

TOOLBOX ELEMENT: PLANNING GUIDELINES

Deliverable D.T2.2.5

FINAL VERSION

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Planning Guidelines

1. Initial approach

“A list of requirements (see document D.T1.2.4 within “Deliverable D.T1.2.7”) were developed in order to analyse the transport framework and suitability of multimodal transport. Those requirements will be elaborated in more detail during the project process. During the elaboration of the planning guidelines a more theoretical approach was focused, thus existing scientific theory was investigated and the practitioners input included. In addition, it was compared with the insights generated through the interviews. As a result, the planning guidelines should serve as a one-stop-shop to facilitate usability.”

Initially, the development of a static list of requirements for analysing transport framework and suitability of multimodal transport was foreseen to fulfil this deliverable. However, in the course of the project the partners agreed on an interactive Excel sheet, which requires the user to insert certain data that in turn can be retrieved from the IT Visualization and CO2 Calculator element. However, during the meetings in Linz (12.-13. September 2018), the project partners agreed that the existing planning guidelines in form of the Excel tool are too complex to use and need to be simplified. The interviews with the stakeholders also revealed that the planning guidelines are the least used element from the toolbox and need some amendment. To provide a more practical and applicable element, a supplementary checklist has been developed which is a succinct version of the original Excel tool. The aim of the checklist is to support forwarders in the decision whether to introduce multimodal transport services for a given shipment.

1.1. Development of Planning Guidelines Checklist

The checklist includes a set of 29 questions which help to evaluate the feasibility of multimodal transport services for a given transport demand. The questions comprise various topics such as the characteristics of the shipment (regularity of transport, pairing or one-way services, etc.) available infrastructure (loading units, terminals, equipment), schedules and other issues that have to be considered when introducing multimodal transport services. The questions evolved from the content of the Excel file and deliver a concise overview of the most relevant topics related to multimodal transport operation. The determinants of multimodal transport acceptance that have been collected in the pilot phase were also taken into account when creating the questions of the checklist. Additionally, a figure has been added to illustrate the steps in multi-modal network planning. The figure gives an overview of the core activities that have to be taken into account in the planning process.



1.2. Checklist

- Regarding to Incoterms who (consignee/shipper) has to arrange and paying the shipment?
- Check driving restrictions in the different countries i.e. weight restrictions, holidays, ban of driving at night, weekends, holidays, etc.
- Basic information regarding goods and differences regarding transports on road, rail, ship or multimodal i.e. dangerous good (yes/no/classification/restrictions, gas/liquid/solid)?
- Are logistic service providers able to handle multimodal transports? (quality, sustainable, their handling agents, truck services, knowledge, handling, etc.)
- Is the logistic service provider able to organise and handle every aspect of multimodal transport shipments?
- Does the nearest terminal to the loading point have a suitable range of services for road/rail/ship/handling/storage for multimodal transports?
- Does the start terminal have suitable direct train connections and/or gateway services to handle the shipping order?
- Are the journey times, time slots and frequency of services suitable for carrying out the shipment?
- Do you have intermodal loading units, i.e. cranable semi-trailers, swap bodies or containers for packed load on pallets?
- Are these technically approved and available for the planned shipment?
- Might it be necessary to use special equipment, for example jumbo swap trailers?
- Can the scheduled loading units be used on the whole route with regard to the maximum permitted profile?
- If the intended equipment cannot be used, is it possible to obtain alternative loading units tailored to requirements?
- Is the hire or leasing of loading units possible?
- Do the shipment flows include return loads or not?
- Are shipment flows regular or sporadic?
- If there are no return loads, might it be possible to arrange “triangular shipments” incorporating multimodal transport?



