Development of Swedish bases for decision-making and ranking of terminal solutions within the TEN and Motorways of the Sea (MOS) programmes

WP7 – Sensitivity analysis and impact of road pricing on the Swedish MOS links

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0 About this deliverable

This deliverable summarizes the results of WP's 7, 8.1 and 10 of the project "Utveckling av svenska besluts- och prioriteringsunderlag för terminalprioriteringar inom ramen för TEN och Motorways of the Sea (MOS)", BV dnr "S 05-30" (Development of Swedish bases for decision-making and ranking of terminal solutions within the TEN and Motorways of the Sea (MOS) programmes).
The deliverable presents the results of a simulation of the Swedish international freight flows distributed on the available networks, a corresponding sensitivity analysis and an assessment of the impact of a potential road pricing scheme on the Swedish MOS-links.

The deliverable is the last in a series of reports previously published under www.sir-c.se.

1.Background and Definition of MOS, (pdf 519 kB), BMT, August 2006

2. Selection of Ports (pdf 507 kB), BMT/TFK Borlänge, September 2007

3. Selection of Potential MOS Links (pdf 109 kB), BMT, January 2008

4. Analysis of Cargo Damages (pdf 1.2 MB), MariTerm, October 2007

5. Simulation of Selected MOS Links (pdf 276 kB), BMT, February 2008

6. Additional Support Measures (pdf 817 kB), BMT, February 2008

A summary of the findings of the project was presented in Gothenburg at a "Workshop om Intermodala Transporter" on 11 November 2008. The results of the workshop are published in the TFK-report 2008-9.

1 Summary and Conclusions

- This report includes simulations dealing with the future transport demand on the two selected Swedish Motorways of the Sea (MOS) links between Karlshamn and Klaipeda and between Trelleborg and Sassnitz.
- Simulated volumes of the two selected MOS links show potential for a successful shift from road to sea.
- However, overall effects of both selected Swedish MOS links between Karlshamn-Klaipeda and Trelleborg-Sassnitz onto the route and modal split seem to be rather modest.
- This is due to the fact that the ferry links already exist and are already high frequency ferry links. Their inclusion into a MOS scheme will result in better hinterland infrastructure and slightly increased capacity on the ferry links, but not in a complete new service pattern.
- The Karlshamn-Klaipeda link can work very well together with the proposed new railway link between Älmhult and Karlshamn. However, the system only seems to attract considerable freight volumes if the capacity of the ferry link is increased, which is identified as a bottleneck blocking a better usage of the railway infrastructure in the base MOS scenario.
- The freight volumes on the Trelleborg-Sassnitz MOS link will benefit from the planned measures as detailed in the MOS application. Capacity extension seems to be the key to more volumes on that link which however is in fierce competition with the neighbouring ferry links from Lübeck, Rostock and Ystad.
- A Swedish truck road tolling scheme would impact on the MOS links by minimising the forecast truck ferry volumes. In this case it has to be regarded as contra-productive to the envisaged development of the MOS links as the scheme
- The Swedish truck road tolling scheme does not seem to result in higher railway ferry volumes.

2 Introduction

In Deliverable 5 of this project, a number of - at that time fictional - Motorways of the Sea (MOS) links were tested concerning their potential and their impact on the other transport modes in Sweden. Meanwhile, the Swedish Ministry of Transport and the corresponding ministries in Germany and Lithuania together with the European Commission have decided which MOS projects are to be supported. The two selected MOS links are:

- the Swedish-Lithuanian Motorways of the Sea Project and
- the Swedish-German Motorways of the Sea Project

The ferry links concerned are

- Karlshamn – Klaipeda and
- Trelleborg – Sassnitz

The MOS projects include a number of infrastructure measures in the concerned ports and hinterlands. This includes e.g. measures for ramps, transhipment equipment, terminals and road and rail hinterland links. By definition, the ferry links as such are not part of the MOS applications. However, in the case of Trelleborg-Sassnitz the enlargement of the railway decks of the operated ferries is part of the application.

Instead of carrying out a sensitivity analysis of single factors among the fictional MOS links selected in Deliverable 5, this deliverable focuses on the potentials and the likely impacts of these two selected links.

It has to be stressed that both projects have developed own forecasts of future transport demand which use a different methodology than the model approach chosen here. For a purchaser's cost optimisation model such as EFM-STAN, it is necessary to translate infrastructure and operational improvements into costs. That has been done where possible; however, such a methodology cannot include other qualitative assumptions which might have been used in the other forecasts.

2.1 Differentiation between the approach in Deliverable 5 und this Deliverable

The differences between a fictional MOS link, which includes in its rather theoretical appearance within a freight flow simulation model all the expected service parameters and a real MOS link, which is set-up step by step in the real competitive environment, are obvious.

Ideally a MOS, as defined by the European Commission within their vademecum[1], should have at least one departure per day per direction. It should also move considerable transport work from road to sea.

On short distance links as between Trelleborg and Sassnitz a frequency of 4 departures per day per direction is already in place. The modal shift aspect for this specific short distance ferry route could be questioned, however, in the application a strong emphasis have been made on the rail infrastructure, in the ports, on the rail ferry and in the hinterland.

On longer links a desired daily frequency could cause an uneconomic deployment of vessel capacity because in such cases maybe a third or fourth vessel would have to be put in place. However on the link Karlshamn – Klaipeda a daily frequency can be sustained with two

[1] http://ec.europa.eu/transport/intermodality/motorways_sea/doc/2005_03_21_projecs_call2005_en.pdf

vessels a daily departure per direction is already state of the art, the frequency on that service is 10 per week at peak times.

