MINISTRY OF INFRASTRUCTURE AND SPATIAL PLANNING

SEETAC

South East European Transport Axis Cooperation

SOUTH EAST EUROPE Jointly for our common future

Programme co-funded by the EUROPEAN UNION

COMPARISON OF EFFECTS OF DIFFERENT TRANSPORT SYSTEMS SELECTION IN VIEW OF THE REQUIREMENTS FOR SUSTAINABLE TRANSPORT DEVELOPMENT IN THE SEETAC PROJECT MEMBER COUNTRIES

ABSTRACT

Ljubljana, August 2012

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Project report:

Comparison of effects of different transport systems selection in view of the requirements for sustainable transport development in the SEETAC project member countries

Abstract

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1 PRESENTATION OF THE SEETAC PROJECT

Slovenia participates in the SEETAC (South East European Transport Axis Cooperation) project that aims to present the opportunities for creating sustainable high-quality and efficient transport links from South - Eastern Europe and linking to Asia to the EU transport system (TEN-T: Trans-European Transport Network). Southeast Europe has significant strategic position in terms of transport, as it connects the EU countries with Turkey and the Asian countries. This potential however, is not exploited.

SEETAC project aims to establish the administrative, institutional, environmental and legal framework that will enable setting priority projects within the transport corridors and their rapid implementation in the SEETAC countries. In practice, this means an end to cross-border bottlenecks, the establishment of common safety and environmental standards, coordination of transport modes and the opportunity and responsibility for the implementation of sustainable transport system forms.

Operationally, SEETAC consists of 6 main work packages (WPs):

- WP1 refers to the transnational project management and coordination;
- WP2 concerns the establishment of an institutional system of communication, which aims to promote information activities;
- WP3 relates to the implementation of a harmonized system for database management;
- WP4 explores the definition of multimodal transport scenarios and common standards for mobility and environmental guidelines;
- WP5 deals with the identification of necessary financial resources and funding mechanisms;
- WP6 concerns the completion of spatial planning and the set-up of a legal framework for the implementation of projects.

The subject of this project report is substantively part of WP4 and deals with the evaluation of external effects of transport for various scenarios of economic growth in different countries, considering the variety of travel choices available.

2 OBJECTIVES

The project report entitled “Comparison of effects of different transport systems selection in view of the requirements for sustainable transport development in the SEETAC project member countries" is divided into four thematic sections:

a) examination of the relevance and validity of the existing SEETAC project data system as basis for predicting traffic flows with an assessment of suitability of collected data for different modes of transport (road, rail and water transport) by estimating the effects of transport mode changes on external impacts of transport;
b) detailed analysis of existing databases;
c) design of scenarios for the transport system South East Europe (Balkan area) according to the different economic growth rates, different transport modes and traffic load assessments;
d) assessment and evaluation of external effects of transport according to specific transport system scenarios.

The objective of this report is to assess the sensitivity level of external costs of transport to changes in the passenger travel choices – transport mode selection for personal and freight transport (road, rail, inland waterway and maritime transport). Assessment of the sensitivity level of external costs of transport shall be made for different levels and speed of economic development of individual countries of Southeast Europe. A monetary estimate of external effects of transport for different transport policy scenarios that affect the choice of transport will be made as well.

The following two findings represent the expected results:

- What is the influence of traffic development scenarios and their combinations on the physical volume of traffic flows, on vehicle kilometres, passenger kilometres, tonne kilometres and on traffic growth rates;
- What levels of splitting traffic per various modes could be achieved and which of the scenarios could provide the key measures that would lead to sustainable transport policy development in the next 10 years.

3 METHODOLOGY

The following main methodological steps were taken in order to achieve the objectives of the report:

1) Set-up of SEETAC network traffic model replica.
2) Design of probable scenarios of future transport development in SE Europe.
3) Forecasts of traffic flows for each scenario.
4) Calculation of external costs of transport for each scenario.