- Do you use trucks from your vehicle pool with your own personnel or do you use trucking companies?
- Is the price/performance ratio adequate for shipments to be handled by trucking companies over the long term in comparison to multimodal transports?
- Can multimodal transport be used to “bypass” restrictions on road traffic with regard to driving bans, hazardous goods regulations, truck weights and working time regulations?
- What about multimodal packaging? Is there a service provider available?
- Is load packed correct, loaded on pallets and fastened according to the European best practice for cargo securing?
- Are there weight limits for multimodal shipping?
- Can you ship anything using multimodal shipping?
- What information is needed for a multimodal shipping quote?
- Full truckload freight moving 500 km or more is generally the best fit for multimodal transport! Are you reaching this range?
- Departure terminal is able to handle goods using multimodal transport?
- Arrival terminal is able to handle goods using multimodal transport?

1.3. Checklist - Answers

- Regarding to Incoterms who (consignee/shipper) has to arrange and paying the shipment?

See: www.incoterms.com, www.tradefinanceglobal.com/freight-forwarding/incoterms/



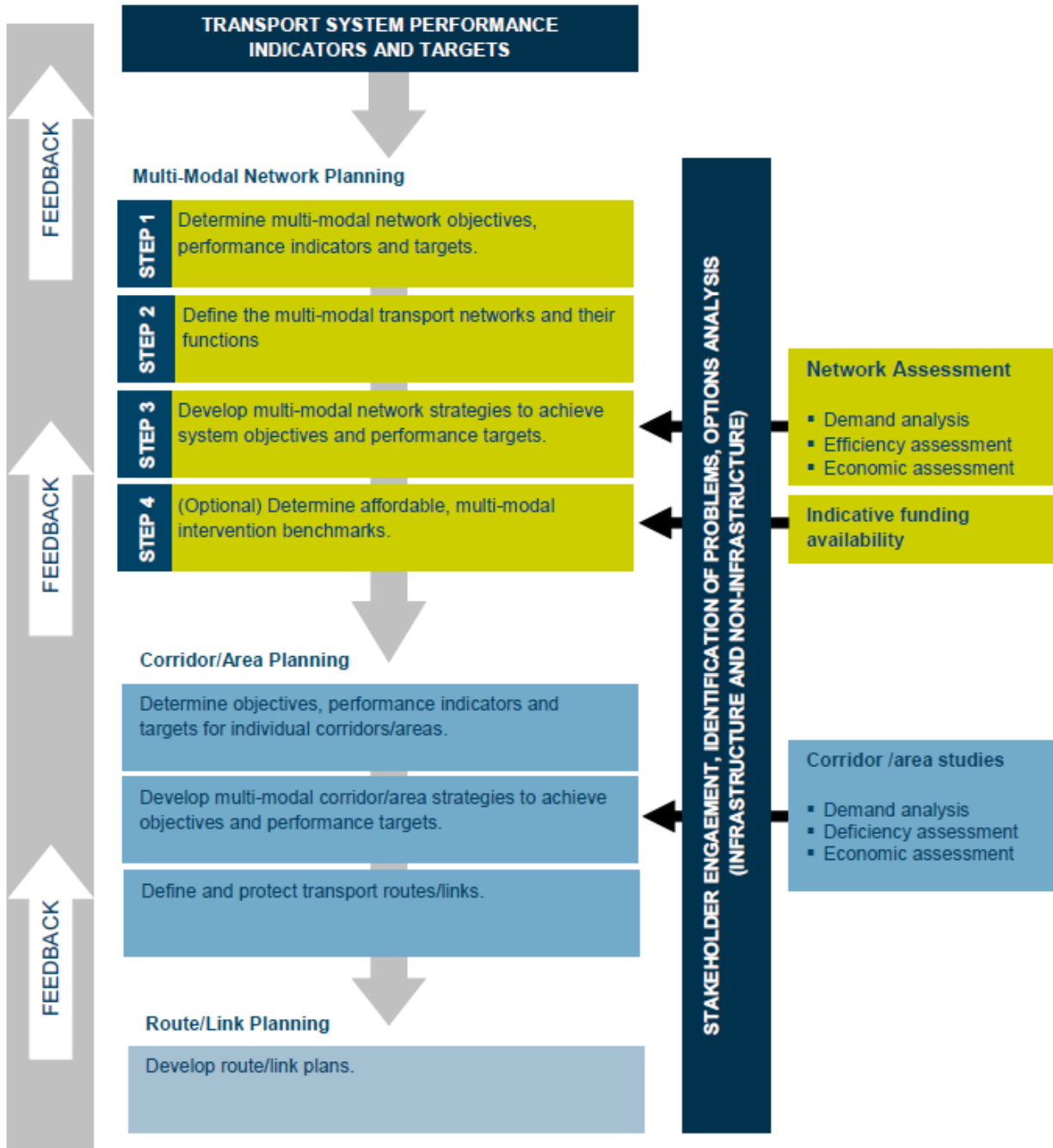
- Check driving restrictions in the different countries i.e. weight restrictions, holidays, ban of driving at night, weekends, holidays, etc.
See: 2.5 Loading and Driving Regulations
- Basic information regarding goods and differences regarding transports on road, rail, ship or multimodal i.e. dangerous good (yes/no/classification/restrictions, gas/liquid/solid)?
*See: www.unece.org/trans/danger/publi/adr/adr2019/19contentse.html - ADR
www.otif.org/en/?page_id=174 - RID*
- Are logistic service providers able to handle multimodal transports? (quality, sustainable, their handling agents, truck services, knowledge, handling, etc.)
- Is logistic service provider able to organise and handle every aspect of multimodal transport shipments?
- Does the nearest terminal to the loading point have a suitable range of services for road/rail/ship/handling/storage for multimodal transports?
- Does the start terminal have suitable direct train connections and/or gateway services to handle the shipping order?
See: <https://intermodallinks.com/GetAccess>
- Are the journey times, time slots and frequency of services suitable for carrying out the shipment?
See: www.kombiverkehr.de, www.metrans.eu; www.hupac.ch, etc.
- Do you have intermodal loading units, i.e. cranable semi-trailers, swap bodies or containers for packed load on pallets?
- Are these technically approved and available for the planned shipment?
See: 2.6. Loading units
- Might it be necessary to use special equipment, for example jumbo swap trailers?
- Can the scheduled loading units be used on the whole route with regard to the maximum permitted profile?
See: web UIRR www.uirr.com/fr/component/downloads/downloads/951.html
- If the intended equipment cannot be used, is it possible to obtain alternative loading units tailored to requirements?
- Is the hire or leasing of loading units possible?
- Do the shipment flows include return loads or not?