Both MOS projects have in common, that rail transport plays an important role within the applications.

In the case of Karlshamn – Klaipeda the rail hinterland infrastructure will be extended. The construction of the so called South-East link, a missing railway link to connect the ports of Blekinge with the main Swedish rail network, is part of the project. The intermodal facilities in Karlshamn, namely the terminal, are also part of the application, including a new shunting yard.

On the link Trelleborg – Sassnitz both conventional and intermodal rail transport play an important role. The extension of the existing intermodal terminals in Trelleborg and in Sassnitz is part of the project, as well as the refitting of the railway decks of the Scandlines ferries to an adequate length. Ramps will be equipped with two rail sidings to enable the ports to carry out double shunting operations. All these measures aim at reducing the dwell time of the ferries in the ports, thus saving energy and reducing the emissions of the ships' exhaust.

The impact of these two real MOS cases in Sweden is modelled within the STAN EFM System.

2.2 Set up of simulation

2.2.1 Trade Matrices

Two trade matrices have been used per simulated year;

- a regionalised European non-bulk trade matrix, in which all European regions trade which each other and
- a regionalised oversea container matrix, where all European regions trade with oversea nodes (e.g. USA, Asia).
- The first one is attributed to the simulated RoRo links and all other transport modes, the container matrix is attributed to the LoLo links and all other transport modes.

2.2.2 Scenario definition

- Base Scenario 2012 S0: This scenario does not include any additional or improved MOS links. It serves as the benchmark base scenario.
- Scenario S1: Trelleborg-Sassnitz Improvement Scenario:
- Scenario S2: Karlshamn – Klaipeda improvement scenario;

To simulate the real MOS between Sweden and the Continent, some parameters have to be adapted. For all parameters that remain unchanged, no distinct impact onto the purchasers costs (both time and distance dependent) of the measures laid down in the MOS applications could be identified.

Table 1: Scenario structure

Characteristics	***S0: Base Scenario 2012***	***S1: Karlshamn – Klaipeda***	***S2: Trelleborg-Sassnitz***	***S1M : Karlshamn – Klaipeda Truck toll in Sweden***	***S2M: Trelleborg-Sassnitz Truck toll in Sweden***
Capacity of the vessels		Remains unchanged	Remains unchanged for road, for rail ferry the cap increases by 10%	As in S1	As in S2
Frequency of the vessels		Remains unchanged, since minimum frequency of MOS already met.	Since the MOS application shortens the dwell time in the ports, which would allow a fifth departure, the daily frequency is increased from 4 to 5 per direction.	As in S1	As in S2
Speed of the vessels		Remains unchanged	Remains unchanged	As in S1	As in S2
Time and distance dependent costs for the use of the vessels		Remains unchanged	Remains unchanged	As in S1	As in S2
Price for transhipment within the port between Truck and ferry		Remains unchanged	Remains unchanged	As in S1	As in S2
Price for transhipment within the port between Rail and rail ferry		Reduced by 10% because of planned port infrastructure measures	Reduced by 10% because of planned port infrastructure measures	As in S1	As in S2
Hinterland infrastructure		Syd-Ost railway link in Blekinge is added	No changes, the new ring road around Trelleborg and the new port entry gate location have not been quantified. The extension of the motorway towards Trelleborg is not part of the MOS application.	As in S1	As in S2
Truck toll in Sweden	No	No	No	Implemented	Implemented

The changes compared to the reference scenario (= as is) are modest compared to what has been changed within the simulation system in Deliverable 5, which included completely new links with a high frequency within the competitive environment of sea transport in the Baltic Sea Region.

