LONG-DISTANCE FREIGHT

ROADMAP

TRANSFORUM
TRANSPORT 2050

This project is co-funded by the European Union

SEVENTH FRAMEWORK PROGRAMME

ROADMAP towards goal 3 of the White Paper on Transport:
»30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed.«

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THE CONVERSATION DOES **NOT** STOP ON 8 DECEMBER 2014!

The comments we receive at the conference on 8 December 2014 will still be considered in the condensed version of the TRANSFORuM Roadmaps and for the Strategic Outlook document. We will also compile the essence of the Brussels discussions on our project website.

The conversation about the revision of the White Paper and the best ways to implement its goals will also continue on the TRANSFORuM website, where we provide an online forum for all your thoughts, comments, criticisms and suggestions. Keep the discussion alive.

www.transforum-project.eu

GENERAL INFORMATION

The present document is the Roadmap 2.0 on Long-distance Freight of the FP7 project TRANSFORuM. This roadmap is one element of the formal Deliverable 6.2 "Consolidated roadmaps and recommendations to reach selected EC 2011 WP goals".

More information about the project can be found at www.transforum-project.eu

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LIST OF ACRONYMS

AGV – Automatic guided vehicle

Btkm – billion tonne-kilometre

CCT – CarConTrain

CEF – Connecting Europe Facility

CIP – Customer information platform

CLCS – City logistics service centre

EEIG – European Economic Interest Group

ERTMS – European Rail Traffic Management System

GHG – Greenhouse gas

Ha – Hectares

HSR – High-speed rail

ICT – Information and communication technology

ITS – Intelligent transport systems

IWW – Inland waterway

LNG – Liquefied natural gas

MGO – Marine oil gas

NEAT – New rail link through the Alps

PA – Private actors

R&D – Research and development

Ro-Ro – Roll-on, roll-off

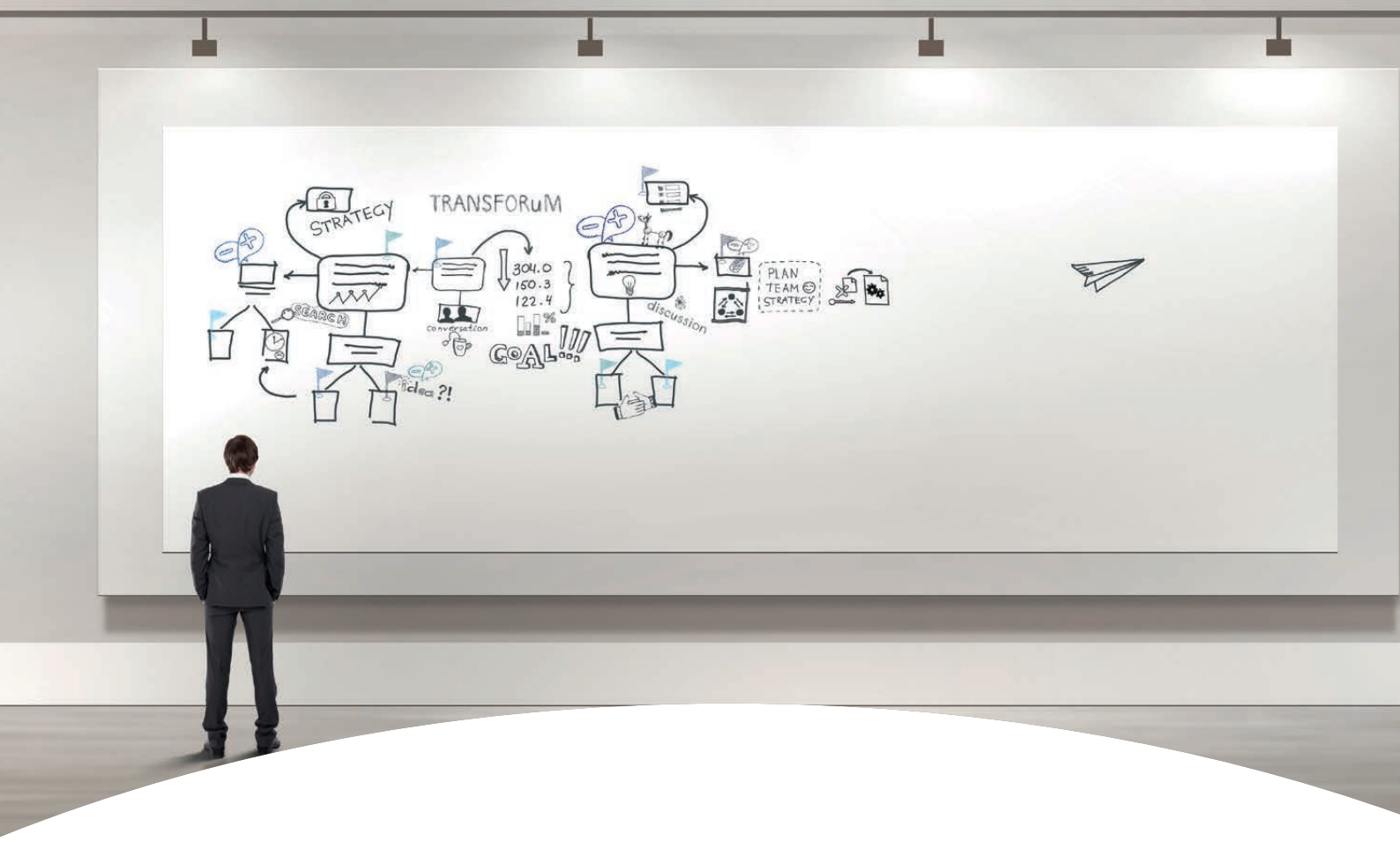
SME – Small and medium enterprises

TEN-T – Trans-European Transport Network

TEU – Twenty-foot equivalent units

TKM – Tonne-kilometre

ZARA – Zeebrugge, Antwerp, Rotterdam and Amsterdam



1 Information about the TRANSFORuM project

Generally speaking, the FP7 project TRANSFORuM contributes to the transformation of the European transport system towards more competitiveness and resource efficiency. It has done so by engaging key stakeholders in carefully moderated forum activities and through other consultation measures in order to identify their views about the related challenges, barriers, trends, opportunities and win-win potentials. TRANSFORuM thus facilitated a discussion forum of relevant actors and stakeholders about the best ways to reach four key goals of the 2011 European White Paper on Transport:

- Clean urban transport and CO_2-free city logistics (goal 1)
- **Shift of road freight to rail and waterborne transport (goal 3)**
- Complete and maintain the European high-speed rail network (goal 4)
- European multimodal transport information, management and payment (MIMP) system (goal 8)

TRANSFORuM's underlying assumption was that policymaking should be based on an in-depth understanding of all stakeholders' positions and that coordinated action among them is more effective than any solo attempts. The TRANSFORuM consultation process was therefore designed to elicit these views and to facilitate the emergence of synergy ideas.

The concrete conversations with and among stakeholders were conducted through many direct interviews, 130 responses to our online survey, via various social media channels and the feedback function of our project website. Most importantly, though, TRANSFORuM organised 10 face-to-face workshops in 10 different European countries – at four of which long-distance freight was addressed (see overleaf).

We paid careful attention to ensure a balanced representation of all types of stakeholders. Men and women, established large companies and innovative start-ups, representatives from all corners of Europe, suppliers and users, hardware and software companies etc. This selection process was based on TRANSFORuM's first official deliverable ("Shaping the TRANSFORuM Network" – available on our website), which spells out

the criteria that guides our stakeholder selection. To ensure the complete transparency of this process we made the list of attendees of our events always publicly available on our website. Our participants included representatives of national administrations, transport operators, mobility service providers, representatives of logistics organisations, non-governmental organisations (NGOs) and members of national and European programmes and platforms.

This roadmap is primarily based on the stakeholder debates at the following TRANSFORuM workshops (similar workshops were conducted for the other three goals):

- A two-day workshop in Gdansk, Poland, in June 2013, which provided basic identification of key policies, actors, funding mechanisms and trends with regard to Long-distance Freight, as well as an identification of barriers, challenges, and ways to overcome them;

- A two-day workshop on good practice lessons and on learning processes was held in Basel, Switzerland, in November 2013, including presentations about and a visit to a multimodal freight terminal close to Basel;

- A two-day workshop in Vienna, Austria, in January 2014 with a particular focus on cross-cutting issues between TRANSFORuM's four White Paper goals and a discussion of the preliminary roadmaps;

- A two-day workshop to discuss the draft roadmap 2.0 on Long-distance freight which was held in Duisburg, Germany, in June 2014, including presentations and a visit to a multimodal freight terminal.

- The roadmap was carefully reviewed by two external experts ensuring a consistency and quality check and allowing for some further improvements.

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2 The White Paper goal on Long-distance freight

TRANSFORuM's Thematic Group on Long-distance freight deals with goal no. 3 from the European Commission's 2011 Transport White Paper:

> **30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed.**

The White Paper states that freight shipments over short and medium distances (below some 300 km) will mostly remain on trucks. For the longer distances, options for road decarbonisation are more limited and efficient options for freight multimodality are needed. With its particular focus on the facilitation through "efficient and green freight corridors", the goal emphasises the importance of coordination, of bundling activities and packaging policies in these corridors. This can be interpreted as a claim for an optimised organisation of transport flows that helps tapping the potential of the existing infrastructure much more efficiently. On the other hand, the goal also explicitly emphasises the relevance of a further development of "appropriate infrastructure" for freight transport. It is not specified to what extent this will be achieved by new tracks, extended waterways and new facilities for intermodal transhipment respectively.

Furthermore, the goal clearly addresses the relationship between trucking at the one side and rail freight and waterborne transport at the other side. It implicitly aims at increasing the relative competitiveness of the latter. A roadmap towards the goals needs also to take into account potential developments in the trucking sector. The goal is actually addressing all modes of surface-based transport and, thus, caters to a broad range of different actors, interests and strategies.

Based on these reflections, the TRANSFORuM team assumes that, in a somewhat simplified form, the goal can be achieved by applying three basic strategies:

- Make rail freight more competitive by improving service quality, lower costs and by increasing transport capacity;
- Make waterborne freight more competitive by improving service quality, lowering costs and increasing transport capacity;

- Realise a level playing field. Make road freight (and all other modes) pay fully for its external costs. Enforce existing rules for road freight regarding e.g. cargo weight, speed limits and working conditions. Such rules are already followed in the rail sector.

More detailed measures and policies supporting these strategies are described in chapters 3, 4 and 5. The roadmap will highlight that a combination of policies from all these three basic strategies is needed to archieve the goal.

2.1 The TRANSFORuM process

The overall objective of the TRANSFORuM roadmap on long-distance freight is to analyse:

- "Who should be doing what by when?" to achieve the White Paper goal;
- Which milestones are suitable to track progress in the field;
- Which recommendations for European transport policies can be drawn from the findings.

The roadmap aims to provide general recommendations and demonstrate pathways of European-wide significance. However, given that there are substantial differences between European regions in terms of geographical conditions (coastal/non-coastal locations, significant water courses, mountains etc. all influence freight decisions), in terms of economic, societal and cultural dynamics. Therefore it seems necessary to focus also on concrete regions or corridors when it comes to the more detailed formulation of actual approaches. Therefore, the roadmap also aims at illustrating how the White Paper goals could be reached in specific regional settings.

2.2 Stakeholder perceptions of the goal

In the workshops and consultations mentioned in Chapter 1, TRANSFORuM collected stakeholders' feedback on the appreciation of the White Paper goal. The majority of stakeholders consider the goal as ambitious (some even said too ambitious), but meaningful.

The related discussions at the workshops suggested that stakeholders from the rail and waterborne sectors are in general aware of the goal. However, it was questioned whether the White Paper goal is well known to a wider audience. It was acknowledged that "decarbonisation" is in general a much more prominent target.

It was further stated that the goal is general. There are many differences between countries; in praxis, there will be a need to adopt the targets and related strategies for achieving the goal to the specific settings in different European regions. Due to large economic and social differences between the EU Member States all policies should include the possibility to consider national characteristics. Specifically, this includes examples like the development potential for existing inland waterway transport (IWW) in the Netherlands and Germany, and little if any need, for IWW development in countries like Switzerland (which is not in the EU but highly crucial for long-distance freight).

Although the goal leaves some scope for interpretation, in TRANSFORUM we have assumed that the shift from road freight refers to a reference scenario for 2030 (and 2050). That means that 30% of road freight over 300 km in 2030 should be shifted to rail and waterborne modes. The goal does not specify how much should be shifted to water and how much to rail. Again, this might differ considerably between European regions and Member States.

3 Mapping of the field

3.1 Present structure of freight markets

The total demand for freight transport in EU27 has been doubled since 1970. The market share for road transport has increased from 41% in 1970 to 76% in 2011, while the rail share during the same period has decreased from 49% to 15%. In the last ten years the rail market share has stabilised and increased slightly. IWW has generally been constant and whilst it has increased the last ten years market share has been stable at 6%.

The present freight transport volume and modal split is shown in Figure 1. Rail stood for 414 billion tonne-km (tkm) and IWW for 137 billion tkm in 2012. Although maritime transport (short sea shipping) represents an impressive market share, it should be noted that about 68% of this transport consist of bulk goods (Eurostat, 2010). If measured as tkm, the share would be even higher. The segments of maritime that are of most interest with regard to shifting freight from road to waterborne are container transport and roll-on, roll-off (Ro-Ro) transport. These segments represent roughly 15% of intra-EU maritime freight measured as tkm.

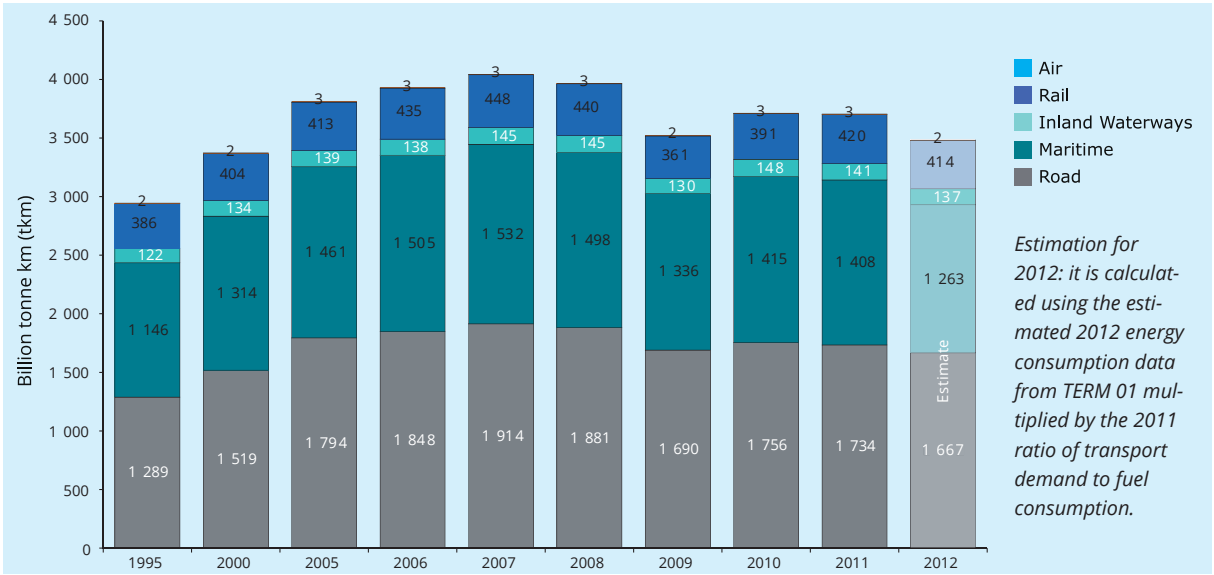


Figure 1: Freight transport volume and modal split within the EU (EEA, 2013)

This means that these segments of maritime together would amount to around 180 billion tkm in 2012.

The focus of the White Paper goal is the segment of road freight travelling covering distances above 300 km. This segment constitutes 11% of tonnes lifted and 56% tkm within road freight. In Figure 2 the tkm are distributed by distance.

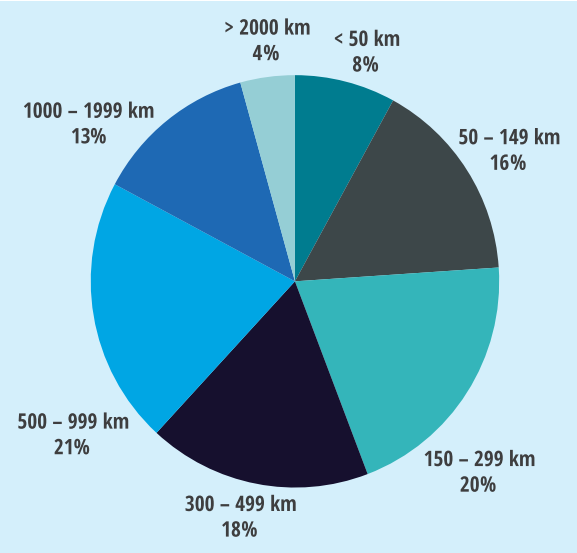


Figure 2: EU road freight (tkm) by distance (Eurostat, 2012)

The major groups of goods (NST, 2007) carried in road transport exceeding 300 km are food products (17% tkm), agricultural products (10% tkm), mixed goods (10% tkm), chemical products (9% tkm), metal products (9% tkm) and wood, paper and pulp (8% tkm) (Eurostat, 2012).

3.2 Reference scenario and changes required to meet the goal

In the Commission's 2001 White Paper, increasing the competitiveness of rail and maritime freight was already an important objective. The current goal can still be seen as clearer and more ambitious. Freight over 300 km represents 11% of tonnes lifted and 56% tkm. Total intra-EU freight transport amounted to 3700 billion tkm in 2010. Road transport over 300 km contributes to 965 billion tkm.

We use the projection developed in "EU Energy, Transport and Greenhouse Gas (GHG) Emissions Trends to 2050 Reference Scenario 2013" (EC, 2013a). That scenario contains no additional policies beyond those that have already been decided. The projections show an increase in the total freight transport activity by about 57% (1.1% p.a.) between 2010 and 2050 as shown in Figure 3. Road freight is projected to grow by 55% during the same period while rail freight is projected to grow by 79% and IWW by 41%.

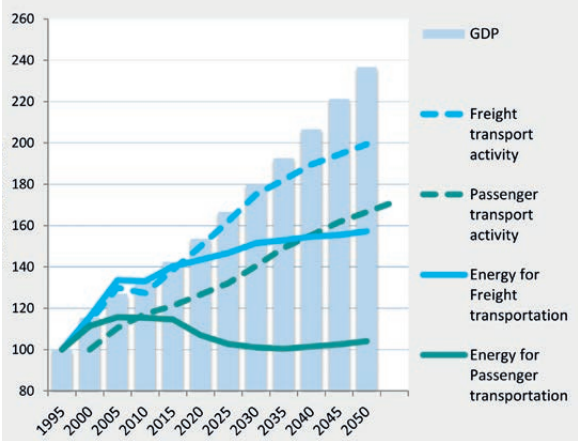


Figure 3: Trends in transport activity and energy consumption (EC, 2013b), Index 1995 = 100

This means that road freight is projected to amount to 2721 billion tkm in 2050. If we assume that 56% of this volume still consists of freight on distances over 300 km, then 760 billion tkm need to be shifted from road to rail and waterborne until 2050, according to the goal. In addition the reference scenario assumes increases by 300 billion tkm for rail freight and by 60 billion tkm for IWW shipping. If the freight was to be shifted to rail and waterborne according to current market shares (only including container and Ro-Ro transport for maritime), rail freight would have to increase from 391 billion ton-km in 2010 to around 1100 billion tkm in 2050.