- Are shipment flows regular or sporadic?
- If there are no return loads, might it be possible to arrange “triangular shipments” incorporating multimodal transport?
- Is logistic service provider able to organise and handle every aspect of multimodal transport shipments?
- Do you use trucks from your vehicle pool with your own personnel or do you use trucking companies?
- Is the price/performance ratio adequate for shipments to be handled by trucking companies over the long term in comparison to multimodal transports?
- Can multimodal transport be used to “bypass” restrictions on road traffic with regard to driving bans, hazardous goods regulations, truck weights and working time regulations?
- What about multimodal packaging? Is there a service provider available?
- Is load packed correct, loaded on pallets and fastened according to the European Best Practice for cargo securing...?
See: www.uirr.com/fr/component/downloads/downloads/302.html
- Are there weight limits for multimodal shipping?
See: 2.5 Loading and Driving Regulations
- Can you ship anything using multimodal shipping?
- What information is needed for a multimodal shipping quote?
- Full truckload freight moving 500 km or more is generally the best fit for multimodal transport! Are you reaching this range?
See: Tab 3 - Suitability of route based on distances
- Departure terminal is able to handle goods using multimodal transport?
- Arrival terminal is able to handle goods using multimodal transport?



1.4. Steps in multi-modal network planning



Source: <https://atap.gov.au/framework/policy-choices-system-planning/4-multi-modal-network-planning.aspx>



2. Development of Planning Guidelines

Transport is defined as the movement of goods from one point to another. Depending on the distance of transport, one either refers to local traffic, which counts up to 50 km, regional traffic, which ranges from 50 to 150 km and long-distance traffic, which includes distances above 150 km. The majority (78 %) of the categories “local” and “regional” traffic is executed via truck, whereas above 150 km the share of road transport declines. This indicates that the remaining 22 % of overall goods’ transport were carried on distances above 150 km.¹ Thus, it is assumed that above the threshold of 150 km multimodal transport is considered as an option. Still, road transport dominates the transport sector, which is due to its high degree of flexibility.