3 Results of the simulation

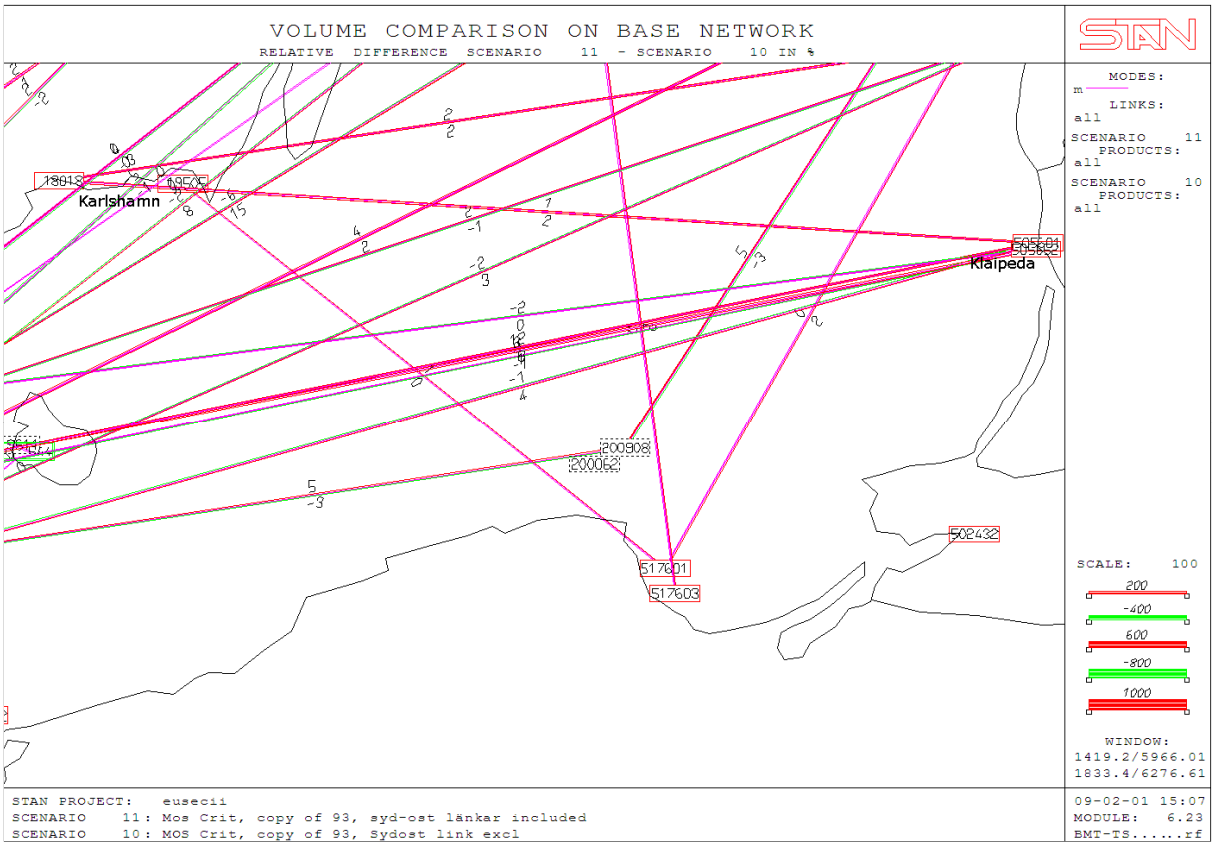
If the proposed measures from the MOS application are translated into the EFM freight simulation system in the proposed way, the results show overall quite modest impacts of the MOS programs. The following results are presented in the format provided by the EFM-STAN tool. The Baltic Sea coast line is schematically outlined and the freight flows or the changes in freight flows are indicated in red or green with two figures for each link – one in each direction. When the figures indicate changes, red means increase and green indicates decrease. The figures contain a number of other links than those investigated.

3.1 Karlshamn – Klaipeda scenario S1

The changes included in S1 cause a rise of transport demand on the ferry link Karlshamn – Klaipeda. Since this ferry is only a truck ferry, there is no possibility for any growth of rail volumes on the ferry link, however, through the new Syd-Ost link between Älmhult, Olofström and Karlshamn a considerable increase of rail volumes can be recognised, that enter the intermodal terminal at Karlshamn.

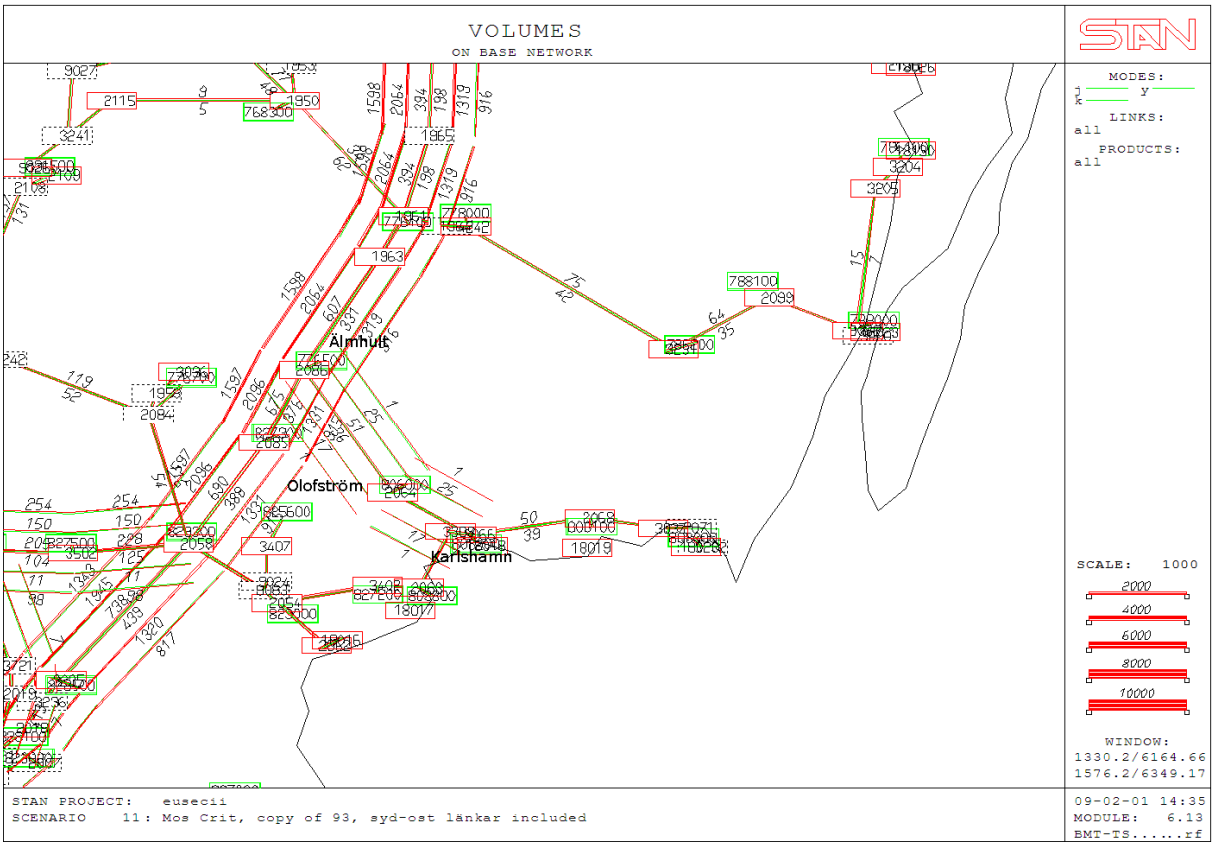
- Truck transport is forecast to rise very modestly by 1-2%, in both directions

Figure 1: S1; Simulated percentage changes on ferry links in the south eastern Baltic Sea



Rail transport on the new Syd-Ost link is forecast to carry about 77.000 tonnes /year northbound and 54.000 tonnes southbound (under the chosen set-up).