3.1 SET-UP OF SEETAC NETWORK TRAFFIC MODEL REPLICA

In order to establish an analytical research tool for the verification of the requirements of project objectives, our own SEETAC network traffic model replica was developed. This was in terms of vehicle kilometres, passenger kilometres and tonne kilometres per transport mode calibrated to the SEETAC traffic model. The replica includes all data from the database system that has been collected to the extent, where it could be attributed to all sections of the considered transport network

It is based on the same transport network by all modes of transport (road, rail, maritime and inland waterway) as the original SEETAC traffic model, including all anticipated and considered measures for the future transport network by 2020. These measures are provided within the existing regional infrastructure and transport policy and have been considered in the SEETAC traffic model for 2020.

Our traffic model (replica) enables the prediction of traffic flows and the assessment of scenarios of future transport development. Outputs from the model are multimodal, which makes it possible to assess the effects of transport mode changes on the external impacts of transport.

3.2 DESIGN OF PROBABLE FUTURE SEETAC TRANSPORT NETWORK DEVELOPMENT SCENARIOS

For the needs of external costs calculations in the traffic model, four different scenarios of SEETAC countries' development for the target year 2020 were verified. All scenarios are based on the basic SEETAC traffic model with the same predicted upgrades of the future transport network. The scenarios differ according to the observed dynamics of economic development and the structure of modal split (road, rail, maritime and inland waterway) in 2020. These scenarios are the following:

1) Traffic Scenario SEETAC:

   This traffic scenario is based on original scenario from international SEETAC project, calibrated to the traffic model, which was developed in the scope of this project. Changes in transport mode structure in 2020, compared to base year 2011, are the same as in the SEETAC forecast, which was constructed within the scope of WP4 (SEETAC, Modelling functions and outcomes of modelling elaboration, Final report on the status quo and scenario of 2020 of the transport model activities in WP4, July 2012).

2) Traffic Scenario SEETAC 0:

   The starting point of this scenario is the Scenario SEETAC. Compared to it, Scenario SEETAC 0 encompasses an equal total traffic volume, but differs in the structure of transportation modes for freight transport. The modal split according to Scenario SEETAC 0 does not change and stays the same as in base year 2011. This scenario has the function of verification and control. It was namely created for the needs of comparability of results to the baseline Scenario SEETAC when calculating the external costs of freight transport relative to changes in the modal split.

3) Traffic Scenario A:

This scenario takes into account the traffic growth forecast by the year 2020 that was elaborated in the context of this project and is presented in section 3.3. The forecast considers the developmental impact of the integration of Balkan candidate countries, including Turkey into the EU. This scenario does not foresee changes in the structure of freight transport modal split within the countries in 2020 compared to base year 2011. However, due to the different predicted levels of economic growth among the countries, Scenario A brings a change in modal split in the SEETAC area. Passenger traffic forecast was made on the basis of motorization forecast for the target year 2020, provided that the considered increase in rail passenger transport was slightly lower (factor 0,9) than in the road passenger transport.

4) Traffic Scenario T:

Scenario T takes into account the traffic growth forecast by the year 2020 from Scenario A, presented in section 3.3. At the same time it considers the implementation of sustainable transport system development, meaning that the majority of freight traffic growth between 2011 and 2020 is due to the transition to more ecologically acceptable forms of transport.

Scenarios A and T consider the geopolitical strategic position and the specifics of SEETAC region (EU accession candidate countries), which could largely determine the future pace of economic development in the region and in return also direct and steer the dynamics of traffic flows.

3.3 TRAFFIC FLOW FORECAST

Forecasts of traffic flow volumes in the target year 2020 for Scenarios SEETAC and SEETAC 0 are equal to the prediction made by the SEETAC traffic model. For Scenario A and T the forecast of traffic flow volumes was made based on the considered economic activity forecasts for each country. For freight transport forecasts, projections of GDP growth in the countries until 2020 were taken into account. On the other hand, passenger cars' growth forecast considered the motorization trends in individual countries and created motorization prognosis for 2020.

Gross domestic product (GDP) is the indicator of economic activity and the volume of freight transport is very closely linked to GDP. Figure 3.1 below shows the historical GDP growth trend as well as freight transport growth in EU-27 countries along with the growth forecast for both until 2030 (European Environment Agency, 2011). Based on this forecast the elasticity factor of freight transport relative to GDP was calculated and it amounts to 0,75.