A study in the UK (McKinnon and Piecyk, 2010) based on a Delphi survey of 100 logistics specialists suggested that mode shift could potentially decrease roads share of the freight market by 14% (from 64% tkm to 50%) by 2050. A study by den Boer et al. (2011) deals with the shift from road to rail of freight transport in the EU to 2020. One conclusion is that there is a potential to increase the market share for rail from 18 to 31–36% and reduce GHG emissions by 19% where road and rail compete. This is roughly consistent with the modal shift target as exemplified above. Although such studies are always associated with considerable uncertainties, they seem to indicate that the goal is achievable, even if challenging.

It may also be acknowledged that some Member States already have market shares for rail and waterborne that are close to those required by the White Paper goal. This is shown in Figure 4.

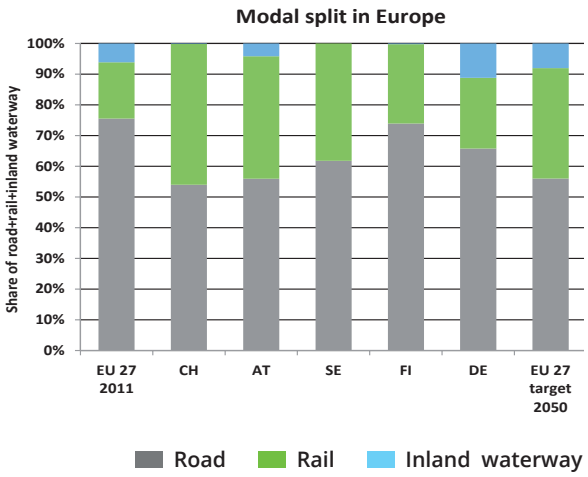


Figure 4: Market share for truck, rail and IWW for EU27[1] *(EU and Tosca Project, 2010)*

3.3 Key trends influencing long-distance freight markets

3.3.1 Globalisation

The globalisation of trade patterns continues. There are, however, signs that future trends may disrupt these developments. With a stagnating population in Europe, the demand for new residential areas may be weak, which in turn has the potential to decrease transport needs. There are also weak signs of re-regionalisation (The Economist, 2013). Having said this, globalisation still seems to be a strong driver to consider at least in the short- and medium-term.

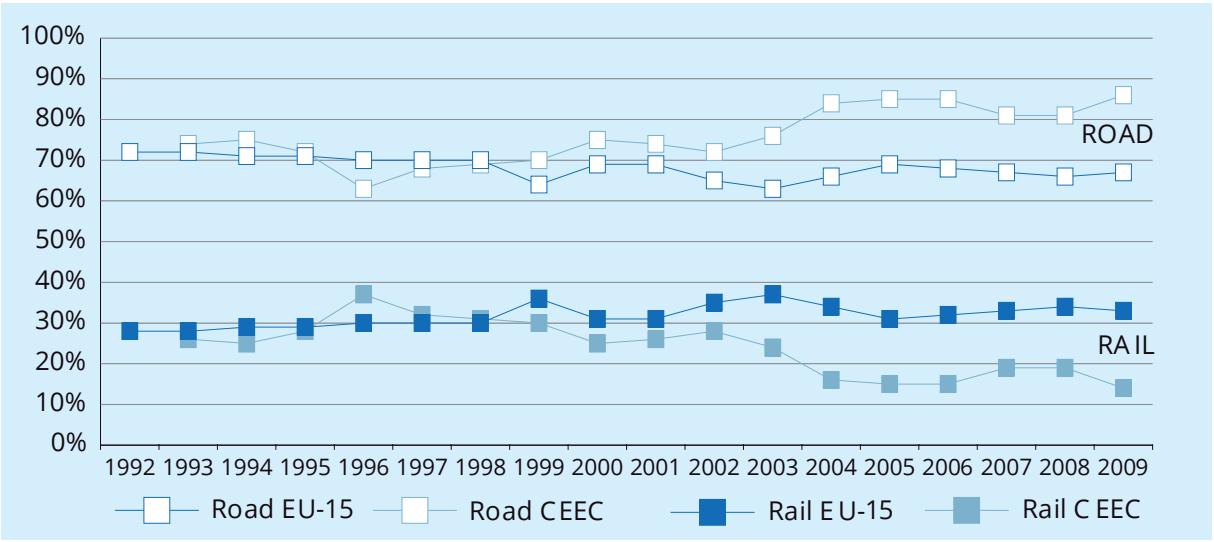
3.3.2 Liberalisation of freight markets

Deregulation and liberalisation of freight markets is an important trend. The four "Railway packages" constitute key elements for this policy development. The first was passed in 2001 and recently the fourth Railway package was proposed. As a consequence, markets for rail freight became open for competition in 2007 (Guihéry, 2013). Although the pace of implementation has differed considerably between Member States, on the EU scale effects are evident. The EU27 market share of new entrants in the freight market was 14% in 2006, 19% in 2008 and 25% in 2010 (CER, 2013).

3.3.3 Infrastructure investments

Figure 5 shows the development regarding infrastructure investments over the last decades. The share of rail investments (road and rail together) has been around 30% throughout the whole period in the EU15. However, for Central and Eastern European Countries the share for rail investments has been halved between 1999 and 2009 (CER, 2013).

Figure 5: Rail and road market share of infrastructure investment in EU15 and Central and Eastern European Countries, 1992–2009 (CER, 2013)



1 This figure illustrates selected countries with high rail market share (2011), alongside a 2050 scenario for the EU27 following implementation of the White Paper. Derived from EU statistics and forecasts from the TOSCA-project

3.3.4 Fuel availability

In recent years the oil price has hovered around a high of $100 (€80) per barrel with subsequent increases over the last decade. This especially affects sea and air transport, which are exempt from fuel taxes. The price of bunker oil increased by a factor of about four between 2002 and 2010 and most projections point out increasing oil prices, although short-term fluctuations in both directions may be common, as they have been historically. The availability and cost of unconventional oil will be a critical factor, as of course will the political situation, for example in the Middle East. A factor is also to what extent key consumers will demand "dirty", unconventional oil. For instance, the proposed EU legislation that takes into account indirect (upstream) emissions will make it difficult for many of such fuels to make it into the European market.

3.3.5 Containerisation

Trade using containers is increasing faster than trade in general. Figure 6 shows that growth of the container trade has been on average over 5% since 1996.

3.3.6 E-commerce

E-commerce is increasing rapidly. In the coming years e-commerce in the US and Europe is expected to increase by around 10% annually (Forrester, 2011; eMarketer, 2013). An effect of this is that consignment sizes are getting smaller and total transport volumes are increasing due to longer distances travelled (TRANSFORuM Gdansk Workshop, 2013). The load factor of vehicles may be negatively affected.

Recently published studies conducted by logistic companies (Cf. DHL Global Mail, 2013; Deutsche Post DHL, 2014) are integrating assumed future trends like 'Everywhere Commerce' into four scenarios (e.g. collaborative consumption or hybrid consumer behaviour) to illustrate potential changes in lifestyle choices. Results show that the impacts on the transport sector may vary considerably depending on different contexts; but the worldwide volume of transportation is expected "to increase substantially" (Deutsche Post DHL, 2014).

E-Commerce trends are potentially inspired as they offer more convenience for consumers (e.g. home shopping). The share of e-commerce related to total retail is expected to double between 2011 and 2018. This trend estimates that part of this will come from a growth in "distance selling" (e.g. ordering goods in China) (Cf. DHL Global Mail, 2013). These findings are supported by a study that investigated the rising usage of e-commerce in different European regions/ countries. The percentage of citizens who ordered products via the Internet in 2010 ranged between

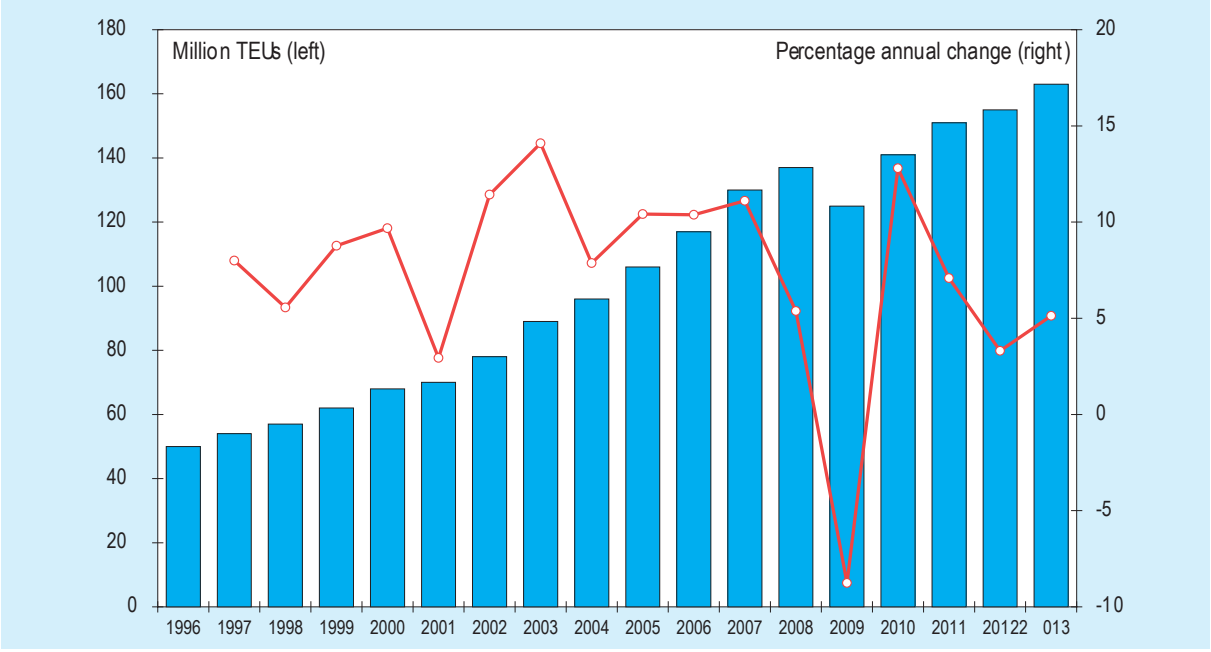


Figure 6: Global container trade in 1996-2013 (UNCTAD, 2013)

less than 15% and more than 75% as a percentage of regional population (Epson, 2013).

3.3.7 Sharing economy/Car-sharing

In 2013 "Shareconomy" was the keynote theme at the world's largest business event for digital IT and telecommunications solutions, the CeBIT in Hannover, Germany. Sharing economy, or collaborative consumption is used to describe the value ascribed by a growing population to access (e.g. to cars, software, or information) over ownership. The transport market is also affected. Even though, car-sharing does not have particularly high shares yet there seems to be a huge potential in the market.[2] Enormous dynamics are involved and related approaches are underway that accelerate the growth of the market. Car-sharing growth has occurred in nearly all car-sharing countries, with the biggest growth rates in North America. North America has now replaced Europe as the epicentre of car-sharing activity (Schippl and Puhe, 2012). Information and communication technology (ICT) clearly enables access to such options and as well as bottom-up and informal traditional car-sharing schemes, several carmakers have started to enter the market with their own concepts such as car2go (Daimler) or drive now (BMW).

The increasing demand for such services is particularly noticeable among a growing group of younger adults living in urban areas. This group seems to be less interested in car ownership than the generation before (Schippl and Puhe, 2012). In spite of the impressive growth rates (between 10–20% yearly over the last 20 years, (BCS 2014), the share of people actually car-sharing is still relatively low (for example 500,000 out of 80 million Germans are users) and isn't changing regular transport behaviour too much. However, the trend is clear and definitely valid. It needs to be taken into account because it might become relevant for long-distance transport over the next decades. The idea of a sharing economy might influence transport demand and related capacities (fewer road investments may be needed) or it might induce far-reaching changes in production and goods flow patterns.

3.3.8 Lower wages in road freight

In the road freight sector, Central and Eastern European Member States are rapidly increasing their market shares. For instance, between 2004 and 2012 trucks registered in Poland increased their transport volume from 102 to 222 billion tkm. In comparison, German trucks only increased their haulage from 303 to 307 billion tkm during the same period, and in France the transport volume decreased from 203 to 172 billion tkm (Eurostat, 2013b).

An implication of this shift is decreasing average wages in the EU27 road freight sector. Average annual personnel cost per employee in the road freight sector is €26,000 in Germany, €34,000 in France but only €6,000 in Poland (Eurostat, 2013c). Since wages account for a large part of the total costs in the road freight sector, this development will significantly increase the competitiveness of the sector in relation to rail and waterborne transport.

3.3.9 Recycling of materials/products

There is a clear trend towards increased recycling of materials/products under the paradigm "Extended Producer Responsibility" (LogMan, 2008). The share of municipal waste going to landfills in the EU27 decreased from 68% in 1995 to 38% in 2009 (Eurostat, 2011). The impact of this on transport depends on various factors including collection system and the localisation of recycling facilities in relation to where extraction of virgin materials occurs, for example.

3.3.10 Ageing population in Europe

The total EU population is projected to be stable over the period 2010 to 2050. However, the share of people over 65 will increase by 70% and the share of people over 80 will increase by 146%. The ratio between the total population and those between 15 and 65 is thus projected to increase from 1.44 in 2010 to around 1.76 in 2050 (Lanzieri, 2011). This means that there will be fewer people of a productive age needing to support an increasing number of elderly people. Although this to some extent could be counteracted by raising the retirement age, the associated costs of an older population (for healthcare etc.) may mean that funds that could be allocated to infrastructure budgets may be reduced.

Another effect of an ageing population is that consumption patterns may be shifted more towards services, which will to some extent reduce the need for freight transport. That the population growth in the

2 See Frost & Sullivan (2009) and Shaheen & Cohen (2013) for car-sharing trends and Shaheen et al. (2011) for bike sharing trends

EU is projected to diminish may also decrease the need for extending the stock of buildings, which in turn may also reduce demand for freight transport.

3.4 Central and Eastern European Freight Markets

3.4.1 Central and Eastern Europe perspectives

Firmly establishing the co-modality principle in Europe is one of the most important means through which freight transport can be made more sustainable. Freight transport is a very competitive economic sector in Central and Eastern Europe countries, and these Member States are strategically and geographically important to deliver against the long-distance freight goal. Regarding IWW leading countries include especially the Netherlands, Belgium and Germany in Western Europe, but only Romania in Eastern Europe. The remaining EU countries have rather small shares of IWW. Naturally, such disproportion is caused by proximity to large rivers, river mouths and seaports in the aforementioned countries (Fleischer, 2010). In spite of the given prerequisites for the utilisation of IWW in Eastern Europe, there are some countries with promising potential in this area, particularly Poland as a maritime country with important ports and big rivers. Countries along the Danube River (Hungary, Slovakia, and Romania) also have the potential to take advantage of access to the river and increase freight transport. It is important to highlight that even countries without such rivers can still increase the extent to which they are used for freight transport, as they can connect their own rivers by artificial canals and dams in order to extend the river infrastructure network.

The majority of Central and Eastern European Member States have extensive rail networks. These require huge investments to improve and maintain the quality of the infrastructure; unfortunately, limited financial sources have led to the deterioration of some less-frequented corridors. On the other hand however, plans to build Trans-European Transport Network (TEN-T) corridors are important for Eastern European states. After completion of the TEN-T corridors, freight transport on these lines will be faster and cheaper and such qualities are most important for users when selecting modes for transporting freight (Bąk and Borkowski , 2010).

Another problem arises from the fact that there is a lack of terminals for multimodal transport with suitable parameters in Central and Eastern European countries, which will need to be addressed through the construction of public logistics centres in the coming years to facilitate the achievement of the goal (Wichser et al., 2007).

3.4.2 Newcomer states

The next potential EU enlargements (if realised) will most probably reach out towards the East and South of the continent. Initial steps have already been made for Turkey and the Ukraine to join. Other European countries from the Balkans have signed the Stability Pact and are preparing to enter the negotiation phase. The official status of an aspiring country may be as an official candidate (Montenegro, Macedonia, Serbia and Turkey), as a country going through the stabilisation and association process of Western Balkans (Albania, Bosnia and Herzegovina) and associated countries (Georgia, Moldova and Ukraine). All together, these potential newcomer states represents a large market with long-distance transportation needs and, in addition, a substantial transit capacity to further destinations like Russia, Caucasus, Middle Asia (Georgia, Armenia, Azerbaijan, Iran etc.),and even China.

Considering that the transport sector provides infrastructural integration and free flows of people and commodities, both future EU transport policy and current transport policy of non-EU members should be focused on cohesion. For this reason the following actions are suggested:

- Gradual implementation of the European Commission's 2011 Transport White Paper goals into national legislative systems of aspiring states;
- Consideration of EU-wide infrastructure development (especially TEN-T) in aspiring states' national development plans and strategies.

These are only suggestions and should be treated by aspiring states as recommendations for future negotiation phases, which would facilitate a smoother accession into the EU, at least from the perspective of transport policy.

4 Building blocks

This chapter highlights the key elements that require consideration in building the freight roadmap. The stakeholder consultations carried out in this project clearly highlighted that a combination of different approaches is needed to achieve significant modal shift. However, for reasons of clarity in this chapter we introduce the three key areas separately. We will explicitly deal with their combinations in the chapters 4, 5 and 6.

Good practice examples

Throughout the following sections, examples from TRANSFORuM's previous work on good practice in the context of the White Paper (Deliverables 5.1. and 5.2[3]) will demonstrate identified factors of success. These examples will be presented in small blue boxes.

4.1 Rail freight

4.1.1 Improved service quality and reduced costs

The most important factors for customers it that transport fulfils some basic quality requirements and that the cost is acceptable. Customers will not pay much of a premium for environmentally-friendly transport. It is therefore important that all modes pay for external effects like emissions, noise and infrastructure wear. To get more customers to choose rail the following measures are essential:

- Deregulation of freight railways, in combination with other measures, to improve service and cut costs;
- Establishment of rail freight corridors to improve service in international transport;
- Better maintenance of tracks and operation planning for freight;
- Improved freight wagons and trains;
- More efficient intermodal transport systems, not least regarding hubs;
- Information systems about available supply of rail transport;
- Information systems for tracking and tracing of consignments (KTH Railway Group, 2013).

3 Deliverables 5.1 and 5.2 are available at www.transforum-project.eu/resources/library.html

There is an on-going process of freight rail deregulation. The aim is that customers should have more rail alternatives to choose from and also that increased competition should make old rail companies more efficient. The process has not yet been implemented in practice in all EU countries. In some countries deregulation has been successful and rail market share has begun to rise. However, there does not seem to be a clear correlation between market opening and rail freight share across the EU (European Commission, 2014). There may be several causes for this situation. The average labour cost in road freight is diminishing as drivers from low income Member States take an increasing share of the market. The enforcement of regulations regarding working hours, weight limits and speed limits is still rather poor in road freight. This means that deregulation needs to be complemented with supporting measures creating a level playing field among modes. Furthermore, the administrative framework, which has been implemented to control and guarantee a free market, has often made it more complex to operate railways.

Rail market share is much lower in international transport despite long distances and large volumes, which should favour rail by economy of scale. That is why the implementation of international rail freight corridors is very important, to make it easier for long and cross-border transport in Europe. The first step is a question of making timetabling, administration and operation of international freight easier. Secondly, it is a question of technical harmonisation of train lengths, loading gauges, axle loads and signalling system.