Figure 2: Simulated yearly volumes in 1.000 tonnes on the 3 rail modes[2] on the Syd-Ost link in 2012



These tonnes, however, do not seem to be much connected to the ferry link to Klaipeda. The simulated transport demand seems to originate from local demand and demand from Karlskrona. Very likely, the capacity on the ferry link limits its ability to attract any additional volumes and is already a bottleneck in this scenario. In the sensitivity analysis in chapter 4 an increased capacity will be tested.

[2] In EFM STAN three rail modes exist, conventional rail, intermodal and system rail. Since every mode in STAN requires a link, these three modes result in total 6 links in both directions

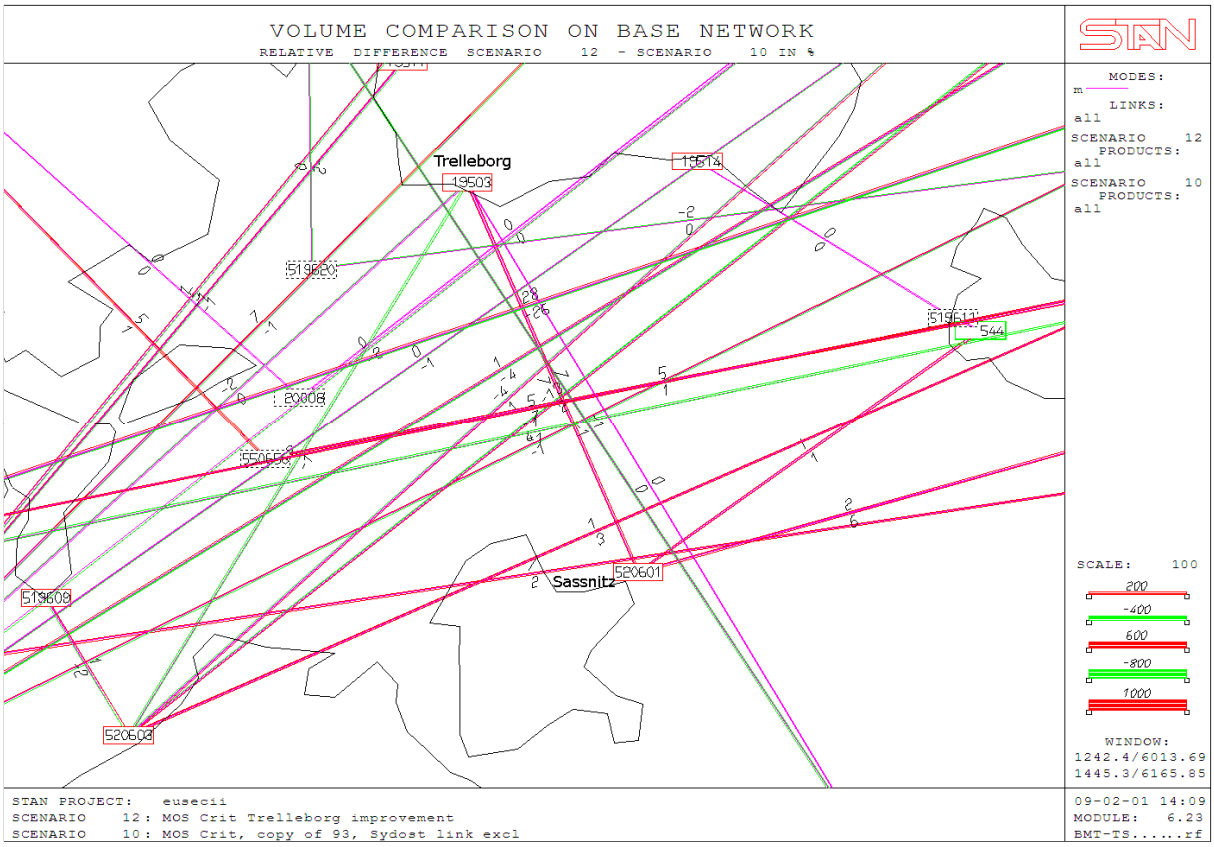
3.2 Trelleborg - Sassnitz Scenario S2

The changes included in the simulation cause a rise of transport volumes on the ferry link Trelleborg-Sassnitz:

- Truck transport is forecast to rise by 7%, in both directions
- Rail transport on the rail ferry is forecast to rise by 20% northbound and 17% southbound (c.f. figure 4).

