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BANKABLE PAPER

EVALUATION OF WULKAPRODERSDORF-SOPRON LINE

(WP 6.4.1)

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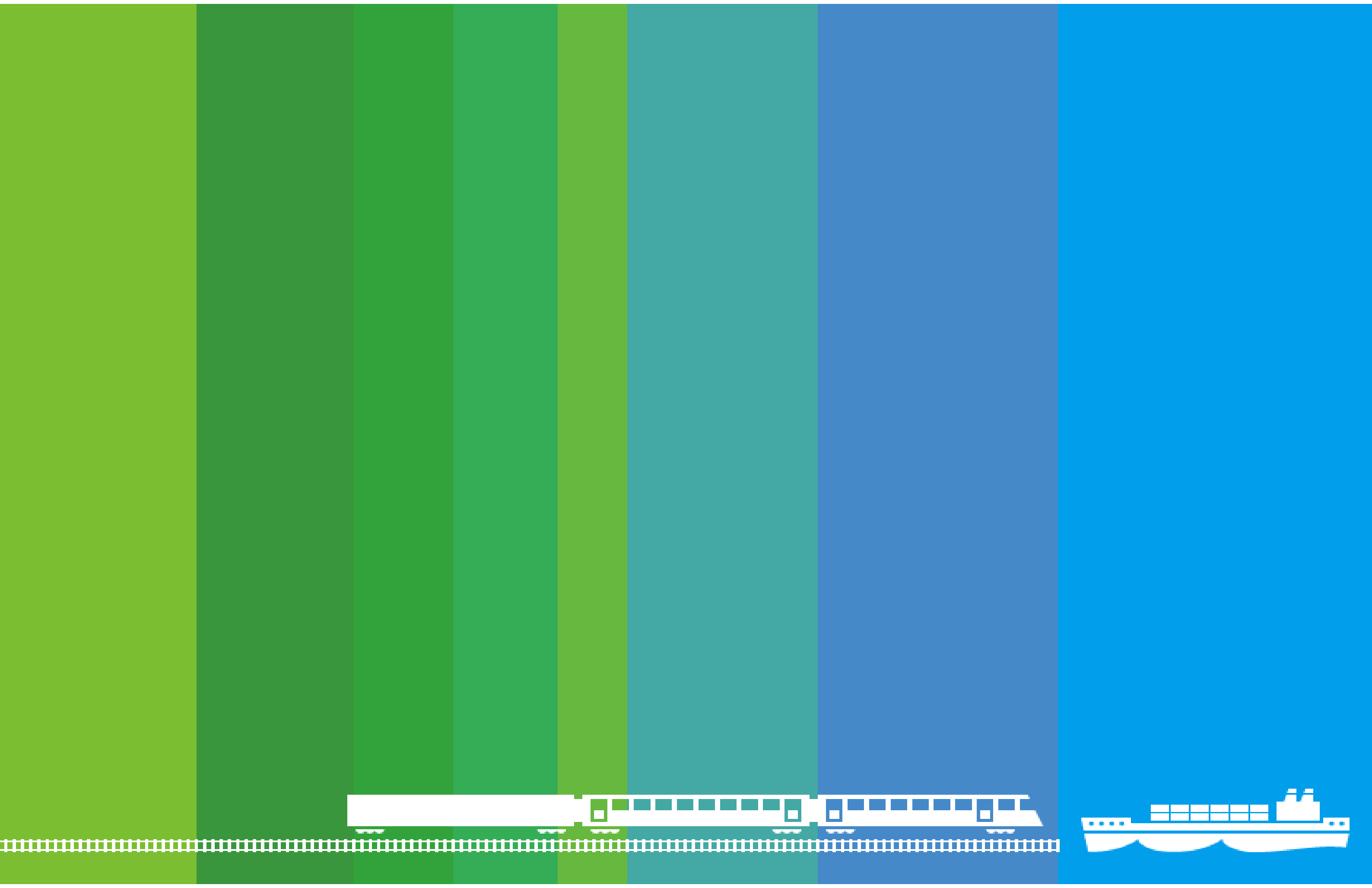

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1 Introduction

The project Sopron-Wulkaprodersdorf essentially consists of the straightening of the current route of the railway in this section, with a focus on avoiding very tight curve radii that prevent a qualitative and in terms of capacity better and faster rail link from Sopron to Eisenstadt and Vienna.

The pilot project „bankable paper“ for the upgrading of the line Sopron-Wulkaprodersdorf outlines the process necessary to implement a railway project in accordance with the requirements of the lending institutions (especially EU Funds, EIB).

Accordingly, this project contains:

- the procurement and delivery of all data bases necessary for the evaluation
- the results of a technical investigation to determine the investment costs
- the results and methods for calculating the passenger potentials, as well as the traffic impact of the project (modal split) as part of a feasibility study
- the methods and results of the evaluation
- recommendations for the present project

following the CBA guidelines (WP 6.4.2).

2 Context analysis and project objectives

2.1 Socio – economic context

The study area covers the entire northern Burgenland region and was structured according to the rail sections mentioned below, for which the influence of measures on the Sopron-Wulkaprodersdorf section cannot be excluded. Consequently the sections are:

- Eisenstadt –Sopron-Deutschkreuz (blue)
- Eisenstadt-Ebenfurth/Wulkaprodersdorf-Wien (pink)
- Sopron-Wr. Neustadt

were designated as the „core area“ of the study.

In 2013 the „core area” had a total population of around 75.000 people (total area: 150.000 inhabitants). With a growth rate of 11.3% from 2011 (the time of the last census) to 2013 the area of Eisenstadt-Ebenfurth has seen the highest population growth in the entire Burgenland region in this time frame. With approximately 8% the population increase in the area Sopron-Wulkaprodersdorf was only slightly smaller. Even the forecasted population growth rates (6% and 5.8%) will be significantly reduced from 2013 to 2020, the area of the two sections remains a very dynamic growth area. With the population growth the mobility needs of the population and the need for good public transport connections also increase, and commuting (professionals and students) plays a very important role in northern Burgenland. These commuters can be separated into:

- Commuters from the municipalities of Burgenland (2013: 22.500 commuters from the communities of the „core area“)
- Other Austrian commuters to major destinations in Burgenland (2013: 1.400 commuters to Eisenstadt)

The preliminary results of border cross survey (WU, TU Wien; KTI: EMAH Eco-mobility in the Austro-Hungarian border region, 2014) shows:

- Commuters in traffic across the border at Klingenbach (cross-border commuters 2013: 14.400).. The cross-border traffic is expected to have approximately doubled in the last 7 years; the share of public transport is relatively low (around 15%). The most important centre of commuting in the „core area” is Eisenstadt (20.000 trips), Vienna (17.000 trips) and Wr. Neustadt (7.500 trips).

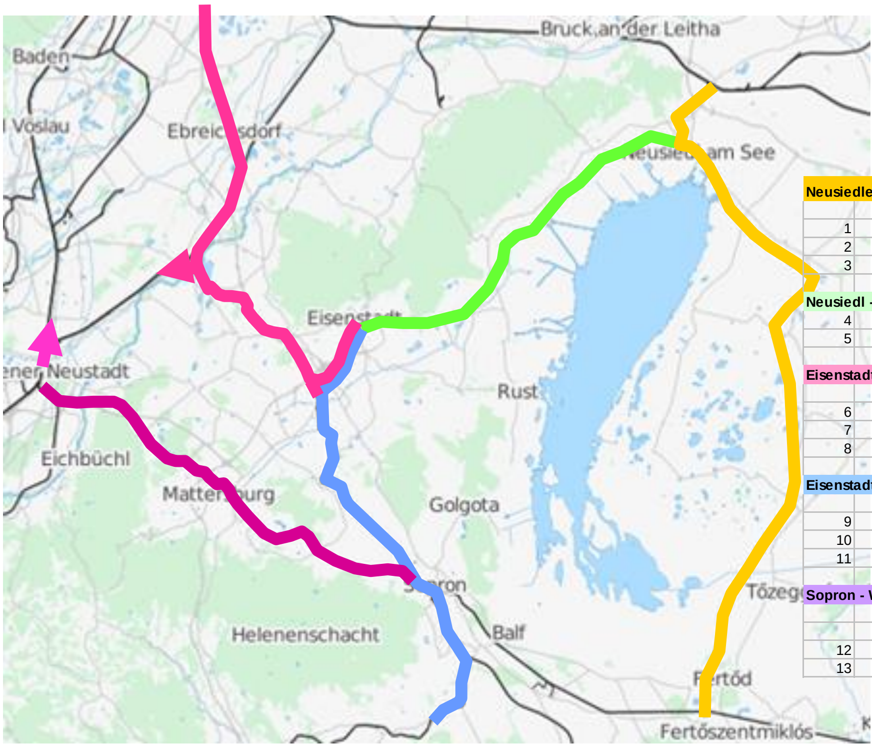
All these people carry out around 60.000 trips per day

Given the situation of a continuing increase in commuting, especially high growth in cross-border traffic, the goals of the present project and of the transport policy of Burgenland are:

- to improve the situation of public transport significantly through a sustainable improvement in transport services for railway transport

- to raise the transport share of public transport significantly, particular for the fast growing cross-border traffic
- to reduce the transport share of car traffic and thus traffic emissions in favour of public transport significantly

Figure 1: project area and railway sections



Neusiedler Seebahn		
	from/to Hungary	
1	Pamhagen-Frauenkirchen	
2	Frauenkirchen-vor Neusiedl	
3	Neusiedl-Parndorf	
Neusiedl - Eisenstadt		
4	Neusiedl-Donnerskirchen	
5	Donnerskirchen-Eisenstadt	
Eisenstadt - Ebenfurth		
	von Wien,Nö nach Eisenstadt	
6	Eisenstadt - Wulka	
7	Wulka - Müllendorf	
8	Müllendorf - Ebenfurth	
Eisenstadt -Sopron - Deutschkreutz(Neckenm.)		
	from/to Hungary	
9	Sopron - Wulka	
10	Deutschkreutz - Sopron (o.Neckenm)	
11	Neckenmarkt - Deutschkreutz	
Sopron - Wr.Neustadt		
	from/to Hungary	Mattersburg
12	Sopron - Mattersburg	
13	Mattersburg - Wr.Neustadt	

Source: TMC, 2014.

2.2 Definition of project objectives

The objectives of the project are primarily focused on the development of the railway, adjusted to regional traffic demand. In particular, the rapidly increasing border crossing traffic should be developed as a competitive alternative to private individual transport. The objectives of the project can be summarised as follows:

- Improvement of railways for regional passenger traffic
- Development of railway as a competitive alternative to private individual transport for trans-border trips
- Contribution to an integrated transport system
- Improvement of regional accessibility
- Improvement of effectivity of railway operation

2.3 Consistency with EU and national frameworks

The following objectives are mentioned by the European Union in relation to regional transport (White Paper 2011):

- Promotion of accessible, environmentally friendly transport services
- The recognition and organisation of public transport
- A change of modal shift towards public transport (art.31)

The Burgenland transport concept 2002 sets the following objectives for transport in Burgenland:

- sustainable improvement of the international accessibility of Burgenland by road, rail and air traffic
- ensure and improve the quality of life in Burgenland through sufficient environmentally and cost-efficient mobility of population and economy
- securing the use of regional development opportunities that arise from expected changes in general conditions by site-specific, adequate transport services for freight and passenger transport
- creation of the necessary transport infrastructure to enable optimum transport service for the implementation of regional and economic development programs in Burgenland
- targeted mobility service in public transport, which is tailored to user groups and operationally optimised

The objectives of the project are consistent both with those of the EU as well as with the national transport planning. The objectives correspond to the definition of the project.