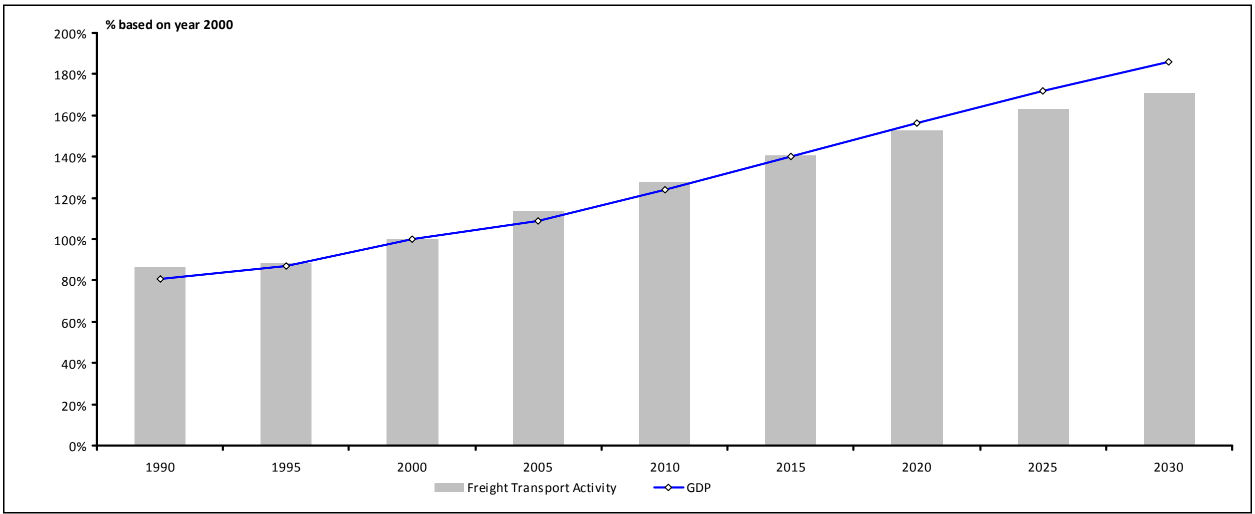

Figure 3.1: Growth and the projection of growth of freight transport and GDP in the EU 27, 1990-2030; Source: European Environment Agency (EEA), 2011

Indices for GDP growth until 2017 have been taken from the latest IMF (International Monetary Fund) economic forecast for the countries of Europe. This growth forecast was then interpolated for further 3 years until the target year 2020 for the needs of this project. On top of that, all EU accession candidate countries in the Balkans including Turkey were given a mark-up on economic growth. This mark-up refers to the estimated impact that would occur at the time of EU accession. Given the similar baseline development levels, geographical proximity and coordinated accession periods, Scenarios A and T assumed the economic growth mark-up, based on Romania's and Bulgaria's EU accession.

Passenger cars' growth forecast has taken into account the trend of motorization in individual countries and on that basis the prognosis for motorization levels in 2020 was designed. This was determined based on motorization growth in individual countries between 1990 and 2009 and in accordance with the initial level of motorization in 2011. Motorization growth that was considered in Scenarios A and T was the largest in countries with low baseline motorization, which will due to relatively high GDP growth rates and improved standard of living by 2020, potentially activate new car purchases. In the developed countries of Western Europe, the rate of car ownership has almost reached saturation, so motorization levels in those countries are expected to stagnate or increase only minimally by 2020.

3.4 EXTERNAL COSTS CALCULATION FOR EACH SCENARIO

External costs of transport are the costs caused by transport to society and to environment, and are not replaced by a reverse transaction. The main sources of these costs are traffic accidents, congestion, air pollution, noise and climate changes. Valuation of investments in road infrastructure in developed countries exposes the issue of internalising external effects (or the integration of broader social environment costs) and so, in addition to direct investment effects includes also the external effects (previously not considered) in the evaluation of benefits and costs (eligibility) of specific investment projects.