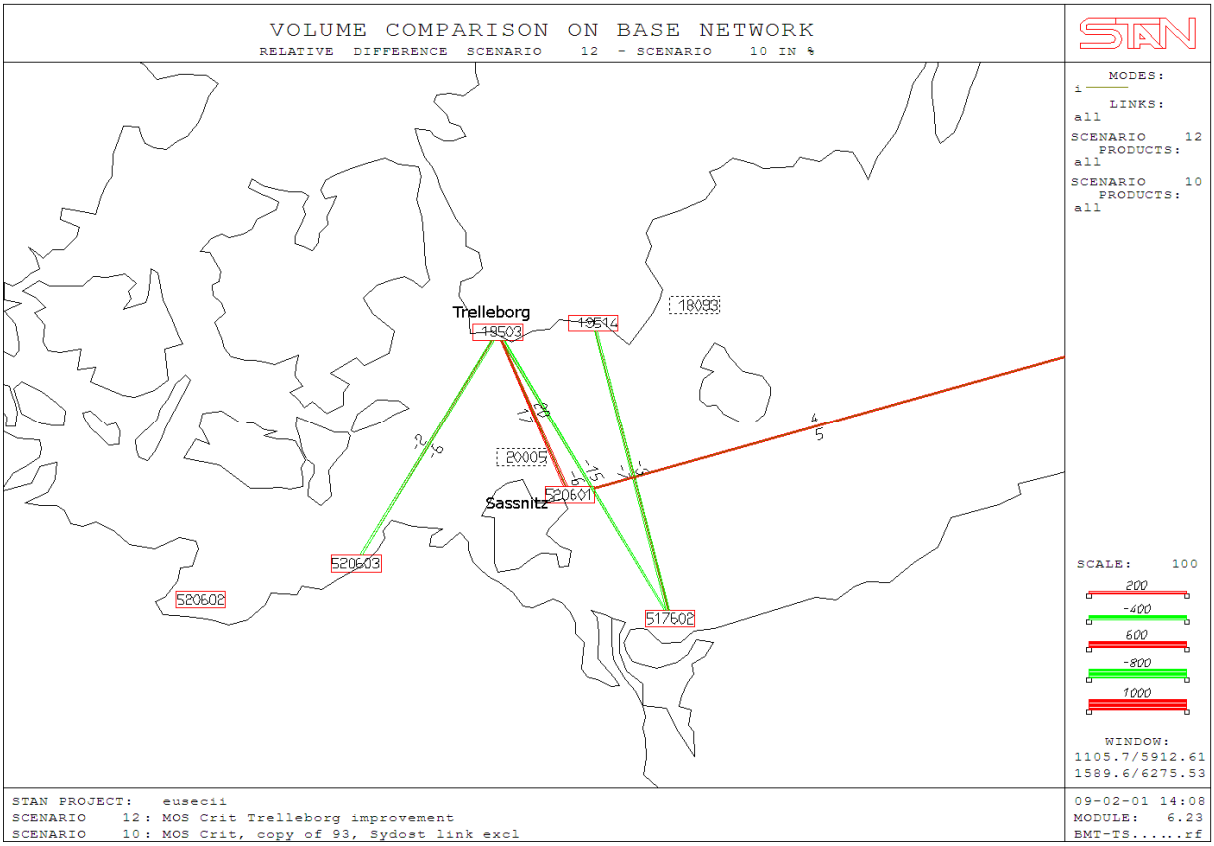
Truck volumes are attracted from various sources such as Rostock. However, the Ystad line seems not to be affected.

Figure 3: S2: Simulated percentage changes on ferry links in the southern Baltic Sea 2012



Rail volumes are attracted from Rostock (- 6% nothbound, -2% southbound, and from the Ystad lines -15% northbound, - 6% southbound[3])

Figure 4: S2: Simulated percentage changes on the rail ferries in the southern Baltic Sea 2012



[3] The shift of the ferry lines from Ystad to Trelleborg has not been implemented in the network in order to avoid another change in the comparison with previous scenarios (Deliverable 5) within the same study.

4 Sensitivity analyses

4.1 Impact of road pricing, Scenarios S1M and S2M

4.1.1 Results of the SIR-C Roadprice project

The SIR-C project "Roadprice"[4] concluded that the planned road taxes in Sweden will have a clear impact onto modal split in Sweden and on the links connecting Sweden to Europe. "Roadprice" simulations did show that potential changes in modal-split from road transports to mainly intermodal rail transports are evident, if a Swedish road user charge for heavy vehicles is introduced. The outcome predicted, that road ton-kilometres are reduced by 13% in Sweden, while intermodal rail transport work increases by 29% and conventional rail transport work by 12%. However, it has to be stated that within this project very strong changes in costs parameters were simulated, such as an increase of distance dependent costs for road by 50%, and, in some scenarios, a reduction for rail distance dependet costs by 10% at the same time. However, experiences in Germany with the Maut suggest, that rising truck costs offer the rail operators the opportunity to raise their prices as well and so the competitive advantage of rail is reduced.

A sensitivity analysis of the impact of reduced road user charge level still indicated a clear effect on modal-split, but on a lower level. The tested reduced charge level resulted in a reduction of the transport work of trucks by -4%, and increases in intermodal rail transport by 11% and in conventional rail transport by 4%.