3 Project identification

The project should show specific properties in relation to the above mentioned objectives: rail operations and the implementation of the transport policy objectives of the country. It should

- allow a shortening of travel time, which makes it possible not only to implement the proposed symmetrical rail hub Eisenstadt, but also to install a symmetrical rail hub in Sopron
- to enable an non existing transfer-free connection between Eisenstadt and Sopron

Accordingly it will be necessary

- to improve the existing railway infrastructure (extension of existing railway infrastructure)
- to significantly increase the capacity and allowable maximum line speed (increase railway capacity)

Functional type of investment

- To identify accompanying measures for the realisation of optimal connections between bus and train in order to take advantages of faster rail link through coordinated railway connections in the area (improved use of existing network(railway nodes)) and maximise the impact of accessibility improvement in regional traffic (improving accessibility for public transport)
- The measures of the project should also help to reduce the operating costs of rail transport and the operating costs of infrastructure (decrease railway operation costs)

4 Technical Study and Feasibility study

For determining the capital cost of the project, one did fall back to the study EWESO which was adjusted accordingly. For the feasibility study one could fall back to the counts and forecasts of Statistics Austria, as well as to traffic counts (EMAH) which for the first time contain comprehensive information on the cross-border traffic

4.1 Technical Study

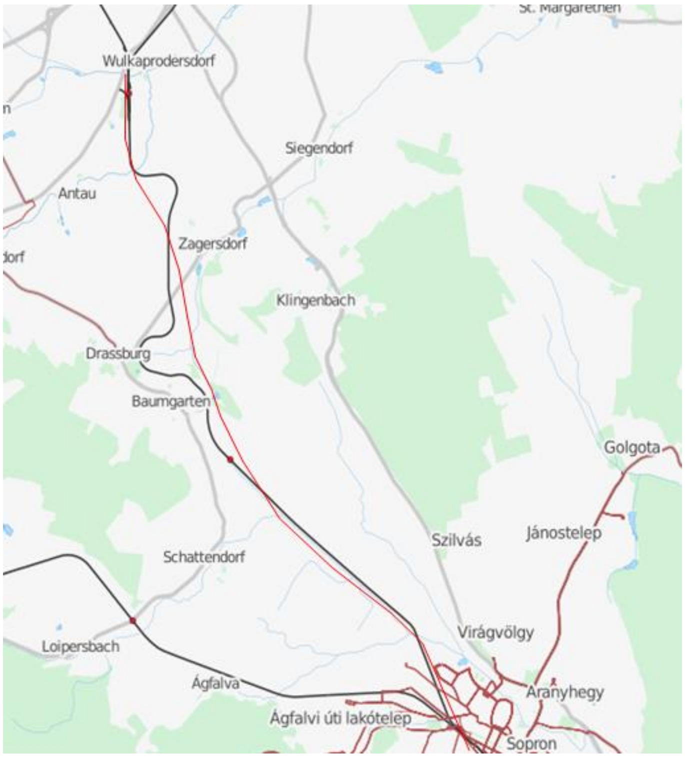
The EWESO study (RoeEE AG+HL AG: High-level rail link Wampersdorf-Eisenstadt-Sopron, Vienna 2000) was the basis of the estimation of investment costs. The object of investigation was the straightening of the route of the railway section Sopron-Wulkaprodersdorf.

Reference case (alternative 2020/0):

- The situation (2020/0) in the section Sopron - Wulkaprodersdorf –(Ebenfurth) is considered as a reference case, according to the 2020 planned program of measures of Raaberbahn (situation of railway network according to the national planned measures) and the Austrian Federal Railways. Further it is assumed that the loop Eisenstadt is completed and Eisenstadt has been established as a symmetrical rail hub.
- An explicit reference to measures of the international project SETA is not required, because the project is limited to regional passenger traffic only. The identified, existing international passenger and freight services in SETA will be adopted.

4.1.1 Calculation of investment costs

Figure 2: The project: Alignment of a new railway track Wulkaprodersdorf – Sopron (15.5 km)



Source: TMC, 2014.

For the calculation it was possible to use maps in scale 1:25.000, as well as detailed descriptions of the site and the measures. From 5 possible routes alternatives the relatively close to existing route was used as the basis of assessment of the investment costs. In a first step it was necessary to reduce the cost parameters of a high-level rail link of the EWESO study to the appropriate extent of a railway with 120-160 km/h. Subsequently the necessary path corrections as well as the length sections of the individual „stages of construction“ and the labour costs necessary for the creation of these phases of construction were calculated in terms of costs according to unit values. The conditions applied for the individual sections are:

1. **Section Wulkaprodersdorf-Sopron Deli (km 15,800-29,401) without Wulkaprodersdorf station**
    - Single track section design, layout according to EWESO variant 5
    - Stop Drassburg/Baumgarten, single track

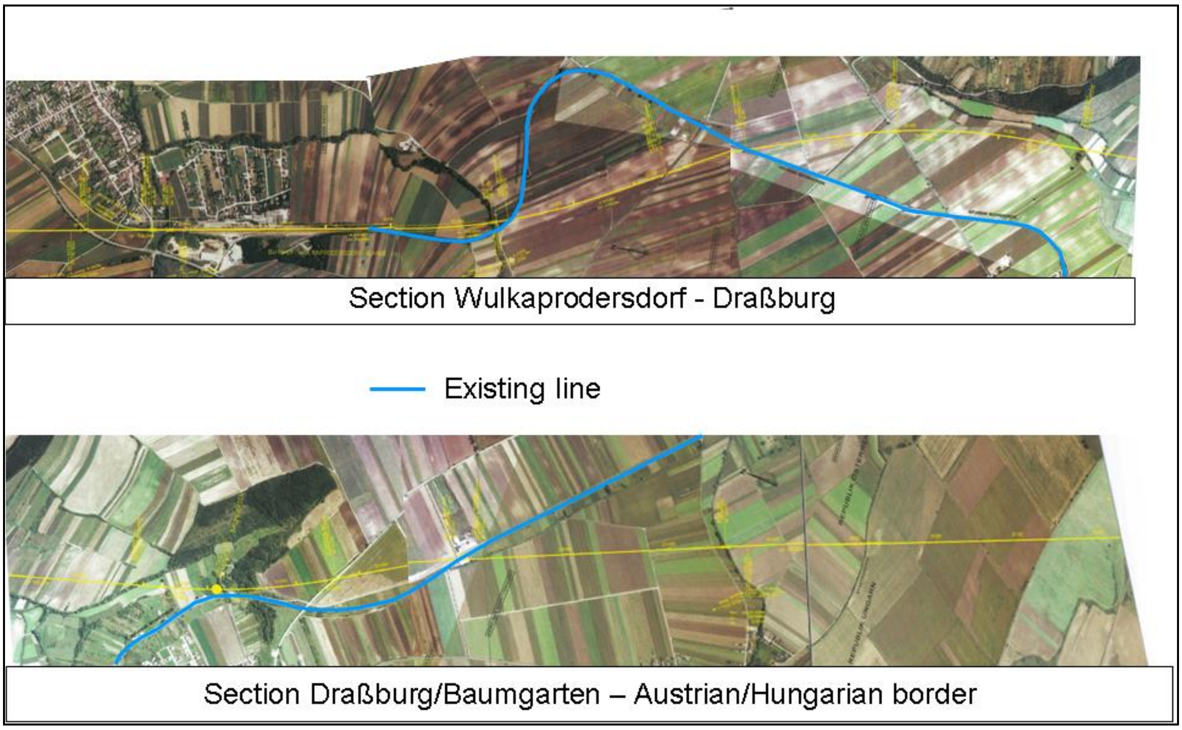
   Prerequisite:

    - Today´s system is maintained, intersections/nodes in Wulka (for maintenance of 2 platform edges, with a 3 edge or by means of signal protection solution, trains are handled from/to Eisenstadt)
    - Loop Eisenstadt is implemented in today´s planning
    - Route 195 Wulkaprodersdorf-Eisenstadt remains existing

- Construction of new safety technology on the Raaberbahn, especially Wulkaprodersdorf under 7.MIP/8.MIP, services advertised and awarded in option
- Extension of station Wulkaprodersdorf (2 tracks) for freight train crossings (scheduled for 8. MIP)
- Construction of new platforms in Wulkaprodersdorf (scheduled for 8.MIP)

2. **Rebuilding of railway station Wulkaprodersdorf**
    - Measures required by SETA (extension platform at 400m, pedestrian tunnel, adaptation of safety technology
3. **Section Neufeld-Müllendorf**
    - Evasive track Steinbrunn + additional route block at km 112.0
4. **Other conditions**
    - V-increase between Wulkaprodersdorf and Müllendorf should be realised in 7th MIP (with construction of loop Müllendorf)
    - V-increase on the existing line Neufeld-Müllndorf should be realised in 7th MIP (with track renewal 2013/14)
    - Installation of protection signals in station Müllendorf for doubling(trains of Raaberbahn with trains from Eisenstadt)possible with new security technology
    - Track between Wulkaprodersdorf-Müllendorf-Neufeld remains existing, except evasive track Steinbrunn

Figure 3: Alignment of the new railway track Wulkaprodersdorf - Sopron (EWESO, 2000)



Source: TMC, 2014.

As a result of the cost estimate the following monetary expenses were calculated:

Table 1: Investment costs: Sopron – Wulkaprodersdorf - Ebenfurth

Investment costs: route straightening Sopron - Wulkaprodersdorf - Ebenfurth	
SECTIONS	Costs EUR
Section Neufeld- Müllendorf	**26.385.000**
Section Bahnhof Wulkaprodersdorf	**8.200.000**
Section Wulkaprodersdorf- Hst. Drassburg/Baumgarten	**32.279.865**
Section Hst. Drassburg/Baumgarten	**640.000**
Section Hst. Drassburg/Baumgarten- Staatsgrenze	**22.758.965**
ZWISCHENSUMME Abschnitt Sopron- Wulkaprodersdorf Übergreifend	**16.904.200**
Section Staatsgrenze- Sopron Deli	**17.761.170**
Section Sopron Deli	**200.000**
Section Sopron Deli- Bf. Sopron	**200.000**
Total	**125.329.200**

Source: TMC, 2014.

4.1.2 Calculation of infrastructure maintenance costs

In the area of the new line, state border – Wulkaprodersdorf, the unit rates of maintenance costs are expected to increase by 20%, as increased spending in maintenance will be expected due to a higher proportion of structural engineering /dams/cuts. The higher part of ETCS components and structural engineering will cause in an increase of renovation costs by 10%. In these increases the higher train density was taken into account. In the area of the existing line Wulkaprodersdorf-Neufeld/Leitha growing of of maintenance costs by 10% is expected, due to 3 tracks at evasion Steinbrunn. Renovation costs in this section was increased by 5% (ETCS components at evasion Steinbrunn). These increases also take into account the higher train density of alternative 2020/1.

Table 2: Infrastructural and maintenance costs

Element	Section	Costs/section
Construction, renewing, security and signalling	**Section Neufeld/Leitha-Wulkaprodersdorf, Total**	**1.229.531,35**
Construction, renewing, security and signalling	**Section HU-AT border-Wulkaprodersdorf, Total**	**787.883,60**
Construction, renewing, security and signalling	**Section HU-AT border - Sopron Deli, Total**	**174.567,33**
	all Sections	2.191.982,28

Source: TMC, 2014.

4.1.3 Calculation of network operation costs

In the area of network operating between Neufeld/Leitha and the state border (Austria) the Raaberbahn's total costs of network operation were determined based on the known number of dispatchers and overhead personnel in Wulkaprodersdorf. Restructuring in the field of dispatchment in Wulkaprodersdorf resulting out of the merger of the dispatchments of NSB+Roee as well as the automatisation (ARAMIS etc.) and the resulting estimated savings equalling 600.000 EUR by 2025 have been considered. In the area of network operating between Sopron Deli and the state border, the dispatch administration that provides service in Sopron is therefore responsible for the entire route Sopron-Neufeld/Leitha was considered.

Table 3: Network operation costs

Network operation costs			
Element	Section	km	network operation costs (EUR)
Network operation costs Austria 2015	Neufeld/Leitha- Staatsgrenze	24,60	1.750.000,00
Network operation costs Austria 2020/0		24,60	1.320.000,00
Network operation costs Austria 2020/1		24,60	880.000,00
Network operation costs Hungary 2020/1	Staatsgrenze- Sopron Deli	4,84	103.575,32
Dispatcher Sopron (Neufeld- Sopron Deli)	Neufeld/Leitha- Sopron Deli	29,43	19.425,45

Source: TMC, 2014.