2.1. Product Type

The execution of a transport in a unimodal or multimodal manner is also dependent on the type of product. Thus, the product type needs to be considered because some chemical substances can only be transported under certain temperature, pressure, etc.² Besides warming and cooling activities during the actual transport, temperature controlled transports concern handling and storage of actively or passively frozen, cooled and warmed goods. In the recent years, temperature-controlled transport increased due to changing consumer behaviour and stricter transport regulations.³ As part of the planning process, it is necessary to specify the following data: product type, dangerous goods class, physical state and volume.

2.2. Volume and Infrastructure

When transporting in a multimodal manner, the ability to transfer bigger volumes compared to unimodal transport demonstrates an important advantage. Especially in a multimodal manner, when pre- and post-haulage are kept to a minimum, the permitted weight of transport differs. With unimodal transport, the maximum gross weight is limited to 40 tons for a truck, whereas with combined transport the maximum gross weight for trucks is 44 tons.⁴ Therefore, the actors make use of the possibility to transfer higher volumes and utilize capacities of the transport mode to a greater extent. Apart from this, the actual length of a truck is allowed to exceed the common length by 15 cm when being involved in combined transport.⁵ Regardless of this, the high transport

¹ Pikelj (2012, p. 205)

² FP Transport LLC (2017)

³ Hofmann and Oettmeier (2016)

⁴ Babst (2012, p. 323)

⁵ Beuthe (2007, p. 69)



capacities pose a real advantage compared to road transport. Therefore, the carriage via railways enables shippers and LSPs to transfer between 1.000 and 4.000 tons at once. The high leverage evolves from the type of product transport e.g. steel versus raw materials. In terms of product type, also the density of the transported product is of relevance, especially with gaseous or liquid substances. Thus due to the underlying price structure (Euro per ton) and the possibility to transport high volumes by train, intermodal transport poses the ideal mean of transport for large and heavy goods as well as for materials with a high density.⁶

The existence of suitable infrastructure and terminals with corresponding equipment serves as a facilitating factor for multimodal transport. Whereas, differences in gauge dimensions, electricity networks or signal systems (technical nature) are hindering cross-border transport by railway. Furthermore, ICT systems will gain in importance as it serves as a factor to speed up transshipment and cross-border transports. Railway operators and infrastructure providers are advised to prepare for intensified use of ICT systems.⁷ Ideally, the routes are listed in combination with experienced LSPs that offer regular connections or are able to organise appropriate transport connections. Intermodal Links lists LSPs that operate on the routes inserted and selected during the use of the Intermodal Links Planner. Thus, the user has the option to contact the LSP and ask for a specific offer.

2.3. Distance and Location of Actors

As multimodal transport becomes an actual alternative once a certain distances is reached. It is inevitable to include a section tackling this aspect. According to Hodea (2012), intermodal transport starts to become an interesting alternative as soon as transporting distances increase. Among practitioners, the number of the minimum transport distance differs between 300 and 500 kilometres.⁸ Thus, the longer the distance the more attractive is the option of transporting intermodal. Average distances on a national (European) level are 550 km, which would theoretically be an option for multimodal transport. On an international level, distances have an average of 800 km, however, a tendency of growing volumes is anticipated.⁹

Beuthe (2007) argues that intermodal transport is more costly on short-distance, thus the pioneering role on short-distance haulage will remain with the truck. Attractiveness of combined transport processes rises with distance, but simultaneously organizational efforts, costs and time increase too. Additionally the frequency (daily, weekly) of

⁶ Chopra and Meindl (2014, p. 490)

⁷ Moritz (2017)

⁸ Hodea (2012, p. 608)

⁹ Beuthe (2007, p. 70)



connections is depending on the route.¹⁰ In terms of so-called racetracks, which show sufficient distances and volumes, daily connections are established.¹¹

Practitioners underlined that multimodal transport needs to reach a certain number of kilometres to consider it as an actual alternative. This threshold, where multimodal transport makes sense (out of an economic perspective), is commonly termed as the break-even-point. At this point multimodal transport brings along monetary advantages in comparison to unimodal transport. As long as this is not achieved, practitioners stick to common road transport. However, other factors such as volume, frequency of departure, transport time, available LSPs, terminals characteristics etc. have an influence on the decision of transport modes. The next step is to determine the distance and the further determination of the route: locations of shipping company, departure/arrival terminal and the final destination.