Good practice: InnovaTrain

InnovaTrain AG is a company located in Switzerland, which focuses on innovative technical solutions to provide faster rail connections for time-sensitive cargo on short routes. The company's ContainerMover can horizontally transfer a container in three minutes and needs little space. RailCare Ltd, a major client of InnovaTrain, use the ContainerMover to run a network with six short and fast hybrid container trains which run up to three times a day on the Swiss railway network. Unused passenger train slots between the scheduled local commuter trains are used. At the end of 2013, there were 11 hubs with this fast rail/road transhipment in place in and around major Swiss cities.

Today intermodal is rather efficient for transport to and from ports, because the goods are already containerised and must be reloaded from the ship. For other types of transport, the terminal costs are too high and make intermodal profitable only on very long distances. There is a need to develop small-scale terminal technology so that containers can be transferred under the overhead contact wires during a short stop at a siding. The train can be loaded and unloaded during a stop of 15–30 minutes. This also obviates the need to park wagons. The terminals can also be made more compact and fully automated.

Good practice: CarConTrain, Megaswing

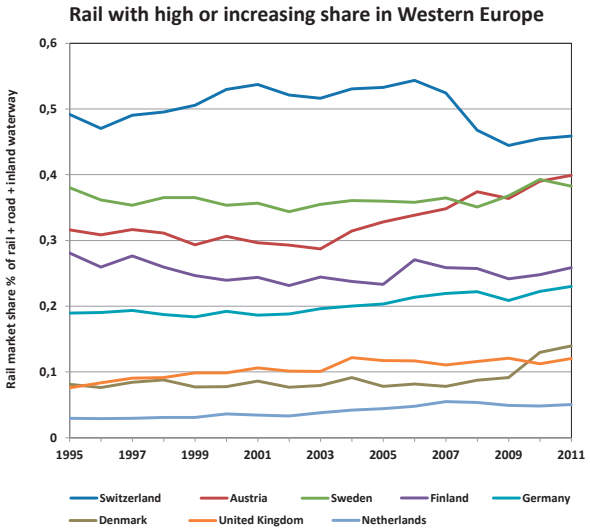
CarConTrain (CCT) and **MegaSwing** are two concepts that have been developed in Sweden to facilitate the required modal shifts through offering horizontal transshipment. Whereas CCT uses hydraulic poles and conveyer belts to roll containers between trains and trucks, MegaSwing enables semi-trailers to enter and leave the train on their own wheels. Both technologies have been successfully piloted and hold considerable promise in facilitating the movement of loads between modes.

If the rail system is improved, customers will use rail much more than they currently do. Some countries in Europe have for long had a high rail market share. Switzerland has 45–50%, and in Austria the rail share of the market is 30–40%, see Figure 7. These countries also have much transit traffic. Sweden and Finland have high market shares with 25–35%. The market share in Germany has increased from 19% in 1995 to 23% in 2011.

Good practice: Switzerland

Switzerland's freight transport policy since the 1990s has been geared towards promoting rail freight. Measures implemented include heavy vehicle fees; railway tunnels through the Alps and a general modernisation of the rail infrastructure contribute to the country's high rail market share.

But there are also countries in EU15 with a low or decreasing market share, including France and Spain. Recently however, rail market shares in most countries have increased slightly.



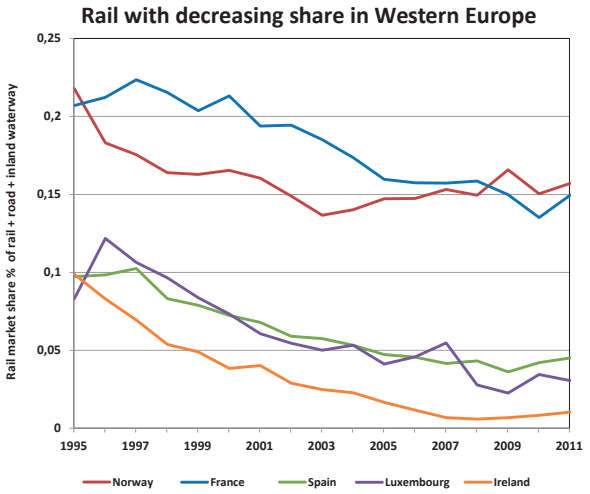


Figure 7: Market share for truck, rail and inland waterway in some countries in EU15 (EC, 2013b – statistics processed by KTH)

In the newer EU12 Member States, rail markets in total have decreased dramatically because the rail monopolies have been abolished. In the EU15 the market share in total has been stable or increased. Reliability is important in order for customers to trust rail. Extreme weather has been more frequent in the last decade and events are expected to continue or worsen. Therefore the rail system must be adapted to this situation through better maintenance and operation.

Deregulation means that there are more rail operators on the market. The problem with this, especially for small customers, is that they don't know how to go about shifting to rail. A coordinated information system about existing supply of rail transport could help the customers to choose and also fill up existing trains better.

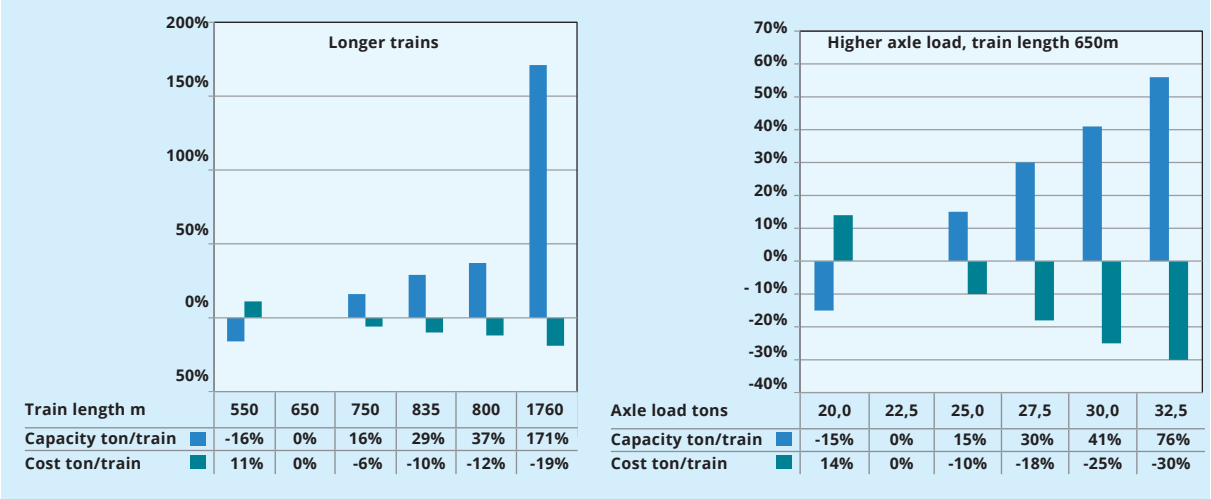
4.1.2 Increased capacity

In many forecasts, freight demand in Europe is projected to increase by 60% until 2050. With business as usual, road will maintain or increase its modal share. With a mode shift scenario, rail may increase its market share from 18% to 36%, meaning that there will be more than three times more freight rail transport than today. Compared with business as usual it will be doubled. In this scenario IWW will double, but other waterborne modes (i.e. short sea shipping, for example) are not taken into account.

There are many measures to increase capacity on rail, the most important ones are:

- Longer and heavier freight trains;
- Higher and wider gauge, higher axle load and metre load;
- Faster freight trains make it possible to run more freight between passenger trains;
- Improvement of signaling systems like shorter block sections and the European Rail Traffic Management System (ERTMS);
- Investments in conventional rail network i.e. with double track and longer crossing stations;
- Investments in high-speed rail (HSR), which frees capacity up for freight on the conventional network.

Longer freight trains are perhaps the most efficient measure (KTH Railway Group, 2013). Today the maximum length varies between 450 and 835m in different countries in Europe. Only to apply the TEN-T standard of 750m will extend capacity substantially. Recently a test with a 1,500m long train was performed in France successfully, which will almost double the capacity. In the USA, freight trains today are 3,000m. Although there are operational shortcomings that would need to be addressed, the technique that exists today could be successfully implemented in specific corridors. The impact of train length and axle load on capacity and cost is shown in Figure 8.



Train length m	550	650	750	835	800	1760
Capacity ton/train	-16%	0%	16%	29%	37%	171%
Cost ton/train	11%	0%	-6%	-10%	-12%	-19%

Axle load tons	20,0	22,5	25,0	27,5	30,0	32,5
Capacity ton/train	-15%	0%	15%	30%	41%	76%
Cost ton/train	14%	0%	-10%	-18%	-25%	-30%

Figure 8: Measures for improving freight rail capacity and the effect on operating costs (KTH, 2013)

If freight trains can run faster it is possible to find more slots for them between passenger trains during the day. Today the ordinary maximum speed is 100 km/h but many wagons and locos are prepared for 120 km/h so this could be the first step. High speed is particularly important for the high-value products segment, whose volume is increasing.

Building an HSR network will free capacity, making it possible to operate twice as many freight trains on the conventional network as today. Axle loads, which are currently 22.5 tonnes in Europe, could be increased to 25 tonnes, which would increase capacity by 15%. Increasing to 30 tonnes would increase capacity by 30%. Wider loading gauges are important especially for intermodal transport. The signalling system ERTMS level 3 can raise capacity by 30–40% (TOSCA, 2010). For these measures there is a higher need for investments so it will take longer to implement, but all these measures also cut the operating costs per tonne. Figure 9 summarises the effects of some measures to increase capacity.

Increasing capacity by 3–4 times is not impossible, but assumes significant investments in rail infrastructure.

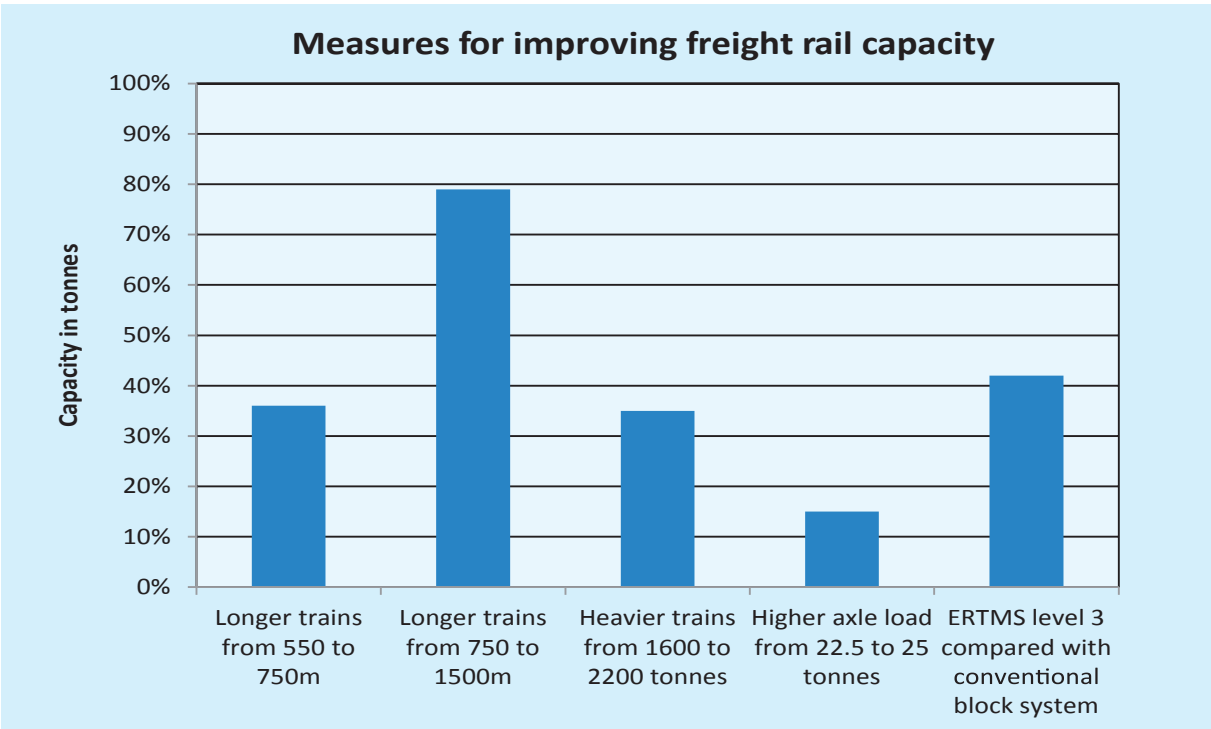


Figure 9: Measures for improving freight rail capacity (KTH, 2013 and TOSCA, 2010)

4.2 Waterborne freight

4.2.1 Improved service quality and reduced costs

In this section we discuss the key measures or building blocks that are required to improve service quality and/or reduce shipment cost for waterborne transport, and thus increase it's modal share. First we list some key measures and then continue with motivations for these;

- Time at sea/rivers savings (by optimising routes, schedules and speed);
- Time in port savings (simplification and automation of all administrative issues);
- Online freight information platforms for all intermodal transport;
- Efforts to increase co-operation among the multitude of stakeholders in the intermodal chains;
- Reduction of damages or cargo losses;
- Research and development (R&D) for improved technology and optimisation processes;
- Fuel savings (by more efficient hull designs, engines and propellers).

The three main problems with road-to-water intermodal transport are: quality, price and coverage. More specifically, intermodal transport is often slower, less reliable and more expensive than truck-only transport, and furthermore it is only offered on selected corridors. Addressing these problems is the key to increasing intermodal transport. Intermodal transport in Europe today is relatively disorganised; often it involves multiple parties working together on an ad-hoc basis. To increase quality, a single responsible party should coordinate all transport chain partners, information flows should be improved, quality improvement strategies must be implemented, and all partners need to share the same objectives. The latter seems to be a common challenge for most intermodal transport chains. Instead of having short-term competition within the intermodal segment, the goal should rather be co-operation leading to consolidated and thus more efficient and profitable intermodal freight flows. Eventually an intermodal sector which is more competitive vis-a-vis dedicated road transport should be realised.

New terminals must be built and the capacity of existing terminals increased to support development of new operational strategies (e.g. liner trains or hub-and-spoke systems). In some locations new track infrastructure must be built to improve rail freight connections to ports. The main responsibility for planning and financing these infrastructure investments must lie with national governments and the EU, however intermodal operators could support these efforts.

Good practice:
Duisport, Railport Scandinavia

Duisport, in Duisburg, Germany, is the largest inland port in Europe. It has been undergoing expansion since 2001 to promote the integration between water and rail transport. It is home to nine intermodal container terminals and handles 110 million tonnes of cargo and 2.6 million twenty-foot equivalent units (TEU) every year.

Similarly **Railport Scandinavia** in the Port of Gothenburg (Sweden) is saving the industry 5–10% in transport costs annually by shifting loads entering the port to rail from road. Approximately half of all containers are now moved through the port by rail.

The quality of waterborne services is generally considered a key factor for increasing its market share. But this is complex as quality consists of many factors, including punctuality, reliability, security, frequency, capacity, directness, flexibility and accessibility. In addition, from an economic point of view two other factors are transit time and service price.

Making full use of intelligent transport systems (ITS) is a key building block to improve services. ITS allows real time tracking control, and may also provide smoother customs clearance and payment (all kinds) between infrastructure management, operators, subcontractors and forwarders. Thanks to Electronic Data Interchange, all kinds of documentation is delivered

and submitted simultaneously and may be accessible to all authorised stakeholders. All this leads to the improvement of accessibility, reliability and punctuality. Introducing and maintaining an online freight information platform may improve customer friendliness and at the same time consolidate freight flows yielding lower transport costs. In the field of security, actions are needed to address standardisation and information about hazardous cargo movements, packaging and cargo protection, cargo unitisation.

Good practice: KASSETTS

The **KASSETTS project** which ran in eight Central European countries between 2008–2012. It developed a 'Logistics Broker Solution' to enable manufacturing companies to collaborate with logistic service providers. It enabled small and medium enterprises (SMEs) to gain access to optimised ICT-based transport solutions for improving regional and transnational freight and logistics.

A crucial factor for achieving punctuality and reliability in IWW navigation is ensuring a minimum water level. This means that improvements in the maintenance of canals, locks and other infrastructure are required.

A lot of damages to cargo in maritime transport chains occur in the transshipment phase. A related problem is that hazardous cargo is becoming more common in container traffic and currently only one international convention regulates this aspect. Any kind of damage causes delays and/or extends damages to other, neighbouring cargo. This especially concerns ocean container traffic, where increasingly a single ship may carry more than 15,000 TEUs.

Accessibility and punctuality in maritime transport depends strongly also on weather and water conditions. Most affected are seaports located by rivers some distance from the sea (Hamburg, Bremen, Antwerp, London), where access to the port is regulated by water level and potential storms (closing of seaports in Amsterdam, Hamburg during tides). With present dense traffic flows, even small shutdowns may cause serious delays in shipping lines schedules, and in seaport congestion and queues. Consequently measures to minimise such events are required.

The average service time at terminals also need to be shortened in order to both reduce total transport time and increase system capacity. Currently, some 57% of the average time utilisation for transport by barge is taken up by loading and waiting, meaning that barges are currently only running 43% of the time on the IWWs (Kerstgens, 2008).

Quality of terminal equipment and capacity need to be increased. Generally, this is a case of private business interests, but public actors could contribute by supporting quality improvement via R&D financing (innovation and implementation as well as modelling of organisation, economics and ICT).

Cutting costs is obviously a key objective for all transport operators, and is crucial in order to achieve the needed increase in intermodal transport. Since costs associated with hub operations typically accounts for 30–40% of total costs for intermodal freight chains, it is paramount to reduce these costs. One potentially effective measure is to spread automatic transshipment technologies, like Automatic Guided Vehicles (AGV), which are special driverless container-moving trucks.

Shipping lines undergo deep network changes and modifications leading to more effective vessels usage, line capacity utilisation and crew management optimisation. Collectively, this should allow for a reduction in final service prices for the customer. However, it may also be acknowledged that the ships generally have a long lifetime, generally 20–40 years, which makes fleet turnover comparatively slow. This may be counteracted to some extent by the present high growth of the global container fleet, for example.

Fuel costs can amount to between 25% and 60% of total shipping costs and despite the fact that maritime transport is already rather energy efficient; there is still room for further improvements. The 2008 economic crisis has highlighted the importance of fuel saving in shipping to all actors in the maritime business.

A notable policy that may significantly affect maritime transport is the "Annex VI" of Marpol 74/78 Convention on emissions control areas. It will establish Sulphur Emission Control Areas in the Baltic Sea, English Channel and the majority of the North Sea. In practice, this legal act will have considerable impacts on ship-

ping costs since the options to meet the standards set include installing scrubbers or shifting to alternative fuels like marine oil gas (MGO), liquefied natural gas (LNG) or methanol, are all quite costly (Czermański, 2014).

The convention will lead to some freight market changes with a risk that shippers will switch from maritime to road or rail transport. In the last few years there has been a tendency to create land corridors for cargo coming from South and East to North Europe through Central Europe, as an alternative route to the previous flows based on sea transport to North Sea hubs and feeder services into Baltic Sea Region. The environmental effects of such changes may be positive or negative depending on the share of rail and road respectively in these new land corridors.

4.2.2 Increase transport capacity

In this section we discuss the key measures or building blocks that are required to increase capacity and modal share of waterborne transport. An advantage for maritime transport vis-à-vis road and rail transport is that capacity increases at the system level are usually less costly, since the connections between ports are largely free. First we list some key measures to increase capacity (below) and then we move on with a discussion of these.