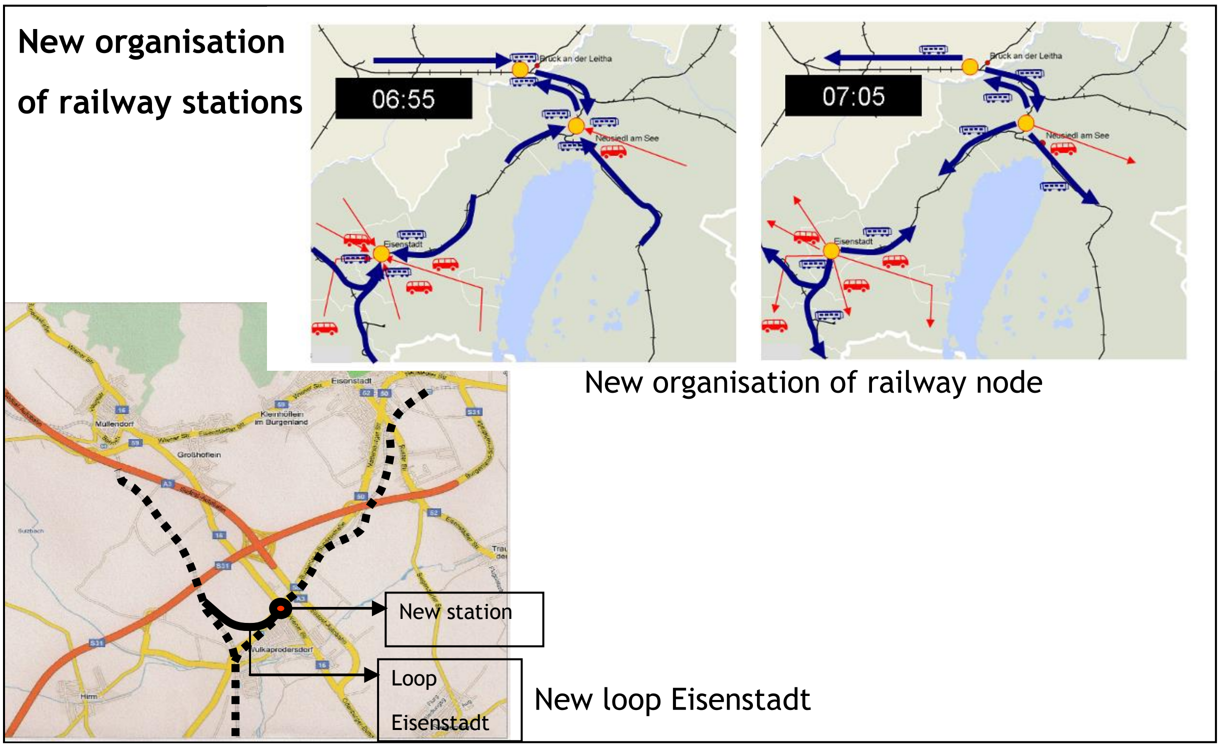
Network operation costs for the new line are calculated to be 33% cheaper than for the „old“ line.

4.2 Railway operational program

The current transport service for rail transport is dominated by the system of symmetrical hub nodes in Neusiedl and Wulkaprodersdorf, which means that a change at this node is possible in both directions by the simultaneous arrival of all trains. As Eisenstadt is currently not a hub node, no continuous change-free connections between Sopron and Eisenstadt are possible, which – given the short distance (appr. 17km) - already represents a significant disadvantage for users. The infrastructural measures in this field will cause a significant improvement in this area as well. In a future operating program the following pints need to be considered:

- the planned start of loop Eisenstadt in 2015
- the then planned implementation of a symmetrical hub node in Eisenstadt and the orientation of the urban and regional bus traffic to the hub node (the impact of the measure on the use of the railway was not included in the calculation)

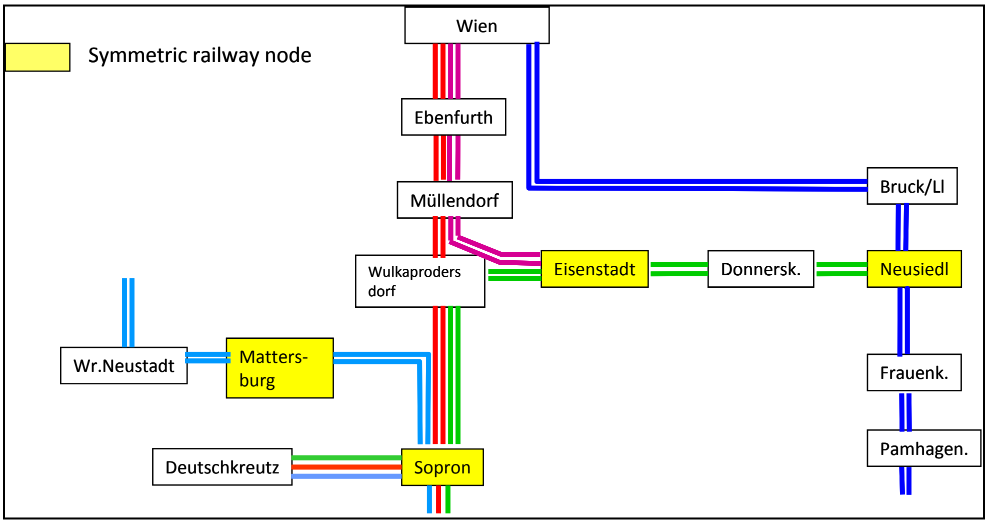
Figure 4: Measures to be considered within the operational program



Source: TMC, 2014.

As a main organizational measure a change in the operating program is to be provided, which schedules direct connections between Sopron and Eisenstadt. This program was technically rated as feasible. The concept schedules a ½ hour hub at weekday morning peak hour to Eisenstadt, Vienna and on the track Sopron-Wr. Neustadt also a ½ hour hub to Wr. Neustadt

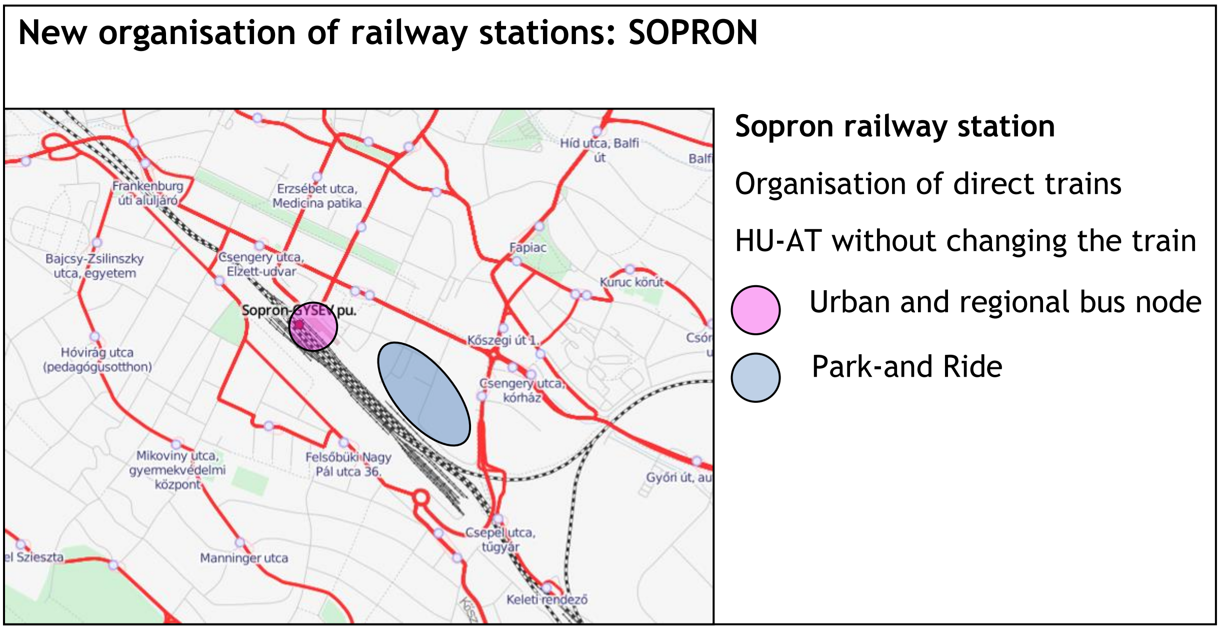
Figure 5: operational program 2020; railway connections/ hour (morning)



Source: TMC, 2014.

In addition to these organizational measures a significant improvement of the access road to Sopron station should be envisaged. The reduction in travel time between Eisenstadt and Sopron should allow to set up the train station as an important public transport centre and to establish a link with the urban and regional bus services not only in Eisenstadt but also in Sopron. Also the installation of a P+R car park at Szombathely railway station shall be provided (currently there are only limited parking zones). Under these conditions modal split in rail transport can be achieved which are substantially higher than those that were calculated in the traffic forecast (where such measures were not considered).

Figure 6: recommended organisational measures for Sopron railway station



Source: TMC, 2014.

As a result of the calculations from the operating program the numbers of required passenger trains were used as the basis for determining the operation costs for rail traffic, as well as the calculation of the revenue from the infrastructure access fee.

Table 4: Operation costs of rail operation and infrastructure revenues

	Operation costs of rail operations		Infrastructure revenues (access charge)/year (EUR)
	Number of trains (additive to 2013)	operation costs/year (EUR)	
Alternative 2020/0	4	947.000	374.665
Alternative 2020/1	10	2.108.000	936.663

Source: TMC, 2014.

4.3 Feasibility Study

The aim of the feasibility study is to estimate on the one hand the transport potential and its future development, and on the other hand to provide all data bases for the evaluation of the measures (quantity structure). Accordingly, as part of the feasibility study, the following steps were carried out:

- Calculation of transportation demand (existing, transportation forecast)
- Calculation of impact of measures on modal shift (reduction of no. of cars)
- Operation program (number of trains, schedule density) additional organisational measures and calculation of operational costs of railway operation
- Calculation of infrastructure revenues (access charges)
- Calculation of revenues from passenger tariffs

4.3.1 Calculation of transport demand

First of all, the project will bring benefits to regional traffic. Based on the available data it is not possible to detect all weekday traffic purposes in regional traffic. During rush-hour traffic and school transport sufficient data bases are available for transport purposes, but there is almost a complete lack of information concerning weekday traffic purposes such as:

- leisure traffic
- shopping transport
- business trips
- purchases
- visitor traffic

This is disadvantageous as around 50% of traffic concerns private transport trips and trips for extracurricular purposes. In public transport these trips play a subordinate role, not more than 20% of public transport journeys are be undertaken outside profession or education. (Amt der oö.Landesregierung: Oö. Verkehrserhebung 2001, Linz 2004; BMVIT: Verkehrsprognose Österreich 2025+; Wien 2009))

It can therefore be assumed for calculation purposes that the restriction to work and school traffic is able to reproduce the general capacity requirements of trains and buses in regional weekday traffic.

A further restriction was made regarding the objectives. Rail services do not usually operate mostly short distance traffic, transport over medium and large distances are the „principal market“ for trains in regional passenger traffic. This is also confirmed by the analysis of target traffic at rush hours 2011 (WU, TU Wien; KTI: EMAH Eco-mobility in the Austro-Huangarian border region, 2014)

- for the 32% of the entire rush-hour traffic of the study area (northern Burgenland) the destination is Vienna, in rail transport however 87%
- Eisenstadt was the destination for 19% of commuters , in railway traffic only for 2%

- Wr. Neustadt was the destination for 8.7% of commuters from the northern Burgenland, in railway traffic only for 2.5%

The Hungarian centres Sopron and Mosonmagyarovar are destinations of Burgenland commuters. However, reliable figures are not available.

In total the three centres of Vienna, Eisenstadt and Wr. Neustadt represent the main destinations for around 60% of all trips of Burgenland commuters, but for 91.5%! of the railway trips: To capture almost all train journeys it is sufficient to restrict the commuter destinations within the origin-destination-matrix of journeys in rush-hour traffic and student traffic on the following three destinations:

- Vienna
- Eisenstadt
- Wr. Neustadt

Cross-border weekday passenger traffic is of great importance for the traffic volume in northern Burgenland. There are first preliminary results from the ETZ-project EMAH: project for eco-mobility in the Austrian-Hungarian border region (2012-2015) on cross-border passenger transport. At the border crossing Klingenbach in 2013 approximately 30.000 daily trips were conducted, of which:

- 53% had the destination Vienna
- 29% Wr.Neustadt and Vienna-surrounding areas
- 22% Eisenstadt

This traffic has increased rapidly for Hungarian workers with the opening of the labour market in Austria 2011. Continuing traffic growth – although not to the same extent as in the past 7 years (in this time the cross-border traffic is expected to have approximately doubled) can be expected by 2020.

