for terminals, financial and environmental issues for each ADB country. Afterwards, PP10 Uni Lub prepared a draft report entitled "Review of the external cost calculation approaches", which did not include the questionnaires and county reports for Croatia and Italy. PP3 AUTh and LP provided input and comments on the review and an improved version of the report was created.

The report was revised again, in order to integrate the Croatian questionnaire which was delivered with delay. **The final version will be modified after Italy delivers its questionnaire answers.**

PBN PP11 undertook the elaboration of task concerning the compliance of methodologies with the main EU guidelines and with on-line manuals for external cost calculation and prepared a report entitled "Compliance of methodologies. The analysis implemented in the framework of Task 3 was based on an extensive literature survey and on the results of the questionnaire survey of Task 2. ERDF PP3 AUTh, ERDF PP10 Uni Lub and LP provided comments on the draft report and a new version was also prepared.

The last task of activity 6.1 focused on the development of a methodology for external cost calculation. ERDF PP3 AUTh, after examining crucial aspects of external cost calculation, prepared a draft report describing the alternative approaches for the assessment of external costs and presenting the most appropriate one for the project. ERDF PP3 prepared also some general tables concerning data and parameters on which the calculation process is based and instructions which describe the calculation steps per each cost category and transport mode. This contribution of AUTh was further elaborated by ERDF PP10 Uni Lub concluding to the output report of task 4. ERDF PP3 AUTh made some additional comments and recommendations and the final version of the document on task 4 entitled "Development of a common methodology" was prepared.

After the elaboration of the four main tasks of Activity 6.1, ERDF PP3 AUTh finalized Activity 6.1 by integrating all documents and reports into one deliverable entitled **"External costs of transport in ADB area: lessons learnt"** (6.1-Version 1).

The structure of the final deliverable of activity 6.1 is the following one:

- General information: Chapters 1-6
- Task 1 Review of external cost calculation: Chapters 7,8, Annex 16.1
- Task 2 Survey of external cost calculation approaches applied in projects and initiatives in ADB area: Chapters 9,10
- Task 3 Compliance of methodologies with the main EU guidelines and with "on-line manuals" for external cost calculation: Chapters 11-13
- Task 4 Development of a common methodology: Chapter 14, Annexes 16.2, 16.3, 16.4

Note: The questionnaire and the country report for Italy will be incorporated in this final version when it will be available.

The above description of the work progress in regard to Activity 6.1 is summarized at the following table which presents all preparatory, further elaboration or contribution steps:

Summary Table: Steps of progress of Activity 6.1

Revision/ Version	Time period	Modification steps	Comments	Partners
0.4	January 2013	Proposal of tasks assignment by AUTh in Belgrade meeting and approval.	-	AUTh
0.5	January-February 2013	Design of the survey on external cost calculation and synthesis of a relevant questionnaire.	-	Uni Lub and AUTh
0.51	February 2013	Adaptation of the questionnaire	-	Uni Lub and AUTh
0.52	February 2013	Distribution of questionnaire to all partners and collection of answers.	•Croatia delivered the questionnaire later. •Italy has not delivered the questionnaire yet.	All partners
0.6	February 2013	Preparation of draft version of an output report on Task 1: Review of external cost calculation	-	Uni Lub
0.61	February-March 2013	Comments and remarks on the draft report of Task 1	-	AUTh LP
0.62	April 2013	Preparation of final version of the output report on Task 1: Review of external cost calculation, including also the results of the questionnaire survey and the analysis of the answers at country level.	This version did not include the answers and country reports for Italy and Croatia. Task 1 Review of externalcost calculation. (Chapters 7-10, Annex 16.1 of Deliverable)	Uni Lub
0.7	March-June 2013	Preparation of draft version of an output report on Task 3: Compliance of methodologies with the main EU guidelines and with "on-line manuals" for external cost calculation	-	PBN

0.71	May	Provision of comments and suggestions on the draft report of task 3.	-	AUTh Uni Lub LP
0.72	June 2013	Creation of a new improved version of the output report on task 3.	(Chapters 11-13 of Deliverable)	PBN
0.8	July –August 2013	Preparation of a draft report on the calculation approaches. Preparation of tables and instructions on external cost calculation.	-	AUTh
0.81	August 2013	Further elaboration of the draft report on task 4 - Additional remarks about the limitations and obstacles of the calculation process.		Uni Lub
0.82	August 2013	Preparation of the final output report on task 4: Development of a common methodology	(Chapter 14, Annexes 16.2, 16.3, 16.4)	AUTh and Uni Lub
0.9	August 2013	Revision of final version of the output report on Task 1: Review of external cost calculation	Inclusion of the questionnaire and country report for Croatia.	Uni Lub
1.0	September 2013	Finalization of the deliverable 6.1 (Version 1)	-	AUTh

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2 Authors

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3 Terms and abbreviations

ADB	Adriatic-Danube-Black-Sea
CBA	Cost-benefit Analysis
DG MOVE	Directorate-General for Mobility and Transport
DG TREN	Former Directorate-General for Transport and Energy
EC	European Commission
EPC TT	European Parliament's Committee on Transport and Tourism
EU-27	European Union with 27 members included
EUROSTAT	European Statistics database
GHG	Greenhouse Gas
HDV	Heavy duty vehicles
LDV	Light duty vehicles
NECD	National Emission Ceilings Directive
NOx	Nitrogen oxide
NTM	Network for Transport and Environment
pkm	Passenger kilometer
PM25	Particles smaller than 2.5 micrometers
SA	Sensitive Areas
SEE	South East Europe
SO_2	Sulfur dioxide
TEN-T	Trans-European Transport Networks
TEU	Twenty-foot equivalent unit
tkm	Tone kilometer

TREMOVE	EU-wide transport model
TSA	Transport Sensitive Areas
UIC	International union of Railways
VoT	Value of time
VOC	Volatile organic compound
WTA	Willingness to accept
WTP	Willingness to pay

4 Summary

The report presents a comprehensive survey of external costs calculation approaches referred in EU documents and applied in the most recent research projects. This information is derived from (a) reference EU documents, (b) relevant past EU projects and (c) cooperation and research projects covering ADB area. The study on recent methodologies of calculating external costs is a part of activity 6.1 "External costs of transport in ADB area: lessons learnt" which examines methodologies, calculation approaches and initiatives to estimate and further internalize external costs of freight transport. The present study also focuses on analyzing various impacts of transport in terms of external costs and initiatives in ADB area. The purpose of the study is to develop and present a comparative analysis of the most recent and relevant findings on external cost calculation within the various EU research projects and to provide a solid background for further proposals of possible internalization of transport external costs in the Adriatic-Danube-Black sea area.

Through an integrated approach of the methodological framework concerning the estimation of transport external costs this survey provides the basis for the development of a relevant methodology adjusted to the requirements and special characteristics of the ADB area. The importance of this review is crucial, since an efficient and sustainable transport system which reflects the true costs involved, is a prerequisite for fostering the competiveness and attractiveness of ADB countries and of the broader area of Southeast Europe. According to impact assessment (2008), if nothing is done in the next few years, the environmental costs (air pollution, CO_2 emissions) could reach €210 billion by 2020. Individuals and businesses would also face congestion on more than a quarter of Europe's roads.

The first part of the study presents some general and basic aspects of external cost of freight transport. The concept of externality in the transport sector is provided with special emphasis on the definition of external costs and the main methodologies for estimating them. The most important external costs of transport are presented and their effect on the nature and society is examined. An integrated table summarizes the main issues of external costs of transport. and provides some basic cost elements, critical valuation issues, cost functions, data needs and main cost drivers for the freight transport related external cost i.e. accidents, climate change, air pollution, noise, congestion and scarcity costs.

Chapter 7, the second part of the study, (Review of external cost calculation), presents and summarizes relevant international studies and projects which, besides other activities and pilots, also analyze external costs of freight transport. The scope of activity 6.1 is to present and compare the existing data within recent and ongoing research projects in the field of external costs calculation, which were identified within the ADB Multiplatform meetings in Trieste, Budapest and Belgrade. Each study was analyzed in the scope of applicability and possible contribution to the ADB Multiplatform project. Finally, comparisons of the mostly used and applicable approaches of external cost of transport calculations are presented.

The third part of the report analyses and illustrates the review of issues related to external costs of transport in SEE area. The main inputs are the results from the questionnaires on external cost calculation methodologies that were sent to all participating countries in ADB Multiplatform project area. Since we presumed the lack of wide national or regional consensus to analyze and internalize the external cost of transport in the ADB region countries, questionnaires mainly examined whether there are any external costs calculations or projects in the region. Further on main methodological issues and results are collected from the external costs studies and presented within the report. Questionnaires also addressed the main legal aspects of an environmentally sound multimodal transport in the ADB area. Data concerning on-line manuals used by the project partners were collected and will be really helpful for the next WP6 activities

At the end of the study conclusions on methodology for the external cost calculation in the partner countries are drawn up. The collected questionnaires are analyzed and the results on current situation of external costs analysis in the ADB area are presented.

5 Background

In order to achieve successful development of common measures of external cost calculation what is needed is a holistic approach to define which negative impacts of transport can be defined as external costs, how can they be calculated and which the principles of internalization within the transport sector are.

In order to prepare a sufficient methodology for the external costs internalization firstly an overview of recent activities and projects that partially or in the whole scale dealt with internalization of external costs in transport must be made.

It must be taken into account that assessment of environmental impact of intermodal transport and logistics activities is a complex activity due to the peculiarities of modes of transport involved and the geographical differences.

6 External costs of transport

External costs of transport are costs to the society and - without policy intervention - they are not taken into account by the transport users. Transport users are thus faced with incorrect incentives for transport supply and demand, leading to welfare losses. The IMPACT study (2008) states that it is important to distinguish between:

- Social costs reflecting all costs occurring due to the provision and use of transport Infrastructure, such as wear and tear costs of Infrastructure, capital costs, congestion costs, accident costs, environmental costs.
- Private (or internal costs), directly borne by the transport user, such as wear and tear and energy cost of vehicle use, own time costs, transport fares and transport taxes and charges.

In general external costs refer to the difference between social costs and private costs. Based on the economic welfare theory, transport users should pay all marginal social costs which are occurring due to a transport activity. Considering the private marginal costs (such as wear and tear costs of the vehicle and personal costs for the driver), optimal Infrastructure charges should reflect the marginal external costs of using an infrastructure. These costs include wear and tear costs for the use of infrastructure, congestion costs, accident costs and environmental costs. Only parts of these costs are monetary relevant. Some parts (such as time losses, health damages, etc.) are social welfare losses. In the short run, these costs are linked to constant Infrastructure capacity. Thus fixed Infrastructure costs are not relevant for efficient pricing. In the long run however, the change of infrastructure capacity due to the construction of additional traffic infrastructure is relevant, too. From an economic viewpoint, an infrastructure project is economically viable, if additional social benefits of a specific project exceed additional social costs (IMPACT, 2008).

When analyzing the transport activities environmental impacts, accidents and congestion must also be taken into account. In contrast to the benefits of transport, the costs of these effects of transport are generally not borne by the transport users. Without policy intervention, these so called “external costs” are not taken into account by the transport users when they make a transport decision.

Table 6-1: Internal and External transport costs

	Social costs	
Cost of categories	**Internal/Private costs: borne by transport user**	**External costs: borne by other transport users or society**
Transport operating expenditure	Fuel and vehicle costs Ticket/fares	Cost paid by other users or by society
Infrastructure use costs	Costs covered by infrastructure charge Costs covered by tickets/fares	Costs partly uncovered
Accidents costs	Costs covered by insurance, own accidents costs	Uncovered accident costs (e.g. pain and suffering imposed on others), administrative and police costs
Noise costs	Own disbenefits	Costs borne by people exposed to noise (noise disturbance, health effects)
Air pollution costs	Own disbenefits (depending on individual situation)	Costs borne by people exposed to air pollution (health effects)
Climate change costs	Own disbenefits (including future generation i.e. children)	Costs borne by society and by future generation
Congestion costs	Own time costs	Delays/time costs imposed on others

Source: Preparation of an Impact Assessment on the Internalisation of External Costs Consultation Document: adapted from Table 2.1. of the Green Paper "Towards fair and efficient pricing in transport COM (95) 691 final.

According to the results of relevant EU studies on external cost of transport the sector of road transport has by far the largest share in the total sum of transport related external costs (93%). This can be explained by the large share of road in the overall transport volume as well as the higher average external costs per passenger-km or tonne-km. Passenger cars have a share of about 61%, followed by trucks (13%), vans (9%), two-wheelers (6%) and buses (4%). From the non-road modes, aviation has the largest share in external costs with about 5%, although only intra-EU flights are included. Rail transport is responsible for less than 2% and inland shipping for only 0.3%. Sea shipping was not included in this study (INFRAS, CE Delft, Fraunhofer ISI, 2011).

When combining the average costs with transport volume data, the sum of all external costs can be calculated. The studies show that the total external costs of transport in the EU plus Norway and Switzerland in 2008 amount to more than € 500 billion, or 4% of the total GDP. About 77% of the costs are caused by passenger transport and 23% by freight. On top of these, the annual congestion cost of road transport delays amounts to between € 146 and 243 billion (1 to 2% of the total GDP) (INFRAS, CE Delft, Fraunhofer ISI, 2011).

The internalisation of external costs, the last stage in the evaluation of external costs calculation methodology, means making such effects part of the decision making process of transport users. According to the welfare theory approach, internalisation of external costs by market-based instruments may lead to a more efficient use of infrastructure, reduce the negative side effects of transport activity and improve the fairness between transport users (INFRAS, CE Delft, Fraunhofer ISI, 2011). A substantial amount of research projects, including support of the

European Commission; suggest that implementing market-based instruments inspired by the economic theoretical concept of marginal social cost pricing could yield considerable benefits. Fair and efficient transport pricing has also been advocated in a number of policy documents issued by the EC (INFRAS, CE Delft, Fraunhofer ISI, 2011), but the issue will be further analyzed in the other outputs of the ADB Multiplatform project. First, some impacts of external costs on

the nature and society are discussed and next in table 6-4 an overview of the main issues of main external costs is presented. In the next table there is on overview of the main issuesofmainexternal costs presented, but firstly we must observe some impacts of the external costthat they have on the nature and society in general.

In practice, the main economic instruments for internalising external costs are taxation, tolls (or user charges) and, under certain circumstances1, emissions trading (Strategy for the internalisation of external costs, 2008).

Price signals play a crucial role in many decisions that have long-lasting effects on the transport system. Transport charges and taxes must be restructured in the direction of a wider application of the 'polluter-pays' and 'user-pays' principle. They should underpin transport's role in promoting European competitiveness and cohesion objectives, while the overall burden for the sector should reflect the total costs of transport including infrastructure and external costs. Wider socioeconomic benefits and positive externalities justify some level of public funding, but in the future, transport users are likely to pay for a higher proportion of the costs than today. It is important that correct and consistent monetary incentives are given to users, operators and investors [White Paper: Roadmap to a Single European Transport Area-Towards a competitive and resource efficient transport system, 2011].

Each external cost has specific characteristics which require the use of the appropriate instruments. Some external costs relate to the use of infrastructure and vary according to time and place. This is the case for congestion, air pollution, noise and accidents, all of which are highly localised and vary depending on the time, place and type of network. The use of differentiated charging is the best way of taking those variations into account [Strategy for the internalisation of external costs, 2008)].

According to various studies the most important category of transport external costs is accident costs. An accident may be defined as a specific but unexpected and unintended external event which occurs at a particular time and place, without apparent or deliberate cause but with marked effect. In this respect, the external costs generated by transport accidents are of major concern, as part of these costs is borne by the users but, more importantly, there is also almost always a cost to others. This cost can be direct or indirect, as well as being linked to either the

[1]Under Directive 2003/87/EC, Member States are to allocate at least 90% of CO_2 allowances free of charge. For emissions permits to internalise external costs, the granting authorities must sell them at a price that is, for example, equal to those external costs. In January 2008, the Commission put forward a proposal (COM(2008) 16) to set up an auction system that would make it possible to reflect the "polluter pays" principle. The system is to be introduced gradually, and at least two thirds of all allowances are expected to be sold by auction by 2013.

health of the people involved in the accident or to the material damage caused by the accident itself (European Parliament's Committee on Transport and Tourism (further on EPC TT), 2009). The term climate change (or global warming) normally refers to changes in the concentration of greenhouse gases which have been causing a progressive warming of earth's near surface, mainly because of human influence. Indeed, there is a scientific consensus that the increase in atmospheric greenhouse gases attributable to human activity has caused most of the warming observed since the start of the industrial era (EPC TT, 2009).

Air pollution is dependent upon many factors, from fuel composition to engine characteristics and maintenance, types and main characteristics of vehicle, infrastructure layout, speed, congestion, etc.. Moreover, air pollution is measured by the emission and concentration of particular primary pollutants, which include nitrogen oxides (NOx), carbon dioxide (CO_2), sulphur dioxide (SO_2), lead (Pb) and, finally, particulate matter (PM10 and PM2.5) such as dust and soot. These primary pollutants can cause damage to materials and buildings, agricultural crops and forests, as well as being harmful to human health when inhaled (EPC TT, 2009).

Noise is one of the main environmental impacts that arise from a transport scheme. Noise can cause serious impacts on individuals' well-being by leading to damage to both psychological and physical health. Hearing damage can be caused by noise levels higher than 85 dB(A), whilst lower levels (above 60 dB(A)) can be sources of nervous stress reactions, including increased heart rate, increased blood pressure and hormonal changes, as well. Finally, damage occurs particularly when exposure to noise is continued over a long period of time (EPC TT, 2009).

Infrastructure capacity is limited and a problem of allocation occurs when traffic increases. When there is increased travel time for all users the result is congestion costs. Within the category of air transport and railways, the main result is that other operators will not be able to get the slot that they want: in this situation, scarcity costs arise when a particular slot or track assigned to an incumbent could have a higher value if used by another operator (EPC TT, 2009).

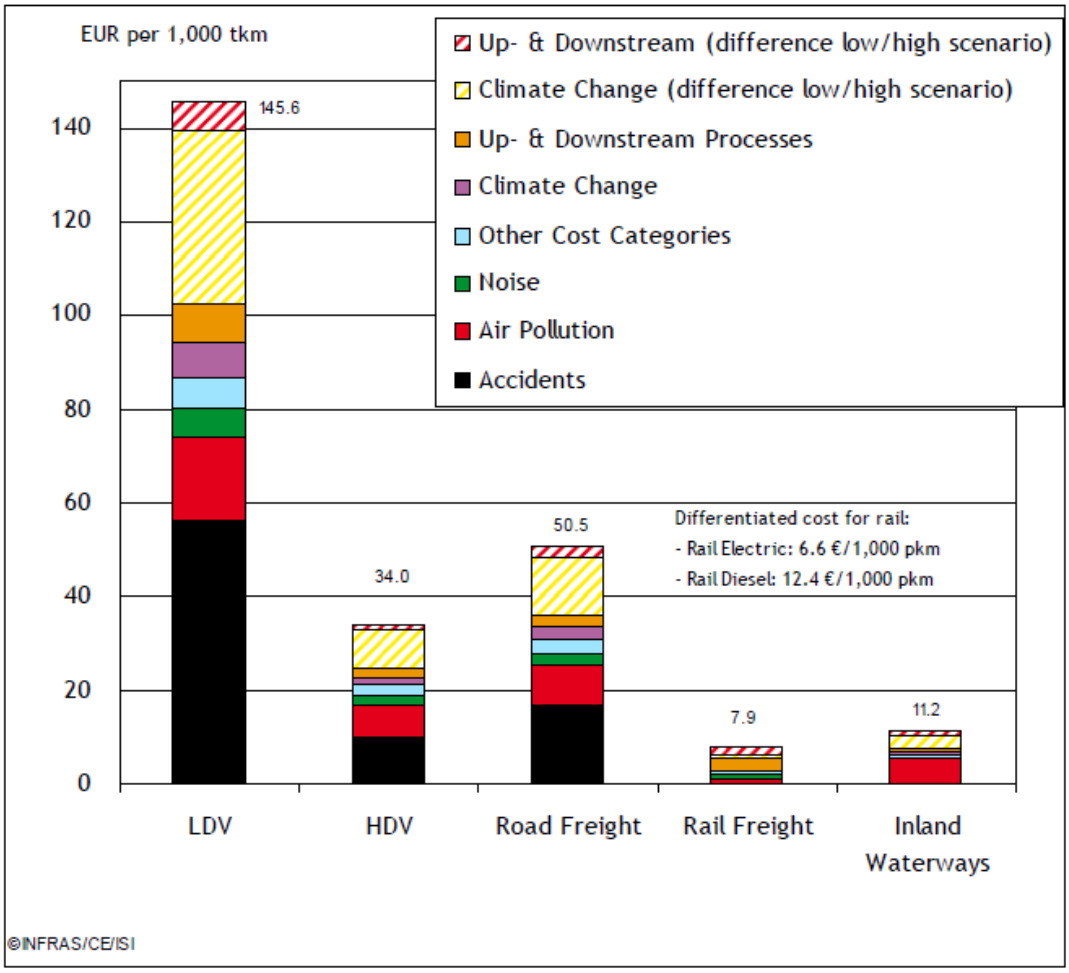
During the last years, many different methods for estimating external costs have been developed. Next table indicates the best practice approach for each cost component of transport external cost.

Table 6-2: External cost components and best practice approaches for their estimation

Cost component	Best practice approach
Costs of scarce Infrastructure	WTP for the estimation of the value of time (based on stated preference approaches). Alternatively: WTA. WTP for scarce slots (based on SP with real or artificial approaches).Alternatively: WTA
Accident costs	Resource costs for health improvement. WTP for the estimation of Value of Statistical Life based on SP for the reduction of traffic risks. Alternatively: WTA
Air pollution costs and human health	Impact pathway approach using resource cost and WTP for human life (Life years lost) base. Alternatively: WTA
Air pollution and building/material damages	Impact pathway approach using repair costs
Air pollution and nature	Impact pathway approach using losses (e.g. crop losses at factor costs).
Noise	WTP approach based on hedonic pricing (loss of rents – this reflects WTA) or SP for noise reduction. Impact pathway approach for human health using WTP for human life
Climate change	Avoidance cost approach based on reduction scenarios of GHG emissions; damage cost approach; shadow prices of an emission trading system.
Nature and Landscape	Compensation cost approach (based on virtual repair costs).

WTP = Willingness to pay. SP = Stated preference approach. WTA = willingness to accept.
Source: IMPACT, 2008.

In general, results from external cost calculation of freight transport in the EU-27 show that average external costs for road freight transport are higher than for rail or inland waterways freight transport. The figure below shows that average external costs (excluding congestion) for light duty vehicles outreaches 140 EUR per 1,000 tkm (average external cost of total road freight transport is 50,5 EUR/1.000 tkm) whereas rail freight is responsible for almost 8 EUR/1.000 tkm and inland waterways for 11,2 EUR/1.000 tkm (average external cost for the same amount of cargo transported).



Other cost categories: Costs for nature and landscape, biodiversity losses (due to air pollution), soil and water pollution costs, additional costs in urban areas. Data do not include congestion costs.
Road Freight Total: The weighted average of all road freight transport modes.
* Data include the EU-27 with the exemption of Malta and Cyprus, but including Norway and Switzerland.

Figure 6-1: Average external costs 2008 for EU-27: freight transport (excluding congestion)
Source: External costs of transport in Europe: update study for 2008 (CE Delft, INFRAS, Fraunhofer, 2011)

Table 6-2: Overview of main issues and cost elements of external costs of transport

Cost component	Cost elements	Critical valuation issues	Cost function	Data needs	Main cost drivers
Accident costs	Medical costs Production losses Loss of human life	Valuation of human life Externality of self-accidents in individual transport Allocation of accidents (causer/victim related)	Only limited correlation between traffic amount and accidents; other factors (such as individual risk factors and type of Infrastructure)	Accident database Definition of fatalities and heavy/slight injuries very important	Type of Infrastructure Traffic volume Vehicle speed Driver characteristics (e.g. age, medical conditions, etc.) Others
Climate change	Prevention costs to reduce risk of climate change Damage costs of increasing temperature	Long term risks of climate change Level of damage in high altitudes (aviation)	Proportional to traffic amount and fuel used (marginal cost close to average cost)	Emission levels	Level of emissions, depending on: – Type of vehicle and add. equipment (e.g. air conditioning) – Speed characteristics – Driving style – Fuel use and fuel type
Air Pollution	Health costs Years of human life lost Crop losses Building damages Costs for nature and biosphere	Valuation of life years lost Market prices for crops Valuation of building damages Valuation of long term risks in biosphere	Correlation with traffic amount, level of emission and location	Emission and exposure data (exp. PM, NOx, SO2, VOC)	Population and settlement density Sensitivity of area Level of emissions, depending on: – Type and condition of vehicle – Trip length (cold start emissions) – Type of Infrastructure – Location – Speed characteristics
Noise costs	Rent losses Annoyance costs Health costs	Valuation of annoyances	Declining marginal cost curve in relation to traffic amount	Noise exposure data (persons)	Population and settlement density Day/Night Noise emissions level, depending on: – Type of Infrastructure – Type and condition of vehicle

Cost component	Cost elements	Critical valuation issues	Cost function	Data needs	Main cost drivers
Congestion and scarcity	Increased travel times Overcrowding Delay of public transport, reliability problems	Vehicle hours lost	Correlation with traffic amount and the value of time lost	Infrastructure capacity Speed/flow function Value of travel time (VAT) demand elasticity	–Bottlenecks and capacity shortages at links or nodes –The physical condition and quality of infrastructure –Infrastructure condition activities –Accidents –Weather conditions

Source: European Parliament's Committee on Transport and Tourism, 2009; IMPACT, 2008.

7 Review of external cost calculation

Analysis of recent and ongoing research projects in the field of external costs calculation is the main objective of the Task 1 in WP 6.1. During the ADB Multiplatform project meetings in Trieste (Kick of meeting, 2012), Budapest (November 2012) and Belgrade (January 2013) relevant international projects were identified. Hereafter, a list of identified international projects related to the external cost calculation and intermodality is presented.

7.1 Overview of the most relevant and recent research projects identified

Several European research projects have been already carried out on the topic of external cost calculation. Since the main scope of the activity is to present a comprehensive survey of external costs calculation approaches in the most recent freight and infrastructure related projects, there was a pre-selection of the most relevant projects. The selection was based on the most "up to date" and relevant projects within the freight transport domain in EU and SEE area. The selected projects are:

- **Reference EU documents:**

- **External costs of transport in Europe**: update study for 2008 (CE Delft, INFRAS, Fraunhofer, 2011), September 2011
- **IMPACT:** Internalisation Measures and Policies for All external Cost of Transport, commissioned by EU DG TREN: its results have been used as the basis for the 2008 Commission proposal for amending the Eurovignette Directive. European Commission DG TREN, from app. 2006 to February 2008.

- **Past projects:**

- **ASSET:** ASsessing SEnsitiveness to Transport, 6th FP, 2007-2009
- **NEEDS:** New Energy Externalities Development for Sustainability, 2004-2009

- **RECORDIT:** REal COst Reduction of Door-to-door Intermodal Transport, 5th FP, 2000-2002

- **Cooperation and research projects covering ADB area:**

- **SONORA:** SOuth-NORth Axis - Improving transport infrastructure and services across Central Europe, Central Europe program EU Territorial Cooperation, Nov. 2008 – Feb. 2012
- **BATCo:**Baltic-Adriatic Transport Cooperation, Central Europe, Central Europe program EU Territorial Cooperation, March 2010 - February 2013
- **TRANSITECTS:** Transalpine Transport Architects - Improving intermodal solutions for transalpine freight traffic, Alpine Space Programme – European Territorial Cooperation Development Found, July 2009 – September 2012
- **CAFÉ CBA:** Clean Air for Europe, 2007-2012
- **SuperGreen:** Supporting EU's Freight Transport Logistics Action Plan on Green Corridors Issues, 2010-2013
- **WATERMODE:** Transnational Network for the Promotion of the Water-ground Multimodal Transport, 2009-2011

8 Overview of relevant recent research projects identified

8.1 Reference EU documents and studies

8.1.1 External costs of Transport in Europe: update study for 2008

a) Background of the study

The study "External costs of transport in Europe: update study for 2008" is performed from CE Delft, INFRAS and Fraunhofer ISI. Since the last update study in 2004 using data for 2000, the relevance of the subject to perform an updated study has increased. As it is stated in the study internalisation of external costs is one of the main focus points of the EC Greening Transport Package from 2008 and also in the 2011 EU White Paper on Transport. The latest revision of the Eurovignette Directive now allows Member States to calculate tolls based on costs of air pollution and noise of road freight traffic. In addition, the topic of externalities was further developed by different European and national studies. For that reason UIC commissioned CE Delft, INFRAS and ISI to carry out external costs study, to obtain a state-of-the-art overview of the total, average and marginal external costs of transport in the EU. With the EU enlargements of the last decade, the scope of the study was extended to the EU-27 with the exemption of Malta and Cyprus, but also including Norway and Switzerland.

In the study "External costs of transport in Europe" transport external costs are calculated for the following four different modes of transport whilst the results are differentiated for passenger and freight transport which are:

1.Rail passenger and freight transport (diesel and electric traction);
2.Road passenger: passenger cars, buses and coaches (one category), motorbikes/mopeds;
3.Road freight: light duty vehicles (LDV), heavy duty vehicles (HDV);
4.Air transport: passenger aviation and
5.Inland waterways: freight.

Within the study different data and approaches were used. For road transport performance (pkm, tkm) the basic values (total data per transport mode and country) are mainly taken from EUROSTAT. Only where no comprehensive data were available (e.g. for motorcycles), the study used TREMOVE data. For vkm data, EUROSTAT could only be used for heavy goods vehicles. For cars, national data have been used for seventeen countries. For the other countries as well as for buses and motorcycles TREMOVE values are used. For rail transport UIC rail statistics are used. Since all the data could not be collected from one source, certain gaps of the UIC statistics were compensated with EUROSTAT data. Air transport data are based on EUROSTAT information

with cross-checks to some national statistics. Transport data for inland waterways used in the study are taken from the EU Statistical Pocketbook. Emission factors for all modes are taken from TREMOVE since this was the only comprehensive up-to-date database on emission factors for all countries and transport modes included (based on the Copert emission model). Total emissions of greenhouse gases and air pollutants are then calculated using adjusted mileage data as described above and TREMOVE emission factors (External costs of transport in Europe, 2011).

Emission and transport data are differentiated by region type (metropolitan, other urban, non-urban) and fuel type (gasoline, diesel, electric). Therefore, different share of various regions, fuel types, etc. are taken into account in the calculations. The present study, like most external cost studies, is implicitly based on the "causer approach", since transport data (vkm) from EUROSTAT are also having the same perspective and the relevant data are easier to be collected.

In this update study total, average and even marginal external costs are calculated for the following five core cost categories: accidents, air pollution, climate change, noise and congestion. The most special, marginal external costs are applied on various network types, vehicle technologies and traffic situations. The results of the study show that also the marginal external costs for road are much higher than for rail transport and the same applies for the marginal costs in urban areas which are much higher than in non-urban areas. The share of various cost categories in the total marginal costs depends strongly on the type of network. In urban areas, accident costs are about half of the marginal external costs, while in non-urban areas and particular on motorways the costs of emissions are dominant, in particularly those of climate

change. Table 8-1 presents average external costs in the year 2008 for EU-27 analyzed within the study (External costs of transport in Europe, 2011).

Table 8-1: Average external costs 2008 for EU-27 by category and freight transport mode (excluding congestion) in EUR/1,000 tkm) *

Freight Transport Mode / Cost Category	Road Freight transport			Rail Freight transport	Waterborne freight transport	TOTAL freight transport
	Light duty vehicles (LDV)	Heavy duty vehicles (HDV)	All road freight transport			
Accidents	56,2	10,2	17,0	0,2	0,0	13,4
Air pollution	17,9	6,7	8,4	1,1	5,4	7,1
Climate change (high scenario)	44,5	9,8	14,9	0,9	3,6	12,1
Climate change (low scenario)	7,6	1,7	2,6	0,2	0,6	2,1
Noise	6,3	1,8	2,5	1,0	0,0	2,1
Up- and downstream (high scenario)	14,3	3,0	4,7	4,2	1,3	4,4
Up- and downstream (low scenario)	8,4	1,7	2,7	2,4	0,8	2,5
Nature & Landscape	0,9	0,7	0,7	0,0	0,4	0,6
Biodiversity losses	0,6	0,5	0,5	0,0	0,5	0,4
Soil & water pollution	1,8	0,8	1,0	0,4	0,0	0,8
Urban effects	3,1	0,5	0,9	0,1	0,0	0,7
TOTAL (High scenario)	**145,6**	**34,0**	**50,5**	**7,9**	**11,2**	**41,7**
TOTAL (Low scenario)	**102,8**	**24,6**	**36,1**	**5,3**	**7,7**	**29,7**

* Data include the EU-27 with the exemption of Malta and Cyprus, but including Norway and Switzerland. Data do not include congestion costs. **Source:** CE Delft, INFRAS; Fraunhofer ISI; External costs of transport in Europe, 2011.

b) Overview of methodology per external cost category

Within the study External costs of transport in Europe (CE Delft, INFRAS and Fraunhofer ISI, 2011) all the usually observed external costs of transport were analyzed, calculated and presented, but the main focus was on the main five external costs of transport which are shortly presented hereafter.

- *Accidents*

Accident costs in general are the result of traffic accidents. In the study these social costs include costs for material damages, administrative costs, medical costs, production losses and immaterial costs (lifetime shortening, suffering, pain, sorrow, etc.). Material costs can be calculated using market prices as they often (but not always) can be insured against. In contrast for immaterial costs no such market prices do exist and other sources are needed to estimate these costs (e.g. risk values through stated-preference studies). The sum of material and immaterial costs builds the total social accident costs. From these external accident costs must be separated by identifying the costs covered through transfers from the insurance systems and

by accounting for risk costs that are well anticipated and therefore already internalised by individuals own cost calculations (CE Delft, INFRAS and Fraunhofer ISI, 2011).

• *Air pollution*

Air pollution caused by transport activities leads to different types of external costs. The most important external costs are health costs due to cardiovascular and respiratory diseases caused by air pollutants. Other external costs of air pollution include building and material damages, crop losses and impacts on biodiversity and ecosystem. The most important transport related air pollutants are particulate matter (PM10, PM2.5), nitrogen oxide (NOx), sulphur dioxide (SO_2), volatile organic compounds (VOC) and Ozone (O_3) as an indirect pollutant. Greenhouse gases are not included in the air pollution costs since they do not have any direct toxic effects. They are covered within the climate change cost category. Within the "External costs of transport study (CE Delft, INFRAS, Fraunhofer ISI, 2011) different approaches and studies that include external costs of transport caused by air pollution are presented:

–Bottom-up approach of air pollution is based on an impact pathway approach. This method requires the following methodological steps: emissions–transmission– concentration (dose)–impact/damage (humans, ecosystems, buildings)–monetisation–costs. As stated in the study "*the bottom-up approach has been applied in a variety of European studies such as NEEDS (2006, 2007, 2008); HEATCO (2006); CAFE CBA (2005);*

–ExternE (2005); UNITE (2003). This detailed approach is regarded as the most elaborated and therefore best practice methodology, above all for calculating site-specific external costs. The IMPACT study (CE/INFRAS/ISI, 2008) also lists unit costs values (in € per ton of pollutant) for all relevant air pollutants, based on HEATCO and CAFE CBA. The most recent study applying this approach for air pollution cost was the European research project NEEDS (INFRAS, 2012). In the INFRAS study the bottom-up approach is applied, thus the calculation methodology is modified compared to the last study (INFRAS/IWW, 2004)" (CE Delft, INFRAS and Fraunhofer ISI, 2011).

–Top-down approach of air pollution is, as stated in the study of "External costs of transport in Europe (CE Delft, INFRAS and Fraunhofer ISI, 2011), a less used methodology. It estimates health effects due to the exposure of air pollutants and evaluates with specific costs per additional case of mortality or morbidity. The health effects are valuated with cost factors for the different health effects. An important precondition for the application of this approach is the availability of detailed country specific exposure data for the relevant air pollutants (at least for PM2.5 or PM10). Cost allocation to different modes and vehicle categories requires additional information on the contribution of each mode and vehicle category to the overall ambient concentration of the respective pollutant (CE Delft, INFRAS and Fraunhofer ISI, 2011).

• *Climate change*

In 2007 about 19.5% of total greenhouse gas (GHG) emissions in Europe were caused by transport (European Commission, 2010). These emissions contribute to global warming resulting in various effects like sea level rise, agricultural impacts (due to changes in temperatures and rainfall), health impacts (increase in heat stress, reduction in cold stress, expansion of areas amenable to parasitic and vector borne disease burdens (e.g. malaria, etc.), ecosystems and biodiversity impacts, increase in extreme weather effects, etc. The main greenhouse gases with respect to transport are carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4) (CE Delft, INFRAS and Fraunhofer ISI, 2011).

The general approach of estimating the average climate change external costs for various transport modes presented in the External cost of transport in Europe (CE Delft, INFRAS and Fraunhofer ISI, 2011) study consist of four steps:
1.Assess total GHG emissions by type of vehicle per country;
2.Calculate total CO_2 equivalent GHG emissions using Global Warming Potentials;
3.Multiplication of the total ton of CO_2 equivalent GHG emission by an external cost factor in €/ton to estimate total external costs related to global warming per country;
4.Calculate the average climate change costs (per tkm/pkm) by dividing the total costs per
5.vehicle type per country by the number of tkm/pkm per country.

• *Noise*

Noise can be defined as the unwanted sound or sounds of duration, intensity or other quality that causes physical or psychological harm to humans. In general, two types of negative impacts of transport noise could be distinguished (CE Delft, INFRAS and Fraunhofer ISI, 2011):
–Costs of annoyance: Transport noise imposes undesired social disturbances, which result in social and economic costs like any restrictions on enjoyment of desired leisure activities, discomfort or inconvenience, etc.
–Health damages: First, noise levels above 85 dB(A) can cause hearing damage. Lower noise levels (above 60 dB(A)) may increase the risk on cardiovascular diseases (heart and blood circulation) and may also result in nervous stress reactions such as increase of blood pressure and hormonal changes. Finally, transport noise can also result in a decrease of subjective sleep quality. These negative impacts of noise on human health result in various types of costs, like medical costs, costs of productivity loss and the costs of increased mortality.

In the study of External costs of transport in Europe (CE Delft, INFRAS and Fraunhofer ISI, 2011) the methodology to estimate the average noise costs for the various modes, usually a bottom-up approach is presented. The approach consists of three steps:
–Estimation of the number of people affected by noise per vehicle type;
–Estimation of total noise costs by multiplying the number of people affected by the noise costs per person exposed;
–Calculation of the average noise costs by allocating the total noise costs to the various transport modes by using specific weighting factors.

• *Congestion*

The study (CE Delft, INFRAS and Fraunhofer ISI, 2011) presents that transport users experience congestion through increases in travel times, travel time unreliability and operating costs. These delays have multiple purposes, including accidents, construction sites and weather, and their level of acceptability may change by travel purpose, time and even city size. Congestion arises in transport networks, such as road networks, where infrastructure users compete individually for limited infrastructure-capacity. The relation between speed and traffic load is specific to every road section, junction or larger network parts. Speed or travel time per km can be measured and expressed by speed-flow (or time-flow) functions. They vary significantly with network characteristics, but also by traffic flow compositions, weather, driver behavior, road works or accidents. By introducing values of time, which again depend on a number of factors such as travel purpose, time of day, etc., the travel time-load function can be translated into a corresponding cost-load function.

Table 8-2: Summary details of the updated study "External costs of transport in Europe

The external costs calculation presented in the updated "External costs of transport in Europe" study is based on the latest scientific literature on external cost estimation: the previous UIC external cost studies, a broad range of EU research projects (particularly NEEDS, UNITE, HEATCO and GRACE) and recommendations from the IMPACT Handbook on external costs. There are many different benefits from the "External costs of transport in Europe" study to the ADB multiplatform project: •Detailed analysis of external costs of transport in the EU-27 area with possible transposing of the data to the other regions in the Europe (SEE area); •Inclusion of all freight transport modes; •Up-to date and relevant data from the national statistics (EUROSTAT receives national data from the national statistical sources); •Calculation of the total, average and marginal external costs of transport with described methodology for calculation. The study proposes additional subjects that are recommended for further analysis: •A detailed calculation of the external costs related to transport infrastructure and vehicles (operation, maintenance and disposal); •Promotion and update of the case studies on marginal external costs of noise and accidents (that could be an additional output of the ADB Multiplatform project – WP7); •An EU-wide assessment of congestion costs (across all transport modes), nature and landscape and water pollution (shipping).

Geographical coverage	Transport modes	Externalities	Methodology/Approach
EU-27 with exemption of Malta and Cyprus, but also including Norway and Switzerland.	1.Rail passenger and freight transport (diesel and electric traction). 2.Road passenger: passenger cars, buses and coaches (one category), motorbikes/mopeds 3.Road freight: light duty vehicles (LDV), heavy duty vehicles (HDV). 4.Air transport: passenger aviation. 5.Inland waterways: freight.	Air pollution	Bottom-up approach
		Noise	Bottom-up approach
		Accidents	Responsibility approach, damage potential approach
		Climate change	Avoidance cost with damage costs as the upper bound
		Congestion	Vehicle operating, fuel costs and value of time cost approach
		Up- and downstream processes	Avoidance costs due to the emission of air pollutants and GHG emissions because of energy production and distribution
		Cost for nature and landscape	Repair cost approach
		Additional costs in urban areas	Approach to estimate time losses due to separation effects of pedestrians
		Soil and water pollution	Repair cost approach

Source: External costs of transport in Europe: update study for 2008. CE Delft, INFRAS, Fraunhofer ISI, URL:http://ecocalctest.ecotransit.org/CE_Delft_4215_External_Costs_of_Transport_in_Europe_def.pdf.

8.1.2 IMPACT: Handbook on estimation of external costs in the transport sector

When European parliament and the Council amended Directive 1999/62/EC on charging heavy duty vehicles for the use of certain infrastructure, the EU legislator requested the European Commission to present a generally applicable, transparent and comprehensible model for the assessment of all external costs of transport (including those caused by non-road modes). The IMPACT (2008) study was prepared when European Commission ordered to summarize the existing scientific and practitioner's knowledge on the field of external costs of transport. The central aim of the study is to provide a comprehensive overview of approaches for estimation and internalization of external cost and to recommend a set of methods and default values for estimating external costs when conceiving and implementing transport pricing policy and schemes. The IMPACT model was produced within the study "Internalization Measures and Policies for All external Cost of Transport" and is actually a basis for future calculations of infrastructure charges. It also provides technical support to the Commission services to carry out an Impact Assessment of strategies for internalizing transport external costs (IMPACT, 2008).

• **Handbook on external costs**

The IMPAC study (2008) is presented as a handbook with state of the art and best practice cases on external cost estimation to make the topics accessible even for those who are not familiar with the issue. It covers all environmental, accident and congestion costs and considers all transport modes. The focus of methodology and calculation is on marginal external costs of transport activity as a basis for the definition of internalisation policies such as efficient pricing schemes. Within the document there is no information included on the existing taxes and charges and does not present information on infrastructure costs of transport. Besides other issues the IMPACT (2008) handbook recommends and extensively presents:

–Methods for calculating external cost figures;
–Best available input values for such calculation (e.g. value of one life/year lost);
–Estimated default unit values of external cost for different traffic situations (e.g. air pollution cost of a vehicle in euro per km).

• **Methods for estimating external costs**

Although the estimations of external costs in the IMPACT (2008) study considered also several uncertainties on external costs calculation, there is a wide consensus on the major methodological issues of which some are used in the study. The best practice estimation of congestion costs is based on speed-flow relations, value of time and demand elasticity. For air pollution and noise costs, the impact pathway approach is broadly acknowledged and also preferred approach, using Values of Statistical Life based on Willingness to Pay. Marginal accident costs can be estimated by the risk elasticity approach, also using Values of Statistical Life. Given long-term reduction targets for CO_2 emissions, the avoidance cost approach is the best practice for estimating climate cost. Other external costs exist, e.g. costs related to energy dependency, but there is for the time being no scientific consensus on the methods to value them.

Table 8-3: Summary details of IMPACT study

IMPACT study represents one of the most possible reference bases for further external costs studies also in the SE Europe. The methodology for the external cost calculation can be widely used since the unit values for input figures are presented in monetary terms related to the specific value, such as Euro per hour, per accident, per unit of emission, per life year lost, etc. The output values are presented in a form which can be translated for the purpose of internalisation. The main unit for the infrastructure pricing is cost per vkm. Similar to other studies of external costs a transfer in cost per passenger or tkm has been carried out in order to compare different modes and where relevant or useful, other output unit values are shown. When applying the results to the ADB region it should be taken into consideration that the figures are in general representative only for average Western European countries and not directly applicable to the SEE region. The "value transfer approach" is also appropriate to transfer the data to other countries and can still provide reliable data for policy purposes at lower accuracy levels. Study mostly presents and does not select the most appropriate approach for the cost calculation.			
Geographical coverage	**Transport modes**	**Externalities**	**Methodology/Approach**
EU 25	Not all the transport modes are analysed within all the externalities. In general further freight transport modes are analysed: LGV road freight transport HGV road freight transport Rail freight transport Aviation: freight transport Waterborne: Freight transport	Congestion and scarcity costs	WTP approach to estimate VoT
		Accidents costs	WTP for estimate Value of statistical life
		Air pollution costs	Impact pathway approach using resource costs and WTP
		Noise costs	WTP approach or Stated preference for noise reduction
		Climate change	Avoidance costs approach based on reduction of GHG
		Cost for nature and landscape	Repair costs approach and other presented
		Costs for soil and water pollution	Repair costs approach and other presented
		Additional costs in urban areas	Damage costs due to separation effects or compensation costs approach for scarcity problems
		Costs of up- and downstream processes	Climate change and air pollution costs
		costs in sensitive areas	Calculation of air pollution, noise and other effects in sensitive areas
		Costs of energy dependence	Costs of transfer of wealth, potential GDP losses, macroeconomic adjustments costs

Source: IMPACT: Handbook on estimation of external costs in the transport sector, Delft, 2008: CE Delft. URL: http://www.ce.nl.

8.2 Past projects

8.2.1 ASSET: Asessing Sensitiveness to Transport

ASSET: Asessing Sensitiveness to Transport (http://www.asset-eu.org/) (project lasted from 2007 to 2009) developed the scientific and methodological capabilities to implement European policies aiming at balancing the protection of environmentally Sensitive Areas (SA) with the provision of an efficient transport system. Firstly, the project provided a set of sensitiveness criteria to identify and map transport related sensitive areas (TSA) across the EU, allowing for the identification and prioritisation of critical sustainability issues within the development of the Trans-European Transport Networks (TEN-T).

The second part of the project is concentrated on analyzing policy instruments with regard to their applicability to different categories of TSA and the identification of adequate policy packages with focus on market-based instruments. The proposed methodology and the policy instruments were assessed in detail in 10 case studies covering mountainous, urban/metropolitan, natural/protected and coastal areas. Based on spatial specifications the project also assessed different modes, types of traffic and geographical situations.

Main outputs of the project were:

1.) common framework of definitions, criteria and valuation parameters for Transport Sensitive Areas (TSA),
2.) methodology for the assessment of sensitiveness in TSA,
3.) mapping of TSAs across the EU,
4.) review of policy instruments for the protection of SA, analysis of applicability to different TSA categories, identification of policy packages,
5.) detailed assessment of proposed methodology and policy instruments for 10 case studies for different modes, types of traffic and geographical situations,
6.) Policy guidelines for TSA (ASSET, 2007-2009).

In order to prepare cost categories for pricing road usage in transport sensitive areas the project defined *cost categories* and *cost functions* which can be specified as the main drivers to address proper taxation and charging policy. The fact that cost functions were defined differently for each external cost analyzed does not mean that there are no other external costs of transport but implies that these are the ones which are to be internalized in the first place.

Cost functions for pricing road and rail usage in transport sensitive areas are presented below. Charts include cost categories with cost function of different external costs of transport in the sensitive areas and expose the main drivers that are to be considered when analyzing or calculating external cost of transport in the transport sensitive areas.

Table 8-4: Cost function for pricing ROAD usage in transport sensitive areas

Cost categories + cost function	Drivers by charging and taxation policies
NOISE	
–Cost due to noise (€/vkm) –Exposed population (population /km) –Damage factor (€ /dB(A) / person) –Backcountry noise level (high, low)	–Location –Time of day (day, night) –Traffic situation (dense, free flow traffic conditions) –Vehicle type (passenger car, HGV, intercity train, high speed and goods train)
AIR POLLUTION (DIRECT + INDIRECT EMISSIONS)	
–Cost per vkm due to air pollution (€/vkm) –Emission factor – direct emissions (g/vkm) –Damage factor – direct emissions (€/g) –Fuel or electricity consumption factor(g/vkm or kWh/vehicle km) –Damage factor – fuel production (€/g or €/kWh) –Mode of transport	–Vehicle technology (including vehicle type, fuel type, emission standard) –Fuel consumption and fuel type (electricity, petrol, diesel) –Pollutant –Location (urban, non urban)
ACCIDENT	
–Number of actual casualties of specific type (fatality, severe or slight injury) –Type of vehicle and traffic volumes –Value of stat. life, production lose and medical costs	–Traffic volume

Source: ASSET project, WP4, page 38.

Table 8-5: Cost functions for pricing RAIL track usage in transport sensitive areas

Cost categories + cost function	Drivers by charging and taxation policies
NOISE	
–Cost due to noise (€/vkm) –Exposed population (population /km) –Damage factor (€ /dB(A) / person) –Backcountry noise level (high, low)	–Type of rolling stock
AIR POLLUTION (DIRECT + INDIRECT EMISSIONS)	
–Cost per vkm due to air pollution (€/vkm) –Emission factor – direct emissions (g/vkm) –Damage factor – direct emissions (€/g) –Fuel or electricity consumption factor(g/vkm or kWh/vehicle km) –Damage factor – fuel production (€/g or €/kWh) –Vehicle technology and mode (including vehicle type, fuel type, EURO standard) –Location (urban non urban) –Fuel type (electricity, petrol, diesel, …) and Pollutant	–Fuel production
ACCIDENT	
–Delay on the track sections in specific time period –Section specific constant –Rail capacity on the track section in time period	–Capacity utilization

Source: ASSET project, WP4, page 47.

Table 8-6: Summary details of ASSET project

ASSET project developed scientific and methodological capabilities to implement European policies aiming at balancing the environmental protection of Sensitive Areas with the provision of an efficient transport system. Its scope was not to deal with the external costs of transport in the first place but to contribute mainly to the methodology for internalizing external costs of transport sector in the EU countries. As far as the ADB Multiplatform is concerned, ASSET project is relevant mostly in the scope of defining which cost categories and cost functions are caused by road or rail freight transport and which drivers are to be addressed when internalizing those parameters (Table 8-1).			
Geographical coverage	**Transport modes**	**Externalities**	**Methodology/Approach**
Focus on selected sensitive areas in EU (alpine regions – alpine area Pi, urban regions, locations near transport hubs).	Road, Urban road, Interurban rail, Urban rail, Maritime shipping, Inland Waterways, Air transport.	–Air pollution –Noise –Infrastructure effects (scarcity) –Accidents	Not focused on external cost calculation approaches, but on the internalization of external cost approaches (pricing, taxation, infrastructure and planning, regulation, information and public awareness).

Source: http://www.asset-eu.org/

8.2.2 NEEDS

NEEDS (New Energy Externalities Developments for Sustainability) was a research project funded within the European Commission 6th FP of RTD. It lasted over 4 years (2005 – 2008) and 66 Partners from 26 countries were involved in the project. The ambition of NEEDS extends beyond the purely scientific realm, as the project is intended to provide direct, usable inputs to the formulation and evaluation of energy policies in the overall framework of sustainability, therefore notably taking account of the economic, environmental and social dimensions of energy policies (Policy use of the Needs results, 2008).

NEEDS was evaluating the full costs and benefits (i.e. direct + External) of energy policies and of future energy systems at the level of individual countries and the enlarged EU. Identification of external costs was based on Life cycle inventories (LCI) for 3 scenario families: Business as Usual, 440ppm CO2, Renewables and Energy Efficiency and for 3 time horizons 2000, 2025, 2050.

A good knowledge of the full cost values was obviously directly instrumental in providing basic input to policy formulation and investment decisions. Calculating the full (i.e. internal and external) costs of energy technologies was in fact the most explicit and fundamental goal of the entire NEEDS project. The values of external costs (social costs) for selected Electricity Generation Technologies (EGT), at 2009 are showed below.