- Increased transportation capacity (TEU/y);
- Increased transshipment capacity (TEU/h);
- Storage capacity (TEU/y);
- Time at sea savings (by optimising routes, schedules and speed);
- Time in port savings (acceleration of transshipment and documentation exchange);
- Less delays;
- R&D to improve transshipment technologies, for example.

The transport capacity of shipping (maritime and IWW) can be increased in different ways. It may be increased by adding ships to the current fleet or by utilising the existing fleet more efficiently. As mentioned in section 4.1 the capacity of port transshipment facilities often constitute crucial bottlenecks. This can be remedied either by increasing efficiency of current ports/intermodal hubs, or by adding capacity through more substantial investments. The former is a rather low cost solution while the latter requires large-scale investments in hub/port infrastructures.

An important issue is to improve port-hinterland connections by rail or barge, in order to avoid excessive road haulage on motorways near seaports. Here inland ports/hubs like Duisburg may play an important role. An interesting measure to trigger a modal shift may be to ensure contractual obligations on modal split of new port areas by different legal regulations: limitations for road transport and/or facilities for waterborne transport or rail transport.

Storage of empty containers occupies considerable space in many port areas. Therefore a special focus on consolidating volumes and shipping these containers to/from seaport terminals is required.

4.3 Pricing issues, internalisation of external costs

Pricing of the external effects of transport has for a long time been considered a key component in achieving a sustainable European transport system (EC, 2001; EC, 2008a; EC, 2009), not least because it would help to deliver a modal shift from road to rail and waterborne freight (EC, 2011a). It is important for such internalisation to address external effects in the form of congestion, accidents, air pollution, noise, infrastructure wear and climate impact.

There are two approaches to calculate the level of internalisation. The first – the account or equity approach – takes into account total costs of transport infrastructure as well as total external effects. If there is full recovery of total costs, full internalisation is achieved according. The second is concerned with making actors in the transport system take efficient societal decisions. Here the extent to which marginal social (external) costs are covered by internalising charges which vary with different external effects. Both approaches have their flaws. A disadvantage of

the first approach is that it may lead to inefficient decisions, e.g. underutilised infrastructure. A disadvantage of the second is that it may not lead to full cost recovery.

Although there are large deviations in specific cases, in general the level of internalisation is currently lower for road freight than for rail freight and waterborne transport. According to the account approach, the level of internalisation in the EU27 is 55–75 % for heavy trucks (>32 tonnes), 90–95 % for freight trains and 85–90 % for IWW transport (EC, 2008b).

The efficiency approach is at least as valid as the account approach. Figure 10 shows estimates of the difference between external marginal costs (excluding climate which is to be covered by fuel taxes) and internalising charges for a heavy truck (>32 tonnes) in some European countries (IMPACT, 2008). Although these are aggregated figures, it is clear that only a small part of the marginal external effects is currently covered by internalising charges, according to the efficiency approach. As an average for EU19 the uninternalised marginal social effects of heavy trucks corresponds to roughly €0.55 per vehicle-km (not including climate impact). It should be noted that in specific cases large deviations from these average values occurs.

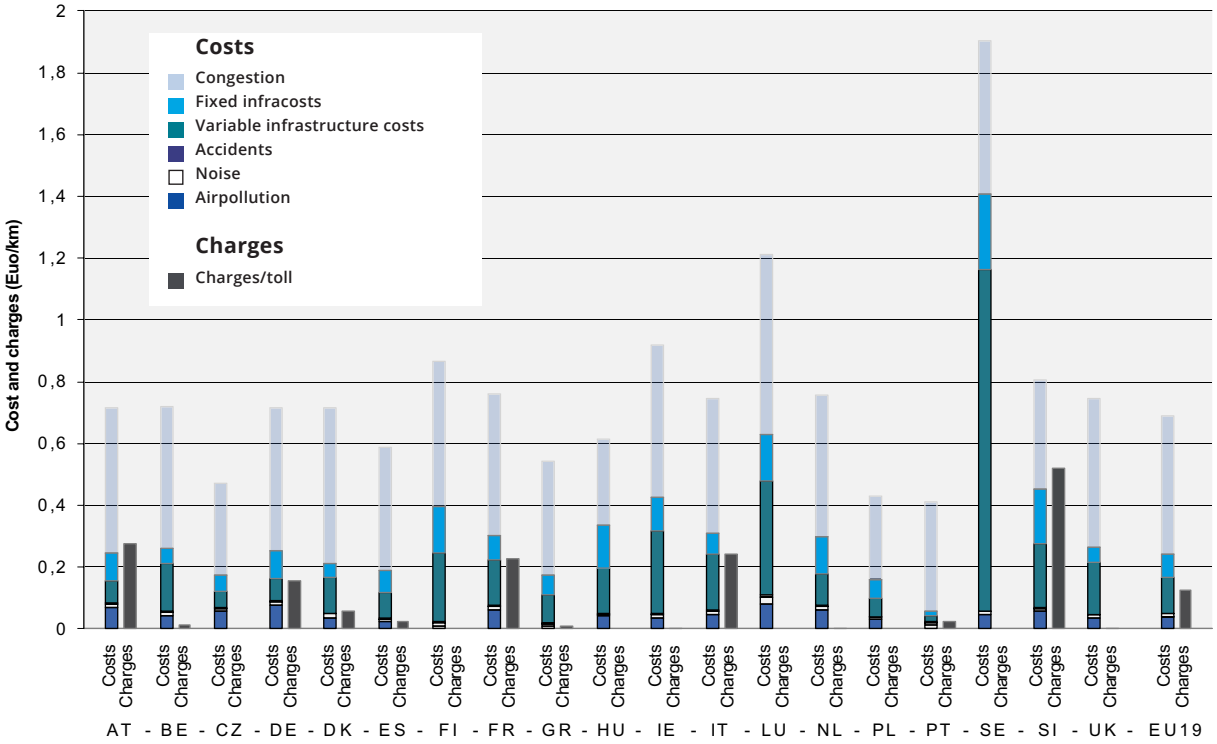


Figure 10: Level of truck internalisation (>32 tonnes) in different Member States (IMPACT, 2008) [4]

4 Figure 10 shows marginal kilometre related costs and existing kilometre charges (which are zero for some countries) - HGV - 32+ tonnes - Euro 3 - Motorways (€2000/vkm, 2010). Infrastructure costs for some countries based on extrapolation. Based on TREMOVE emission data (explanation taken from IMPACT, 2008)

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5 Policy Packages

5.1 The case for policy packaging

It has been increasingly realised that single policy measures do not often achieve in practice what is required to reach policy objectives or broader societal goals. Therefore packages containing more than one policy instrument have been put forward to mitigate the unintended consequences of policies or improve their effectiveness. In order for a policy or a policy package to be successful it needs to fulfil a handful of criteria. It needs to be effective in reaching the target. It should be economically efficient, meeting the target with as low costs as possible. Furthermore, it should be feasible with regard to existing technology etc. Finally, but certainly not least, the policy measures in the policy package should be acceptable to politicians, the public and key stakeholders (OPTIC, 2011). Even after a successful decision process, barriers may occur during the implementation process. This has for instance been the case regarding the four EU "Railway packages" that were adopted by the Council in 2001 and subsequently implemented.

A common reason for using a package of policies is that the most effective policies may not be acceptable as stand-alone measures. For instance, increasing fuel costs without providing alternatives, e.g. in the form of public transport, may be met with public opposition. Another important (and somewhat related) reason is where there is a synergy between two policy measures. The revenues from a 'push' measure (taxing more polluting modes) may be used in parallel with 'pull' measures (investing in less polluting modes). In Switzerland, the introduction of a distance-related heavy vehicle fee in 2001 was accompanied with other measures, with the common aim of shifting goods from trucks to railways. Two thirds of the revenues from the heavy vehicle fees were earmarked for building two railway tunnels through the Alps. In addition, a couple of other measures were considered necessary in order to make the package pass through the Swiss political system and to make the EU agree on trade treaties anticipated to benefit Swiss industry. Maximum weight of trucks was raised from 28 to 40 tonnes and the Swiss Cantons were given one third of the revenues from the heavy vehicle fees (OPTIC, 2011). The latter was a means of securing local support from the Cantons that could otherwise have obstructed the political process.

Regarding the goal of increasing intermodal freight transport, one may add that the sheer complexity of these transport chains with regard to actors, institutions, infrastructure, terminals, rolling stock etc., will make policy packages necessary in order to achieve the required transformations.

5.2 Policy packages towards the freight goal

In this section we outline potential policy packages that may be used to reach the White Paper goal. The two packages represent two alternative strategies to reach the goal. Both packages are intentionally rather extreme. In reality, a policy package would likely combine parts of both approaches. Making them extreme however, clarifies what the specific barriers are for each strategy as well as the consequences of the packages being successfully implemented. The packages presented in the following two sections are rather generally formulated. In chapter 6 we explore more specific policies/policy packages that may be needed in the two cases, the Rhine-Alpine corridor and the Netherlands-Poland corridor.

The packages are not intended to cover the whole range of existing measures. The intention is to set priorities based on findings of TRANSFORuM. The picture that emerges from Table 1 shows that rather different actors need to be included. The role of the EU can change significantly, depending on the kind of measure that needs to be applied. But if the table is understood as policy packages, with most elements needing to be implemented in a coherent way, it is clear that some overall coordination is required. The EU can play an important role, but in particular corridors it is crucial that private actors (e.g. port authorities, train operators etc.) are involved as well, and that clear and transparent roles and leaderships are assigned.

It should be noted that these two policy packages are strongly based on the debates and surveys conducted during TRANSFORuM.

5.3 Policy package A: More efficient use of existing infrastructure

In policy package A the main emphasis is on making smaller investments (longer sidings, more powerful locomotives, upgrading of inland ports, seaports, IWW, etc.) in order to increase capacity of rail freight and waterborne transport, and stimulate an efficient use of existing infrastructure. The shift to waterborne transport will be high compared to policy package B (30–50% of freight shifted from road transport) since increasing capacity of waterborne transport requires comparatively small infrastructure investments. Push measures; making road freight pay for their external effects, is an important element of the package. All modes should pay for their external effects, but the uninternalised effects are particularly large for road freight (EC, 2008b). Although this policy package is focused on utilising the existing infrastructure more efficiently, some new infrastructure is built, not least port transshipment facilities as well as port hinterland rail connections.

5.3.1 Key policies in package A

Table 1 summarises the most important measures in this policy package. The table is rather general, and non-geographically specific. Chapter 6 will link the packages with two more concrete geographical areas.

Bundling of goods is a key strategy to achieve a significant modal shift. Rail freight and waterborne transport will only be able to successfully compete with road freight if the potential economies of scale are utilised to the fullest extent possible (and all modes pay for their externalities). Consequently, using longer trains (heavier and/or more volume capacity) is a key measure. There are two prerequisites for such a development. First, it must be possible to run longer trains from an infrastructural perspective. For instance, building of longer sidings may be required. Second, there needs to be a demand for rail freight large enough for filling long trains with acceptable frequency. Not least in a deregulated environment this calls for cooperation so that competing actors can share the same long train instead of having a couple of short trains. If this is done successfully running costs are reduced (less drivers etc.), but more importantly the expensive infrastructure is used more efficiently. This means that the measures 1, 6 and 12 together form a synergetic sub-package.

	Approach/Measures	Responsible actors	Timeline and milestones	Key barriers / severity	Relevance for White Paper goal
Improved service quality and reduced cost					
1	Catalysing actor cooperation along corridors to improve services and reach economies of scale (synergy with technical measures for longer trains)	Many actors affected; Private and public actors Core support group with clear leadership needed	Significant effects by 2020	Small actors don't have time Low-medium	High
2	One stop shop for intermodal freight/Freight information platform	Pubic authorities as catalysers Stakeholder forum to support platform	Ensure a high quality platform until 2020	Getting all/many actors to support one system Low-medium	Medium
3	Continued technical standardisation, ERTMS etc.	EU and Member States	Finalised before 2030	Costs Medium	High
4	Improved maintenance of tracks, waterways and hubs to improve reliability	National states and private investors EU: set priorities and gives financial support	Immediate action. Significant effects by 2020	Costs Low	Medium
Increased capacity					
5	Strengthen corridor implementation	Public authorities, infrastructure managers etc. to give this task a higher priority	Significant effects until 2020	How to make actors prioritise this task Low	Medium–high
6	Infrastructure upgrading to accommodate for longer trains (longer sidings etc.)	Infrastructure managers, corridor leaders, rail operators	Immediate action. Significant effects by 2025	Coordination along entire corridor needed, Low	Medium-high
7	Spatial planning for, and financing of, increased capacity of inland ports	Cities, EU, Member States	Near doubling of capacity by 2030	Conflicts over land use in urban areas Medium	Medium
8	Improved transshipment facilities for ship to rail and ship to barges (e.g. automatic equipment)	Port operators EU and Member States to support R&D	Significant effects by 2025	Costs and standardisation Medium	Medium
9	Retrofitting of wagons with silent 'LL-brake blocks'. Increases capacity since more tracks can be used more frequently	Railway operators	May be largely accomplished until 2020	Costs Low	Medium
Level playing field (Internalising external effects etc.)					
10	Heavy vehicle fees to better reflect external effects	Member States > raise political and public awareness for the challenge. EU > make Eurovignette Directive compulsory	Clear regulation until 2020 in 10 Central European countries	Road industry and motorists oppose High	Very high
11	Strict enforcement of regulations regarding working time, vehicle weight etc., in the trucking sector	Public authorities	Strong enforcement achieved until 2020 in 10 Central European countries	Police don't prioritise these 'small crimes' Low	Medium-high
12	High fees on congested train paths refunded in relation to carried cargo (tonnes and m3) and differentiated after noise characteristics etc. (Incentive for using longer trains)	Member States. EU to coordinate. Network operators	Clear regulation until 2020 in 10 Central European countries	Choice of criteria for refunding Low	Medium

Table 1: Policy package A: More efficient use of existing infrastructure

During the project it was emphasised several times, that not only the upgrade or extension of infrastructures key to success; but maintenance must be amongst the first priorities when it comes to financing infrastructure investments. There is a clear difference between this policy package and policy package B, with the latter putting much more emphasis on new infrastructure. Here, money is not at all the only resource that is needed. In several cases, it is rather manpower or just political and public support that is needed to progress these areas; a lack of such resources can also be regarded as a barrier.

Regarding timelines, the credo could be to implement as much as possible as fast as possible. However, since resources are limited and synchronisation of measures is crucial, a high priority is given to measures that do not need too much financial investment and to cooperative measures.

5.3.2 Overcoming barriers

An important issue is how to get acceptance among key stakeholders. While most policy measures in this package are rather uncontroversial, heavy vehicle fees are not. Here previous practical experiences may be drawn from Switzerland and to some extent from Germany (OPTIC, 2011). One option would be to get the trucking sector on board by increasing the maximum allowed weight of trucks on the continent in a similar way as was done in Switzerland. Another barrier concerns the coordination of the multiple stakeholders involved in multimodal transport chains. To get the main players to work together is a key challenge that was emphasised at the Basel workshop. Often smaller companies can't allocate resources to common working groups etc. They are so busy competing with other intermodal companies that they do not allocate time for increasing the competitiveness of the intermodal sector as a whole.

Another barrier to the modal shift in general is that the gap between wages in rail freight and road freight seems to be increasing (see section 3.3.8), which increases the competitiveness of road freight. This could imply that truck fees, even higher than anticipated earlier, would be needed to achieve the required modal shift.

5.4 Policy package B: Large scale investments in new rail tracks

This policy package entails a radical increase in rail capacity. Many new tracks are built, in most cases for HSR passenger trains. This allows for a separation of slow and fast trains, which yields a high capacity increase (with two parallel double tracks, instead of one, capacity increases by a factor 3–4). Focus is on making full use of the economies of scale associated with rail transport. The high capacity freight corridors are connecting mega-hubs forming a highly efficient industrialised multimodal transport system. This may be an economically-efficient system in the long-term (although the initial investments are large), but only if the transport demand matches the huge capacity of the network. In this package, waterborne transport will receive less attention (15–30% of freight shifted from road transport).

If this package is accepted (high funding requirements) and implemented, both the HSR target and the freight target may be achieved, even in a scenario with strong drivers for (road) freight growth.

5.4.1 Key policies in package B

Table 2 summarises the most important measures that make up this policy package. Some of the measures are of the same character as measures from Table 1, but they differ in terms of intensity.

As in policy package A, bundling of goods is a focus of this policy package as well. Achieving a modal shift in ports has a pivotal role. Goods that arrive by ship need transshipment anyway, whether it is to truck, train or barge. So the extra (expensive) transshipments needed are reduced from two to one, compared to a shift from dedicated road transport.In addition the large, and rapidly increasing, freight volumes in major ports assure that the economies of scale of rail and IWW may be utilised. Good practice in this area is demonstrated for instance by the ports of Gothenburg, Bremen and Duisburg. Contractual obligations on modal split for new port areas and/or financial support may be used.

	Approach	Responsible actors	Timeline and milestones	Key barriers / severity	Relevance for White Paper goal
Improved service quality and reduced cost					
1	Catalysing actor cooperation in corridors to improve services and to reach economies of scale (synergy with technical measures for longer trains)	Private and public actors Core support group with clear leadership needed	Strengthen exiting initiatives continuously. Significant effects by 2020	Small actors don't have time Low	High
2	One stop shop for intermodal freight/Freight information platform	Pubic authorities as catalysers > organise stakeholder forum to support platform	Ensure a high quality platform until 2020	Getting all/many actors to support one system Low-medium	Medium
3	Continued technical standardisation, ERTMS etc. European Investment Bank loans to retrofit locomotives with ERTMS equipment. Loans may be repaid with long-term user charges	EU and Member States. Railway operators.	Retrofitting may be largely accomplished by 2020–2025	Costs Medium	High
Increased capacity					
4	High investments in new rail infrastructure. Mostly dedicated HSR tracks but also freight corridors	EU and Member States	If funding may be raised (see measures below) before 2020, significant capacity increases may be achieved by 2025-2030	Raising funding High	High
5	Port hinterland development by new dedicated freight tracks. Contractual obligations on modal split for new port areas and/or financial support.	Railway and port operators. EU and Member States to offer funding and setting rules	Major capacity increases until 2025–2030	Costs. Local opinions as these areas are densely populated Medium	High
6	Localisation of new manufacturing plants and freight villages in close connection to selected freight corridors	Planning authorities	Long-term effect e.g. >2040	Short-term planning Low	Medium
7	Substantial shift of funding from road to rail and waterborne, in order to raise adequate funding (e.g. from present 30–70% to 50–50%)	EU and Member States to argue for this changed policy	In the best case a significant shift may be accomplished 2020–2025	Will most likely meet strong opposition from motorist organisations and truck lobby High	High
Level playing field (Internalising external effects etc.)					
8	Heavy vehicle fees to reflect full external effects	Member States > raise political and public awareness for the challenge	Clear regulation until 2020 in 10 central EU countries	Road industry/ motorists will oppose High	Very high
9	Strict enforcement of regulations regarding working time, vehicle weight etc., in the trucking sector	Member States and public authorities	Clear regulation until 2020 in 10 central EU countries	Police don't prioritise these 'small crimes' Low	Medium-high

Table 2: Policy package B: Large scale investments in new rail tracks

The measures of this policy package surely show a harder, or more ambitious course towards the targets; it is obvious that this package is more difficult to implement. Much more resource is required in a shorter period of time compared to policy package A.