[4] Effects of road user charges for heavy goods vehicles and the potential to influence modal-split

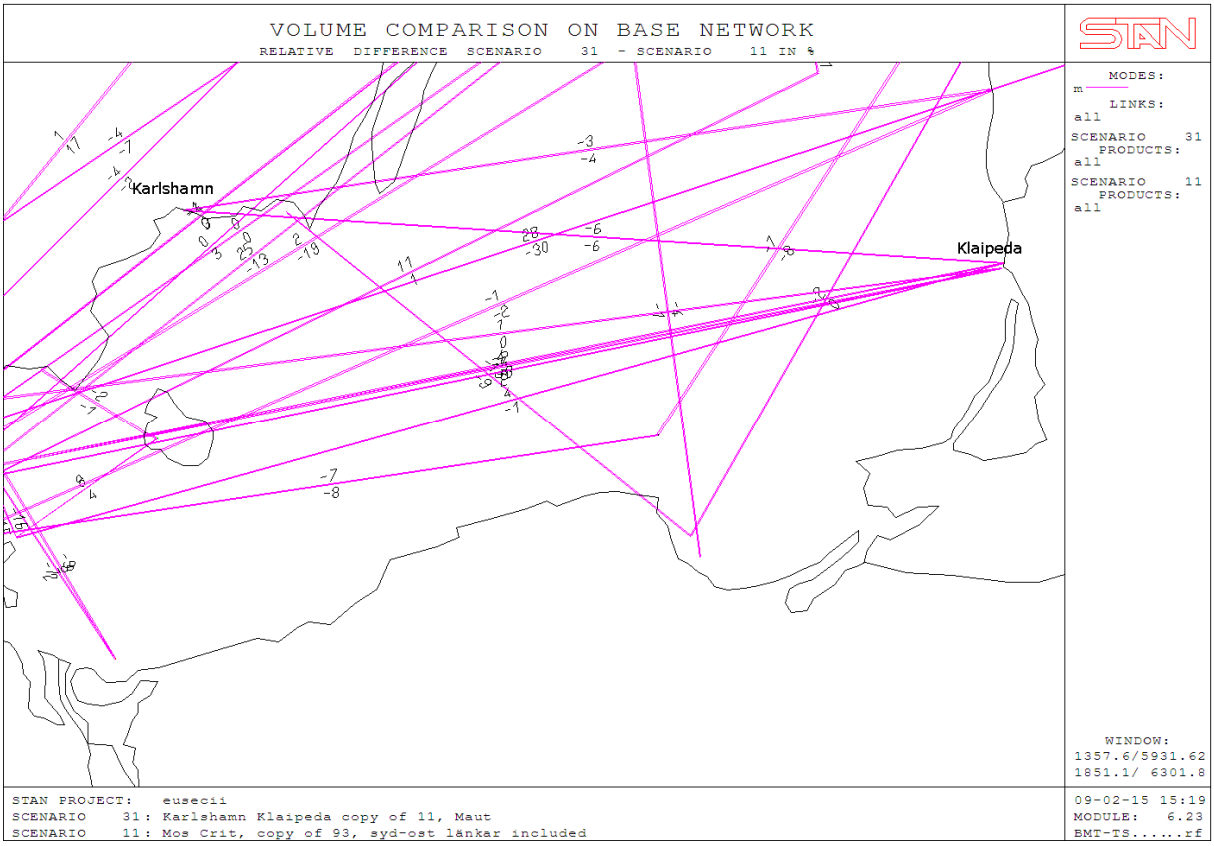
4.1.2 Will road user charges have a measurable impact on the two Swedish MOS projects?

Following the approach chosen in the Roadprice project, the changes made within the systems remains according to VTU/SIKA proposal +50% of operative distance dependant cost for truck transports.

An introduction of a road tolling schemes for trucks in Sweden will create a reduction of road transport and in consequence also reduce the market for truck ferries. It seems, that the more alternatives in route and mode choices exist, the more likely it is that the truck ferries, including the MOS links, lose volumes. Both MOS links are in the south of Sweden, which means as a consequence, truck transports from/ to these two ports can be quite long. The average transport distance between Sweden and Germany is in the range of 1.500 km.

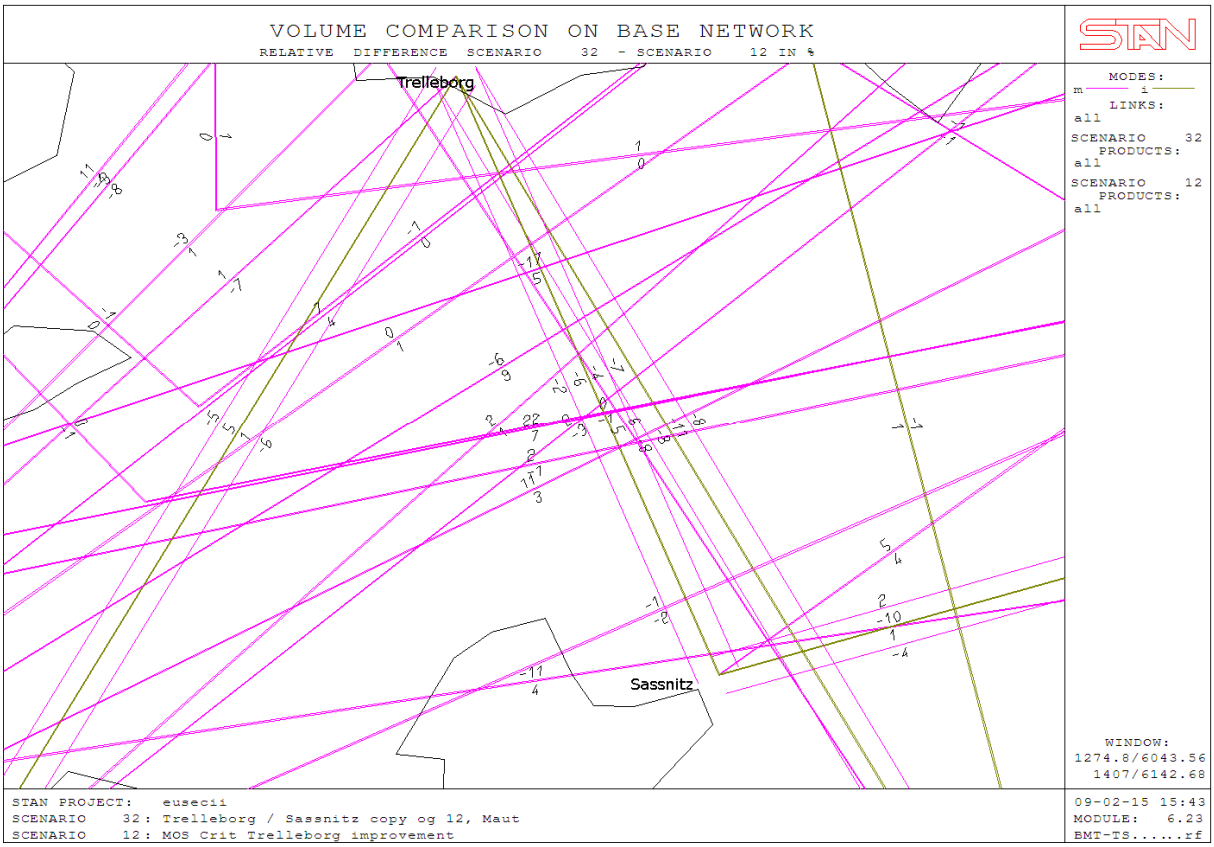
For the Karlshamn – Klaipeda MOS the losses are simulated to be in the range of 6% in both directions, if truck costs are increased as described above.