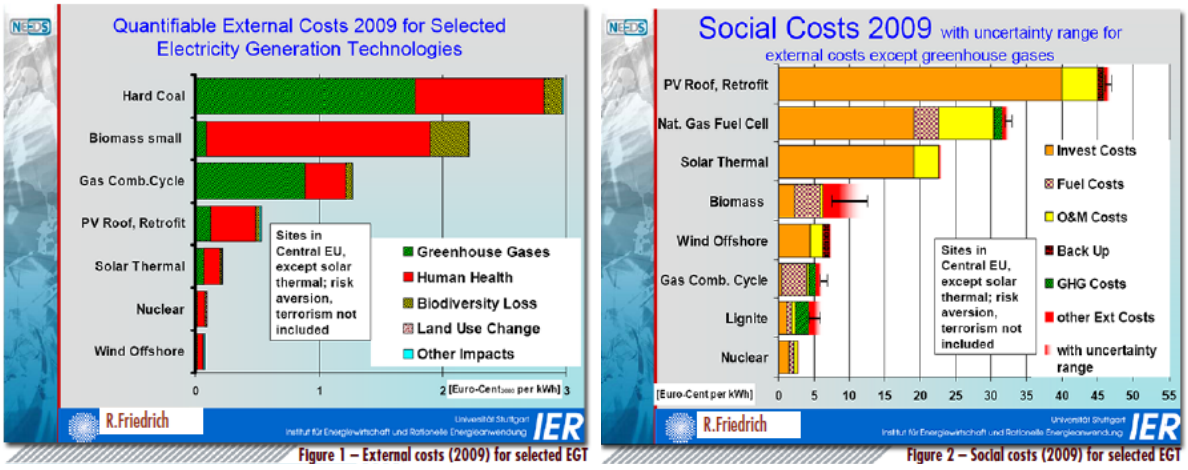


Figure 8.1: External costs for selected EGT

Source: http://www.needs-project.org/.

Table 8-7: Summary details of NEEDS project

NEEDS project was evaluating the full costs and benefits (i.e. direct + External) of energy policies and of future energy systems at the level of individual countries and the enlarged EU. Its scope was not to deal with the external costs of transport in the first place but with the external costs of energy in EU countries. NEEDS has taken into consideration the following externalities: air pollution, soil and water pollution, climate change, biodiversity losses and land use. NEEDS project was only covering EU countries, so most of ADB area is left out of this study.			
Geographical coverage	**Externalities**	**Transport modes**	**Methodology**
Enlarged EU.	Air pollution, soil and water pollution, climate change, biodiversity losses and land use.	External costs of energy.	New methodological framework Life Cycle Assessment (LCA).

Source: http://www.needs-project.org/.

8.2.3 RECORDIT

RECORDIT was an international project funded under the European Commission's Fifth Framework Programme for Research, co-ordinated by DG TREN. It addresses on a European scale the theme 'Analysis of the cost structure of door-to-door intermodal freight transport services and the conditions to optimise it'. Main objective of the project was to improve the competitiveness of intermodal freight transport in Europe through the reduction of cost and price barriers which currently hinder its development, while respecting the principle of sustainable mobility. Within Deliverable “External cost calculation for selected corridor” the methodology for calculation of door-to-door external costs for intermodal transport chains in Europe was tested (RECORDIT Final report, 2003).

The following impact categories were addressed: impacts from airborne pollutants on human health, building materials and agricultural products, impacts from noise, climate change, accident risk, congestion and slot scarcity. RECORDIT analysed short-run marginal external costs. A site-specific calculation of externalities was made by using the bottom-up Impact Pathway Approach developed in the ExternE-series of projects. The study showed a significant difference in external costs between intermodal and all road transport. Intermodal transport showed much lower external costs than all-road good transport (RECORDIT Final report, 2003).

Table 8-8: Summary details of RECORDIT project

Main objective of RECORDIT project was to improve the competitiveness of intermodal freight transport in Europe through the reduction of cost and price barriers which currently hinder its development, while respecting the principle of sustainable mobility. Its scope was to deal with the external costs of intermodal freight transport. It is one of the few projects concerning external costs in a corridor and terminal perspective. The project only covers the next ADB countries: Greece, Italy, Slovenia, Croatia, Hungary, and Slovakia. As in previously mentioned projects the Impact approach was used as well.			
Geographical coverage	**Externalities**	**Transport modes**	**Methodology**
3 selected European corridors (countries relevant for ADB: Greece, Italy, Slovenia, Croatia, Hungary, and Slovakia).	Air pollution, noise, accidents, climate change, and congestion.	Intermodal freight transport.	Bottom-up.

Source: http://www.recordit.org/objectives.asp.

8.3 Cooperation and research projects covering ADB area

8.3.1 SONORA: SOuth-NORth Axis - Improving transport infrastructure and services across Central Europe

SoNorA project facilitates environmental sustainability in transport by increasing the deployment and use of intermodal transport solutions, with a special focus on freight transport. Project supports sustainable development of the network through the development of case studies and guidelines regarding infrastructure realizations in environmentally sensitive areas, focusing on how to conduct consensus building and to qualify the consequences of not addressing the issues sufficiently (SoNorA, 2008-2012).

The objective of the project is to prepare recommendations generally applicable across the SoNorA project countries, i.e. without specific conditions determining the processes of spatial planning, project preparation and environmental impact assessments in individual countries. By their nature, these conclusions are targeted at rather strategic and political levels, as it is exactly at these levels, where the support and willingness to proceed with the reforms (mainly legislative) of the system is needed, especially where a lot of shortcomings have been observed.

Recommendations are formulated in order to ensure their transversal applicability and therefore not all measures will be relevant and their practical application, of course, will have to be adapted to legislative conditions, administrative procedures and common practice in each country. A brief summary of proposed recommendations from the SoNoRa project are:

–Optimization of route alignment in environmentally sensitive areas.
–Modernisation of legislative frameworks that regulate environmental impacts assessments, in order to make processes more transparent and simpler to implement.
–Enforcement of social acceptance criteria for infrastructure projects.
–Ensuring professional and objective project assessment.
–Establishment of a stable and consistent political attitude.

Table 8-9: Summary details of SoNoRa project

When analyzing external costs, SoNoRa project is not at full scale applicable to the ADB Multiplatform project. In the environmental terms SoNoRa is focusing mostly on negative environmental aspects of freight transport and is not fully assessing all the external costs of transport in the European area. Some data on recommendations for future implementation of transport infrastructure in sensitive areas is applicable to the ADB Multiplatform (recommendations also for pilots in the projects) but otherwise the level of applicability is not wider. Project mostly Highlights the need of inclusion of external costs and benefits, as a selection criterion for the TEN-T core network (including air pollution, noise pollution, land, regional development, etc.).			
Geographical coverage	**Externalities**	**Transport modes**	**Methodology**
Central European area, from the Adriatic to the Baltic Sea	General comparison of total external cost including –Air pollution, –Noise pollution, –Effects on land.	Comparison of external cost of road and rail freight transport from other EU studies.	No own calculations of marginal external cost evident in the study.

Source: http://www.sonoraproject.eu

8.3.2 BATCo: Baltic-Adriatic Transport Cooperation

The main objective of the BATCo (2010-2013) is the sustainable and harmonised advancement of the Baltic-Adriatic transport axis and its competitiveness, in the frame of Central Europe's North–South connection. One of the results of the BATCo project is to identify the potential negative effects on the environment (incl. axis-wide transport impact model, identification of environmental protection and safety potentials, decision support model) caused by passenger and freight transport along the Baltic-Adriatic Axis. Within the study the related costs in regard to Air Pollution (CO2, PM10, NOx, HC), Noise Pollution and Traffic Safety (accident rates, insurance rates etc.) in order to initiate and accelerate necessary implementations based on

created awareness on reduction potentials (BATCo, 2010-2013).

Within the activities focused on analysis of environmental effect of transport related activities on the presented corridor the BATCo project:

- Composed the BATCo Transport Impact Model using TRANS-TOOLs as modelling software;
- Identified transport related effects on the environment in order to initiate and accelerate necessary implementations based on created awareness on reduction potentials;
- Determined and described standardised parameters for the definition of a common understanding on transport related environmental impacts;
- Elaboration of a standardised design for the collection of environmental data to identify the reduction potentials
- Assessed an axis-wide calculation model for already defined and standardised environmental parameters (BATCo, 2010-2013).

Table 8-10: Summary details of BATCo project

Although BATCo project presents some results and proposals for the environmentally acceptable transport systems the results of the project are not jet publicly available since there are no outputs on the environmental achievements to be seen. From the perspectives of the ADB Multiplatform project the BATCo is appropriate to investigate further more since the collection of the environmental data and results are collected also on a basis of the main analyzed corridor, which is also a goal of the ADB Multiplatform project. The external costs calculation of the BATCo project focuses mostly on the Central Europe territory thus the data is not directly applicable to the ADB area. Some further analysis on the outputs of the BATCo results and deliverables are proposed.

Geographical coverage	Externalities	Transport modes	Methodology
Focus on Ten-T corridors on Baltic-Adriatic axis	Inclusion of total external costs of rail and road transport	Intermodal combinations of road and rail freight transport	Methodology of calculation complied from other EU projects on external costs

Source: http://www.baltic-adriatic.eu/en/batco/about-batco-background

8.3.3 TRANSITECTS: Transalpine Transport Architects - Improving intermodal solutions for transalpine freight traffic

Substantial damage to the environment caused by noise and particle emissions, poor transport safety as well as high economic losses in the fields of logistics and tourism are putting a strain on the Alpine region. Alternative means of transport are in urgent need of being strengthened in order to relieve the burden on the area, the people and the roads (Transitects, 2009-2012).

Through activities with an environmental scope of the alpine transport, project TRANSITECTS is

mostly focused on:

- creating sustainable intermodal solutions for transalpine freight traffic;
- improving the railway network's attractiveness and accessibility for the logistic market;
- disburdening alpine transport routes and generate positive ecologic and economic impacts;
- implementing the shift from road to rail related traffic;
- activating synergies and leverage effects through transnational cooperation.

Within the Transitects project (2009-2012) it was taken into consideration that although the global economic crisis caused a decrease of transport flows, road traffic congestion is growing continuously and at a rapid pace. Besides other problems the main are found in concentrated form on the small number of transit routes across the Alps. In 2007, 71% of the freight traffic across the Brenner was running on the road. Substantial damage to the environment caused by noise and particle emissions, poor transport safety as well as high economic losses in the fields of logistics and tourism are putting a strain on the region. Already existing developments and prognoses indicate that the global growth of cargo volumes and related transalpine transports will surely be enhanced in the long term. An insufficient supply of attractive rail products will additionally bust already existing growth of freight traffic on the road and related environmental, ecologic and social problems (Transitects, 2009-2012).

• Specific Environmental Model

To make cross Alpine transport easier, greener and more efficient, TRANSITECTS (2009-2012) develops and promotes intermodal solutions for transalpine freight traffic, particularly on important transit routes. An environmental model prepared within the project activities illustrates the positive effects of the pilot measures taken. Main task of the prepared "Specific Environmental Model" is the implementation of potential air quality benefits which will fallow from new logistic concept. This represents a cluster of specific pilot projects where estimation on benefits in terms of reduction of emissions is generated from each pilot-project per single TEU. Calculations in the Transitects (2009-2012) project also included environmental benefits from modal split (transfer of goods from road to rail) which was a methodological innovative approach forecasting an integrated analysis regarding emission dynamics of different ways of transport (maritime system included).

• Methodology

For the assessment and calculation of pollutant emissions of Pilot Projects of the new rail services the algorithm T-ENV Model was used which is the specific emission modeling system selected by the Italian Ministry of Environment to evaluate emissions generated from transport activities in Alpine and Carpathian area projects ("AlpCheck, "AlpenCors", "Alpfrail"). Model estimates emissions from vehicles of main atmospheric pollution, (NOx, PM10, etc) and gasses (CO2), transport energy consumptions (gasoline, diesel, GPL), noise on the local and macro-area level.

The input of environmental model is the results of the transalpine transport simulation model (zoning with 1034 centroids deriving from AlpenCors Project), the unit emission in each vehicle

typology and territorial data in different country. The model of interaction of the transport system simulates the way in which the application uses the system to offer producing flows on the arcs of the network that represent it. The transport system model is characterized by congestion, with a circular dependency between demand, flows and costs (Volume delay function). In particular, the demand for transport is influenced by the time value (translated into costs) in the different dimensions of choice (frequency, destination, type of vehicle and route) flows depend on the demand and how it uses the network and costs, turn, depend on the flows on the arcs of the network in a non-linear due to congestion.

Main functional parameters to prepare a transport model for the estimation of gasses, pollutants and noise were mainly the specifications of reference network, geo-referenced sequence of arcs and nodes, supply technical references, demand framework (O/D matrix), socio economic references and trends, modal split transfer, aggregated functional indicators (average commercial speed in Km/h, average time costs, etc.) and environment related data (average emissions per vehicle type, EURO standards, noise values, …).

Table 8-11: Summary details of Transitects project

Considering the wide scope of selected environmental parameters and functional assessment of environmental benefits of Transitects pilot project, the presented environmental transport model is very suitable also for further use in the ADB Multiplatform project. Within the project activities of Transitect project there was a clear definition, interpretation, standardization of technical parameters aiming to estimate, in a dynamic way, each pilot project implemented which should be fallowed also by ADB Multimodal project. Within the activities of WP 6.4 the ADB Multiplatform project is to prepare environmental impacts of pilot activities, which are to be similar to those prepared in the Transitects project. Although the Transitects transport model does not fallow corridor approach, but is focusing mostly on pilot implementations prepared during the lifetime of the project, there is to be found a clear resemblance to the planned activities in the ADB Multiplatform project. Transitects environmental assessment included all the modes of freight transport and also defined functional assessment of future transport scenarios which promote project activities also in the longer period.			
Geographical coverage	**Externalities**	**Transport modes**	**Methodology**
Central Europe area focusing on two areas interesting for the envestment south and (Upper Italy and Slovenia) and north of the Alps (Southern Germany and Austria).	Within the pilot activities focus was on calculation of emission (CO_2, PM10, NOx) and external costs of: – Air pollution; – Climate change.	Relation of external costs among truck or rail freight transport: calculation of savings for: –Road freight; –Rail total; –Rail accompanied combined transport –Rail unaccompanied combined transport	Adoption of model for emission savings calculation from pilot installations.

Source: http://www.asset-eu.org/

8.3.4 CAFE CBA

In May 2001, the European Commission launched the Clean Air for Europe (CAFE) Programme – a knowledge based approach with technical/scientific analyses and policy development that led to the adoption of the Thematic Strategy on air pollution, fulfilling the requirements of the Sixth Environmental Action Programme. Its aim was to develop a long-term, strategic and integrated policy advice to protect against significant negative effects of air pollution on human health and the environment.

The main objective of CAFE programme was to establish the capability to assess the costs and benefits of Thematic Strategy objectives and associated air pollution policies.

- **The CAFE CBA Framework**

In combination with the PRIMES model (that provides information on national energy balances), IIASA's GAINS model (which assesses emission reduction potentials and abatement costs), the

GEM-E3 model (which assesses macro-economic impacts of policy and development) and EMEP (which models the pollution climate and impacts), a framework has been developed for assessing costs and benefits of AQ policy proposals.

The underlying methodology used in the benefits analysis for quantification and monetisation of impacts in the study is the 'impact-pathway' approach, as developed by the US/EC fuel cycle project and advanced in Europe by the ExternE project.

CAFE CBA study is important concerning air pollution, it is in favour an EU perspective and is based on costs per tonne of pollutant and is therefore recommended for deriving unit values. In this respect and also as a result of its solid methodological approach has potential transferability to other national contexts. Among all pollutants, PM2.5 and P10 are considered by far the most relevant owing to their serious harmful effects on human mortality and morbidity. This is the case with CAFE CBA, which considers various types of primary pollutants and produces an average of damage between urban and rural areas by highlighting how PM2.5 is the pollutant for which the location of release is of particular relevance.

Table 8-12: Summary details of CAFE project

The main objective of CAFE programme was to establish the capability to assess the costs and benefits of Thematic Strategy objectives and associated air pollution policies. The focus of CAFE CBA study was air pollution, which was based on costs per tonne of pollutant and was therefore recommended for deriving unit values. In this respect and also as a result of its solid methodological approach has potential transferability to other national contexts. Among all pollutants, PM2.5 and P10 are considered by far the most relevant owing to their serious harmful effects on human mortality and morbidity. Again the study was using the Impact pathway methodology and was only covering EU countries.			
Geographical coverage	**Externalities**	**Transport modes**	**Methodology**
EU.	Air pollution.	Road and rail transport.	Bottom-up.

Source: http://www.cafe-cba.org/project-team/

8.3.5 SUPERGREEN

A new EU project entitled "Supporting EU's Freight Transport Logistics Action Plan on Green Corridors Issues" ("SuperGreen") has started on Jan. 15, 2010. The 3-year project is a Coordinated Action supported by the European Commission (DG-TREN) in the context of the 7th Framework Programme. The purpose of the project is to promote the development of European freight logistics in an environmentally friendly manner. Environmental factors play an increasing role in all transport modes, and holistic approaches are needed to identify 'win-win' solutions. The objectives of the SuperGreen project concern supporting the development of sustainable transport networks by fulfilling requirements covering environmental, technical, economic, social and spatial planning aspects.

As the part of "Literature review" the most relevant studies and research projects in terms of KPIs and their calculation, the calculation of external costs for goods transport were summarized. The methods to calculate external costs are in general based on the following simplified formula:

External cost = unit cost * degree of harm * intensity * volume

The most used method today to assess transport externalities associated with emissions is the **impact pathway approach**. The most important substances normally considered are nitrogen oxides (NOX), particulate matter (PM), volatile organic compounds (VOC), carbon monoxide (CO) and the secondary pollutant ozone (O3). Typically, health risks are most important but also the impact on ecosystems (acidification, eutrophication etc.) and corrosion are important.

In the Supergreen project a number of different values for external costs in the literature were presented. The tools mainly contain data from Maibach et al. (2008). However, in the tool there is a possibility to choose between costs for "mitigation" and costs for "impact". This applies only to the emissions and is most important for the GHG. The mitigation costs are the costs for avoiding the emission. The impact costs are the costs for society for dealing with negative effects. In the tool there are three levels of values (max, mid, min) for each parameter and calculations are made for all three levels in order to illustrate the uncertainty in the method. The tool is intended to calculate external costs and is not primarily a tool for calculating emissions. However, the latter is needed within the tool and is included following the principles of the Network for Transport and Environment (NTM, 2009). The number of vessels and vehicle types is limited basically to what is found in the NTM documents and, for road, in the Artemis model. In addition, a number of vessels/vehicles have been added since they were needed in the different case studies. The distances for each route are to be given by the user.

•Emission calculations

The emissions for each route were calculated from the emission factor for the chosen vehicle, the distance given, the amount of goods and the given load factor. In the tool we use emission factors expressed as mass of emissions per travelled distance and load (in g/tonne-km). The actual emission factor in per tonne-km is then obtained by dividing the emission factor for the vehicle with the load factor. The tool automatically switches between mass and volume depending on the data given by the user. The density where this switch occurs depends on the transport mode. The emission of GHG is given in CO2-equivalents. The impact on global warming from the emission of particles and from the formation of secondary pollutants is not included in the model.

• External costs calculations

The calculations of external costs for the emissions and the use of fossil fuel were done by multiplying the emissions for a route with the values for the external costs in € per mass unit of the respective substance. The tool contained external costs divided in urban and non-urban values. The fraction of the emission that was multiplied with the respective value was obtained through the urban factor given by the user for each route. The values for the external costs were taken mainly from Maibach et al. (2008) and Steen (2000). The costs for noise, congestions, up- and downstream, nature, soil and water, and accidents were calculated based on a list with values in € per distance travelled for a vehicle/vessel.

The main uncertainty in the calculations was lying in the estimation of external costs in € per tonne-km or € per kg of emission. A number of parameters had to be given by the user. Sometimes the type of vehicle used was not known in detail which led to uncertainties in the results. The load factor was often even harder to establish. The external costs for emission of particles vary strongly between sites depending on the population density of a specific location. In the tool there were values divided into urban and non-urban locations. It was not straightforward to assess which part of the costs associated with negative impacts were already

internalised. The taxes and fees charged in the transport sector are often motivated by infrastructure cost. The policy measures were taken as well as the levels of fees and taxes and were usually not motivated by the actual external costs that should be internalised.

• Transport cost calculators

A number of previous studies reported serious difficulties in collecting transport cost information, thus a good alternative is to use a model for the calculation of transport costs. Two SuperGreen partners have developed such calculators for internal use; one of them has even upgraded their tool especially for the needs of this project. Two more cost calculators were found in the literature reviewed. All these calculators are briefly presented under this heading.

• The COMPASS tool

IHS Fairplay developed a tool within project MOSES (Motorways of the Seas European Style). MOSES was terminated, but IHS Fairplay continued developing the tool at its own expense. The tool is named "COMPASS", which is an acronym for comparison tool for co-modal transport assessments. COMPASS enables the entire transport chain to be modelled in steps and activities. Each transport chain can be setup with as many nodes and links as is required. The output will give a description of the transport by: the total direct cost for the transport (operational cost), the time to produce the transport, and the total socioeconomic costs to produce the transport. COMPASS can be used to benchmark different transport solutions, to find the cost relation between different transport systems, and to select the most favourable transport alternative. The country data as well as vehicle data can be stored to be reused or adjusted/edited and used. In this way it has a generic function that builds up when it is used. Some typical load carriers and vehicles are present at start. New specified load carriers and related information can be fed in to be stored and used. Also cost levels and other specifications of vehicles or performance of vehicles or fuels may be stored in the application.

• The NP Should calculator

The NP Should cost calculator was developed internally in Procter & Gamble in the framework of the 2009 internship program. The tool estimates transport costs, lead times and external costs. Calculations are made based on collected data, which are linked to a user specified intermodal transport chain. The model was improved by the developer in 2010 in terms of number of countries, infrastructure objects and modes of transport (e.g. inland waterways) covered. These improvements were made in order to benchmark the SuperGreen corridors as an internal project in Procter & Gamble. The tool is owned by Procter & Gamble but, in the case it is finally selected for use under the SuperGreen project, it can be made public and available free of charge. Otherwise the tool will remain restricted and shall be used only by its developer. The NP Should calculator is a MS Excel based tool which can estimate the following indicators: Average cost in €/TEU, Average lead time in hours and Total external costs in €/TEU.

• **Model input and output**

Calculations can be made for the intra-EU intermodal transportation considering country specific data, like fuel price, infrastructure fees and cost of labour, etc. Currently the model covers 13 European countries, including Central Europe, Nordic countries, the UK and the Mediterranean area. An average default unit value (per km) is used for countries not covered. The system can also take into consideration working time limitations in road transport and time delays due to gauge differences in rail transport. The user describes the route to be examined by specifying: the route segments, the distance of each segment, the mode used in each segment, the node type (seaports, inland navigation terminals or inland bi-modal road-rail terminals), the use of special infrastructures and some other variables like: the load factor, the average number of wagons per train, and the current fuel prices, as provided in the website http://www.energy.eu/#prices. The model has the ability to compare user specified input against acceptable ranges in order to identify potential mistakes. The user has the ability to modify all default values used by the model.

External costs are calculated based on an average unit figure of 0.035 €/tkm for trucks, 0.015 €/tkm for rail and 0.009 €/tkm for ships. Accuracy tests of the model results run internally by Procter & Gamble have shown deviations from real costs in the range of 5-10% for road transport. Deviations for rail transport were higher (10-50%) due to lower visibility of cost structures in this sector. No accuracy tests have been run so far for inland waterway transport and short sea shipping, modes for which the background information on costs and cost structures need to be updated.

• **The IMTIS calculator for combined transport with CO2 emissions**

The German company Contargo has developed an "Intermodal Tariff Information System" (IMTIS), which helps clients with evaluating the best transport mode and route. The system is permanently being updated and by now possesses knowledge of more than 115,000 destinations in Europe. In 2007, the calculator was extended by a new factor: the CO2 emissions of each mode of transport. The system is easy to handle as you only need to enter the name of

the seaport and the destination in the hinterland: the programme will suggest a route by means of combined transport, also including CO2 emissions. Thus, a comparison of the environmental friendliness of barge, train and truck is possible. IMTIS acknowledges a variety of factors in its calculations, i.e. if a ship travels up- or downstream, if the carriers need to travel with an empty container, the consumption relating to loading and unloading in the terminals and many more.

Table 8-13: Summary details of SUPERGREEN project

The main concern of SUPERGREEN PROJECT is to support the development of sustainable transport networks by fulfilling requirements covering environmental, technical, economic, social and spatial planning aspects. The project covers all modes of intermodal freight transport and logistics (excluding air). Geography-wise, the covering is from Turkey to Portugal as well as from Scandinavia to Greece and Cyprus. Both EU and non-EU partners are included. The calculation of external costs for goods transport was summarized only as the part of "Literature review" on the most relevant studies and research projects in terms of KPIs and their calculation. On the other hand the project does include a review on transport cost calculators what can be a benefit to ADB Multiplatform project.			
Geographical coverage	**Externalities**	**Transport modes**	**Methodology**
9 corridors in enlarged EU (from Turkey to Portugal as well as from Scandinavia to Greece and Cyprus).	Focus on air pollution, congestion and noise.	Road, rail, sea and inland navigation.	The calculation of external costs for was summarized only "in terms of KPIs and their calculation.

Source: http://www.supergreenproject.eu/info.html.

8.3.6 WATERMODE

WATERMODE (Transnational Network for the Promotion of the Water-Ground Multimodal Transport) is an EU territorial cooperation project co-financed under the South East Europe Programme (SEE). Leaded by the Venice Port Authority, with a total budget of about 3 million euro, it promotes a better coordination between policy actors and stakeholders to increase the competitiveness of the alternatives to road transport in the South East Europe regions, especially valorising the potentials of multimodal transport solutions (http://www.watermode.eu/).

The Eastward shift of the European economy barycentre, the growing importance of the economies of the Eastern neighbouring regions (Russia, Ukraine and Caucasian countries) and the increasing traffic to and from the Far East implies the need to improve accessibility to and from the "new Europe" and to optimize the port gateways for the traffic to and from the Asiatic markets. This means reinforcing the South-East Mediterranean and Eastern Black Sea port gateways, naturally closer to Far East via Suez pursuing the target of maximizing the shipping routes and minimizing the impacts of energy costs and CO2 emissions.

WATERMODE fosters the improvement of the connections between sea ports, inland ports and hinterland logistics centres in the SEE area, by defining joint shared indicators and mapping the multimodal logistics facilities, as well as supporting the implementation of national and local infrastructural plans. Furthermore, the project also:

•Investigates the competitiveness of multimodal transport compared to road transport by evaluating internal and external costs along 3 pre-defined routes;
•Promotes common training tools to be presented as common criteria in the framework of the action of the EU Commission for Safety training in logistics.

The SEE programme area (South-East Europe) is crossed by relevant freight traffic flows, originated and directed in - and outside it. This traffic is mainly supported by road infrastructures that were not planned for these flows. This involves a negative impact on the territorial competitiveness and environment, due to air pollution, noise and reduced mobility.
The project objective is to promote the coordination between actors dealing with logistics for a better management of the transport policies and an efficient implementation of the multimodal logistics cooperation, especially exploiting the ground/water connections (http://www.watermode.eu/).

The project will therefore highlight the potentials of the waterways crossing the area, contributing to the full integration of the maritime and river transport in the logistics chain.
These objectives will be achieved through a set of actions concerning, mainly: the analysis of the competitiveness of multimodal transport compared with road transport, on three pre-defined routes , by including the external costs in the overall evaluation (Route 1: Constantza-Wien; Route 2: North Adriatic-Aegean-Black Sea; Route 3: Bari-Bar-Sofia);

Table 8-14: Summary details of WATERMODE project

The main objective of WATERMODE project is to support the improvement of the connections between sea ports, inland ports and hinterland logistics centres in the SEE area. External costs are only used in the overall evaluation for analysing the competitiveness of multimodal transport compared with road transport, on three pre-defined routes in SEE area.			
Geographical coverage	**Externalities**	**Transport modes**	**Methodology**
Three pre-defined routes: Route 1: Constantza-Wien; Route 2: North Adriatic-Aegean-Black Sea; Route 3: Bari-Bar-Sofia.	Focus on air pollution and global warming.	All modes of freight transport (excluding air).	The air pollution and global warming assessment will be carried out using a recent Study conducted by APV in the Sonora Project.

Source: www.watermode.eu/

8.4 Summary on methodology of external costs

The table summarizes methodologies for external costs calculation of the documents, studies and projects that were presented and analysed above. The most common methodology for the external costs calculation is described for all the freight transport modes combined. In the case of different calculation methodologies or any other data differences the specificities are presented in the remarks column. The presented values for average external costs represent the general costs for the EU-27 countries (2008) and are not estimated for SEE.

Table 8-15: Summary table on methodologies of external costs of freight transport

Cost category	Transport mode	Degree of relevance [2]	Average external costs (€/1.000 tkm)	Most common methodology (approach)	Input values (cost categories)	Output values	Main strengths	Remarks
Accidents	Road	☑☑☑	LDV: 56,2 HDV: 10,2 Total: 17,0	Bottom up approach, (estimation of marginal costs). Combination of bottom-up and top-down approach possible (estimation of total, average and marginal costs).	Number of casualties (fatalities, severe and slight injuries) caused by transport users. Social cost per casualty: Risk value, human capital losses, medical care and administrative costs.	Allocation of total external costs of transport users: according to the responsibility or damage potential. AVERAGE OR MARGINAL COST PER TKM of transport usage.	Good quality of data concerning European (mainly road) accident database. Results applicable to the specific selected corridor and area (based on the national data).	
	Rail	☑☑	0,2					Rail accidents are not frequent; values represent average costs rather than marginal costs. All rail injuries are severe, fatalities and injuries from suicide attempts are not included, data do not differentiate passenger and

[2] Legend:
☑= low degree of convergence/relevance
☑☑= medium degree of convergence/relevance
☑☑☑= high degree of convergence/relevance

Cost category	Transport mode	Degree of relevance [2]	Average external costs (€/1.000 tkm)	Most common methodology (approach)	Input values (cost categories)	Output values	Main strengths	Remarks
								freight trains.
	Maritime	☑	0,0					There is no data available on accidents.
	Inland waterways	☑	0,0					
Climate change	Road	☑☑☑	*LDV: 44,5 *HDV: 9,8 **LDV: 7,6 **HDV: 1,7 *Total: 14,9 **Total: 2,6	Two methodologies mostly used: damage costs and avoidance costs (mitigation costs).	GHG emissions per vehicle category (tone). Cost factors of CO_2 equivalents (possible differentiation of low and high price).	Average costs per tkm of transport mode or total external costs of transport mode.	Strengths of damage costs approach – analyses directly the damages related to external effects and the monetary value of the impacts. Avoidance costs approach: better approach if reduction targets are already set, more accurate modeling of the results. In general avoidance cost approach is more widely used.	Discussion if fuel taxes represent part of the external costs internalization.
	Rail	☑	* 0,9 ** 0,2					
	Maritime	☑☑	* 0,6 ** 3,6					
	Inland waterways	☑☑☑	* 0,6 ** 3,6					
Air pollution	Road	☑☑☑	LDV: 17,9 HDV: 6,7 Total: 8,4	Bottom-up approach, the use of data on emission of pollutants from the source to the final receptor.	Emission factors of air pollutants per vehicle category including particles and other pollutants. Transport volume per vehicle	Allocation of total external cost to vehicle categories. Data on average costs per pkm and tkm by mode.	Availability of the input data on the European level (TREMOVE database). Some cost factors can be transformed from past studies and	Data on average air pollution of the vehicle category cannot be directly transformed from European level to the ADB area (different emission factors and EURO standards).
	Rail	☑☑	1,1					Rail transport marginal

Cost category	Transport mode	Degree of relevance [2]	Average external costs (€/1.000 tkm)	Most common methodology (approach)	Input values (cost categories)	Output values	Main strengths	Remarks
					category (vkm) Social costs per ton of analyzed air pollutants.		multiplied with the total emissions on the corresponding pollutants.	costs vary more considerably than for road transport, differentiation according to the type of traction (electric or diesel).
	Maritime	☑	5,4					Difficult to compare owing to different locations and vessel sizes, difference exists between bulk, container and truck and trailer Ro-Ro transport.
	Inland waterways	☑	5,4					
Noise	Road	☑☑☑	LDV: 6,3 HDV: 1,8 Total: 2,5	Studies usually make bottom-up approach in estimating external noise pollution costs.	Number of people affected by noise per road freight transport vehicle category (used per noise class of 5 dB(A). Noise cost per person exposed.	Allocation of total external costs to road vehicle categories based on the weighting factors (difference in transport modes, night/day, urban/rural,). Average costs per tkm by road transport mode.	Differentiation of the results on the area type, traffic situation, time of the day based on the recommended values.	Exact allocation of the people affected by the noise is impossible to calculate. The methodology includes data on agglomerations of inhabitants on the areas with a population density over 500 inhabitants/km^2.
	Rail	☑☑	1,0					In rail transport the level of noise largely depends upon the characteristics of the rolling stock (speed, tracks, brakes, surface conditions).
	Maritime	☑	0,0					Noise costs are assumed to be negligible in maritime and inland waterways due to low emission factors and because most of the activities occur outside densely populate areas.
	Inland waterways	☑	0,0					
Congestion and	Road	☑☑☑	No data	Congestion is typically focused on	Data on network (length, capacity,	Allocation of the total Deadweight	Values of travel time for freight transport	Individual transport is causing collective

Cost category	Transport mode	Degree of relevance [2]	Average external costs (€/1.000 tkm)	Most common methodology (approach)	Input values (cost categories)	Output values	Main strengths	Remarks
scarcity				the road transport (rail transport does not produce congestion). Harmonized bottom-up approach is used (vehicle hours lost, value of travel time).	annual demand on roads). Travel behavior (speed flow curves, hourly loads, elasticity). Cost data (VOT, Fuel price). Urban data (demand of the transport modes and motorvehicles).	loss (DWL), potential revenues and delay costs: by cost category. Average cost per pkm and tkm by county.	can be gained from other studies (observation of route shifts or multimodal studies).	congestion (bottlenecks and peak times). Some European countries already have national congestion statistics which can be applied in the external costs study. The data on average delay per freight vkm on the traffic network can be used as a data for the external cost calculation.
	Rail	☑	No data					In scheduled transport, slots or tracks are preplanned and congestion occurs because of the variations compared with the planned timetable.
	Maritime	☑	No data					If there is no slot allocation in ports/channels, congestion is individual.
	Inland waterways	☑	No data					

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009).

* High scenario: Low scenario:

9 Review of issues related to external costs in SEE area

9.1 Questionnaire – Survey design and participating countries

The questionnaire on external cost calculation methodologies was designed by ERDF PP10 Institute of Traffic and Transport Ljubljana in collaboration with ERDF PP AUTh and ERDF PP3 PBN.

The questionnaires were made in order to examine the situation regarding the status quo of external costs in the participating countries of the ADB Multiplatform project.

As far as the structure of the questionnaire is concerned, the first part provides basic information on the recent studies, both international and national, on transport external costs in each participating country. The second part deals with details of the latest national study on external costs of freight transport for each country and provides specific data concerning transport modes, parameters and the approach used in the study. The questionnaire concludes with information on legislation and other aspects of external costs of transport.

Below there is a summary of the questionnaires filled in by the participating countries in alphabetical order. The whole completed questionnaires are presented in Annex 1 of this report.

9.2 Countries reports

9.2.1 Albania

The situation in Albania is not inspiring, since there hasn't been any relevant international neither national study on external cost calculation of freight transport made. Also there is no legislation (regulation, directive etc.) at national, regional or local level regarding external costs of transportation and the reasons have not been identified yet.

9.2.2 Bulgaria

Basic information on the recent studies on transport external costs

The international study of freight transport external costs calculation that also includes Bulgaria is listed below.

International study n.1

NAME OF THE STUDY	*EXTERNAL COSTS OF TRANSPORT IN CENTRAL AND EASTERN EUROPE*
NAME OF THE PROJECT	*The Environmentally Sustainable Transport (EST) outreach activity "EST goes East" to Central and Eastern Europe. A consortium of consultants mandated by the CEI Working Group on Transportand the Environment and the OECD Working Group on Transport has conducted the study.*
YEAR OF STUDY	*27-28 May 2003*
FREIGHT TRANSPORT MODES ANALYSED	*Rail: passenger, freight (diesel and electric traction). Road: Road passenger: passenger cars, buses and coaches (one category), motorbikes/mopeds. Road freight: light duty vehicles (LDV), heavy duty vehicles (HDV). Air transport: passenger aviation. Inland waterways: freight*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents Noise Air Pollution Climate Change Nature & Landscape*
DIRECT LINK TO LOCATION OF THE STUDY	*OECD/ENV website www.oecd.org/env/transport.*

There are two national studies on external cost calculation of freight transport in Bulgaria.

ORIGINAL NAME OF THE STUDY	*Възможности за измерване и интернализиране на външни разходи за транспорт при определяне на инфраструктурни такси*
ENGLISH TRANSLATION OF THE STUDY	*Ability to measure and internalization of external transport costs in determination of infrastructure charges*
YEAR OF STUDY	
AUTHORS	*Christina Nikolova - senior assistant-professor, University of National and World Economy*
CONTRACTOR	*Scientific publication*
FREIGHT TRANSPORT MODES ANALYSED	*Rail, road, air and water transport.*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, environment protection costs; Congestions*
DIRECT LINK TO LOCATION OF THE STUDY	*(If relevant write direct URL location to the study on the internet)*

This study deals with internalization of external costs, general information on approaches, evaluation of the possibility of including the external costs in the infrastructure charges and applicability of the approaches to different modes of transport.

Improving the system of infrastructure charges will provide a more accurate basis for comparison of returns on investment in transport and will improve the conditions for private

investment and usage of infrastructure. With the introduction of direct infrastructure charges, each shipment will be assessed according to the costs and benefits that are triggered as all costs will be taken into account. On the other hand, the internalization of the costs of environmental protection will increase the eco-efficiency, i.e. the fees reflect the cost of eliminating harmful emissions, and the level of these emissions will be reduced to the point where the cost of the reduction will be equal to the benefits of this measure. Thus, from the standpoint of social efficiency, internalization will maximize the welfare of society and not the volume of traffic. From financial perspective, more efficient use of the transport system will reduce the need for government spending on infrastructure, health and environmental protection. The net effect in the commercial sector will be positive and direct effect of higher transportation charges will be offset by reducing the costs of congestion and accidents, and any possible reduction of taxes provided by the government.

ORIGINAL NAME OF THE STUDY	*Единен подход за определяне на инфраструктурните такси в транспорта*
ENGLISH TRANSLATION OF THE STUDY	*Common approach for transport infrastructure charging*
YEAR OF STUDY	*Mechanics, Transport, Communications Academic Journal, 2007*
AUTHORS	*Christina Nikolova - senior assistant-professor, University of National and World Economy*
CONTRACTOR	*Scientific publication*
FREIGHT TRANSPORT MODES ANALYSED	*Rail, road, air and water transport.*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, environment protection costs; Congestions*
DIRECT LINK TO LOCATION OF THE STUDY	*http://www.mtc-aj.com/conf_2007/dok_126.pdf*

In the second study mentioned above the application of marginal social costs pricing was a starting point in establishing infrastructure charging system in transport sector. These principles were used in the process of development of a common approach for infrastructure charging in different modes of transport.

The study contains Actions and effects of application in different modes. The primary long term goal of applying a uniform approach to infrastructure charges in transport is to increase the efficiency in using national transport infrastructure. Options to achieve this goal can be determined by analyzing the impacts and implications of the approach in terms of the infrastructure of transport modes.

No transport related data were used in the above mentioned national studies. They are short and more general, based on the international approaches.

The average external costs of freight transport for Bulgaria are:

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents	0.0	2.2	0.0
Climate change	0.5	1.5	0.3
Noise	0.3	1.1	0.0
Air pollution	9.0	33.1	2.2
OTHER (if relevant)	0.1	0.9	0.0

Source: *The Environmentally Sustainable Transport (EST) outreach activity "EST goes East" to Central and Eastern Europe. A consortium of consultants mandated by the CEI Working Group on Transport and the Environment and the OECD Working Group on Transport has conducted the study, mentioned as in p. 1.1.*

Reference year (the year against which EUR was calculated): **1995.**

Average external costs 2008 (excluding congestion), source External Costs of Transport in Europe, update study for 200, mentioned in p.1.1.

Rail freight (€/1,000 tkm*a)	Road freight (LDV and HDV) (€/1,000 tkm*a)	Inland and sea waterways (€/1,000 tkm*a)
16.3	57.6	16.2

Total external costs of freight transport

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents	0.0	23.7	0.0
Climate change	4.1	16.6	0.2
Noise	2.4	11.5	0.0
Air pollution	77.0	359.4	1.6
OTHER (if relevant)	0.5	10.3	0.0
OTHER (if relevant)			

Source: *The Environmentally Sustainable Transport (EST) outreach activity "EST goes East" to Central and Eastern Europe. A consortium of consultants mandated by the CEI Working Group on Transport and the Environment and the OECD Working Group on Transport has conducted the study, mentioned as in p. 1.1., in Million Euro/Year*

Total external costs per inhabitant , year (2008) for EU-27* by country and transport mode (excluding congestion), source External Costs of Transport in Europe, update study for 2008, mentioned in p.1.1.:

Rail freight (€/inhab.)	Road freight (LDV and HDV) (€/inhab.)	Inland and sea waterways (€/inhab.)
10.0	136	6

9.2.3 Croatia

Basic information on the recent studies on transport external costs

The international study of freight transport external costs calculation that also includes Croatia is listed below.

International study n.1

NAME OF THE STUDY	*"est goes east" -External Costs of Transport in Central and Eastern Europe*
NAME OF THE PROJECT	
YEAR OF STUDY	*2002*
AUTHORS	*OECD, Austrian Ministry of Agriculture, Forestry, Environment and Water Management elaborated by INFRAS Consult, Zurich and HARRY Consult Vienna, under the auspices of CEI Working Group Environment and its Task Force Environment and Transport.*
FREIGHT TRANSPORT MODES ANALYSED	*Road, Rail, Water-borne, Aviation*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Noise, Air pollution, Climate change, Nature and Landscape*
DIRECT LINK TO LOCATION OF THE STUDY	*http://esteast.unep.ch/phocadownload/cei0201.pdf*

9.2.4 Greece

Basic information on the recent studies on transport external costs

Relevant international study[3] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in Greece are listed below:

International study n.1

NAME OF THE STUDY	External cost calculation for selected corridors (8.THE FREIGHT FREEWAY CASE STUDY BETWEEN PATRAS,BRINDISI,MUNICH,HAMBURG)
NAME OF THE PROJECT	RECORDIT(Real Cost Reduction of Door-to-Door Intermodal Transport
YEAR OF STUDY	2001
AUTHORS	Stephan A. Schmid (IER) Peter Bickel (IER) Rainer Friedrich (IER)
FREIGHT TRANSPORT MODES ANALYSED	Pre haulage by road SSS Rail Post haulage by road
EXERNAL COSTS OF TRANSPORT ANALYSED	Air pollution Noise Accidents Congestion

[3] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

	Global Warming Up and downstream processes
DIRECT LINK TO LOCATION OF THE STUDY	http://www.recordit.org/deliverables/deliv4.pdf

International study n.2

NAME OF THE STUDY	UNIfication of accounts and marginal costs for Transport Efficiency
NAME OF THE PROJECT	UNITE (COMPETITIVE AND SUSTAINABLE GROWTH PROGRAMME
YEAR OF STUDY	2003
AUTHORS	Chris Nash, with contributions from partners
FREIGHT TRANSPORT MODES ANALYSED	Road, Rail, Air, water (inland waterways, maritime shipping)
EXERNAL COSTS OF TRANSPORT ANALYSED	Infrastructure, accident, environnent,(air pollution, climate change, noise, nature& & landscape, soil &water pollution, nuclear risks), congestion
DIRECT LINK TO LOCATION OF THE STUDY	http://www.its.leeds.ac.uk/projects/unite

International study n.3

NAME OF THE STUDY	State-of-the-art in project assessment
NAME OF THE PROJECT	HEATCO: Developing Harmonised European Approaches for Transport Costing and Project Assessment
YEAR OF STUDY	2005
AUTHORS	Peter Bickel Arnaud Burgess Alistair Hunt James Laird Christoph Lieb Gunnar Lindberg Thomas Odgaard
FREIGHT TRANSPORT MODES ANALYSED	Road Rail Air Inland Waterway Sea
EXERNAL COSTS OF TRANSPORT ANALYSED	safety noise air pollution – local/regional climate change
DIRECT LINK TO LOCATION OF THE STUDY	http://heatco.ier.uni-stuttgart.de/

There is not any official integrated national study on external cost calculation of freight transport in Greece apart from several scientific papers, PhD studies, conference presentations and other individual approaches of certain cost categories (e.g. accidents, or pollution etc.) based

mainly on data from literature review. There is also a PhD study relevant to the externalities of energy.

9.2.5 Hungary

Basic information on the recent studies on transport external costs

Hungary is included in many of the studies of external cost calculation, but since most of them are already mentioned in the study we present the ones listed below:

NAME OF THE STUDY	*The True Costs of Automobility: External Costs of Cars Overview on existing estimates in EU-27*
NAME OF THE PROJECT	*These studies include a number of projects funded by the European Union (e.g. UNITE (Nash, 2003), ExternE (Bickel & R., 2005), NEEDS) but also national or privately funded research projects (e. G. INFRAS/IWW (Schreyer, et al., 2004), Swiss Federal Office for Spatial Development (ARE, without year), CE Delft et al. (CE Delft; Infras; Fraunhofer ISI, 2011)).*
YEAR OF STUDY	*October 2012*
AUTHORS	*TU Dresden (Prof. Dr. Ing. Udo J. Becker, Thilo Becker, Julia Gerlach)*
FREIGHT TRANSPORT MODES ANALYSED	*Passenger cars on roads*
EXTERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Air pollution, Noise, Upstream and downstream effects (covering all effects before and after the utilization phase), Smaller other effects (land use, separational effects etc.), Climate Change*
DIRECT LINK TO LOCATION OF THE STUDY	*http://www.greens-efa.eu/fileadmin/dam/Documents/Studies/Costs_of_cars/The_true_costs_of_cars_EN.pdf*

NAME OF THE STUDY	*UNIfication of accounts andmarginal costs for Transport Efficiency*
NAME OF THE PROJECT	*COMPETITIVE AND SUSTAINABLE GROWTH (GROWTH) PROGRAMME*
YEAR OF STUDY	*November 2003*
AUTHORS	*Chris Nash, ITS, University of Leeds*
FREIGHT TRANSPORT MODES ANALYSED	*Road transport, public transport, railway transport, aviation, inland waterway transport and maritime shipping*
EXTERNAL COSTS OF TRANSPORT ANALYSED	*Costs of road transport, Road revenues and taxes, Total rail transport costs, Rail revenues and subsidies, Total air transport costs, Revenues, charges, taxes and subsidies within the aviation sector*
DIRECT LINK TO LOCATION OF THE STUDY	*http://www.its.leeds.ac.uk/projects/unite/downloads/Unite%20Final%20Report.pdf*

In Hungary there is only one national study on external cost calculation of transport. It was prepared in the year 2010 and includes road and railway transport modes.

ORIGINAL NAME OF THE STUDY	*A KÖZÚTI ÉS VASÚTI KÖZLEKEDÉS TÁRSADALMI MÉRLEGE MAGYARORSZÁGON*
ENGLISH TRANSLATION OF THE STUDY	*The Social Balance of Road and Railway Transport in Hungary*
YEAR OF STUDY	*September 2010*
AUTHORS	*KTI KÖZLEKEDÉSTUDOMÁNYI INTÉZET NONPROFIT KFT. & Levegő Munkacsoport & Via Kárpátia Kft.*
CONTRACTOR	*Közlekedési Hírközlési és Energiaügyi Minisztérium*
FREIGHT TRANSPORT MODES ANALYSED	*Road transport; Railway transport;*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Air pollution, Climate change, Congestion, Noise and Other External costs (costs for nature and landscape, soil and water pollution)*
DIRECT LINK TO LOCATION OF THE STUDY	*www.levego.hu/sites/default/files/ kozuti_vasuti_kozlekedes_tarsadalmi_merlege_magyarorszagon_0.pdf*

Details on the latest study on external costs of freight transport

One of the primary objectives is to clarify the methodological issues. These data have been gained primarily from the database of the Hungarian Central Statistical Office. The study has been based on such data, which are stemmed from the most authentic possible resources, primarily Hungarian ones, secondly non-Hungarian ones, accepted in the most wide-ranging sphere. The reference year of the study was 2006.

This project is primarily focused on defining social balance of transport, within which content, meaning and elements of the balance are specified. To define the balance we devided it into two sections: in one section there is all of the transport expenditure of society and in the other section there are its benefits. In contrast with the general objectives described above, this study can cover the partial issues in this length, as follows:
–it can define the transport balance of state budget,
–it can define the external impacts.

The study defines transport balance of state budget, which is supplemented with external impacts and deals with the out-of-budget, non-market conform financial advantages.
Extended state budgetary balance of transport essentially consists of the items, as follows:
-„conventional" transport state budgetary balance (state revenues and expenditure),
-balance of asset change of transport infrastructure,
-external balance (basically out of natural resources and change of condition in human health.

The study has examined scopes of external costs primarily through social balance of road and rail transport. It has analyzed impacts of externals in each transport modes, as follows: Climate change, Air pollution, Noise pollution, Harmful environmental effects of soil and water pollution, Destruction and deviding of natural habitats, Accidents, Costs of traffic congestion, Indirect external effects relating transportation.

The study focused generally and comprehensively on exploring externals of road and rail transport. In this relation it referred to components of both personal traffic and transportation of goods in the same process. Neither the survey made on the basis of data acquired in 2006, nor the report finished in 2010 detailed the importance and relations of the intermodal transportation. This viewpoint has become in focus and highlighted since 2009 to a larger extent. As far as we experience, intermodal transportation is funded in more and more logistics development programs.

Parameters included in the study of external costs of freight transport

a) Differentiation of night/day freight flows: Density of the Hungarian traffic, their dividing rates, density of night traffic (between the period of 10 pm and 6 am) regarding certain road network elements were estimated on the basis of results of the Hungarian Public Roads Non-profit Authority (2008).
b) Differentiation of urban/interurban/rural areas: The differentiation of urban& interurban &rural areas was taken into consideration at the noise, air pollution and congestion (jam) external cost calculation.
c) Energy production mix: In the course of calculation costs of air pollution were indicated in the category of external costs of electrical traction rail transportation.
d) High and low scenario of price for 1 tone of CO_2 : Social costs arisen in relation to climate change effects due to CO_2 emission are uncertain. According to experts, damages of 1 ton of CO_2 emitted into air are rising decades by decades. It was estimated to be 25 €/t by 2010 but also extreme values (7–45 €/t) were taken into account in the course of calculation due to huge uncertainty of effects. On the basis of data mentioned above, social costs amounted to 6,9 €CT (1,9–12,4) and 7,8 €CT (2,2–14) are created due to burning 1 litre of petrol or diesel fuel.
e) Slopes for road and rail infrastructure: Slope of road infrastructure max 15%; rail infrastructure – main line max 2, 5%, side-line and electrical traction max 6%. The study didn't calculate the effect of slopes.

The study, which details external costs of transportation applies primarily the bottom-up calculation method and at several points it refers to also statistical sources and international reference studies.

- In calculation of effects on climate change, the study used international reference studies for benchmarking (top-down effect), while calculations in Hungarian studies were estimated on the basis of bottom-up approaches.
- In the section, in which effects on air pollution endangering human health were examined, the study was based on the benchmarking data of the reference study (top-down effect), but primarily

they were calculated on the basis of the database of the Hungarian Public Roads Nonprofit Authority along the bottom-up methods by weighted.

- Calculation of effects on noise pollution endangering human health was based on traffic data and application of planning factors and experience (bottom-up logic), partially using the international reference study for benchmarking (top-down calculation effect).
- Calculation of external costs relating to effects of soil and water pollution endangering environment was based and estimated on the Hungarian data (bottom-up) supplemented with data of the international reference study (top-down effect).
- Calculation of external costs relating to destruction and deviding of natural habitats was based on synthesis of deduction and models described in several international studies (top-down logic) and was defined by estimation supplementing with data acquisited about length and development of infrastructure.
- Calculation of external costs relating to accidents was based on the database of the Hungarian Central Statistical Office as well as the data of data sources acquisited about the different transport modes (primarily bottom-up method). To define uncertainty of certain external components, the study used both the HEATCO and the COWL references (top-down).
- Traffic congestion: The study was stemmed from the traffic statistics made in Budapest and the registered data acquisited about fleet of vehicles (bottom-up method) and calculation of external costs will be covered for Hungary on the basis of population distribution and (increasing) probability of traffic congestion (estimation)

Average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport (2006 reference year):

Average external costs of freight transport

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents	105,980	870,8	n.a.
Climate change	2,442	90,1	n.a.
Climate change low scenario	0,814	25,3	n.a.
Climate change high scenario	4,884	154,8	n.a.
Noise	3,256	86,4	n.a.
Noise low scenario	2,442	78,6	n.a.
Noise high scenario	3,093	189,9	n.a.
Air pollution	10,582	366,4	n.a.
Land & water pollution	0,578	28,3	n.a.
Nature damage high	9,768	35,4	n.a.
Nature damage low	0,814	14,2	n.a.
Line&Road damage	4,070	93,8	
Congestion, jam	0,000	0,5	n.a.
Total - mean	132,2	1 561,0	n.a.
Total - low	125,3	1 477,9	n.a.
Total - high	139,0	1 740,0	n.a.