5.4.2 Overcoming barriers

As in the previous policy package gaining acceptance for heavy vehicle fees may require additional policies. Another substantial challenge is to fund the big infrastructure investments. The revenues from heavy vehicle fees may contribute significantly, but even if the barriers to introducing them are overcome, more, new funding sources are necessary. One of few feasible alternatives is to shift a large part of present funding for road investments to investments in rail infrastructure (Nelldal and Andersson, 2012). Such a strategy also contributes to the White Paper goal by not improving road capacity to the same extent as in a business as usual scenario. However, a substantial shift within infrastructure budgets will most likely be opposed by the passenger car industry and motorist organisations, not least in some Eastern European Member States. On the other hand there are signs (although still rather weak) of the passenger car losing some of it's appeal (at least in the EU15) both as a status symbol and as a means of transport, The latter is partly caused by a continuing urbanisation and revival for the idea of liveable cities. Car ownership and obtaining a driver's licence is declining among young people in some Western European countries (Schippl and Puhe, 2012). Although these trends may reduce the need for new road capacity, they will increase the need for public transport investments in urban areas.

One might also think that this package will face local opposition to new infrastructure. While this may be partly true, the assumed substantial decrease of budgets for building new road infrastructure will to a great extent counteract this effect.

5.5 The policy packages in relation to different external developments

An important issue is how the potential policy packages may cope with external developments that are not (wholly) controlled by the EU and its Member States. In section 2.3 some key trends influencing freight transport were discussed and some of these will be revisited here in the context of the policy packages. Several of the trends have impacts on the relative costs of different freight modes, and thus on the possibility for rail and waterborne transport to compete with road freight. A clear trend the last decade is that average wages of truck drivers in the EU is getting lower, due to an increasing market share for drivers from Member States with comparatively low income levels. In the short- and medium-term this trend will probably continue, if counteracting regulations are not introduced. Such regulations, however, may possibly be judged as interfering with the free labour markets of the EU. It is worth noting that the reduced costs from lowered wages do not only increase the share for road transport (all else equal), but does also induce an increase in total freight transport volumes. Regarding policy responses, this means that tougher policies need to be implemented, such as heavy vehicle fees etc.

Fuel cost is another key variable. The price of oil has increased considerably since 2002. This has increased the cost for road transport and waterborne transport in comparison with rail transport. Although the price of fuel will certainly continue to show substantial short-term fluctuations, the long-term trend will probably point upwards, as non-conventional fuel and biomass will increasingly have to be used. This trend will to some extent be counteracted by technical developments leading to more fuel efficient trucks. A faster increase of the oil price means a slower growth of road freight. This in turn makes policy package A more relevant since increasing oil prices reduce the total freight volume and thus the amount of goods that need to be shifted from road transport to rail and waterborne transport.

The higher the GDP growth is, the faster freight transport will grow. In the reference scenario we have taken from the EC (2013), it is assumed that annual GDP growth will be on average 1.6% for the period 2015–2030 and 1.4% for 2030–2050. A high GDP growth tends to increase the relevance of policy package B, since larger volumes need to be shifted away from road freight.

As described in section 3.3, the population in Europe is projected to become older. If a larger part of the

population is above 65 years old, public budgets will be more strained and it will be increasingly difficult to finance infrastructure projects. This development (ceteris paribus) is better handled by policy package A, which contains less costly investments than policy package B. Another effect of difficulties to balance public budgets will be an increased emphasis on push measures (e.g. heavy vehicle fees) and less emphasis on pull measures (e.g. investments in new rail infrastructure). Yet another implication of scarce public funding is that prioritisation of infrastructure projects needs to be carefully analysed. If the White Paper goals are to be reached then there is very little room for picking the wrong projects.

The composition of goods transported is not fixed but is changing continuously. An ageing and stagnating population may imply less transport of material for construction of houses and infrastructure (e.g. concrete, gravel and steel) and, at least in relative terms, more transport of goods with high value and low density. If tendencies towards a sharing economy grow stronger this may decrease freight transport as for instance cars, boats and sports equipment are used more intensively (by different users) before they are worn out or become obsolete for other reasons. A more efficient use of infrastructure brought about by e.g. differentiated user charges may also decrease the need for freight transport somewhat.

A key issue which is affected by the trends discussed above, is how fast freight transport, and in particular road freight, will grow in the reference scenario. In Table 3 below it is shown how the two packages may cope with different scenarios regarding the drivers for road transport growth. As expected policy package A is adapted to a development with low road transport growth, while policy package B is more suitable in case road transport grows more rapidly.

Semi-external factors / Policy package	Stronger drivers for road transport growth	Weaker drivers for road transport growth
Package A: More efficient use of existing infrastructure	Bad (goal is not achieved)	Good
Package B: Large scale investments in new rail tracks	Good	Medium (goal is achieved but at a high cost)

Table 3: Simplified general outcomes of each policy package considering varied road transport growth drivers


INKU 6446244 45G1
TRITON
TCNU 942067 4 45G1
MAX.GROSS
TARE
PAYLOAD
CUBIC CAP
GVC
GVCU 531073 (1) 4561
MAX.GROSS
TARE
NET
CU.CAP

6 Applying the policy packages

The overall aim of this chapter is to illustrate how the White Paper goal can actually be achieved in selected geographical areas, hereinafter mentioned as cases. It explores the applicability of the two policy packages in chapter 5.

The freight goal is expressed as an average for the EU. Given the substantial geographical and economic diversity between European countries and regions, it seems appropriate to make a selection of highly relevant cases for demonstrating the elements of the roadmap. The idea is to test the usability of the two policy packages by applying it to two concrete cases. The cases should shed light on the question to what extent the policy packages can be "customised". It should help us to understand the relevance of policy measures in different contexts. Lessons learned provide valuable input for the recommendations in chapter 7. It surely would be beneficial to apply the policy packages to more than two cases; however, this would go beyond the scope of this project with its strong focus on stakeholder consultations.

We selected the Rhine-Alpine corridor as case 1 because of its high significance for long-distance freight in Europe. With the ZARA ports (Zeebrugge, Antwerp, Rotterdam and Amsterdam) it includes by far the most important European channels for the import and export of freight. It is a long-established route for North-South freight and a core element of the TEN-T Network. It is well connected to other TEN-T corridors (Rhine-Alpine; Atlantic, North Sea-Mediterranean and Rhine-Danube). Many efforts were undertaken in the last decades to improve traffic flows along the corridor. In the meantime, with the European Economic Interest Grouping (EEIG), a management structure was implemented that is dedicated to the corridor. Road, rail and waterborne transport play different roles in the different sections of the corridor. With the Alps, it includes a section where rail is the only alternative to road. North of the Alps, both rail and water provide alternatives.

The second case also includes the ports of the 'North Range', but in contrast to the first case; it consists only partly of the official TEN-T network. Besides the West-East Corridor it includes also many other parallel rail and maritime connections and in addition, has significant IWW potential to be extended in the future, if significant modernisation took place. The case illustrates the important role of maritime transport for serving the East-West direction that connects Eastern Europe with the Western parts.

With this selection, we cover a wider range of rather different situations of European goods flows with clear growth prospects. Investigating at least one corridor with high capacities was determined as important in the stakeholder consultation. The White Paper stipulates that achieving the freight target should be "facilitated by efficient and green freight corridors". Working with the concept of corridors means to combine different policies in one area (policy packaging). Such an approach is crucial to achieve not only the White Paper goal, but also to meet the challenges of a growing economy.

6.1 Case 1: Rhine-Alpine corridor

In this section we briefly describe the main characteristics of the Rhine-Alpine corridor. On that basis, we will discuss to what extent policy package A and policy package B might help to achieve the envisioned 30% modal shift in that region.

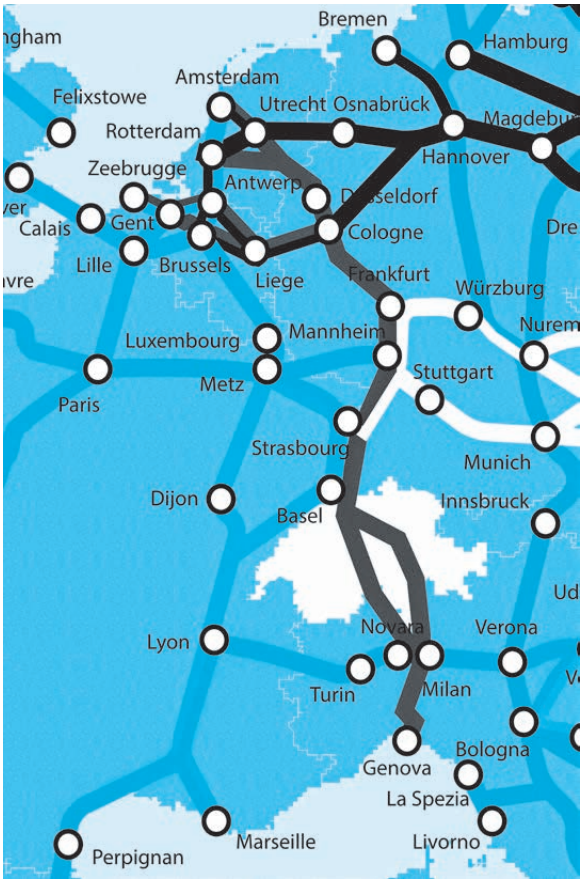

Figure 11: Area of the Rhine-Alpine corridor (EC, 2013c)

It should be emphasised that the corridor concept is a rather vital element of EU transport policy. Further activities and investments are envisioned in the coming decades, which will support the implementation of the White Paper goal. The multimodal TEN-T core network not only leads along existing main traffic flows but also were established to develop a coherent network throughout Europe. With regards to the technical and organisational aspects, corridors are built on an administrative framework helping all involved actors to enhance their cross-border cooperation. Aiming at a persistent network throughout Europe, the EU Commission transformed most of the priority projects into a core transport network to be completed by 2030. In order to ensure a full coverage of all regions in the EU, the Commission also plans to establish a comprehensive network by 2050. With the adoption of the new TEN-T guidelines in 2013, the Commission presented the Connecting Europe Facility (CEF) as a new funding instrument helping to bundle all existing transport corridors together.

Operating along the major transport axis across the Netherlands, Belgium, Germany, Switzerland and Italy, huge amounts of Europe's freight traffic volume are handled along the Rhine-Alpine Corridor. The rail freight section of the corridor went operational in November 2013 and was established by EU Regulation 913/2010 concerning a European Rail Network for Competitive Freight. With some 100 terminals on the entire route, the corridor connects the ZARA seaports, as well as ten major inland ports with the Mediterranean port of Genoa. The overall length of the Rhine-Alpine Corridor is 1,400km (calculated from Rotterdam to Genoa).

With the Betuweroute in the Netherlands and the Lötschberg and Gotthard tunnel in Switzerland, the Rhine-Alpine corridor integrates some of the most important infrastructure projects in Europe. Shifting around 700 million tonnes of freight per year in an area involving some 70 million inhabitants (Saalbach, 2012), the corridor furthermore covers one of the strongest economic regions in the EU. With firmly established governance structures, the Rhine-Alpine corridor (former ERMTS Corridor A and Rail Freight Corridor 1) plays a pioneering role in accomplishing future challenges for freight transport throughout Europe.

6.1.1 Selected sectors on the Rhine-Alpine corridor

In the following section, we briefly describe the characteristics and prospect of important sections in the Rhine-Alpine corridor. We look at traffic flows at the ZARA ports, the Betuweroute, the Rhine Valley between Karlsruhe and Basel and the AlpTransit.

It should be noted that apart from studies dealing with particular sections, coherent and more detailed forecasts for the entire corridor are scarce[5] or not publically accessible.

6.1.1.1. ZARA ports and Betuweroute

A high share of today's trade with non-European countries travels through the ZARA ports. Future growth is clearly expected, with forecasts indicating a growth in container handling between 3,5 to 4,0% p.a. until 2030 (Planco GmbH, 2013). Handling an increasing amount of goods requires high performance infrastructure connections.

The Betuweroute, is a railway line dedicated to freight transportation, which was completed in the Netherlands in 2007. Currently, the utilisation of the route is approximately 100 trains per day (EEIG, 2012). As one of the shareholders of the Betuweroute, the port of Rotterdam has an ambitious vision to increase the amount to 900 trains per day in the future. To achieve this, however, additional tracks need to be built. Figure 12 illustrates a strong modal shift scenario for the port of Rotterdam, which is well in line with the White Paper goal.

Considering the traffic volume coming from the ZARA ports to the Rhine corridor, the volume of both waterborne and road transport is much higher compared to cargo shipped by rail (1,6 million TEU – waterborne; 1,5 million TEU – road; 0,8 million TEU – rail in 2012 (Planco GmbH, 2013)). Despite the low modal share of rail transport on this section, there are already huge challenges to overcome. Looking at rail traffic from the port of Antwerp to the hinterland, the route between Aachen and Cologne has almost reached its maximum capacity with currently 255 trains and a capacity limit of 280 trains running daily (Deutscher Bundestag, 2013). In addition, railways often run along densely populated areas making it impossible to further extend the infrastructure. Moreover, high noise levels of rail freight transport are often a source of public opposition.

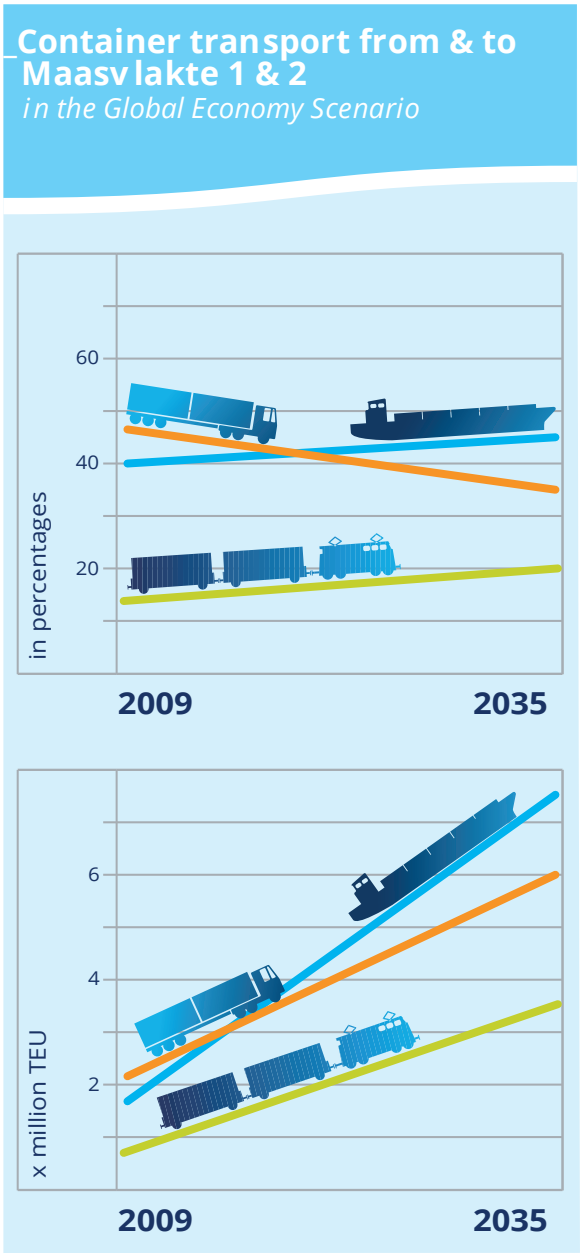

Figure 12: Port Vision 2030 (Port of Rotterdam Authority, undated)

6.1.1.2. Duisport – Main tri-modal hub along the corridor

A focal point in the corridor surely is the port of Duisburg. With some huge investments in multimodal and combined transport starting in the early 2000s, Duis-

5 Some data is provided by the Rhine-Alpine-Corridor Project's Customer Information Platform (CIP)

port now is one of the most important transshipment centres along the Rhine-Alpine corridor. The port authority of Duisburg handles between 110–120 million tonnes of freight per year, which makes Duisburg the largest inland port in European (Duisport, 2012; Dooms et al., 2013).

Huge growth in the amount of freight handled by the port over the past 10 years, particularly in the rail transport moving through the area, demonstrates that rail and IWW modes can be competitive with road transport. Emphasis has been placed on improving the rail hubs at the port over the past decade. By 2015, the port is aiming to move 5 million TEU (Duisport, 2014). The tri-modality (IWW, rail and road) infrastructure concept as well as the good business network and collaboration of logistics partners support the strength of Duisport (Boldt, 2010).

6.1.1.3. Infrastructure extension from Karlsruhe to Basel and New Rail Link through the Alps (NEAT)

Further important measures to meet the increasing transport volume are the infrastructure extension from Karlsruhe to Basel and the development of the two main transport axes in Switzerland. With the completion of the base tunnels Lötschberg (35 km) and Gotthard (57 km) through the Swiss Mountains, the AlpTransit allows huge capacity expansions by the end of the 2010s. The new railway link trough the Alps will also contribute to decreased congestion on the roads. The aim is to move 90% of all transit goods through Switzerland via NEAT. With low gradients on the new tunnel lines, freight trains can be heavier and can go faster through the Alps, increasing the overall competitiveness of rail freight transport (INFRAS, 2012). In addition to the base tunnels, Switzerland aims at updating existing railway lines on the main axes around Lötschberg and Gotthard (known as 4-m-Korridor), especially with regard to technical and safety standards. For the Gotthard line, an increase of train path capacity by 40% is expected after completion of all expansion measures (*Ibid.*).

Most of the existing predictions indicate that the overall transport volume will continue to rise in the future. It is noteworthy that estimates vary depending on the section of the corridor. However, it is obvious that with the Betuweroute coming from the Netherlands and the future completion of NEAT, Germany in particular is faced with the challenge to meet the growing capacity demands from its neighbouring countries in the future.

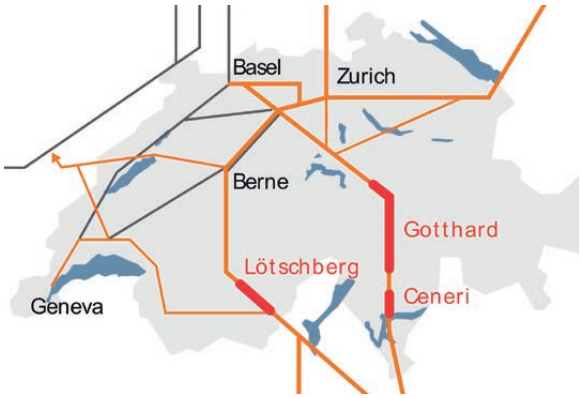

Figure 13: The New Rail Link through the Alps (AlpTransit Gotthard AG, 2012)

Eliminating bottlenecks, especially on highly congested railways in Germany, remains one of the biggest challenges. It has to be ensured that the stretch from Karlsruhe to Basel is able to operate with the growing capacity demands from North and South. In the following section, we have closer look this section.

6.1.1.4. About rail capacities between Karlsruhe and Basel

A very rough, scenario-like calculation was made in order to check whether the infrastructure extensions that are planned in a certain stretch of the Rhine-Alpine corridor would also be capable of carrying the additional load that can be assumed if the White Paper goal is reached (see Annex I). While transport volume data and projection expectations for the different modes can be found in official studies and reports, for the concrete example of upgrading the Offenburg–Basel rail line, only numbers for rail freight were available. Obtaining data for the shipping sector proved particularly difficult. Therefore, the calculation in Annex I is based on a number of assumptions which vary in degree or accuracy. The calculation is intended to give an impression of the magnitude of changes that are needed to achieve the 30% shift.

According to this scenario achieving the White Paper goal is a huge challenge for this section. With the massive planned infrastructure extension, the rail line can still only carry around half of the aspired 30% shift

from long-distance road freight. This is only a theoretical value and the rail line would then have a 100% load. The remaining shift would need to go to shipping on the Rhine and the question here is whether the Rhine and/or its port facilities including the hinterlands are capable of carrying that much freight. For shipping, taking the other half of the shift from road freight would translate into more than doubling the shipping transport compared to the current expectations for 2025, or almost tripling compared to today. In the next section, we will therefore take a closer look at shipping capacities in that region.