The different colours and the underlying kilometre range of suitability are illustrated in Table 1.

Tab. 1 Categorization of distances

Shipper to departure terminal	< 101km	101-129km	> 129km
Departure terminal to arrival terminal	<200km	201-299km	>299km
Arrival terminal to destination	< 101km	101-129km	> 129km

Green signalizes a high suitability, whereas red means that the route is not suitable for multimodal transport as the pre-haul is too long. This has to be evaluated in relation to the total distance. In the ideal case, pre-haul is below 101km, main leg is above 300km and the post-haul is again below 101km. Here, multimodal transport should be executed. If companies are not sure about the kilometres, they can make use of the Intermodal Links Planner (= IT Visualization) to deduce the kilometres for pre- and post-haul. Regarding the total kilometres per route, the operator of the Intermodal Links Planner is currently working on to also display the total distance. Alternatively, users can make use of other online tools.

Nevertheless, the kilometre range is primarily applicable for inner European transports as the suitability of multimodal transport is strongly dependent on the total kilometres. A transport from any European country towards China is still suitable for multimodal transport via e.g. the FELB (Far-Eastern Land Bridge) even though a pre-haul or post-haul is longer than 129km. Therefore, single routes with respective volumes and

¹⁰ Notteboom (2008, p. 67)

¹¹ Beuthe (2007, p. 72)



additional customer requirements needs to be investigated separately instead of basing one's decision on the results of another company.

2.4. Bundling of Transport Flows

The concept of bundling starts at the level of putting parcels on a pallet. The next step is to gather pallets and load them into a container followed by gathering containers to put them on a suitable mode of transport such as train. Terminals serve as bundling locations. This results in handling costs and bears the risk of damage while transshipment and an increase in transit time. Nevertheless, by joint planning and resulting route consolidation an option to realize cost savings in practice is demonstrated.¹² Bundling of freight poses the opportunity to utilize spare capacities and make use of economies of scale¹³, which has a positive effect on operational costs per unit.¹⁴ As a consequence of a greater loading factor the costs, which are generated, either neutralize the advantages generated or the advantage outweighs the costs and a better utilization becomes possible. However, when LSPs start to bundle freight volumes and reach certain break-even-points in terms of distance the establishment of further connections is a possible result. Thereby, also the frequency of connections might be increased.

When distributing freight joint route planning poses a possibility to save distribution costs through the effect of bundling. Transport vehicles are utilized more efficiently, cost savings up to 30 % are possible and the amount of kilometres driven are decreased which in turn result in CO₂ savings. Those aspects are some precise advantages attained through the utilization of a common distribution centre. Furthermore, it is most beneficial in relation with a high number of partners involved, narrow time windows and large distances e.g. cross-border transport in Europe. Regarding companies involved it has to be noted that SMEs are addressed more intensely than large companies. The latter are able to plan and execute routes even without partnering companies as they have a broad network at their disposal. In addition, the necessary financial resources are available to them.¹⁵ Therefore, SMEs see a necessity in cooperating with actors located at the same supply chain level to compensate a lack in resources. Eventually, the aim is to remain competitive and survive on the market. In the end, an increase in profits is anticipated, whereas the separation of such demonstrates a critical aspect in horizontal cooperation.¹⁶ In case that bundling is an option, but companies are hesitant due to costs or similar, the Strategy and Action Plan might be used for clarification as regional and national development programs are listed in this paper. Thereby the company

¹² Cruijssen et al. (2007b, p. 287)

¹³ Notteboom (2008, p. 69)

¹⁴ Kreuzberger (2008, p. 154)

¹⁵ Cruijssen et al. (2007b, pp. 296)

¹⁶ Cruijssen, Cools, and Dullaert (2007a)



interested in bundling might detect a program that promotes and funds single wagon transport and thus is able to get in contact with the respective institute.