The cross-border traffic flows are handled mainly by car. Railway accounts for only around 15% of cross-border traffic. This is due to the given relatively long distance to Vienna and basically well-developed rail traffic destinations Wr. Neustadt and (to a lesser extent) Eisenstadt, an surprisingly low value.

In comparable relations (Seewinkel-Vienna), the traffic split of rail is around 45%.

4.3.2 Development of regional traffic

The development of traffic in regional transport is dominated by the development of commuting. It is based on

- The development of the resident population, in particular the labour force (or employment) based on the population forecast ÖROK (Austrian Conference on Spatial Planning: Small area population forecast for Austria from 2010 to 2030, Vienna 2010)
- in the entire study area, the population will increase by 3.5% from 2010-2030
- the number of workers on the other hand increases only by 2.3%

- due to the fact that the community of commuters make up an ever increasing share of the labour force, the number of commuters will increase by approximately 4.9%

The development in cross-border traffic is hard to assess - it was therefore assumed that the growth is in line with the average development rates of Austrian commuting. This is a very conservative estimate in relation to developments so far.

Table 5: Population development and development of commuting 2013 - 2020

		Population development 2001 - 2020					Commuter development 2013 - 2020 *		
		Population (no.of persons)			Development in %		no. of persons		developm.in%
		2001	2013	2020	2001-2013	2013-2020	2013	2020	2013 -2020
Neusiedler Seebahn									
1	Pamhagen-Frauenkirchen	13.497	12.533	12.051	-7,1	-3,8	1.572	1.701	8,2
2	Frauenkirchen-vor Neusiedl	14.429	15.135	15.488	4,9	2,3	1.830	1.858	1,5
3	Neusiedl-Parndorf	18.760	22.593	24.509	20,4	8,5	3.700	3.808	2,9
Neusiedl - Eisenstadt									
4	Neusiedl-Donnerskirchen	12.450	13.039	13.360	4,7	2,5	2.701	2.771	2,6
5	Donnerskirchen-Eisenstadt	6.143	6.216	6.259	1,2	0,7	1.732	1.799	3,9
Eisenstadt - Ebenfurth									
	from Wien,NÖ to Eisenstadt						1.290	1.393	8,0
6	Eisenstadt - Wulka	9.808	9.889	9.937	0,8	0,5	2.754	2.852	3,6
7	Wulka - Müllendorf	6.270	6.560	7.062	4,6	7,7	1.865	2.019	8,2
8	Müllendorf - Ebenfurth	11.422	12.709	13.473	11,3	6,0	3.719	3.990	7,3
Eisenstadt -Sopron - Deutschkreutz(Neckenm.)									
	from Hungary						3.098	3.262	5,3
9	Sopron - Wulka	2.835	3.063	3.239	8,0	5,8	809	847	4,7
10	Deutschkreutz - Sopron (o.Neckenm)	6.791	6.433	6.395	-5,3	-0,6	683	709	3,8
11	Neckenmarkt - Deutschkreutz	4.051	3.987	3.980	-1,6	-0,2	499	519	3,9
Sopron - Wr.Neustadt									
	from Hungary						1.302	1.315	1,0
12	Sopron - Mattersburg	8.471	8.410	8.356	-0,7	-0,6	1.598	1.635	2,3
13	Mattersburg - Wr.Neustadt	22.312	24.055	25.600	7,8	6,4	4.922	5.254	6,7
	Total	**137.239**	**144.622**	**149.710**	**5,4**	**3,5**	**34.075**	**35.732**	**4,9**
	* to the main centres Eisenstadt, Wr.Neustadt, Vienna								

Source: Statistik Austria, TMC, 2014.

4.3.3 Transportation demand by means of transport

Based on statistical surveys and forecasts the modal choice for the most important centres by mode of transport for the „core area” and the entire study area were calculated:

Recent situation (2013)

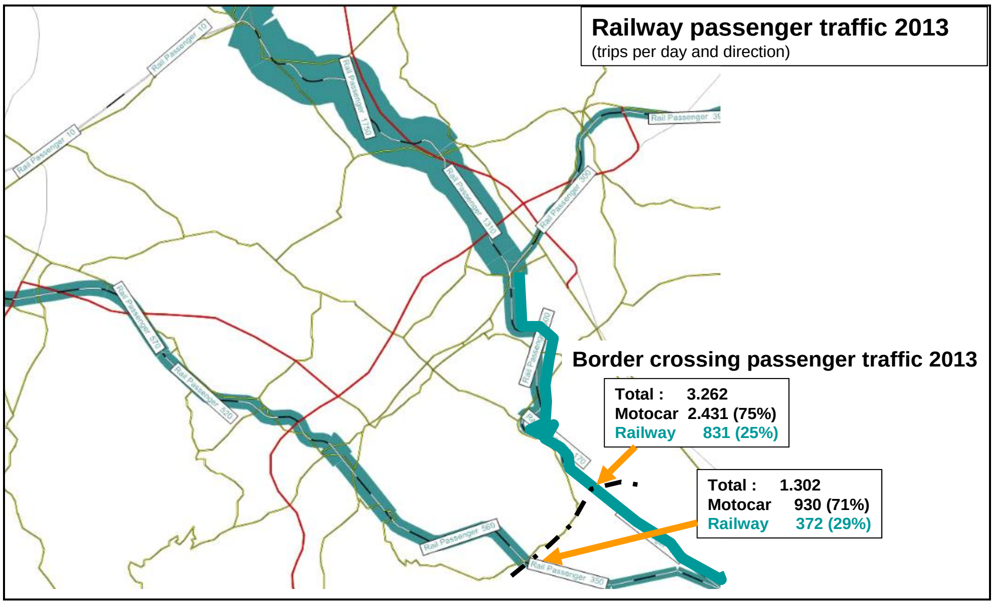
Table 6: Calculation of daily trips to the main centres by means of transport 2013 for the whole project area and the “Core Area”)

	Eisenstadt					Wiener Neustadt					Wien				
	Car	Bus	Railway	Others	Total	Car	Bus	Railway	Others	Total	Car	Bus	Railway	Others	Total
Neusiedler Seebahn	696	84	243	10	1.033	27	0	2	0	29	6.110	1.353	5.601	79	13.142
Neusiedl - Eisenstadt	3.363	1.371	108	69	4.912	100	37	2	0	139	1.988	116	1.664	48	3.816
Eisenstadt - Ebenfurth	9.311	3.856	182	259	13.607	686	266	19	4	975	2.939	433	1.257	46	4.674
Eisenstadt -Sopron - Deutschkreutz	2.632	299	409	13	3.353	213	41	119	0	372	4.123	170	2.152	8	6.453
Sopron - Wr.Neustadt	3.171	616	8	14	3.809	3.783	1.056	1.160	58	6.058	3.623	408	1.697	51	5.779
Total	19.172	6.227	951	365	26.714	4.809	1.400	1.302	62	6.403	18.782	2.479	12.370	232	32.430
Eisenstadt - Ebenfurth	9.311	3.856	182	259	13.607	686	266	19	4	975	2.939	433	1.257	46	4.674
Eisenstadt -Sopron - Deutschkreutz	2.632	299	409	13	3.353	213	41	119	0	372	4.123	170	2.152	8	6.453
Sopron - Wr.Neustadt	3.171	616	8	14	3.809	3.783	1.056	1.160	58	6.058	3.623	408	1.697	51	5.779
	15.114	4.771	599	286	20.770	4.682	1.363	1.298	62	7.405	10.684	1.010	5.106	105	16.905
Eisenstadt - Ebenfurth	68,4	28,3	1,3	1,9	100,0	70,3	27,3	2,0	0,4	100,0	62,9	9,3	26,9	1,0	100,0
Eisenstadt -Sopron - Deutschkreutz	78,5	8,9	12,2	0,4	100,0	57,2	10,9	31,9	0,0	100,0	63,9	2,6	33,3	0,1	100,0
Sopron - Wr.Neustadt	83,2	16,2	0,2	0,4	100,0	62,5	17,4	19,1	1,0	100,0	62,7	7,1	29,4	0,9	100,0
	72,8	23,0	2,9	1,4	100,0	63,2	18,4	17,5	0,8	100,0	63,2	6,0	30,2	0,6	100,0

Source: TMC, 2014.

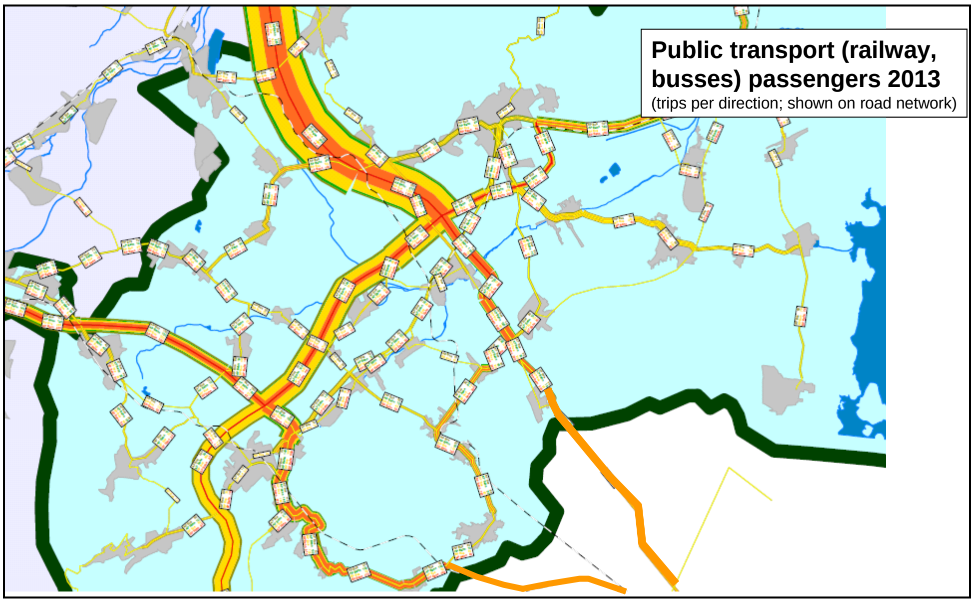
If we restrict ourselves to the results of the core area it can be seen that the main destination for commuters and students is the capital of Burgenland – Eisenstadt. Only second is the dominant commuter destination for northern Burgenland, Vienna. The dominant transportation is by car. Currently the train only plays an important role with respect to driving to Vienna. For trips to Eisenstadt the railway in total plays only a minor role (see Table 6). This is an indication that the rail links to Eisenstadt are not particularly attractive. The traffic load of trains in both regional passenger rail lines shows the relatively high importance of the line Sopron-Ebenfurth in the execution of trips to Vienna. The entire public transport load also makes it quite clear, that the bus has a very high importance in the daily traffic of Burgenland. However, cross-border bus services do not exist. Thus, the railway remains the only efficient means of public transport.

Figure 7: Railway passenger traffic 2013



Source: TMC, 2014.

Figure 8: Public transport (railway and busses) 2013



Source: TMC, 2014.

4.3.4 Development 2013 - 2020

The development of traffic is closely linked with the development of commuting. For 2020 the alternative 0 is also the reference case, which only includes those measures provided for in the existing development plans up to 2020, and thus no major infrastructure projects. Between 2013 and 2020 the traffic in the area of the „core zone" to the selected centres will grow at different heights:

- Journeys to Eisenstadt will increase by about 1.300 trips, an increase of 6.2%
- Increase of journeys to Vienna will be lower, 900 additional trips means an increase of 4.9%
- The highest increase of journeys is expected to Wr. Neustadt, 530 additional trips represent an increase of 7%

In the choice of transport mode, trips in private transport may increase at a total of about 1800; in modal split little will change however.