Figure 5: S1M: Simulated percentage change if Swedish road truck toll is introduced on truck ferry lines



The MOS link from Trelleborg to Sassnitz will also suffer a loss volumes because of the introduction of the Swedish road toll for trucks. The truck ferries between Trelleborg and Sassnitz are projected to lose 2%(southbound) and 7% (northbound) respectively. A modal shift from road to rail cannot be confirmed. Also the rail ferries will lose volumes, between 4% and 6%.

Figure 6: S2M: Simulated percentage change if Swedish road truck toll is introduced on truck and rail ferry lines



4.2 Additional sensitivity analysis, extended capacities

Within such a sensitivity analyses it could be tested, which of the critical quality parameters such as capacity, frequency and speed will have the most impact onto the route and modal split.

To keep to the realistic MOS cases, also within this sensitivity analysis not all parameters will be changed along a whole range of possibilities, but according to the special cases. This sensitivity analysis does not include the Swedish road toll.

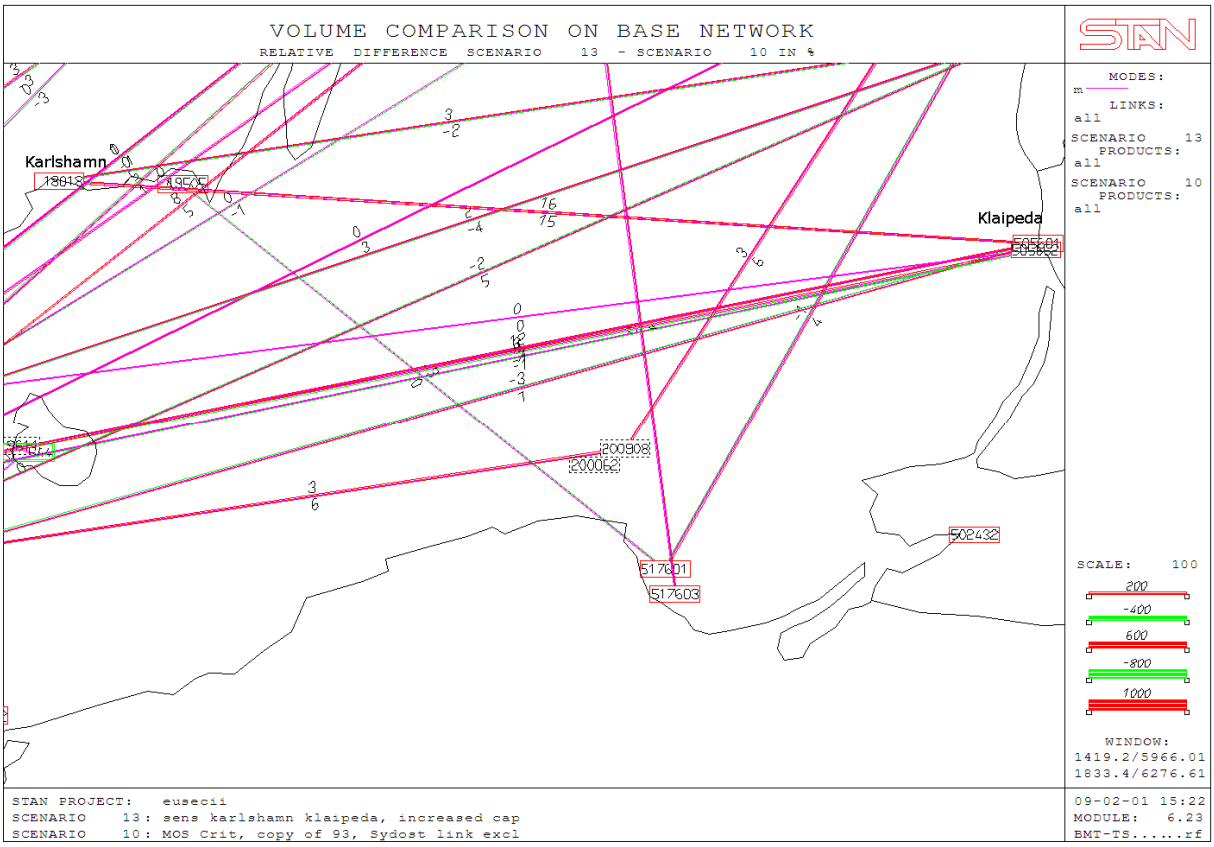
Table 2: Changes in the sensitivity analysis compared to the scenarios S1 resp. S2.