Total external costs of freight transport

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents	47 345,5	938 661,8	n.a.
Climate change	1 090,9	97 090,9	n.a.
Climate change low scenario	363,6	27 272,7	n.a.
Climate change high scenario	2 181,8	166 909,1	n.a.
Noise	1 454,5	93 090,9	n.a.
Noise low scenario	1 090,9	84 727,3	n.a.
Noise high scenario	1 381,8	204 727,3	n.a.
Air pollution	4 727,3	394 909,1	n.a.
Land & water pollution	258,2	30 545,5	n.a.
Nature damage high	4 363,6	38 181,8	n.a.
Nature damage low	363,6	15 272,7	n.a.
Line&Road damage	1 818,2	101 090,9	n.a.
Congestion, jam		520,4	n.a.
Total - mean	57 240,0	1 682 636,7	n.a.
Total - low	54 149,1	1 593 000,4	n.a.
Total - high	60 258,2	1 875 545,8	n.a.

The external cost level of road transportation is roughly 29 times higher than the external cost level od railway transport. In the external cost elements of railway trasport the '*accidents*' cathegory represented the 80% of total external cost, so this cathegory is dominant. The share of air pollution and the nature damage is quite low (8,3 & 7,2%).

The external cost level of road transportation is dramatically high in this model according to the study dated 2006. In this structure the accident cost is dominant with 55,8%. The second higher rate is at air pollution (23,5%) and the third ones are line&road damage (6%), climate change (5,8%) and the noise (5,5%).

Our proposal is the facing to these major components of external cost matrix.

9.2.6 Italy – included when the questionnaire will be received

9.2.7 Montenegro

Basic information on the recent studies on transport external costs

Montenegro is not included in any relevant international study regarding freight transport external costs and currently there is no national study on external cost calculation of freight transport for Montenegro.

9.2.8Romania

Basic information on the recent studies on transport external costs

Romania is included in the international studies: WATERMODE, IMPACT and study of External costs of transport in Europe. Within the studies comparisons between multimodal and road transport systems were also prepared. More details concerning these studies are presented below.

NAME OF THE STUDY	*External Costs of Transport in Central and Eastern Europe*
NAME OF THE PROJECT	
YEAR OF STUDY	*2003*
AUTHORS	*Organisation for Economic Co-operation and Development (OECD)*
FREIGHT TRANSPORT MODES ANALYSED	*Road , rail, air, waterborne*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, noise, air pollution, climate change, nature & landscape*
DIRECT LINK TO LOCATION OF THE STUDY	

Despite Romania is included in many international studies of external costs there are no national studies on external costs calculation of freight transport for this country.

9.2.9 Serbia

Basic information on the recent studies on transport external costs

International study (EU or other countries) of freight transport external costs calculation that also includes Serbia is listed below.

NAME OF THE STUDY	REACT: Guidelines for best practice in funding Research & Development on climate friendly transport and Report on the development of a common set of indicators for carbon impact
NAME OF THE PROJECT	Supporting Research on Climate-friendly Transport
YEAR OF STUDY	2009-2011
AUTHOR	Conventry University Enterprises Ltd, coordinator, University of Belgrade, Faculty of Transport and Traffic engineering (Radmilovic Z., Maras, V.) and seven others partners.
FREIGHT TRANSPORT MODES ANALYSED	All modes of transport: road, railway, inland waterways and multimodal transport: passenger and freight road transport
EXERNAL COSTS OF	Direct Costs of the environmental impact and indirectly: infrastructure

TRANSPORT ANALYSED	costs, security and accident costs and costs on congestion
DIRECT LINK TO LOCATION OF THE STUDY	www.react-transport.eu

A relevant national study on external cost calculation of freight transport in Serbia is presented below.

ORIGINAL NAME OF THE STUDY	Institucionalna izgradnja kapaciteta u transportnom sektoru Srbije
ENGLISH TRANSLATION OF THE STUDY	Institutional Capacity Building in the Transport Sector in Serbia
YEAR OF STUDY	2007.
AUTHORS	Hallof,U., Herting,J., Radmilovic, Z. ect.
CONTRACTOR	AF Group, Sweden, Swedish National Road Consulting AB, Transport Consult GmbH Austria and Swedish Maritime Agency
FREIGHT TRANSPORT MODES ANALYSED	Road, railway, air, inland waterways, intermodal and multimodal transport
EXERNAL COSTS OF TRANSPORT ANALYSED	Infrastructure costs, costs of the environmental impact, security and accident costs and costs on congestions.
DIRECT LINK TO LOCATION OF THE STUDY	European Agency of Reconstruction-Belgrade and "Ministry of capital Investments"

Average external costs of freight transport in Serbia

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents	0.115	1.891	0.015
Climate change	/	0.428	/
Noise	0.637	0.370	/
Air pollution	0.177	1.455	0.212
Effects on delimination	/	0.061	/
Utilization of lands	0.022	0.054	/
Total	**0.952**	**0.259**	**0.227**

9.2.10 Slovenia

Basic information on the recent studies on transport external costs

Slovenia is included in some of the studies of external cost calculation, but since most of them are already mentioned in the study we just present one more listed below:

NAME OF THE STUDY	*External costs of Transport in Europe (Update study for 2008)*
NAME OF THE PROJECT	*External costs of Transport in Europe (Update study for 2008), project commissioned by Union of Railways (UIC)*
YEAR OF STUDY	*September 2011*
AUTHORS	*CE Delft, INFRAS, Frauhofer ISI*
FREIGHT TRANSPORT	*Road freight transport (Light duty vehicles, Heavy duty vehicles)*

MODES ANALYSED	*Rail Freight transport* *Waterborne freight transport*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Air pollution, Climate change, Noise, Congestion and Other External costs (up-and downstream processes, costs for nature and landscape, soil and water pollution)*
DIRECT LINK TO LOCATION OF THE STUDY	*URL: http://ecocalc-test.ecotransit.org/CE_Delft_4215_External_Costs_of_Transport_in_Europe_def.pdf*

In Slovenia there is only one holistic national study on external cost calculation of transport. It was prepared in the year 2004 and includes most of the transport modes.

ORIGINAL NAME OF THE STUDY	*Analiza eksternih stroškov prometa*
ENGLISH TRANSLATION OF THE STUDY	*Analysis of External Costs of Transport*
YEAR OF STUDY	*2004*
AUTHORS	*Lep Marjan and other (University of Maribor, Faculty for civil engineering)*
CONTRACTOR	*Slovenian research Agency, Ministry for transport, Ministry for environment, space and energy*
FREIGHT TRANSPORT MODES ANALYSED	*Road freight transport (Light duty vehicles, Heavy duty vehiclesm, all duty vehicles combined)* *Rail Freight transport*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Noise, Air pollution, Congestion, Climate change (high and low scenario), costs for nature and landscape, external costs in build-up area, up and downstream processes*
DIRECT LINK TO LOCATION OF THE STUDY	*/*

Details on the latest study on external costs of freight transport

The last study on external cost of transport in Slovenia represents a first comprehensive assessment of the external costs of transport for the Slovenian territory. The study deals with external effects of transport in Slovenia for the base year 2002 and also presents some forecasts on external costs of transport for the year 2010. Several different methodologies have been listed, but finally the methodology described and used by the Infras/IWW study on external costs of transport (2000) was favored. The objective of the study is to analyze and present first comprehensive assessment of transport related external costs in Slovenia. The study still plays an important part in further calculations of external costs in Slovenia.

The purpose of the authors of the study was constant update of the presented calculating principles and methodologies. The study was used for the preparation of financial instruments for possible internalization of external costs (road pricing, city-toll, pricing of public transport), as a support to European, national and regional transport, environmental and economic policies. Some of the results were also used in the processes of implementation of any spatial, transport of other relevant projects.

There are two study outputs: the calculation of total and average external costs per means of transport and the consideration of marginal external costs as well as some corridor estimations (which could be used as a basis for the pricing and other instruments of traffic policy). Within the study of external costs the following externalities are considered: accidents, noise, air pollution (including global climate change risks), congestion and other externalities (additional damage on nature and landscape, additional costs in urban areas and up- and downstream processes).

The results on external costs of accidents are derived from calculation of "social costs per injured" (risk value, human capital losses, medical care and administrative costs) combined with numbers of overall injured (fatalities, severe injuries, slight injuries) in Republic of Slovenia due to transport. Data for the analysis of external costs of accidents came from Slovenian statistics concerning number of different accidents within the transport sector. The data from the transport flows came from Slovenian roads agency and statistics on accidents on Ministry of the interior. Statistics on the possibilities for fatal injuries for freight transport came from EU statistics (Infras/IWW). Projection of external costs of transport concerning accidents includes: projection of statistical life in year 2010, prediction of fatalities and injuries and changes in the legal frame (insurances,).

Referring to the external costs of noise the study resembled to INFRAS/IWW methodology which included: counting the number of people affected by noise per vehicle category and noise cost per exposed person (above 65 dB (A)). Some of the results were analyzed by the principle WTP (Willingness to pay), which presents the amount of money that suffering person is willed to pay to minimize the negative impact of the transport noise in comparison to the average GDP of Slovenia.

Emission based external costs of transport were analyzed in the study by calculating emission factors of air pollutants per vehicle category (including differentiation of average speeds, different engines propellants, …), transport volume per vehicle category and costs per ton of air pollutant. Calculation of rail freight transport pollution included differentiation of diesel and electric engines, where also electricity production mix was analyzed. Prognosis of the external costs of freight transport in Slovenia for the year 2010 is included in prediction of further transport flows and reduction of total exhaust emission factors. In the study also impacts on building & material damages, crop losses and impacts on ecosystems and biodiversity were analyzed.

Methodology for calculations of external cost of GHG emission from the freight transport took into account average GHG emissions (CO_2, CH_4 and N_20) per vehicle category in tones and cost factor of CO_2 equivalents (€/ton). Average external costs for 1.000 pkm were divided on lower (14 €/t) and high (135 €/t) cost of 1 ton of CO_2 emitted. The calculation based on "avoidance costs" determined the cost options to achieve required level of GHG emission reduction. Target to be achieved was set from "Operational program of GHG emission reduction in Slovenia" presented in line with acceptance of Kyoto protocol in 2002.

Congestion based external costs of freight transport included national database of length and capacity of state owned road infrastructure, data on VAT (Value of time) of passenger and freight road transport in Slovenia, average structure of travel purposes in Slovenia, average occupancy of the vehicles and estimations of travel duration in Slovenia.

The study of external costs of transport took into perspective light and heavy duty vehicles in the section of road freight transport and overall rail freight transport in Slovenia. The study does not focus specifically on some intermodal freight transport statistics or modes and comments that for the further development of sustainable freight logistic and lowering of total external costs in Slovenia further development and promotion of intermodal freight transport is very important.
Within the study there are different parameters of external costs calculation included. The most important of them are included hereforth:

f) **Differentiation of night/day freight flows:** in the calculation of external costs of noise there were estimations on different effects of night/day freight transport
g) **Differentiation of urban/interurban/rural areas**: the parameter was included in the analysis of noise (specification of noise in dense urban areas with more than 5.000 inhabitants)
h) **Energy production mix:** external costs of air pollution from electrified rail transport included calculation of energy production mix for electricity.
i) **High and low scenario of price for 1 tone of CO_2 :** lower (14 €/t) and high (135 €/t) cost of 1 ton of CO_2 emitted
j) Slopes for road and rail infrastructure: _____
k) **Transport infrastructure peculiarities**: The methodology calculating the external costs of noise included the spatial differentiation and average speed on the road and rail infrastructure in Slovenia.
l) External costs of intermodal freight terminals: _____
m) **OTHER:** Calculation of external costs of congestion included analysis of travel times within peak /rush) hours in the urban and interurban areas.

The study of external costs of transport in Slovenia mostly used bottom-up approach, but there are still some particularities among different external costs factors.

- Calculation of external costs of accidents concentrates on bottom-up approach where value of human life, production losses and medical costs are the main factors of external cost calculation;
- Costs of annoyance from the transport noise focus on the "willingness to pay" principle and the health damages from noise (calculated from evaluation of inhabitants living in the near of sources of transport noise);
- In the calculation of external cost of air pollution bottom-up approach was used. The principle analyses impact of different concentration of transport emissions on humans, ecosystem and buildings;

–Methodology for evaluation of climate change focused on the avoidance cost principle. The study calculated the financial resources to result in achieving overall goal of lowering GHG emission from the transport sector in Slovenia;
–External costs of congestion were calculated from "Value of time" principle. Bottom-up approach for calculating overall value of time and time losses due to congestion was used.

The reference year of the study was the year 2002. Average and total external costs of the freight transport for the year 2002 are listed below.

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents	0,0	35,8	not calculated
Climate change (low scenario – 14€/t)	0,3	8,1	nc
Climate change (high scenario – 135€/t)	3,2	77,8	nc
Noise	2,9	8,4	nc
Air pollution	15,5	136,5	nc
Congestion	0,0	5,2	nc
Costs for nature and landscape	0,9	9,4	nc
Costs in urban areas	0,0	0,5	nc
Up- and downstream processes (low scenario – 14€/t)	12,0	8,8	nc
Up- and downstream processes (high scenario – 135€/t)	13,0	14,5	nc
TOTAL	31,6 – low scenario 35,5 – high scenario	212,7 – low scenario 288,1 – high scenario	nc

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents	0,0	39.000	not calculated
Climate change (low scenario – 14€/t)	1.000	10.800	nc
Climate change (high scenario – 135€/t)	9.900	104.700	nc
Noise	8.800	36.900	nc
Air pollution	47.700	237.700	nc
Congestion	0,0	23.100	nc
Costs for nature and landscape	2.900	41.300	nc
Costs in urban areas	0,0	2.400	nc
Up- and downstream processes	36.900	38.600	nc

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
(low scenario – 14€/t)			
Up- and downstream processes (high scenario – 135€/t)	40.100	64.000	nc
TOTAL	97.300 – low scenario 109.300 – high scenario	429.600 – low scenario 549.100 – high scenario	nc

Based on the forecasted transport model study and the growth of the GDP study total average external cost in Slovenia for the year 2010 was also calculated, as shown in the table below.

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents	0,0	71.800	not calculated
Climate change (low scenario – 14€/t)	1.100	10.900	nc
Climate change (high scenario – 135€/t)	10.900	105.200	nc
Noise	11.900	48.100	nc
Air pollution	75.100	316.600	nc
Congestion	0,0	29.300	nc
Costs for nature and landscape	3.600	nn	nc
Costs in urban areas	0,0	Nn	nc
Up- and downstream processes (low scenario – 14€/t)	55.400	50.700	nc
Up- and downstream processes (high scenario – 135€/t)	58.800	76.300	nc
TOTAL	147.100 – low scenario 160.300 – high scenario	527.400 – low scenario 647.300 – high scenario	nc

The study presents first comprehensive analysis of external cost of transport in Slovenia. The list of the main findings can be listed as follow:

– External costs of freight transport in Slovenia are comparable to those in neighboring countries.
–Total and average external costs of rail freight transport are minor in comparison to road transport external costs;
–External costs of freight transport are closely related to transport flows. The principle "polluter pays" is the best possible option to internalize external costs, while other options have minor impacts.
–Technical parameters (EURO standards, exhaust and noise improvements, better safety

regulation, etc.) of the freight transport vehicles will develop at a slower rate than the transport flows, so the external costs of freight transport cannot be easily reduced without any efficient internalization policies.

–In the future studies it is important to make similar analysis of external costs for the specific transport corridors and divide external cost of domestic and foreign (transit) freight transport flows.

–The bottom-up approach has proven to be an appropriate methodology for external cost calculation of transport.

– The study emphasized on the problem of insufficient data in the field of external costs of accidents. Further studies and methodologies were proposed (collection of statistical data, insurance data, causes of the accidents, etc.).

9.3 Summary

With the collected questionnaires on external costs calculation we have received the first insight information concerning status quo concerning external cost calculation and environmental legislation on freight transport in the ADB countries. Main scope of the analysed questionnaires is to observe the situation on environmental aspects of freight transport in the ADB countries so that more detailed and accurate methodology for the external cost calculation of freight transport in ADB area can be prepared.

Overall the situation on external cost calculation in the ADB area is for sure not the best to imagine. In present analysis we have focused on the quality and quantity of the national and international studies concerning calculation of external cost in the countries presented. Further focus was given on the calculations and methodology of the national studies and the lessons learnt that could be also used for the preparation of the proper methodology within the ADB Mulfiplaftorm project. The last focus of the analysis was on the legislation concerning environmental issues of freight transport in the ADB area, and collection of the data of known on-line manuals that are used by the transport operators or other transport related institutions.

The main outputs indicate that there are few national studies on the calculation of external cost of transport in the ADB area. Considering currently received questionnaires only four countries report on national studies that evaluate and present external cost of transport in monetary terms. In general, all of the presented studies are focusing also on the comparison of the external cost of road or rail freight transport but do not at all mention the external cost of multimodal freight transport.

As far as the international studies on external costs of transport is concerned, there are more reports on countries included in the studies of external costs. Most of the studies are the one presented also in the chapter 8, where reference documents and European projects concerning external costs of transport are presented. Hungary and Romania are the countries in the ADB

area that are mostly included in the international projects for external costs calculation. Some of the countries have no national study of external cost of transport (except some partial scientific research projects and articles) but are included in the international studies. From this perspective, it can be seen that there are projects mostly international that compel the national partners to prepare some first methodologies and studies on external costs.

From some of the ADB countries we have received data on estimations of average and total external cost of freight transport in the countries. Because of the differences in the year of the data calculation, methodologies applied, different input data, national specifications and many other reasons we can conclude that the average external costs from freight transport vary significantly within the countries. In Romania, the data indicate that the average external cost of rail freight transport is estimated on 16 EUR/1.000 tkm and for road freight transport 57,6 EUR/1.000 tkm and in Hungary from more than 1,000 EUR /tkm of road transport (due to accidents) to 140 EUR for rail transport. Other results show that within the preparation of national studies on external costs it is hard to draw any conclusion if the national studies can be compared in the terms of methodology and results to be further implemented in the ADB external costs calculation. Most of the methodologies of reports used the methodologies from other relevant EU studies/handbooks on external cost calculation. Almost all included all the main external cost of freight transport (accidents, climate change, noise and air pollution) while some of them external cost applied to almost all of the negative aspects of freight transport in general. Methodologies applied focused mostly on the calculation of average external costs of transport, which are also most appropriate (besides marginal external costs) to be compared.

10 Legislation and other data concerning external costs of transport

Some of the countries that have responded to the questionnaire provided a lot of information and data on “Legislation and Other Data Concerning external costs of transport”, so their answers are presented in this separate chapter.

10.1 Albania

Environmental aspects of legislation on freight transport

In Albania, the environmental impacts of freight transport should be enforced by law, but it is very important that this should be done gradually and simultaneously with an awareness campaign. Also a gradual diffusion and adoption of best environmental practices along the whole logistics chain would be good trigger to begin with basic calculations of external costs of transport and continue later on with the internalization of the external costs. Since there is not any existing calculation approach of external cost of transport there are not any relevant online manuals either.

10.2 Bulgaria

- **Environmental aspects of legislation on freight transport**

The legislation (regulation, directive etc.) at national, regional or local level regarding external costs applied or under application in Bulgaria:

- Fuel tax on road: Excise Duties and Tax Warehouses Act, Act on the Energy from Renewable Sources, Directive 2003/96/EC; Responsible authority: National government, Customs Agency under the Ministry of Finance; Who is charged: Fuel buyers; Charge base: Fuel used.
- Vignette user charge on road: Time related road user charging system covering all national roads, incl. motorways, first, second and third class roads (total length of 19,267 km, out of which 466 km motorways) defined in Roads Act, Ordinance on the rules and conditions for collecting road user charges, toll charges, charges for using certain structures and charges for specific road use Tariff for charges collected by the Road Infrastructure Agency Road Traffic, Directive 1999/62/EC. Responsible authority: National government, Road Infrastructure Agency under the Ministry of Regional Development and Public Works; Who are charged: All 4-wheel road motor vehicles (private and commercial). Internalisation issues: This vignette is a time based method to charge for some of the infrastructure costs. Furthermore, as the toll is differentiated to EURO class, it also provides incentives for purchasing vehicles with lower air pollutant emissions. This vignette is a time based method to charge for some of the infrastructure costs. Furthermore, as the toll is differentiated to EURO class, it also provides incentives for purchasing vehicles with lower air pollutant emissions. Differentiation of price level for commercial vehicles based on emission class (EURO class) was introduced since January 1, 2010. According to the study made before differentiation (in 2007): "It is expected that the predominant part of the international traffic and especially heavy trucks transiting the country would benefit of the reduced price levels because the majority of these vehicles comply with higher emission standards as imposed by CEMT. The share of the vehicles with Bulgarian registration that would take advantage of the reduced rates is relatively small. According to a general assessment of the national commercial fleet, the average age of the vehicles is rather high (over 10 years); this is especially true for vehicles performing carriages by road for own account. The implementation of the proposed measure will contribute for optimization of the Bulgarian vehicle fleet use, e.g. "cleaner" vehicles to be used more intensively compared with the "dirtier" ones, because of the higher vignette costs associated with the latest. In this way it is expected harmful emissions produced by the road transport to gradually decrease. o The proposed decrease of the annual vignette prices for "cleaner" vehicles is expected to result in higher number of annual vignette sold for the vehicle categories concerned. This won't fully compensate the reduction of the revenues as a whole, but having in mind that annual vignettes are generally sold in the beginning of the year, this will tend to the improved planning of National Road Infrastructure Fund's activities. o Last, but not least, the implementation of such a financial instrument would promote faster renewal and

modernization of the national road vehicle fleet, associated not only with less environmental damages but with higher road safety standards, as well."

- Transport Vehicle Tax**:** Articles 52 to 61 of the Local Taxes and Fees Act Road (also applicable for waterborne and air transport). Transport vehicle tax is levied upon first registration and afterwards annually on any transport vehicles registered for operation on the road network in the Republic of Bulgaria, on any ships recorded in the registers of the Bulgarian ports, and on any aircraft recorded in the State register of civil aircraft of the Republic of Bulgaria. Responsible authority: Municipal councils and local tax authorities; Internalisation issues: The tax differentiation provides some incentives for purchasing vehicles with lower CO2 and air pollutant emissions.
- Product charge paid at first registration of road vehicles**:** Environmental Protection Act, Article 56a in relation to Directive 2000/53 EC on end-of life vehicles Waste Management Act Road Traffic Act Ordinance on the rules and level of product charges related products the use of which produces mass disseminated wastes. Charge that is due when registering the vehicle for the first time in the country. The legislation states that the objective is "to minimise the impact of end-of life vehicles on the environment, thus contributing to the protection, preservation and improvement of the quality of the environment and energy conservation, and, second, to ensure the smooth operation of the internal market and avoid distortions of competition in the Community." Responsible authority: National Government, Ministry of Environment and Waters, Enterprise for managing activities for preservation of the environment Traffic Police is responsible for enforcement (no vehicle can be registered for movement on the territory of Bulgaria without proving the respective product charge has been paid; Who is charged: Vehicle importers (corporate) or private purchasers for categories L4, L5, L5e, M1 and N1. Remaining categories are exempted. Charge base Vehicle age; Internalisation issues Vehicle age can be seen as a proxy for general emission level (mainly for local pollutants.
- Infrastructure Railways access charges**:** Railway Transport Act , promulgated SG, No. 97 of 28.11.2000, effective from 1January 2002, item 9, section 4, No. 592. Entering into force on 1January 2013. Charge per train-km and per gross tonne-km. Length of the network: 6,938 km. The main goal is to recover the expenditures of the Infrastructure Manager (IM) resulting from the performance of train service. Responsible authority: The responsible authority is the Ministry of transport, information technologies and communications. The methodology for calculation of the access charge is proposed by the Minister of transport, information technologies and communications and then accepted by the Council of Ministers.Who are charged: Train operators; Charge base Gross tonne-km; train-km, kilometre. Internalisation issues: The only external costs included in the charge are wear and tear costs, to the level of the cost resulting directly from the performance of train services (direct cost), and administrative costs.
- Sea port dues and waste charges:** Port dues have to be in line with the Law on Maritime Spaces, Internal Waterways and Ports of the Republic of Bulgaria, Article 103c and paragraph 4. Waste charges have to be in line with Directive 2000/59/EC and the according national legislation; Charge base: 1. Channel dues: GT; 2. Light dues: levied per call/year; 3. Tonnage dues: GT; 4.

Quay dues: length of vessel (per metre) and time moored (per hour); 5. Waste charges: levied per call.

In Bulgaria they believe that the most appropriate in facing environmental problems of freight transport are Compulsory legislation with appropriate enforcement measures and Gradual diffusion and adoption of best environmental practices along the whole logistics chain.

• **Environmental management systems for terminals**

The legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in Bulgaria:

– WASTE CHARGES in sea ports: All vessels that have a stay or operate in a port, irrespectively if or not using port reception facilities are levied dues for receiving and handling of port-generated waste. Each ship can hand in a maximum amount of waste (differentiated by the total GT of the ship) for the waste charge, if it hands in more, additional fees have to be paid to the waste managers. Wastes not covered in the differentiation below have to be paid directly to the waste collector.Waste charges are differentiated by GT (9 categories) and type of waste (2 categories): GT: 0-2,000G, 2,001-3,000GT, 3,001-6,000GT, 6,001-10,000GT, 10,001-20,000GT, 20,001-30,000GT, 30,001-40,000GT, 40,001-50,000GT, >50,001GT. Type of waste are Oily waste and Garbage.

Maximum waste charges: Charges are highest for ships over 50,001 GT: administrative dues of € 10, oily waste charge of € 485 and garbage € 750.
Exempted from waste charges: Ships are exempted from waste charges if they sail on an liner service, and have contracted the delivery of waste with any of the ports on the line and pays for the service dues to the same port or to the collector.
Total sea port dues for exemplary vessels (see Table 51 of main report for further specifications):
- Aframax liquid bulk carrier: € 30,400
- Panamax bulk carrier: € 24,500
- Handy container vessel: € 9,200
- RoPax vessel: € 14,400, All dues/charges quoted are exclusive VAT. **Internalisation issues:** With the waste charge an incentive not to discharge ship-generated waste at sea is given..

In Bulgaria they know next on-line manuals for external cost calculation:
–Marco Polo EC calculator;
–EMEP/CORINAIR Emission Inventory Guidebook – 2009
–Group 8: Other mobile sources and machinery

PP 15 BDZ Cargo has used EMEP/CORINAIR Emission Inventory Guidebook – 2009 Group 8: Other mobile sources and machinery.

10.3 Croatia

- **Environmental aspects of legislation on freight transport**

In Croatia there is no legislation regarding external costs. External costs of transport are still not in the focus of experts and research in Croatia. It is believed that the environmental impacts of freight transport should be enforced by law and the most appropriate strategy should be gradual diffusion and adoption of best environmental practices along the whole logistics chain. Legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport in Croatia is applied under the Environmental Protection Act which regulates environmental protection and sustainable development principles, protection of environmental components and protection against environmental burdening, actors in environmental protection, sustainable development and environmental protection documents, environmental protection instruments, environmental monitoring, information system, ensuring access to environmental information, public participation in environmental matters, access to justice, liability for damage, financing and instruments of general environmental policy and administrative and inspection supervision. In Croatia they know External cost calculator for Marco Polo freight transport, but they don't use it.

10.4 Greece

- **Environmental aspects of legislation on freight transport**

There is not any legislation in Greece that refers strictly to the external costs. Of course, there are European Directives regarding external costs that could be taken into consideration as Greece is a member of EU, e.g.:

–DIRECTIVE 2011/76/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures (This Directive has been adjusted and integrated in Greek Law according to the following legislative acts:

–Aviation activities in the scheme for greenhouse gas emission allowance trading (ΟΔΓ_ΕΕ 0101/2008, ΦΕΚ L-8).

–Greenhouse gas emission allowance (ΥΑ Η.Π//2010, ΦΕΚΒ-2030).

–Internal structure of the Environmental Protection Department (Civil Aviation service) with two additional offices. (ΥΑ Η.Π//2010, ΦΕΚ Β-2027).

–DIRECTIVE 2008/101/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community.

–DIRECTIVE 2001/14/EC of the European Parliament and of the Council on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification.

It should be noted that a Directive is a legislative act of the European Union which requires member states to achieve a particular result without dictating the means of achieving that result and it can be distinguished from Regulations.

National legislation has included only few of the environmental issues regarding the freight transport sector. Therefore, government and citizens should take into serious account more environmental aspects in order to achieve a sustainable transport system.
One of the most indicative legislative measures is that marketing authorizations for public use trucks are granted only for trucks, which fall into the category of emissions EURO IV or EURO V or later directives laid down by the Minister of Infrastructure, Transport and Networks, and cannot be replaced with other trucks of larger or smaller gross weight (LAW No.3887).
In Greece they think that reducing the environmental footprint of freight transport should not be enforced by the Government or any other formal Authority, since it would influence the free competition among transport modes. Instead, the right incentives should be provided in order to achieve a smooth shift from road to other freight modes, such as real pricing of road use and investments for upgrading the rail system.

In addition, a promising step for facing the environmental impacts concerning air pollution and climate change could be the integration of transport sector in a general policy for reducing and trading emissions.

In Greece it is believed that the most appropriate approach in facing environmental problems of freight transport is Compulsory legislation with appropriate enforcement measures and Gradual diffusion and adoption of best environmental practices along the whole logistics chain.

In order to face these problems in Greece a strategy including gradual establishment of sustainable principles would be the most appropriate. A holistic approach of environmental issues along the supply chain towards a more efficient and “green” network of transport systems is necessary nowadays. Of course, an effective strategic plan should provide the implementation of certain pricing policies and guidelines such as the “polluter pays” principle in combination with proper educational or training campaigns and curriculums for users and freight forwarders.

In Greece during the recent years various on-line manuals for external cost calculation have been developed such as EcoSense model (calculating environmental external costs according to the Impact-Pathway-Approach) and GRACE Webtool.

On-line manuals in external cost calculation for freight transport are not commonly used in Greece by scientists. Two on-line tools that we have used are:
1.http://www.ecotransit.org/calculation.en.html: quite good and easy in use, it includes also Greece. It provides results only for PM10 and not for PM2.5. Since the particulates have the highest cost on the environmental pollution, information for PM2.5 is required for more accurate calculations.
2.http://ecocalc-test.ecotransit.org: very good, it receives information from the first on-line tool (ecotransit) and calculates the external cost of climate change and accidents. Main disadvantages are the fact that it doesn't contain Greece (it has just a limited number of countries) and it doesn't calculate all elements/ components of external cost.

- **Environmental management systems for terminals**

It is worth mentioning PERS (Port Environmental Review System) which is an environmental management system for ports and has been developed by the research project ECOPORTS and the European Sea Ports Organisation (ESPO). Seven Greek port terminals belong to ECOPORTS network and implement specific environmental action plans concerning their daily operation and also seven of them have received PERS certification. In addition two of them received ISO14001 certification.

There is also recent legislation (LAW No. 4014/2011) regarding the environmental management of terminals, among other facilities, in Greece. According to this, all terminals, in order to operate legally, should get an official environmental approval and thus implement an appropriate environmental management system.

- **Financial and Environmental issues**

The "Green Fund" finances programmes developed by the Ministry of Environment, Energy and Climate Change and other ministries and agencies, administrations, municipalities and unions, legal or natural persons, who care about the protection, enhancement and restoration of the environment. Main purpose of the "Green Fund" is to foster development through environmental protection by providing support on management, financial and technical issues to programs, measures, interventions and actions which forward the environmental policy of the country.
The main resources of "Green Fund" are the following:
– "Green resources" (resources of the "Special Fund for the Implementation of Regulatory Planning and Design", resources of the "Special Agent of Forest", resources of the special code "Environmental Fund Balance".
– Resources from the contributions of energy distributors, distribution system operators and retail energy sales companies.
– Any other fee, tax, duty, levy, income or resources have been established wholly or partly for the "Special Fund for the Implementation of Regulatory Planning and Design".

– Any kind of contributions, donations, grants, bequests from public or private bodies or other domestic or foreign legal or natural persons.
– Funding of programs and initiatives of the European Union and any other resource that comes from international organizations and funds of environmental aid.
– Profits, interest or other income from the participation of the "Green Fund" to other private entities.
– Sponsorships and donations from natural or legal persons governed by public or private law.
– Revenue from management, exploitation and use of movable and immovable property.
– Subsidies from the state budget and funding from the public investment program.
– Any other income from legitimate source (http://www.prasinotameio.gr/index.php/el).

Existing legislation in Greece concerning external costs and environmental aspects of freight transport is limited to the vehicle specifications and therefore the implementation of other institutional policies and official strategies could be also considered.

10.5 Hungary

• **Environmental aspects of legislation on freight transport**

Legislation regarding external costs applied or under application in Hungary:

➢190/2008. (VII. 29.) Government Decree for Limitation of transport of heavy trucks (before 111/1995. (IX. 21.) Korm. r.)

The restriction refers to trucks, which exceeds 7.5 tons. The paragraphs, which regulate the restriction are, as follows:
Paragraph 1: Scope of the regulation covers every truck, tractor, agricultural tractor, slow vehicle as well as combination of vehicles combined of the above mentioned vehicles and trailers, which are licensed with Hungarian or foreign number plates (hereinafter referred to as truck), of which allowed biggest total weight exceeds 7.5 tons.
Paragraph 2:
(1) It is not allowed to travel by the truck indicated in the paragraph above on the public roads of Hungary during the time period, as follows:
a)from 1 July to 31 August
–on Saturdays, excluding the Saturdays, which are working days, from 3 pm to Sunday until 10pm,
– on public holidays from the previous day 10 pm until the given public holiday 10 pm,
b)from 1 September to 30 June from the previous day 10 pm until 10 pm on Sundays and public holidays.
(2) If the public holiday is before Saturday or Sunday in the period specified in (1) (a) or it is before Sunday in the period specified in (1) (b), then the traffic restriction shall be applied

continuously from 8 am of the first day in the period when the restriction applies until 10 pm of the last day without any interruption.
(3) The restrictions regulated in the paragraphs (1) b) and (2) do not apply between the period from 4, November until 1, March to the trucks, which are transported in international traffic and defined in the international category mimimum 7 (Euro 3) in the regulation, which regulates the technical stipulations regarding putting and keeping road vehicles in circulation.
The paragraph (3) refers to only a small amount of trucks.

By taking the periods described above into account, we have calculated that the restriction is applied for 1 462 hours a year including restrictions applied on public holidays, which are not on Saturdays or Sundays.

In accordance with the restrictions applied in 2006 (this is the year when the data were examined) restrictions are applied from the 15th of June until the 31st of August and are valid from 8 am on Saturday. In accordance with the data, in 2006 restrictions were applied for 1 536 hours out of 8760 hours. This is 17.5% of the total time. By taking the so-called tranzient loss into account, (for instance when the vehicles did not leave their location points at 10 pm on time) we can say that the loss time can be considered 23% of the total time. Therefore, due to the available 77% of time period, the freight companies have to operate 1298 pieces of transport vehicles (100/77= 1298), of which number is higher by approximately 1.3 than as if the companies could transport every hour a year.

36 365 pieces of trucks, of which payload was higher than 5 tons were in operation in Hungary in 2006. The allowed 7.5 tons of total load approximately falls under this category of vehicles.
By taking some of the trucks into account, of which payload is less than the ones described above, we have calculated that restrictions for trucks, of which payload is 7.5 tons have had impacts on 40 000 trucks. The regulation applies also for trailers and vehicle trailers.

In accordance with these data, further 3000 vehicles are estimated to be added to the 40 000 trucks, which fall under the restrictions due to the pulling of trailers. This equals to 43 000 trucks and combination vehicles.
In accordance with the database of the Central Hungarian Statistical Office, in Hungary there are 61 025 pieces of trailers, of which payload is 5 tons, and their total weight is approximately 7.5 tons. It is obvious that restrictions are applied also to these vehicles. It can be assumed that due to the fact that there is not work done at the loading points nor at the unloading points at weekends, 40% of trucks and trailers would not be used for transportations, hence only the 60% of the above mentioned vehicles can be considered surplus transportation capacity due to the restriction. 30% of the remaining vehicles can be considered unnecessary capacity. In case of the trucks, there are 7740 pieces (.000 × 0.60 × 0.3 = 7740 pieces), while there are 11 000 trailers (61.065 × 0.6 × 0.3 = 10991).

If we calculate the average procurement price of a truck on 40 million HUF and the average procurement price of a trailer on 3 million HUF, the value of unnecessary capacity can be

calculated, as well. Procurement price of the 7740 pieces of trucks is in total 3120 billion HUF, which is, assuming for 7-year period of renewal, 44.2 billion HUF /year (310/7 = 44.2 billion HUF/year).

In case of the trailers, this amount is 4.7 billion HUF (11.000*3/7 = 4.7 billion HUF).

Loss due to the total surplus capacity can be amounted to 48.9 billion HUF (177 MiO EURO). This is the amount, which the freight companies have to bear as competition disadvantage by extra cost due to the transport restrictions of trucks on weekends.

In Hungary serious workshops have been launched for the past two years to internalize external costs of transport and share burdens in a more justified way among certain transport modes. This process has not resulted in legal regulations.

Requirements meeting aspects of environmental protection are practical to be set by the participation of stakeholders as much as possible. In this respect a centrally-managed and conscious process is possible to be created, within which driving force of the stakeholders could be manifested through their volunteer and proactive participation. Therefore, they could admit and accept easily that changes are necessary to be made. The process could be closed by legal regulations.

In Hungary it is believed that the most appropriate strategy in facing environmental problems of freight transport is Gradual diffusion and adoption of best environmental practices along the whole logistics chain.

The on-line manual for external costs know in Hungary are:

- ExternalCost - **External Transport Cost** - This tool calculates the external costs of transport in Europe due to climate change and accidents. http://ecocalc-test.ecotransit.org/tool.php
  Basic concept: The existence of external costs in transport creates many distortions in the transport market. Transport users are not given the right incentives as a result of which they are not taken socially optimal decisions. As a consequence scarce resources like energy and infrastructure are not used in an economic efficient way. Moreover, the level playing field between transport modes is adversely affected. The competiveness of modes that cause relatively few external costs, like railways and inland waterways, is harmed by the existence of external costs.
- ExternE - External Costs of Energy - http://www.externe.info/externe_d7/?q=node/2
  EcoSenseWeb - the integrated environmental impact assessment model. EcoSenseLE is an online tool for estimating costs due to emissions of a typical source (e.g. power plant, industry, transport) or all sources of a sector in an EU country or group of EU countries. It is a parameterised version of EcoSense, based on European data for receptor (population, crops, building materials) distribution, background emissions (amount and spatial distribution), and meteorology. The input required is annual emissions of NOx, SO2, PM10, NMVOC, CO2, N2O,

CH4; the pollutants considered are O3, SO2, PM10, sulfates, nitrates and greenhouse gases. The cost calculation is based on ExternE exposure-response function and monetary values, user defined valuation of mortality and greenhouse gas emissions is possible.

- **EcoTransIt** - The calculation of energy consumption and emission data of a worldwide transport chain can be done rather quickly with the help of EcoTransIT World. http://www.ecotransit.org/calculation.en.html The key factor influencing the environmental impact of freight transport is the choice of transport mode. Using EcoTransIT World, it is possible to assess the various modes of transport available as truck, rail, inland waterways, sea-going vessels and aircraft. In addition, transport modes can be combined to suit individual requirements. Even within individual transport systems, there are considerable differences due to the vehicle technology deployed, the transport capacity and other factors. In the case of a truck, the key influencing factors are the vehicle size (and thus the max. permissible load), the capacity utilisation level, and the engine's technical standards for the reduction of exhaust emissions (Euro standards).

• **Environmental management systems for terminals**

In Hungary the legal regulations are valid within and relating the management system in the field of environmental protection, as follows:

- Government decree 62/1994 (IV.22) about the major combined transportation routes and their facilities in Genf. Proclamation ''European Agreement'' drafted on the 1st of February.
- LXI Decree of 2001 about proclamation of the Agreement about combined freight transport and defined stipulations of road transportation of goods between the European Community and the Hungarian Republic.
- LXIV decree of 2003 about the proclamation of international agreement of 1972 about the secure containers.
- Government decree of 266/2003 (XII.24) about allowances of international combined freight transport.
- Government decree of 185/2006 (VIII.31.) about the proclamation of minutes of combined water transportation modifying European Agreement (AGTC) of 1991 about the major combined international transport routes and their facilities.
- Government decree of 190/2008(VII.29) about restrictions of transportation of heavy trucks.
- NFM decree of 13/2010(X.5.) about transport of vehicles exceeding the defined weights, weights of axis and sizes.
- Decree of LXXVIII. of 2011 about proclamation and inland application of Rules attached to the European Agreement drafted about the International Transportation of Dangerous Goods on Inland Waterway (ADN) as of 26, May, 2000, Genf.
- Decree of LXXIX of 2011 about proclamation of the unified drafted with Appendices ''A'' and ''B' of the European Agreement about the International Transportation of Dangerous Goods on Roads (ADR).

- Government decree of 358/2008(XII.31) about certain production and service activities practiced as of permission of location and establishment of location and rules of location permission and anouncement.
- Government decree of 194/2007 (VII.25) about government modifications relating to decrees of the European Parliament and Council about the European Pollution emmission and transport Registry and modification of 91/689EGK and 96/61 EK.
- Government decree of 267/2004/(IX.23) about vehicles becoming waste.
- Government decree of 306/2010 (XII.23) about air protection.
- Government decree of 147/2010 (IV.29) of general rules relating to activities and facilities serving use and protection of waters, damage elimination.
- Government decree of 284/2007(X.29) about certain rules of protection against environmental noise and vibration.
- KvVM-EüM decree of 27/2008 (XII.3.) about defining limit values of environmental noise and vibration burden.
- Government decree of 280/2004 (X.20.) assessment and management of environmental noise.

Legal regulations provide a significant base for mitigating environmental damages created in the logistic process by further conscious development in the framework of a program established consistently. Further possibilities could be created by the fact that the ISO 9001 and ISO 14001 quality assurance systems have been induced by significant number of Hungarian logistic service providers. It is expected that in the near future further legal regulations will stimulate intermodal, multimodal relations and characteristics.

10.6 Montenegro

• Environmental aspects of legislation on freight transport

There is no legislation in Montenegro (at national, regional or local level) regarding external costs.

The process of improving the legislation regarding freight transport in Montenegro, in general, is ongoing. It is expected that this will result to regulation and related on external costs of freight transport. Additionally, as EU opened accession negotiations with Montenegro and the membership criteria include conditions for member country integration through the appropriate adjustment of its administrative structures (since it is important that European Community legislation be reflected in national legislation), we believe that all legislation regarding external costs of freight transport which is implemented in EU will be applied in Montenegro.

In Montenegro it is believed that the most appropriate strategy in facing environmental problems of freight transport is Compulsory legislation with appropriate enforcement measures.

10.7 Romania

- **Environmental aspects of legislation on freight transport**

Legislation regarding external costs applied or under application in Romania:

➢ Romanian Government Ordinance no. 15/2002 regarding the introduction of tariffs for the use of road transport infrastructure. Scope: Set out a fair mechanism to impose the infrastructure related costs to transporters and road users. Encourage to use less pollutant and road damaging vehicles. Implementation field: road transport**.** Results: Improvement of road network quality due to larger investments**.** Reduction of the number of polluting vehicles (cars and freight trucks) due to bigger road tariffs applied to them.

– Ministry of Transport and Infrastructure Order no. 769/2010 regarding approval of norms for the appliance of the tariffs for national road network use**.** Scope: Regulates the methodology for applying Ordinance no. 15/2002: definitions, field of application, responsible authorities, enforcement, fines and penalties for noncompliance. Implementation field: road transport. Results: Improvement of road network quality due to larger investments Reduction of the number of polluting vehicles (cars and freight trucks) due to bigger road tariffs applied to them.

– Law no. 9/2012 regarding the tax applied for noxious emissions generated by vehicles**.** Scope: Set out the level of the tax applied for noxious emissions from vehicles based on the capacity (cm3) and polluting norm (Euro). Implementation field: road transport. Results: Reduction of the number of polluting vehicles (cars and freight trucks) due to bigger road tariffs applied to them.

– Romanian Government Decision no. 470/2007 regarding limitation of sulfur in liquid fuels (transposes Directive 93/12/CEE, Directive 1999/32/CE and Directive 2005/33/CE). Scope: Reduction of SO2 emissions from fuels combustion by imposing a maximum limit content of sulfur in those fuels. Implementation field: maritime (inside ports and harbors) and inland navigation. Results: improvement of air quality, diminishing negative impact of the maritime transport activities on people's health.

– Romanian Government Decision no. 935/2011 regarding promotion to use bio fuels (transposes Directive 2003/30/CE and Directive 2009/28/CE). Scope: Set out of national mandatory objectives regarding the share of renewable energy used in transports and encourage the use of bio fuels instead of diesel oil and petrol in order to decrease the greenhouse gases emissions, beginning with 2012. Implementation field: road. Results: not quantified yet.

–Romanian Government Decision no. 928/2012 regarding the terms for merchandising of petrol and diesel oil and also the introduction of a monitoring and reducing system for

–Emissions of greenhouse gases (transposes Directive 98/70/CE, Directive 2003/17/CE, Directive 2009/30/CE and Directive 2011/63. Scope: Regulates the technical specifications of petrol and diesel oil considering environment and health aspects. Implementation field: road and inland navigation. Results: improvement of air quality, diminishing negative impact of the transport activities on people's health.

In Romania it is believed that the most appropriate strategy in facing environmental problems of freight transport is Compulsory legislation with appropriate enforcement measures.

In Romania they know EcoTransIT World on-line manuals for external cost calculation.

10.8 Serbia

- **Environmental aspects of legislation on freight transport**

In Serbia they believe that the next strategies are the most appropriate in facing environmental problems of freight transport:
a)Compulsory legislation with appropriate enforcement measures
b)Gradual diffusion and adoption of best environmental practices along the whole logistics chain

In Serbia they know some on-line manuals for external cost calculation: ECORYS, ASIF, External Costs in the Transport Sector, University of Cologne, Institute for Transport Economics, CE Delft Handbook: Methodological critics, Theoretical defaults, Conceptual deficiencies, Instruments for internalizing external costs.

10.9 Slovenia

- **Environmental aspects of legislation on freight transport**

Some general resolutions and operational programs in Slovenia are dealing with possible measures to minimize negative impacts of transport to the society and environment. Slovenia is also taking part in acceptance of new Eurovignette directive.

Resolution on Transport Policy of the Republic of Slovenia (OG RS, no. 58/2006) presents the starting point for analyzing potential financial measures regarding the external costs of transport. One of the aims of the resolution is to ensure more coherent charging system for the use of transport infrastructure with external costs included. The resolution emphasizes that the internalization of all costs of infrastructure use, would cause a temporal redistribution of traffic flows, which would result in a better utilization of the road infrastructure and a reduction in

external costs of transport. However it should be taken in to consideration that the Resolution on Transport Policy did not specify starting points into quantified objectives or implement supporting activities or policies.

Slovenia is taking part in the new Eurovignette directive which aims to allow EU member states to calculate tolls based not only on infrastructure costs but also on the cost of traffic-based air pollution and noise (which was not the case in the former Eurovignette directive). The external cost charge would represent 3-4 ct/km depending on the Euro class of the vehicle, the location of the roads and the level of congestion. The charge was predicted to be collected by the electronic systems foreseen to be fully interoperable at EU level by 2012 and a receipt clearly stating the amount of the external cost charge will be given to the haulers so that they can pass on the cost to their clients.

The newer Eurovignette directive will also allow a wider differentiation of toll rates at constant revenue so Member States can better manage traffic and reduce congestion. In practice, higher tariffs can be applied during peak periods provided that lower tariffs are applied during off-peak periods. The compromise ensures revenue neutrality and allows in congested areas higher tariffs of up to 175% above the average tariff, with top tariffs collected during a maximum of five peak hours per day and lower tariffs applying during the rest of the time on the same road section. In Slovenia there are currently no broad discussions on newer Eurovignette directive.

In Slovenia there is some legislation (general regulation) to promote internalization of external costs of transport but it should be strictly enforced.

At the beginning, it is necessary to prepare an appropriate strategy, which will involve the progressive tightening of legislation and preparation of measurement methodology, evaluation and external cost charges by individual modes of transport.

In the next steps the environmental impacts of freight transport should be enforced with proper governmental fiscal and legislative measures. In Slovenia it is believed that the most appropriate in facing environmental problems of freight transport is Compulsory legislation with appropriate enforcement measures.

The on-line manuals for external cost calculation know in Slovenia are:

1.)The External Cost calculator that determines transport cost for external parties due to climate change and accidents Europe wide (http://ecocalc-test.ecotransit.org/tool.php).
2.)EcoTransIT World calculates environmental impacts of different carriers across the world. This is possible due to an intelligent input methodology, large amounts of GIS-data and an elaborate basis of computation. Data and methodology are scientifically funded and transparent for all users (http://www.ecotransit.org/calculation.en.html).

ERDF PP10 Institute of Traffic and Transport Ljubljana used the on-line manual COPERT 4 (http://www.emisia.com/copert/General.html) which is a software tool used world-wide to calculate air pollutant and greenhouse gas emissions from road transport. The development of COPERT is coordinated by the European Environment Agency (EEA), in the framework of the activities of the European Topic Centre for Air Pollution and Climate Change Mitigation.

The COPERT 4 methodology is part of the EMEP/EEA air pollutant emission inventory guidebook for the calculation of air pollutant emissions and is consistent with the 2006 IPCC Guidelines for the calculation of greenhouse gas emissions. The use of a software tool to calculate road transport emissions allows for a transparent and standardized, hence consistent and comparable data collection and emissions reporting procedure, in accordance with the requirements of international conventions and protocols and EU legislation.

The tool was used for calculating emissions for optimization of deliverables within the project Civitas Elan in Ljubljana. The on line manual proved to be a useful tool for the calculation of emission savings from freight transport modes, but it offered no other calculations on external costs or possible noise reduction.

- **Environmental management systems for terminals**

Resolution on Transport Policy of the Republic of Slovenia - Intermodality: Time for synergy, adopted in 2006, represents the first policy document that comprehensively regulates the national transport policy. Before the resolution transport policy was created, in Slovenia there was only framework of development documents for specific transportation subsystems which did not refer to the whole multimodal chain. The document defines the national transport policy followed by the baseline transport development in the European Union, while ensuring achievement of the priority objectives of the Slovenian transport sector. Besides other measures the document includes numerous measures to promote intermodal transport and establish the basis for the full operation of logistics centers, Within the document Republic of Slovenia also seeks to ensure an adequate fiscal policy to support the implementation of intermodal transport and modern on the environment cost based transport policy in the long run, with the objective of ensuring the economic viability of intermodal transport in the inland freight transport (road, rail). Special attention is also devoted to developing new technologies that allow different types of intermodal transport.

There is legislation in operation concerning Law on Transportation of Hazardous Goods (Ur.l. 97/2010) in Slovenia which defines procedures imposed to the traffic operators in order to provide safe transport and efficient intervention in emergency case. The legislation also applies to multimodal transport since the marking system and procedures for the transport of hazardous goods are to be standardized and fallowed by the different freight operators.

Multimodal terminal are mainly fallowing ISO standards and procedures. Port of Koper is certificated by the standard ISO 14001, which was established in the year 2000 and in the year 2010 updated with the EMAS (Eco-Management and Audit Scheme). Environmental parameters on multimodal systems or operators are not directly covered by specific environmental legislation.

10.10 Summary

Scope of the environmental issues and legislations concerning efficient operation of freight transport in the ADB area, was also included in the questionnaires. Data on the most important environmental legislation from participating countries were collected. From the results we can conclude that not all the countries have successfully implemented environmental aspect of freight transport in their national laws and legislatives. Half of the countries reporting the situation have stated that there is no legislative that would reinforce environmental issues to the freight transport operation. Countries that presented their main legislation concerning environmental issues mainly focused on fuel tax on road, vignette user charge on the road (which can be also applied on the environmental capacities of the vehicles), transport vehicle taxes at first registration of the vehicles including charge on the influence to the environment, charges on the usage of railway infrastructure, usage of sea ports and wastes on the terminals. Legislation is mainly reinforced by the European Parliament and by the European Council. Majority of the data concerning environmental legislation was received from country reports from Greece, Romania, Bulgaria, Hungary and Slovenia. Most of the environmental legislation focus on preservation of nature and society and are not directly dealing with minimising external cost of freight transport.