Table 7: Calculation of daily trips to the main centres by means of transport 2010/0 for the whole project area and the "Core Area")

Daily Regional Traffic 2020/0 (daily trips)															
Project area	Eisenstadt					Wiener Neustadt					Wien				
	Car	Bus	Railway	Others	Total	Car	Bus	Railway	Others	Total	Car	Bus	Railway	Others	Total
Neusiedler Seebahn	714	87	246	10	1.057	28	0	2	0	30	6.337	1.426	5.804	82	13.648
Neusiedl - Eisenstadt	3.491	1.420	109	73	5.092	103	39	2	0	144	2.036	120	1.699	49	3.904
Eisenstadt - Ebenfurth	9.902	4.120	202	278	14.502	726	285	21	5	1.036	3.111	462	1.349	49	4.971
Eisenstadt -Sopron - Deutschkreutz	2.773	313	428	13	3.527	222	42	123	0	388	4.321	177	2.252	8	6.758
Sopron - Wr.Neustadt	3.337	649	8	15	4.009	4.076	1.123	1.251	62	6.512	3.748	429	1.788	54	6.019
Total	20.217	6.588	993	389	28.187	5.155	1.490	1.399	66	8.110	19.551	2.615	12.891	242	35.300
Core area, absolut															
Eisenstadt - Ebenfurth	9.902	4.120	202	278	14.502	726	285	21	5	1.036	3.111	462	1.349	49	4.971
Eisenstadt -Sopron - Deutschkreutz	2.773	313	428	13	3.527	222	42	123	0	388	4.321	177	2.252	8	6.758
Sopron - Wr.Neustadt	3.337	649	8	15	4.009	4.076	1.123	1.251	62	6.512	3.748	429	1.788	54	6.019
Total	16.012	5.082	638	307	22.038	5.024	1.451	1.395	66	7.936	11.179	1.069	5.389	111	17.748
Core Area, modal split															
Eisenstadt - Ebenfurth	68,3	28,4	1,4	1,9	100,0	70,1	27,5	2,0	0,4	100,0	62,6	9,3	27,1	1,0	100,0
Eisenstadt -Sopron - Deutschkreutz	78,6	8,9	12,1	0,4	100,0	57,3	11,0	31,7	0,0	100,0	63,9	2,6	33,3	0,1	100,0
Sopron - Wr.Neustadt	83,2	16,2	0,2	0,4	100,0	62,6	17,3	19,2	0,9	100,0	62,3	7,1	29,7	0,9	100,0
	72,7	23,1	2,9	1,4	100,0	63,3	18,3	17,6	0,8	100,0	63,0	6,0	30,4	0,6	100,0

Source: TMC, 2014.

4.3.5 Impact of project measures on choice of transport mode

The traffic model VISA calculates the impact of measures on the choice of transport and on the rides induced by the measures. Key measures that have been taken into account in the calculation were (alternative 2020/1):

- The reduced travel time by the measures in the railway traffic. For all ongoing rail connections on the line Sopron-Wulkaprodersdorf the travel time improved by about 10 minutes.
- The introduction of a direct connection Sopron-Eisenstadt and better transport links in the feeder traffic to the Sopron train station. With the loop Ebenfurth (2020) the travel time will be reduced by a further 7 minutes, which is particularly important for trips to Vienna. To this extent

the calculated rides reflect a minimum of the effects of the measures. Induced trips were calculated in the first place to Eisenstadt at around 1.200 additional trips. Clear is the increase in rail traffic:

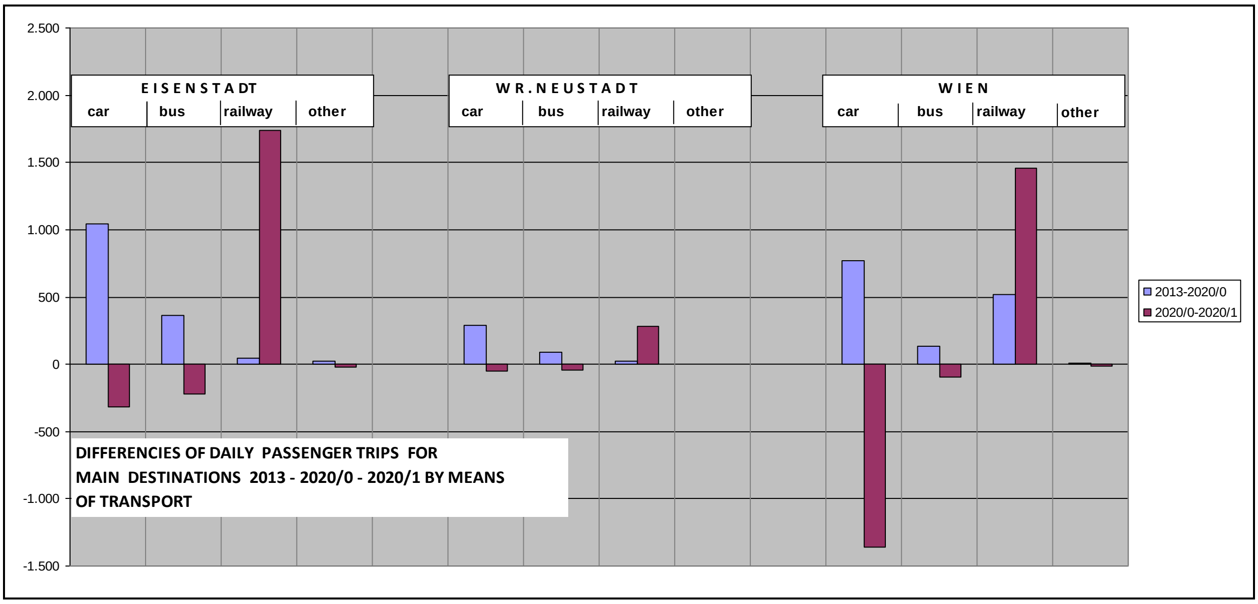
- for the „core area an increase of 3.500 daily trips in rail traffic was calculated as a result of the above measures, which would mean an increase of rail transport in the „core area“ by 44% (!)
- the main part of this increase can be expected in the traffic to/from Eisenstadt. The travel time savings of around 10 minutes and 2 through train connections per peak hour would increase the train rides to Eisenstadt by about three times, train rides to Vienna would increase by 27%, those to Wr. Neustadt by 14%. Accordingly a reduction of car traffic would be expected by around 6%. Small losses would also be expected in bus traffic.

Table 8: Calculation of daily trips to the main centres by means of transport 2020/1 for the whole project area and the “Core Area”)

Daily Regional Traffic 2020/1 (daily trips)															
Project area	Eisenstadt					Wiener Neustadt					Wien				
	Car	Bus	Railway	Others	Total	Car	Bus	Railway	Others	Total	Car	Bus	Railway	Others	Total
Neusiedler Seebahn	714	87	246	10	1.057	28	0	2	0	30	6.337	1.426	5.804	82	13.648
Neusiedl - Eisenstadt	3.491	1.420	109	73	5.092	103	39	2	0	144	2.036	120	1.699	49	3.904
Eisenstadt - Ebenfurth	9.457	3.936	849	260	14.502	709	278	45	5	1.036	2.825	423	1.679	45	4.971
Eisenstadt -Sopron - Deutschkreutz	2.182	287	1.046	12	3.527	215	40	133	0	388	3.500	165	3.086	7	6.758
Sopron - Wr.Neustadt	4.057	640	478	15	5.189	3.987	1.087	1.425	60	6.558	3.497	389	2.084	49	6.019
Total	19.901	6.369	2.729	370	29.367	5.041	1.444	1.607	64	8.156	18.194	2.523	14.351	232	35.300
Core area, absolut															
Eisenstadt - Ebenfurth	9.457	3.936	849	260	14.502	709	278	45	5	1.036	2.825	423	1.679	45	4.971
Eisenstadt -Sopron - Deutschkreutz	2.182	287	1.046	12	3.527	215	40	133	0	388	3.500	165	3.086	7	6.758
Sopron - Wr.Neustadt	4.057	640	478	15	5.189	3.987	1.087	1.425	60	6.558	3.497	389	2.084	49	6.019
Total	15.696	4.862	2.373	287	23.218	4.910	1.405	1.602	64	7.982	9.822	976	6.849	101	17.748
Core Area, modal split															
Eisenstadt - Ebenfurth	65,2	27,1	5,9	1,8	100,0	68,4	26,9	4,3	0,4	100,0	56,8	8,5	33,8	0,9	100,0
Eisenstadt -Sopron - Deutschkreutz	61,9	8,1	29,7	0,3	100,0	55,4	10,4	34,2	0,0	100,0	51,8	2,4	45,7	0,1	100,0
Sopron - Wr.Neustadt	78,2	12,3	9,2	0,3	100,0	60,8	16,6	21,7	0,9	100,0	58,1	6,5	34,6	0,8	100,0
	67,6	20,9	10,2	1,2	100,0	61,5	17,6	20,1	0,8	100,0	55,3	5,5	38,6	0,6	100,0

Source: TMC, 2014.

Table 9: Daily passenger trips: difference 2013 -2020/0 – 2020/1 by means of transport (Source: TMC 2014)



Source: TMC, 2014.

4.3.6 Tariff revenues

As a result of changes in the modal choice and the expected increase in rail traffic the tariff revenues that are generated by these additional rides can be roughly calculated. Subsidies and tariff subsidies were not considered. Basis of calculation was the zone classification of the tariff group Eastern Region (VOR). As different time cards are offered for the weekday traffic, an allocation of these time cards had to be the basis for calculation, namely:

- 45% of all travellers in regional transport use yearly network cards
- 30% a monthly pass
- 20% a weekly ticket
- 5% pay the full price

Table 10: Calculation of tariff revenues

	tarif revenues		
	2013	2020/0	2020/1
	in 1000 Euro	in 1000 Euro	in 1000 Euro
Neusiedler Seebahn	8.115	8.420	8.420
Neusiedl - Eisenstadt	2.566	2.618	2.618
Eisenstadt - Ebenfurth	1.411	1.515	2.293
Eisenstadt -Sopron - Deutschkreutz(Neckenm.)	3.611	3.777	5.397
Sopron - Wr.Neustadt	3.589	3.833	4.494
Total	19.291	20.163	23.223
Additional revenues	Difference 2013 - 2020/0		872
	Difference 2020/0 - 2020/1		3.059

Source: TMC, 2014.

From this calculation result additional annual tariff revenues of around EUR 3 million

4.3.7 Reduction of road traffic

The calculation of reduction in road transport (reduction of traffic performance) by private car traffic is based on a simple formula:

$$\sum_{i=1}^{n}\left((\mathbf{Dij} * \mathbf{250}) * \left(\frac{\mathbf{Fij}}{\mathbf{B}}\right)\right)$$

The calculated reduction in the mileage is around 18 million vehicle kilometres/year

Table 11: Calculation of road traffic reductions (TMC, 2013)

				car capacity (km*nr.of cars)/year		
				2013	2020/0	2020/1
Neusiedler Seebahn						
		from/to Hungary				
1		Pamhagen-Frauenkirchen		16.541.857	17.885.534	17.885.534
2		Frauenkirchen-vor Neusiedl		15.870.897	16.096.420	16.096.420
3		Neusiedl-Parndorf		25.949.766	26.617.683	26.617.683
Neusiedl - Eisenstadt						
4		Neusiedl-Donnerskirchen		21.580.667	22.137.707	22.137.707
5		Donnerskirchen-Eisenstadt		8.393.375	8.704.027	8.704.027
Eisenstadt - Ebenfurth						
		von Wien,Nö nach Eisenstadt		21.212.550	22.909.554	20.506.389
6		Eisenstadt - Wulka		11.626.333	12.028.868	10.850.653
7		Wulka - Müllendorf		7.727.230	8.272.956	7.673.405
8		Müllendorf - Ebenfurth		14.973.028	15.902.547	15.179.057
Eisenstadt -Sopron - Deutschkreutz(Neckenm.)						
		from/to Hungary		32.803.750	34.534.788	26.075.568
9		Sopron - Wulka		5.408.355	5.644.607	5.195.438
10		Deutschkreutz - Sopron (o.Neckenm)		6.550.987	6.819.049	5.926.407
11		Neckenmarkt - Deutschkreutz		6.878.811	7.124.692	6.759.654
Sopron - Wr.Neustadt						
		from/to Hungary	Mattersburg	17.427.630	18.585.525	17.512.950
12		Sopron - Mattersburg		11.512.819	11.736.779	10.974.118
13		Mattersburg - Wr.Neustadt		32.252.940	34.071.808	32.388.957
				256.710.995	269.072.543	250.483.967
			Difference			**18.588.576**

Source: TMC, 2014.