6.1.1.5. Waterborne capacities between Karlsruhe and Basel

Several projects and studies focus on IWW transport on the Rhine and address IWW-related issues in order to stimulate the competitiveness and quality of IWW at the European level (cf. PLATINA 2010; Code 24, undated). However, most publications are heterogeneous and difficult to compare due to different spatial and administrative scopes as well as different ways of aggregating data.

Regarding IWW in Western Europe, the Rhine corridor accounts for the greater part – approximately two thirds – of inland navigation (DRE Alsace and Oberrheinkonferenz, 2008; PLATINA 2010). This demand affects all countries along the Rhine, but most of it may be allocated to the Netherlands and Germany (Cf. MWP, 2014.) As Figure 14 shows the IWW structure of the Upper Rhine Valley and the strong relationship to the most important maritime seaport in northern Europe. It further illustrates that logistics operators and port authorities on the corridor have implemented hinterland distribution concepts. The tri-national connectivity along the Upper Rhine Valley plays an important role for the German IWW sector (Cf. Planco Consulting 2013).

Several recent studies at national (Planco Consulting, 2013; HaCon/CombiConsult, 2012) and regional levels (Bernecker, 2013; IVT, 2010; DRE Alsace and Oberrheinkonferenz, 2008) have been published, addressing combined transportation strategies (e.g. tri-modal hinterland hubs) for 2025 and later as well as general descriptions of the IWW Rhine and its inflows. Key assumptions are generally inspired by national long-term traffic forecasts with a reference basis of 2010 (cf. Intraplan Consult and BVU, 2014; MWP, 2014), and 2004 (ITP and BVU, 2007). For example, it is assumed that the total German IWW performance will increase from 62 billion tkm in 2010 to 76 billion tkm in 2030 (Intraplan Consult & BVU, 2014).

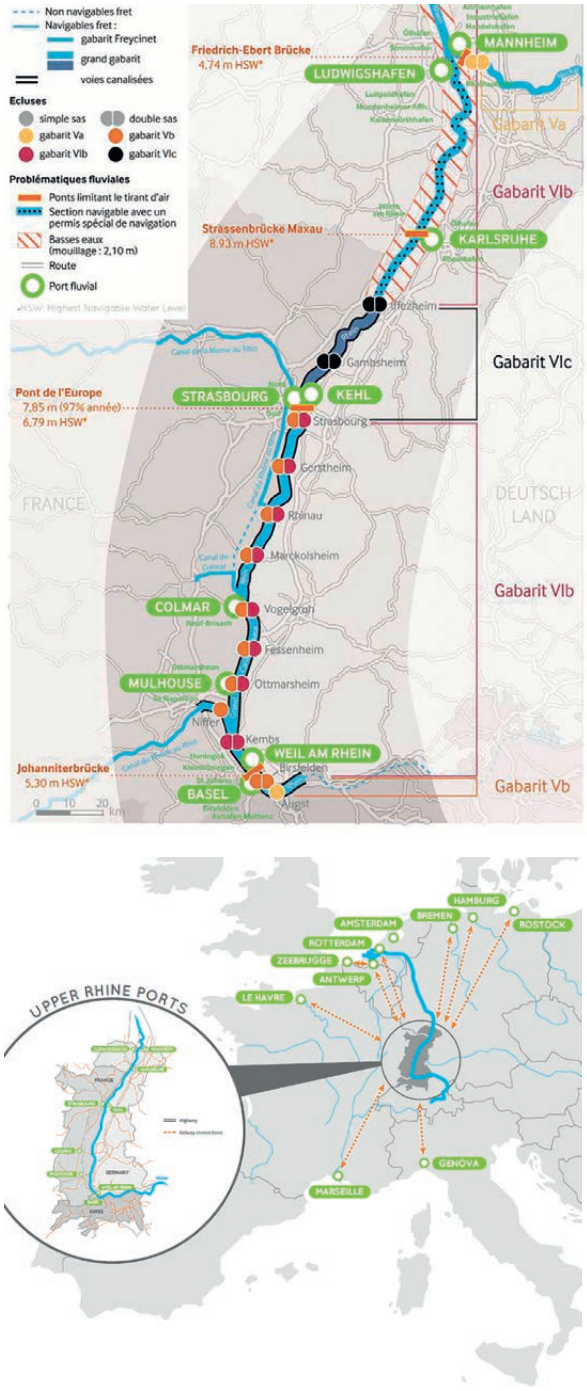

Figure 14: Geographic location; catchment area (down) and IWW structure of the Upper Rhine Valley (up) (Upper Rhine Ports, 2012)

These studies also provide a general overview and consider possible IWW developments, like the expected containerisation processes, especially for semi-finished and finished goods, which will lead to more container freight demand and likely to a need for maintenance and expansion of multimodal distribution centres along the Upper Rhine Valley and its inflows, like the Neckar (HaCon/CombiConsult, 2012; Bernecker, 2013; IVT, 2010).

Intraplan and BVU (2014) assume that IWW volumes in Germany are growing stronger in comparison to the assumed growth for road freight volumes by 2030. Especially IWW container freight as part of intermodal transport is assumed to increase up to 72%, with conventional IWW goods expected to grow by 15%. As a result there will be a rising share of container freight rates in IWW volumes from approximately 9% up to 13%.

In TRANSFORuM, three interviews were conducted with German stakeholders operating in IWW in the context of intermodal freight concepts (a private carrier, a boatman and a researcher – see Annex 2). In particular, they were asked on expected growth rates, capacities and measures that are needed to cope with future growth. The main statements were that:

- Under the given assumptions the White Paper goal seems rather unattainable;
- Capacity limits along the Rhine are generally described as currently irrelevant all the way from ZARA to Iffezheim (first lock further towards Basel);
- The crucial point is more the capacity of multimodal terminals rather than a lack of infrastructure extensions along the river (e.g. locks);
- Reaching capacity limits in the future may depend on whether and to what extent the concept of hinterland hubs will be developed and pursued further;
- There is no doubt that closer collaboration is needed between all actors in the logistics sector and the responsible authorities in order to stimulate untapped potentials. ICT is particularly important;
- It is assumed that a closer synchronisation within multimodal supply chains could play a major role;
- Inland navigation does not seem to have enough 'positive' publicity to be present on the political agenda, although it plays a key role in ensuring the supply of bulk commodities;
- The increasing number of boatmen who retire soon is an underestimated challenge for IWW transport. Jobs in this field are not attractive for younger people.

In the literature, no real capacity problems are assumed for the Rhine today and excluding events like accidents, or high/low water developments, congestion problems do not exist in general (cf. CE Delft et al., 2012; Kliwas, undated). According to estimations, the current capacity utilisation rate is between less than 25% (BVB et al., 2009) and 50% (VBW, 2013). Bottlenecks, in terms of the capacity to carry significantly more loads, are expected at inland ports, where the ships have to be discharged and freight has to shift to other modes.

On the basis of the total freight demand expectations for the Swiss, especially the rising cross-border share, which is assumed to rise between 34% for 2020 and up to 46% for 2030 (2010 baseline) (BAV, 2013), the Swiss Port authority assumed reaching its container terminal capacity limit in the very near future (Port of Switzerland, undated).

No indication can be found that the Rhine itself would not be able to carry a 20–30% increase in waterborne freight. The main bottlenecks for further growth are the port facilities and the corresponding hinterland connections. This accounts in particular for Basel, where freight definitely has to be shifted to rail or road. What is needed is an adequate extension of ports infrastructures, like basins and tri-modal terminals (for example project Basel Nord). Such port enlargements are usually space intensive and often need to take place in densely populated (urban) areas. It is not only financial restrictions but also environmental concerns and a lack of public and political acceptance that are often barriers for the necessary extension of port infrastructures.

6.1.2 Policies to overcome barriers – applying the policy package

6.1.2.1. Policy Package A: More efficient use of existing infrastructure

Several measures of Policy Package A appear to be applicable to both segments of the corridor or to the corridor as a whole.

The handling of goods at transshipment facilities constitutes a large part of the total transport costs, which is one of the main challenges. Terminals, ports and other hubs on the corridor constantly have to improve their service in order to cope with increasing traffic flow and customers' requirements. Quality can be improved by offering solutions for the last mile transport or other specific services for the customer. There are numerous companies operating at terminals, particularly with respect to special handling facilities. As these processes are usually complex and very time consuming, solutions that aim at making the connections between modes more efficient and even seamless are necessary to improve the product as a whole. A key measure for improving service quality without large-scale investments in infrastructure is a better coordination of actors and processes. This was mentioned quite often in the TRANSFORuM workshops together with the need for appropriate governance structures. Public policy can serve as a catalyser here; but the main actions have to be carried by private actors.

With the implementation of the corridor one stop shop, a first step towards a more customer-friendly ordering process is complete. As this currently applies only for rail traffic, a single online platform for all transport modes could be a promising approach for the future. Giving the customer the option to compare easily between different transport modes is a chance to raise awareness for the benefits of long-distance rail or waterborne transport. In addition, the growing demand for sustainable solutions by customers and businesses can motivate entrepreneurs to develop appropriate tools.

The integration of a high number of actors it actually at the heart of the corridor concept, but it comes along with challenges in terms of coordination and harmonisation. The transportation of goods from a port to the end user requires the participation of many actors such as terminal operators, transportation companies, infrastructure operators, etc. The coordination of all those involved is very important for success, but has not been adequately addressed to date. With a high number of private suppliers integrated in the production process, the automotive industry can serve as good practice example. All processes here are tuned so that at the end an optimal product is formed. It was pointed out in one of the TRANSFORuM workshops that for this purpose, there must be "a player who sets the tone", taking others with them. Member States and the EU could set priorities in order to find similar solutions for the rail and waterborne sector. This also includes interoperability as measures in this context only make sense if they are implemented in a synchronised manner. Based on the managing body of an EEIG, the rail freight corridor Rhine-Alpine shows some demonstrable success in cooperation between different stakeholders. As any party is responsible for the final product, cooperation is more targeted towards a specific goal.

Lock-ins hampering changes in this field are stabilised by habits, routines and inertia of SMEs but also by larger actors dominating the field. It was mentioned in a TRANSFORuM interview that not only is bringing actors together crucial, but it also helps to create change and trust in new solutions.

The big challenge is to create favourable conditions for competition to shift freight from road to rail. While Switzerland established the heavy vehicle fee to better reflect external effects, all other countries on the corridor are still looking for suitable solutions. No matter how it may look, it is important for both national governments and the EU to increase internalisation of external costs in the future. This is a general claim that needs to be applied EU-wide in order to affect the entire corridor.

To ensure that rail and waterborne transport is made more attractive, all parts of the corridor must have the ability to handle growing amounts of transport volume. There are several options to increase capacity on the corridor without building new tracks. One possibility is to upgrade the signalling systems by shorter block sections or introduce ERTMS and other technical specifications for interoperability. This signalling system allows operators to increase frequency without investing in costly infrastructure projects or high path pricing. The EU must ensure that national transport infrastructure plans do not contradict the idea of the TEN-T. After other countries on the corridor, such as Switzerland and the Netherlands, have already made

massive investments for the ERTMS development, the German Government now also intends to undertake further investments towards an interoperable rail network. It must be ensured, however, that all terminal connections are equipped with ERTMS as well in order to facilitate seamless rail freight transportation.

Another option is longer freight trains and improved signalling systems. One of the most important measures is enabling the use of longer trains. Ordinary freight trains are 650–740m but can be up to 835m long today in Germany and Denmark and 850m in France. Much longer trains, up to 1,500m, were tested in the Marathon project and could be used in the future. Although passing loops must be built or extended, this option is much cheaper than massive infrastructure extension. A coordinated cooperation between all transport operators and public authorities is crucial to benefit from these rather modest improvements. The EU has the primary responsibility to create consistent rules that can be implemented in a realistic period of time.

The following policy actions seem advisable in order to stimulate IWW:

- Better utilisation of existing waterway capacities by facilitating the flow of goods between the different modes without barriers; implementing a network of combined multimodal transportation terminals is of utmost importance;
- Maintenance and retrofitting (e.g. ICT-based automation) of existing infrastructure (e.g. bridges, locks, and ports);
- Prevent urban planning zoning policies that convert areas that were formerly dedicated to (freight) rail and port operations;
- Accompanying and enhancing data comparability and availability to enable a more details assessment, possibly from the perspective of a cross-institutional corridor management – combining and harmonising European, national and regional developments at a strategic spatial planning level;
- Enhancing the attractiveness of job profiles in the IWW sector and the logistics sector in general.

It can be concluded that without larger investments in extending the infrastructure it is possible to significantly improve the situation for rail and waterborne transport and to achieve this on a comparatively short timescale. However, in order to fully achieve the 30% target by 2030, and even more the 50% target by 2050, some more substantial investments in new tracks will also be required.

6.1.2.2. Policy Package B: Large scale investments in new rail tracks

While the corridor leads along densely populated areas, the building of new tracks (except for those already planned and approved) is hardly in option in most countries. However, major bottlenecks can only be removed by applying measures that are actually dedicated to policy package B. The biggest challenges are seen in bottlenecks located all along the corridor between Rotterdam and Genoa.

With its dense network and no separation between passenger and freight trains (mixed traffic), the capacity limits in Germany are almost reached on many routes.

To achieve a 30% shift as stated in the White Paper (and 50% by 2050), measures for infrastructure extension and thus an increase in capacity for rail freight seems inevitable, especially considering the 2050 perspective where an increase of rail freight by roughly 180% may be required. Without any dedicated lines for freight transport and almost full capacity on some German railway lines, for instance, measures that only improve existing services are insufficient. A recently published study, which examines the number of trains on the heavily utilised Rhine Valley line between Karlsruhe and Basel, further concludes that technical improvements are not sufficient to meet the growing demand for freight traffic (see Annex I).

Looking at existing bottlenecks all along the corridor, it is of utmost importance for national infrastructure planning to incorporate plans from neighbouring countries to ensure consistent traffic flow on the whole corridor. Moreover, it is important to develop a long-term strategic perspective and not rely solely on short-term business analysis.

Whilst it remains crucial for national governments and the EU to strengthen the implementation of corridors,

these measures alone are not sufficient to achieve the 2030 goal. Infrastructure extension is not the only solution as the last-mile problems remains a serious barrier for modal shift across Europe. Planning authorities of all corridor countries must be encouraged by the EU to work together more closely in order to fulfil not only the White Paper goal but also the idea of European cross-border cooperation.

However, fully implementing policy package B is based on really huge investments. For example, the project CODE 24 is assuming, that all proposed projects for the whole railway corridor Rotterdam–Genoa might sum up to around €35 billion (Günther et al., 2013). Currently the official cost analysis for the completion of the 'Rheintalbahn' (Upper Rhine valley) was estimated at €5.7 billion (DB Netze, 2013).

6.1.2.3. Conclusions – towards 30%?

It can be concluded that quite a lot of progress can be made relying solely on policy package A, that allows for focus to be placed on smaller investments to increase the capacity of rail and waterborne transport. Measures that stimulate an efficient use of infrastructure should be implemented. It is worth implementing the package and even necessary to establish a sound basis for a stronger modal shift. Trust in new solutions is needed and lock-in needs to be resolved.

However, to fully achieve the 30% goal in this corridor is hardly possible without a significantly extending the infrastructure, as it is envisioned in policy package B – given the envisioned growth rates in the freight sector. For some of the crucial bottlenecks in term of rail capacities, it is not only financial resources that impose a barrier for progress. An even higher barrier seems to be the large public resistance in some areas such as Southwest Germany, which could delay the realisation of increased capacity for decades. Political communication, awareness raising about the sustainability of freight rail; and participation in early stages are aspects that need to be considered in context this policy package as well.

For policy package A measures, financial issues are not the only limiting factor. Public resistance might as well be an issue but mainly due to noise. Action is required not only from the public policy but from various actors in the freight transport business. Further, coordination and a willingness of key actors to embark on new approaches together in an open and efficient manner are issues that need to be addressed here. This requires not only improving services and enabling an increase in capacity but also investing in solutions that account for the interests of all stakeholders.

It is also important that the capacity on all parts of corridor is adequate in order to remain competitive. It must be clear that any part of the corridor that has its own specific needs should be accounted for in the planning process. Bearing this in mind, the target set of shifting 30% from road to rail (and the required 180% increase in rail freight by 2050, see section 3.2) is only within reach if all countries along the corridor are to develop infrastructure adequately. Since it is not sufficient that only one country upgrades its technical specifications, clear rules and guidelines are required to ensure that the entire corridor is equally competitive. Furthermore, a coordinated planning process is crucial to avoid bottlenecks that may affect the economic development of the entire region.

6.2 Case 2: Netherlands – Poland

The 3,200km long North Sea-Baltic trade route served by an official TEN-T Network Corridor was established by Regulation 913/2010 and stretches from the North Sea ports of Antwerp, Rotterdam, Amsterdam, Bremen and Hamburg, as well as the inland port of Brussels, through Poland to the Belarus border and to the Baltic ports of Klaipeda, Ventspils, Riga and Tallinn, as well as to Helsinki. It shall be operational by 10th November 2015. But, besides the official corridor, there do exist other transport activities along the route. The case of the Netherlands – Poland corridor is therefore a multimodal and multidimensional trade corridor served by rail, IWW and maritime routes, as well as the road network.

The North Sea-Baltic corridor crosses eight Member States, strongly contributes to European cohesion and strengthening the internal market as it will provide transport links between Finland, the three Baltic States and Poland, Germany, Netherlands and Belgium, covering an area of 159 million inhabitants. In addition, this corridor is also important for the Central European transport network and for the transit to Belarus, Ukraine and Russia.

Figure 15: The North Sea-Baltic Corridor (EC, 2014)

Although, the current transport connections along the entire West–East route are not well developed, the connection between port of Rotterdam (and in a broader sense – the Netherlands) and Poland is one of best developed transport corridors in the EU (covering an area with 85 million people), including especially inland transport on the route Rotterdam – Duisburg – Frankfurt Oder and maritime transport from Rotterdam to Gdańsk/Gdynia by short sea shipping, ocean lines and feeder services. The route is also important for longer-distance transport, especially to Belarus, Ukraine, Russia, Kazakhstan and the Black Sea Area.

The transport connections within the corridor carry a large volume of trade between Poland and Netherlands (5.8m tonnes in total: 3.6m tonnes from Netherlands to Poland, 2.2m tonnes from Poland to Netherlands), as well as goods in transit – especially from the USA and China to Eastern Europe and goods in transit to other North Sea Range hubs: Hamburg, Bremerhaven or Antwerp (0.7m tonnes).

6.2.1 Policy Package A: More efficient use of existing infrastructure

Based on interviews and stakeholder discussions it has perceived that the waterborne element of the freight goal is most relevant for policy package A and focusing primarily on the improvement of existing infrastructure and service quality will help to achieve the modal shift required.

On the Poland–Netherlands corridor most of the rail container services fulfil current market expectations and offer two-day carriage on average or three-day maximum. All maritime connections pass through few other ports or go directly, thus offering relative short transit time (3–6 days). This aspect therefore does not need much improvement. In addition, the existing schedules are quite dense and can be modified by ship owners at short notice when required.

The question of vessel speed also seems to be of less importance. The strong correlation between speed, marine engine fuel consumption and concomitant cost increases – indicates rather the advantage of slow steaming. But specific periods (like 2006–2007) demonstrate that speeds can be easily accelerated up to 20–25% (Czermański, 2014) and the market will cover the increased fuel costs by higher demand for maritime services paying higher freight rates.