The first cost estimates of external effects of air pollution for Europe were published in 2002 by the Environment Directorate of the European Commission. By 2008, the range of cost categories considered in the calculation of external costs of transport was expanded and in 2008, spurred on by the Eurovignette Directive »Handbook on the estimation of external costs and the transportation sector« (INFRAS, CE Delft, The Fraunhofer Gesellschaft - ISI, University of Gdansk, 2008; hereinafter reffered to as »Manual«) was published. That Manual includes the external costs of congestion, accidents, air pollution, noise, climate change and other external costs of transport and provides guidelines for the assessment of some of these costs and their inclusion in eligibility valuations of investment projects.

External costs of transport calculations base on two studies:

1) For the calculation of the external costs of road and rail passenger transport cost estimates from the study “External Costs of Transport in Europe” (CE Delft, INFRAS, Fraunhofer ISI, 2011), which provides updates of the estimates from the Manual for the needs of International Union of Railways, have been used.

2) To calculate the external costs of road, rail, inland waterway and maritime freight transport the estimates of external costs for freight transport from the study Marco Polo Project Proposals (European Commission - Joint Research Centre - Institute for Prospective Technological Studies, 2011) have been used. The study follows the methodology specified in the Manual, and uses its estimates of external costs as basis for its own calculations.

4 CONCLUSIONS AND RESULTS

This project report gives a forecast of vehicle kilometres, passenger kilometres and tonne kilometres by transport mode for different growth rates and different modal shift scenarios (changes in proportions of transport means choices) between these modes (light and heavy vehicles for road, rail, inland waterway and maritime transport) (Table 4.1).

Table 4.1: Increase of tonne kilometres, vehicle kilometres and passenger kilometres per mode according to different scenarios in the period 2011–2020

	Tonne kilometres					Passenger transport	
	Road transport	Rail transport	Inland waterway transport	Maritime transport	Together	Road vehicle kilometres	Rail passenger kilometres
Scenario SEETAC	3,7%	3,9%	1,1%	2,7%	3,3%	4,8%	9,9%
Scenario SEETAC 0	3,5%	7,3%	1,0%	2,5%	3,3%	4,8%	9,9%
Scenario A	19,6%	25,3%	15,4%	15,7%	18,4%	17,4%	16,8%
Scenario T	14,1%	94,7%	17,6%	17,5%	18,8%	17,4%	16,8%

Cost estimates of external effects of transport for the period from 2011 to 2020 for different traffic development scenarios on the SEETAC network were made. At the same time monetarisation of these external effects was also estimated (Table 4.2).

External costs of transport on the environment were assessed for four development scenarios (presented in Section 3.2). These were namely: Scenario SEETAC, which takes into account the development of the transport system in line with current plans for future operations on the network; comparative Scenario SEETAC 0, which differs from Scenario SEETAC only in the fact that it presumes the existing modal split structure for 2020; Scenario A, which considers differentiated traffic growth in the countries according to their economic development; and Scenario T, which stems from Scenario A, and upgrades it by considering that most of the newly generated traffic flows will be using more sustainable transport forms.

The external costs calculations for four scenarios provided the following results:

- Comparison between Scenario SEETAC and the comparative Scenario SEETAC 0 (the current modal split) shows slightly poorer impacts of Scenario SEETAC in terms of external costs of transport. The reason is that, in general, the majority of positive external effects arise from the diversion of freight transport from road to rail. However, in the Scenario SEETAC, the freight modal split deteriorates in terms of sustainable transport in favour of road freight transport. The value of negative external effects of transport in 10 years is estimated at 151 million EUR.
- Scenarios A and T cannot be compared to the reference Scenario SEETAC 0, since Scenarios A and T take into account the mark-ups of economic growth due to the EU accession of candidate countries in SE Europe and Turkey, resulting in greater volumes of traffic and vehicle kilometres, passenger kilometres and tonne kilometres than in the reference scenario. The largest increase in is reflected precisely in these countries that have less developed infrastructure. However, Scenarios A and T are comparable in terms of the extent of vehicle, passenger and tonne kilometres.
- Scenario A, which takes into account the differentiated growth of traffic per country and retains the existing modal split within individual countries, represents a comparative scenario for evaluating the effects of Scenario T. Both scenarios cover the same amount of kilometres, passenger kilometres and tonne kilometres, but the Scenario T assumes an active sustainable transport policy that aims to maximize the use of sustainable transport modes. In rail transport, we assumed that even in 2020 the share of electric traction would not sink below 90%. The difference of external effects of transport costs between scenarios A and T is estimated at 5.25 billion EUR in 10 years.