For some basic calculation of the costs of freight transport concerning its environmental impacts of the freight transport it is essential to use some manuals with which proper methodologies for calculation are applied. Within the research activities the partners were asked to state their main on-line manuals that are used to calculate environmental or other impact of freight transport or transport in general to the environment. Most of the countries that have established some systems to analyse or even internalise some of the main external cost of transport in general also are familiar with some online manuals with which the external cost or environmental impacts of transport can be calculated. The mostly used tool to evaluate external costs of transport in the ADB area is ECoTransit tool, by which calculation of energy consumption and emission data of a worldwide transport chain can be done rather quickly with the help of EcoTransIT World. Other online programs or manuals to be used are: ExternalCost, EcoSenseWeb and COPERT4. Within the further activities of the project there is a need to further promote currentlly used online manuals, which can be a start of the holistic approach internalisation of external costs of freight transport in the ADB area.

Participating countries that reported lack of implemented strategies to calculate or even internalize external costs of transport were asked to state their view on further steps to

establish the efficient system of external costs internalisation. In order to face these problems most of the reporting partners stated that strategy including gradual establishment of sustainable principles and also compulsory legislation are the proper ways to begin with the actions of more environmentally friendly freight transport. It should be taken into consideration that the effective long-term strategic plans should be prepared to provide the implementation of certain pricing policies and guidelines such as the "polluter pays" principle. Proper educational or training campaigns could also be used.

Most of the existing legislation on the environmental issues of freight transport in the ADB area is mainly focusing on the vehicle specifications. For implementation of additional institutional policies and official strategies, emphasis should also be placed on the internalization of external cost measures derived from environmental specifications (environmental impacts on sensitive areas, impacts on urban areas) and on other specification (impacts of freight transport within the night time and rush hours).

From the data received we can also come to the conclusion, that there is not many legislatives focusing on the environmental issues of multimodal transport and intermodal terminals. Further development of legislatives to minimize negative impacts from inland or sea ports and the whole logistic chain should be considered.

11 Compliance of methodologies with the main EU guidelines and with on-line manuals for external cost calculations

11.1 Introduction

External cost calculation is a difficult and comprehensive task due to several reasons. On the one hand, the definition of external costs holds potential for misunderstandings, while the proper structure of external costs is also a question of interpretations.

Several attempts to estimate and inter alia internalise external costs in the transport sector have been made and they are prsente here. The results of several research projects, especially within the 4th, 5th, and 6th EU-framework programmes are the most important. We can distinguish different type of outputs.

The most influential reference document officially published by the European Commission entitled to Internalization of external costs strategy follows the recommendations set by the IMPACT project. IMPACT Deliverable 3: Internalisation measures and policy for the external cost of transport (2008) covers the innovative set of pricing and non-pricing instruments providing the backbone of the European countries' external cost calculation schemes and internalization methods.

So far, very few measures have been introduced directly aimed at internalisation. The most important exception is the Swiss toll for heavy goods vehicles (HGV), which was aimed at internalisation of external costs. Many other pricing measures, however, have been introduced or modified to reach specific aims related to external effects of transport. Examples are charges that have been differentiated to environmental parameters (like circulation taxes differentiated to Euro standard, tax exceptions for hybrid cars, LTO charges differentiated to night and day time or to aircraft noise emission level).Table 1 provides an overview on existing charges and taxes at Member States:

Table 11-1: Overview on existing charges and taxes at Member States

Mode	Existing taxes and charges
Road - HGV	Infrastructure charge: User charge (fixed). Toll on specific parts of the network (e.g. bridges and tunnels). Toll on motorways. Toll on all roads.
	Fuel excise duty Circulation tax Congestion charge Insurance tax VAT
Road - cars	Fuel excise duty Circulation tax Vehicle purchase tax Toll Parking fees Congestion charge Insurance tax VAT
Rail	Infrastructure charge Diesel excise duty Electricity tax VAT
Water	Harbour due Dues for locks and bridges Fuel excise duty (in a few specific cases)

Mode	Existing taxes and charges
Aviation	LTO charge (often differentiated wrt noise emissions) En-route charge (for air traffic control services) Noise surcharge (in several Member States) Emission charge (at a few specific airports) Fuel excise duty (in a few specific cases) VAT (domestic flights)

Source: IMPACT Internalisation measures and policy for the external cost of transport, 2008

As regards ***pricing information based on marginal costs***, the most important work has been developed at EU-level. The CAPRI project (1999) has made recommendations for best practice approaches, within a dialogue between researchers and policy experts. The methodology has been further developed and used within the two research projects UNITE (2003) and GRACE (2007), in order to provide cost figures for different modes, mainly based on representative case studies.

As regards ***information for cost benefit analysis***, there are attempts at EU and at national level. HEATCO (2006) has made recommendations for unit cost figures for externalities which can be used for the evaluation of transport related projects at EU level. For air pollution, the figures are compatible with the approach developed for the CAFE CBA standards (CAFE, 2005), with unit costs per country and per air pollutant, as a basis for Cost Benefit Analysis of air pollution related measures. At national level, the sources are heterogeneous. The most recent recommendations have been developed in Germany, with the Methodological Convention to estimate environmental costs (UBA, 2006).

As regards ***total cost figures and transport accounts for different countries***, UNITE (2003) is the most important study at EU-level containing transport accounts and total external cost estimates for most Western European countries. The INFRAS/IWW study (2004) commissioned by the railways is also presenting total and average cost figures per country. At the same time several national studies have estimated costs for different transport modes. The attempts carried out by UK, the Netherlands and Switzerland are the most advanced.

11.2 Compliance of ADB countries' external cost calculation methodologies with EU guidelines

Evidence shows that external costs are more or less internalized in EU Member States due to the widespread application of taxes, charges and regulation. Regarding trucks, in all Member States measures are insufficient to cover the gap between marginal external costs and marginal user charges for truck 32 tons. In other words, when an additional truck travels, it will pay a certain amount of charges/tolls linked to the distance of trip, but in comparison, will generate additional

external congestion, noise, air pollution and accident costs for which it will not pay entirely. Charges and tolls fail to provide this message when decision is made to travel.

Italy as exemplary country in many studies and reports on internalization for instance follows a bottom-up approach in calculating external costs and internalising them. Regarding road transport, highway and road tolls are the most influential data for internalization. Italy has a congestion and scarcity charge for rail infrastructure. The infrastructure charge depends both on the time of the day and the speed profile of the train, so as to optimize the capacity of the track. For each route, standard speed profiles are designed to optimize the line. Higher prices are charged on trains the speed of which diverges from the norm for the route in question because this will stall other traffic and reduce capacity. In addition, there is a charge per node that varies with the implicit amount of congestion at the node by categorizing nodes according to traffic levels. In Italy road infrastructure charges are in place for all vehicles. infrastructure charge depends both on the time of the day and the speed profile of the train, so to optimize the capacity of the track. For each route, standard speed profiles are designed to optimize the line. Higher prices are charged on trains which speed diverges from the norm for the route in question because this will stall other traffic and reduce capacity. In addition, there is a charge per node that varies with the implicit amount of congestion at the node by categorizing nodes according to traffic levels. In Directive 2001/14 on allocation of railway infrastructure capacity and levying of charges a detailed framework for railway infrastructure charging is established. It allows for higher charges for scarce infrastructure. Italy in one out of those 9 EU countries where the infrastructure manager applies charges that are based on scarcity levels. Other examples are *Belgium* (rail user charge depends on traffic density), the capacity charge in the *UK* and the increased charges in the *Netherlands* for stretches that have been declared congested.

On the contrary, in the case of *Albania, Bulgaria, Montenergo, Croatia* external cost calculation schemes are not well developed or not functioning well. So far, hardly any attention has been paid on external costs. Albania does not have any compliance with EU external cost calculation methodologies and internalization approaches. At present, data availability on main EU external cost categories per transport modes are not applicable at national level. Bulgaria has been included in various international studies. So far, national efforts have been focusing on freight transport and freight-related externalities in the form of various scientific publications and university researches. This approach is also reflected in legislations implied in terms of fuel taxes in freight and vignette system, that completely follows the European Union's regulations. Montenegro and Croatia do not have any compliance with EU external cost calculation methodologies and internalization approaches at all. Regarding Montenergo, improvements on the freight legislations have started that may result in a more comprehensive set of complying regulations and calculation approaches based on international best practices. Real commitment has been already made at national level to include all the European Union's legislative framework at the national freight external cost calculation methodology. At present, data availability on main EU external cost categories per transport modes are not applicable at national level and is going to be made available in the very near future.

Similar to Italy, *Hungary* follows a bottom-up approach when calculating external costs of transport. Calculation schemes and methodologies are available regarding road and rail transport. The Hungarian external cost calculation methodologies are completely in line with EU guidelines and have been heavily influenced by international projects such as IMPACT and HEATCO.

Although, in *Romania and Greece* at national level, there are no external cost calculation scheme in force. Greece is special in this respect, as Greece has been involved in previous researches (RECORDIT, UNITE) and several Ph.D researches are addressed to the internalization approach. In these countries the national calculations are in compliance with the EU guidelines only partly. These fields cover all transport modes clearly indicated in the report prepared by the OECD.

Serbia is the only country among pre-accession countries that applies EU guidelines in internalising external costs of road, railway, air, inland waterways, intermodal and multimodal transport. In *Slovenia* there is only one holistic national study containing methodology for external cost calculation of transport. It was prepared in the year 2004 and includes most of the transport modes, especially road freight transport. Slovenia applies national vignettes for passenger cars.

Table 11.2: Compliance of ADB countries' external cost calculation methodologies with EU guidelines

Country	**Accident costs**	**Noise costs**	**Air pollution**	**Other external costs**	**Congestion costs**	**Infrastructure costs**
Albania	NA	NA	NA	NA	NA	NA
Austria						
Bulgaria		road/ rail/ air/ IWW	road / rail /air/ IWW		road/rail /air/ IWW	
Croatia						
Greece	road/rail/ IWW	road/ rail/ IWW			road/rail/ IWW	
Hungary	road/ rail	road/ rail	NA	road / rail	road / rail	NA
Italy						
Montenegro	NA	NA	NA	NA	NA	NA
Romania	road/rail /air/	road/ rail/	road/ rail/ air/	road/rail /air/	NA	NA

Country	Accident costs	Noise costs	Air pollution	Other external costs	Congestion costs	Infrastructure costs
	waterborne	air/ waterborne	waterborne	waterborne		
Serbia	Road, railway, air, IWW	Road, railway, air, IWW	NA	Road, railway, air, IWW	Road, railway, air, IWW	Road, railway, air, IWW
Slovak Republic						
Slovenia	road / rail	road / rail	road/ rail		road / rail	

Source

11.2.1 Road transport – compliance with EU guidelines

Practically, each of road-related externalities (namely, climate change, air pollution, noise, accident, congestion, infrastructure wear and tear) requires (a given combination of) different cost items to achieve internalisation. For climate change costs, fuel taxation is the theoretically the first best internalisation measure together with emission trading systems (ETS). ETS has the advantage of providing a marketbased mechanism for determining the internalisation price, whereas taxation offers a more stable pricing signal over time. Ideally, the taxation component that is meant to internalise the cost of greenhouse gas emissions should be linked to the ETS price to maintain a comparable price signal across the sectors subject to the two systems. It is important to remark, however, that ETS provides a price for what is considered the 'acceptable' level of emissions, as established by the overall cap on emissions fixed by the system, and not an estimate of the actual climate change costs.

Accident costs are best internalised with insurance taxes based on accident rates and pay-as-you drive insurance. For the other cost categories, fully differentiated distance-based charges are generally regarded as theoretically optimal.

Tax levels in Europe for the most common fuel types (gasoline and diesel: unleaded, low sulphur, minimum required level of biofuel blended) are shown in the following graphs, extracted from DG TAXUD's Excise duty tables for energy products. In several cases, mainly for natural gas, the tax level is below the minimum level set in Directive 2003/96/EC. This is because, for LPG and natural gas exemptions are made possible in Art. 15 (1) I of Directive 2003/96/EC. Four countries (Bulgaria, Romania) have tax level lower than the minimum for diesel, which is due to the transitional periods allowed by their Accession Treaty (Bulgaria and Romania), or by Directive 2004/74/EC (Latvia and Lithuania).

Table 11.3: Pricing instruments for road transport per countries

Country	Fuel	Registration	Ownership	Insurance	Infrastructure
Albania	✓	✓	✓	✓	✓
Austria	✓	✓	✓	✓	✓
Bulgaria	✓	✓	✓	✓	✓
Croatia	✓	✓	✓	✓	✓
Greece	✓	✓	✓	✓	✓
Hungary	✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓
Montenegro	✓	✓	✓	✓	✓
Romania	✓	✓	✓	✓	✓
Serbia	✓	✓	✓	✓	✓
Slovak Republic	✓		✓	✓	✓
Slovenia	✓	✓	✓	✓	✓

Source:

Many EU countries (20 of 27) apply a registration tax/charge/fee/excise duty on at least some share of vehicles (re)entered into the fleet. This is an important moment for the government to promote or discourage certain vehicle types. Among ADB countries only the the Slovak Republic does not levying a tax upon vehicle registration.

From the monetary point of view, the efficiency of levied pricing instruments varies from country to country. Estimates prepared by the European Commission (2012) show that fuel taxes are diverse across the EU indicating relative differences among ADB countries how much importance to these instruments is given at national level. Regarding fuel taxation, countries such as Italy, Austria and Greece are the most advanced in internalising external costs. Besides, countries such as Romania, Hungary and the Slovak Republic have already made significant steps to cover this area. Comparing the territory of Bulgaria and Slovenia it is getting obvious, that Bulgaria is at the moment not applying its full set of available instruments to internalise externalities completely.

Table 11-4: Revenues of pricing instruments for road transport per country (million €, 2012)

Country	Fuel	Registration	Ownership	Insurance	Infrastructure
Albania	NA	NA	NA	NA	NA
Austria	€ 4,350.00	€ 452.25	€ 1,721.00	€ 324.00	€ 1,535.50
Bulgaria	€ 940.49	NA	€ 378.60	€ 100.73	NA
Croatia	NA	NA	NA	NA	NA
Greece	€ 4,359.66	€ 249.00	€ 1,194.00	€ 301.62	€ 530.00
Hungary	€ 1,886.89	€ 111.81	€ 265.00	-	€ 167.90
Italy	€ 22,767.37	€ 1,142.00	€ 6,610.00	€ 4,051.00	€ 4,971.00

Country	Fuel	Registration	Ownership	Insurance	Infrastructure
Montenegro	NA	NA	NA	NA	NA
Romania	€ 2,082.54	€ 42.26	€ 197.85	€ 30.44	NA
Serbia	NA	NA	NA	NA	NA
Slovak Republic	€ 1,058.08	-	€ 122.04	€ 48.56	€ 418.10
Slovenia	€ 955.59	€ 40.10	€ 105.80	€ 36.08	€ 298.34

Source:

Regarding the efficiency and efficacy of freight transport measured by the level of CO_2 emissions and taxes on fuel ADB countries are at different development stages. Compared to the fuel tax level minimums, in all European countries there is a slight increase in tax levels, especially Italy and Greece in case of gasoline. Regarding diesel prices the picture is more balanced.

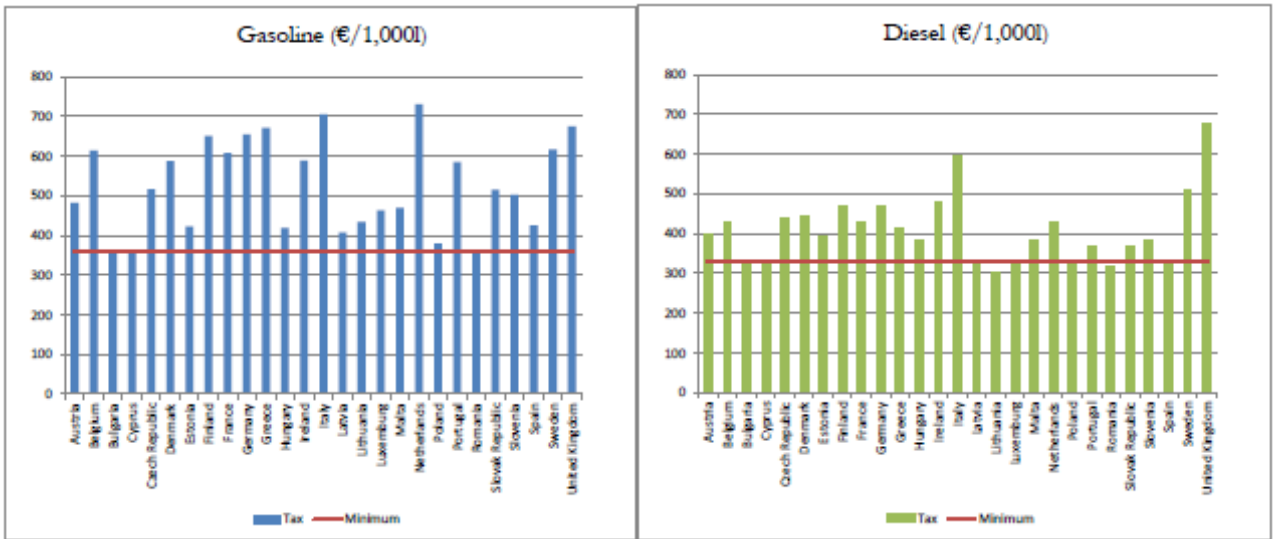


Figure 11-1: Fuel tax levels in various countries
Source:

In three ADB Member States (Austria, Romania, Slovenia) and the CO_2 emissions (expressed in g/km) are a main cost contributors in registration taxes. Regarding non-EU countries statistics show no direct link between CO_2 emission charges. Overall, Hungary, Greece, Italy and Austria have the highest vehicle tax levels for passenger cars entering the fleet. Tax levels vary greatly between countries, and are very often progressive, with larger vehicles being taxed disproportionately higher. This is another way to include the luxury value of a vehicle in the level of the tax, as it is mainly more luxurious vehicles that have higher emissions, engine power or weight. Another form of taxing vehicle purchases is excise duty.

Greece applies this form of taxation, while Bulgaria levies a product charge paid at first registration.

Distance-based systems for heavy duty transportare only used in Austria, the Slovak Republic, and Slovenia. Furthermore Greece and Italy, have systems in place that charge all road users on specific parts of the road network.

Austria, Bulgaria, the Czech Republic, Hungary, Romania, the Slovak Republic and Slovenia all use national vignettes for passenger cars. Trucks in Bulgaria, Hungary and Romania are subject to the same system (albeit at a much higher rate), while the other countries use distance-based systems for heavy duty transport.

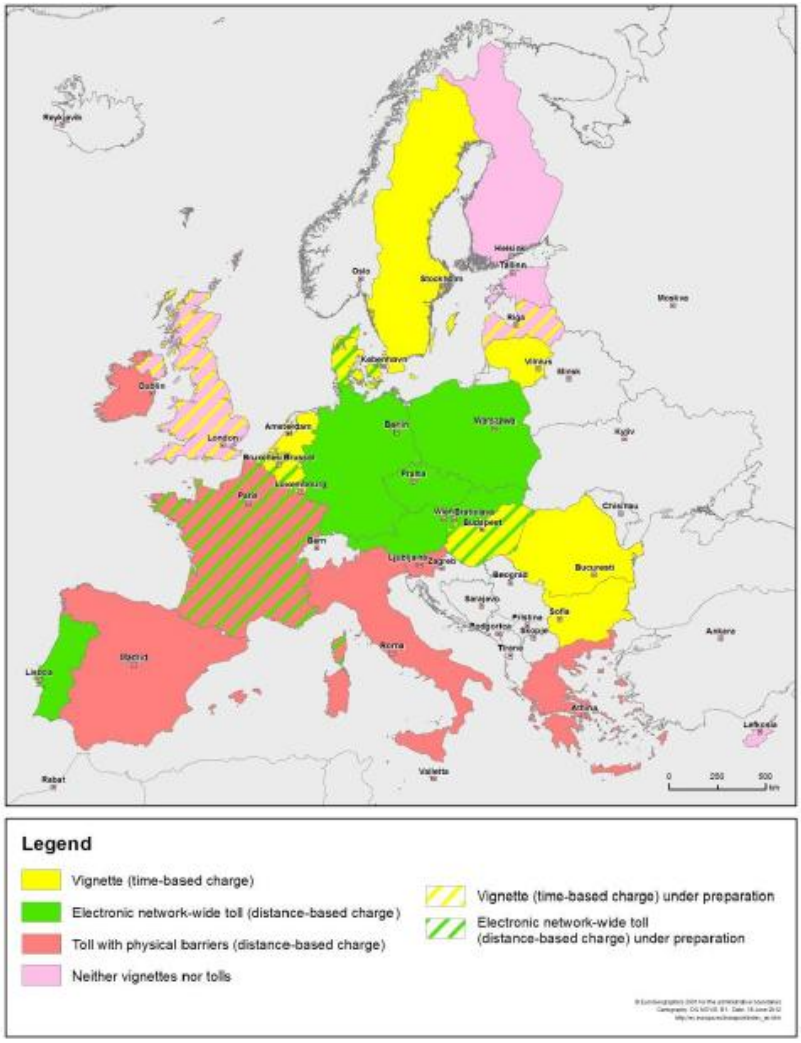


Figure 11-2: Different road charges
Source:

11.2.2 Rail transport – compliance with EU guidelines

ADB countries are at a very different stage of development regarding internalisation ofrail-related external costs. Most developed countries fall into the category of 'old member states' while pre-accession countries have a lot to deal with.

In mostost EU countries infrastructure charges, energy taxes on gasoline and electricity – as part of the energy policy of the given countries are applied. Obviously, old member states have reached a higher level of efficiency regarding the internalization of external costs than candidate countries. However, in this field, considerable benefits are exploitable within a short notice. Among ADB countries, Austria, Greece and Bulgaria fully internalize the abovementioned externalizies.

Table 11-5: Instruments applied to internalize external costs

Country	**Infrastructure access charge**	**Energy taxation**	
		Gasoline	**Electricity**
Albania			
Austria	✓	✓	✓
Bulgaria	✓	✓	✓
Croatia			
Greece	✓	✓	✓
Hungary	✓		✓
Italy	✓	✓	
Montenegro			
Romania	✓	✓	✓
Serbia			
Slovak Republic	✓	✓	
Slovenia	✓	✓	✓

Source:

The comparison between rail usage charges adopted in the European Union is not always straightforward. Charge structures are generally complex, as they often include different components (train path-line charge, train installations charge, shunting charge, etc.). Moreover, these charges are highly dependent on different charge basis (train-km, gross tonne-km, etc.). There is existing a wide variety of structures, from the quite simple one of Finland, applying charges based only on gross tonne-km and train type, to the very complicated one adopted in Austria, where charges are based on all relevant variables. A synthetic comparison of charge structures across EU countries is shown in the next table.

Table 11-6: Comparison of charge structures of rail usage charges: charge base: 2012

Country	Infrastructure Manager	Gross tonne-km	Trainkm	Line or section category	Time	Train type	Charge structure approach
Albania	NA						
Austria	ÖBB Infrastruktur AG	✓	✓	✓	✓	✓	Variable charge per train-km (capacity) and per gross tonne-km (maintenance and renewal).
Bulgaria	National Railway Infrastructure company	✓	✓				Charge per train-km and per gross tonne-km
Croatia	NA						
Greece	OSE		✓	✓	✓	✓	Marginal value for traffic management multiplied by capacity occupancy coefficient and peak period coefficient plus marginal value for line maintenance multiplied by line quality coefficient and line burden coefficient plus charge for traction power per tonne-km

Country	Infrastructure Manager	Gross tonne-km	Trainkm	Line or section category	Time	Train type	Charge structure approach
Hungary	VPE	✓		✓	✓	✓	Charge for ensuring the train path per train-km plus running fee per train-km by type of line plus running fee per gross tonne-km
Italy	RFI		✓	✓	✓	✓	Fixed reservation fee based on line type plus variable operating fee (speed, weight, density on line, length of line used, and time in node section)
Montenegro	NA						
Romania	CFR	✓		✓	✓	✓	Variable charge by weighted tonne-km by type of line plus variable charge per train-km
Serbia							

Country	Infrastructure Manager	Gross tonne-km	Trainkm	Line or section category	Time	Train type	Charge structure approach
Slovak Republic	ZSR	✓		✓	✓	✓	Variable charge per path km by line type plus variable charge per gross tonne-km by line type plus charge for the use of passenger stations, marshalling yards and freight terminals
Slovenia	AZP			✓	✓	✓	Variable charge per train-km adjusted for type of train and relative weight

Source:

As the above table indicates, ADB countries have reached only partial achievements in this field, more specifically, none of the ADB countries have fully covered this cost contributor. Significant internalization has been achieved by Italy, Hungary, Romania and Greece. Countries, where these pieces of information are not officially published, are not indicated in the table at all.

Table 11-7: Cost categories in the rail usage charges

Country	Wear and tear	Power	Scarcity / Congestion	Noise	Air pollution	Accident
Albania						
Austria	✓		✓			
Bulgaria	✓					
Croatia						
Greece	✓	✓	✓			
Country	**Wear and tear**	**Power**	**Scarcity / Congestion**	**Noise**	**Air pollution**	**Accident**
Hungary	✓					
Italy	✓		✓			
Montenegro						
Romania	✓					
Serbia						
Slovak Republic	✓					
Slovenia	✓					

Source:

From this overview it becomes clear that all countries charge for the wear and tear costs, although at different level. Some countries apply access charges including scarcity and/or congestion costs, only few charge for the power costs, environmental and accidents costs. Power costs include charge for traction power consumption and are considered by Greece. Scarcity costs incur when the presence of a train prevents another train from operating or requires it to take another inferior path. Congestion costs incur when one train delays another. Although timetables are planned in order to avoid such an inconvenience, this can happen when rail lines are highly used and the presence of an additional train on the tracks may lead to additional delays to other trains by reducing the ability of the system to recover from delays (ECMT, 2005). Scarcity may be charged through a supplement for congested infrastructure like in Austria, Italy, or through a specific parameter for scarcity associated to track sections as in Greece. Congestion can be charged through the payment for the delay provoked like in Austris and Greece. On the contrary, a specific parameter in the access fee formula for specific routes like in Italy which in this respect applies not only a payment per delay minute, but also a parameter for busy routes. Environmental costs are distinguished in noise and air pollution costs. Currently none of the EU countries internalize noise costs. Finally, accident costs are not charged by ADB countries at all. Regarding administrative costs, countries such as Austria, Bulgaria, Hungary, Italy, Romania and Slovakia applies charges to internalize this external cost item.

Regarding the level of annual revenues and total costs of railway usage charges in the ABD countries the following table gives an overview on the current internalization practices:

Table 11-8: Annual revenues and total costs of railway usage charges

Country	Annual revenues (million €)	Total costs (million €)	Year
Albania	NA	NA	2011
Austria	437.0	NA	2011
Bulgaria	48. 9	175.5	2011
Croatia	NA	NA	2011
Country	**Annual revenues (million €)**	**Total costs (million €)**	**Year**
Greece	NA	NA	2011
Hungary	479.4	NA	2011
Italy	2,132.1	NA	2011
Montenegro	NA	NA	2011
Romania	215.5	464.1	2011
Serbia	NA	NA	2011
Slovak Republic	95.6	352.0	2011
Slovenia	7.6	71.6	2011

Source:

In this respect, the annual revenues are mainly deriving from access charges and total costs where available. On the other hand, there are no exact calculations on what the total costs are per countries. In most cases, total costs exceed the annual revenues that is underpinning the unadequate pricing structures in ABD countries' and in many European countries' practice. From countries like Albania, Montenegro and Serbia statistics are not always included in international comparisons.

Administrative costs in the rail sector are intended as charges imposed by rail infrastructure managers on railway operators for the handling of the capacity demands. In Austria as one of the ABD countries administrative costs are included in the access charge as the handling of capacity is included in the price of services provided by the infrastructure manager. Countries like Hungary, Romania, Slovakia include administrative costs in the infrastructure access charge through a specific component. Furthermore, in countries like Greece, Slovenia no administrative costs are not adopted in the rail usage charges at all.

In addition, large differences of charge levels between countries are also the result of unlike political choices and in particular of the charging principle applied in the various countries. ECMT, 2005 distinguishes three approaches that the European governments have tended to follow:

–The social marginal cost pricing (MC), requiring government compensation for the difference between marginal cost and financial cost.
–Marginal cost with a mark-up (MC**+**) to reduce (or eliminate) government compensation and the gap between marginal cost and financial cost such as Austria, Bulgaria.
–The full cost recovery after receipt of grants (FC**–**), setting access charges to collect the difference between government contribution and full financial cost, where Hungary ad Romania falls into the category of FC, and Italy into FC-.

Assuming that electricity producers pass on the full costs of ETS to the electricity consumers, it can be deduced that CO_2 external costs from electricity production are internalized only if railway infrastructure users pay the full electricity price. Data shows that the levels of excises on gas oil and electricity applied to railways substantially vary between Member States.

Table 11-9: CO_2 internalization through taxes on gasoline and electricity

Country	**Gasoline**	**Electricity**
Albania		
Austria	Reduction	Standard rate
Bulgaria	Standard rate	Standard rate
Croatia		
Greece	Standard rate	Standard rate
Hungary	Exemption	Standard rate
Italy	Reduction	Exemption
Montenegro		
Romania	Standard rate	Standard rate
Serbia		
Slovak Republic	Standard rate	Exemption
Slovenia	Partial refund	Standard rate

Source:

The instruments considered for the internalisation of external costs in the rail sector are railway infrastructure access charges and gas oil and electricity excises. Information on calculation and internalisation schemes show that national methodologies are actually used to cover only part of the external costs produced by the rail mode of transport. Railway infrastructure access charges are in general quite complex and with considerable differences among the structures applied. The internalisation level substantially differs between Member States.

As for average charge level per train typology large differences between countries emerge. These differences are the result both of specific features of the national networks and of their use (i.e. traffic mix and traffic densities, technology employed, etc.), and of the pricing principle adopted. On the basis of available data, the comparison between average and maximum charge level per country highlights high variability among intercity charges and lower variability among regional and freight trains.

With reference to energy taxation ofrailways, Slovenia internalizes explicitly environmental costs with respect to gas oil only. No environmental costs are internalized by Member States through the electricity taxation. Many countries apply reductions/exemptions on railways gas oil and electricity excises. In the case of electricity, this situation leads to the mitigation or cancellation of the ETS' impact on rail transport.

With regard to VAT rates on energy for railways, the national standard rates are applied by almost allMember States. Reductions are registered in few countries i.e. Slovenia. A VAT exemption is not applied in any ADB countries at all. Similarly to the energy used in road transport VATs on rail services strongly vary between countries as far as domestic transport is concerned, while as for intra-community and international transport most of the countries apply VAT exemption with refund of tax paid.

Regarding pre-accession Balkan countries no data is accessible for further conclusions.

11.2.3 IWW – Compliance with EU guidelines

Fuel taxes imposed on freight IWW are partly applied in Austria and the Slovak Republic, while charges are required partly in Austria, Italy and the Slovak Republic regarding passanger IWW. On the contrary, regarding recreation purposes taxes are levied in all countries.

Port dues are the main charging measures for inland navigation, and can be found in all Member States. Port dues are mostly decided upon by local government, and have a wide range of both charge structure and charge level. Internalisation of external costs is mostly done indirectly through the differentiation in vessel size. Due to Mannheim and Danube Conventions it is not allowed to have direct charges on either the Rhine or the Danube. Therefore, fairway dues are mostly implemented on smaller fairways. Just as with port dues, there is an indirect internalisation element in the charge base due to the differentiation in vessel size. Another effect of the Mannheim and Danube Conventions is that in most Member States all commercial inland vessels are exempted from fuel taxes. However, in some countries there is a (limited) fuel charge to compensate for the waste water treatment costs. These charges were applicable under the Mannheim Convention, because it is not regarded as a user charge, but as a compensation for waste disposal.

Table 11-10: Internalization of external costs

Country	Fuel tax exemption	Port dues	Fairway dues	VAT Exemption / Discounts	Waste Water discharge
Albania	NA	NA	NA	NA	NA
Austria	✓	✓		✓	
Bulgaria	✓	✓		✓	
Croatia	NA	NA	NA	NA	NA
Greece	NA	NA	NA	NA	NA
Hungary	✓	✓		✓	
Italy	✓	✓		✓	
Montenegro	NA	NA	NA	NA	NA
Romania	✓	✓	✓	✓	
Serbia	NA	NA	NA	NA	NA
Slovak Republic	✓	✓		✓	
Slovenia	NA	NA	NA	NA	NA

Source:

For inland navigation, fuel taxes are exempted for freight transport in all ABD countries. Fuel taxes are also exempted for commercial passenger transport, with the exception of France and Italy. However, fuel taxes need to be paid in all countries for recreational vessels, in general.

Table 11-11: Application of fuel taxes for different types of Inland Navigation Vessels

Country	Freight	Passanger	Recreation / pleasure
Albania	NA	NA	NA
Austria	Partly	Partly	Yes
Bulgaria	No	No	Yes
Croatia	NA	NA	NA
Greece	NA	NA	NA
Hungary	No	No	Yes
Italy	No	Yes	Yes
Montenegro	NA	NA	NA
Romania	No	No	Yes
Serbia	NA	NA	NA
Slovak Republic	Partly	Partly	Yes
Slovenia	NA	NA	NA

Source:

Above mentioned reductions follow Directive 2003/96/EC, which allows Member States to apply exemptions for inland navigation except for pleasure crafts. Furthermore, both the

Mannheim and Danube Convention oblige Member States to refrain from imposing any toll, tax, duty or charge based directly on inland navigation. Both conventions allow for fees on services (for instance port dues) and taxation on other bases (such as VAT).

- **Recommendations**

The following recommendations are made with respect to data availability:

–The data basis on infrastructure costs is weak for all transport modes and could be further developed. However, this is a very time consuming effort as it would require an in-depth study on transport infrastructure accounts for each Member State and would covera long period of time.

–Data on (the use of) revenues is not complete and could be further developed.

–For many instruments, there is a clear lack of data on administrative costs, which could be further developed.

12 Online manuals and external cost calculation tools

12.1 TREMOVE

The TREMOVE (http://www.tremove.org/) model offers a comprehensive solution to measure transportation in and beyond the EU-27 countries developed by the Catholic University of Leuven and Transport & Mobility Leuven. The broad scope of the TREMOVE model enables the assessment of the integrated environmental policy packages covering the whole of Europe and all modes. On the other hand, the level of detail is sufficient to simulate effects of country- or mode-specific measures. Welfare costs of policies are calculated taking into account costs to transport users, transport suppliers, governments as well as the general public. The strength of TREMOVE is that it is an integrated simulation model. Both for passenger and freight transport, the model simulates in a coherent way the changes in volume of transport, modal choice and vehicle choice (size & technology) relative to a transport and emissions baseline.

TREMOVE consists of 31 parallel country models: the EU27 region, Switzerland, Norway, Croatia and Turkey. For these 31 countries, all land transport has been modelled as well as maritime port transport. The model entails the following countries in alphabetic order: Austria, Belgium, Bulgaria, Switzerland, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Ireland, Italy, Lithuania, Luxemburg, Latvia, Malta, The Netherlands, Norway, Portugal, Romania, Sweden, Slovenia, Slovakia, Turkey, United Kingdom. Each country model consists of three inter-linked ‘core’ modules: a transport demand module, a vehicle turnover module and an emission and fuel consumption module, to which we add a welfare cost module and a well-to-tank emissions module.

The transport demand module describes transport flows and the users' decision making process when it comes to making their modal choice. Starting from the baseline level of demand for passenger and freight transport per mode, period, region etc., the module describes how the implementation of a policy measure are likely to affect the users' and company's choice between these 388 different transport types. The key assumption here is that the transport users will select the volume of transport and their preferred mode, period, region etc. based on the generalized price for each mode: cost, tax or subsidy and time cost per km travelled. The output of the demand module consists of passenger kilometres (pkm) and ton kilometres (tkm) that are demanded per transport type for a given policy environment. The pkm and tkm are then converted into vehicle kilometres. In sum, Transport Demand includes (million pkm, tkm, vkm), occupancy rates, load factors per country, trip purpose, trip distance, region, period, network, vehicle category, fuel type, vehicle type, year.

The vehicle stock turnover module describes how changes in demand for transport or changes in vehicle price structure influence the share of age and type of vehicles in the stock. The output of the vehicle stock module is twofold: we split both the total fleet and the number of km for each year according to vehicle type and age. In sum, vehicle stock includes road and rail stock (# vehicles) per country, vehicle category, fuel type, vehicle type, vehicle technology, vehicle age, year.

The fuel consumption and emissions module is used to calculate fuel consumption and emissions, based on the structure of the vehicle stock, the number of kilometres driven by each vehicle type and the driving conditions. Consequently, emissions module overs emissions and fuel consumption (ton/year), marginal external costs (euro/vkm), apparent emission factors (g/vkm).

In addition to the three core modules, the TREMOVE model includes a well-to-tank emissions and a welfare cost module. The well-to-tank emissions module enables to calculate emissions during production of fuels and electricity. It also accounts for the effects of the use of (blended) biofuels.

The welfare cost module has been developed to compute the cost to society associated with emission reduction scenarios in European urban and non-urban areas. The welfare effect of a policy change is calculated as the discounted sum of changes in utility of households, production costs, external costs of congestion and pollution and benefits of tax recycling. These benefits of tax recycling represent the welfare effect of avoiding public funds to be collected from other sectors, when the transport sector generates more revenues.

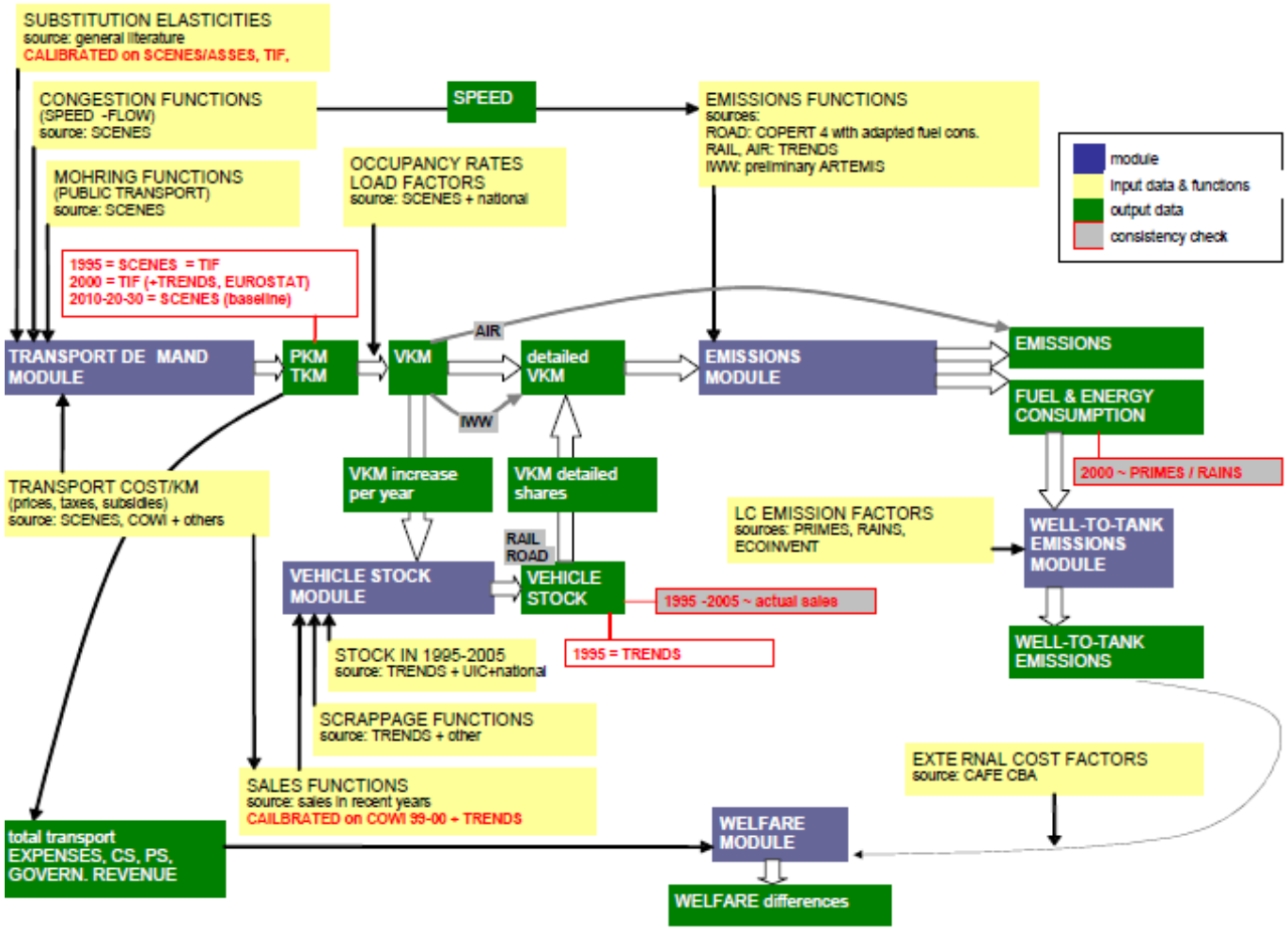


Figure 12-1: The structure of the Tremove

Source: TREMOVE, Final report, 2007.

Amongst others, the model has been used to evaluate following policy scenarios:

–Euro 5 and Euro 6 emission standards for cars;

–EURO VI emission standards for heavy duty vehicles;

–Fuel efficiency improvements beyond the 2008/2009 voluntary objectives of the car industry;

–Infrastructure charging;

–Fiscal measures for road transport vehicles;

–Speed limits for trucks on motorways;

–Shore side electricity, after-treatment technology and changes in fuel specifications for marine vessels.

TREMOVE has also been used for the mid-term assessment of the White Paper on Transport Policy. The TREMOVE software and the pivot tables are available at: http://www.tremove.org/documentation/index.htm

12.2 MARCO POLO (2004 – 2011, 2012 -)

The Marco Polo programme aims to shift or avoid freight transport off the roads to other more environmentally friendly transport modes. The programme is implemented through yearly calls for proposals. Proposals submitted under each call have been evaluated based on an unique set of indicators, namely the quantitative modal shift/traffic avoidance, their credibility and innovative features, and their merits in terms of environmental and social benefits. The 'value' of each proposal hasbeen measured by the external cost coefficients designed for each transport (sub)mode. Each transport (sub)mode-specific coefficient is calculated as the external costs of air pollution, noise, accidents, congestion, and climate change per tonne-kilometre transported with that specific transport (sub)mode [JRC, (2012)].

The external costs coefficients used in Marco Polo programme calls before 2011 were calculated in 2004 on the basis of a number of sources, some dating back to 2000. Following a request by the European Commission's Directorate General for Energy and Transport (now Directorate General for Mobility and Transport), the Commission's Joint Research Centre, Institute for Prospective Technological Studies (JRC-IPTS) updated the external cost coefficients to be applied and developed a software application that automates the estimation of the impact on external costs for specific projects.

The new external cost calculator, which was used for the first time for the 2011 call, covers road, rail, inland waterways and short sea shipping. External cost coefficients are provided for environmental impacts (air quality, noise, climate change) and socio-economic impacts (accidents, congestion). The methodology permits the estimation of coefficients and total external cost estimates for each of the 27 EU member states in which a certain transport mode is available as well as an aggregate value for EU27 (see JRC-IPTS 2011). For the 2012 call, additional modifications were implemented, primarily aimed at increasing the level of detail and hence accuracy of the cost coefficients for the inland waterways mode.

The elaborated methodology is primarily building on the findings of the well-acknowledges IMPACT project with the following limitations and extensions:

<u>Limitations</u> have been applied regarding the following cost categories:

–inclusion of external cost charges for infrastructure use (in line with the Commission's guidelines)

–scarcity costs of rail and inland waterways;

–costs of energy security;not covered at all!

–dependency on fossil fuel.

Extensions and modifications have been applied in converting the calculation unit of external costs on a per vehicle kilometre basis (e.g. CO2 emissions per extra kilometre of a truck) into per tonne kilometre terms. Moreover, congestion costs of road and rail has been integrated into the Marco Polo model based on estimations of the TRANS-TOOLS transport model (TRANS-TOOLS 2008).

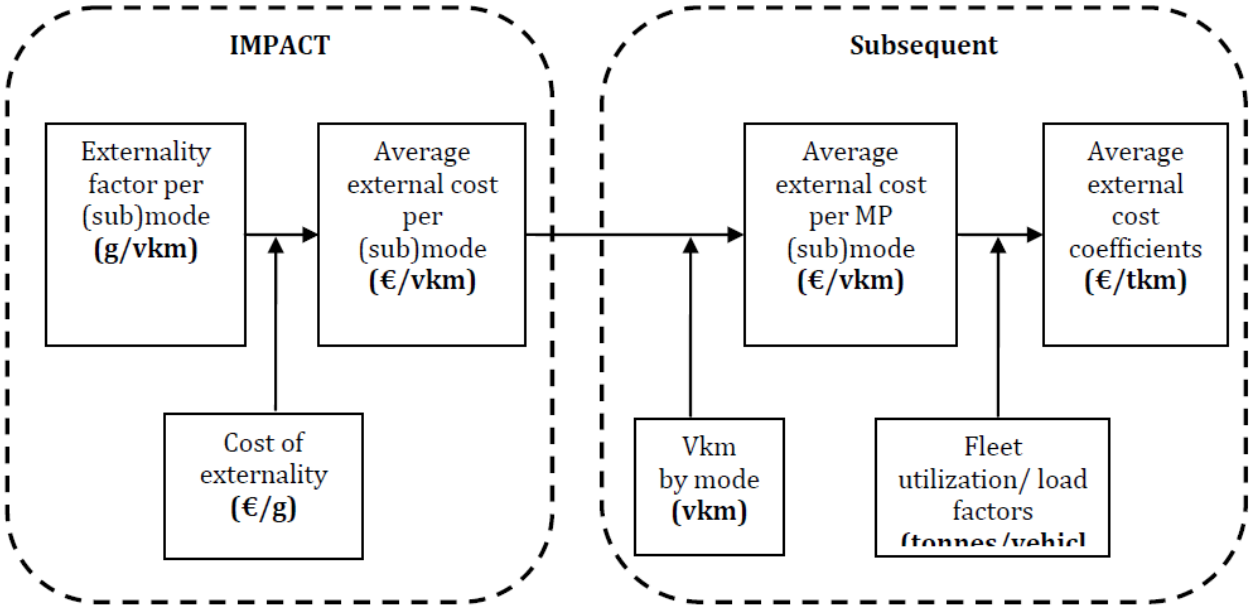


Figure 12-2: The Marco Polo methodology
Source: JRC, 2012

The Marco Polo model differentiated the following transport modes: road (motorways), rail, inland waterways, short sea shipping.

Table 12-1: Marco Polo subcategories per transport modes

Transport mode	Categorization criterion	Submodes
Road (motorways)	Network	motorways
Rail	Fuel technology	diesel electric
Inland waterways	Ship / cargo type	IWW ship IWW tanker Push barge combination
	Freight capacity*	<250 tonnes 250-400 tonnes 401-650 tonnes 651-1000 tonnes 1001-1500 tonnes 1501-3000 tonnes > 3000 tonnes
	Fuel technology	standard low sulphur fuel oil (LSFO) LSFO + Diesel Particulate filter (DPF) LSFO + Selective Catalytic Reduction (SCR) LSFO + DPF + SCR Liquefied Natural Gas (LNG)
Short sea shipping	Ship / cargo type	General cargo/ bulk Containerships RoRo/RoPax
	Speed (only for RoRo/RoPax)	- Less than 17 kn (knots) - 17 to 20 kn - 20 to 23 - more than 23 kn
	Fuel technology	- Conventional fuel (high or low sulphur) - Liquefied natural gas (LNG) - Seawater scrubbing - Freshwater scrubbing

Source:

*For certain member states (BE, DE, FR, NL) the data on emission factors per vehicle kilometre are equal among certain freight classes, effectively reducing the level of detail in terms of the number of freight classes as follows. For IWW ship and IWW tanker: 250-650t; 651-1000t; 1001-1500t; >1500. For push barge combinations: <3000t, >3000t.
Source: JRC, 2012

At the EU27 level, the marginal costs per vehicle kilometre for road, rail and IWW are transformed into marginal costs per tonne kilometre, using mode-specific conversion factors, i.e. tonnes per vehicle, which are calculated as weighted averages of member-state specific conversion factors. As for certain sub-modes, the use of the same mode-level conversion factors would lead to inaccurate results, sub-mode-specific conversion factors are used.

Table 12-2: Overview on input data in the Marco Polo model based on TREMOV model

Mode	**Submode**		**Load factor**
Road	Motorways		7,7
Rail	Diesel		292
	Electric		367
Inland waterways	IWW ship	< 250 tonnes	7
		251-400 tonnes	104
		401-650 tonnes	162
		651-1000 tonnes	226
		1001-1500 tonnes	297
		1501-3000 tonnes	488
		>3000 tonnes	744
		< 250 tonnes	38
		251-400 tonnes	49
		401-650 tonnes	256
		651-1000 tonnes	274
		1001-1500 tonnes	459
		1501-3000 tonnes	919
		>3000 tonnes	1225
		< 250 tonnes	10
		251-400 tonnes	35
		401-650 tonnes	66
		651-1000 tonnes	174
		1001-1500 tonnes	260
		1501-3000 tonnes	700
		>3000 tonnes	1309

Source: JRC, 2012

12.3 Ecocalc

ExternalCost - External Transport Cost - This tool calculates the external costs of transport in Europe due to climate change and accidents.
http://ecocalc-test.ecotransit.org/tool.php

Basic concept:
The existence of external costs in transport creates many distortions in the transport market. Transport users are not given the right incentives as a result of which do not takesocially optimal decisions. As a consequence scarce resources like energy and infrastructure are not used in an economic efficient way. Moreover, the level playing field between transport modes is adversely affected. The competiveness of modes that cause relatively few external costs, like railways and inland waterways, is harmed by the existence of external costs. The tool provides a standard mode, which uses external cost estimates from the IMPACT Handbook (CE/INFRAS/ISI, 2008). In addition it contains an extended mode. In that mode the user can choose various cost estimates ranging from low, medium to high estima tes which are all based on the latest 2011 update study on external costs, which was carried out in parallel to the development of the tool (CE Delft/INFRAS /ISI (2011). In addition the user can in the extended mode use own cost values. The tool contains both a standard and extended mode. In the standard mode the external costs are calculated based on default parameters in the tool (e.g. marginal external accident costs. The extended mode provides users the opportunity to change some of the parameters by themselves and run the tool based on the adapted parameters. The 20 countries covered by the tool ar e: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and UK. All external costs calculated in the tool refer to 2008 and are also expressed in the price level of 2008.

Methodology:
The estimation of the monetary value of climate and accident costs on specific trips selected by users for freight transport consists of two steps:

Calculates trip specific traffic and emission data; based on trip characteristics traffic (vehicle and tonne kilometres) and emission
Calculates trip-specific climate change and accidents costs. Based on the results of the first step, the monetary value of climate change and accident costs will be estimated.

In the extended input mode via-nodes and transport specific input parameters can be defined. At weight the user can input the respective netto weight of the transport. There are two units for the weight: Tons [metric tonnes] and TEU [Twenty-foot Equivalent Unit]. The weight type defines the kind of weight and is important for the load factor / empty trip run of the respective transport type. At the standard mode there are four transport modes (Truck, train, sea ship and

barge). Every selected transport mode will be calculated as single transport chain. Every location (origin, destination, via) can be defined as city district, railway station, harbour, airport or zip code.

Traffic and emission data

To calculate trip specific traffic and emission data, the same methodology is used as in EcoTransIT. Anextended overview of this methodology is referred to the Methodology and Data report on EcoTransIT (IFEU et al., 2010). The Ecological Transport Information Tool (EcoTransIT) calculates environmental impacts of any freight transport. Thereby it is possible to determine the energy consumption, CO_2 and exhaust emissions transported by rail, road, ship and aircraft in any combination. Within the External Cost Calculator not all the functionalities of EcoTransIT are needed. The calculation principle can be divided in the following stages:

Definition of the freight transport (Standard Mode or extended mode).
XML-Request with input data to the EcoTransIT-Server.
Calculation of every transport chain.
Determination of the route.
Route splitted in small sections.
Determination of the respective emission factor for each section.
Calulation of the emission response.
XML-Response with output data to the front-end.
Presentation of the results.