Improvement of service quality on waterborne and rail connections between Netherlands and Poland can mainly be achieved in the following ways:

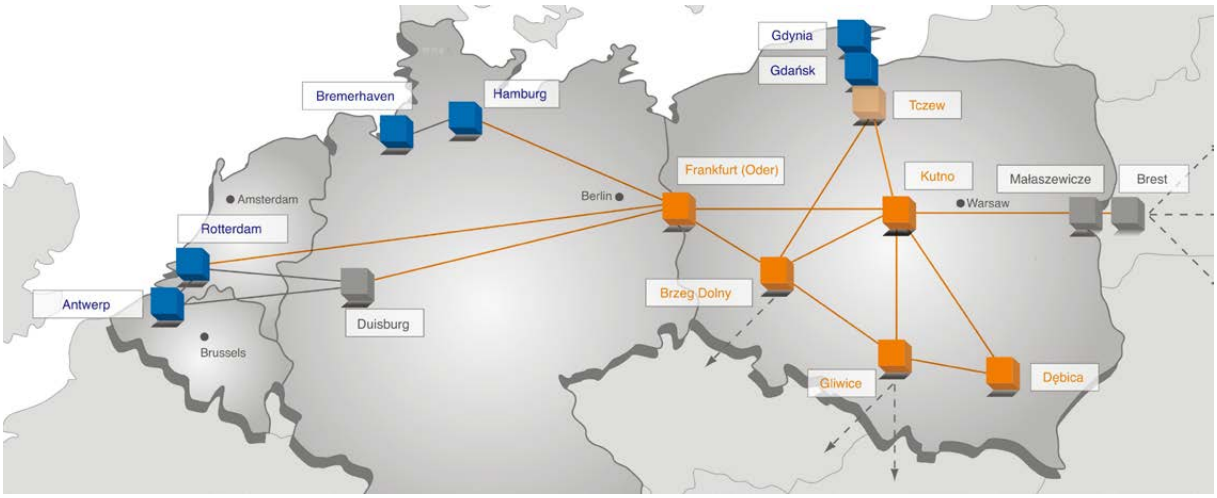

Figure 16: Poland – Netherlands trade connections (PCC intermodal transport, 2014)

- ICT solutions;
- Direct shipments (without transit ports like Hamburg or Bremerhaven);
- Unification of rail track standards (voltage, safety systems etc.);
- Improving rail track capacity, e.g. by adaption to longer trains;
- Improving rail service capacity in the port of Rotterdam;
- Rationalising IWW between Rotterdam and Duisburg;
- Reconstructing E-70 IWW route via Poland;
- Kiel Canal modernisation.

The last proposal refers to the infrastructure network, but may have serious impact on the re-routing (from the alternatively used Danish Strait via Great Belt) or ensuring operation without shutdowns or part-time breaks. Currently the uncertainty of Kiel Canal route leads ship owners to re-route in an ad hoc manner.

6.2.2 Policy Package B: Large scale investments in new rail tracks

The corridor is equipped with rail, maritime, road and IWW infrastructure and services, starting from Rotterdam, which is the largest logistics and industrial hub in Europe. The port and industrial complex stretches over a length of 42km and covers some 12,603 hectares (ha) (including Maasvlakte 2), of which 7,791ha is land and 4,812ha is water. With five deep sea and three short sea terminals, 18 empty depots, break-bulk terminals, six RoRo terminals and 20 other general cargo areas, Rotterdam throughput reached 387 m tonnes in 2009, making it the largest seaport in Europe. The port owns this position due to its excellent accessibility from the sea, the hinterland connections and the many businesses and organisations active in and around the port and industrial area.

The flow of goods on the Netherlands-Poland route is managed through several operators, including land connections (Table 4) and maritime lines (Table 5). The direct links can be fully and flexibly completed by many rail connections between Duisburg and surrounding inland terminals (Herne, Neuss-Hessentor, Cologne Eifeltor or Marl-Huels) in an easterly direction and many IWW shipping lines to the port of Rotterdam via the Rhine.

The Netherlands – Poland route is however best connected via shipping lines – ocean and feeder. The current transport volumes in the maritime corridor between Rotterdam and Gdynia/Gdańsk are approximately 500,000 TEU per year.

Beside the well-developed Netherlands-Poland connections, there are still missing links and bottlenecks in the North Sea-Baltic trade route:

- A Rail Baltica 1435mm gauge direct line from Tallinn to the Lithuanian/Polish border;
- An upgrade between the Lithuanian/Polish border and Bialystok;
- An IV category (at least) upgrade to the Oder – Vistula waterway, with further connection to Belarus and Kaliningrad;
- A rail track upgrade between Warsaw and Bialystok;
- The use of cross-border operational systems, such as ERTMS for rail and ITS for road.

Other issues are the need to develop fully a traffic and payments management system along the corridor, and the development of multimodal connections with port of Rotterdam and Polish ports.

6.2.3 Designation and measurement of potential cargo shifts

As previously mentioned, total current trade between Poland and the Netherlands (including import from the rest of the world via Rotterdam), currently reaches about 6.0m tonnes (in both directions). Slightly more than 1m tonnes of transported goods are already unitised in containers, which gives a yearly turnover of approximately 141,000 TEU. Only 25,000 TEU of that cargo is transported by rail. Road transport currently accounts for 3.88m tonnes. According to the White Paper goal 30% of this should be shifted until 2030, which is approximately 1.16m tonnes. This could increase by 20% by 2030 (EC, 2013b), which leaves a need to transfer around 1.4m tonnes away from road transport to achieve the goal. This corresponds to 140,000 TEU a year for 2030 and 300,000 TEU for 2050. A significant portion of this could be carried by maritime transport, with moderate investments in ports and ships. A prerequisite is of course that the cargo is containerised.

Operator	Loading terminal	Discharge terminal	Train type
ERS Railways	Rotterdam RSC	Swarzędz (Poznań)	Kombi (container + trailer) block train
	Europort		
	Maasvlakte		
ERS Railways	Rotterdam RSC	Warsaw Cargosped CT	Kombi (container + trailer) block train
	Europort		
	Maasvlakte		
PCC Intermodal	Rotterdam RSC	BrzegDolny – Gliwice	Container train
		Kutno – Moscow	Container train
Polzug	Rotterdam RSC	Gądki (Poznań)	Container train
	Europort		Container train
	Maasvlakte		Container train
Hupac	Antwerp Combinant	Sławków Euroterminal	Container train
Hupac	Antwerp Combinant	BASF Schwarzheide – Gądki – Warsaw	Container train
Hupac	Rotterdam RSC via Ludwigshafen	Gądki (Poznań)	Container train
Kombiverkehr	Rotterdam ECT Delta/APM	DUSS – Pruszków (Warsaw)	Container train
Kombiverkehr	Rotterdam ECT Delta/APM	Wrocław (Polzug CT)	Container train
Kombiverkehr	Rotterdam RSC	DUSS – Pruszków (Warsaw)	Container train
Kombiverkehr	Rotterdam RSC	Wrocław (Polzug CT)	Container train

Table 4: Land connections in the Netherlands-Poland corridor (TRANSFORuM research)

Operator – Service name	Route (terminals)
APL – Poland Express (PEX)	Bremerhaven – Hamburg – Gdynia – Bremerhaven
CMA CGM – FAS Baltic Feeder (Loop 2)	Hamburg – Bremerhaven – Gdynia – Hamburg
CMA CGM – FAS Danbot Feeder 2	Hamburg – Fredericia – Copenhagen – Halmstad – Szczecin – Hamburg
CMA CGM – FAS Klaipeda Feeder	Hamburg – Gdańsk – Klaipeda – Hamburg
Eimskip – Blue Line	Reykjavik – Rotterdam – Fredrikstad – Świnoujście – Helsingborg – Aarhus – Reykjavik
Hapag-Lloyd – Russia Express Service	Bremerhaven – Hamburg – Gdynia – St. Petersburg – Helsinki – Gdynia – Bremerhaven
Unifeeder – Polish Service 1	Hamburg – Bremerhaven – Szczecin – Gdynia – Hamburg
Unifeeder – Polish Service 2	Hamburg – Bremerhaven – Gdynia – Gdańsk – Hamburg
Unifeeder – Polish Service 3	Rotterdam (APM, ECT Delta, ECT City, ECT Euromax, RST, Uniport) – Szczecin (CDB) – Gdynia (BCT, GCT0 – Klaipeda (KCT, Smelte) – Rotterdam
Unifeeder – Polish Service 4	Rotterdam – Riga – Gdynia – Gdańsk – Rotterdam
OOCL – Scan Baltic Express 1	Rotterdam – Antwerp – St. Petersburg – Gdynia – Hamburg – Gdynia – St. Petersburg – Rotterdam
MSC – Loop 4	Rotterdam (ECT Delta) – Bremerhaven (MSC, NTB) – Gdynia (GCT) – Klaipeda (KCT) – Bremerhaven (MSC) – Rotterdam (ECT Delta)
Seago Line (Maersk Group) AE10 feeder	Rotterdam (ADM) – Bremerhaven (NTB) – Gdańsk (DCT)
Seago Line – Baltics and Finnish Gulf service	Bremerhaven – Gdańsk – Gdańsk – Ust-Luga – St. Petersburg – Gdańsk – Kaliningrad – Gdańsk – Helsinki – Hamina/Kotka – Bremerhaven
Team Lines – POL 3	Hamburg – Gdynia – Hamburg
Mann Lines – Service 2	Rotterdam (RSC) – Gdynia (GCT) – Baltijsk/Kaliningrad – Riga – Rotterdam
Seago Line – Atlantic Sea	Casablanca – Agadir – Rotterdam – Bremerhaven – St. Petersburg – Gdańsk – Bremerhaven – Antwerp – Casablanca
Maersk Line – AE10	China – Rotterdam – Bremerhaven – Gothenburg – Gdańsk

Table 5: Maritime connections in the Netherlands-Poland corridor (TRANSFORuM research)

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7 Conclusions and roadmap table

One of the aims of TRANSFORuM was to create a stakeholder forum to discuss the White Paper goal on long-distance freight transport and make explicit the views of different actors. The second aim was to use these inputs to produce a roadmap showing feasible pathways towards achieving this goal.

Most stakeholders consulted in TRANSFORuM consider the 30% target until 2030 to be achievable, whereas there were more doubts in relation to the 2050 target. Three main fields of action were identified:

- Make rail freight more competitive by improving service quality, lowering costs and increasing transport capacity;
- Make waterborne freight (maritime and IWW) more competitive by improving service quality, lowering costs and by increasing transport capacity;
- Create a level playing field. Make road freight (and all other modes) pay fully for it's external effects. Enforce existing rules for road freight regarding e.g. cargo weight, speed limits and working conditions.

Figure 17 demonstrates how these three main fields of action may be combined in order to reach the goal.

Elements from all three fields were used to design the exemplary policy packages in chapter 5. To achieve substantial shift towards intermodal solutions integrative approaches are needed. This is also underpinned by the two case studies carried out in chapter 6. Since the goal is rather challenging, almost all of these measures/initiatives need to be combined. However, the intensity of each will need to be adjusted to account for different external developments (e.g. economic growth, supply of fuels, etc.), as well as to different regions of the EU. The balance between building completely new infrastructure and upgrading existing network is a case in point. A more rapid growth of freight volumes will (ceteris paribus) tend to shift the balance towards building new infrastructure and vice versa. In a similar way, increasing strains on public budget (due, for example, to an ageing population), will require more emphasis to be put on cost effectively upgrading the present transport system. In the following the conclusions of this TRANSFORuM roadmap are summarised in ten points that are highly crucial for achieving the White Paper target on long-distance freight.

1) The discussion with stakeholders revealed that a **stakeholder forum** is a measure needed to enable significant changes in the structure of freight transport. It was pointed out several times and in relation to several fields of action that communication and coordination between responsible organisations is indispensable for coming close to the targets in the envisioned timeframe. For successful integrative and intermodal approaches communication and coordination is indispensable. Public authorities shall play an important role in catalysing and establishing such processes.

> EU and Member States to trigger and coordinate stakeholder collaboration.

2) The **focus on corridors** is necessary. Establishing freight corridors is definitely a useful approach, not only for technical reasons but also for enabling the organisational structures that are needed to convene the relevant actors in a coherent and efficient way. Efficient governance structures with clear leadership are needed to successively develop the corridors. Corridors are an appropriate frame to catalyse the integration of actors from different fields and modes and, thus, to enable successful intermodal solutions.

> EU to further improve the corridors by offering financial support and promoting efficient management structures.

3) **Efficient feeder transport** and smoothly working **terminals** are also essential components. The last mile problem is a serious barrier for modal shift and it might be overlooked by approaches focusing only on corridors. As was stated in TRANSFORuM's roadmap on Urban Mobility, city logistics service centres (CLSC) in urban agglomerations are a crucial measure, to facilitate the shift from road to rail and water in the long-distance segment. More efficient transshipment technologies in ports and other hubs are also necessary to reduce costs of intermodal transport.

> EU and Member States to support CLSC planning and market introduction of innovations, e.g. automatic transshipment facilities in hubs.

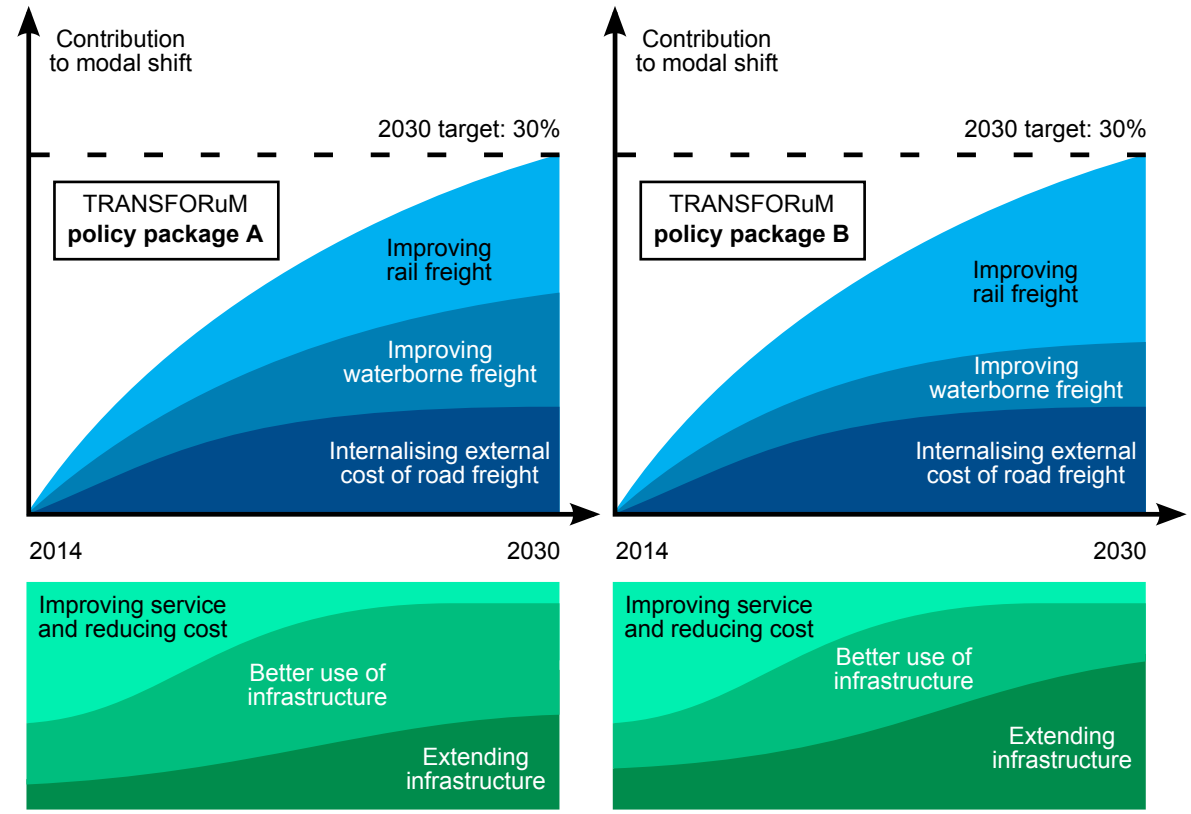

Figure 17: Feasible pathways towards the White Paper goal

4) Substantial capacity increases may be achieved by making **more efficient use of existing network/infrastructure**, without costly extensions of infrastructure. This is illustrated by policy package A. Measures cover, for instance, building longer sidings and purchasing more powerful locomotives in order to allow for longer trains, or introducing faster freight trains that will increase capacity on lines with mixed traffic. Deployment of silent breaks may also increase network capacity by allowing enhanced use of tracks in densely built areas.

   Furthermore, some stakeholders considered organisational bottlenecks as the most important barriers for increasing rail freight capacity (for example the implementation of ERMTS; freight priority and uniform standards for longer trains). A requirement for success here will also be cooperation among intermodal freight operators in order to fill the longer trains, whilst keeping reasonable frequency. Finally, running longer trains must be economical for the operator. Levying high track charges (per train passage) which then are refunded in proportion to produced transport volume may be an efficient instrument to that end. Efficient use of existing infrastructure will be important in any scenario, but in particular if public budgets are squeezed, as illustrated in policy package A.

   > EU and Member States stimulate and financially support a range of small cost-efficient investments, including improved track maintenance, which together may have a substantial effect on capacity. EU to promote efficient charging schemes.

5) **IWW and short sea shipping** still have substantial potential to be tapped with comparatively small funding needs. This also means that the waterborne sector will most likely take a larger share (although still a smaller total share than rail) of the shift from road freight, if public budgets are tight as in policy package A. A key measure in such a scenario is to raise the capacity of inland ports by careful spatial planning and financial support. Maintenance of existing IWW infrastructure, in order to guarantee a reliable high quality network, is also important. The bottlenecks for short sea shipping are mainly the capacity and efficiency of ports and the hinterland connections. Motorways of the sea may be used on some routes but service speeds need to be kept relatively low and load factor high in order to yield any significant climate benefit over road freight.

   > EU, Member States and cities to jointly raise capacity and efficiency of inland ports and seaports. Also to raise status of IWW as a modern and sustainable transport mode.

6) **Port hinterland development** by financing new dedicated freight tracks is important. Goods that arrive by ship need transshipment anyway, whether it is to truck, train or barge. With new transshipment technologies, the extra (expensive) transshipments required can be reduced from two to one, compared to a shift from dedicated road transport. In addition the large, and rapidly increasing, freight volumes in major ports assure that the economies of scale for rail and IWW may be utilised. Contractual obligations on modal split for new port areas may also be used.

   *> EU and Member States to contribute to financing of infrastructure, but in return request ports to achieve a certain (high) share for rail and waterborne in hinterland transport***.**

7) A different way of reaching the long-distance freight goal – the more relevant, the higher the total freight volumes turn out to be – would be **large scale investments in new rail tracks,** highlighted in policy package B. Such a development might be triggered by a will to radically extend the HSR passenger network, which would entail a significantly increased capacity for freight trains (and local/regional passenger trains) on old tracks. In any case such a scenario would require massive public funding. One of the few alternatives to achieve this would be to shift funding from road investments to investments in rail and waterborne transport. Lobbying from road interest groups here may constitute a substantial barrier.

   > EU and Member States to raise awareness of the importance of modal shift.