5 Financial Analysis

5.1 Methodology

An important part of the evaluation is the financial analysis. This analysis is explained in detail in the methodological section in Work Package 5.3 (Evaluation of SETA measures) of this project. The financial analysis follows the recommendations contained in the "Guide to cost benefit analysis of investment projects".

The main output of the financial analysis is

- the FNPV (financial net present value) and
- the FIRR (financial rate of return).

5.2 Necessary data

Following data are necessary for evaluation:

1. Estimation of investment costs (alternative 2020/1)
2. Estimation of infrastructure maintenance costs for the Business as Usual (BAU) scenario (without the project under evaluation – alternative 2020/0) and for the project scenario (with the project under evaluation – alternative 2020/1)
3. Estimation of network operation costs for the alternatives 2020/0 and 2020/1
4. Estimation of operation costs of rail operations for the alternatives 2020/0 and 2020/1
5. Estimation of tariff revenues for the alternatives 2020/0 and 2020/1
6. Real discount rate: 5%[1]

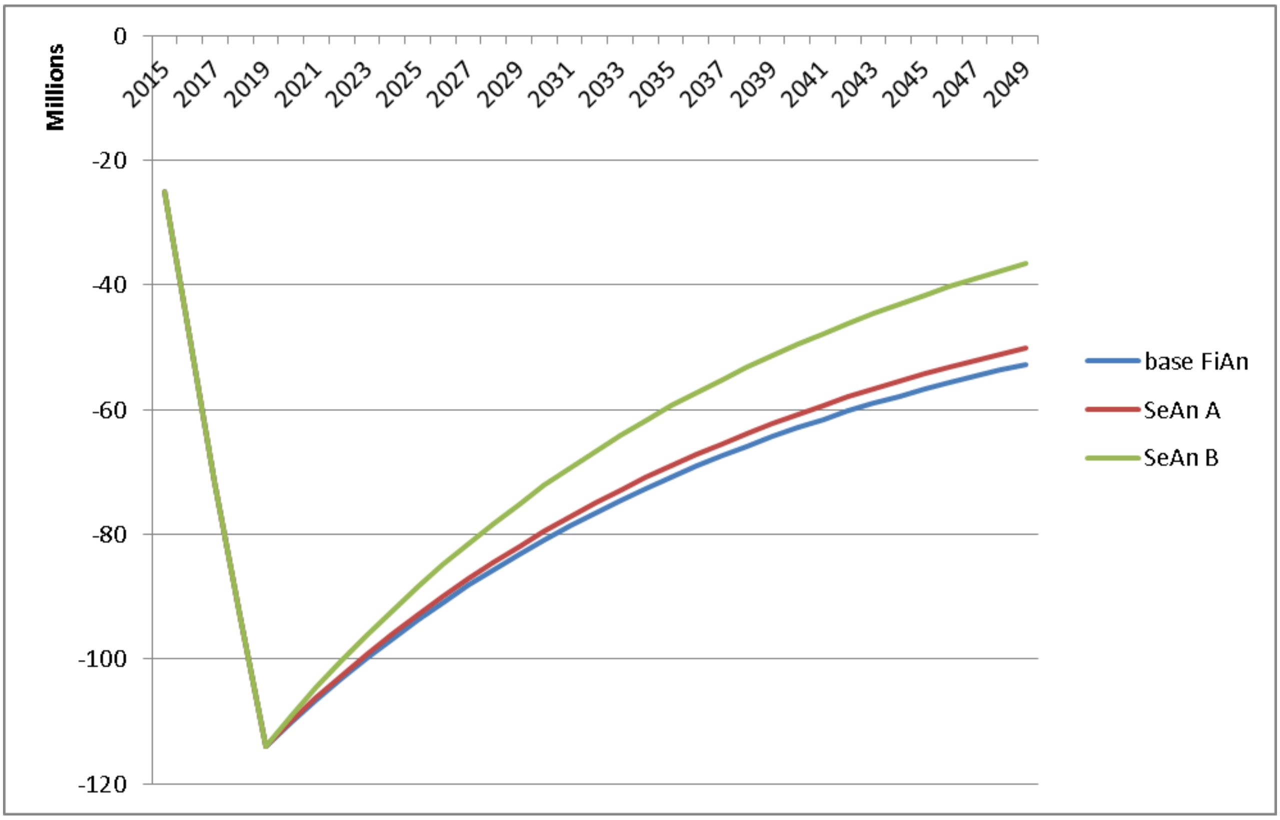
These data are presented in this chapter, parts 4.1 to 4.3.

5.3 Calculations

In order to analyse the effects of the investment (only in alternative 2020/1), the differences between the scenarios of 0 and 1 are of main importance. Thus, the differences in the costs and revenues are taken in account. The financial analysis includes a sensitivity analysis, which checks the stability of results when distinctive input parameters are changed. A **sensitivity analysis** was performed for the "critical" inputs, namely O&M and infrastructure fees. Like in the report for Work Package 5.3 (Evaluation of SETA measures) in the first sensitivity analysis scenario (SeAn A) a reduction of infrastructure maintenance costs, network operation costs and operation costs of rail operations by 20% is assumed; in the second sensitivity analysis scenario (SeAn B) an increase in infrastructure usage fees and tariff revenues is assumed additionally.

[1] In the "Guide to Cost Benefit Analysis of Investment Projects" from EU DG Regional Policy (2008), a real financial discount rate of 5% is recommended.

Figure 9: Cumulated, discounted cash flows



Source: TMC & IHS, 2014.

None of the scenarios, the base financial scenario (base FiAn), the first (SeAn A) and second sensitivity analysis scenario (SeAn B), succeed in reaching a positive FNPV. The results are as follows:

Table 12: Results of dynamic investment analysis, financial base scenario, in Mio. €

	FNPV	FIRR
Financial Anaylsis	-52,7	-3,9%
Sensitivity Analysis A	-50,2	-3,7%
Sensitivity Analysis B	-36,6	-2,6%

Source: TMC & IHS, 2014.

5.4 Results of the financial analysis

The results of the financial analysis are only one aspect of the decision on the realisation of the suggested measures. The results of the economic and environmental evaluations are an equally important factor in the recommendations. From an isolated financial-analysis perspective, the realisation of the suggested measures can not be recommended.

6 Savings in travel time

6.1 Methodology

The calculations presented in this chapter are in line with the EU Guideline on Cost-Benefit Analysis[2], which outlines the process of monetising travel-time savings. Table 13 summarises the necessary assumptions made.

Table 13: Assumptions for monetization of travel time savings

Assumption	Explanation
Composition of travellers	• 70% short-distance commuters • 20% other non-work short distance • 10% business trips
Total hourly rate	As cross-border commuters, the average of Austrian and Hungarian hourly values was taken: EUR 10.72 (in 2012, adjusted for inflation, based on assumption of composition of travellers. Values based on HEATCO [3]).
(working) days per year	300 days (i.e. excluding Sundays)
Social Discount Rate	4%, as trans-border personal transport between Austria (CBA suggestion 3.5%) and Hungary (5.5%)

Source: IHS – Institute for Advanced Studies, 2014.

6.2 Results

Figure 10: Sum of minutes saved per day. Data source: TMC.

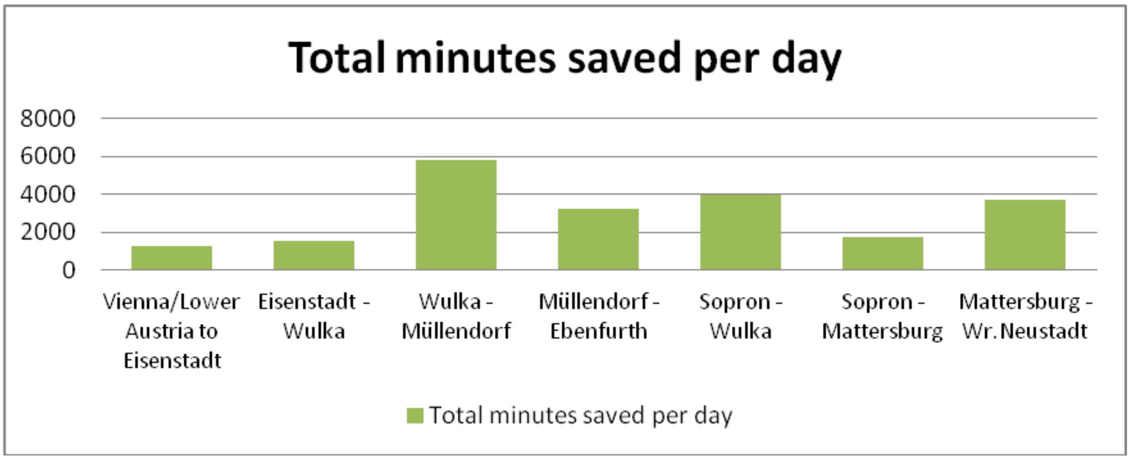


Figure 10 gives an overview over total daily travel time savings in minutes by origin/destination. Given the here presented reductions in travel time and the above

[2] Commission 2008
[3] Source for rates: HEATCO (Bickel et al. 2006)

described assumptions, **the total present value in 2012 (in 2012 prices) of monetised travel time savings for the period 2020-2049 amounts to EUR 14.945 million.**

7 Short-term economic effects

7.1 Methodology

An input-output analysis, among other methods, was used as an instrument to quantify the short- and medium-term economic effects. This analysis and the necessary input-output tables are explained in detail in the methodological section in Work Package 5.3 (Evaluation of SETA measures) of this project. Since this method should be applied not only at the national level but also at the regional level, a (multi-)regionalisation of the existing national input-output tables – provided by the national statistics offices – was required.

7.2 Results

The results of the multi-regional input-output model analysis will be presented for the two countries involved – Austria and Hungary. The resulting economic effects - divided into value added, employment (in person years and full-time equivalents) and taxes - are included for each country. These results include both one-time effects (such as investments) and durable effects (such as maintenance and operating costs). In each case, the impact on the economies of the individual regions and the country itself is reported.

In the following subsection the short-term effects of the investment expenses as well as the effects of the induced changes in maintenance and operating expenses are reported explicitly for each country and their respective regions.

Caution is required in the interpretation of the effects on labour, since the time range of the investment stretches over several years. Thus, “person-years” are calculated as the number of employed persons multiplied by the duration of employment in 2015 to 2049. The effects occur mainly in the investment phase.

Table 14 to Table 16 illustrate the results of the economic input-output analysis.

Table 14: Economic effects on value added in countries and regions, in million EUR (base year 2012, present value)

Value added in million EUR	
Burgenland	49.91
other regions	31.19
Austria	**81.10**
Nyugat-Dunántúl	11.12
other regions	5.51
Hungary	**16.63**
"EU26"	43.14
EU28	140.87
Rest of the world	15.31
World	156.18

Source: IHS – Institute for Advanced Studies, 2014.

Table 14 shows the value added effects for the three quantified alternatives for all involved countries and their regions as well as for the “EU26” countries (EU Member States excluding Austria and Hungary), the EU28 countries and the rest of the world. The effect on value added is calculated as the present value on the base prices of 2012 with a social discount rate (SDR) of 3.5 % for Member States which joined the EU before 2004 (Austria) and an SDR of 5.5 % for those who joined after 2004 (Hungary). The effects presented show the results for investment, maintenance and operating expenses.

The economic effects are much higher in Austria than in Hungary due to the much higher investment costs in Austria. In Austria, the effect on gross value added is 81 million EUR – in Hungary 16.6 million EUR. The involved regions Burgenland and Nyugat-Dunántúl profit with 50 and 11 million EUR, respectively. The economic effect outside the involved countries Austria and Hungary is nearly as high as in the affected regions Burgenland and Nyugat-Dunántúl; In “EU26” and “Rest of the world” the economic effect on gross values added is 58.5 million EUR. Altogether, the effect on gross value added is around 156 million EUR (present value, base year 2012).

Table 15 shows the economic effects on employment in person-years and in in full-time equivalent employees. The highest employment effects are registered in Austria, but since Hungary’s income level is lower, employment effects in Hungary represent two third of the effective impact on Austria. In summary, the effects for the whole project period are 3,150 person-years or 2,727 full-time equivalent employees.