Table 4.2: External costs of traffic for the considered scenarios in the period 2011-2020 (in million EUR)

Year	Scenario SEETAC	Scenario SEETAC 0	Scenario A	Scenario T
2011	42.748	42.748	42.748	42.748
2012	42.927	42.924	43.573	43.467
2013	43.107	43.100	44.414	44.198
2014	43.287	43.277	45.271	44.941
2015	43.468	43.455	46.145	45.697
2016	43.650	43.634	47.035	46.466
2017	43.833	43.813	47.943	47.247
2018	44.017	43.993	48.868	48.042
2019	44.201	44.174	49.811	48.850
2020	44.386	44.356	50.772	49.672
Sum	**435.625**	**435.474**	**466.580**	**461.329**

Network traffic loads in the traffic model according to Scenario T are shown in Figure 4.1.

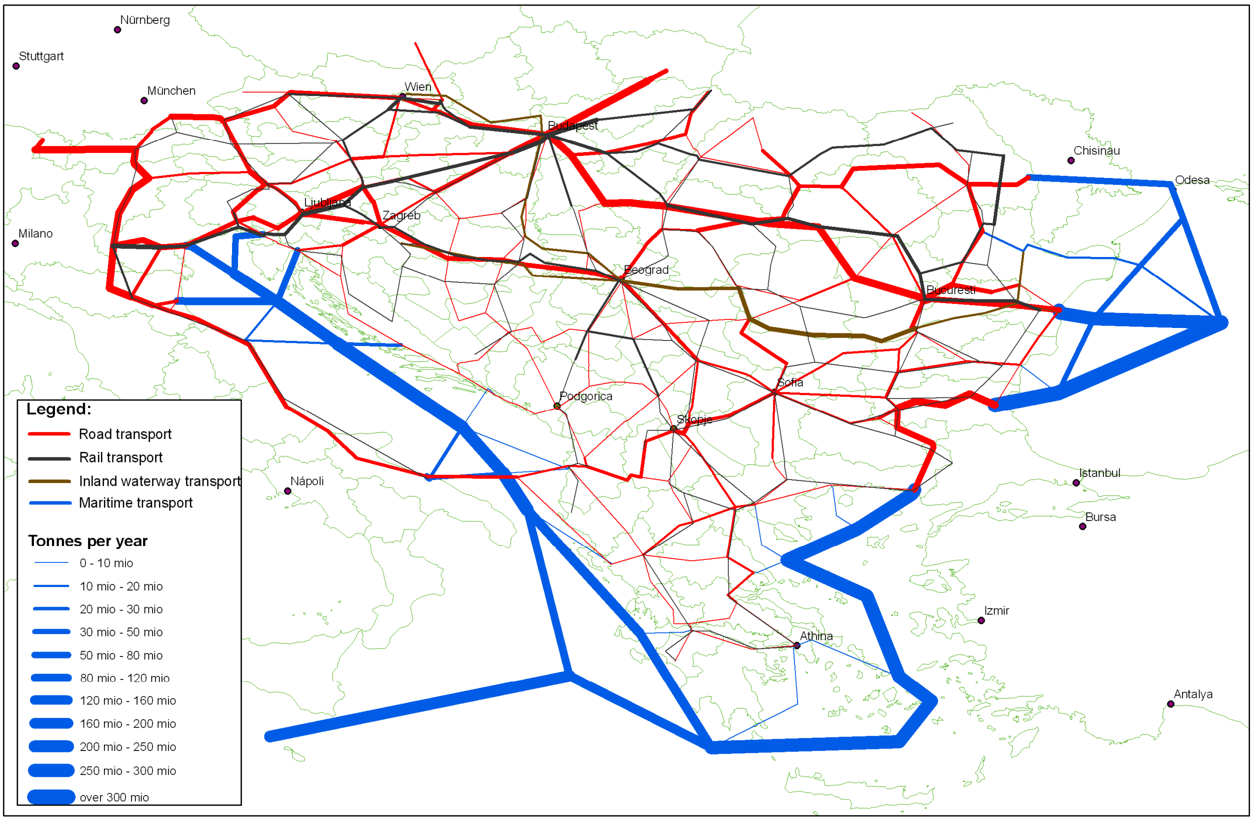

Figure 4.1: Yearly load (in tonnes) of the transport network along with the sustainable development of SEETAC network – Scenario T of the traffic model, year 2020
(source: OMEGA consult Ltd, 2012)