Different product types show different requirements of transport. Depending on a product type's characteristics the shipper or LSP might be allowed to bundle transport flows. This would facilitate the attainment of sufficient volumes to realize multimodal transport. However, not all dangerous goods are allowed to be loaded together at the same mode of transport.

2.5. Loading and Driving Regulations

In contrast to North America or China, the European landscape is characterised by a mosaic of different countries speaking different languages and obeying different rules, which are introduced by different national institutions. Furthermore, technical differences hinder smooth cross-border transports by train or barge. Only those mentioned aspects contribute to challenges faced when aiming for multimodal transport. Cooperation among the players of a multimodal transport chain requires more effort but is considered as an important success factor. Thus, it is of major importance to restructure and reorganize the system e.g. by introducing a paramount regulative framework for the European transport sector in terms of multimodal transport - *inter alia* to enhance cooperation among relevant stakeholders. This would enable multimodal transport to properly compete with unimodal road transport.¹⁷ By now, the European Union developed a document "Roadmap to a Single European Transport Area" that should facilitate more sustainable ways of transport. This document is part of the White Paper 2011.¹⁸

However, multimodal transport shows benefits in terms of driving restrictions. The majority of European countries have introduced driving bans during the night, on weekends and public holidays. In most of the cases, combined transport is excepted from driving bans, also sectoral ones such as the one on the A12 Inntalautobahn in Austria. Interestingly, individually operating trucks, which are EURO 5 or 6 certified, are permitted. Even though those trucks involved in intermodal transport are not concerned with the driving bans the opening hours and delivery windows of companies need to be considered.¹⁹

Practitioners mentioned that multimodal transport is more complex in planning and execution phases. This is due to a higher number of actors involved, additional interfering points, regulative and technical differences across countries. As a precise example, transport towards France is more favourable via truck, because differing gauge

¹⁷ Beuthe (2007, p. 54)

¹⁸ European Commission (2011)

¹⁹ Notteboom (2008, p. 71)



dimensions let time and cost rise. However, truck transport is constrained by driving restrictions during public holiday, weekends and night times. This might act as a facilitating factor for combined transport as trucks being involved in combined transport are exempted from this regulation. Within the Planning Guidelines the user is able to select those countries that are crossed while transport. The information about the countries crossed can be retrieved from the Intermodal Links planner.



Tab. 2 Differing, national Driving and Loading Regulations

Country		Driving restrictions					Loading Regulations					
			Night	Weekend	Public holiday	Max. allowed speed		2 axle tractor with 3 axle semitrailer	Semitrailer combination used in a CT	3-axle tractor + 3-axle semi-trailer	Road train used in a combined transport	Vehicle combination used otherwise than CT
Austria		Road	10p.m. - 5a.m.	Saturday 3p.m. - Sunday 10a.m.	00:00 am to 10:00 pm; On Sundays and public holidays, the weekend driving ban will go seamlessly into the night driving ban from 22:00 until 5:00 o'clock!		Unimodal	40t		40t		n.a.
	Austria	Rail	Does not apply for combined transport	Does not apply for combined transport	Does not apply for combined transport		Combined		44t		n.a.	
Czech Republic		Road	none	a) on Sundays and other days of rest according to a special legal regulation (hereinafter referred to as "rest day") from 13.00 to 22.00 hours; b) on Saturday from 1 July to 31 August from 7.00 to 13.00; c) on Friday from 1 July to 31 August from 17.00 to 21.00.			Unimodal	32t		32t		48t