The structure of the results obtained for the employment in person-years indicator is the same as those obtained for value added. In general, Alternative 3 produces the highest employment rates in the SETA countries, the EU Member States and the world as a whole.

Employment effects are reported both in person-years (number of jobs) and in full-time equivalents (FTE). One FTE corresponds to a full-time job defined by a collective bargaining agreement.

Table 15: Economic effects on employment in person-years and in full-time equivalent employees on a country and regional basis

Employment	person-years	FTE
Burgenland	840	752
other regions	511	460
Austria	**1,352**	**1,212**
Nyugat-Dunántúl	725	615
other regions	213	189
Hungary	**938**	**804**
"EU26"	861	711
EU28	3,150	2,727

Source: IHS – Institute for Advanced Studies, 2014.

Induced fiscal effects are illustrated in Table 16. Taxes are calculated as current value on the 2012 base prices with an SDR of 3.5 % for Member States which joined the EU before 2004 (Austria) and 5.5 % for those countries who became EU Member States after 2004 (Hungary).

The Austrian government would receive additional taxes in the amount of 32.7 million EUR. The fiscal effects for Hungary sum up to 5.97 million EUR. Outside the project countries

(Austria and Hungary) other EU-Countries would receive additional public revenue of 14.85 million EUR. In total, public income would increase by 53.51 million EUR (present value, base year 2012).

Table 16: Fiscal effects at national level for the three alternatives, in million EUR

Taxes in million EUR	
Austria	32.70
Hungary	5.97
"EU26"	14.85
EU28	53.51

Source: IHS – Institute for Advanced Studies, 2014.

8 Long-term economic effects

8.1 Methodology

The IHS EAR 2.0 is an accessibility-dependent regional model which follows a spatial econometric approach. This economic impact analysis is in accordance with the methodological section in Work Package 5.3 (Evaluation of SETA measures) of this project. This model has already been used to evaluate a variety of Austrian and international infrastructure projects.

8.2 Results

The final present values by country based on the IHS EAR 2.0 model (discounted and then aggregated additional effects) are displayed in Table 17:

Table 17: Overall economic effects due to measures, present values (only countries with large effects shown)

Country	Present value in 2012 (in 2012 million EUR)
Austria	11
Hungary	15
Croatia	5
Total	**31**

Source: IHS – Institute for Advanced Studies, 2013.

The overall present value for all local countries in 2012 equals 31 million EUR. This value represents the sum of all discounted future streams of monetised economic benefits due to the reduction of generalised costs (approximated travel time savings) by measures introduced in the period from 2020-2049.

Hungary benefits most from travel time savings with a present value of 15 million EUR. Austria is ranked second with 11 million, followed by Croatia with 5 million EUR. As accessibility is improved, the accessibility elasticity of output generates an additional effect.

Table 18 shows the regional distribution of effects caused by travel time savings for Austria and Hungary.

Table 18: Overall regional economic effects for Austria and Hungary due to measures, present values

Country	Region	Present value in 2012 (in 2012 million EUR)
Austria	Burgenland	0.82
	Lower Austria	2.80
	Vienna	5.60
	Styria	1.99
Hungary	Central Transdanubia	5.97
	Western Transdanubia	5.95
	Southern Transdanubia	3.12

Source: IHS – Institute for Advanced Studies, 2013.

In order to approximate the additional employment generated through the implementation of the SETA measures, average GVA for the years 2000–2006 divided by the average employment in the same period was calculated. This ratio was then multiplied by the additional GVA generated by the measures. Since GVA is generated through either capital, labour or technological advance, the resulting values were then multiplied with the labour share. The 2000-2006 period was chosen as a comparable period of time since it is assumed that the inclusion of later years would bias the result due to the economic boom in 2007 and 2008 and the subsequent crises in the years thereafter.

Table 19: Average additional employment during operational phase (only countries with effects > 1 shown)

Country	Average additional employment during operational phase
Austria	6
Hungary	40
Croatia	22
Total	**68**

Source: IHS – Institute for Advanced Studies, 2013.

With respect to additional employment, Croatia and Hungary benefit even more than they do in GVA terms. One reason for this might be that these countries are characterised by lower labour costs. On average, additional employment amounts to 22 persons in Croatia and 40 persons in Hungary, and 6 persons in Austria.

The next approach is about estimating additional tax revenue. A national tax ratio (in relation to GVA) was derived from the input-output tables also provided in work package 5.3 of this project. This tax ratio was simply multiplied with the additional GVA generated by the infrastructure measures. This is fairly straightforward at the national level, but it is far more complicated at the regional level, since the tax regimes vary substantially between countries and regions (from a more federal system to a more centralised system).

Table 20: Additional tax revenue (only countries with effects shown)

Country	Tax revenue due to measures (present value in 2012 million EUR)
Austria	4
Hungary	6
Croatia	3
Total	**14**

Source: IHS - Institute for Advanced Studies, 2013.

9 Environmental and social analysis

9.1 Methodology

Global warming and air pollution caused by transport activities leads to different types of external costs. The most important regional external costs are health costs due to cardiovascular and respiratory diseases caused by air pollutants. The main climate change factors identified are the greenhouse gases CO_2 (carbon dioxide), nitrous oxide (N_2O) and methane (CH_4), whereas the most important transport related air pollutants are particulate matter (PM_{10}, $PM_{2.5}$), nitrogen oxide (NOx), sulphur dioxide (SO_2), volatile organic compounds (VOC) and ozone (O_3) as an indirect pollutant.

Air pollution: The monetary values for air pollution (NOx, PM10, PM2.5, NMHC and SO_2) have been taken from HEATCO, applied on a country level according to EU guidelines and adjusted to GDP.[4]

Global warming: Climate change or global warming impacts of transport are caused mainly by emissions of the greenhouse gases carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). The method of calculating costs due to the emission of greenhouse gases (usually expressed as CO_2 equivalents) basically involves multiplying the amount of CO_2 equivalents emitted by a cost factor. Due to the global scale of the damage caused, there is no difference how and where in Europe the emissions of greenhouse gases take place. For this reason, we have applied the same values in all countries. With respect to global warming, the relevant values were taken but not GDP per capita adjusted, since HEATCO and Watkiss (2005) argue against such an adjustment as the values they recommend are based on the 2K climate change goal[5], which is unrelated to changes in GDP. This means that the monetary estimates gained from the environmental analysis might be conservative with regard to air pollutants.

9.2 Results

Table 21: Overview of emissions reduced by measures

Difference 2020-2049								
Country	CO2 [t/y]	NOx [t/y]	PM10 [t/y]	PM2.5 [t/y]	NMHC [t/y]	SO2 [t/y]	N2O [t/y]	CH4 [t/y]
Austria	1005.024	2.143	0.056	0.055	0.134	0.007	0.023	0.006
Hungary	1322.979	2.821	0.074	0.072	0.176	0.009	0.030	0.008
Total	**2328.003**	**4.964**	**0.129**	**0.127**	**0.309**	**0.017**	**0.054**	**0.014**

Source: IBV Fallast, illustration by IHS, 2013. 6

[4] For the emission of particulate matter, the monetary value assigned also depends on whether the area of emission is considered urban or rural. As the information supplied did not include the declaration of particulate matter by urban/non-urban area, an average of 50% each was applied.
[5] The target of staying below a two degree Kelvin/Celsius increase in global temperature, which was a goal of the Kyoto Protocol and also supported in the Copenhagen Accord in 2009.
[6] Values for the period 2040-2049 were extrapolated from the period 2030-2039.

Table 21 gives an overview of annual reductions in pollution by region for the given periods of time. The reductions were subsequently converted into monetary terms as described above.[7]

Both Austria and Hungary accrue positive environmental effects from the proposed measures: Figure 11 gives the distribution of the monetised effects of the infrastructure measures over time. The skips in values each decade can be explained by changes in monetary values attributed to the effects:

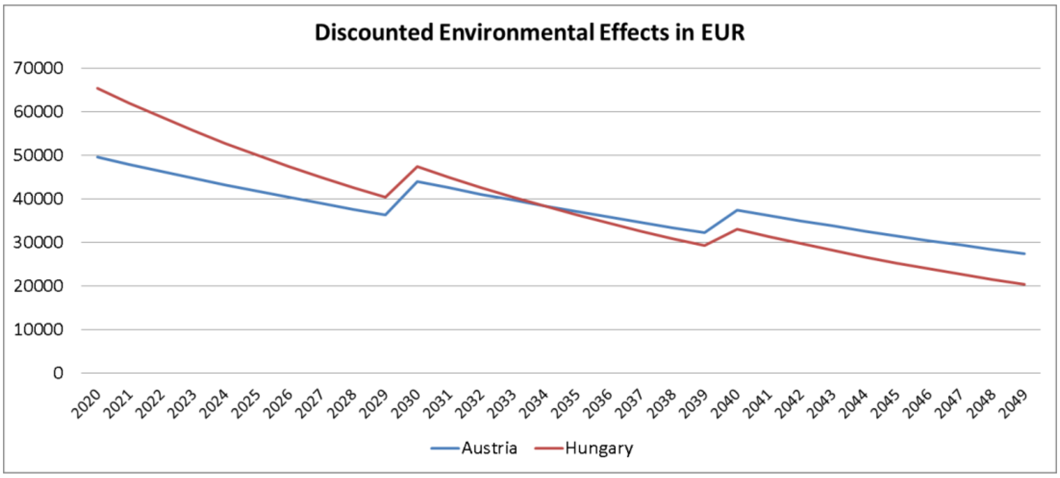


Figure 11: Discounted Environmental Effects in EUR over time

The present values of monetised emissions until 2049 add up to nearly 2.3 million EUR in 2012, with nearly the same amount of positive environmental effects in both countries.

Table 22: Present value of total positive effects of emission reductions in EUR[8]

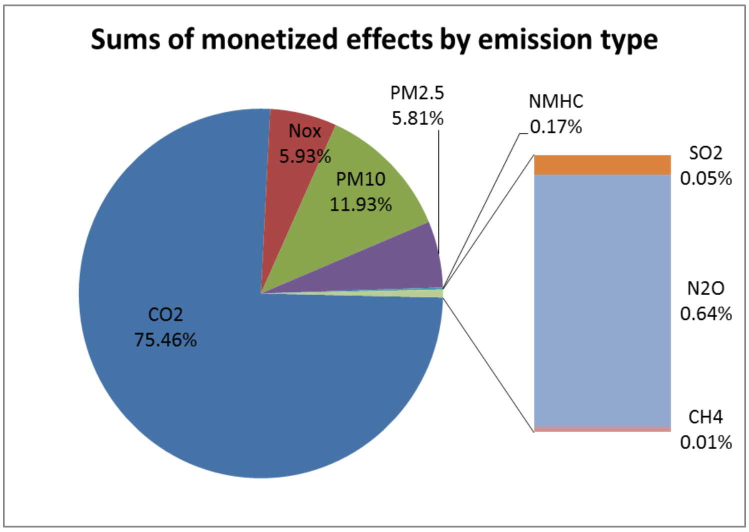
	Net Present Value in EUR (2012)
Austria	€ 1 128 096
Hungary	€ 1 161 163
Total	**€ 2 289 259**

Source: IHS – Institute for Advanced Studies, 2013.

[7] In this step, HEATCO (Bickel et al. 2006) values were also compared to global warming values supplied by CE DELFT (see Maibach et al. (2008)), and values supplied by AIR CAFÉ on air pollution (see Holland et al. (2005)). Both AIR CAFÉ and CE DELFT values attribute higher costs to emissions based on differences in the methodology applied (the overall difference in total costs with an SDR of 5.5 % were found to amount to 132 % of HEATCO values for global warming and 154 % for air pollution). The HEATCO approach was chosen for consistency reasons.

[8] For the period 2012-2049, assuming an SDR of 5.5 % for Croatia, Hungary, Slovakia and Slovenia and 3.5 % for Austria and Italy.

Figure 12: Shares of monetised emissions by emission types (before discounting)



Source: IHS - Institute for Advanced Studies, 2013.

Figure 1Figure 12 clearly shows that the majority of monetised benefits before discounting (75.46 %) arise from saved CO_2 emissions, followed by reductions in PM10 with a share of 11.93 % and NoX with 5.93%. Accordingly, the most monetised effects are the result of climate change implications with more than 80% (CO2 and NoX). As these emissions have global ramifications not specific regional effects, this share has to be taken into consideration when looking at the share of positive effects attributed to different areas.