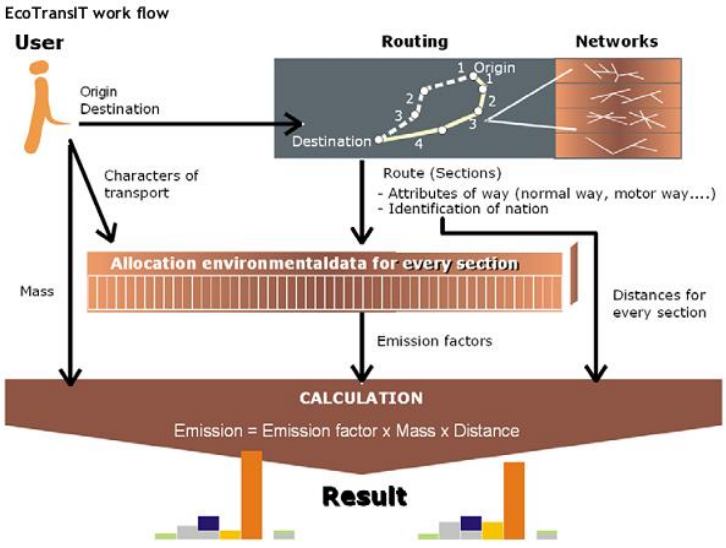


Figure 12-3: EcoTransIT work flow

Source:

Climate change

Climate change or global warming impacts of transport are mainly caused by the emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). These emissions could be weighted by using so called Global Warming Potentials (GWP), which indicates the impact on radiative forcing in relation to pure CO_2 . For CO_2 , CH_4 and N_2O the GWP is equal to 1, 25 and 298, respectively. Based on this weighting procedure the three greenhouse gases could be expressed in one unit, CO_2 equivalents. The climate change costs of a trip can be found by multiplying the amount of greenhouse gas (GHG) emissions by a cost factor. Due to the global scale of the damage caused, the effects do not depend on when and where in Europe the GHG emissions take place. In the tool the estimates of climate change costs are related to well-to-wheel GHG-emissions (both exhaust GHG-emis sions and GHG-emissions of fuel/ electricity production). The cost function applied in the tool for calculating the various CO_2 equivalents costs are the following:

$$\mathbf{C}_{TTW,m}=\mathbf{E}_{TTW,m}*\mathbf{MC}_{CO2}$$
$$\mathbf{C}_{WTT,m}=\mathbf{E}_{WTT,m}*\mathbf{MC}_{CO2}$$
$$\mathbf{C}_{WTW,m}=\mathbf{C}_{TTW,m}*\mathbf{C}_{WTT,m}$$

In which:

C=Costs per trip due to climate change from GHG-emissions (€/trip)
E=Emissions of CO_2 equivalents (ton/trip)
$\mathbf{MC}_{CO2}$=Marginal costs of climate change

TTW=Tank-to-wheel
WTT=Well-to-tank
WTW=Well-to-Wheel
m=Mode

Accident costs

The number and severity of traffic accidents depends on various factors. In general, the tool distinguishes the following groups of cost drivers:
Vehicle kilometres; there is a direct and positive relationship between the number of kilometres driven and the number of accidents
Transport mode; e.g. passenger cars are more often involved in traffic accidents than passenger trains, and cyclists involved in an accident are in general more severely injured than truck drivers
Location-specific factors; such as traffic speed and traffic volumes, type of infrastructure and country (accident risks in Southern Europe are larger than in Northern Europe)
Individual factors; like driving behaviour and driving experience
Meteorological factors; e.g. rainy weather increase the probability on traffic accidents.
The cost function applied in the tool fo calculating the accident costs of road transport is the following:

$C_m=\Sigma_{c,i}\ (VK_{m,c,i} * MC_{m,c,i})$
In which:

C=Accident costs per trip (€/trip)
VK=Vehicle kilometres (vkm/trip)
MC=External marginal accident costs
i=Type of infrastructure (urban road, interurban road, motorway)
c=Country
m=Mode

For rail transport a slightly adapted cost function is applied:
$C_m=\Sigma_{c}\ (VK_{m,c,i} * MC_{m,c})$
Method:
In the extended input mode via-nodes and transport specific input parameters can be defined. At weight the user can input the respective netto weight of the transport. There are two units for the weight: Tons [metric tonnes] and TEU [Twenty-foot Equivalent Unit]. The weight type defines the kind of weight and is important for the load factor / empty trip run of the respective transport type. At the standard mode there are four transport modes (Truck, train, sea ship and barge). Every selected transport mode will be calculated as single transport chain. Every location (origin, destination, via) can be defined as city district, railway station, harbour, airport or zip code.

Calculation result
As result the user gets new graphs and tables which include the cost for every selected traffic type. EcoTransIT has world wide coverage but the External Cost Calculator only covers Europe. This difference will be handled within the cost calculation. So if the user selects parts outside of Europe there will be no output for external cost in the results. The result will be shown according to the following indicators (depending on the given parameters). The used methodology for accident cost is Medium-Truck Marginal cost with damage potential allocation (UIC study) and rail average cost values from UIC study and the climate change calculated with 25 EUR/tCO

Train accident costs and Train climate cost
Truck climate costs and truck accident costs
Sea ship accident costs and see ship climate cost
Inland ship accident cost and inland ship climate cost

12.4 EcoTransit

EcoTransIt - The calculation of energy consumption and emission data of a worldwide transport chain can be done rather quickly with the help of EcoTransIT World.
(http://www.ecotransit.org/calculation.en.html)

The key factor influencing the environmental impact of freight transport is the choice of transport mode. Using EcoTransIT World, it is possible to assess the various modes of transport available as truck, rail, inland waterways, sea-going vessels and aircraft. In addition, transport modes can be combined to suit individual requirements. Even within individual transport systems, there are considerable differences due to the vehicle technology deployed, the transport capacity and other factors. In the case of a truck, the key influencing factors are the vehicle size (and thus the max. permissible load), the capacity utilisation level, and the engine's technical standards for the reduction of exhaust emissions (Euro standards).Different technical standards of the vehicles are reflected in the calculations as well as fuel quality or the electricity mix in different countries. This helps companies to improve the carbon footprint of their logistics activities The free accessible internet-tool enables the exact calculation of environmental impact of freight transports within Europe and this overall transport types.

Calculation basis:
GIS-based europe-wide net work for the determination of the distance for each transportation type
–Definition of the transported good by mass or TEU incl. the degree of load capacity and empty trips
–Accepted methodology of calculation developed by independent environmental institutes
–Extended input enables a detailed specification of the shipments
–CEN-norm required differences of the results in well-to-tank (WTT) and tank-to-wheel (TTW)

Environmental evaluation
Primary energy consumption

–Carbon dioxide (CO2)
–Greenhouse gases (CO2-eq)
–Sulphur dioxide (SO2)
–Nitrogen oxides (NOX)
–Non-methane hydrocarbons (NMHC)
–Particles (PM10)

Currently EcoTransIT is financed by seven European rail-way companies (DB-Schenker, SBB Cargo, SNCF, Green Cargo, Trenitalia, SNCB, Renfe) and the UIC. The environmental evaluation is based on founded scientific fundamentals. The calculation method was developed at the independent ifeu-institute from Heidelberg and the underlying emission factors are updated regularly.

EcoTransIT provides GIS-system information on the routes taken by the goods, volumetric weight of the transported cargo allows a precise assessment of the size of the trains and the type of loading locations (rail station, harbour, airport, roadway platform) enables accurate modelling to reflect reality. EcoTransIT analyses the energy consumption and emissions of

freight transported by rail, road, ship and aircraft. It also takes into account the intermodal transport services and the different technical standards of the vehicles. Analyses deliver an overview on primary energy consumption (Energy resource consumption measured in Megajoules), carbon dioxide (CO2, Greenhouse Gas, climate changes measured in tonnes), Greenhouse gases (CO2-eq, measured in tonnes), Sulphur dioxide (SO2, measured in kg), Nitrogen oxides (NOX, measured in kg), Non-methane hydrocarbons (NMHC, measured in kg), Particles (PM10 combustion related measured in the unit of kg) and distances for each transport modes in km. CO2 equivalent is calculated as follows: CO2e is calculated as follows (mass weighted): CO2e = CO2 + 25 * CH4 + 298 *

Table 12.3: Classification and modes

Sector	Parameter	Road	Rail	Sea ship	Inland Ship	Aircraft
Vehicle, Vessel	Type, size, payload capacity	E	E	E	E	E
	Drive, energy	A	E	A	A	A
	Technical and emission standard	E	A	A	A	A
Traffic route	Road category, waterway class	R			R	
	Gradient, water/wind resistance	A	A	A	A	A
Driving Conditions	Speed	A	A	E	A	A
	No. of stops, acceleration	A	A	A	A	A
	Length of LTO/cruise cycle					R
Transport Logistic	Load factor	E	E	E	E	E
	Empty trips	E	E	E	E	E
	Cargo specification	S	S	S	S	S
	Intermodal transfer	E	E	E	E	E
	Trade-lane specific vessels			R		
Transport Work	Cargo mass	S	S	S	S	S
	Distance travelled	S	S	S	S	S

Remarks: A = included in average figures; S = selection of different categories or values possible in the standard input mode, E = selection of different categories or values possible in the extended input mode, R = selection by routing algorithm; empty = not relevant

Source: EcoTransIT Methodology

The most decisive speficiation of the tool is that it also distinguishes between empty weight and payload capacity. Accordingly, EcoTransIT can be used for routes traversing Austria, Belgium, Czech Republic Denmark, Finland, France, Germany, Hungary, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom. Therefore,the tool is able to develop the compliance with EU internalization guidelines in ADB countries partly, except for pre-accession countries. Measuring an optional route between Budapest and Bucarest comparing trucks and rail freight calculations clearly show that rail transport is a more environmentally-friendly option. With special attention to primary energy consumption, the tool prefers rail freight transport to trucks. Regarding carbon-dioxide emissions, abatement measured in tonnes reflect the clear dominance of rail freight in terms of environmental aspects.

12.5 ExternE and EcoSenseWeb

ExternE - External Costs of Energy – http://www.externe.info/externe_d7/?q=node/2

EcoSenseWeb - the integrated environmental impact assessment model that is accessible through a user fee of 310 euros. It allows to calculate location specific marginal external costs of a stationary source (e.g. a power plant) due to emissions of air pollutants. The user can modify all relevant input parameters.

Other versions of EcoSense ('transport' for calculating external costs of transport, 'multi-source' to calculate external costs for all sources of a sector and/or country or for the whole EU.EcoSenseLE is an online tool for estimating costs due to emissions of a typical source (e.g. power plant, industry, transport) or all sources of a sector in an EU country or group of EU countries. It is a parameterised version of EcoSense, based on European data for receptor (population, crops, building materials) distribution, background emissions (amount and spatial distribution), and meteorology.

The EcoSenseWeb and the calculation of external costs follow as far as possible the so called Impact Pathway Approach (IPA). EcoSense was typically used for assessing the emissions due to operation of a single source, like an oil fired power station. However, the tool can also be used to evaluate the pressure on the environment (e.g. emissions and land occupation) caused by other sources. Input sources cover mainly information on power plants such as location, building properties and emission specifications including major parts (SO2, NOx, PM10, PM2.5, NH3, NMVOC measured in the unit of mg/Nm3), minor parts (Cd, As, Cr, Ni, Hg, Pb, Cr-VI, CH2O, Dioxin measured in the unit of ng/Nm3), land use change, emissions of GHGs (CO2, CH4, N2O measured in the unit of tons) and radio nuclicide emissions. As regards output data, the tools delivers reports on 'Concentration levels of primary and secondary particles and ozone', 'Receptor (i.e. population, crops, building material) exposure', 'Physical impacts resulting from exposure to airborne pollutants' and last but not least,'Costs due to impacts on human health, crops, building materials, ecosystems and due to climate change'.

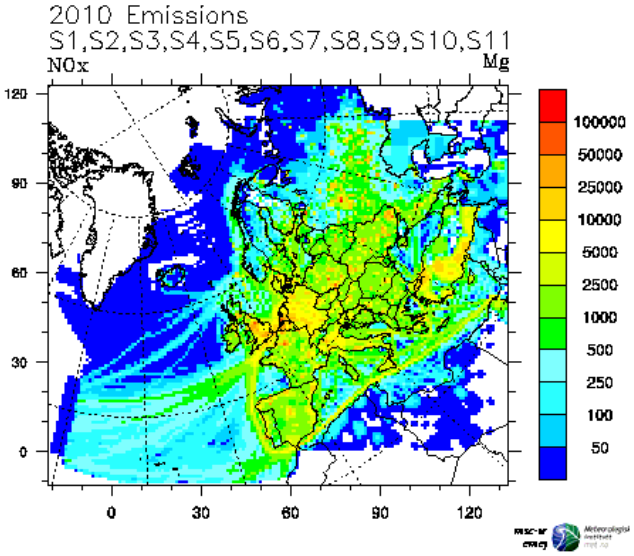


Figure 12-4: 2010 Emission
Source:

Regarding ADB countries, transport-related emissions NOx-emissions for the year 2010 show that ADB countries represent a fairly low level of Nox emissions compared to the rest of the EU. Calculations highlight, that countries along freight corridors possess relatively higher level of Nox-emissions than other Member States and pre-accession countries.

In ExternE the air quality is estimated by the use of atmospheric dispersion models. It is important to note that not only local damages have to be considered - air pollutants are transformed and transported and cause considerable damage hundreds of kilometres away form the source. So local, European wide, and north hemispheric modelling is considered in EcoSenseWeb.

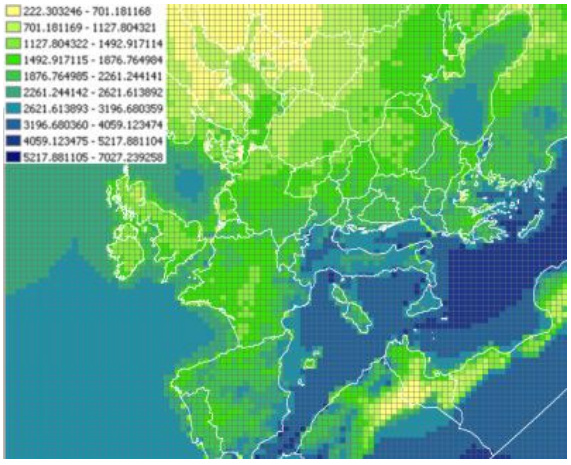


Figure 12-5: Air quality – EcoSenseWeb
Source:

With reference to the Concentration of relevant pollutants and change in concentration, EcoSense gives estimates on air quality, one influential factor of transport-related externalities. Regarding ADB countries, the tool shows that pollutants concentrate mainly in pre-accession countries and in Italy, where internalization and policy measures have relevance to tackle this issue. The darker the colour displayed is, the more important the intervention from policy-makers is. Therefore,the tool advises pre-accession countries (Montenergo, Croatia, Serbia) to take steps, while EU countries to user-taylor policy measures in force. According to the chart, Romania, Hungary, Bulgaria are in a fairly balanced situtation.

12.6 HER-ST

HERS-ST Highway Economic Requirements System - State Version (http://www.fhwa.dot.gov/infrastructure/asstmgmt/hersindex.cfm)

HERS-ST is an engineering/economic analysis (EEA) tool that uses engineering standards to identify highway deficiencies, and then applies economic criteria to select the most cost-effective mix of improvements for system-wide implementation. HERS-ST is designed to evaluate the implications of alternative programs and policies on the conditions, performance, and user cost levels associated with highway systems. The model will provide cost estimates for achieving economically optimal program structures, as well as predict system condition and user cost levels resulting from a given level of investment. [Additional information on HERS-ST]. This website is intended to serve as a resource for new and current users of HERS-ST. The Software link to the left will take you to a page that contains that current version of the software as well as sample data for those desiring to evaluate the software. The Documentation link will take you to a page that contains the current HERS-ST documentation.

12.7 STEAM

STEAM Surface Transportation Efficiency Analysis Model – (http://www.fhwa.dot.gov/steam/products.htm)

The Intermodal Surface Transportation Efficiency Act emphasized the assessment of multimodal alternatives and demand management strategies. This emphasis increased the need for planners to provide useful comparative information to decision makers with regard to proposed alternative transportation solutions. Benefit-cost analysis is a useful tool to compare the economic worth of alternatives through the evaluation of trade-offs between the mobility and safety benefits of transportation infrastructure projects and the cost of building, maintaining and operating these projects. To facilitate detailed corridor and system-wide analysis, in the 1990's the FHWA developed the Surface Transportation Efficiency Analysis Model (STEAM). STEAM uses information developed through the travel demand modeling process to compute the net value of mobility and safety benefits attributable to regionally important transportation projects. The current version of this model, STEAM 2.02, is able to report mobility and safety benefits by user-defined districts and a new accessibility measure. The district-level reporting

feature allows users to compare the impacts of transportation investments to resident trip-makers across aggregations of zones, which may represent neighborhoods, policy areas or political jurisdictions. The accessibility feature produces estimates of employment opportunities within a user-defined travel-time threshold of a district across a base and improvement scenario. Both an index and the percentage change are provided. The district reporting and accessibility features are useful new tools for gauging the social impacts of transportation investments.

13 Additional relevant projects to external cost of transportation

13.1 Reasoning for the extension of ADB exemplary projects

Starting in the early 90s a number of studies and extensive research projects has been conducted with the aim of improving estimations of cost and the methodology used for estimations of external cost. These studies include a number of projects funded by the European Union (e.g. UNITE (Nash, 2003), ExternE (Bickel & R., 2005), NEEDS) but also national or privately funded research projects (e. g. INFRAS/IWW (Schreyer, et al., 2004), Swiss Federal Office for Spatial Development (ARE, without year), CE Delft et al. (CE Delft; Infras; Fraunhofer ISI, 2011)).

Recent 'mainstream' methodology choices follow an evolution of external cost identification (including cost categories) and internalization practices. Since the early 1990's the European Commission's Framework Programmes (4th FP, 5th FP, 6th FP and 7th FP respectively) and under the territorial cooperation programmes, regardless of funding schemes have assigned millions of euro for shaping the EU guidelines and summarizing best approaches per transport modes – as there is no 'one size fits for all' methodology. Besides EU approaches and national practices, OECD and U.S. methodologies have also affected the current acknowledged methods. Early projects were addressed to the identification of cost categories playing decisive role in external costs, while since 2006 projects' scope have been assigned to develop and implement internalization measures. In the followings these projects are presented.

13.2 UNITE: UNIfication of accounts and marginal costs for Transport Efficiency

UNITE is a part of the European Union's Fifth RTD Framework Programme (1998-2002) in the thematic programme Competitive and Sustainable Growth. It has been built on previous European research to a great extent such as the Concerted Action on Transport Pricing Research Integration (CAPRI) and the High Level Group on Infrastructure Charging. At the empirical level, projects such as ExternE and QUITS (environment) and TRENEN, PETS and the ongoing UIC study on the External Costs of Transport (multiple cost categories) have provided valuable evidence on the nature and valuation of costs. For transport accounts, examples of accounts for

multiple modes were elaborated for Germany, France and Switzerland, whilst focusing on the road sector, the UK Road Track Cost and USA Federal Highway Cost Allocation Study provide illustrations of attempts to compare costs with revenues for individual vehicle classes. A range of cost allocation approaches have been examined in DIW et al. (1998) - that work has been extended and developed within UNITE.

UNITE has applied alternative methodology for the estimation of marginal costs (applied as total social costs – abbreviated as TSC) for the cost categories - infrastructure costs, supplier operating costs, transport user costs, accident costs and environmental costs. Furthermore, UNITE has implemented specified methodologies for all transport modes – road, rail, aviation, inland waterways (IWW) and short-sea shipping. In UNITE marginal social costs have been defined and calculated as a cost of additional transport unit – vehicle kilometer for road, train km for rail, aircraft km for air, ship km for materborne modes. Infrastructure capacity has been fixed, while the rolling stock may vary.

$$TSC = TSC_{infra} + TSC_{operator} + TSC_{user} + TSC_{accident} + TSC_{env}$$

Marginal social transport costs of an extra vehicle km differentiated with respect to output (Q) have been calculated by subcontracting the marginal private cost (MPC) of an extra vehicle km from the marginal social transport cost:

$$MC = MC_{infra} + MC_{operator} + MEC_{user} + MEC_{accident} + MEC_{env}$$

where for the respective specialist cost category:

$$MEC = \partial TSC \, \partial Q - MPC$$

Table 13-1: Marginal cost categories in UNITE

Infrastructure	Supplier operating	Transport user	Accidents	Environment
Capital costs (renewals) -replacement of assets *Running costs (partly)* -maintenance of infrastructure -operation of infrastructure	*Vehicle related costs* -wear and tear of vehicles -tyres and other consumables -net fuel costs -wages of drivers -vehicle cleaning, service, maintenance -liability costs -other operating costs *Service related costs* -general services -external services *Infrastructure related costs*[(1)] -building maintenance *Administrative and Commercial Costs* -staff wages -general administrative costs	*Extra Time costs* -extra waiting/access time -extra travel time -crowding effects -extra search time *Extra operating costs* -fuel consumption -driving and handling personnel -depreciation/capital costs -vehicle wear and tear -administrative costs *Mohring benefits* -access time savings -travel time savings -crowding costs savings -queuing coast savings	*Risk value* *Material damages* -Medical cost -Administrative cost -Production losses	*Air pollution* -human health -natural environment -building materials *Global warming* -damage costs (agriculture, health, energy use, water availability, coastal impacts) -avoidance costs *Noise* -human health -amenity losses *Soil and water pollution* -heavy metals, oil -de-icing salts *Nuclear risks* -operation of power plants -accident risks

Note: [(1)] Infrastructure costs specific to the operating company (e.g. ticket offices).

Source: UNITE Deliverable 3.1: Marginal Cost Methodology (2001), Version 2.1, pp. 17.

Table 13-2: Summary details of UNITE project

UNITE has been implemented as a cooperation of 18 European partners with the aim of designing support to policy-makers in the development of pricing and taxation policies for the transport sector. UNITE has provided state-of-the-art methodology for the estimation of transport procedure costs based on a great number of case studies, which in this approach consists of infrastructure provider and supplier operating costs, are the econometric approach and engineering approach. Previous applications of these approaches, although rare, exist for road and rail modes. In the past, aviation and waterborne transport were not studied in great depth, since it was assumed that marginal cost categories represent a limited proportion of overall costs.

Source:

13.3 GRACE: Generalization of Research on Accounts and Cost Estimates

The **GRACE** project has been implemented to support policy makers in developing sustainable transport systems by facilitating the implementation of pricing and taxation schemes that reflect the costs of infrastructure use. It covered the following areas of research:

–Case study research to address gaps in the existing level of knowledge of marginal social costfor road, rail air and waterborne transport,
–Development and refinement of methods to enable the use of transport accounts as monitoring instrument for the implementation of transport pricing reform in an enlarged Europe,
–Innovative research on the appropriate degree of complexity in transport charges,
–Guidance on the marginal social cost of the different modes of transport in specific circumstances and on simple and transparent methods for determining charges,
–Modelling the broad socio-economic impacts of pricing reform.

GRACE project was driven by the efficient pricing in transport and the internalisation of the external costs of transport. It also contributed greatly to the European Commission's preparations of the Communication on the internalisation of the external costs of transport in line with the European Parliament's request for a model for the assessment of all external costs. In the frame of GRACE the following transport modes have been examined for both freight and passanger transport: road and rail, ports, airports, inland navigation. Regarding road and rail transport the following cost categories have been integrated into the calculations: infrastructure costs, road congestion and rail scarcity, accidents, air pollution and greenhouse gases, noise. The external costs of ports have been measured by infrastructure costs as a consequence of using locks in the ports, crew cost on the vessel, operating and maintenance cost of the vessel, tugboats and pilotage boat (or helicopter), accident costs (cargo as well as injuries of persons), noise costs and air pollution costs.

Table 13-3: Summary details of GRACE project

GRACE undertook extensive new research on cost estimation across the various modes and cost categories. Furthermore, it sought to understand how costs vary with circumstance and to encapsulate this understanding within a user-friendly software tool that can be used to derive reasonable approximations of external costs. In this way, GRACE has sought to build upon the cost estimation evidence base and to make it generalisable. Within GRACE specific online tool has been developed and harmonized with the IMPACT Handbook. The GRACE online tool has been finalized in April 2008 and available at: http://www.grace-eu.org/logindbms.asp

Source:6th FP, 2002-2006, available at: http://www.grace-eu.org/

13.4 IMPRINT-NET: Implementing pricing reforms in Transport – Networking

IMPRINT-NET a Sixth Framework Coordination Action project for the European Commission (2005-2008). It has provided a discussion platform for policy makers, transport operators, researchers and other stakeholders to exchange views on the implementation of new pricing regimes, cost calculation methods, derivation of tariffs to be levied and on successful approaches to overcome barriers and to affect attitudes and perceptions.

IMPRINT-NET has directly benefited from the experience accrued by its predecessors CAPRI (1998-1999) and IMPRINT-EUROPE (2001-2004), while featuring major innovations, in both contents and organisation. It has closely cooperated with all relevant pricing research projects. As for its predecessor, the basic thrust of the IMPRINT-NET is to improve and enhance the links between pricing RTD and the policy community, notably by:

–transferring research findings to policy makers and stakeholders involved in the formulation and implementation of transport pricing reforms;
–stimulating the debate among stakeholders in order to build consensus on the principles and the practice of transport pricing, thus facilitating and accelerating the implementation of pricing reforms and contributing to the implementation of the EU transport policy.

The six Expert Groups set up during the implementation of IMPRINT-NET has elaborated specific methodologies for the following transport modes: interurban road, rail, maritime, inland waterways, air and revenues.

Interurban road pricing contains infrastructure, accident, congestion and environmental costs. There are three approaches to measuring infrastructure costs – engineering, econometric and cost allocation approaches. The engineering based approach analyses the impacts of the traffic load and the climate on the lifetime of the road surface. The econometric cost function approach analyses the functional relationship between expenditures, traffic loads, climate, etc. The cost allocation approach assumes a linear curve where average variable costs equal marginal costs. Accident costs are a mix of external and internal costs. They are external to the extent that some costs are borne by third parties (e.g. the state) and that the accident risk changes as more vehicles are added to the roads. In terms of quantifying the environmental costs, the relevant cost categories are: air pollution (impacts on health, agricultural crops, man-made material), noise (health, annoyance), climate change (greenhouse gases CO_2, nitrous oxide N_2O, methane CH_4 etc), and arise from vehicle operation and fuel provision. The costs vary depending on the site (local environment, geographical location) and vehicle technology, as well as the size of the population exposed to the pollution. The main cost drivers (apart from vehicle characteristics) are: for air pollution – receptor density close to the route, local meteorology (average wind speed) and geographical location within Europe; for noise – traffic situation (speed and traffic volume; background noise) and population density close to the emission source; for global warming – fuel consumption and type of fuel.

The components of the marginal social cost of *rail infrastructure* use have been identified as marginal wear and tear cost, marginal congestion and scarcity costs, marginal environmental costs and marginal accident costs.

The main cost categories within *maritime transport* include emissions (noise en exhaust), accidents, infrastructure costs and congestion costs. These are to be differentiated by the area where the vessel operates: open sea, fairway and port area.

In case of *inland waterways* the main cost categories cover infrastructure cost, safety and accident cost, environmental cost and congestion cost.

Regarding *air transport*, the following cost categories have been measured such as infrastructure costs, environmental costs (noise and air pollution), congestion and global warming.

Table 13-4: Summary details of IMPRINT-NET project

IMPRINT-NET project's main objective was to support policy-makers as a result of 6 Experts Groups (EG) discussing all issues possibly relevant to the implementation of pricing reforms in the transport sector.

Source:

13.5 HEATCO: Developing Harmonised European Approaches for Transport Costing.

HEATCO (6th FP, 2002-2006. Developing Harmonised European Approaches for Transport Costing and Project Assessment http://heatco.ier.uni-stuttgart.de/)partnership has been carried out a Cost-Benefit Analysis (CBA) and a valuation methodology to develop a set of harmonised guidelines for project assessment and transport costing on the EU level in the areas. The main focus of HEATCO was major European infrastructure projects, for which a sound evaluation scheme was established that in the long run may become a standard procedure. The elaborated methodical frame was primarily addressed to value of time and congestion, value of accident risk reduction, costs from health impacts and costs of other nuisances due to pollutants and noise, wider economic effects, i.e. indirect effects, infrastructure costs and general CBA aspects; e.g. inter- and intragenerational distribution, risk and uncertainty. In more details the methodology includes general issues (incl. non-market valuation techniques, benefit transfer, treatment of nonmonetised impacts, discounting and intra-generational equity issues, decision criteria, the project appraisal evaluation period, treatment of future risk and uncertainty, the marginal costs of public funds, producer surplus of transport providers, the treatment of indirect socio-economic effects), value of time and congestion (incl. business passenger traffic, non-work passenger traffic, commercial goods traffic time savings and treatment of congestion, unexpected delays and reliability), value of changes in accident risks (incl. accident impacts considered, estimating accident risks, valuing accident costs), environmental costs (incl. air pollution, noise, global warming), costs and indirect impacts of infrastructure investments (incl. capital costs for project implementation, costs for maintenance, operation and administration, changes in infrastructure costs on existing networks, optimism bias, residual value). Country-specific fall-back values being suggested for application in cases where no state-of-theart national values are available for valuation of time and congestion, accident casualties, damage due to air pollution, noise and global warming.

Table 13-5: Summary details of HEATCO project

HEATCO has been co-financed by DG TREN Directorate General Energy and Transport and has brought 25 partners.

Source: http://heatco.ier.uni-stuttgart.de/

13.6 TRANSPRICE – Trans Modal Integrated Urban Transport.

The TransPrice (4th FP, 2000-2002, Trans Modal Integrated Urban Transport Pricing for Optimum Modal Split) project was aimed to address the issue of integrated trans modal urban transport pricing, towards achieving optimum modal split in urban areas, at pan-European level. TransPrice (Trans Modal Integrated Urban Transport Pricing for Optimum Modal Split) commenced in January 1996 with a 3-year work programme. TransPrice involves analysis and evaluation for eight urban sites throughout Europe, covering a wide range of cities.

The TransPrice modelling methodology comprised:

–User response and travel behaviour analysis through a common Stated Preference (SP) survey in all eight project sites.

–Analysis and assessment of the determinants of mode choice, particularly related to price-related variables.

–Simulation modeling, integrating the SP analysis results with strategic and/or disaggregate mode choice modellng (using existing models where available) and detailed traffic management modeling.

External costs in TransPrice include local environmental effects (health effects), regional environmental effects (e.g. acidification), global environmental effects (e.g. global warming), congestion, accidents, noise, road wear and tear.

Table 13-6: Summary details of TRANSPRICE project

The TransPrice Consortium comprised 19 partners from 9 EU member states and it involved 8 urban test sites in 7 EU member states. It addressed Task 5.4/24 in the Urban Transport sub-programme of the EU 4th RTD Framework Transport Programme (Pricing and Financing Section). The project had links to other parts of the Urban Transport Work Programme, namely transport demand management and strategies for changing modal split. Moreover, TransPrice had direct links with the Strategic Research sub-programme on valuation of externalities of transport and on pricing of transport systems (Tasks 1.2/14 and 1.2/15), as well as relevant projects within other EU projects [Telematics Applications (DGXIII), JOULE-THERMIE, SAVE]. The final report is available at http://www.transport-research.info/Upload/Documents/200310/transprice.pdf

Source: http://www.transport-research.info/Upload/Documents/200310/transprice.pdf

13.7 CAPRI - Concerted Action on Transport Pricing Research Integration

CAPRI (, 4th FP, 1998-1999, available at: http://www.its.leeds.ac.uk/projects/capri/) was commissioned to facilitate the exchange of information and results from research projects dealing with the pricing of transport. The project ran from January 1998 to December 1999. The key objectives of CAPRI were:

to aid dissemination of research results to Member States and other parties;

to present a syntheses of research findings;
to facilitate discussion and debate of research findings; and
by identifying areas of agreement and disagreement, to attempt to build up a consensus on the policy implications of this research.

Conclusions of the project has been grouped into 6 themes:
–Recommendation for pricing principles – for infrastructure use by all modes;
–Recommendations on valuations of externalities;
–Road pricing – urban and inter-urban;
–Rail and other public transport;
–Air transport; and,
–Conclusions on likely impacts of implementing efficient pricing.

Marginal costs are classified into the following categories: operating costs (except those costs borne by the individual user); infrastructure wear and tear; congestion costs (except those costs borne by the individual user); opportunity cost for the use of capacity (when other users are displaced); accidents (except those costs borne by the individual user); noise; air pollution; and, global warming.
Recommendations elaborated regarding the valutation of externalities highlight that externalities within the transport sector are of equal relevance as externalities that are caused outside the transport sector. All of the key externalities can be valued and incorporated in the development of pricing structures – although substantial uncertainty exists in relation to cost estimation, in principle there is no reason to exclude any of the cost categories listed under "Pricing Principles". Evidence of external benefits from increased private use of transport infrastructure is weak – in contrast to public transport, where external benefits arise due to increased demand resulting in improved service levels to the benefit of other public transport users. External costs of congestion, scarcity and accidents should be valued using willingness to pay approaches – and it is essential that the internal element that the user already 'pays' is separated from the price-relevant external element. Regulatory policy may often be more powerful than pricing policy in the control or reduction of some categories of environmental emission – particularly for aspects such as noise, where in some circumstances the marginal costs are very low. At present there is no consensus on the values that should be placed on emissions of global warming gases – thus, values used in pricing should be based on political decisions about target emission levels.

Table 13-7: Summary details of CAPRI project

In addition to drawing on the reports of pricing related projects in the European Commission's 4th Framework Programme, research evidence was put forward by researchers and civil servants from the EU, Norway, Switzerland, the USA and a number of Accession Countries. The implications of the synthesis of research findings were extensively discussed in four meetings during the course of CAPRI.

Source: http://www.its.leeds.ac.uk/projects/capri/

13.8 QUITS - Design and testing of an integrated methodology for the valuation of the quality of transport and systems and services

Table 13-8: Summary details of QUITS project

This project (Design and testing of an integrated methodology for the valuation of the quality of transport and systems and services) used a bottom up approach to quantify the internal and external quality of transport. The study methodology was validated for multiple modes for three corridors: Frankfurt Milan, London Lille, and Munich, Patras. (4th FP, 1996-1997)

Source:

13.9 PETS - Pricing European Transport systems

PETS project has been co-financed by the European Commission's 4th Framework Programme between 1996-1999. PETS' external costs of transport infrastructure comprise all costs imposed on third parties by transport infrastructure use. PETS has focused, in particular, on accident costs, noise, air pollution and global warming.PETS project has pawed the way for influential projects like NEEDS, RECORDIT or UNITE.

The project has quantified social marginal costs as a sum of producer costs, user costs and external costs:

$TSC = TC_{prod} + TC_{user} + TC_{ext}$

where TC prod, TC user and TC ext are function of Q.

Table 13-9: Summary details of PETS project

This project gives practical advice on what the consequences of implementing efficient prices will be in terms of volume of traffic, choice of mode and environmental consequences. The pricing scenarios tested included: (i) marginal cost pricing; (ii) marginal cost pricing subject to a budget constraint; and, (iii) full internal and external cost recovery. The project also examines the relationship between deregulation and pricing. It involves five case studies: crossing of the Alps, Oslo Gothenburg, Finland, and the Tagus River crossing, Lisbon.

Source:4th FP, 1996-1999, available at:
ftp://ftp.cordis.europa.eu/pub/transport/docs/summaries/strategic_pets_report.pdf

13.10 REVENUE – Revenue Use from Transport Pricing

REVENUE has been co-financed by the European Commission's Fifth Framework Programme by DG TREN. TheREVENUE project focused on analysing the efficiency and equity impacts of different options to use revenues from infrastructure charges, and dealed also with the acceptability and feasibility of these options.The REVENUE project was set up with three main objectives:

–to assess current practice for transport revenue use;
–to develop guidelines for good use of the revenues from social marginal cost pricing;
–to examine current practice and the use of the guidelines on a set of case studies.
The project developed theoretical guidelines on optimal use of revenues and their comparison with current practice and spending schemes which are proposed or under discussion in the EU countries. These were demonstrated in a series of case studies focusing on interurban transport - dealing with revenue use in road, rail, airports and seaports – and urban transport.
The REVENUE partnership has elaborated the MOLINO methodology that covers the following cost categories:

Table 13-10: The MOLINO methodology

	Type	Assumptions used in Molino	Procurement matters?
Investment in infrastructure	Investment cost	Function of investment and existing capacity	Yes, tendering versus non-tendering
Maintenance of infrastructure	Maintenance	Function of existing capacity and of total use by type of user	Yes, tendering versus non-tendering
Operation cost	All operation costs (building, vehicles and other)	Fixed cost + (constant variable cost in peak) . (volume peak) + (constant variable cost in off- peak) . (volume off- peak)	Yes, tendering versus non-tendering
User cost	Time costs	Bottleneck formulation: function of volume over capacity	No
	Resource costs	Proportional to volume of transport by user	No
External cost (other than congestion)	Air pollution, accidents, noise, ..	Constant per trip, depends on type of user	

Source: REVENUE Deliverable 2 – Theoretical Frame, 66.pp.

A research version of Molino has been programmed in Mathematica with input and output via Excel worksheets. MOLINO programme is also applicable to measure passanger and freight transport.

5th FP, 2002-2006, available at: http://www.revenue-eu.org/

13.11 MC-ICAM – Implementation of Marginal Cost Pricing in Transport

MC-ICAM (Integrated Conceptual and Applied Model Analysis) has been a research project funded by the European Union which examines policy reform in the pricing of transportation. In particular, it has examined optimal implementation (or transition) paths from a situation with low pricing of transportation to a situation with socially optimal pricing, in which users bear the full marginal social cost of their activities. Paths which reach the same final goal can differ in the prices they set over time until the final prices are reached, in the uses of revenue, and in the speed with which they reach the final goal. MC-ICAM evaluated the different paths by examining how they affect social welfare over time, the technological and institutional changes which they generate or require, and the political support for marginal cost pricing which they induce over time. Some of the work has consisted of theoretical analysis. Other work examined selected geographic areas, providing both descriptive studies (of institutions, attitudes, etc.) and numerical estimates of optimal implementation policies. The project hasl thus produced policy recommendations about how to implement marginal cost pricing.

Project MC-ICAM investigated the implementation of marginal cost pricing (MCP) in transport. Its goal was to provide clear policy conclusions on this topic, based on strong theoretical analysis, in-depth case studies and analyses of current situations in transport markets in different modes and countries with a large number of modelling case studies covering many different situations. The project covered intramodal, inter-modal and inter-sectoral aspects. It focuses on a 'phased approach' to implementation of pricing measures.

Regarding rail transport the following types of externalities have been identified: wear and tear costs, congestion and delays, scarcity, accidents, noise and air pollution. In terms of air transport, externalities include runway capacity (maximum number of take offs and landings per hour that can be performed safely); terminal capacity (number of passengers that can move about the terminal at an acceptable pace in a given time unit); apron capacity (maximum number of aircraft per area that can be served per time unit), air traffic control (ATC) capacity (maximum number of aircraft approaching or departing the airport in a given time frame); gates (number of gates available in a time frame), traffic pattern (passengers' origin-destination demand matrix), which in part reflects the configuration of airlines' networks (e.g., hub-and–spoke, multi hub, alliances linked networks, linear networks), peak and off-peak daily and seasonal demand patterns. With regards to air transport, the following aspects should be taken into account: port congestion and delays, accidents (probability, frequency, severity of accidents), landside pollution (port vicinity, landside), waterside pollution (within port limits). Inland shipping is also influenced by cost categories of global emissions, local emissions and infrastructure use. 5th FP, 2002-2004, http://www.its.leeds.ac.uk/projects/mcicam/

13.12 IMPRINT EUROPE – Implementing Pricing Reform in Transport

IMPRINT-EUROPE (Implementing Pricing Reform in Transport – Effective Use of Research on Pricing) is a Fifth Framework Thematic Network project for the European Commission (2001-

2004). This project aimed to bring together policy-makers, operators, researchers and other stakeholders in order to promote the implementation of fair and efficient transport prices. Moreover it was addressed to organise five high profile, international seminars where the needs of policy-makers and the findings of research will be synthesised and debated, to produce high quality reports summarising research and putting forward recommendations on how to implement the required pricing reforms.
In the frame of IMPRINT EUROPE project all together 5 types of infrastructure related cost externalities were considered: use-related wear and tear costs; congestion costs; scarcity costs; external accident costs and environmental costs.

Table 13-11: Summary details of IMPRINT EUROPE project

There is an established approach to measuring congestion costs, though it is not clear whether the highly variable results are related to different modelling techniques or to actual differences in circumstances. That is, the approach involves being able to model traveller behaviour so as to capture the range of responses made in the face of congested conditions, and there is a concern that variability in the results relating to different places might be linked to the type of model used – its degree of aggregation, its definition of the network etc – rather than linked to actual differences between congestion in those different places. Another source of variability may arise out of simple differences in the ways in which the city centre is defined from one place to another or from one study to another. There are also concerns about data availability and the lack of studies on modes other than road. Identifying the external component of accident cost remains uncertain because of the limited amount of evidence on risk elasticities. Traditionally has been thought that extra traffic will make it less safe for those already on the roads, but it is not clear that this is always the case. There has been evidence that in some cases extra traffic which adds to congestion actually makes roads safer, so there is still work to do. Great progress has been made on measurement and valuation of environmental cost, in particular noise and air pollution, though uncertainties and disagreements remain, particularly regarding the valuation of global warming. A common methodological framework – the impact pathway – has been applied in almost ten different countries to derive estimates for all modes of transport. There are a large number of input functions used in the approach and concerns have been expressed about the transferability of some of these functions from one set of conditions to another. Hence, further development of local knowledge, in particular relating to how functions apply in different conditions, is necessary.

Source: 5th FP, 2002-2004, http://www.imprint-eu.org/

13.13 FISCUS – Cost Evaluation and Financing Schemes for Urban Transport Systems

The Project FISCUS (4th FP, 1998-2002) has analysed existing cost allocation methodologies and financing schemes, and conceived new ones in response to identified gaps and weaknesses. It addressed in detail: the evaluation of real transport costs (internal and external) for the various urban transport modes (bus, tram, rail, private transport, water transport, underground, walking and cycling) with the objective of enabling cost comparisons between public transport

and private car over the same journey. The financing of urban mobility here understood as corresponding to who pays, directly or indirectly the provision of transport infrastructure and services, but also to who bears its (positive or negative) consequences without being directly involved.

Table 13-12: Overview on most relevant cost items

Cost Category	Main Determinants	Most Relevant Final Payers	Degree of Externality
Costs due to infrastructure supply	Size, technology and age of transport networks, share of heavy traffic, maintenance policy.	Different state levels and private investors	Partly covered by user charges and partly earmarked vehicle-related taxes.
Costs related to vehicle operation	Density of P.T. provision Composition of vehicle fleet and traffic management sophistication, maintenance policy.	User in individual public transport frequently with strong contribution from taxpayer in public transport.	Totally internal in individual transport, partly covered by fares in public transport. (in some countries commuting costs can be deducted in income taxation in which case it can not be considered as fully paid for)
Costs of traffic congestion	Infrastructure capacity, traffic demand structure, traffic management.	Transport users occupying the same infrastructure.	Internal to the transport sector. Covered by user charges or via other users' time losses.
Costs of traffic accidents	Driver's behaviour, safety measures, traffic control.	Municipality, health system, economy and victims.	Partly covered by liability insurance payments.
Costs due to emissions into the air	Vehicle technology, energy mix, share of heavy traffic.	Health system, land owners and affected inhabitants.	Possibly covered by emission-related fuel or vehicle taxes
Costs due to traffic noise	Traffic volume and mix, settlement structure and land use.	Land owners and directly affected inhabitants.	Usually totally external.
Other transport-related effects	Traffic network, environmental structure, energy mix, etc.	General society, depending on effect	Usually totally external.

Source: FISCUS – Final Report, pp.4.

Table 13-13: Summary details of FISCUS project

FISCUS has opted for a review and estimation of all costs of urban mobility in the sense of total resource costs, that is, anything that consumes any resources of real or potential value, but disregarding issues that merely constitute transfers of money or of any type of rights. By adopting this position, the issue of internal versus external costs loses relevance for the total bill, although it is of course not forgotten, in particular when, on the other side of the coin (i.e. financing) the issue of "who pays or suffers what" is addressed.

Source:

13.14 AFFORD - Acceptability of fiscal and financial measures and Organisational Requirements for Demand Management

AFFORD has focused on marginal cost pricing of the use of transport infrastructure. The project has classified cost categories into internal and external ones. External costs related to the usage of transport infrastructure use can be subclassified into intra-sectoral externalities and inter-sectoral externalities. The former are contained wholly within the transport market; the latter cover the effects on the "third parties" (cf. above) and may be seen as an "unpaid bill" which transport poses upon society at large. The former may be further subdivided to distinguish

between intra-modal externalities, describing costs which users of a single mode impose upon each other, and inter-modal externalities, which users of one transport mode impose on users of another. Intra-sectoral external costs are external to users of the infrastructure but internal to the infrastructure operator. Within these categories, a further distinction could be made to address the time dimension: some externalities are instantaneous, while others materialise in the longrun.

The major external cost categories in the context of urban transport according to the concept of AFFORD are the following:

–congestion costs;
–infrastructure damage;
–external accident costs,
–noise;
–visual intrusion and barrier effects;
–local emissions; and
–global emissions.

The first two items are intra-sectoral externalities, the last two are inter-sectoral externalities. The fourth item (noise) contains both elements. Notice that infrastructure damage can (in principle) be well defined for property rights, and is not an externality in the same strict sense as the other items. However, the implications for marginal cost pricing as addressed in the AFFORD study are the same. AFFORD has focused on marginal cost pricing as applied by the government/regulator, with the aim to correct distortions due to discrepancies in marginal private and social costs. This is called marginal social cost pricing or marginal externality cost pricing (in distinction from marginal cost pricing as applied by competitive firms in the market).

AFFORD has assumed the external costs of transport also depend on behavioural aspects to a great extent. Regarding car use the following behavioural aspects influence the mechanisms behind the generation of such costs: the vehicle (technology) used; the actual state of this vehicle; the kilometrage; the time of driving; the place of driving; the actual route chosen; and the driving style.

Table 13-14: Dependence of various external costs of road transport on behavioural

	Car use					Car ownership		Spatial behaviour**
	Vehicle kilometres	Number of trips	Time of driving (peak or off-peak)	Place of driving (area or route)	Driving style	Fleet size*	Vehicle technology	
Intra-sectoral externalities:								
– Flow congestion	*	-	**	**	**	*	-	**
– Bottleneck congestion	-	**	**	**	-	*	-	**
– Infrastructure damage	**	-	-	-	-	*	*	**
– Accidents	*	-	*	*	**	*	*	*
Inter-sectoral externalities:								
– Noise	*	-	*	**	**	*	**	**
– Local emissions	**	*	*	**	**	*	**	**
– Global emissions	**	*	-	-	**	*	**	**

** particularly strong and direct relation
* possibly strong indirect relation, or moderately strong direct relation
– no particular strong or direct relation
* Also allows for car size.
** Location of residence vs. work and leisure activities.

Source: AFFORD Final Report, pp. 26.

In sum, AFFORD has elaborated a great number of policy recommendation on external cost calculations.
(4th FP, 1998-2002, available at: http://www.transport-research.info/Upload/Documents/200310/afford.pdf)

13.15 DIFFERENT – User reaction and efficient differentiation of charges and tolls

In the European Union, levels and structures of transport infrastructure charges vary strongly across transport modes and countries. Some degree of convergence exists on the intention to apply the principle of marginal cost pricing in various transport sectors, but, in the presence of unsolved difficulties in funding transport investment and even serious concerns about marginal social cost pricing in several countries, any such convergence is slow. Furthermore, at present, the charging regimes that can be observed are often far from internalising external costs and are rarely based on efficiency principles. In this situation, differentiation of existing charges appears to be a sensible intermediate step.
The potential scope of price differentiation is broad and includes dimensions such as:

–time, for example in the case of congestion or noise nuisance;
–place, for example depending on congestion level or region;
–type of infrastructure, to represent differences in quality supplied;
–type of user and/or type of goods, to capture willingness to pay of clients;
–type of vehicle and axle loads to take for instance maintenance costs into account.

(6th FP, 2004-2006, available at: http://www.different-project.eu/)

13.16 ENACT – Design Appropriate Contractual Relationships

The increasing involvement of the private sector – mostly in Public-Private Partnerships (PPP) – in the provision of assets and/or services previously provided directly by the states raises significant questions about the application of socially optimal pricing schemes such as Social Marginal Cost (SMC) pricing. Private engagement entails allowing adequate rates of return in a purely financial perspective, which is too often incompatible with SMC pricing principles. The aim of the ENACT project was two-fold: (i) to assess the extent to which the introduction of SMC pricing obligations may hinder or not the further development of PPP schemes in the transport sector and, (ii) to devise ways to incorporate such obligations in PPP schemes while, at the same time, taking advantage of the positive aspects that such partnerships can have.

In a first step, the ENACT (6th FP, 2007-2009) project has leveraged on existing research on the issues of SMC pricing and Second-Best alternatives (optimal mark-ups for cost recovery). The second step have consisted of analysing the PPP phenomenon under the light of Incentive and Contract Theory, and the impacts that SMC pricing might have in terms of the informational and incentive structures of PPP contracts. The third step was to focus on financial markets, and on the impacts that SMC calculation and pricing have on the perception of risk and the demanded rates of return. From this theoretical framework, case studies and simulations have been performed. The results of the project have served as the basis of a set of Guidelines to establish a Common European Policy/Regulatory Framework for socially optimal SMC pricing obligations in Public-Private Partnerships in the provision of transport infrastructure and/or services.

13.17 COMPETE – Analysis of the Contribution of Transport Policies to the Competitiveness of the EU Economy and Comparison with the United States

The COMPETE (Analysis of the Contribution of Transport Policies to the Competitiveness of the EU Economy and Comparison with the United States) project has been funded by the European Commission's DG TREN aimed to examine how transport contributes to the competitiveness of the EU and, additionally, how effective it is compared with the US. Though COMPETE broadened the scope of analysis by including congestion impacts, by analysing structural change and by analysing appliedeconomic models, the finally proved, quantified causal chain on how transport actually improves competitiveness of nations could not be provided.

Project findings have revealed that policy objectives, transport pricing and taxation shows similarities but differences as well comparing the EU and U.S. Regarding policy objectives, the EU is primarily focusing on four main objectives: shifting the balance between modes of transport, eliminating bottlenecks, placing users at the heart of transport policy and managing the globalisation of transport defined in the White Paper on Transport (2001). On the contrary, U.S. priorities are addressed to safety, mobility, global connectivity, environmental stewardship and security. In both cases, transport is to generate innovations and vice versa there is the need to bring innovations into the transport system, in particular new propulsion concepts and alternative fuels. In terms of introduction of transport pricing policies the US is converging towards the EU, as the latter is promoting transport pricing since about a decade, while in the US only in recent policy programs transport pricing is considered as an option to be tested in pilot applications. Another significant difference between the two policy approaches concerns fuel taxation. In the EU countries, fuel taxation is about five to fifteen times higher than in the US. The usage of fuel tax revenues in the US is strictly dedicated for infrastructure provision, in particular highways, while in some EU countries at least a share of fuel tax revenues goes into the general government budget.

The project has classified the most influential factors affecting transport operation costs grouped into 5 categories, such as general transport development/ Transport demand; liberalisation in the transport sector and productivity potentials; capital financing conditions (liberalisation, rolling stock market, interest rates); energy prices and efficiency, transport taxation and charges.

Table 13-15: Cost elements of transport operation cost

Element	Development Past and Future	Relevance for different modes	Effect on operating cost
General transport development/ Transport demand	Increase in the past and in the future	Road and air transport and container shipping are most dynamic (EU and US)	Increase in total cost closely related to GDP growth; probably no change of average costs per pkm/tkm unless the increased transport demand leads to scarce infrastructure which means higher op. costs
Liberalisation in the transport sector and productivity potentials	Different speeds in different sectors will carry on	Most dynamic development in the road freight and air transport sector (US has been more dynamic in the past, EU is more dynamic since EU enlargement)	Pressure on operating cost (esp. running cost, personnel cost)
Capital financing conditions (liberalisation, rolling stock market, interest rates)	Improved efficiency in the rolling stock market, improved conditions	Rolling stock markets and financing instruments have become global. More capital intensive sectors (rail, air) are profiting (EU and US)	Capital cost will probably increase because interest rates are generally getting higher in the future and future technological progress (increasing quality of rolling stock) tends to result in higher investment costs
Energy prices and efficiency	Fossil fuels: increase in the late past and in the future. Different trends for electricity price: decrease due to liberalisation processes vs. increase due to higher prices of fossil fuels for electricity generation.	Road and esp. air transport will face increased prices, with bigger substitution potential for road. Rail transport might profit from lower or at least stable energy prices.	Energy cost will increase for air transport and probably road transport. Energy cost for rail transport might remain stable or at least increase slower.
Transport taxation and charges	Depending on transport policy (internalisation of external cost, climate policy)	More dynamics in Europe than in US, esp. for road transport. Rail: Infrastructure charges might develop along competitiveness in relation to road	The volume of taxes and charges might increase slightly, esp. for road and air transport.