Name of Scenario	Karlshamn - Klaipeda	Trelleborg-Sassnitz	Remarks
S1S	Capacity of the truck ferry link is increased by 25%	None	Larger vessels could be deployed on this link
S2S	None	Capacity is increased also for truck transports by 10%	Since parts of the MOS application aim at reducing the dwell time of the vessel in the port, a fifth departure per day per direction will be possible

4.3 Sensitivity Scenario S1S

The increase of the capacity on the ferry link Karlshamn – Klaipeda is identified as one of the major success factors for the MOS link, because with the increase, the additional volumes from the syd-ost rail link become a part of the potential for this ferry link.

Figure 7: Simulated percentage changes on the truck ferries in the south eastern Baltic Sea with increased capacity on the Karlshamn – Klaipeda link

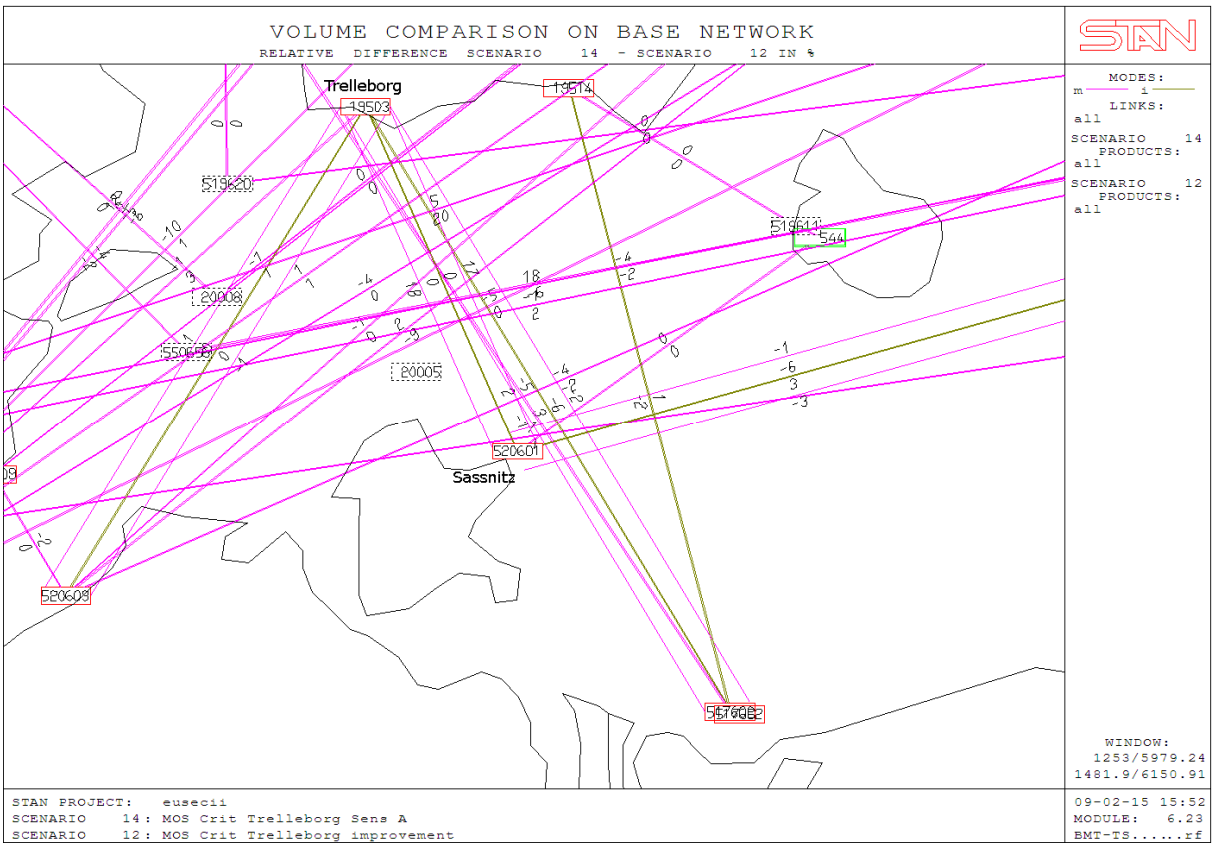


The simulated potential rises by 15% eastbound and 16 % westbound. Also the volumes that are forecast in this set-up on the syd ost link are higher than in the base scenario. The conclusion is, that there is a strong interrelation between the capacity on the ferries from Sweden to the Baltic States and the volume attracted to the new rail infrastructure in Blekinge.

4.4 Sensitivity Scenario S2S

The increase of the capacity on the truck ferry link Trelleborg-Sassnitz reveals additional potential for this link, since the simulation indicates 17 resp. 18% increase in volumes on that link. The rail link volume is stable in the comparison, so that this additional truck volumes seems to come from other truck ferries, especially from the Ystad link.

Figure 8: Simulated percentage changes on the truck ferries in the southern Baltic Sea with increased truck capacity on the Trelleborg-Sassnitz link



Generally, a ferry link within a competitive environment will always benefit from improvements in capacity, frequency or/ and speed. Especially in areas with dense networks, the additional volumes will come from neighbouring ferries or from ferries serving a comparable hinterland.

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