We conclude that the range of benefits, defined as reduction in external costs of transport, is only possible with the development of sustainable systems that primarily enable the diversion of freight flows from road to electrified rail network. The choice of water transport is more or less also reflected in changes in road transport. Such development is possible only, if the transition between transport modes is enabled by development of mode change capacities (ports, logistic centres, etc.). Development of intermodal centres is crucial for the development of a sustainable transport system. For efficient transitions between modes, a network of inter-modal centres needs to be established, with sufficient capacity and the right equipment. This way, the formation of the logistic chain can be approximated to the use of transport modes that represent the most efficient trade-off between benefits and costs.

The result of freight diversion would also be an economic impulse that would be formed by the establishment of efficient logistic centres network. More accessible infrastructure with higher capacity would improve the connectivity between Central and SE Europe.

Scenario A, although it maintains existing relationships between freight transport modes at the level of individual countries, exhibits a relatively higher proportion of use of sustainable modalities across the whole of Southeast Europe. This is due to variation in economic growth between countries and the associated differential increase in freight traffic of individual countries. From Scenario A can be concluded that even with existing modal split, the choice of more sustainable modes in the European region would be relatively higher than today. This suggests that an active transport policy can divert freight traffic from road to other modes and thus achieve the objectives of sustainable development, as well as reduce the negative external effects of transport.

European transport policy actively influences the trend of moving freight from roads to other transport modes. The Marco Polo II programme is one of the most important tools of the European Union for the promotion of modal shift in freight transport. Funding of this program annually enables a shift of freight from road to other modes in the equivalent of having 700,000 heavy goods vehicles between Paris and Berlin reduced. This has positive environmental, economic and social impacts totalling billion of euros per year.

5 CONCLUSION

External costs of transport were assessed for the period from 2011 to 2020 for four traffic development scenarios on the SEETAC network:

- Scenarios SEETAC and SEETAC 0 consider basic economic and traffic growth, with the difference that Scenario SEETAC 0 uses an unaltered modal split.
- Scenarios A and T consider an accelerated economic growth due to the EU accession of candidate countries with consequently higher traffic growth, differing in fact that Scenario T anticipates an active sustainable transport policy.

Scenario SEETAC (in comparison with Scenario SEETAC 0) estimates the value of negative external effects of transport at 151 million EUR. The main reason is to be found in freight modal split, where Scenario SEETAC is more favourable to road than rail freight transport.

According to Scenario T (in comparison with scenario A) the value of external effects of transport is estimated at 5.25 billion EUR. In this case, the use of an active sustainable transport policy in Scenario T provided the migration of freight flows from road to rail (with a 95% increase in tonne kilometres on rail until the year 2020).

Such development is only possible with an infrastructure for shifting between modalities: intermodal centres at appropriate locations with adequate equipment and capacity.

Special attention needs to be drawn to the shift of freight from road to rail. In order for the shift to take place, the legal, institutional and financial framework for the construction of logistic centres in Southeast Europe needs to be set-up. These centres need to be efficient and competitive to road transport, so they will be able to deal with the surplus of freight transport due to rapid economic development of the area in the future.

From Slovenia's point of view and in accordance with findings, the usefulness and functionality of further construction of the intermodal logistic centre »Phoenix« at the Cerklje airport, which will according to plans allow four choices of travel modes (railway, airport, river and road), is confirmed. It is necessary to develop practical tools for monitoring the effects of traffic (both physical and monetary) on the economy and social development, while achieving a change in energy sources in transport (e.g. from diesel to electric traction) – from short- to long-term accessible energy sources. Electrification of rail links would also be a step towards the reduction in energy dependence.