Source: COMPETE elaboration

Regarding the future development of average transport operation costs, the project is describing how unit costs per ton-km and passenger-km are expected to further move per transport modes.

Table 13-16: Future expected transport operation costs

Cost factor	Transport mode				
	Road passenger	Road freight	Rail	Air	Water
Personnel costs	↘ Private transport: no personnel cost. Public transport: Ongoing liberalisation process in public transport leads to decreasing costs.	→ Cost pressure from Eastern Europe. However, liberalisation process in the road freight sector is already very advanced. Therefore, little scope for decreasing costs.	↘ Ongoing liberalisation process in the rail sector leads to cost pressure.	→ Further cost pressure from low cost carriers and due to liberalisation process in the air transport sector. However a consolidation process has to be expected.	→ Wages are already low due to global competition. Further liberalisation process (above all for ports) will hardly change the situation.
	Personnel costs will rise generally in the long term, if workforce is getting scarcer in the EU (due to demographic development). In the short term, however, there can be an ongoing pressure on wages because the level of unemployment is still high.				
Capital costs	↗ Interest rates are generally getting higher in the future compared to the low level nowadays. Future technological progress tends to result in higher investment costs. Liberalisation process in rolling stock sector has already taken place and led to productivity gains (e.g. rail sector).				
Fuel costs	↗ Continuous increase in fuel prices (petrol, diesel)	↗ Continuous increase in fuel prices (petrol, diesel)	→ Electricity costs will remain more or less stable (liberalisation in electricity sector vs. increasing fossil fuel price).	↗ Continuous increase in fuel prices (kerosene)	↗ Continuous increase in fuel prices (diesel, oil)
Infrastructure costs (charges, taxes)	↗ Infrastructure is getting scarcer. KM-charges and road pricing will be important.	↗ Infrastructure is getting scarcer and external costs are being internalised.	→ Falling costs due to productivity gains of the rail (infrastructure) sector. Opposite effect because of growing infrastructure scarcity.	↗ Infrastructure is getting scarcer, especially in big hubs. Environmental charges are on the political agenda (integration ETS)	↗ Port infrastructure (terminals) are getting scarcer

Source: COMPETE Final Report – Summary, Executive pp. 42.

Table 13-17: Summary details of COMPETE project

COMPETE has brought together key research institutes from Europe to provide qualitative and quantitative comparison of the EU and U.S. transport sector. COMPETE has succeeded in elaborating and quantifying a large number of data for the EU and the US like transport operating cost data, congestion data, trade data, data on the economic and spatial structure and finally the productivity of the transport sector. Results in almost all cases haveshown that in the EU operation costs exceed those of the U.S. as main bottleneck of the recent EU structure.

Source: 6th FP, 2006, available at: http://www.isi.fhg.de/projects/compete_

13.18 NEW EXT: New Elements for the Assessment of External Costs .

Within the ExternE projects (New Elements for the Assessment of External Costs from Energy Technologies) funded under the JOULE Programme, a detailed bottom-up 'impact pathway' (or damage function) approach was developed to quantify external costs from energy conversion resulting from impacts on human health, crop losses, material damage, and global warming. The ExternE external costs accounting framework is widely accepted and has been successfully used to support decision making in the field of energy and environmental policy. However, there are also areas for which a need for further research was identified in previous ExternE phases. Major uncertainties in the current external cost data result from uncertainties in the monetary valuation of mortality effects, and from the omission of impacts on ecosystems due to acidification, eutrofication and global warming. The existing accounting framework was also criticised for not taking into account the contamination of water and soil. Due to accumulation processes of persistent substances there is a significant potential for long term effects that were not addressed in previous work. Another source for criticism is the unbalanced treatment of severe accidents, as the current framework is very much focused on accidents in the nuclear fuel chain, while neglecting severe accidents from other energy sources.

Therefore, NEW EXT project has offered an improvement of the existing framework in key areas which are considered as most relevant for the assessment of external costs, and which were expected to be primarily affected by new scientific findings. The main objective of the project was to improve the assessment of externalities by providing new methodological elements for integration into the existing EU external costs accounting framework that reflect the most important new developments in the assessment of external costs.

For instance, the past ExternE project was not yet able to provide external cost estimates for ecosystem damage resulting e.g. from acidification, and global warming damage costs are considered as very uncertain. Thus, the external costs accounting framework did not properly

address those environmental themes that are the main driving force for current environmental policy.

The research topic entitled to damage costs and external costs on accidents is applied to measure transport

Table 13.18: Summary of full chain damage costs and external costs (€-Cents(2002)/kWh) of severe accidents with at least 200 evacuees

		Damage costs in €-Cents(2002)/kWh			External costs in €-Cents(2002)/kWh		
		Occupational	*Public*	*Total*	*Occupational*	*Public*	*Total*
Coal	*OECD*	1.70E-3	1.21E-5	1.71E-3	3.40E-4	6.06E-6	3.46E-4
	non-OECD w/o China	6.48E-3	4.32E-5	6.53E-3	3.24E-3	3.46E-5	3.28E-3
	China (1994-1999)	1.22E-2	NA	1.22E-2	6.10E-3	NA	6.10E-3
Oil	*OECD*	9.94E-4	9.02E-4	1.90E-3	1.99E-4	4.51E-4	6.50E-4
	non-OECD	1.82E-3	1.08E-2	1.26E-2	9.11E-4	8.66E-3	9.57E-3
Natural gas	*OECD*	2.24E-4	4.35E-4	6.59E-4	4.47E-5	2.18E-4	2.62E-4
	non-OECD	3.27E-4	5.89E-4	9.15E-4	1.63E-4	4.71E-4	6.34E-4
Hydro	*OECD*	NA	4.06E-5	4.06E-5	NA	2.03E-5	2.03E-5
	non-OECD	NA	1.23E-1	1.23E-1	NA	9.82E-2	9.82E-2
	non-OECD w/o Banqiao/Shimantan	NA	1.61E-2	1.61E-2	NA	1.29E-2	1.29E-2
Nuclear	*OECD*	NA	NA	NA	NA	NA	NA
	non-OECD	5.74E-4	NA	5.74E-4	2.87E-4	NA	2.87E-4

Source: NEW EXT Final Report, pp. 241.
5th FP, 1998-2002, available at: http://www.ier.uni-stuttgart.de/forschung/projektwebsites/newext/index.html

13.19 IMPACT Deliverable 1– complementary information

This point contains additional information to IMPACT project description in Task 6.1.This could be added to the part on IMPACT project description on demand.

The Handbook covers all environmental, accident and congestion costs and considers all transport modes. The focus is on marginal external costs of transport activity as a basis for the definition of internalisation policies such as efficient pricing schemes. The handbook does not include information on the existing taxes and charges and does not include information on Infrastructure costs. The handbook makes a clear distinction between social costs referring to the provision and use of transport infrastructure (including wear and tear costs of Infrastructure, capital costs, congestion costs, accident costs, environmental costs) and private (or internal costs) directly borne by the transport user, such as wear and tear and energy cost of vehicle use, own time costs, transport fares and transport taxes and charges. The recent

interpretation of external costs means roughly 'the difference between social costs and private costs'.
It groups main external costs into the following categories:

Table 13-19: Main external cost categories

Cost component	**Private and social costs**	**External part in general**	**Differences between transport modes**
Costs of scarce Infrastructure (Congestion and scarcity costs)	All costs for traffic users and society (time, reliability, operation, missed economic activities) caused by high traffic densities.	Extra costs imposed on all other users and society exceeding own additional costs.	Within non-scheduled transport (road), the external part is the difference between marginal cost and average cost based on a congestion cost function. Within scheduled transport (rail, air), the external part is the difference of the willingness to pay for scarce slots and the existing slot charge.
Accident costs	All direct and indirect costs of an accident (material costs, medical costs, production losses, suffer and grief caused by fatalities).	Part of social costs which is not considered in own and collective risk anticipation and not covered by (third party) insurance.	There is a debate on the level of collective risk anticipation in individual transport: Are the cost of a self accident a matter of (proper) individual risk anticipation or a collective matter? Besides there are different levels of liability between private insurances (private road transport) and insurances for transport operators (rail, air, waterborne).
Environmental costs	All damages of environmental nuisances (health costs, material damages, Biosphere	Part of social costs which is not considered (paid for).	Depending on legislation, the level of environmental taxation or liability to realise avoidance measures is

	damages, long term risks).		differing between modes.

Source: IMPACT Handbook, (2008) pp.18.

Collected best practice methodologies include: valuation approach and top-down & bottom-up estimations. Valuation methods entail two sub-methods on estimating damage costs. It assesses individual preferences in two ways:

– The willingness to pay (WTP) for an improvement.
– The willingness to accept (WTA) a compensation for non improvement.

In order to get the real costs, taxes and subsidies have to be extracted using factor costs. If resource costs are not available, hypothetical market situations have to be constructed. Several methods can be used, all of them have strengths and weaknesses: The stated preference (SP) method using a contingent valuation approach is directly measuring the WTP, but depends very much on the survey design and the level of information, and suffers from the fact that it involves hypothetical expenditures only. Also indirect methods like revealed preferences (RP; e.g. hedonic pricing where house price differentials can be used to estimate costs of noise) are therefore viable.

For several environmental costs (e.g. relevant for long term risks and habitat losses), more differentiated approaches are necessary, since the stated preference approach is only useful for the valuation of individual key values such as the value of a human life. In order to estimate the costs for a long term environmental problem (e.g. global warming), it is necessary to consider different risk scenarios: These contain direct and indirect costs to decrease and repair environmental damage and further costs of damages which cannot be repaired. A major recommended approach is the impact pathway approach (as used by the ExternE model specifically developed for air pollution) which follows the dose-response function considering several impact patterns on human health and nature.

Table 13-20: Cost components of best cases

Cost component	**Best practice approach**
Costs of scarce Infrastructure	WTP for the estimation of the value of time (based on stated preference approaches). Alternatively: WTA. WTP for scarce slots (based on SP with real or artificial approaches). Alternatively: WTA.
Accident costs	Resource costs for health improvement. WTP for the estimation of Value of Statistical Life based on SP for the reduction of traffic risks. Alternatively: WTA.

Cost component	Best practice approach
Air pollution costs and human health	Impact pathway approach using resource cost and WTP for human life (Life years lost) base. Alternatively: WTA.
Air pollution and building/material damages	Impact pathway approach using repair costs.
Air pollution and nature	Impact pathway approach using losses (e.g. crop losses at factor costs).
Noise	WTP approach based on hedonic pricing (loss of rents – this reflects WTA) or SP for noise reduction. Impact pathway approach for human health using WTP for human life.
Climate change	Avoidance cost approach based on reduction scenarios of GHG emissions; damage cost approach; shadow prices of an emission trading system.
Nature and Landscape	Compensation cost approach (based on virtual repair costs).

WTP = Willingness to pay. SP = Stated preference approach. WTA = willingness to accept.
Source: IMPACT Handbook, 2008.

On the contrary, top-down and bottom-up approaches are focusing on the estimation of marginal costs. Due to the relatively costly and difficult manner of calculations, in practice a bottom-up approach following the impact pathway methodology is applied. The following table compares the similarities and differences of the top-down and bottom-up approaches:

Table 13-21: Relation between marginal and average costs and links to internalisation

Cost component	Difference between marginal and average costs	Practical implementation and proposed differentiation
Costs of scarce Infrastructure	In congested areas, marginal costs are above average costs: Difference is relevant to define external costs.	Estimation of marginal cost based on standardised curves for specific traffic clusters (urban-interurban, peak-offpeak). Top-down approaches are hardly feasible.
Accident costs	Marginal costs differ individually (for non-scheduled traffic). Clustering of Infrastructure users according to accident risk is possible (and	Differentiation (cluster of users) according to schemes applied by insurance companies.

Cost component	Difference between marginal and average costs	Practical implementation and proposed differentiation
	typically applied by insurance companies). Thus, average and marginal costs can be assumed to be similar in each cluster.	
Air pollution costs and human health and building/material damages	Linear dose response function: Marginal costs similar to average costs.	Marginal (averaged) costs per type of vehicle (EURO-class) and traffic and population clusters (urban, interurban).
Air pollution and nature	Linear dose response function: Marginal costs similar to average costs.	Marginal (averaged) costs per type of vehicle (EURO-class) and traffic clusters (urban, interurban).
Noise	Decreasing impact of an additional vehicle with increasing background noise due to logarithmic scale. Marginal costs below average costs.	Marginal (averaged) costs per traffic and population clusters (urban, interurban).
Climate change	Complex cost function. As a simplification: Marginal damage costs similar to average costs (if no major risks included). For avoidance costs, marginal costs are higher than average costs.	Marginal (averaged) costs per type of vehicle and/or fuel.
Nature and landscape	Marginal costs are significantly lower than average costs.	Averaged (or marginal) variable costs per type of Infrastructure.

Source: IMPACT Handbook, 2008

Empirical studies have shown that the road transport is responsible by far for the largest share of external costs among all. The following table indicates the similarities and differences between modes:

Table 13-22: Most important specification of different costs according to transport modes

Cost component	Road	Rail	Air	Water
Costs of scarce Infrastructure	Individual transport is causing collective congestion, concentrated on bottlenecks and peak times.	Scheduled transport is causing scarcities (slot allocation) and delays (operative deficits).	Please see rail	If there is no slot allocation in ports/channels, congestion is individual.

Cost component	Road	Rail	Air	Water
Accident costs	Level of externality depends on the treatment of individual self accidents (individual or collective risk) insurance covers compensation of victims (excluding value of life).	Difference between driver (operator) and victims. Insurance is covering parts of compensation of victims (excluding value of life).	Please see rail	No major issue.
Air pollution costs	Roads and living areas are close together.	The use of diesel and electricity should be distinguished.	Air pollutants in higher areas have to be considered.	Air pollutants in harbour areas are complicated to allocate.
Noise	Roads and living areas are close together.	Rail noise is usually considered as less annoying than other modes (rail bonus). But this depends on the time of day and the frequency of trains.	Airport noise is more complex than other modes (depending on movements and noise max. level and time of day).	No major issue.
Climate change	All GHG relevant.	All GHG relevant, considering use of diesel and electricity production.	All GHG relevant (Air pollutants in higher areas to be considered).	All GHG relevant.
Nature and landscape	Differentiation between historic network and motorways	Differentiation between historic network and extension of high	No major issue.	New inland waterways channel relevant.

Cost component	Road	Rail	Air	Water
	extension.	speed network.		

Source: IMPACT Handbook, 2008

Of course, it may be a theoretically elaborated methodology or driven by transport-related aspects so the main uncertainties per transport mode can be identified and must be treated accordingly:

Table 13-23: Main external cost calculation uncertanties per transport mode

Cost component	Cost elements	Critical valuation issue	Cost function	Data needs	Main cost drivers
Congestion costs (road)	Time and operating costs Add. safety and environmental costs	Speed-flow relations Valuation of economically relevant value of time (reliability)	Increasing marginal cost in relation to traffic amount, depending on time of the day/week/year and region	Speed-flow data Level of traffic and capacity per road segment	Type of Infrastructure Traffic and capacity levels, mainly depending on: – Time of the day – Location – Accidents and constructions
Scarcity costs (scheduled transport)	Delay costs Opportunity costs Loss of time for other traffic users	Valuation approach as such (measurement of opportunity costs, WTP enlargement costs, optimisation model)	Increasing marginal cost in relation to traffic amount, depending on time of the day/week/year and region	Level of traffic, slot capacity per Infrastructure segment	Type of Infrastructure Traffic and capacity levels, mainly depending on: – Time of the day – Location
Accident costs	Medical costs Production losses Loss of human life	Valuation of human life Externality of self accidents in individual transport	Only limited correlation between traffic amount and accidents; other factors (such as	Accident database Definition of fatalities and heavy/slight injuries very important	Type of Infrastructure Traffic volume Vehicle speed Driver characteristics (e.g.

Cost component	Cost elements	Critical valuation issue	Cost function	Data needs	Main cost drivers
		Allocation of accidents (causer/victim related)	individual risk factors and type of Infrastructure)		age, medical conditions, etc.) Others
Air pollution	Health costs Years of human life lost Crop losses Building damages Costs for nature and biosphere	Valuation of life years lost Market prices for crops Valuation of building damages Valuation of long term risks in biosphere	Correlation with traffic amount, level of emission and location	Emission and exposure data (exp. PM, NOx, SO2, VOC)	Population and settlement density Sensitivity of area Level of emissions, dep.on: – Type and condition of vehicle – Trip length (cold start emissions) – Type of Infrastructure – Location – Speed characteristics
Noise costs	Rent losses Annoyance costs Health costs	Valuation of annoyances	Declining marginal cost curve in relation to traffic amount	Noise exposure data (persons)	Population and settlement density Day/Night Noise emissions level, depending on: – Type of Infrastructure – Type and condition of vehicle

Cost component	Cost elements	Critical valuation issue	Cost function	Data needs	Main cost drivers
Climate change	Prevention costs to reduce risk of climate change Damage costs of increasing temperature	Long term risks of climate change Level of damage in high altitudes (aviation)	Proportional to traffic amount and fuel used (marginal cost close to average cost)	Emission levels	Level of emissions, depending on: – Type of vehicle and add. equipment (e.g. air conditioning) – Speed characteristics – Driving style – Fuel use and fuel type
Costs for nature and landscape	Costs to reduce separation effects Compensation costs to ensure biodiversity	Valuation approach as such (replacement versus WTP approach)	Most of the cost are Infrastructure related, and do not vary very much with traffic volumes	GIS information on Infrastructure	Type of Infrastructure Sensitivity of area
Additional environmental cost (water, soil)	Costs to ensure soil and water quality	Valuation approach as such (avoidance versus damage cost approach)	Complex: Increasing marginal cost curve in relation to traffic amount	GIS information Infrastructure, emission levels	Level of emissions Type of Infrastructure
Additional costs in urban areas	Separation costs for pedestrians Costs of scarcity for non motorised traffic	Valuation approach as such (Avoidance versus WTP approach)	Increasing marginal cost curve in relation to traffic density	Infrastructure data in urban areas (network data, data on slow traffic)	Type of Infrastructure Level of traffic
Up- and downstream	Costs of the whole	Valuation of long term	Rather proportional	Data on energy	Level of indirect

Cost component	Cost elements	Critical valuation issue	Cost function	Data needs	Main cost drivers
processes	energy cycle (environmental and risk effects of energy supply)	energy risks, such as climate change and nuclear risk	correlation with traffic amount and (marginal cost close to average costs)	processes and electricity mix	energy need Electricity mix (level of non renewables)

Source: IMPACT Handbook, 2008

Project commissioned by EU DG TREN: its results have been used as the basis for the 2008 Commission proposal for amending the Eurovignette Directive. European Commission DG TREN, from app. 2006 to February 2008

13.20 ECOTALE: External Costs Of Transport And Land Equalization

ECOTALE has started in January 2012 and will end in the mid of 2014. The Project is carried out by 9 partners from 7 countries. It is co-financed by the European Regional Development Fund (ERDF) and was made possible by the INTERREG IVC programme.

ECOTALE project aims at integrating the traditional approach based on the "economic" internalization of external costs (i.e. pricing measures) with a wider internalization approach considering land use and environmental planning as well. ECOTALE promotes the exchange, sharing and transfer of policy experience, knowledge and good practices in the field of the internalization of external cost of transport, planning and investment decisions.

The reduction and/or internalization of the environmental, spatial and social costs caused by the transport sector are policy objectives which have been commonly assumed over the last decades. Within a market approach and according to the "polluter pays" principle, internalization is a way towards a comprehensive payment actually born by the transport users. In the "classic" vision, this is obtained by means of some additional pricing (tolls, vignette, park pricing, vehicle/fuel taxation) imposed to citizens/enterprises generating road traffic. However, incompleteness of the application of direct pricing and a missing or only partial link with modal policies, spatial planning and infrastructural decisions limit the internalization policies in terms of their ability to reach improvements of the sustainability of the transport systems over the time. Therefore ECOTALE project collects EU policies and strategies and provides overview on past projects supported to internalize external costs of transport.

INTERREG IV C Programme, 2012-2014, available at: www.ecotale.eu

13.21 TRANSITECTS: Transalpine Transport

TRANSITECTS : (Transalpine Transport Architects - Improving intermodal solutions. for transalpine freight traffic, Alpine Space Programme – European Territorial Cooperation Development Found, July 2009 – September 2012, available at: http://www.transitects.org/project have been supported by the Alpine Space Programme - European Territorial Cooperation 2007-2013 (INTERREG IV B) and funded by the European Regional Development Fund (ERDF) and national co-financing.

The TRANSITECTS partnership has elaborated the T-ENV Model to calculate the polluting emissions for the pilot projects, comparing the trip on the road to the new rail connection. As indicators for the environmental effects CO2, NOx and PM10 have been chosen. For some pilot projects it has also been possibile to measure the average energy consumption per km per transport mode. The calculation of the itinerary and the air pollutant emissions is based on the bare connection between the involved intermodal platforms. To make the calculations more transparent it has been decided not to consider pre- and on-carriage to/from the intermodal terminals in the calculation. The T.Env modelling tool allows the evalution of the existing and foreseen road and rail traffic flows (freight and passengers), both in relation to the implementation of new pilot projects and for the considered transport system in different conditions (development scenarios).

The transport functional model is integrated into the emission model and evaluates the functional outcomes of long-haul freight transport vehicles (sharing of flows on the network, average speed, modal split, etc.) . This implementation brings into account the deployment and calibration in the context of several projects carried during the ETC Alpine Space programme, such as Alpencors, Alpfrail and AlpCheck.

The latest implementation of Transitects modelling tool, specifically concerning the road traffic, is based on the first results of the modelling tool of the ETC AlpineSpace project Alp-Check2.

This modelling system is composed of three elements:
–supply model with the relevant assets for the functioning of the transport network;
–demand model, which allows to estimate the demand of transport with the related characteristics (level and distribution per destination and mode of transport) in function of a defined asset of the territory and of the transport supply;
–interaction demand-supply model which allows simulating how the supply meets thedemand by determining a series of variables relevant for the evaluation phase (e.g. flows, travel times, costs, criticism on links).

The environmental model provides methodical alternative to measure externalities related to transport. The model has been designed to evaluate the relationship between demand and supply of freight transport, considering the effects upon the environment. Specificallly, the model allows the evaluation of the emissions both at a local (single track) and at a wider level

(the whole corridor involved from the selected Pilot Project). In order to meet the project's goals, the level of emissions have been evaluated for each single directional link relation for the emissions of the (main) vehicles responsible of atmospheric pollution (NOx, PM10, ecc) and gases (CO2), transport energy consumptions (fuel, gas oil, GPL).

The **inputs** of the emission model are:
–outcomes of the transport model, in terms of allocation of traffic flows (vehicles/h);
–composition of the vehicles flow (trucks), in Euro classes;
–length of the road and rail involved by the pilot project (km)
–average speed in the road sections involved by the pilot project
–emission factors (expressed in g/lt or g/km or g/Kwh)
–loading factors (average loading rate).

This algorithm consents the estimation of emissions from road transport, in relationship to defined units of measurement, according typologies, load and "euro classes" of vehicle, the average speed and traffic conditions. The overall emissions are calculated as follows:
Eij = Σj (FCJ x EFij)
Where:
Eij: the emissions of the pollutant elements "i" deriving from the category of vehicles "j" (g polluters)
fCj: consumptions of the vehicles per category "j" (fuels kg)
EFij: the consumption per emissions factor with respect to the typology of vehicle (g / kg of fuel)
Where I = **Co_2**, **nox**, **Pm10**.

Alpine Space Programme – European Territorial Cooperation Development Found, July 2009 – September 2012, available at: http://www.transitects.org/

13.22 Comparison of different approaches for the internalization of external costs

Next table presents the approaches for internalization in terms of revenue allocation, externalities, impact assessment, price policy, pricing and calculation scheme.

Table 13-24: Comparative table of different approaches for the internalization of external costs

Acronym	**Revenue Allocation**	**Externalities**		**Impact assessment**	**Price policy**	**Pricing and calculation scheme**
		Transport	*Energy*			
AFFORD		✓	✓			✓
ASSET		✓		✓	✓	
CAPRI	✓	✓	✓		✓	✓
COMPETE		✓		✓		✓

Acronym	Revenue	Externalities		Impact	Price	Pricing
CONNECT	✓					
DIFFERENT				✓		
ENACT					✓	
EUROTOLL				✓	✓	
FISCUS						✓
GRACE	✓	✓		✓		✓
HEATCO		✓	✓			✓
IMPACT		✓				
IMPRINT EUROPE		✓	✓		✓	✓
IMPRINT-NET		✓		✓	✓	✓
MC-ICAM					✓	✓
NEEDS			✓		✓	✓
NEW EXT						
PETS		✓			✓	✓
QUITS				✓		
RECORDIT		✓	✓			✓
REVENUE		✓	✓			✓
SUPERGREEN				✓	✓	
TRANSPRICE		✓		✓		✓
UNITE		✓	✓	✓		✓

Source: own compilation

14 Development of a common methodology for external cost calculation

14.1 Introduction

The commitment of transnational institutional stakeholders to acknowledge and implement successful measures towards the internalization of external costs imposes an extensive analysis of lessons learnt. Within the ADB Multiplatform project many different issues on the current state of the art on environmental impacts from freight transport were analyzed. Since the final allocation of the environmental impacts of the project will be put into the scope of project pilot implementations, there must be an agreed methodology on the issues concening how the allocation of the environmental impact will be collected, calculated and presented. In order to select, develop and implement a proper methodology, all the past activities should be reconsidered and put into the scope of presented ADB actions.

Within the WP6 activities an extensive analysis of transport environmental impacts, external costs of transport and possible measures of internalization has already been performed. .
In order to collect suggestions and data from past projects related to environmental issues of freight transport and external costs calculation, further issues and approaches were checked and discussed:
–EU documents and legislations concerning freight transport related to external cost calculation and different approaches for the calculation;
–relevant past EU projects in the field of freight transport related to environmental issues and projects that focused on environmental issues of freight transport in the non-EU countries of the ADB area;
–survey and further analysis of current external costs legislation within the EU and non-EU countries in the area of Adriatic-Danube-Black sea;
–references to past and recent international projects in the area of Adriatic-Danube-Black sea that are dealing with environmental impacts or external costs calculation for specific transport corridors within ADB area.

In order to prepare an overview of compliance of methodologies on environmental legislation and external cost calculation, studies have been prepared which in the grater scope are dealing with:

–compliance of ADB countries' external cost calculation methodologies with EU guidelines;
–available online manuals and external cost calculation tools that are used or at least known in the ADB area and

–analysis of additional projects relevant to external cost of transportation, which may have an added value for the adjustment of proper methodology for freight transport external cost calculation in the ADB area.

Since different aspects of the external costs calculation in the EU and ADB area countries have already been examined, , the selection of the proper methodology is an issue of major importance for the further environmental analysis and other expected project outcomes. Assessment of environmental impact of freight transport systems in ADB area is a serious matter which demands a careful, tactical and analytical approach. Activity 6.1 is complementary and supportive to Activity 6.4 which will focus on the development of a common methodology for the environmental evaluation of actions foreseen in ADB. When calculating freight transport related externalities in the ADB project area, it will be easier to define all the necessary (legislation, administration, and implementation) actions and steps to be implemented within the timeframe of the ADB Multiplatform project or even further on.

It must also be taken into consideration that besides the general framework and parameters for the development of a proper methodology, the special characteristics of ADB countries and the

project objectives should also be examined. The most appropriate basis for the calibration of the calculation model should thus include some special characteristics of the ADB countries. When selecting the proper methodology for the evaluation of current environmental situation and calculation of external cost of transport in the ADB countries, the benefits and negative elements of specific possible methodologies should be presented too.

14.2 Approach for calculating external costs of freight transport

In order to calculate external costs of freight transport in ADB area there are different approaches which can be followed for estimating the environmental impacts of the ADB actions. Considering the presented methodology in the first activities within WP6 and the availability of the data that is needed for the calculation, at least two approaches can be used. The decision on the final options concerning the methodology for calculating external cost depends on the expected results and the availability of time, data and tools. Further on, we present the main issues and methodology for the two main approaches that can be used in ADB calculation of external costs.

14.2.1 Calculation of the external costs with assessment methodology

Within the previous activities on external costs data analysis the **IMPACT study** (2008) and the study "**External costs of transport in Europe: update study for 2008**", conducted bybyCE Delft, INFRAS and Fraunhofer ISI (2011), were identified as the two main reference studies to be used in the further external costs analysis of the transport sector. Within the both studies the methodology for the calculation of the external costs is presented in detail for many cost categories and transport modes. The aim of thisfirst methodology is to follow the similar approach used in both studies and collect the proper and detailed data to conduct the analysis of the external cost of freight transport in ADB project countries. The IMPACT Handbook (2008) provides typical European and Member State input values, based on a literature assessment. These input values can be used to produce own output values, with relatively high level of accurateness.

Within the presented methodology for the calculation further **steps and approaches should be followed:**

–**Selection of an existing methodology** for each cost category as proposed by IMPACT Handbook and the Update Study External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011).

–Adjustment of the chosen methodology to **specificities of ADB area** (quality of the infrastructure and the rolling stock, capacity per network segment, modal shares, …)

–**Definition of data** by using relevant sources used also within the presented studies:

✓the available data for the countries within the EU should be available from the official EUROSTAT statistics, the EU Transport Pocket book and the TREMOVE database which gives a

complete picture for all EU countries and transport modes. For non-EU countries the data should be collected from other sources with the help of project partners from those countries.
✓For road transport performance (pkm, tkm) the basic values (total data per transport mode and country) should also be mainly taken from EUROSTAT. Only where no comprehensive data areavailable for the non-EU countries, other relevant data canbe used. It should be considered that vkm data derived from EUROSTAT database could only be used for heavy goods vehicles.
✓According to the INFRAS study (2011) the data on rail transport can be derivedfrom UIC rail statistics. Certain gaps of the UIC statistics can be compensated with EUROSTAT data and data provided by the project partners of the specific ADB partners' countries.
✓Transport data for inland waterways can be taken from the EU Statistical Pocketbook and from project partners from non-EU countries (INFRAS, 2011)
✓Since the available data from all the ADB project partners is unlikely to be available for the same reference year, for further analysis there is a need to **harmonize the data** on the same base year. . Relevant existing data for different years can be adjustedby using GDP per capita values provided by EUROSTAT or by any other appropriate methodology. In the case that some data sets are not available for some of the partner countries, values can be estimated by using existing values from countries with similar characteristics.
✓After the collection of the required transport and other type of data, the work concerning the methodology will be further located.
✓Application of methodology for the exact computation of external cost per category, transport mode and country will follow.. In order to compute the overall data on emission production and savings, the use of an "on-line tool" for calculation of emission data (tones of pollutants) can be used.
✓On the premises of the methodology of the exact **calculation** within the IMPACT and INFRAS study the calculation of external cost (total, average and marginal values) can then be implemented. Depending on the reliable data sources and collected input data, external costs of freight transport can be calculated based on selected cost elements and valuation approaches presented within the INFRAS and IMPACT studies.

It should be taken into account that the above mentioned methodology for calculation of the external costs in the ADB project activity area would take huge amount of time and demand a proper data management system and calculation techniques**. Although the approach is effective with high level of accurateness, however it is a demanding process and a lot of time and data is needed for the calculations and it is overall not likely to be achieved within the project timeframe.** Tables in Annexe 8.1 present the data requirements and the data sources for external cost calculation per cost category for all the mentioned methods.

14.2.2 Calculation of external costs with emission data and average or marginal external costs (expressed in €/vkm or €/pkm or tkm or €/ton of pollutant)

The second proposed approach concerns the calculation of emission data and **use of output values provided by IMPACT and INFRAS studies**. The data on average or marginal external

costs (expressed in € vkm or €/pkm or tkm or €/ ton of pollutant) for the EU countries that are presented within the studies can be important input data for further external costs calculation. Within the presented methodology the ADB project countries would have to **provide infrastructure and transport flows** related data on all freight transport modes within their countries. By using data on the transport flows and data on average or marginal external costs from the same year, the estimation of the total external costs is feasible.

The methodology for the calculation of the external costs with emissions data and average or marginal external costs per vehicle kilometers or tone kilometers performed in specific country includes further mentioned **approaches and procedures**:

–For the calculation of the emission data (tones of pollutants) there is a need to use an **existing and reliable "on-line tool"** (e.g. ECOTRANSIT). Provided that data on average or marginal cost of emitted CO_2 equivalent for the low and high scenario are available (€/ ton of pollutant), total external cost of freight emissions can be calculated for the ADB area.
–In order to calculate total external costs per country in the ADB area or total external costs for implemented pilot routes of the ADB Multiplatform project, the **output values for average or marginal costs from tables of IMPACT (expressed in €/vkm or €/pkm or tkm or €/tonne of pollutant) can be used**. Considering the received data on transport flows and specific average or marginal values produced within the examined country or corridor, the total values of external costs can be analyzed. It must be taken into notice that the values depend on specific parameters (according to the following tables of Annex 8.2), so certain assumptions should be made according to the parameters like: selection of transport mode, selection of specific route and selection of specific freight vehicle.

–**Transport flows** and values of average or marginal external cost should be updated,(since the data used in the INFRAS and IMPACT study represents the year 2008 or previous years).
–Estimation of external cost per selected cost category based on emission data and output values..
–**Calculation of total external cost** (for the specific case based on the assumptions) for the specific country and for the reference year.

In comparison to the first presented methodology (Calculation of the external costs with assessment methodology) the option of using the transport flows data and average or marginal costs, **is more suitable for the targets and the timeframe of the ADB Multiplatform project Although the data is less accurate in terms of specific country parameters, the overall received results suffice for the purpose of the external costs study and allow the assessment of the impact of the implemented pilots.**
Since internationally recognized studies like IMPACT and INFRAS studies are good references and offer in most cases reliable data on average external costs of transport, we believe that the approach is appropriate for further determination of the methodology. By making certain assumptions external cost calculation is feasible by using recommended values from IMPACT

and INFRAS handbooks. As already mentioned, the emissions can be computed by using an on-line tool such as ECOTRANSIT. Tables in annex8.2 present the parameters on which output values depend.

14.3 Limitations and obstacles

Before the implementation of the external cost calculation within the scope of ADB project there are some limitations and other issues that should be considered and agreed upon for further analysis and allocation, concerning mainly which exact data sets are required in order to properly calculate transport related external cost.

The data sets to be collected and analyzed should be derived from similar backgrounds (reference to the infrastructure, unified units) and have the **same or similar reference years**. The data that is used for the calculation must be reliable and easy to verify. From the perspective of the future environmental analysis and the impact analysis of the long term project impacts, the data sets must allow **yearly update** so that the comparisons could be made also on a yearly scale.
Some of the relevant data can be also used from reference portals like EuroStat where data on rail, road and other transport infrastructure is collected and stored. Considering the fact that not all the ADB countries are included in the EU, not all the data that is needed for the environmental analysis is available on the EU portals. Despite the availability of some data from relevant European data sources the problem of **availability of the data from non-EU** countries remains. To receive the relevant infrastructure data for the non EU countries close cooperation with the partners from those countries is necessary.
If the transport or environmental data that are needed for calculation of environmental impacts from ADB pilot implementations are not available, the methodology for calculation of external cost should be properly adjusted.. It has to be taken into consideration that the data taken from **many different sources can become unreliable** when they are further used for the calculation of environmental impacts of the established ADB pilots.
The recent work on the external cost of transport in EU in general was mostly based on calculation of marginal costs, However, in some cases the use of average costs is preferred,mostly because of the further mentioned reasons(INFRAS, 2011):
–Total and average costs provide a comprehensive overview on economic impacts of transport, especially for the New Member States which are in the midst of the transformation of their transport system;
–The level and structure of the total and average external costs of transport show the progress of each state towards sustainable mobility;
–Total and average external costs provide information on equity between modes and between different vehicle categories within a mode;
–Total and average costs are much easier to communicate than marginal costs;
–Pure marginal cost pricing may be difficult to implement, since marginal costs (esp. noise, accidents and congestion) vary considerably over time, place, etc.

It should be taken though into consideration that the values of averageexternal cost provided by the Update Study "External Costs of Transport in Europe" (Ce Delft, INFRAS and Fraunhofer ISI, 2011) refer to 2008. Update of average values is not simple and cannot be achieved in the same way as in the case of updating marginal costs (for example by using indicators such as GDP per capita development), so the availability of recent or updated values of average cost provided by databases, individual studies or forecasts should be always examined.

14.4 Conclusion/Summary

According to the above mentioned specifications of the different methodologies and the purpose of the ADB external costs study, the overall agreement of the partners, included in the process of selection for the proper methodology, considers the second proposed option (Calculation of external costs with emission data and average or marginal external costs per vkm or tkm or ton of polutant) as the most appropriate one for the calculation of the total external costs of freight transport for the project purposes.

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16 Annexes

16.1 Annex 1: Questionnaires on external cost calculation

16.1.1 Albania

1.Basic information on the recent studies on transport external costs

1.1. Is your country included in any relevant international study[4] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country? *(Please, fill in important details for each international study you know of. Multiply the table if necessary.)*

Albania is not included in any relevant international study on the external cost of freight transport.

1.2. Are there any national studies on external cost calculation of freight transport made for your country[5]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

[4] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

[5] As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

There are no national studies on external cost calculation of freight transport.

2.Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date national study of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

2.1.What is the overall objective of the study?

2.2.Which transport related data/statistics were included in the study of external costs of freight transport? (Shortly describe specifications of transport, environmental, demographic, economic, and infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)

2.3.Additionally describe freight transport modes analyzed in the study. Which intermodal freight transport statistics/modes were included?

2.4.Which parameters are included in the study of external costs of freight transport? (Bold the relevant parameters and write additional comments. If necessary add additional parameters)

a) Differentiation of night/day freight flows:_____
b) Differentiation of urban/interurban/rural areas:_____
c) Energy production mix: _____
d) High and low scenario of price for 1 tone of CO_2 : _____
e) Slopes for road and rail infrastructure: _____
f)Transport infrastructure peculiarities: _____
g) External costs of intermodal freight terminals: _____
h) OTHER: _____

2.5.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.

2.6.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport in your country? Specify the reference year of the calculation.

a.Reference year (the year against which EUR were calculated): _____

b.Average external costs of freight transport

External cost	**Rail freight** (EUR/1.000 tkm)	**Road freight (LDV and HDV)** (EUR/1.000 tkm)	**Inland and sea waterways** (EUR/1.000 tkm)
Accidents			
Climate change			

Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

c.Total external costs of freight transport

External cost	**Rail freight** (1.000 EUR)	**Road freight (LDV and HDV)** (1.000 EUR)	**Inland and sea waterways** (1.000 EUR)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

2.7.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

Legislation and other data concerning external costs of transport

2.8.Is there any legislation (regulation, directive etc.) at national, regional or local level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

There is no legislation (regulation, directive etc.) at national, regional or local level regarding external costs of transportation.

2.9.If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

There is no legislation in Albania concerning external cost of transportation on local, regional or national level.

2.10.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

I believe that facing environmental impact in freight transport should be enforced by law, but it is very important that it should be done gradually and simultaneously with an awareness campaign.

2.11.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?

a) Gradual diffusion and adoption of best environmental practices along the whole ogistics chain

2.12.Is there any legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

No.

2.13.Do you know any on-line manuals for external cost calculation? If yes, please describe the name of the on-line manual.

No.

2.14.Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.

No.

16.1.2Bulgaria

1.Basic information on the recent studies on transport external costs

1.1.our country included in any relevant international study[6] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country? *(Please, fill in important details for each international study you know of. Multiply the table if necessary.)*

International study n.1

NAME OF THE STUDY	*EXTERNAL COSTS OF TRANSPORT IN CENTRAL AND EASTERN EUROPE*
NAME OF THE PROJECT	*The Environmentally Sustainable Transport (EST) outreach activity "EST goes East" to Central and Eastern Europe. A consortium of consultants mandated by the CEI Working Group on Transport and the Environment and the OECD Working Group on Transport has conducted the study.*

[6] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

YEAR OF STUDY	*27-28 May 2003*
AUTHORS	
FREIGHT TRANSPORT MODES ANALYSED	*Rail: passenger, freight (diesel and electric traction). Road: Road passenger: passenger cars, buses and coaches (one category), motorbikes/mopeds. Road freight: light duty vehicles (LDV), heavy duty vehicles (HDV). Air transport: passenger aviation. Inland waterways: freight*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents Noise Air Pollution Climate Change Nature & Landscape*
DIRECT LINK TO LOCATION OF THE STUDY	*OECD/ENV website www.oecd.org/env/transport.*

International study n.2

NAME OF THE STUDY	*External Costs of Transport in Europe, update study for 2008*
NAME OF THE PROJECT	*(Write the name of the project, if the study was part of it)*
YEAR OF STUDY	*Delft, September 2011*
AUTHORS	*CE Delft INFRAS Fraunhofer ISI*
FREIGHT TRANSPORT MODES ANALYSED	*Rail: passenger, freight (diesel and electric traction). Road: Road passenger: passenger cars, buses and coaches (one category), motorbikes/mopeds. Road freight: light duty vehicles (LDV), heavy duty vehicles (HDV). Air transport: passenger aviation. Inland waterways: freight*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents; Air pollution; Climate change; Noise; Congestion.*
DIRECT LINK TO LOCATION OF THE STUDY	*www.cedelft.eu*

Multiply the table if necessary!

1.2.Are there any national studies on external cost calculation of freight transport made for your country[7]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

National study n.1

ORIGINAL NAME OF THE STUDY	*Възможности за измерване и интернализиране на външни разходи за транспорт при определяне на инфраструктурни такси*
ENGLISH TRANSLATION OF THE STUDY	*Ability to measure and internalization of external transport costs in determination of infrastructure charges*
YEAR OF STUDY	
AUTHORS	*Christina Nikolova - senior assistant-professor, University of National and World Economy*
CONTRACTOR	*Scientific publication*

[7] As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

FREIGHT TRANSPORT MODES ANALYSED	*Rail, road, air and water transport.*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, environment protection costs; Congestions*
DIRECT LINK TO LOCATION OF THE STUDY	*(If relevant write direct URL location to the study on the internet)*

National study n.2

ORIGINAL NAME OF THE STUDY	*Единен подход за определяне на инфраструктурните такси в транспорта*
ENGLISH TRANSLATION OF THE STUDY	*Common approach for transport infrastructure charging*
YEAR OF STUDY	*Mechanics, Transport, Communications Academic Journal, 2007*
AUTHORS	*Christina Nikolova - senior assistant-professor, University of National and World Economy*
CONTRACTOR	*Scientific publication*
FREIGHT TRANSPORT MODES ANALYSED	*Rail, road, air and water transport.*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, environment protection costs; Congestions*
DIRECT LINK TO LOCATION OF THE STUDY	*http://www.mtc-aj.com/conf_2007/dok_126.pdf*

2.Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date national study of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

2.1.What is the overall objective of the study?

National study n.1: Ability to measure and internalization of external transport costs in determination of infrastructure charges: internalization of external costs, general information on approaches, evaluation the possibility of including the external costs in the infrastructure charges and applicability of the approaches to different modes of transport.

National Study 2: Common approach for transport infrastructure charging

The application of marginal social costs pricing is a starting point in establishing infrastructure charging system in transport sector. These principles are used in the process of development of common approach for infrastructure charging in different modes of transport. The main stages in the application of the approach are presented in this paper.

2.2.Which transport related data/statistics were included in the study of external costs of freight transport? *(Shortly describe specifications of transport, environmental, demographic, economic, and*

infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)

No data were used in the above mentioned national studies. They are short and more general, based on the international approaches.

*2.3.*Additionally describe freight transport modes analyzed in the study. Which *intermodal freight transport statistics/modes were included?*

National study n.1: From the macroeconomic perspective, the application of the approach will have long-term effects and an indirect impact on GDP growth, but there will be secondary benefits through revenue growth. . By improving the system of infrastructure charges will provide a more accurate basis for comparison of returns on investment in transport and improve the conditions for private investment and usage of infrastructure. With the introduction of direct infrastructure charges, each shipment will be assessed according to the costs and benefits that are triggered as it will take into account all costs. This will create opportunities in different transport modes to provide economic benefits. On the other hand, the internalization of the costs of environmental protection will increase the eco-efficiency, i.e. the fees reflect the cost of eliminating harmful emissions, and the level of these emissions will be reduced to the point where the cost of the reduction will be equal to the benefits of this measure. Thus, from the standpoint of social efficiency will maximize the welfare of society and not the volume of traffic. From financial perspective, more efficient use of the transport system will reduce the need for government spending on infrastructure, health and environmental protection. The net effect in the commercial sector will be positive and direct effect of higher transportation charges will be offset by reducing the costs of congestion and accidents, and any possible reduction of taxes provided by the government. There may be some shrinkage of transport intensive industries where transport makes up the final price of the product is high. This reduction, however, will be less because the overall increase in freight charges will be slow and firms will adjust (correct) their logistical supply and production.

National study 2 contains Actions and effects of application in different modes. The primary long term goal of applying uniform approach to infrastructure charges in transport is to increase the efficiency of use of the national transport infrastructure. Options to achieve this goal can be determined by analyzing the impacts and implications of the approach in terms of the infrastructure of transport modes.

2.4.Which parameters are included in the study of external costs of freight transport? *(Bold the relevant parameters and write additional comments. If necessary add additional parameters)*

i) Differentiation of night/day freight flows:_____
j) Differentiation of urban/interurban/rural areas:_____
k) Energy production mix: _____

l) High and low scenario of price for 1 tone of CO_2 : _____
m) Slopes for road and rail infrastructure: _____
n) Transport infrastructure peculiarities: _____
o) External costs of intermodal freight terminals: _____
p) OTHER: _____

2.5.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.

2.6.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport in your country? Specify the reference year of the calculation.

a.**Reference year** (the year against which EUR were calculated): **1995,**

b.Average external costs of freight transport

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents	0.0	2.2	0.0
Climate change	0.5	1.5	0.3
Noise	0.3	1.1	0.0
Air pollution	9.0	33.1	2.2
OTHER (if relevant)	0.1	0.9	0.0
OTHER (if relevant)			

Source: *The Environmentally Sustainable Transport (EST) outreach activity "EST goes East" to Central and Eastern Europe. A consortium of consultants mandated by the CEI Working Group on Transport and the Environment and the OECD Working Group on Transport has conducted the study, mentioned as in p. 1.1.*

Average external costs 2008 (excluding congestion), source External Costs of Transport in Europe, update study for 200, mentioned in p.1.1.

Rail freight (€/1,000 tkm*a)	Road freight (LDV and HDV) (€/1,000 tkm*a)	Inland and sea waterways (€/1,000 tkm*a)
16.3	57.6	16.2

c.Total external costs of freight transport

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV)	Inland and sea waterways

		(1.000 EUR)	(1.000 EUR)
Accidents	0.0	23.7	0.0
Climate change	4.1	16.6	0.2
Noise	2.4	11.5	0.0
Air pollution	77.0	359.4	1.6
OTHER (if relevant)	0.5	10.3	0.0
OTHER (if relevant)			

Source: *The Environmentally Sustainable Transport (EST) outreach activity "EST goes East" to Central and Eastern Europe. A consortium of consultants mandated by the CEI Working Group on Transport and the Environment and the OECD Working Group on Transport has conducted the study, mentioned as in p. 1.1., in Million Euro/Year*

Total external costs per inhabitant , year (2008) for EU-27* by country and transport mode (excluding congestion), source External Costs of Transport in Europe, update study for 2008, mentioned in p.1.1.:

Rail freight (€/inhab.)	Road freight (LDV and HDV) (€/inhab.)	Inland and sea waterways (€/inhab.)
10.0	136	6

2.7.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

3.Legislation and other data concerning external costs of transport

3.1.Is there any legislation (regulation, directive etc.) at national, regional or local level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

Fuel tax on road: *Excise Duties and Tax Warehouses Act, Act on the Energy from Renewable Sources, Directive 2003/96/EC; Responsible authority: National government, Customs Agency under the Ministry of Finance; Who is charged: Fuel buyers; Charge base: Fuel used*
Vignette user charge on road: *Time related road user charging system covering all national roads, incl. motorways, first, second and third class roads (total length of 19,267 km, out of which 466 km motorways) defined in Roads Act, Ordinance on the rules and conditions for collecting road*

user charges, toll charges, charges for using certain structures and charges for specific road use Tariff for charges collected by the Road Infrastructure Agency Road Traffic, Directive 1999/62/EC. Responsible authority: National government, Road Infrastructure Agency under the Ministry of Regional Development and Public Works; Who are charged: All 4-wheel road motor vehicles (private and commercial). Internalisation issues: This vignette is a time based method to charge for some of the infrastructure costs. Furthermore, as the toll is differentiated to EURO class, it also provides incentives for purchasing vehicles with lower air pollutant emissions. This vignette is a time based method to charge for some of the infrastructure costs. Furthermore, as the toll is differentiated to EURO class, it also provides incentives for purchasing vehicles with lower air pollutant emissions. Differentiation of price level for commercial vehicles based on emission class (EURO class) was introduced since January 1, 2010. According to the study made before differentiation (in 2007): "It is expected that the predominant part of the international traffic and especially heavy trucks transiting the country would benefit of the reduced price levels because the majority of these vehicles comply with higher emission standards as imposed by CEMT. The share of the vehicles with Bulgarian registration that would take advantage of the reduced rates is relatively small. According to a general assessment of the national commercial fleet, the average age of the vehicles is rather high (over 10 years); this is especially true for vehicles performing carriages by road for own account. The implementation of the proposed measure will contribute for optimization of the Bulgarian vehicle fleet use, e.g. "cleaner" vehicles to be used more intensively compared with the "dirtier" ones, because of the higher vignette costs associated with the latest. This way it is expected harmful emissions produced by the road transport to gradually decrease. o *The proposed decrease of the annual vignette prices for "cleaner" vehicles is expected to result in higher number of annual vignette sold for the vehicle categories concerned. This won't fully compensate the reduction of the revenues as a whole, but having in mind that annual vignettes are generally sold in the beginning of the year, this will tend to the improved planning of National Road Infrastructure Fund's activities.* o *Last, but not least, the implementation of such a financial instrument would promote faster renewal and modernization of the national road vehicle fleet, associated not only with less environmental damages but with higher road safety standards, as well.*"

Transport Vehicle Tax: *Articles 52 to 61 of the Local Taxes and Fees Act*
Road (also applicable for waterborne and air transport). Transport vehicle tax is levied upon first registration and afterwards annually on any transport vehicles registered for operation on the road network in the Republic of Bulgaria, on any ships recorded in the registers of the Bulgarian ports, and on any aircraft recorded in the State register of civil aircraft of the Republic of Bulgaria. ***Responsible authority:*** *Municipal councils and local tax authorities;* ***Internalisation issues:*** *The tax differentiation provides some incentives for purchasing vehicles with lower CO2 and air pollutant emissions.*

Product charge paid at first registration of road vehicles: *Environmental Protection Act, Article 56a in relation to Directive 2000/53 EC on end-of life vehicles Waste Management Act Road Traffic Act Ordinance on the rules and level of product charges related products the use of which produces mass disseminated wastes. Charge that is due when registering the vehicle for the first time in the country. The legislation states that the objective is "to minimise the impact of end-of life vehicles on the environment, thus contributing to the protection, preservation and improvement of*

the quality of the environment and energy conservation, and, second, to ensure the smooth operation of the internal market and avoid distortions of competition in the Community." ***Responsible authority:*** *National Government, Ministry of Environment and Waters, Enterprise for managing activities for preservation of the environment Traffic Police is responsible for enforcement (no vehicle can be registered for movement on the territory of Bulgaria without proving the respective product charge has been paid;* ***Who is charged:*** *Vehicle importers (corporate) or private purchasers for categories L4, L5, L5e, M1 and N1. Remaining categories are exempted.* ***Charge base*** *Vehicle age;* ***Internalisation issues*** *Vehicle age can be seen as a proxy for general emission level (mainly for local pollutants.*

Infrastructure Railways access charges: *Railway Transport Act , promulgated SG, No. 97 of 28.11.2000, effective from 1January 2002, item 9, section 4, No. 592. Entering into force on 1January 2013. Charge per train-km and per gross tonne-km. Length of the network: 6,938 km. The main goal is to recover the expenditures of the Infrastructure Manager (IM) resulting from the performance of train service.* ***Responsible authority:*** *The responsible authority is the Ministry of transport, information technologies and communications. The methodology for calculation of the access charge is proposed by the Minister of transport, information technologies and communications and then accepted by the Council of Ministers.****Who are charged:*** *Train operators;* ***Charge base*** *Gross tonne-km; train-km, kilometre.* ***Internalisation issues:*** *The only external costs included in the charge are wear and tear costs, to the level of the cost resulting directly from the performance of train services (direct cost), and administrative costs.*

Sea port dues and waste charges: *Port dues have to be in line with the Law on Maritime Spaces, Internal Waterways and Ports of the Republic of Bulgaria, Article 103c and paragraph 4. Waste charges have to be in line with Directive 2000/59/EC and the according national legislation;* ***Charge base:*** *1. Channel dues: GT; 2. Light dues: levied per call/year; 3. Tonnage dues: GT; 4. Quay dues: length of vessel (per metre) and time moored (per hour); 5. Waste charges: levied per call.*

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3.2. If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

No enough national study-analyzes on economic impact on different transport modes.