8) If infrastructure is to be extended, it is important to **communicate the overall benefits** to the public and other stakeholders. The linkage between a high quality transport system and improved quality of life needs to be at the centre of debates (not only cost-benefit analysis). Better communication of the advantages for a modal shift in the freight sector is not only relevant to generate acceptance for the implementation of infrastructures but also to generate the political acceptance for public funding.

> EU and Member States to trigger public debates about freight and to increase acceptance of corresponding investments.

9) Achieving a **level playing field** across modes is essential. The need for a better internalisation of external costs in the freight sector has been voiced for decades. Still, the discussions in the TRANSFORuM workshops clearly underpin that this is still a highly relevant point. The EU and Member States can level the playing field by implementing two types of measures. The first is to levy taxes that fully internalise the external effects of road transport (and of other modes), e.g. in the form of heavy vehicle fees such as those used in Switzerland. The second type covers a much better enforcement of current regulations in road transport. This refers to weight limits, speed limits and working time rules.

> EU to trigger and coordinate further action in this field. Member States to levy appropriate fees and to strengthen control of existing regulations and imposing more effective punishments.

10) Many stakeholders also emphasised that better quality and lower costs are needed to attract customers, not least since new trucks impose less external effects than the old ones and wages in road freight are going down. **Improved quality of services and reduced costs** are thus necessary as well. Continued, and synchronised liberalisation of rail freight is one of the measures needed. Improved maintenance of rail tracks and IWW are also paramount in order to achieve satisfactory reliability and punctuality. Cooperation and alliances between actors need to be promoted to achieve customer-friendly intermodal services and utilise economies of scale. This process involves trust building in order to achieve sustained collaborations, and this should not be overlooked. The ordering of intermodal transport must be made much easier. "One stop shops" that embrace all modes in the intermodal chains are much needed.

> EU to accelerate and monitor progress in this field and support good practices that enable a high level of cooperation in a liberalised market. The setting up of 'one stop shops' should be facilitated.

Based on the key findings of the project, the roadmap shown in Figure 18 was developed. It identifies key milestones closely related to the main messages. The milestones are ordered according to which actors have primary responsibility for their realisation. Since several of the milestones are associated with considerable inertia, rapid action is necessary. As with the main messages, the importance of the respective milestones will vary with different external developments.

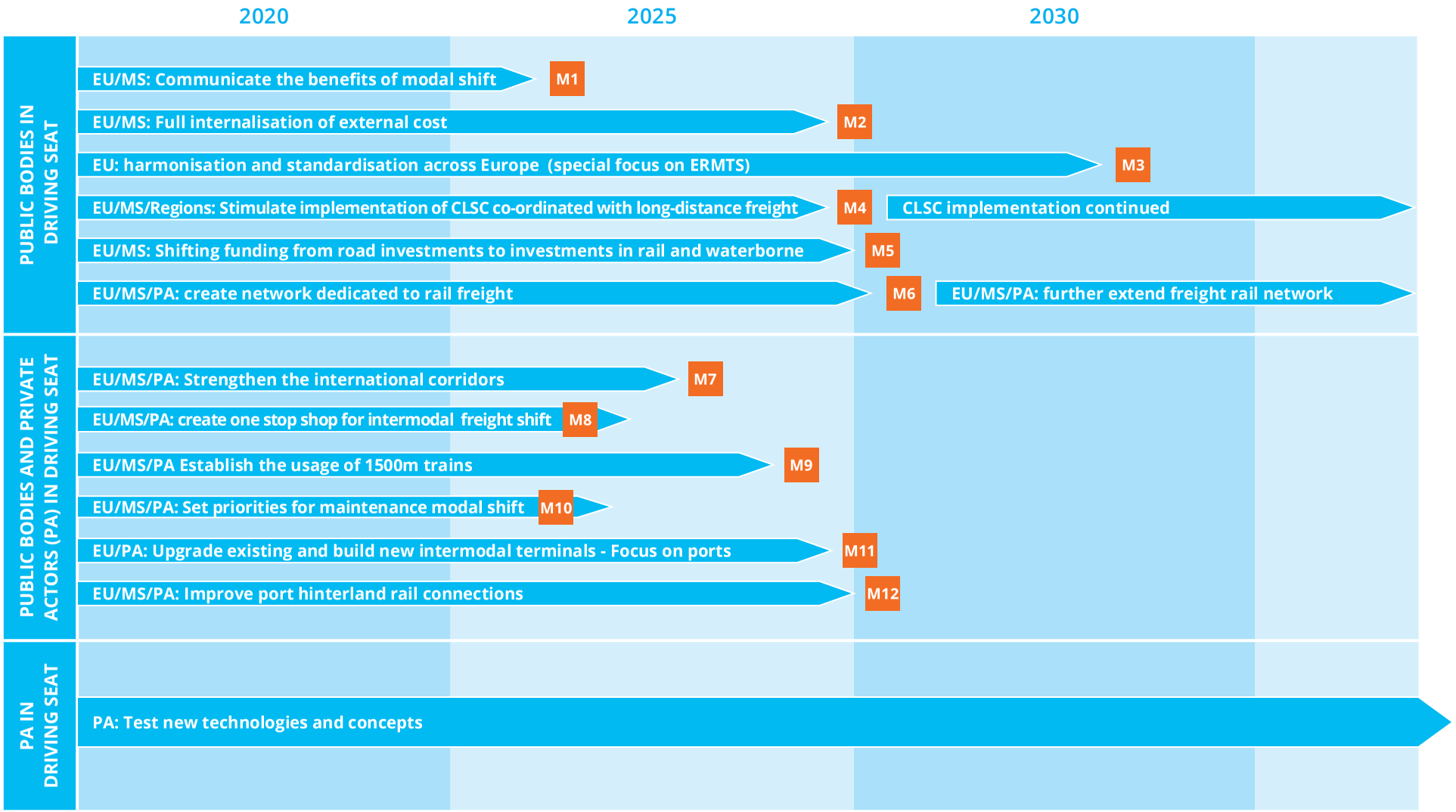

Figure 18: Long-distance freight roadmap

Milestones:

- M1: Stakeholder Forum established
- M2: Level playing field, all external costs are internalised
- M3: ERTMS fully operational
- M4: CLCS as a common element of EU transport systems
- M5: Shifting investment funding: 50% to rail, 50% to road (compared to 30%–70% in 2010)
- M6: Dedicated network for freight in 50% of the corridors
- M7: Extension of 90% of the corridors finalised
- M8: One stop shops established
- M9: 1,500m long trains are widespread across the EU
- M10: Improved maintenance of infrastructure to ensure reliability
- M11: At most ports terminals are not a major bottleneck
- M12: Share for rail and waterborne transport in port hinterland transport exceeds 70%

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ANNEX I

Rough estimation of freight flows and capacities in the Rhine valley in 2025

It is clear that the Upper Rhine Valley is one of the major bottlenecks preventing the envisioned 30% shift in the Rhine-Alpine corridor. To get a better understanding on the required shift to rail and water and how much the region could actually carry, a rough calculation was made. The necessary data for a proper assessment is not publically available, so this is an approximation only. While transport volume expectations for the different modes could be found in official studies and reports, for the concrete example of upgrading the Offenburg–Basel rail line, only numbers for rail freight were available. The data for the shipping sector is especially difficult to access.

It could be argued that the calculations and results are rather speculative because of this vague data basis. However, it gives an indicative idea on the magnitude of change required to allow for a 30% shift in this region. We understand this as a scenario, where it is crucial to make the assumptions transparent.

		2004 billion tonne kilometres (btkm)	Share	2025 btkm	Share	Load (train numbers)
Expected numbers	**Germany: total**	**548,1**	**100%**	**936,5**	**100%**	
	Germany: road	**392,5**	**72%**	**704,3**	**75%**	
	Germany: rail	**91,9**	**17%**	**151,9**	**16%**	
	Germany: water	**63,7**	**12%**	**80,2**	**9%**	
Expected numbers	Basel: total	63,1	100%	113,0	100%	
	Basel: road	45,2	72%	84,9	75%	
	Basel: rail	**10,6**	**17%**	**18,3**	**16%**	**Freight: 304 (Passenger.): 230 Total: 534/Capacity: 652 –82% load–**
	Basel: water	7,3	12%	9,7	9%	???

Table 6: Assumptions for freight flows and capacities of the Upper Rhine Valley in 2025

Our assumptions and the related calculations are as follows: Marked in **orange**, our point of departure was the data for the Basel node from 2004 and a projection for 2025 (18,3 btkm) (BVU, 2008b). The numbers for the Basel node include the complete German part (in btkm) of incoming and outgoing transport from/to Germany from/to Italy and Switzerland (**Bold numbers:** data from available reports).

No data was available for the modal share in Basel; therefore we use the modal share for Germany as a point of orientation (BVU, 2010).[6] In other words: it is assumed that the modal spilt for the whole freight sector in Germany accounts also for Basel (which is surely not the case in reality). Further, it is assumed that 56% of road freight is long-distance (more than 300km) of which 30% should be shifted.

In a next step the estimated number of trains is used for the 2025 calculations. According to these numbers, roughly 82% of capacity will be used in 2025 if the projected growth is realised (BVU, 2008a).

This assessment assumes that for Basel the planned infrastructure extensions and improved operating procedures are realised (cf. BVU, 2008a). It refers to the busiest section (Buggingen–Müllheim) along the line from Offenburg to Basel that will be upgraded. Older load numbers from an earlier planning state (cf. BVU, 2008b) would have suggested that the extended capacity of the line will be sufficient only for an even smaller part of the modal shift.

In the modal split data for whole Germany in 2025, there is a slight reduction in freight share projected. In order to relate the 30% shift to the recent modal split, the situation for 2025 was calculated on the basis of a constant modal split:

6 More recent numbers are available in Intraplan Consult and BVU (2014). These refer to 2010 as a basis and projections for 2030 and were not used here because the expected numbers for the extensions in the Upper Rhine Valley (see below) refer to 2025 and were only comparable with the numbers in BVU (2010)

		2004 btkm	Share	2025 btkm	Share	Load (train numbers)
Fictive: Assuming no modal shift	Basel: total			113,0	100%	
	Basel: road			80,9	72%	
	Basel: rail			19,0	17%	Freight: 316 (Passenger): 230 Total: 545/Capacity: 652 –83% load–
	Basel: water			13,1	12%	???

Table 7: Capacity projections for the Upper Rhine Valley assuming no modal shift

Finally, we calculated the 30% shift on basis of this constant modal share (Table 8). The calculations for this specific section in the Rhine Valley show that achieving the target is a huge challenge. With the planned massive infrastructure extension, the rail line could still only carry around 14% of the intended 30% shift from long-distance road freight. This is only a theoretical value and the rail line would then have a 100% load. The remaining shift would need to go to shipping on the Rhine, and it is not clear whether the Rhine would be capable of carrying that much freight. This is because shipping today has the lowest share and a 16% shift of road freight would therefore translate to a more than doubling the shipping transport activity compared to the current projections for 2025 or almost tripling compared to today.

		2004 btkm	Share	2025 btkm	Share	Load (train numbers)
Assuming shift: 14% to rail, 16% to water	Basel: total			113,0	100%	
	Basel: road			67,3	60%	
	Basel: rail			25,4	23%	Freight: 422 (Passenger): 230 Total: 652/Capacity: 652 –100% load–
	Basel: water			20,3	18%	???

Table 8: Capacity projections for Upper Rhine Valley assuming a 14% shift to rail and a 16% shift to water

ANNEX II

Viewpoints of IWW stakeholders in Germany

Three interviews (guideline telephone interviews) with actors from the IWW sector in Germany were carried out by KIT from July to August 2014 for validating elements of the present roadmap. The interviewees (from a private carrier, a boatman and a researcher) are all active in the logistics sector and within their field of work they engage with multimodal freight concepts: The interviewees were promised that we deal with their feedback in an anonymised way. The interviews were guided by following questions:

- How would you rate the overall political objectives such as the EU White Paper 2011 in terms of inland navigation?
- In your opinion, which growth rate can be expected for inland transportation on the Rhine based on the new Transportation Forecast 2030 document [for Germany]?
- Do you think shipping on the Rhine has the potential to handle this growth as forecasted?
- Which further measures do you consider to be of great importance in order to achieve a significant shift of freight transportation towards more inland navigation?
- In your opinion, who would be in charge of realising the respective measures?
- Which other potential measures can you think of in order to increase and to strengthen the competitiveness of inland navigation?

Main discussed subjects were: assessment of future growth in transport in the Upper Rhine Valley (as part of the Rhine-Alpine corridor), potential measures to cope with this growth, and possible measures to stimulate competitiveness and a significant shift from road freight to other freight transport modes. The main statements extracted from all three interview partners are summarised as follows:

- Under the given assumptions, based on the transportation forecasts, the objectives (e.g. White Paper goal to shift to other modes) seem rather unattainable. However, if there are no ambitious goals, these cannot be realised at all.
- The new Transportation Forecast 2030 (Intraplan Consult & BVU, 2014) for Germany seems more realistic, compared to the previous Transportation Forecast 2025 (ITP & BVU, 2007), but as well rather optimistic – particularly the emphasis on the future role of the German sea ports in comparison to the ZARA ports.
- Capacity limits along the Rhine as a transportation route are generally described as currently irrelevant all the way up from ZARA to Iffezheim (first lock further towards Basel). At the moment the crucial point is the capacity of multimodal terminals rather than a lack of infrastructure extensions along the river (e.g. locks). An extension of these multimodal terminals is of utmost importance. Reaching capacity limits in the future may depend on whether and to what extent the concept of hinterland hubs will be developed and pursued further.
- The job description of working in the logistics sector is not attractive for young people at all. The increasing number of boatmen who are expected to go into retirement presents an underestimated challenge for inland navigation in particular, and the logistics sector in general.
- Inland navigation does not seem to have enough 'positive' publicity to be present on the political agenda, although it plays a key role in ensuring the supply of bulk commodities. Particularly the maintenance of essential infrastructures (e.g. locks, bridges) has too long been neglected in the last decades.
- Related to the question, which actors should be in charge for infrastructure maintenance and upgrades?, it was pointed out that the existing federal authorities are liable. Nevertheless the great problem of financing future infrastructure investments was mentioned as an unsolved problem that should be carefully considered.

Different viewpoints arose from questions related to financing models and political mandates, like subsidies and infrastructure investments (e.g. repair, modification or extension). It is, for instance, clear that the main strength of inland shipping is cross-border transport of bulk freight. Disagreement may exist between source and destination regions, as well in cases where cross-border infrastructure projects have already been approved and are financed.

Despite these differences, there is no doubt that there is a need for closer collaboration between all actors in the logistics field and the responsible authorities in order to stimulate untapped potentials. New ICT technologies are particularly important: It is assumed that a closer synchronisation within multimodal supply chains could play a major role, based on mutual knowledge of needs and benefits by the customer on the one hand, and the strengths and weaknesses of the specific modes by the haulers on the other hand.

A word on the independence, credibility and relevance of TRANSFORuM's results

Goals raise expectations and attract criticism but without them, we could only stumble into the future. So TRANSFORuM's starting point was to take the goals as formulated in the European Commission's White Paper on Transport (2011) seriously. A second constitutive principle of TRANSFORuM was to listen to those whose job it is to implement these goals, that is, all kinds of stakeholders in the European transport arena. Because transformation requires, by definition, innovative ideas, products, policies, services and new actors we made sure that the stakeholders we consulted included the entire spectrum from incumbent market players to emerging niche creators. For the same purpose, our workshops were held under the Chatham House rules and their minutes as well as list of attendees are available to the public on our website.

At times, these two principles (loyalty to the White Paper goals and a stakeholder-driven approach) got into conflict when stakeholders questioned the sensibility, operationalisation or feasibility of certain White Paper goals. We consider this in itself a worthwhile finding and as such this is recorded at appropriate points in the Roadmaps. On such occasions, the TRANSFORuM team felt called upon as a neutral broker to think about possible amendments of the goals to ensure that they are more widely accepted and therefore more likely to be implemented. A similar phenomenon occurred where stakeholders highlighted that certain aspects of a White Paper goal are already outdated, for example, due to technical developments since 2011. It is worth emphasising in this context that the perceived appropriateness of these goals varied across the four thematic areas pursued by TRANSFORuM.

In other words, we had to find a balance between our loyalty to the White Paper goals and to the principle of a stakeholder-driven process. An ideological dominance of either of them would not have led to a coherent set of policy packages. To put it bluntly: TRANSFORuM is not a frictionless communication channel of stakeholders' wish lists to the European Commission. Neither is it the Commission's unconditional servant. Instead, TRANSFORuM used the strength of its members' scientific calibre and independence in the process. Our results are therefore "based on" stakeholders' views but essentially TRANSFORuM's. There is, however, a slight "division of labour" across TRANSFORuM's different outputs.

For the **Roadmaps**, we tended not to question the White Paper goals as such. They are designed to be implementation-oriented, focusing on actors, budgets, time horizons, etc. TRANSFORuM has released

A wish is a dream until you write it down. Then it's a goal!"
(Anonymous)

four Roadmaps, corresponding to its four thematic areas: Urban mobility, long-distance freight, high-speed rail and multimodal travel information, management and payment systems.

The **Recommendations** are also contained in a separate document, covering all four thematic areas in combination. They highlight proposed actions by all relevant actors and show how coordinated action can be more than the sum of isolated efforts.

The **Strategic Outlook** will be released in January 2015 and is essentially a sensitivity analysis to assess the robustness of the current Roadmaps and recommendations against the inevitable insecurity of long-term trends beyond the year 2030.

We hope this suite of products is not only useful to practitioners, stakeholders and policy-makers but also of particular value for the forthcoming review of the Transport White Paper. And even if not every page abounds with radically new ideas, the added value of TRANSFORuM is still:

- A new robustness and independence of the suggested prioritisations;
- A cross-disciplinary and cross-sectoral consolidation of what has been done in silos before;
- A fresh approach, based on a balanced chorus of voices, including incumbent and new actors;
- A refreshing sensitivity to the national and cultural differences across Europe;
- A rare legitimacy and credibility of our conclusions based on the transparency of the entire process;
- A first-ever attempt to build a Roadmap specifically towards the Transport White Paper goals;
- A holistic view, manifest in suites of suggested measures in the form of "policy packages";
- An encouraging and transferability-aware good practice collection across four White Paper themes;
- A novel and thorough participatory process with stakeholder-backing throughout;

Ralf Brand
(Project coordinator)

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- 34 stakeholders and experts, who agreed to being interviewed by a member of the TRANSFORuM team.

- 127 stakeholders who attend one or several of the 10 TRANSFORuM workshops.

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Ralf Brand
(Project coordinator)

List of Deliverables

TRANSFORuM's final results are primarily based on the views of stakeholders we consulted through various means, in particular through a series of 10 face-to-face workshops. In the spirit of complete transparency and credibility we made the essence of these events available online at www.transforum-project.eu/resources/library.html.

Our conclusions also build upon a dovetailed set of background research and genuine analysis, which was condensed into a number of Deliverables we produced along the way. These are:

D2.1: "Shaping the TRANSFORuM Network". This document spells out the criteria that guided the selection of stakeholders to TRANSFORuM events;

D3.1: "Summary on main policies, funding mechanisms, actors and trends";

D4.1: "Challenges and barriers for a sustainable transport system – A state of the art report";

D4.2: "Challenges and barriers for a sustainable transport system – exploring the potential to enact change";

D5.1: "Good Practice Repository - Transformation is possible!";

D5.2: "Good practice in the context of delivering the White Paper";

D7.1: "Communication and Outreach Strategy". This document defined TRANSFORuM´s target audience and the best means and channels of communication with them.

These documents are also available at www.transforum-project.eu/resources/library.html

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