10 Risk Assessment

The EU Guide to Cost Benefit Analysis of Investment Projects stipulates that a project appraisal has to contain an assessment of the risk which should be conducted in five steps: a sensitivity analysis, making assumptions of probability distributions of critical variables, calculating the distribution of performance indicators, discussing the results and acceptable levels of risk as well as to discuss ways to mitigate the levels of risk.

However, the results of both the financial as well as the economic analysis suggest that with exception of View 4, the NPV is strongly negative and it should be advised against the implementation of the transport investment project under consideration. As the negative financial and economic results, it is not necessary to consider the risk concerning several critical variables any further because the probability that after considering yet other risk factors a positive outcome will result is extremely low. On the contrary, the assessment of relevant risk factors would only further decrease the already negative NPV.

11 Consolidated economic analysis

The previous chapters analysed the effects with regard to a variety of aspects. Chapter 5 contained the financial analysis, Chapter 6 estimated the economic values of the savings in travel time, Chapter 0 a short-term economic analysis by means of a multiregional input-output analysis, Chapter 8 analysed the long-term economic effects using a regional accessibility-dependent model (EAR) and, finally, Chapter 9 evaluated the environmental and socio-economic aspects. This chapter aims to consolidate these different aspects and present a single, aggregated view. The IHS developed the so-called consolidated economic analysis for this specific purpose. The result of this analysis is presented on the following pages.

This chapter reviews the summaries of the four different analyses. All figures presented here are present values (except where stated otherwise). This means that future values were discounted[9] to reflect present values, where present refers to the year 2012. Further, these values are real values rather than nominal values. All nominal values were inflated or deflated to reflect 2012 prices.

This section presents the aggregated results from four different points of view.

View 1 is based on the approach specified in the European Commission's 'Guide to cost-benefit analysis of investment projects'[10]. It includes the results of the financial analysis (Chapter 5), the travel-time savings (Chapter 6) and the environmental and socio-economic analysis (Chapter 9). In the view 1 aggregation, the results of the input-output analysis – short- and medium-term economic effects – (Chapter 0) and the regional accessibility-dependent model (EAR), which explains the long-term economic effects (Chapter 8) are not included.[11]

View 2 presents the **viewpoint of a potential subsidising institution.** It includes the results of the financial analysis (Chapter 5), the long-term economic effects derived with the help of the regional accessibility-dependent model (EAR, Chapter 8), and the environmental and socio-economic analysis (Chapter 9). In the view 2 aggregation, the results of the input-output analysis – short- and medium-term economic effects – (Chapter 7) and the results of travel-time savings are not included.[12]

View 3 reflects the **viewpoint of government, national/regional administration and relevant supra-national entities** and focuses on the fiscal effects. More precisely, it takes the state revenues, i.e. tax revenues, into account. This approach incorporates the tax revenues (e.g. from value added taxes, corporate taxes, excise duties, etc.) resulting from different analyses and compares the aggregated sum of tax revenues to total investment and maintenance costs. This view includes the results of all previous chapters and methodological aspects: the results of the financial analysis (Chapter 5), the short-term

[9] According to the present value method.
[10] European Commission (2008): Guide to cost-benefit analysis of investment projects. Structural Funds, Cohesion Fund and Instrument for Pre-Accession.
[11] The short-term effect calculations are required by the Funds regulations, but should not be part of the cost-benefit analysis (European Commission 2008, p. 57).
[12] The short-term effect calculations are required by the Funds regulations, but should not be part of the cost-benefit analysis (European Commission 2008, p. 57).

economic effects (input-output analysis, Chapter 7), the long-term economic effects (regional accessibility-dependent model (EAR), Chapter 8) and the environmental and socio-economic analysis (Chapter 9).

Finally, **view 3** reflects the **viewpoint of the economy and focuses solely on economic effects, i.e. economic benefits**. Value added effects calculated in the single methodological approaches in the different chapters are aggregated and compared to the investment and maintenance costs. This view also includes the results of all previous chapters and the methodological aspects described in Chapters 0 to 9.

In short, the three viewpoints presented are as follows:

View 1: based on the approach specified in the European Commission's 'Guide

View 2: Potential subsidising institution

View 3: Tax revenues (state/government)

View 4: Economic benefits (economy)

A ratio between the total benefit of the particular outcome to the total investment and maintenance costs is calculated in all three views for all three SETA investment measures alternatives. These ratios refer to a comparison between the positive outcome (benefits) and the costs of the project, i.e. the sum of the benefits (state revenues, economic effects, etc.) is expressed as a proportion of the investment costs.

One further distinction was made in the consolidated economic analysis: the views are first presented in aggregated terms from the perspective of the involved countries Austria and Hungary only (**variant A**) and are then aggregated in a second step from the perspective of the "EU28" countries (**variant B**).

For the description of the methodology of the Consolidated Economic Analysis please refer to the methodological section in Work Package 5.3 (Evaluation of SETA measures) of this project.

11.1 Financial Analysis

From an isolated financial-analysis perspective, the realisation of the suggested measures is not recommended. The financial net present value is negative (-52.7 million EUR).

11.2 Savings in travel time

The **total present value** of monetised **travel time savings for the period 2020-2049 adds up to 14.9 million EUR**.

11.3 Short-term economic effects

The Multiregional Input Output Model of the IHS (IHS MRIOM) appraises the short- to mid-term effects by the measurement of the economic impacts of investments expenses as well as the effects of the induced changes in maintenance and operating expenses.

The overall present value of the gross added value in 2012 in EU28 is 141 million EUR, outside the EU 15 million EUR. Austria profits with 81 million EUR, Hungary with 16.6 million EUR.

The employment effect equals around 2,700 full-time equivalent employees in the EU28 over the period 2015 to 2049 (or in average 77 per year). Austria benefits with around 1,200 FTEs and Hungary profits with 800 FTEs.

The fiscal impact equals around 54 million EUR in the EU28. Austria benefits with around 33 million EUR and Hungary profits with 6 million EUR.

11.4 Long-term economic effects

The IHS EAR 2.0 model estimates the long-term economic effects by adding up all future additional increases in GVA for the years 2020-2049 which are generated through a reduction in generalised costs due to the implementation of the suggested infrastructure measures.

The overall present value of the additional GVA in 2012 for Austria and Hungary equals EUR 26 million, with Croatia gaining EUR 5 million. Hungary benefits the most, with a present GVA value (over a 30-year period, i.e. from 2020 to 2049) of 15 million EUR. Next come Austria and Croatia, with 11 million EUR and 5 million EUR, respectively.

11.5 Environmental and social analysis

Aggregated positive environmental effects through measures are estimated to be approximately EUR 2.3 million[13]. Even though reductions in emission can be attributed to both Austria and Hungary in equal shares, consideration must also be given to the fact that since roughly 80 % of the monetised benefits are accrued from reductions in carbon dioxide and nitrous oxide, the environmental effects of the proposed measures have not only regional but also to a large part global effects. A sensitivity analysis[14] has shown that the estimated monetised environmental benefits presented here have to be considered as conservative values, with a high chance of producing increased actual benefits.

11.6 Consolidated economic analysis

The three tables below (Table 23 to Table 25) show the results of the aggregation (1) based on the approach specified in the European Commission's 'Guide (Table 23), (2) from the involved countries' perspective (Table 24) and (3) the from the EU28's perspective (Table 25) and the calculated benefit-cost ratios.

[13] according to standard evaluation methods, see Bickel et al. (2006)
[14] Not presented here due to space limitations

Table 23: Aggregation of results, View 1 (CBA Guide), in million EUR

	View 1
Financial Analysis: costs	123.1
Financial Analysis: benefits	38.7
Financial net present value	-84.4
Reduced Travel Time	14.9
Environmental effects	2.3
Economic net present value	-67.2
Benefit - cost ratio	0.45

Source: IHS – Institute for Advanced Studies, 2014.

Table 23 illustrates the aggregated results for a potential subsidising institution based on the European Commission's CBA Guide. It can be seen that the benefit-cost ratio is much lower than 1. A ratio <1 indicates that the investment is not profitable neither for providers nor for the involved economies.

Table 24: Aggregation of results, the perspective of the involved countries (variant A), in million EUR

	View 2 A	View 3 A	View 4 A
Financial Analysis: costs	123.1	123.1	123.1
Financial Analysis: benefits	38.7	7.4	19.4
Financial net present value	-84.4	-115.7	-103.7
Short-term economic effects		36.8	97.7
Long-term economic effects	26.3	10	26.3
Environmental effects	2.3	2.3	2.3
Economic net present value	-55.8	-66.6	22.6
Benefit - cost ratio	0.55	0.46	1.18
EIRR			0,88%

Source: IHS – Institute for Advanced Studies, 2014.

Table 24 shows the aggregated results based on a broader economic concept than travel-time-savings. The perspective of the involved countries Austria and Hungary are shown (variant A).

View 2 in Table 24 reflects for a potential subsidising institution's perspective. Here the short- to medium-term effects are ignored. Hence the economic effects are lower than the costs. The benefit-cost ratio is only 0.55.

View 3 in Table 24 reflects a government standpoint and focuses on state revenues. The ratio shows public revenues as the sum of all economic approaches in proportion to the costs. The benefit-cost ratio is 0.46. Accordingly, it can be said that state revenues are just below half of the costs (investments plus maintenance- and operations).

View 4 in Table 24 summarises all economic effects including the short- to mid-term effects. With this point of view the benefits are higher than the costs (1.18), but the short-to mid-term effects outmatch the long-term-effects by far (3.71 times). As a rule of thumb this ratio should be lower than 1 for the recommendation for implementation of an investment. Otherwise it is a “pork barrel project”[15].

Table 25: Aggregation of results, the perspective of the EU28 (variant B), in million EUR

	View 2 B	View 3 B	View 4 B
Financial Analysis: costs	123.1	123.1	123.1
Financial Analysis: benefits	38.7	7.4	19.4
Financial net present value	-84.4	-115.7	-103.7
Short-term economic effects		51.7	140.9
Long-term economic effects	41	13	41
Environmental effects	2.3	2.3	2.3
Economic net present value	-41.1	-48.7	80.5
Benefit - cost ratio	0.67	0.60	1.65
EIRR			1,94%

Source: IHS – Institute for Advanced Studies, 2014.

Table 25 shows the aggregated results based on a broader economic concept than travel-time-savings. The perspective of the EU28 is shown (variant B).

View 2 in Table 25 reflects for a potential subsidising institution’s perspective. Here the short- to mid-term effects are ignored. Hence the economic effects are lower than the costs. The benefit-cost ratio is only 0.67.

View 3 in Table 25 illustrates a government standpoint and focuses on state revenues. The ratio shows public revenues as the sum of all economic approaches in proportion to the costs. The benefit-cost ratio is 0.60. Accordingly, it can be said that state revenues are just above the half of the costs (investments plus maintenance- and operations).

View 4 in Table 25 summarises all economic effects including the short- to mid-term effects. With this point of view the benefits are higher than the costs (1.65), but the short- to mid-term effects overshine the long-term-effects by far (3.44 times). As a rule of thumb this ratio should be lower than 1 for the recommendation for implementation of an investment. Otherwise it is a “pork barrel project”.

11.7 Conclusions

Three different tables have been presented in this chapter, each depicting a different point of view (based on the approach specified in the European Commission’s ‘Guide, potential subsidising institution, public body, economy) either for the involved countries alone or for all 28 EU Member States.

In the EU Guide to Cost Benefit Analysis of Investment Projects the preferred performance indicator is the net present value (NPV). The results show that based on the Views 1 to 3

[15] Pork barrel is the appropriation of government spending for localized projects secured solely or primarily to bring money to a representative's district. (Bickers et al. 2008)

the NPV is negative. In View 4 it is admittedly positive, but the short- to mid-term effects outrange the long-term effects by far.

Hence, an implementation of the examined investment cannot be recommended from a consolidated economic perspective.

12 References

Bickel et al. (2006): HEATCO -Developing Harmonised European Approaches for Transport Costing and Project Assessment. Deliverable 5, Proposal for Harmonised Guidelines + Appendices.

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