3.3.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

3.4.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?

b)Compulsory legislation with appropriate enforcement measures

c)Gradual diffusion and adoption of best environmental practices along the whole logistics chain

d)Other:_____

3.5.Is there any legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

WASTE CHARGES in sea ports:

Waste charges: *All vessels that have a stay or operate in a port, irrespectively if or not using port reception facilities are levied dues for receiving and handling of port-generated waste. Each ship can hand in a maximum amount of waste (differentiated by the total GT of the ship) for the waste charge, if it hands in more, additional fees have to be paid to the waste managers. Wastes not covered in the differentiation below have to be paid directly to the waste collector.Waste charges are differentiated by GT (9 categories) and type of waste (2 categories): GT:*

- *0-2,000GT*
- *2,001-3,000GT*
- *3,001-6,000GT*
- *6,001-10,000GT*
- *10,001-20,000GT*
- *20,001-30,000GT*
- *30,001-40,000GT*
- *40,001-50,000GT*
- *>50,001GT*

Type of waste:

- *Oily waste*
- *Garbage*

Maximum waste charges:

- Charges are highest for ships over 50,001 GT: administrative dues of € 10, oily waste charge of € 485 and garbage € 750.

Exempted from waste charges:

- Ships are exempted from waste charges if:

o they sail on an liner service, and

o have contracted the delivery of waste with any of the ports on the line and pays for the service dues to the same port or to the collector.

Total sea port dues for exemplary vessels (see Table 51 of main report for further specifications):

- Aframax liquid bulk carrier: € 30,400

- Panamax bulk carrier: € 24,500

- Handy container vessel: € 9,200

- RoPax vessel: € 14,400, All dues/charges quoted are exclusive VAT. ***Internalisation issues:*** *With the waste charge an incentive not to discharge ship-generated waste at sea is given..*

3.6.Do you know any on-line manuals for external cost calculation? If yes, please describe the name of the on-line manual.
Marco Polo EC calculator;
EMEP/CORINAIR Emission Inventory Guidebook – 2009
Group 8: Other mobile sources and machinery

3.7.Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.

PP 15 BDZ Cargo has used EMEP/CORINAIR Emission Inventory Guidebook – 2009 Group 8: Other mobile sources and machinery.

16.1.3 Croatia

1.Basic information on the recent studies on transport external costs

1.1.Is your country included in any relevant international study[8] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country? *(Please, fill in important details for each international study you know of. Multiply the table if necessary.)*

International study n.1

NAME OF THE STUDY	*"est goes east" –External Costs of Transport in Central and Eastern Europe*
NAME OF THE PROJECT	
YEAR OF STUDY	*2002*
AUTHORS	*OECD, Austrian Ministry of Agriculture, Forestry, Environment and Water Management elaborated by INFRAS Consult, Zurich and HARRY Consult Vienna, under the auspices of CEI Working Group Environment and its Task Force Environment and Transport.*
FREIGHT TRANSPORT MODES ANALYSED	*Road, Rail, Water-borne, Aviation*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Noise, Air pollution, Climate change, Nature and Landscape*
DIRECT LINK TO LOCATION OF THE STUDY	*http://esteast.unep.ch/phocadownload/cei0201.pdf*

Multiply the table if necessary!

1.2.Are there any national studies on external cost calculation of freight transport made for your country[9]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

National study n.1

[8] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

[9] As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

ORIGINAL NAME OF THE STUDY	*There are no studies performed in Croatia.*
ENGLISH TRANSLATION OF THE STUDY	
YEAR OF STUDY	
AUTHORS	
CONTRACTOR	
FREIGHT TRANSPORT MODES ANALYSED	
EXERNAL COSTS OF TRANSPORT ANALYSED	
DIRECT LINK TO LOCATION OF THE STUDY	

Multiply the table if necessary!

2.Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date <u>national study</u> of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

There is no national study of external costs in Croatia.

1.3.What is the overall objective of the study?

1.4.Which transport related data/statistics were included in the study of external costs of freight transport? *(Shortly describe specifications of transport, environmental, demographic, economic, and infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)*

1.5.Additionally describe freight transport modes analyzed in the study. Which intermodal freight transport statistics/modes were included?

1.6.Which parameters are included in the study of external costs of freight transport? *(Bold the relevant parameters and write additional comments. If necessary add additional parameters)*

n) Differentiation of night/day freight flows:_____
o) Differentiation of urban/interurban/rural areas:_____
p) Energy production mix: _____
q) High and low scenario of price for 1 tone of CO_2 : _____
r) Slopes for road and rail infrastructure: _____
s) Transport infrastructure peculiarities: _____
t) External costs of intermodal freight terminals: _____

u) OTHER: _____

1.7.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.

1.8.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport in your country? Specify the reference year of the calculation.

a.Reference year (the year against which EUR were calculated): _____

b.Average external costs of freight transport

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

c.Total external costs of freight transport

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

1.9.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

3.Legislation and other data concerning external costs of transport

1.10.Is there any legislation (regulation, directive etc.) at national, regional or local level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

No legislation.

1.11.If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

External costs of transport are still not in the focus of experts and research in Croatia.

1.12.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

Environmental impacts in freight transport should be enforced.

1.13.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?
a)Compulsory legislation with appropriate enforcement measures
b)Gradual diffusion and adoption of best environmental practices along the whole logistics chain
c)Other:_____

1.14.Is there any legislation on the compulsory implementation of environmentalmanagementsystems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

Yes, Environmental Protection Act which regulates environmental protection and sustainable development principles, protection of environmental components and protection against environmental burdening, actors in environmental protection, sustainable development and environmental protection documents, environmental protection instruments, environmental monitoring, information system, ensuring access to environmental information, public participation in environmental matters, access to justice, liability for damage, financing and instruments of general environmental policy, administrative and inspection supervision.

1.15.Do you know any on-line manuals for external cost calculation? If yes, please describe the name of the on-line manual.

No. There are some documents explaining the procedure of calculation: example: **External cost calculator for Marco Polo freight transport project proposals**

1.16.Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.
No.

16.1.4 Greece

1.Basic information on the recent studies on transport external costs

1.1. Is your country included in any relevant international study[10] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country? *(Please, fill in important details for each international study you know of. Multiply the table if necessary.)*

International study n.1

NAME OF THE STUDY	External cost calculation for selected corridors (8.THE FREIGHT FREEWAY CASE STUDY BETWEEN PATRAS,BRINDISI,MUNICH,HAMBURG)
NAME OF THE PROJECT	RECORDIT(Real Cost Reduction of Door-to-Door Intermodal Transport
YEAR OF STUDY	2001
AUTHORS	Stephan A. Schmid (IER) Peter Bickel (IER) Rainer Friedrich (IER)
FREIGHT TRANSPORT MODES ANALYSED	Pre haulage by road SSS Rail Post haulage by road
EXERNAL COSTS OF TRANSPORT ANALYSED	Air pollution Noise Accidents Congestion Global Warming Up and downstream processes
DIRECT LINK TO LOCATION OF THE STUDY	http://www.recordit.org/deliverables/deliv4.pdf

International study n.2

NAME OF THE STUDY	UNIfication of accounts and marginal costs for Transport Efficiency
NAME OF THE PROJECT	UNITE (COMPETITIVE AND SUSTAINABLE GROWTH PROGRAMME
YEAR OF STUDY	2003
AUTHORS	Chris Nash, with contributions from partners
FREIGHT TRANSPORT MODES ANALYSED	Road, Rail, Air, water (inland waterways, maritime shipping)
EXERNAL COSTS OF TRANSPORT ANALYSED	Infrastructure, accident, environnent,(air pollution, climate change, noise, nature& & landscape, soil &water pollution, nuclear risks), congestion
DIRECT LINK TO LOCATION OF THE STUDY	http://www.its.leeds.ac.uk/projects/unite

[10] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

International study n.3

NAME OF THE STUDY	State-of-the-art in project assessment
NAME OF THE PROJECT	HEATCO: Developing Harmonised European Approaches for Transport Costing and Project Assessment
YEAR OF STUDY	2005
AUTHORS	Peter Bickel Arnaud Burgess Alistair Hunt James Laird Christoph Lieb Gunnar Lindberg Thomas Odgaard
FREIGHT TRANSPORT MODES ANALYSED	Road Rail Air Inland Waterway Sea
EXERNAL COSTS OF TRANSPORT ANALYSED	safety noise air pollution - local/regional climate change
DIRECT LINK TO LOCATION OF THE STUDY	http://heatco.ier.uni-stuttgart.de/

1.2.Are there any national studies on external cost calculation of freight transport made for your country[11]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

There is not any official integrated national study on external cost calculation of freight transport in Greece apart from several scientific papers, PhD studies, conference presentations and other individual approaches of certain cost categories (e.g. accidents, or pollution etc.) based mainly on data from literature review. There is also a PhD study relevant to the externalities of energy.

2.Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date national study of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

2.1.What is the overall objective of the study?

[11] As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

2.2. Which transport related data/statistics were included in the study of external costs of freight transport? *(Shortly describe specifications of transport, environmental, demographic, economic, and infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)*

2.3.Additionally describe freight transport modes analyzed in the study. Which intermodal freight transport statistics/modes were included?

2.4.Which parameters are included in the study of external costs of freight transport? *(Bold the relevant parameters and write additional comments. If necessary add additional parameters)*

a) Differentiation of night/day freight flows:_____
b) Differentiation of urban/interurban/rural areas:_____
c) Energy production mix: _____
d) High and low scenario of price for 1 tone of CO_2 : _____
e) Slopes for road and rail infrastructure: _____
f) Transport infrastructure peculiarities: _____
g) External costs of intermodal freight terminals: _____
h) OTHER: _____

2.5.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.

1.1.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport in your country? Specify the reference year of the calculation.

d.Reference year (the year against which EUR were calculated): _____

e.Average external costs of freight transport

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

f.Total external costs of freight transport

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

1.2.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

3.Legislation and other data concerning external costs of transport

3.1.Is there any legislation (regulation, directive etc.) at national, regional or local level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

There is not any legislation in Greece that refers strictly to the external costs. Of course, there are European Directives regarding external costs that could be taken into consideration as Greece is a member of EU, e.g.:

–DIRECTIVE 2011/76/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures

–DIRECTIVE 2008/101/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community

–DIRECTIVE 2001/14/EC of the European Parliament and of the Council on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification.

It should be noted that a Directive is a legislative act of the European Union which requires member states to achieve a particular result without dictating the means of achieving that result and it can be distinguished from Regulations.

3.2.If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

3.3.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

We think that reducing the environmental footprint of freight transport should not be enforced by the Government or any other formal Authority, since it would influence the free competition among transport modes. Instead, the right incentives should be provided in order to achieve a

smooth shift from road to other freight modes, such as real pricing of road use and investments for upgrading the rail system.

In addition, a promising step for facing the environmental impacts concerning air pollution and climate change could be the integration of transport sector in a general policy for reducing and trading emissions.

3.4.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?
a)Compulsory legislation with appropriate enforcement measures
b)Gradual diffusion and adoption of best environmental practices along the whole logistics chain
c)Other:_____

In order to face these problems in Greece a strategy including gradual establishment of sustainable principles would be the most appropriate. A holistic approach of environmental issues along the supply chain towards a more efficient and "green" network of transport systems is necessary nowadays. Of course, an effective strategic plan should provide the implementation of certain pricing policies and guidelines such as the "polluter pays" principle in combination with proper educational or training campaigns and curriculums for users and freight forwarders.

3.5.Is there any legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

3.6. Do you know any on-line manuals for external cost calculation? If yes, please describe the name of the on-line manual.

During the recent years various on-line manuals for external cost calculation have been developed such as EcoSense model (calculating environmental external costs according to the Impact-Pathway-Approach) and GRACE Webtool.

3.7.Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.

As far as we know on-line manuals in external cost calculation for freight transport are not commonly used in Greece by scientists. Two on-line tools that we have used are:
3.http://www.ecotransit.org/calculation.en.html: quite good and easy in use, it includes also Greece. It provides results only for PM10 and not for PM2.5. Since the particulates have the highest cost on the environmental pollution, information for PM2.5 is required for more accurate calculations.
4.http://ecocalc-test.ecotransit.org: very good, it receives information from the first on-line tool (ecotransit) and calculates the external cost of climate change and accidents. Main disadvantages are the fact that it doesn't contain Greece (it has just a limited number of countries) and it doesn't calculate all elements/ components of external cost.

Environmental aspects of legislation on freight transport

National legislation has included only few of the environmental issues regarding the freight transport sector. Therefore, government and citizens should take into serious account more environmental aspects in order to achieve a sustainable transport system.
One of the most indicative legislative measures is that marketing authorizations for public use trucks are granted only for trucks, which fall into the category of emissions EURO IV or EURO V or later directives laid down by the Minister of Infrastructure, Transport and Networks, and cannot be replaced with other trucks of larger or smaller gross weight (LAW No.3887)

Environmental management systems for terminals

It is worth mentioning PERS (Port Environmental Review System) which is an environmental management system for ports and has been developed by the research project ECOPORTS and the European Sea Ports Organisation (ESPO). Seven Greek port terminals belong to ECOPORTS network and implement specific environmental action plans concerning their daily operation and also six of them have received PERS certification

There is also recent legislation (LAW No. 4014/2011) regarding the environmental management of terminals, among others facilities, in Greece. According to this, all terminals, in order to operate legally, should get an official environmental approval and thus implement an appropriate environmental management system.

Finance and Environmental issues (the recently established "Green Fund")

http://www.prasinotameio.gr/index.php/el/
The "Green Fund" finances programmes developed by the Ministry of Environment, Energy and Climate Change and other ministries and agencies, administrations, municipalities and unions, legal or natural persons, who care about the protection, enhancement and restoration of the environment. Main purpose of the "Green Fund" is to foster development through environmental protection by providing support on management, financial and technical issues to programs, measures, interventions and actions which forward the environmental policy of the country.
The main resources of "Green Fund" are the following:

- "Green resources" (resources of the "Special Fund for the Implementation of Regulatory Planning and Design", resources of the "Special Agent of Forest", resources of the special code "Environmental Fund Balance".
- Resources from the contributions of energy distributors, distribution system operators and retail energy sales companies.
- Any other fee, tax, duty, levy, income or resources have been established wholly or partly for the "Special Fund for the Implementation of Regulatory Planning and Design".
- Any kind contributions, donations, grants, bequests from public or private bodies or other domestic or foreign legal or natural persons.
- Funding of programs and initiatives of the European Union and any other resource that comes from international organizations and funds environmental aid.
- Profits, interest or other income from the participation of the "Green Fund" to other private entities.
- Sponsorships and donations from natural or legal persons governed by public or private law.
- Revenue from management, exploitation and use of movable and immovable property.
- Subsidies from the state budget and funding from the public investment program.
- Any other income from legitimate source.

Conclusion

Worldwide, there is an urgent call for decisions and measures towards a sustainable transport system since the overall environmental output of transport activities is really worrying. Existing legislation in Greece concerning external costs and environmental aspects of freight transport is limited to the vehicle specifications and therefore the implementation of other institutional policies and official strategies could be also considered.

16.1.5Hungary

1.Basic information on the recent studies on transport external costs

1.1.Is your country included in any relevant international study[12] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country? *(Please, fill in important details for each international study you know of. Multiply the table if necessary.)*

International study n.1

NAME OF THE STUDY	*HEATCO - Developing Harmonised European Approaches for Transport Costing and Project Assessment*
NAME OF THE PROJECT	*HEATCO - Developing Harmonised European Approaches for Transport Costing and Project Assessment - SIXTH FRAMEWORK PROGRAMME 2002 - 2006*
YEAR OF STUDY	*February 2006*

[12] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

AUTHORS	*IER, Germany; Peter Bickel, Rainer Friedrich, Arnaud Burgess, Patrizia Fagiani, Alistair Hunt, Gerard De Jong, James Laird, Christoph Lieb, Gunnar Lindberg, Peter Mackie, Stale Navrud, Thomas Odgaard, Andrea Ricci, Jeremy Shires, Lori Tavasszy*
FREIGHT TRANSPORT MODES ANALYSED	*Road freight transport; Rail Freight transport; Waterborne& Air freight transport*
EXTERNAL COSTS OF TRANSPORT ANALYSED	*Accident Risks; Environmental Costs: Air pollution, Noise, Global warming, Other effects*
DIRECT LINK TO LOCATION OF THE STUDY	*http://heatco.ier.uni-stuttgart.de/*

International study n.2

NAME OF THE STUDY	*External costs of Transport in Europe (Update study for 2008)*
NAME OF THE PROJECT	*External costs of Transport in Europe (Update study for 2008), project commissioned by Union of Railways (UIC)*
YEAR OF STUDY	*September 2011*
AUTHORS	*CE Delft Huib van Essen (Arno Schroten, Matthijs Otten)* *INFRAS (Daniel Sutter, Christoph Schreyer, Remo Zandonella, Markus Maibach)* *Fraunhofer ISI (Claus Dol)*
FREIGHT TRANSPORT MODES ANALYSED	*Road freight transport (Light duty vehicles, Heavy duty vehicles); Rail Freight transport; Waterborne freight tranport*
EXTERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Air pollution, Climate change, Congestion, Noise and Other External costs (up-and downstream processes, costs for nature and landscape, soil and water pollution)*
DIRECT LINK TO LOCATION OF THE STUDY	*http://ecocalc-test.ecotransit.org/CE_Delft_4215_External_Costs_of_Transport_in_Europe_def.pdf*

International study n.3

NAME OF THE STUDY	*The True Costs of Automobility: External Costs of Cars* *Overview on existing estimates in EU-27*
NAME OF THE PROJECT	*These studies include a number of projects funded by the European Union (e.g. UNITE (Nash, 2003), ExternE (Bickel & R., 2005), NEEDS) but also national or privately funded research projects (e. g. INFRAS/IWW (Schreyer, et al., 2004), Swiss Federal Office for Spatial Development (ARE, without year), CE Delft et al. (CE Delft; Infras; Fraunhofer ISI, 2011)).*
YEAR OF STUDY	*October 2012*
AUTHORS	*TU Dresden (Prof. Dr. Ing. Udo J. Becker, Thilo Becker, Julia Gerlach)*
FREIGHT TRANSPORT MODES ANALYSED	*Passenger cars on roads*
EXTERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Air pollution, Noise, Upstream and downstream effects (covering all effects before and after the utilization phase), Smaller other effects (land use, separational effects etc.), Climate Change*

DIRECT LINK TO LOCATION OF THE STUDY	*http://www.greens-efa.eu/fileadmin/dam/Documents/Studies/Costs_of_cars/The_true_costs_of_cars_EN.pdf*

International study n.4

NAME OF THE STUDY	*External cost calculation for selected corridors*
NAME OF THE PROJECT	*RECORDIT – REAL COST REDUCTION OF DOOR-TO-DOOR INTERMODAL TRANSPORT*
YEAR OF STUDY	*November 2001*
AUTHORS	*Stephan A. Schmid (IER), Peter Brickel (IER), Rainer Friedrich (IER)*
FREIGHT TRANSPORT MODES ANALYSED	*Intermodal transport chains in Europe*
EXTERNAL COSTS OF TRANSPORT ANALYSED	*Benefit transfer values, Monetary values for accident cost components, Risk of fatalities, Monetary valuation of travel time, Marginal external noise costs of heavy goods vehicles, Fatality risk due to goods trains, External noise costs per train km*
DIRECT LINK TO LOCATION OF THE STUDY	*http://www.recordit.org/deliverables/deliv4.pdf*

International study n.5

NAME OF THE STUDY	*Handbook on estimation of external costs in the transport sector*
NAME OF THE PROJECT	*Internalisation Measures and Policies for All external Cost of Transport*
YEAR OF STUDY	*February, 2008*
AUTHORS	*CE Delft*
FREIGHT TRANSPORT MODES ANALYSED	*Intermodal transport chains in Europe*
EXTERNAL COSTS OF TRANSPORT ANALYSED	*Estimated values for casualties avoided, Unit values for accidents for different network types, Air pollution costs,*
DIRECT LINK TO LOCATION OF THE STUDY	*http://ec.europa.eu/transport/themes/sustainable/doc/2008_costs_handbook.pdf*

International study n.6

NAME OF THE STUDY	*UNIfication of accounts andmarginal costs for Transport Efficiency*
NAME OF THE PROJECT	*COMPETITIVE AND SUSTAINABLE GROWTH (GROWTH) PROGRAMME*
YEAR OF STUDY	*November 2003*
AUTHORS	*Chris Nash, ITS, University of Leeds*
FREIGHT TRANSPORT MODES ANALYSED	*Road transport, public transport, railway transport, aviation, inland waterway transport and maritime shipping*
EXTERNAL COSTS OF TRANSPORT ANALYSED	*Costs of road transport, Road revenues and taxes, Total rail transport costs, Rail revenues and subsidies, Total air transport costs, Revenues, charges, taxes and subsidies within the aviation sector*
DIRECT LINK TO LOCATION OF THE STUDY	*http://www.its.leeds.ac.uk/projects/unite/downloads/Unite%20Final%20Report.pdf*

1.2.Are there any national studies on external cost calculation of freight transport made for your

country[13]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

National study n.1

ORIGINAL NAME OF THE STUDY	*A KÖZÚTI ÉS VASÚTI KÖZLEKEDÉS TÁRSADALMI MÉRLEGE MAGYARORSZÁGON*
ENGLISH TRANSLATION OF THE STUDY	*The Social Balance of Road and Railway Transport in Hungary*
YEAR OF STUDY	*September 2010*
AUTHORS	*KTI KÖZLEKEDÉSTUDOMÁNYI INTÉZET NONPROFIT KFT. & Levegő Munkacsoport & Via Kárpátia Kft.*
CONTRACTOR	*Közlekedési Hírközlési és Energiaügyi Minisztérium*
FREIGHT TRANSPORT MODES ANALYSED	*Road transport; Railway transport;*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Air pollution, Climate change, Congestion, Noise and Other External costs (costs for nature and landscape, soil and water pollution)*
DIRECT LINK TO LOCATION OF THE STUDY	*www.levego.hu/sites/default/files/ kozuti_vasuti_kozlekedes_tarsadalmi_merlege_magyarorszagon_0.pdf*

Multiply the table if necessary!

2.Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date national study of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

2.1.What is the overall objective of the study?

The reference year of the study was 2006. One of the primary objectives is to clarify the methodical issues, hence numerical data can be updated later on. These data have been gained primarily from the database of the Hungarian Central Statistical Office. In lack of certain data not indicated in that database, the study has been based on such data, which are stemmed from the most authentic possible resources, primarily Hungarian ones, secondly non-Hungarian ones, accepted in the most wide-ranging sphere.
This project is primarily focused on defining social balance of transport, within which content, meaning and elements of the balance are specified. To define the balance we devided it into two sections: in one section there is all of the transport expenditure of society and in the other section there are its benefits. The expenditure of society: direct transport expenditure of the society members, indirect expenditure realized through state budget and the expenditure, which is not paid by the transport users but the whole society (negative external impacts). Benefits of society: individual and community benefits. (state revenues)

[13]As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

According to the study, behavior of the society is considered rational when balance of transport is positive or in the worst case it is break even in terms of factors taken into account by the society. A social balance, which analyzes transport comprehensively points out whether theformer positive balance remains positive or becomes negative after the impacts, which are usually out of focus, are taken into account, that is whether transport expenditure of the society is beyond its benefits.

In contrast with the general objectives described above, this study can cover the partial issues in this length, as follows:

- it can define the transport balance of state budget,
- it can define the external impacts.

Only can we make balance when we take both the expenditure of the same kind and benefits into account. In this study only the state budget meets this criterium fully, however it is justified to extend this study in two other fields.

The study defines transport balance of state budget, which is supplemented with external impacts and deals with the out-of-budget, non-market conform financial advantages.

Extended state budgetary balance of transport essentially consists of the items, as follows:

-"conventional" transport state budgetary balance (state revenues and expenditure),
-balance of asset change of transport infrastructure,
-external balance (basically out of natural resources and change of condition in human health.

2.2.Which transport related data/statistics were included in the study of external costs of freight transport? *(Shortly describe specifications of transport, environmental, demographic, economic, and infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)*

The study has examined scopes of external costs primarily through social balance of road and rail transport. It has analyzed impacts of externals in each transport modes, as follows:

Climate change

In accordance with the study, annual performance of the actors in road transport can be estimated relatively accurately on the basis of transport monitoring data and also specific consumption can be estimated by categories of vehicles and road network elements. Social costs of effects on climate change caused due to CO_2 emission are uncertain. According to experts, damages of 1 ton of CO_2 emmitted into air have been rising decade by decade. By 2010 value of 25 €/t had been estimated, but due to huge uncertainty of impacts also extreme values (7–45 €/t) were taken into account when the study was made. On the basis of these data, by burning 1 liter of petrol and diesel fuel, there will be 6,9 €ct (1,9–12,4) and 7,8 €ct (2,2–14) social damages created.

On the basis of the calculation of the study, cars can cause damages amounted to approximately 33,8 billion HUF (due to inappropriate estimation as a reason of uncertainty, we can take the extreme values into account: 9,4 and 60,7) due to the burning of fossil fuels. This value is 26,7 billion HUF (extreme values: 7,5 and 47,9) in case of trucks and it is 2,2 billion HUF (extreme values: 0,6 and 3,9) in case of buses.

Due to acceleration of climate change, passenger transport by rail causes 11 (3,1–19,8) €ct social harm per kilometer electrical tarction operation of trains (taking also power generation into account) while the social harm equals to 10,3 (2,9–18,5) €ct in case of pulling of diesel locomotives. In lack of accurate data, the study was based on the above mentioned effective values in the course of calculation of Hungarian costs since it was assumed that consumption of Hungarian trains, which are smaller and, as a consequence use less potential energy does not differ significantly from the Western-European values due to infrastructure and worse technical condition of trains. By taking 82 million km-long performance of passenger transport by rail and 87% rate of electronic pulling into account, experts have calculated social costs amounted to 1,5 (0,4–2,7) billion HUF in case of Hungary. In case of transportation of goods, of 18,9 million trains per kilometer performance, external damages are created amounted to 0,3 (0,1–0,6) billion HUF.

Air pollution

On the basis of social costs calculated in case of Germany in the CE DELFT study (2008) air pollution caused by car transportation (e.g. PM10, PM2,5, SO_2, NOx) ranges between 0,1 and 14,1 €ct/jkm depending on the types of cars and locations of use. Total performance data about each vehicle subtype were not indicated, hence the total data (Hungarian Public Road Nonprofit Private Limited Company, 2008) assessed social impacts of emissions in relation to certain transport modes on the basis of estimation of vehicle stocks in Hungary andperformance rates.

On the basis of the Hungarian traffic data, such as fuel, road types, sizes of motor and rating categories of environmental protection, car transport causes total 58,6 billion HUF in Hungary due their impacts on air pollution.

Social costs are approximately 108,6 billion HUF in case of transportation of goods by road and they are approximately 9,1 billion HUF in case of transportation of buses.

Direct impact of public transportation by rail on air pollution is 1,7 billion HUF in Hungary, within which in case diesel locomotive is represented by 13%, 90,7 €ct/jkm unit cost among settlements and 108,8 €ct/jkm unit cost in the center of the city can be measured. In case of transportation of goods by rail, we can calculate with external damages amounted to 1,3 billion HUF on the basis of 305,8 €ct/jkm and 366,8 €ct/jkm unit costs.

Lower values given for inter-settlement transportation have been taken into account by rate of 85% while data calculated for transportation in a settlement were taken into account by rate of 15%.

Noise pollution

In case of car transportation, social costs of noise are 15,6 (14,5–35,2) billion HUF on the basis of international specific costs and estimation of the Hungarian traffic. The social damages are 25,6 (23,3–56,3) billion HUF in case of trucks, while in case of buses they amount to 0,7 (0,6–1,5) billion HUF.

External social costs were estimated to be 0,8 (0,4-0,8) billion HUF in case of public transportation and 0,4 (0,3–0,4) billion HUF in case of transportation of goods, on the basis of

calculation of traffic on the rate of 85% in inter-settlements and 15% in a settlement in case of rail traffic likewise air pollution (on the basis of the values of the CE DELFT (2008) study).

Harmful environmental effects of soil and water pollution

The CE DELFT (2008) was drafted on the basis of the OSD (2006) study, in which social balance of environmental damage caused by car transportation was 0,06 €ct/jkm on the basis of values calculated for Switzerland. Values were calculated in case of light and heavy trucks as 0,17 €ct/jkm and 1,05 €ct/jkm, in case of buses, they were calculated as 1,06 €ct/jkm and the values were 0,29 €ct/jkm and 1,02 €ct/jkm in case of transportation of goods and public by rail. On the basis of the Hungarian traffic costs data will be assumed, as follows: in case of cars costs are 6,4 billion HUF, in case of transportation of goods by rail, the costs are 8,4 billion HUF, in case of buses costs are 1,7 billion HUF and in case of rail transportation costs are 71 million HUF.

Destruction and deviding of natural habitats

In the calculation based on the OSD data (2003) location of the road network, of which total length was taken into account (6 000 km) and relating division of natural habitats result in external damages amounted to 34,4 billion HUF annually, out of which 23,5 billion HUF was imposed on cars, 10,5 billion HUF was imposed on trucks and 0,5 billion HUF was imposed on buses. In accordance with calculation, transportation of public and goods by rail results in damages amounted to 18,3 billion HUF and 1,2 billion HUF respectively. On the basis of the INFRAS/IWW data (2004) suitable for alternative estimation, location of the road network and the relating division of natural habitats result in external costs amounted to 13,8 billion HUF annually, out of which 9,4 billion HUF was imposed on cars, 4,2 billion HUF was imposed on trucks and 0,2 billion HUF was imposed on buses in the course of calculation. Transportation of public and goods result in damages amounted to 2,0 billion HUF and 0,1 billion HUF respectively.

Accidents

Accident loss consists of elements, as follows:

a) healthcare expenditure,
b) production loss,
c) financial loss,
d) congestion loss,
e) non-financial loss.

Values of specific accident loss accepted currently (as that of 2006) are, as follows (supplemented with estimated average values relating unreported injured people) (mHUF/injured person):

	Reported	Not reported
Death	261,12	261,12

Severe injury	18,12	2,65
Light injury	1,3	0,85
Financial damages	0,6	

Financial damages caused exclusively on rail infrastructure can be divided into 3 big parts. Estimations were done by experts to define real values of damages.
In the first part, accidents of only financial damages, of which value limit exceeds 40 million HUF, average loss was set as 80 million HUF.
In 4 cases this sum amounts to total 0,32 billion HUF.
In the second part values of financial damages created by accidents on rail were divided in rates in accordance with the accidents among value categories of the statistics. In accordance with the value on the basis of this calculation is 1,3 billion HUF.
In the third part values of damages, created due to light accidents were set, which are not represented in the statistics and was estimated to amount between 10-40 mHUF. Value calculated this way is 30, 15 billion HUF.
Loss of accident damages created within one year in railway operation could be estimated total 42,17 billion HUF.

Costs of traffic congestion
Costs of congestion time amounted to 110,372 billion HUF, costs of congestion fuel amounted to 19,5 billion HUF and costs of sufficient air pollution and CO_2 emissions amounted to 3,2 billion HUF in Budapest in 2006. Consequently, by taking all of the three cost factors into account, we can conclude that the cost is 133,113 billion HUF anually in the Hungarian capital.
Problem of the congestion is proportional increasing by changes of the Hungarian population. Consequently, in Hungary, if we calculate by 0,01 multiplier, the cost is 5,325 billion HUF in case of 4 major cities, of which population is around 200 thousand people. In case of 5 cities, of which population is around 100 thousand people, if we calculate cost by 0,0025 multiplier, the cost is 1,664 billion HUF while in smaller settlements this cost is 1 billion HUF. This cost is approximately 2 billion HUF on roads out of settlements.
Direct costs arisen due to congestions, that is operation and time costs of vehicles were 143,101 billion HUF in 2006
Indirect external effects relating transportation
Environmental effects of tightly connected activities, such as production and processing of fuel, disposal of vehicles, vehicle industry, construction and management of roads have to be taken into account in order gross emissions of the total verticum could be also calculated.
In the course of calculation of indirect effects estimated traffic data used for calculation of effects of air pollution were taken into account.
On the basis of the CE DELFT study (2008) external damages were created amounted to 43,6 billion HUF in case of cars, in case of trucks, they amounted to 27,8 billion HUF and in case of buses they amounted to 2,0 billion HUF. Effects of indirect damages in case of transportation of public and goods by rail are 0,7 billion HUF and 0.5 billion HUF respectively.

2.3.Additionally describe freight transport modes analyzed in the study. Which

intermodal freight transport statistics/modes were included?

The study focused generally and comprehensively on exploring externals of road and rail transport. In this relation it referred to components of both personal traffic and transportation of goods in the same process. Neither the survey made on the basis of data acquisited in 2006, nor the report finished in 2010 detailed the importance and relations of the intermodal transportation. This viewpoint has become in focus and highlighted since 2009 to a larger extent. As far as we experience, intermodal transportation is funded in more and more logistics development programs.

2.4.Which parameters are included in the study of external costs of freight transport?
(Bold the relevant parameters and write additional comments. If necessary add additional parameters)

v) Differentiation of night/day freight flows: Density of the Hungarian traffic, their dividing rates, density of night traffic (between the period of 10 pm and 6 am) regarding certain road network elements were estimated on the basis of results of the Hungarian Public Roads Nonprofit Authority (2008).
w) Differentiation of urban/interurban/rural areas: The differentiation of urban&interurban&rural areas was took into consideration at the noise, air pollution and congestion (jam) external cost calculation.
x) Energy production mix: In the course of calculation costs of air pollution were indicated in the category of external costs of electrical traction rail transportation.
y) High and low scenario of price for 1 tone of CO_2: Social costs arisen in relation to climate change effects due to CO_2 emission are uncertain. According to experts, damages of 1 ton of CO_2 emmitted into air are rising decades by decades. It was estimated to be 25 €/t by 2010 but also extreme values (7–45 €/t) were taken into account in the course of calculation due to huge uncertainty of effects. On the basis of data mentioned above, social costs amounted to 6,9 €ct (1,9–12,4) and 7,8 €ct (2,2–14) are created due to burning 1 liter of petrol or diesel fuel.
z) Slopes for road and rail infrastructure: Slope of road infrastructure max 15%; rail infrastructure – main line max 2,5%, sideline and electrical traction max 6%. The study didn't calculated the effect of slopes.
aa) Transport infrastructure peculiarities: Transportation infrastructure of Hungary is characterized primarily by flat country features and the study took no account of geographical features and differences in calculation due to their slight effects.
bb) External costs of intermodal freight terminals: Neither the effects of intermodal terminals, nor their effects on external costs were taken into account in calculation in the study.
cc) OTHER: _____

2.5.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.
The study, which details external costs of transportation applies primarily the bottom-up calculation method and at several points it refers to also statistical sources and international reference studies.

- In calculation of effects on climate change, the study used international reference studies for benchmarking (top-down effect), while calculations in Hungarian studies were estimated on the basis of bottom-up approaches.

- In the section, in which effects on air pollution endangering human health were examined, the study was based on the benchmarking data of the reference study (top-down effect), but primarily they were calculated on the basis of the database of the Hungarian Public Roads Nonprofit Authority along the bottom-up methods by weighted.
- Calculation of effects on noise pollution endangering human health was based on traffic data and application of planning factors and experience (bottom-up logic), partially using the international reference study for benchmarking (top-down calculation effect).
- Calculation of external costs relating to effects of soil and water pollution endangering environment was based and estimated on the Hungarian data (bottom-up) supplemented with data of the international reference study (top-down effect).
- Calculation of external costs relating to destruction and deviding of natural habitats was based on synthesis of deduction and models described in several international studies (top-down logic) and was defined by estimation supplementing with data acquisited about length and development of infrastructure.
- Calculation of external costs relating to accidents was based on the database of the Hungarian Central Statistical Office as well as the data of data sources acquisited about the different transport modes (primarily bottom-up method). To define uncertainty of certain external components, the study used both the HEATCO and the COWL references (top-down).
- Traffic congestion: The study was stemmed from the traffic statistics made in Budapest and the registered data acquisited about fleet of vehicles (bottom-up method) and calculation of external costs will be covered for Hungary on the basis of population distribution and (increasing) probability of traffic congestion (estimation)

2.6.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport in your country? Specify the reference year of the calculation.

a.Reference year (the year against which EUR were calculated): **200**

b.Average external costs of freight transport

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents	105,980	870,8	n.a.
Climate change	2,442	90,1	n.a.
Climate change low scenario	0,814	25,3	n.a.
Climate change high scenario	4,884	154,8	n.a.
Noise	3,256	86,4	n.a.
Noise low scenario	2,442	78,6	n.a.
Noise high scenario	3,093	189,9	n.a.
Air pollution	10,582	366,4	n.a.
Land & water pollution	0,578	28,3	n.a.
Nature damage high	9,768	35,4	n.a.
Nature damage low	0,814	14,2	n.a.
Line&Road damage	4,070	93,8	
Congestion, jam	0,000	0,5	n.a.
Total - mean	132,2	1 561,0	n.a.
Total - low	125,3	1 477,9	n.a.
Total - high	139,0	1 740,0	n.a.

c.Total external costs of freight transport

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents	47 345,5	938 661,8	n.a.
Climate change	1 090,9	97 090,9	n.a.
Climate change low scenario	363,6	27 272,7	n.a.
Climate change high scenario	2 181,8	166 909,1	n.a.
Noise	1 454,5	93 090,9	n.a.
Noise low scenario	1 090,9	84 727,3	n.a.
Noise high scenario	1 381,8	204 727,3	n.a.
Air pollution	4 727,3	394 909,1	n.a.
Land & water pollution	258,2	30 545,5	n.a.
Nature damage high	4 363,6	38 181,8	n.a.
Nature damage low	363,6	15 272,7	n.a.
Line&Road damage	1 818,2	101 090,9	n.a.
Congestion, jam		520,4	n.a.
Total - mean	57 240,0	1 682 636,7	n.a.
Total - low	54 149,1	1 593 000,4	n.a.
Total - high	60 258,2	1 875 545,8	n.a.

2.7.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

The external cost level of road transportation is roughly 29 times higher than the external cost level od railway transport. In the external cost elements of railway trasport the '*accidents*' cathegory represented the 80% of total external cost, so this cathegory is dominant. The share of air pollution and the nature damage is quite low (8,3 & 7,2%)

The external cost level of road transportation is dramatically high in this model according to the study dated 2006. In this structure the accident cost is dominant with 55,8%. The second higher rate is at air pollution (23,5%) and the third ones are line&road damage (6%), climate change (5,8%) and the noise (5,5%).

Our proposal is the facing to these major components of external cost matrix.

3.Legislation and other data concerning external costs of transport

3.1.**Is there any legislation (regulation, directive etc.) at national, regional or local**

level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

190/2008. (VII. 29.) Government Decree for Limitation of transport of heavy trucks (before 111/1995. (IX. 21.) Korm. r.)

The restriction refers to trucks, which exceeds 7.5 tons. The paragraphs of the regulation, which regulate the restriction are, as follows:
Paragraph 1: Scope of the regulation covers every truck, tractor, agricultural tractor, slow vehicle as well as combination of vehicles combined of the above mentioned vehicles and trailers, which are licensed with Hungarian or foreign number plates (hereinafter referred to as truck), of which allowed biggest total weight exceeds 7.5 tons.
Paragraph 2 (1) It is not allowed to travel by the truck indicated in the paragraph above on the public roads of Hungary during the time period, as follows:
c)from 1 July to 31 August
–on Saturdays, excluding the Saturdays, which are working days, from 3 pm to Sunday until 10pm,
– on public holidays from the previous day 10 pm until the given public holiday 10 pm,
d)from 1 September to 30 June from the previous day 10 pm until 10 pm on Sundays and public holidays.
(2) If the public holiday is before Saturday or Sunday in the period specified in (1) (a) or it is before Sunday in the period specified in (1) (b), then the traffic restriction shall be applied continuously from 8 am of the first day in the period when the restriction applies until 10 pm of the last day without any interruption.
(3) The restrictions regulated in the paragraphs (1) b) and (2) do not apply between the period from 4, November until 1, March to the trucks, which are transported in international traffic and defined in the international category mimimum 7 (Euro 3) in the regulation, which regulates the technical stipulations regarding putting and keeping road vehicles in circulation.
The paragraph (3) refers to only a small amount of trucks.

By taking the periods described above into account, we have calculated that the restriction is applied for 1 462 hours a year including restrictions applied on public holidays, which are not on Saturdays or Sundays.

In accordance with the restrictions applied in 2006 (this is the year when the data were examined) restrictions are applied from the 15th of June until the 31st of August and are valid from 8 am on Saturday. In accordance with the data, in 2006 restrictions were applied for 1 536 hours out of 8760 hours. This is 17.5% of the total time. By taking the so-called tranzient loss into account, (for instance when the vehicles did not leave their location points at 10 pm on time) we can say that the loss time can be considered 23% of the total time. Therefore, due to the available 77% of time period, the freight companies have to operate 1298 pieces of transport vehicles (100/77= 1298), of which number is higher by approximately 1.3 than as if the companies could transport every hour a year.
36 365 pieces of trucks, of which payload was higher than 5 tons were in operation in Hungary in 2006. The allowed 7.5 tons of total load approximately falls under this category of vehicles.
By taking some of the trucks into account, of which payload is less than the ones described above, we have calculated that restrictions for trucks, of which payload is 7.5 tons have had impacts on 40 000 trucks.
The regulation applies also for trailers and vehicle trailers.
In accordance with these data, further 3000 vehicles are estimated to be added to the 40 000 trucks, which fall under the restrictions due to the pulling of trailers. This equals to 43 000 trucks and combination vehicles.
In accordance with the database of the Central Hungarian Statistical Office, in Hungary there are 61 025 pieces of trailers, of which payload is 5 tons, and their total weight is approximately 7.5

tons. It is obvious that restrictions are applied also to these vehicles. It can be assumed that due to the fact that there is not work done at the loading points nor at the unloading points at weekends, 40% of trucks and trailers would not be used for transportations, hence only the 60% of the above mentioned vehicles can be considered surplus transportation capacity due to the restriction. 30% of the remaining vehicles can be considered unnecessary capacity. In case of the trucks, there are 7740 pieces (.000 × 0.60 × 0.3 = 7740 pieces), while there are 11 000 trailers (61.065 × 0.6 × 0.3 = 10991).
If we calculate the average procurement price of a truck on 40 million HUF and the average procurement price of a trailer on 3 million HUF, the value of unnecessary capacity can be calculated, as well. Procurement price of the 7740 pieces of trucks is in total 3120 billion HUF, which is, assuming for 7-year period of renewal, 44.2 billion HUF /year (310/7 = 44.2 billion HUF/year).
In case of the trailers, this amount is 4.7 billion HUF (11.000*3/7 = 4.7 billion HUF).
Loss due to the total surplus capacity can be amounted to 48.9 billion HUF (177 MiO EURO). This is the amount, which the freight companies have to bear as competition disadvantage by extra cost due to the transport restrictions of trucks on weekends.

3.2.If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

In Hungary serious workshops have been launched for the past two years to internalize external costs of transport and share burdens in a more justified way among certain transport modes. This process has not resulted in legal regulations.

3.3.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

Requirements meeting aspects of environmental protection are practical to be set by the participation of stakeholders as much as possible. In this respect a centrally-managed and conscious process is possible to be created, within which driving force of the stakeholders could be manifested through their volunteer and proactive participation. Therefore, they could admit and accept easily that changes are necessary to be made. The process could be closed by legal regulations.

3.4.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?
a)Compulsory legislation with appropriate enforcement measures
b)Gradual diffusion and adoption of best environmental practices along the whole logistics chain
c)Other:_____

3.5.Is there any legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

In Hungary the legal regulations are valid within and relating the management system in the field of environmental protection, as follows:

-Government decree 62/1994 (IV.22) about the major combined transportation routes and their facilities in Genf. Proclamation ''European Agreement" drafted on the 1st of February.
-LXI Decree of 2001 about proclamation of the Agreement about combined freight transport and defined stipulations of road transportation of goods between the European Community and the Hungarian Republic.
-LXIV decree of 2003 about the proclamation of international agreement of 1972 about the secure containers.
-Government decree of 266/2003 (XII.24) about allowances of international combined freight transport.
-Government decree of 185/2006 (VIII.31.) about the proclamation of minutes of combined water transportation modifying European Agreement (AGTC) of 1991 about the major combined international transport routes and their facilities.
-Government decree of 190/2008(VII.29) about restrictions of transportation of heavy trucks.
-NFM decree of 13/2010(X.5.) about transport of vehicles exceeding the defined weights, weights of axis and sizes.
-Decree of LXXVIII. of 2011 about proclamation and inland application of Rules attached to the European Agreement drafted about the International Transportation of Dangerous Goods on Inland Waterway (ADN) as of 26, May, 2000, Genf.
-Decree of LXXIX of 2011 about proclamation of the unified drafted with Appendices ''A'' and ''B' of the European Agreement about the International Transportation of Dangerous Goods on Roads (ADR).
-Government decree of 358/2008(XII.31) about certain production and service activities practiced as of permission of location and establishment of location and rules of location permission and anouncement.
-Government decree of 194/2007 (VII.25) about government modifications relating to decrees of the European Parliament and Council about the European Pollution emmission and transport Registry and modification of 91/689EGK and 96/61 EK.
-Government decree of 267/2004/(IX.23) about vehicles becoming waste.
-Government decree of 306/2010 (XII.23) about air protection.
-Government decree of 147/2010 (IV.29) of general rules relating to activities and facilities serving use and protection of waters, damage elimination.
-Government decree of 284/2007(X.29) about certain rules of protection against environmental noise and vibration.
-KvVM-EüM decree of 27/2008 (XII.3.) about defining limit values of environmental noise and vibration burden.
-Government decree of 280/2004 (X.20.) assessment and management of environmental noise.

Legal regulations provide a significant base for mitigating environmental damages created in the logistic process by further conscious development in the framework of a program established consistently. Further possibilities could be created by the fact that the ISO 9001 and ISO 14001 quality assurance systems have been induced by significant number of Hungarian logistic service providers. It is expected that in the near future further legal regulations will stimulate intermodal, multimodal relations and characteristics.

3.6.Do you know any on-line manuals for external cost calculation? If yes, please describe

the name of the on-line manual.

-ExternalCost - **External Transport Cost** - This tool calculates the external costs of transport in Europe due to climate change and accidents. http://ecocalc-test.ecotransit.org/tool.php
Basic concept: The existence of external costs in transport creates many distortions in the transport market. Transport users are not given the right incentives as a result of which they are not taken socially optimal decisions. As a consequence scarce resources like energy and infrastructure are not used in an economic efficient way. Moreover, the level playing field between transport modes is adversely affected. The competiveness of modes that cause relatively few external costs, like railways and inland waterways, is harmed by the existence of external costs.
-ExternE - External Costs of Energy - http://www.externe.info/externe_d7/?q=node/2
EcoSenseWeb - the integrated environmental impact assessment model. EcoSenseLE is an online tool for estimating costs due to emissions of a typical source (e.g. power plant, industry, transport) or all sources of a sector in an EU country or group of EU countries. It is a parameterised version of EcoSense, based on European data for receptor (population, crops, building materials) distribution, background emissions (amount and spatial distribution), and meteorology. The input required is annual emissions of NOx, SO2, PM10, NMVOC, CO2, N2O, CH4; the pollutants considered are O3, SO2, PM10, sulfates, nitrates and greenhouse gases. The cost calculation is based on ExternE exposure-response function and monetary values, user defined valuation of mortality and greenhouse gas emissions is possible.
-**EcoTransIt** - The calculation of energy consumption and emission data of a worldwide transport chain can be done rather quickly with the help of EcoTransIT World.
http://www.ecotransit.org/calculation.en.html The key factor influencing the environmental impact of freight transport is the choice of transport mode. Using EcoTransIT World, it is possible to assess the various modes of transport available as truck, rail, inland waterways, sea-going vessels and aircraft. In addition, transport modes can be combined to suit individual requirements. Even within individual transport systems, there are considerable differences due to the vehicle technology deployed, the transport capacity and other factors. In the case of a truck, the key influencing factors are the vehicle size (and thus the max. permissible load), the capacity utilisation level, and the engine's technical standards for the reduction of exhaust emissions (Euro standards).

3.7. Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.

We hadn't used an on-line manual in external cost calculation, so we haven't any experience on this field.

16.1.6 Montenegro

1.Basic information on the recent studies on transport external costs

1.1. Is your country included in any relevant international study[14] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country? *(Please, fill in important details for each international study you know of. Multiply the table if necessary.)*

International study n.1

NAME OF THE STUDY	*(Write the complete name of the study in English)*
NAME OF THE PROJECT	*(Write the name of the project, if the study was part of it)*
YEAR OF STUDY	*(Write the year when the study was published)*
AUTHORS	*(Write the main and contributing authors of the study)*
FREIGHT TRANSPORT MODES ANALYSED	*(List all the freight transport modes analyzed in the study)*
EXERNAL COSTS OF TRANSPORT ANALYSED	*(List all the external costs of freight transport analyzed in the study)*
DIRECT LINK TO LOCATION OF THE STUDY	*(If relevant write direct URL location to the study on the internet)*

Multiply the table if necessary!

Following our communication with Ministry of Transport and Maritime Affairs, Montenegro is not included in any relevant international study regarding freight transport external costs.

1.2. Are there any national studies on external cost calculation of freight transport made for your country[15]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

National study n.1

ORIGINAL NAME OF THE STUDY	*(Write the complete name of the study in national language)*
ENGLISH TRANSLATION OF THE STUDY	*(Write the name of the project in English translation)*
YEAR OF STUDY	*(Write the year when the study was published/composed)*
AUTHORS	*(Write the main and contributing authors of the study)*
CONTRACTOR	*(Write the contractor of the study)*
FREIGHT TRANSPORT MODES ANALYSED	*(List all the freight transport modes analyzed in the study)*
EXERNAL COSTS OF TRANSPORT ANALYSED	*(List all the external costs of freight transport analyzed in the study)*
DIRECT LINK TO LOCATION OF THE STUDY	*(If relevant write direct URL location to the study on the internet)*

Multiply the table if necessary!

Currently there is no national study on external cost calculation of freight transport for Montenegro.

2. Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date <u>national study</u> of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

[14] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

[15] As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

2.1.What is the overall objective of the study?

2.2.Which transport related data/statistics were included in the study of external costs of freight transport? *(Shortly describe specifications of transport, environmental, demographic, economic, and infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)*

2.3.Additionally describe freight transport modes analyzed in the study. Which intermodal freight transport statistics/modes were included?

2.4.Which parameters are included in the study of external costs of freight transport? *(Bold the relevant parameters and write additional comments. If necessary add additional parameters)*

dd) Differentiation of night/day freight flows:_____
ee) Differentiation of urban/interurban/rural areas:_____
ff) Energy production mix: _____
gg) High and low scenario of price for 1 tone of CO_2: _____
hh) Slopes for road and rail infrastructure: _____
ii) Transport infrastructure peculiarities: _____
jj) External costs of intermodal freight terminals: _____
kk) OTHER: _____

2.5.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.

2.6.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external
costs of freight transport in your country? Specify the reference year of the calculation.

d.Reference year (the year against which EUR were calculated):

e.Average external costs of freight transport

External cost	**Rail freight** (EUR/1.000 tkm)	**Road freight (LDV and HDV)** (EUR/1.000 tkm)	**Inland and sea waterways** (EUR/1.000 tkm)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

f.Total external costs of freight transport

External cost	**Rail freight** (1.000 EUR)	**Road freight (LDV and HDV)** (1.000 EUR)	**Inland and sea waterways** (1.000 EUR)

Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

2.7.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

3.Legislation and other data concerning external costs of transport

3.1.Is there any legislation (regulation, directive etc.) at national, regional or local level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

There is no legislation in Montenegro (at national, regional or local level) regarding external costs.

3.2.If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

The process of improving the legislation regarding freight transport in Montenegro, in general, is ongoing. It is expected that this will result and with regulation related to external costs of freight transport. Additionally, as EU opened accession negotiations with Montenegro and the membership criteria include conditions for member country integration through the appropriate adjustment of its administrative structures (since it is important that European Community legislation be reflected in national legislation), we believe that all legislation regarding external costs of freight transport which is implemented in EU will be applied in Montenegro.

3.3.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

We think that environmental impacts in freight transport should be enforced.

3.4.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?
d)Compulsory legislation with appropriate enforcement measures
e)Gradual diffusion and adoption of best environmental practices along the whole logistics chain

f)Other:_____

3.5.Is there any legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

No.

3.6.Do you know any on-line manuals for external cost calculation? If yes, please describe the name of the on-line manual.

As there was no need to use external cost calculation, we did not research for on-line manuals for external cost calculation.