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	Czech Republic	Rail		the combined transport of goods by rail or by inland waterway and road from the shipper to the nearest transshipment point - no time based restrictions		Combi ned		48t		48t	
Germany		Road	none	<ul style="list-style-type: none"> • On Sundays from 00:00 to 10p.m. • On public holidays from 00:00 to 10p.m. • In case of several consecutive holidays or a combination of Sunday and holiday, the driving restriction applies from the first day 00:00 until the last day 10p.m. 		Unimo dal	40t		40t		40t
	Germany	Rail	Does not apply for combined transport	Does not apply for combined transport	Does not apply for combined transport	Combi ned		44t		44t	
Hungary		Road	none	<p>From 1st July till 31st of August - on Saturdays from 3 p.m. till on Sundays 10 p.m</p> <p>From 1st September till 30th June - on previous days from 10 p.m. till Sundays or bank holidays 10 p.m.</p>	the day before bank holidays from 10 p.m. till on bank holidays 10 p.m.	Unimo dal	40t		40t		40t
	Hungary	Rail				Combi ned		40t		40t	
Italy		Road	none	Every week end starting at 09:00am and ending at 10:00pm (Oct-May) during summer (from 7 am to 10 pm) and during national holidays (Easter, Christmas etc.)	the day before bank holidays from 10 p.m. till on bank holidays 10 p.m.	Unimo dal	44t		44t		44t
	Italy	Rail				Combi ned		42t		44t	

ChemMultimodal



Poland		Road	none		a) from 18:00 to 22:00 on the eve of those public holidays; b) from 08:00 to 22:00 on all public holidays; c) from the last Friday in June until the Sunday before the beginning of the school year: · on Fridays from 18:00 to 22:00 · on Saturdays from 08:00 to 14:00 · on Sundays from 08:00 to 22:00 (NB: as 15 August is a public holiday, driving restrictions are in force at the times indicated under "General restrictions" above)	Unimodal		40t		40t		40t	
	Poland	Rail	Does not apply for combined transport	Does not apply for combined transport	Does not apply for combined transport	Combined			42t		not defined		
Slovakia		Road		Saturday: 7a.m. - 7p.m. (1st July - 31st August) Sunday 00:00 - 10p.m.	<ul style="list-style-type: none"> • on the first rest day following after working day from 1st July to 31st August from 07a.m. to 07p.m.; • on the last rest day from 00:00 to 10p.m.; • if only one rest day follows after a working day, the restriction is effective from 00:00 to 10p.m. 	Unimodal		40t		40t		40t	
	Slovakia	Rail	none	none	none	Combined			44t		44t		



2.6. Loading Units

Insofar, loading units have an impact on the transport as during the planning phase the actors need to know how many and what type of transport unit is foreseen for carriage. Depending on the type of product and consequently the state (liquid or solid) the transport unit differs. Solid substances are carried in container, which usually cohere with the ISO norm and liquid substances are carried via tank containers. Due to the variability of tank containers, we contacted the General Manager of Hoyer (Vienna) asked for tank container dimensions. Most common ones were mentioned and included into the table 3. The table may be the basis for selecting the loading units. Thereby it is aimed for a better understanding in terms of the required number of transport units and the possibility of using block trains of bundling to achieve a more economic transport solution.

Tab. 3 Requirement of transport container options

				Number of Containers	Gross Weight per Container (in tons)	Unused Capacity (in tons)
Container Options	20ft container	Tare weight	2,5 tons			
		Net payload	21,75 tons			
		Max. gross weight	24,25 tons			
	40ft container	Tare weight	4 tons			
		Net payload	26,4 tons			
		Max. gross weight	30,4 tons			
	20ft tank container	Tare weight	3,5 tons			
		Net payload	28 tons			
		Max. gross weight	31,5 tons			
		Capacity	36 000 litres			
	22ft tank container	Tare weight	4,5 tons			
		Net payload	29 tons			
Max. gross weight		33,5 tons				
Capacity		36 000 litres				
24ft tank container	Tare weight	5,5 tons				
	Net payload	30 tons				
	Max. gross weight	35,5 tons				
	Capacity	36 000 litres				

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Hans Fischer, Michael Babst, Reinhard Lankes, Horst Manner-Romberg, Hermann Pikelj et al. 23. Aufl. Hamburg: Dt. Verkehrs-Verl. (DVZ-Wissen), pp. 316-395.

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