3.7.Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.

N/A.

16.1.7Romania

1.Basic information on the recent studies on transport external costs

1.1.Is your country included in any relevant international study[16] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country?

International study n.1

NAME OF THE STUDY	*Preliminary studies on the improvement of the sustainable transport solutions between ports and hinterland logistic facilities or transport infrastructures*
NAME OF THE PROJECT	*Transnational Network for the promotion of the Water-Ground Multimodal Transport (WATERMODE)*
YEAR OF STUDY	*2012*
AUTHORS	*Business & Innovation Center of Attika - BIC OF ATTIKA (Greece)*
FREIGHT TRANSPORT MODES ANALYSED	*Comparison of global costs between multimodal and road transport systems*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Air Pollution*
DIRECT LINK TO LOCATION OF THE STUDY	*http://www.watermode.eu/docs/1855/disc_wp5_2_report_final_BIC_3112012_doc.pdf*

[16] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

International study n.2

NAME OF THE STUDY	*Internalisation Measures and Policies for All external Cost of Transport (IMPACT) – Handbook on estimation of external costs in the transport sector*
NAME OF THE PROJECT	
YEAR OF STUDY	*2008*
AUTHORS	*CE DELFT, INFRAS, ISI, University of Gdansk*
FREIGHT TRANSPORT MODES ANALYSED	*Road , rail, waterways*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Congestion and scarcity, accidents, air pollution ,noise, climate change, other external costs*
DIRECT LINK TO LOCATION OF THE STUDY	*http://ec.europa.eu/transport/themes/sustainable/doc/2008_costs_handbook.pdf*

International study n.3

NAME OF THE STUDY	*External Costs of Transport In Europe*
NAME OF THE PROJECT	
YEAR OF STUDY	*2011*
AUTHORS	*CE DELFT, INFRAS, ISI*
FREIGHT TRANSPORT MODES ANALYSED	*Road , rail, inland waterways*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, air pollution, climate change, noise, congestion, other external costs*
DIRECT LINK TO LOCATION OF THE STUDY	*http://ecocalc-test.ecotransit.org/CE_Delft_4215_External_Costs_of_Transport_in_Europe_def.pdf*

International study n.4

NAME OF THE STUDY	*External Cost Calculator for Marco Polo freight transport project proposal*
NAME OF THE PROJECT	
YEAR OF STUDY	*2011*
AUTHORS	*European Commission Joint Research Centre, Institute for Prospective Technological Studies*
FREIGHT TRANSPORT MODES ANALYSED	*Road , rail, inland waterways*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Air pollution, climate change, noise, accidents, congestion*
DIRECT LINK TO LOCATION OF THE STUDY	*http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=4759*

International study n.5

NAME OF THE STUDY	*External Costs of Transport in Central and Eastern Europe*
NAME OF THE PROJECT	
YEAR OF STUDY	*2003*
AUTHORS	*Organisation for Economic Co-operation and Development (OECD)*

FREIGHT TRANSPORT MODES ANALYSED	*Road , rail, air, waterborne*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, noise, air pollution, climate change, nature & landscape*
DIRECT LINK TO LOCATION OF THE STUDY	

1.2.Are there any national studies on external cost calculation of freight transport made for your country[17]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

No national studies on external costs calculation of freight transport made for Romania.

2.Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date national study of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

2.1.What is the overall objective of the study?

2.2.Which transport related data/statistics were included in the study of external costs of freight transport? *(Shortly describe specifications of transport, environmental, demographic, economic, and infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)*

2.3.Additionally describe freight transport modes analyzed in the study. Which intermodal freight transport statistics/modes were included?

2.4.Which parameters are included in the study of external costs of freight transport? *(Bold the relevant parameters and write additional comments. If necessary add additional parameters)*

a) Differentiation of night/day freight flows:_____
b) Differentiation of urban/interurban/rural areas:_____
c) Energy production mix: _____
d) High and low scenario of price for 1 tone of CO_2 : _____
e) Slopes for road and rail infrastructure: _____

[17] As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

f) Transport infrastructure peculiarities: _____
g) External costs of intermodal freight terminals: _____
h) OTHER: _____

2.5.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.

2.6.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport in your country? Specify the reference year of the calculation.

a.Reference year (the year against which EUR were calculated): _____

b.Average external costs of freight transport

External cost	Rail freight (EUR/1.000 tkm)	Road freight (LDV and HDV) (EUR/1.000 tkm)	Inland and sea waterways (EUR/1.000 tkm)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

c.Total external costs of freight transport

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

2.7.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

3.Legislation and other data concerning external costs of transport

3.1.Is there any legislation (regulation, directive etc.) at national, regional or local level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and

emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

Romanian Government Ordinance no. 15/2002 regarding the introduction of tariffs for the use of road transport infrastructure. Scope: Set out a fair mechanism to impose the infrastructure related costs to transporters and road users. Encourage to use less pollutant and road damaging vehicles. Implementation field: road transport**.** Results: Improvement of road network quality due to larger investments**.** Reduction of the number of polluting vehicles (cars and freight trucks) due to bigger road tariffs applied to them.

Ministry of Transports and Infrastructure Order no. 769/2010 regarding approval of norms for the appliance of the tariffs for national road network use. Scope: Regulates the methodology for applying Ordinance no. 15/2002: definitions, field of application, responsible authorities, enforcement, fines and penalties for noncompliance. Implementation field: road transport. Results: Improvement of road network quality due to larger investments Reduction of the number of polluting vehicles (cars and freight trucks) due to bigger road tariffs applied to them.

Law no. 9/2012 regarding the tax applied for noxious emissions generated by vehicles. Scope: Set out the level of the tax applied for noxious emissions from vehicles based on the capacity (cm^3) and polluting norm (Euro). Implementation field: road transport. Results: Reduction of the number of polluting vehicles (cars and freight trucks) due to bigger road tariffs applied to them.

Romanian Government Decision no. 470/2007 regarding limitation of sulfur in liquid fuels (transposes Directive 93/12/CEE, Directive 1999/32/CE and Directive 2005/33/CE). Scope: Reduction of SO_2 emissions from fuels combustion by imposing a maximum limit content of sulfur in those fuels. Implementation field: maritime (inside ports and harbors) and inland navigation**.** Results: improvement of air quality, diminishing negative impact of the maritime transport activities on people's health.

Romanian Government Decision no. 935/2011 regarding promotion to use bio fuels (transposes Directive 2003/30/CE and Directive 2009/28/CE). Scope: Set out of national mandatory objectives regarding the share of renewable energy used in transports and encourage the use of bio fuels instead of diesel oil and petrol in order to decrease the greenhouse gases emissions, beginning with 2012. Implementation field: road. Results: not quantified yet.

Romanian Government Decision no. 928/2012 regarding the terms for merchandising of petrol and diesel oil and also the introduction of a monitoring and reducing system for emissions of greenhouse gases (transposes Directive 98/70/CE, Directive 2003/17/CE, Directive 2009/30/CE and Directive 2011/63. Scope: Regulates the technical specifications of petrol and diesel oil considering environment and health aspects. Implementation field: road

and inland navigation. Results: improvement of air quality, diminishing negative impact of the transport activities on people's health.

3.2.If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

Not the case.

3.3.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

It should be enforced.

3.4.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?
d)**Compulsory legislation with appropriate enforcement measures**
e)Gradual diffusion and adoption of best environmental practices along the whole logistics chain
f)Other:_____

3.5.Is there any legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

No legislation for compulsory implementation of EMS.
3.6.Do you know any on-line manuals for external cost calculation? If yes, please describe the name of the on-line manual.

Yes, EcoTransIT World.

3.7.Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.

No.

16.1.8Serbia

1.Basic information on the recent studies on transport external costs

1.1.Is your country included in any relevant international study[18] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country? *(Please, fill in important details for each international study you know of. Multiply the table if necessary.)*

NAME OF THE STUDY	REACT: Guidelines for best practice in funding Research & Development on climate friendly transport and Report on the development of a common set of indicators for carbon impact
NAME OF THE PROJECT	Supporting Research on Climate-friendly Transport
YEAR OF STUDY	2009-2011
AUTHOR	Conventry University Enterprises Ltd, coordinator, University of Belgrade, Faculty of Transport and Traffic engineering (Radmilovic Z., Maras, V.) and seven others partners.
FREIGHT TRANSPORT MODES ANALYSED	All modes of transport: road, railway, inland waterways and multimodal transport: passenger and freight road transport
EXERNAL COSTS OF TRANSPORT ANALYSED	Direct Costs of the environment impact and indirectly: infrastructure costs, security and accident costs and costs on congestion
DIRECT LINK TO LOCATION OF THE STUDY	www.react-transport.eu

1.2.Are there any national studies on external cost calculation of freight transport made for your country[19]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

National study n.1

ORIGINAL NAME OF THE STUDY	Institucionalna izgradnja kapaciteta u transportnom sektoru Srbije
ENGLISH TRANSLATION OF THE STUDY	Institutional Capacity Building in the Transport Sector in Serbia
YEAR OF STUDY	2007.
AUTHORS	Hallof,U., Herting,J., Radmilovic, Z. ect.
CONTRACTOR	AF Group, Sweden, Swedish National Road Consulting AB, Transport Consult GmbH Austria and Swedish Maritime Agency
FREIGHT TRANSPORT MODES ANALYSED	Road, railway, air, inland waterways, intermodal and multimodal transport
EXERNAL COSTS OF TRANSPORT ANALYSED	Infrastructure costs, costs of the environment impact, security and accident costs and costs on congestions.
DIRECT LINK TO LOCATION OF THE STUDY	European Agency of Reconstruction-Belgrade and "Ministry of capital Investments"

Multiply the table if necessary!

[18] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

[19] As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

2.Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date <u>national study</u> of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

2.1.What is the overall objective of the study?

2.2.Which transport related data/statistics were included in the study of external costs of freight transport? *(Shortly describe specifications of transport, environmental, demographic, economic, and infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)*

2.3.Additionally describe freight transport modes analyzed in the study. Which intermodal freight transport statistics/modes were included?

2.4.Which parameters are included in the study of external costs of freight transport? *(Bold the relevant parameters and write additional comments. If necessary add additional parameters)*

a) Differentiation of night/day freight flows:_____
b) **Differentiation of urban/interurban/rural areas:**_____
c) **Energy production mix:** _____
d) **High and low scenario of price for 1 tone of CO_2 :** _____
e) **Slopes for road and rail infrastructure:** _____
f) Transport infrastructure peculiarities: _____
g) External costs of intermodal freight terminals: _____
h) OTHER: _____

2.5.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.

2.6.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport in your country? Specify the reference year of the calculation.

a.Reference year (the year against which EUR were calculated): _____

b.Average external costs of freight transport

	Rail freight	Road freight (LDV	Inland and sea

External cost	(EUR/1.000 tkm)	and HDV) (EUR/1.000 tkm)	waterways (EUR/1.000 tkm)
Accidents	0.115	1.891	0.015
Climate change	/	0.428	/
Noise	0.637	0.370	/
Air pollution	0.177	1.455	0.212
Effects on delimination	/	0.061	/
Utilization of lands	0.022	0.054	/
Total	**0.952**	**0.259**	**0.227**

c.Total external costs of freight transport

External cost	Rail freight (1.000 EUR)	Road freight (LDV and HDV) (1.000 EUR)	Inland and sea waterways (1.000 EUR)
Accidents			
Climate change			
Noise			
Air pollution			
OTHER (if relevant)			
OTHER (if relevant)			

2.7.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

3.Legislation and other data concerning external costs of transport

3.1.Is there any legislation (regulation, directive etc.) at national, regional or local level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

3.2.If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

3.3.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

3.4.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?

g)Compulsory legislation with appropriate enforcement measures
3.5.Gradual diffusion and adoption of best environmental practices along the terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

3.6.Do you know any on-line manuals for external cost calculation? If yes, please describe the name of the on-line manual.

ECORYS, ASIF, External Costs in the Transport Sector, University of Cologne, Institute for Transport Economics, CE Delft Handbook : Methodological critics, Theoretical defaults, Conceptual deficiencies, Instruments for internalizing external costs.

3.7.Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.
h)whole logistics chain
i)Other:_____

3.8.Is there any legislation on the compulsory implementation of environmental management systems concerning

16.1.9 Slovenia

1.Basic information on the recent studies on transport external costs

1.1.Is your country included in any relevant international study[20] (EU or other countries) of freight transport external costs calculation that also calculates the external costs of freight transport in your country? *(Please, fill in important details for each international study you know of. Multiply the table if necessary.)*

International study n.1

NAME OF THE STUDY	*External costs of Transport in Europe (Update study for 2008)*
NAME OF THE PROJECT	*External costs of Transport in Europe (Update study for 2008), project commissioned by Union of Railways (UIC)*
YEAR OF STUDY	*September 2011*
AUTHORS	*CE Delft, INFRAS, Frauhofer ISI*
FREIGHT TRANSPORT MODES ANALYSED	*Road freight transport (Light duty vehicles, Heavy duty vehicles)* *Rail Freight transport* *Waterborne freight tranport*
EXERNAL COSTS OF	*Accidents, Air pollution, Climate change, Noise, Congestion and Other External*

[20] As relevant international study on external costs calculation it is considered the most important studies or projects in your view that were prepared by EU or other international institutions and related NOT ONLY to your country.

TRANSPORT ANALYSED	*costs (up-and downstream processes, costs for nature and landscape, soil and water pollution)*
DIRECT LINK TO LOCATION OF THE STUDY	*URL: http://ecocalc-test.ecotransit.org/CE_Delft_4215_External_Costs_of_Transport_in_Europe_def.pdf*

Multiply the table if necessary!

1.2.Are there any national studies on external cost calculation of freight transport made for your country[21]? *(Please, fill in important details of the national study. Multiply table if necessary)*.

National study n.1

ORIGINAL NAME OF THE STUDY	*Analiza eksternih stroškov prometa*
ENGLISH TRANSLATION OF THE STUDY	*Analysis of External Costs of Transport*
YEAR OF STUDY	*2004*
AUTHORS	*Lep Marjan and other (University of Maribor, Faculty for civil engineering)*
CONTRACTOR	*Slovenian research Agency, Ministry for transport, Ministry for environment, space and energy*
T TRANSPORT MODES ANALYSED	*Road freight transport (Light duty vehicles, Heavy duty vehiclesm, all duty vehicles combined)* *Rail Freight transport*
EXERNAL COSTS OF TRANSPORT ANALYSED	*Accidents, Noise, Air pollution, Congestion, Climate change (high and low scenario), costs for nature and landscape, external costs in build-up area, up and downstream processes*
DIRECT LINK TO LOCATION OF THE STUDY	/

Multiply the table if necessary!

2.Details on the latest study on external costs of freight transport

Please focus on the latest and most up to date <u>national study</u> of external costs of freight transport. Collect and check the methodology and results on external costs calculation for that latest study and answer further questions.

2.1.<u>What is the overall objective of the study?</u>

The study represents a first comprehensive assessment of the external costs of transport for the Slovenian territory. The study deals with external effects of transport in Slovenia for the base year 2002 and also presents some forecasts on external costs of transport for the year 2010. Several different methodologies have been listed, but finally the methodology described and

[21] As relevant national study it is considered a study on external costs calculation that is made specifically for your country disregarding if author was from your or any other country.

used by the Infras/IWW study on external costs of transport (2000) was favored. The objective of the study is to analyze and present first comprehensive assessment of transport related external costs in Slovenia. The study still plays an important part in further calculations of external costs in Slovenia. The purpose of the authors of the study was constant update of the presented calculating principles and methodologies. The study was used for the preparation of financial instruments for possible internalization of external costs (road pricing, city-toll, pricing of public transport), as a support to European, national and regional transport, environmental and economic policies. Some of the results were also used in the processes of implementation of any spatial, transport of other relevant projects.

2.2.Which transport related data/statistics were included in the study of external costs of freight transport? *(Shortly describe specifications of transport, environmental, demographic, economic, and infrastructural or any other data used in the study. Specify if data came from European, national or regional statistics)*

There are two study outputs: the calculation of total and average external costs per means of transport and the consideration of marginal external costs as well as some corridor estimations (which could be used as a basis for the pricing and other instruments of traffic policy). Within the study of external costs the following externalities are considered: accidents, noise, air pollution (including global climate change risks), congestion and other externalities (additional damage on nature and landscape, additional costs in urban areas and up- and downstream processes).

The results on external costs of accidents are derived from calculation of "social costs per injured" (risk value, human capital losses, medical care and administrative costs) combined with numbers of overall injured (fatalities, severe injuries, slight injuries) in Republic of Slovenia due to transport. Data for the analysis of external costs of accidents came from Slovenian statistics concerning number of different accidents within the transport sector. The data from the transport flows came from Slovenian roads agency and statistics on accidents on Ministry of the interior. Statistics on the possibilities for fatal injuries for freight transport came from EU statistics (Infras/IWW). Projection of external costs of transport concerning accidents includes: projection of statistical life in year 2010, prediction of fatalities and injuries and changes in the legal frame (insurances, …).

Referring to the external costs of noise the study resembled to INFRAS/IWW methodology which included: counting the number of people affected by noise per vehicle category and noise cost per exposed person (above 65 dB (A)). Some of the results were analyzed by the principle WTP (Willingness to pay), which presents the amount of money that suffering person is willed to pay to minimize the negative impact of the transport noise in comparison to the average GDP of Slovenia.

Emission based external costs of transport were in the study analyzed from emission factors of air pollutants per vehicle category (including differentiation of average speeds, different

engines propellants, …), transport volume per vehicle category and costs per ton of air pollutant. Calculation of rail freight transport pollution included differentiation of diesel and electric engines, where also electricity production mix was analyzed. Prognosis of the external costs of freight transport in Slovenia for the year 2010 are included in prediction of further transport flows and reduction of total exhaust emission factors. In the study also impacts on building & material damages, crop losses and impacts on ecosystems and biodiversity were analyzed.

Methodology for calculations of external cost of GHG emission from the freight transport took into account average GHG emissions (CO_2, CH_4 and N_20) per vehicle category in tones and cost factor of CO_2 equivalents (€/ton). Average external costs for 1.000 pkm were divided on lower (14 €/t) and high (135 €/t) cost of 1 ton of CO_2 emitted. The calculation based on "avoidance costs" calculated that determines the cost options to achieve required level of GHG emission reduction. Target to be achieved was set from "Operational program of GHG emission reduction in Slovenia" presented in line with acceptation of Kyoto protocol in 2002.

Congestion based external costs of freight transport included national database of length and capacity of state owned road infrastructure, data on VAT (Value of time) of passenger and freight road transport in Slovenia, average structure of travel purposes in Slovenia, average occupancy of the vehicles and estimations of travel duration in Slovenia.

2.3.Additionally describe freight transport modes analyzed in the study. Which intermodal freight transport statistics/modes were included?

The study of external costs of transport took into perspective light and heavy duty vehicles in the section of road freight transport and overall rail freight transport in Slovenia. Study does not focus specifically on some intermodal freight transport statistics or modes. The study comments that for the further development of sustainable freight logistic and lowering of total external costs in Slovenia further development and promotion of intermodal freight transport is very important.

2.4.Which parameters are included in the study of external costs of freight transport? *(Bold the relevant parameters and write additional comments. If necessary add additional parameters)*

a) **Differentiation of night/day freight flows**: in the calculation of external costs of noise there were estimations on different effects of night/day freight transport
b) **Differentiation of urban/interurban/rural areas**: the parameter was included in the analysis of noise (specification of noise in dense urban areas with more than 5.000 inhabitants)
c) **Energy production mix:** external costs of air pollution from electrified rail transport included calculation of energy production mix for electricity.
d) **High and low scenario of price for 1 tone of CO_2 :** lower (14 €/t) and high (135 €/t) cost of 1 ton of CO_2 emitted
e) Slopes for road and rail infrastructure: _____

f) **Transport infrastructure peculiarities**: The methodology calculating the external costs of noise included the spatial differentiation and average speed on the road and rail infrastructure in Slovenia.
g) External costs of intermodal freight terminals: _____
h) **OTHER:** Calculation of external costs of congestion included analysis of travel times within peak /rush) hours in the urban and interurban areas.

2.5.Did your study use bottom-up (calculation of external costs from collected data) or top-down approach (use of standard average figures of marginal costs)? Shortly describe.

The study of external costs of transport in Slovenia mostly used bottom-up approach, but there are still some particularities among different external costs factors.
–Calculation of external costs of accidents concentrates on bottom-up approach where value of human life, production losses and medical costs are the main factors of external cost calculation;
–Costs of annoyance from the transport noise focus on the "willingness to pay" principle and the health damages from noise (calculated from evaluation of inhabitants living in the near of sources of transport noise);
–In the calculation of external cost of air pollution bottom-up approach was used. The principle analyses impact of different concentration of transport emissions on humans, ecosystem and buildings;
–Methodology for evaluation of climate change focused on the avoidance cost principle. The study calculated the financial resources to result in achieving overall goal of lowering GHG emission from the transport sector in Slovenia;
–External costs of congestion were calculated from "Value of time" principle. Bottom-up approach for calculating overall value of time and time losses due to congestion was used.

2.6.Please fill in average (EUR per 1.000 tone-km) and total (sum in EUR per cost category) external costs of freight transport in your country? Specify the reference year of the calculation.

a.Reference year (the year against which EUR were calculated): **2002**

b.Average external costs of freight transport

External cost	**Rail freight** (EUR/1.000 tkm)	**Road freight (LDV and HDV)** (EUR/1.000 tkm)	**Inland and sea waterways** (EUR/1.000 tkm)
Accidents	0,0	35,8	not calculated

Climate change (low scenario – 14€/t)	0,3	8,1	nc
Climate change (high scenario – 135€/t)	3,2	77,8	nc
Noise	2,9	8,4	nc
Air pollution	15,5	136,5	nc
Congestion	0,0	5,2	nc
Costs for nature and landscape	0,9	9,4	nc
Costs in urban areas	0,0	0,5	nc
Up- and downstream processes (low scenario – 14€/t)	12,0	8,8	nc
Up- and downstream processes (high scenario – 135€/t)	13,0	14,5	nc
TOTAL	31,6 – low scenario 35,5 – high scenario	212,7 – low scenario 288,1 – high scenario	nc

c.Total external costs of freight transport: 2002

External cost	**Rail freight** (1.000 EUR)	**Road freight (LDV and HDV)** (1.000 EUR)	**Inland and sea waterways** (1.000 EUR)
Accidents	0,0	39.000	not calculated
Climate change (low scenario – 14€/t)	1.000	10.800	nc
Climate change (high scenario – 135€/t)	9.900	104.700	nc
Noise	8.800	36.900	nc
Air pollution	47.700	237.700	nc
Congestion	0,0	23.100	nc
Costs for nature and landscape	2.900	41.300	nc
Costs in urban areas	0,0	2.400	nc
Up- and downstream processes (low scenario – 14€/t)	36.900	38.600	nc
Up- and downstream processes (high scenario – 135€/t)	40.100	64.000	nc
TOTAL	97.300 – low scenario 109.300 – high scenario	429.600 – low scenario 549.100 – high scenario	nc

d.Prediction of total external costs of freight transport: 2010

External cost	**Rail freight** (1.000 EUR)	**Road freight (LDV and HDV)** (1.000 EUR)	**Inland and sea waterways** (1.000 EUR)
Accidents	0,0	71.800	not calculated

Climate change (low scenario – 14€/t)	1.100	10.900	nc
Climate change (high scenario – 135€/t)	10.900	105.200	nc
Noise	11.900	48.100	nc
Air pollution	75.100	316.600	nc
Congestion	0,0	29.300	nc
Costs for nature and landscape	3.600	nn	nc
Costs in urban areas	0,0	Nn	nc
Up- and downstream processes (low scenario – 14€/t)	55.400	50.700	nc
Up- and downstream processes (high scenario – 135€/t)	58.800	76.300	nc
TOTAL	147.100 – low scenario 160.300 – high scenario	527.400 – low scenario 647.300 – high scenario	nc

2.7.What do you believe were the most important findings, contributions or proposals from the presented external cost calculation? Which additional issues do you believe were raised from presented external cost calculation?

The study presents first comprehensive analysis of external cost of transport in Slovenia. The list of the main findings can be listed as following:

–External costs of freight transport in Slovenia are comparable to those in neighboring countries.

–Total and average external costs of rail freight transport are minor in comparison to road transport external costs;

–External costs of freight transport are closely related to transport flows. The principle "polluter pays" is the best possible option to internalize external costs, while other options have minor impacts.

–Technical parameters (EURO standards, exhaust and noise improvements, better safety regulation, etc.) of the freight transport vehicles will develop slower than the transport flows, so the external costs of freight transport cannot be easily reduced without any efficient internalization policies.

–In the future studies it is important to make similar analysis of external costs for the specific transport corridors and divide external cost of domestic and foreign (transit) freight transport flows.

–The bottom-up approach has proven to be appropriate methodology for external cost calculation of transport.

– The study emphasized the problem of insufficient data in the field of external costs of accidents. Further studies and methodologies were proposed (collection of statistical data, insurance data, causes of the accidents, etc.).

3.Legislation and other data concerning external costs of transport

3.1.Is there any legislation (regulation, directive etc.) at national, regional or local level regarding external costs (emissions, reductions and targets, vehicle technologies, charging and emissions trade etc.) applied or under application in your country? Give the name of legislation and shortly describe it (scope, implementation field, results after its introduction).

Some general resolutions and operational programs in Slovenia are dealing with possible measures to minimize negative impacts of transport to the society and environment. Slovenia is also taking part in acceptance of new Eurovignette directive.

Resolution on Transport Policy of the Republic of Slovenia (OG RS, no. 58/2006) presents the starting point for analyzing potential financial measures regarding the external costs of transport. One of the aims of the resolution is to ensure more coherent charging system for the use of transport infrastructure with external costs included. The resolution emphasizes that the internalization of all costs of infrastructure use, would cause a temporal redistribution of traffic flows, which would result in a better utilization of the road infrastructure and a reduction in external costs of transport. However it should be taken in to consideration that the Resolution on Transport Policy did not specify starting points into quantified objectives or implement supporting activities or policies.

Slovenia is taking part in the new Eurovignette directive which aims to allow EU member states to calculate tolls based not only on infrastructure costs but also on the cost of traffic-based air pollution and noise (which was not the case in the former Eurovignette directive). The external cost charge would represent 3-4 ct/km depending on the Euro class of the vehicle, the location of the roads and the level of congestion. The charge was predicted to be collected by the electronic systems foreseen to be fully interoperable at EU level by 2012 and a receipt clearly stating the amount of the external cost charge will be given to the haulers so that they can pass on the cost to their clients.

The newer Eurovignette directive will also allow a wider differentiation of toll rates at constant revenue so Member States can better manage traffic and reduce congestion. In practice, higher tariffs can be applied during peak periods provided that lower tariffs are applied during off-peak periods. The compromise ensures revenue neutrality and allows in congested areas higher tariffs of up to 175% above the average tariff, with top tariffs collected during a maximum of five peak hours per day and lower tariffs applying during the rest of the time on the same road section. In Slovenia there are currently no broad discussions on newer Eurovignette directive.

3.2.If there is no legislation regarding external costs of freight transport in your country please explain what you believe are the main reasons for this situation.

In Slovenia there is some legislation (general regulation) to promote internalization of external costs of transport but it should be strictly enforced.

3.3.Do you believe that facing environmental impacts in freight transport should be enforced or be left as voluntarily?

At the beginning, it is necessary to prepare an appropriate strategy, which will involve the progressive tightening of legislation and preparation of measurement methodology, evaluation and external cost charges by individual modes of transport.

In the next steps the environmental impacts of freight transport should be enforced with proper governmental fiscal and legislative measures.

3.4.Which strategy you believe is the most appropriate in facing environmental problems of freight transport in your country?

j)Compulsory legislation with appropriate enforcement measures

k)Gradual diffusion and adoption of best environmental practices along the whole logistics chain

l)Other:_____

3.5.Is there any legislation on the compulsory implementation of environmental management systems concerning terminals (e.g. ports), transport companies, transport modes (e.g. rail), and corridors for freight transport applied in your country?

Resolution on Transport Policy of the Republic of Slovenia - Intermodality: Time for synergy, adopted in 2006, represents the first policy document that comprehensively regulates the national transport policy. Before the resolution transport policy was created, in Slovenia there was only framework of development documents for specific transportation subsystems which did not refer to the whole multimodal chain. The document defines the national transport policy followed by the baseline transport development in the European Union, while ensuring achievement of the priority objectives of the Slovenian transport sector. Besides other issues the document includes numerous measures to promote intermodal transport and evaluates establishing the basis for the full operation of logistic centers. Within the document Republic of Slovenia also seeks to ensure an adequate fiscal policy to support the implementation of intermodal transport and environmentally based transport policy, with the objective of ensure the economic viability of intermodal road and rail transport. Special attention is also devoted to developing new technologies that allow different types of intermodal transport.

There is legislation in operation concerning Law on Transportation of Hazardous Goods (Ur.l. 97/2010) in Slovenia which defines procedures imposed to the traffic operators in order to provide safe transport and efficient intervention in emergency case. The legislation also applies to multimodal transport since the marking system and procedures for the transport of hazardous goods are to be standardized and fallowed by the different freight operators.

Multimodal terminal are mainly fallowing ISO standards and procedures. Port of Koper is certificated by the standard ISO 14001, which was established in the year 2000 and in the year 2010 updated with the EMAS (Eco-Management and Audit Scheme). Environmental parameters

on multimodal systems or operators are not directly covered by specific environmental legislation. Do you know any on-line manuals for external cost calculation? If yes, please describe the name of the on-line manual.

3.)The External Cost calculator that determines transport cost for external parties due to climate change and accidents Europe wide (http://ecocalc-test.ecotransit.org/tool.php).
4.)EcoTransIT World calculates environmental impacts of different carriers across the world. This is possible due to an intelligent input methodology, large amounts of GIS-data and an elaborate basis of computation. Data and methodology are scientifically funded and transparent for all users (http://www.ecotransit.org/calculation.en.html).

Have you ever used an on-line manual in external cost calculation? Please describe which one you used and what your experiences with the program were.

We used the on-line manual COPERT 4 (http://www.emisia.com/copert/General.html) which is a software tool used world-wide to calculate air pollutant and greenhouse gas emissions from road transport. The development of COPERT is coordinated by the European Environment Agency (EEA), in the framework of the activities of the European Topic Centre for Air Pollution and Climate Change Mitigation.

The COPERT 4 methodology is part of the EMEP/EEA air pollutant emission inventory guidebook for the calculation of air pollutant emissions and is consistent with the 2006 IPCC Guidelines for the calculation of greenhouse gas emissions. The use of a software tool to calculate road transport emissions allows for a transparent and standardized, hence consistent and comparable data collection and emissions reporting procedure, in accordance with the requirements of international conventions and protocols and EU legislation.

The tool was used for calculating emissions for optimization of deliverables within the project Civitas Elan in Ljubljana. The on line manual proved to be a useful tool for the calculation of emission savings from freight transport modes, but it offered no other calculations on external costs or possible noise reduction.

16.2 Annex 2: General instructions for the calculation of external cost

1 Calculation of total external costs per each ADB country by using average values

- Define updated values (recent) of the average external costs (€/tkm) per cost category (except for congestion) and transport mode, if available.

- Define updated (recent) data on transport volumes (tkm) for each type of vehicle and for each country, if available
- Multiply the average values (€/tkm) with the transport volumes (tkm), in order to calculatethe total external cost (€) per each cost category, transport mode and country.

Note: The average values that are provided by the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) refer to 2008. Adjustment of these values is not feasible by just using some indicators. Real update of these values is necessary, based on databases, recent studies or forecasts.

2 Calculation of total external cost for ADB pilot routes by using marginal and average values.

First of all the characteristics of each pilot route should be defined in detail.

a) Calculation of external cost of core categories by using average values

- Define updated values (recent) of the average external costs (€/tkm) per route, cost category (except for congestion) and transport mode, if available.
- Define updated (recent) data on transport volumes (tkm) per type of vehicle and ADB route.
- Multiply the average values (€/tkm) with the transport volumes (tkm), in order to calculatethe total external cost (€) per each cost category, transport mode and route (€).

Note: The average values that are provided by the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) refer to 2008. Adjustment of these values is not feasible by just using some indicators. Real update of these values is necessary, based on databases, recent studies or forecasts.

b) Calculation of external cost of core categories by using marginal values from the IMPACTHand book (2008) or the Update study "External costs of transport" (CE DELFT, INFRAS andFraunhofer ISI, 2011)

➢ **Accidents**

Road

- Define the following data: Network type (motorways, outside urban, urban, all roads), type of vehicle (car, HDV) and vkm for each type of vehicle and section of the network.
- Select the right marginal values (€/vkm) from the relevant table of the IMPACT Hand book

(2008) or the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm) with the total volumes (vkm) in order to calculate the total external cost (€) for the whole route.

Rail

Only average values are recommended by the IMPACT Handbook (2008): 0, 08-0, 30 €/train-km

Air

Only average values are recommended by the IMPACT Handbook (2008): 12-309 €/LTO

Water

No recommended values – calculation is feasible only at a local/national level based on individual studies.

➢ **Congestion**

Road

- Define the following data: Type of area (large urban areas>2,000,000, small and medium urban areas<2,000,000, rural areas), type of vehicle (passenger cars, goods vehicles, HDV), network type (urban motorways, urban collectors, local streets centre, local streets cordon) and vkm for each type of vehicle and section of the network.
- Select the right marginal values (€/vkm) from the relevant table of the IMPACT Hand book (2008) or the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm) with the total volumes (vkm) in order to calculate the external cost (€) for the whole route.

Rail

No recommended values – calculation is feasible only at a local/national level based on individual studies.

Air

No recommended values – calculation is feasible only at a local/national level based on

individual studies.

Water

Calculation hardly possible.

No recommended values - calculation is feasible only at a local/national level based on individual studies.

- **Air pollution**

1. By using an on-line model (e.g ECOTRANSIT) and values from IMPACT Handbook (2008):

Road

- Use of an on-line tool for defining tonnes of pollutants – make all the necessary assumptions according to the model
- Select the right values (€/tonne of pollutant) from the IMPACT Handbook (2008) and adjust them.
- Multiply the selected values (€/tonne of pollutant) with the tonnes of pollutants

Rail

- Use of an on-line tool for defining tonnes of pollutants – make all the necessary assumptions according to the model.
- Select the right values (€/tonne of pollutant) from the IMPACT Handbook (2008) and adjust them.
- Multiply the selected values(€/tonne of pollutant) with the tonnes of pollutants

Air

- Use of an on-line tool for defining tonnes of pollutants – make all the necessary assumptions according to the model
- Select the right values (€/tonne of pollutant) from the IMPACT Handbook (2008) and adjust them.
- Multiply the selected values (€/tonne of pollutant) with the tonnes of pollutants

Water

- Use of an on-line tool for defining tonnes of pollutants – make all the necessary assumptions according to the model
- Select the right values (€/tonne of pollutant) from the IMPACT Handbook (2008) and adjust them.

- Multiply the selected values (€/tonne of pollutant) with the tonnes of pollutants

2. By using marginal values from the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011)

Road

- Define the following data: Type of region (metropolitan, other urban, non-urban), type of vehicle (passenger cars, motorcycles, buses/coaches, LDV, HDV), type of fuel (gasoline, diesel) and vkm or pkm or tkm for each type of vehicle and section of the network.
- Select the right marginal values (€/vkm or €/pkm or tkm) from the relevant tables of the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm or €/pkm or tkm) with the total volumes (vkmor pkm or tkm) in order to calculate the external cost (€) for the whole route.

Rail

- Define the following data: Type of region (metropolitan, other urban, non-urban), type of rail (passenger, freight), type of fuel (electric, diesel) and vkm or pkm or tkm for each type of rail and section of the network.
- Select the right marginal values (€/vkm or €/pkm or tkm) from the relevant tables of the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm or €/pkm or tkm) with the total volumes (vkmor pkm or tkm) in order to calculate the external cost (€) for the whole route.

Air

Values are recommended for aviation passenger only

Water

Standard values are recommended for inland waterways:

- Define vkm or tkm for the route
- Multiply the recommended marginal values (€/vkm or €/tkm) with the total volumes (vkm or tkm) in order to calculate the external cost (€) for the whole route.

➢**Climate change**

1. By using recommended values from IMPACT Handbook (2008) in order to calculate the total cost for all transport modes

- Define tonnes of CO_2
- Make assumptions about the year of application and the value (lower, central, upper)
- Select the recommended value (€/ tonne CO_2)
- Multiply the selected value(€/ tonne CO_2) with tonnes

2.By using marginal values from the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011)

Road

- Make assumptions about the scenario of climate change (low or high),
- Define the type of vehicle (passenger cars, motorcycles, buses/coaches, LDV, HDV), the fuel type (gasoline, diesel), vkm or pkm or tkm for each type of vehicle
- Select the right marginal values (€/vkm or €/pkm or tkm) from the relevant tables of the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm or €/pkm or tkm) with the total volumes (vkm or pkm or tkm) in order to calculate the total external cost (€) per route

Rail

- Make assumptions about the scenario of climate change (low or high)
- Define the type of rail (passenger, freight), the fuel type (electric, diesel), vkm or pkm or tkm for each type of rail
- Select the right marginal values (€/vkm or €/pkm or tkm) from the relevant tables of the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm or €/pkm or tkm) with the total volumes (vkm or pkm or tkm) in order to calculate the total external cost (€) per route.

Air

Standard values are recommended only for passenger aviation

Water

Standard values are recommended for inland waterways.

- Make assumptions about the scenario of climate change (low or high)
- Define vkm or pkm or tkm for the route (inland waterways)
- Select the right marginal value (€/vkm or €/pkm or tkm) from the relevant tables of the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust it.
- Multiply the selected marginal value (€/vkm or €/pkm or tkm) with the total volume (vkm or pkm or tkm) in order to calculate the total external cost (€) per route.

➢ **Noise**

Road

- Assumptions about time of the day (day, night), density of traffic situations (dense, thin)
- Define the following data: Type of vehicle (car, MC, Bus, LDV,HDV), network type (urban motorways, urban collectors, local streets centre, local streets cordon) and vkm for each type of vehicle and section of the network.
- Select the right marginal values (€/vkm) from the relevant tables of the IMPACT Handbook (2008) or the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm) with the total volumes (vkm) in order to calculate the external cost (€) for the whole route.

Rail

- Assumptions about time of the day (day, night), density of traffic situations (dense, thin)
- Define the following data: type of rail (passenger, freight), network type (urban, suburban, and rural) and vkm for each type of train and section of the network.
- Select the right marginal values (€/vkm) from the relevant tables of the IMPACT Handbook (2008) or the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm) with the total volumes (vkm) in order to calculate the external cost (€) for the whole route.

Air

The calculation is difficult

No recommended values – calculation is feasible only at a local/national level based on individual studies

Water

No recommended values – calculation is feasible only at a local/national level based on individual studies

c) Comparison of the values of external cost produced by a) and b)

d) **Calculation of external cost of other categories by using output values from IMPACT Hand book (2008) or the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011**)

➢ **Up and downstream process**

Road

- Make assumptions about the scenario of climate change (low or high),
- Define the type of vehicle (passenger cars, motorcycles, buses/coaches, LDV, HDV, the fuel type (gasoline, diesel), vkm or pkm or tkm for each type of vehicle
- Select the right marginal values (€/vkm or €/pkm or tkm) from the relevant tables of the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm or €/pkm or tkm) with the total volumes (vkm or pkm or tkm) in order to calculate the total external cost (€) per route.

Rail

- Make assumptions about the scenario of climate change (low or high),
- Define the type of rail (passenger, freight) vkm or pkm or tkm for each type of rail
- Select the right marginal values (€/vkm or €/pkm or tkm) from the relevant tables of the Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust them.
- Multiply the selected marginal values (€/vkm or €/pkm or tkm) with the total volumes (vkm or pkm or tkm) in order to calculate the total external cost (€) per route.

Air

Values are recommended only for passenger aviation

Water

Standard values are recommended for inland waterways.

- Make assumptions about the scenario of climate change (low or high)
- Define vkm or tkm/pkm for the route (inland waterways)
- Select the right marginal value (€/vkm or €/tkm) from the relevant tables of the Update study"External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011) and adjust it.
- Multiply the selected marginal value (€/vkm or €/tkm) with the total volume (vkm or tkm) in order to calculate the total external cost (€) per route.

➢ **Nature and landscape**

Road

- Define type of infrastructure(motorways, 1st class/national roads, 2nd class/regional roads, 3rd class roads) and size of infrastructure (km) for each section
- Select the right marginal values (€/km) from the relevant tables (with output values) of the IMPACT Handbook (2008) and adjust them.
- Multiply the selected marginal values (€/km) with km of infrastructure in order to calculate the external cost (€) per route

Rail

- Define type of infrastructure (railway single track, railway multi track) and size of infrastructure (km) for each section.
- Select the right marginal values (€/km) from the relevant tables (with output values) of the IMPACT Handbook (2008) and adjust them.
- Multiply the selected marginal values (€/km) with size of infrastructure (km) in order to calculate the external cost (€) per route

Air

No recommended values – calculation is feasible only at a local/national level based on individual studies.

Water

No recommended values – calculation is feasible only at a local/national level based on individual studies.

➢**Additional costs in urban areas**

Road

- Define type of vehicle (passenger cars, busses and coaches, motorcycles, vans, heavy duty vehicles) and vkm for each type
- Select the right marginal values (€/vkm) from the relevant tables (with output values) of the IMPACT Handbook (2008) and adjust them.
- Multiply the selected marginal values (€/vkm) with the total volumes (vkm) in order to calculate the external cost (€) per route

Rail

- Define type of rail (passenger, freight) and vkm for each type
- Select the right marginal values (€/vkm) from the relevant tables (with output values) of the IMPACT Handbook (2008) and adjust them.
- Multiply the selected marginal values (€/vkm) with the total volumes (vkm) in order to calculate the external cost (€) per route

Air

No recommended values – calculation is feasible only at a local/national level based on individual studies.

Water

No recommended values – calculation is feasible only at a local/national level based on individual studies.

➢**Soil and water pollution**

Road

- Define type of vehicle (passenger cars, busses/public transport,coaches, motorcycles, vans, heavy duty vehicles) and vkm for each type
- Select the right marginal values (€/vkm) from the relevant tables (with output values) of the IMPACT Handbook (2008) and adjust them.

- Multiply the selected marginal values (€/vkm) with the total volumes (vkm) in order to calculate the external cost (€) per route

Rail

- Define type of train (passenger, freight) and vkm for each type
- Select the right marginal values (€/vkm) from the relevant tables (with output values) of the IMPACT Handbook (2008) and adjust them.
- Multiply the selected marginal values (€/vkm) with the total volumes (vkm) in order to calculate the external cost (€) per route

Air

No recommended values – calculation is feasible only at a local/national level based on individual studies.

Water

No recommended values – calculation is feasible only at a local/national level based on individual studies.

➢ **Biodiversity losses**

- Define tonnes of Sulphur Oxide (SO_2) or Nitrogen Oxide (NOx) for each country.
- Select the right values € (2004) per ton from the relevant table of the Update study External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011)
- "Multiply the selected values with tonnes in order to calculate the external cost (€) per country and adjust them.

16.3 Annex 3: Data requirements and data sources for the calculation of external cost

- **Core cost categories**

Table 16.3-: Data requirements and data sources for the calculation of external cost of accidents

Accidents	
Data requirements: **Number of casualties per vehicle category** **Social costs per casualty**	
Transport mode	**Data source**

Road	European Road Accident Database CARE (2008)
Rail	UIC railway statistics (2002-2008 average values) EUROSTAT
Air	EUROSTAT (2002-2008 average values) – no sufficient data
Waterborne	No data available (The cost is considered negligible)

Source: Delft, INFRAS, Fraunhofer (2011), The calculation of the external cost in the transport sector. (2009).

Table 16.3-1: Data requirements and data sources for the calculation of external cost of congestion

Congestion	
Data requirements:	**Transport network data (length, capacity, annual demand on TEN-T roads)** **Travel behavior (speed flow curves, hourly loads, elasticity)** **Urban data (demand)**
Transport mode	**Data source**
Road	TRANS-TOOLS Studies and statistics on road congestion in specific countries. EUROSTAT and national statistics
Rail	-
Air	-
Waterborne	-

Source: Delft, INFRAS, Fraunhofer (2011), The calculation of the external cost in the transport. sector. (2009).

Table 16.3-2: Data requirements and data sources for the calculation of external cost of air pollution

Air pollution	
Data requirements:	**Emission factors of air pollutants per vehicle category** **Transport volume per vehicle category**
Transport mode	**Data source**
Road	Emission factors – TREMOVE (2010- Base year: 2008) Non-exhaust emission factors for particulate matter (PM) - EMEP database

Air pollution	
Data requirements: Emission factors of air pollutants per vehicle category **Transport volume per vehicle category**	
Transport mode	**Data source**
	(EMEP, 2009, EMEP: European Monitoring and Evaluation Programme). Transport volume (mileage) data - EUROSTAT and TREMOVE databases
Rail	Emission factors – TREMOVE (2010- Base year: 2008) Non-exhaust emission factors for particulate matter (PM) - EMEP database (EMEP, 2009, EMEP: European Monitoring and Evaluation Programme). Transport volume (mileage) data -EUROSTAT and TREMOVE databases
Air	Emission factors (2008) Transport volume (mileage) data. EUROSTAT and TREMOVE databases
Waterborne	Emission factors (2008) Transport volume (mileage) data. EUROSTAT and TREMOVE databases

Source: Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009).

Table 16.3-3: Data requirements and data sources for the calculation of external cost of climate change

Climate change
Data requirements: GHG emissions per vehicle category (CO_2,CH_4,N_2O, other substances emitted on high altitudes)

Cost factor CO_2 equivalent	
Transport mode	**Data source**
Road	Emission data CO_2 -TREMOVE (2010).
Rail	Emission data CO_2 -TREMOVE (2010).
Air	Data only for passenger aviation
Waterborne	Emission data CO_2 -TREMOVE (2010).

Source: Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009).

Table 16.3-4: Data requirements and data sources for the calculation of external cost of noise

Noise	
Data requirements: **Number of people affected by noise per vehicle category** **Noise costs per person exposed**	
Transport mode	**Data source**
Road	EEA, 2010 and CIRCA, 2010 HEATCO, 2006a
Rail	EEA, 2010 and CIRCA, 2010 HEATCO, 2006a
Air	EEA, 2010 and CIRCA, 2010 HEATCO, 2006a
Waterborne	No data available

Source: Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009).

- **Other external costs**

Table 16.3-5: Data requirements and data sources for the calculation of external cost of up and downstream processes

Up and downstream processes
Data requirements: **LCA data per transport mode**

Electricity mix data for European railways	
Transport mode	**Data source**
Road	TREMOVE well-to-tank emissions, Ecoinvent database).
Rail	UIC data IFEU (IFEU, 2010).
Air	TREMOVE well-to-tank emissions, Ecoinvent database).
Waterborne	TREMOVE well-to-tank emissions, Ecoinvent database).

Source: Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009).

Table 16.3-6: Data requirements and data sources for the calculation of nature and landscape external costs

Nature and landscape costs	
Data requirements: Infrastructure data (network length)	
Transport mode	**Data source**
Road	Data analysis New findings of NEEDS project (for restoration) as well as updated cost factors from the last UIC study (INFRAS/IWW, 2004) for unsealing.
Rail	
Air	
Waterborne	

Source: Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009).

Table 16.3-7: Data requirements and data sources for the calculation of additional external costs in urban areas

Additional costs in urban areas	
Data requirements: Urban population and estimated time losses due to the road and rail network in urban areas.	
Transport mode	**Data source**

Road	Population data
Rail	National or European statistics
Air	The data have not be gathered yet.
Waterborne	

Source: Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009).

Table 16.3-8: Data requirements and data sources for the calculation of external cost of soil and water pollution

Soil and water pollution	
Data requirements: Emission factors **Restoration cost factors**	
Transport mode	**Data source**
Road	Ecoinvent database (Ecoinvent, 2010)
Rail	
Air	INFRAS/IWW, 2004 and Swiss studies
Waterborne	

Source: Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009)

Table 16.3-9: Data requirements and data sources for the calculation of external cost of biodiversity *losses*

Biodiversity losses	
Data requirements: Air pollutant emissions **Damage cost factors**	
Transport mode	**Data source**

Road	TREMOVE
Rail	
Air	NEEDS PROJECT
Waterborne	

Source: Delft, INFRAS, Fraunhofer (2011),The calculation of the external cost in the transport sector. (2009).

16.4 Annex 4:Parameters for output values of external cost of freight transport

- **Core cost categories**

Table 16.4-1: Parameters for values of external cost of accidents

Accidents	
Road	Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011): Calculation for heavy duty vehicles **Network type:** Motorways Outside urban Urban All roads
Rail	IMPACT Handbook (2008) : **0.08-0.30 €/trainkm**
Aviation	INFRAS/IWW 2004a : **From 12 to around 309/LTO**
Maritime shipping and inland navigation	-

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

Table16.4-2: Parameters for values of external cost of congestion

Congestion	
Road	IMPACT Handbook (2008) and Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011): Road class: Urban motorways

Congestion	
	Urban collectors Local streets centre Local streets cordon Type of area: Large urban areas > 2000000 Small and medium urban areas < 2000000 Rural areas Type of vehicle: Goods vehicle HGV
Rail	**No standard values**
Aviation	**No standard values**
Maritime shipping	**Calculation hardly possible**
Inland navigation	**No standard values**

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

Table 16.4-3: Parameters for values of external cost of air pollution

Air pollution	
Road	Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011): **Type of region:** Metropolitan Other urban Non urban **Type of vehicle**: LDV, HDV
Rail	Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011): **Network type:** Metropolitan Other urban Non urban **Type of fuel:** electric,diesel
Aviation	Update study "External costs of transport" (CE DELFT,

Air pollution	
	INFRAS and Fraunhofer ISI, 2011): **For aviation passenger only**
Inland waterways	Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011): **Standard values**

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. C

Table 16.4-4: Parameters for values of external cost of climate change

Climate Change	
Road	**Scenario of climate change:** Low High **Type of vehicle**: LDV HDV **Fuel type**: Gasoline Diesel
Rail	**Scenario of climate change:** Low High **Type of vehicle:** LDV HDV **Fuel type:** Gasoline Diesel **Network type:** Metropolitan Other urban Non urban **Type of train:** Electric Diesel
Aviation	**Values for aviation passenger only**
Inland waterways	**Scenario of climate change:** Low High

Climate Change	

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

Table 16.4-5: Parameters for values of external cost of noise

Noise costs	
Road	**Type of vehicle:** Light duty vehicle Heavy duty vehicle **Time of the day:** Day Night **Network type:** Urban Suburban Rural **Density of traffic situations:** Thin Dense
Rail	**Time of the day:** Day Night **Network type:** Urban Suburban Rural **Density of traffic situations:** Thin Dense
Aviation	No general values applicable for all cases (the noise cost of air transport depends on local situations, aircraft type, flight path, time of the day.
Maritime shipping and inland navigation	Noise cost of sea and inland shipping is considered negligible.

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

➢ **Other external costs**

Table 16.4-6: Parameters for values of external cost of up and downstream processes

Up and downstream process	
Road	Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011): **Scenario of climate change:** Low High **Type of vehicle:** LDV HDV
Rail	**Scenario of climate change:** Low High **Type of fuel:** Electric Diesel
Aviation	**For aviation passenger only**
Inland waterways	**Scenario of climate change:** Low High

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

Table 16.4-7: Parameters for values of nature and landscape external costs

Nature and landscape costs (1,000 EUR/(kma)	
Road	IMPACT Handbook (2008): Type of infrastructure: Motorways 1st class/national roads

	2nd class/regional roads 3rd class roads
Rail	IMPACT Handbook (2008): Type of infrastructure: Railway single track Railway multi track
Aviation	-
Maritime shipping-inland waterways	-

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

Table 16.4-8: Parameters for values of additional external costs in urban areas

Additional costs in urban areas	
Road	IMPACT Handbook (2008): Values are recommended for heavy duty vehicles (€ct/vkm)
Rail	IMPACT Handbook (2008): Values are recommended for rail freight (€ct/vkm)
Aviation	-
Maritime shipping-inland waterways	-

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

Table 16.4-9: Parameters for values of external cost of soil and water pollution

Soil and water pollution	
Road	IMPACT Handbook (2008): Values are recommended for vans and heavy duty vehicles (€ct/vkm)

Rail	IMPACT Handbook (2008): Values are recommended for rail freight (€ct/vkm)
Aviation	-
Maritime shipping - inland waterways	-

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

Table 16.4-10: Parameters for values of external cost of biodiversity losses

Biodiversity losses	
Road	Update study "External costs of transport" (CE DELFT, INFRAS and Fraunhofer ISI, 2011): Values are recommended per each country (€/ton SO_2 or NO_x)
Rail	
Aviation	
Maritime shipping - inland waterways	

Source: IMPACT: Handbook on estimation of external costs in the transport sector (2008), External costs of transport in Europe: update study for 2008. CE

End of document.