GMBH EKonsult

High
Speed
Freight

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Pre-Study for
UIC High Speed Mission

■ *Eckhard Kuhla*
EKonsult GmbH
ek@ekonsult.de ■

Contents

List of Abbreviations

AFC	**=**	**Air Freight Container**
DFK	**=**	**DEUFRAKO**
EC	**=**	**European Commission**
EHSR	**=**	**European High Speed Rail System**
EMU	**=**	**Electrical Multiple Unit**
FEX	**=**	**Freight Express**
HSF	**=**	**High Speed Freight**
HSM	**=**	**High Speed Mix**
HST	**=**	**High Speed Train**
IM	**=**	**Infrastructure Manager**
LU	**=**	**Load Units**
PBK (F, A)	**=**	**Paris Brussels Cologne (Frankfurt , Amsterdam)**
RFS	**=**	**Road Feeder Service**
SPU	**=**	**Self Propelling Unit**

LIST OF STUDIES

/1/ UIC Broschure - “High Speed Rail” -, 11/2000

/2/ High Speed Mix (EU-project) – Final Report - , 10/2000

/3/ Fraenkle: Road Feeder Service, - Dissertation - 2001

/4/ European Rail Forum for High Speed Cargo
– Conference paper 2001 –

/5/ AFTEI (EU-Project), 2000

/6/ DEUFRAKO “HighSpeed Freight”[1], - Final Report -, 1998

/7/ Deliverable 3 of High Speed Mix /2/

/8/ TransCare-study AMS-FRA, 1998

/9/ Railway Gazette 5/2000

/10/ Großvolumige Fahrzeuge für den Schienengüterverkehr
(v $\geq$ 250 km/h), - Report – IfS Berlin 1993

/11/ Gunther Ellwanger
Die Hochgeschwindigkeit unterstützt nachhaltige Mobilität
ETR No. 7 / 8 2001

/12/ External Costs of Traffic, Summary, INFRAS 2000

[1] DEUFRAKO = German French Cooperation (Governmental Framework for bilateral projects)

List of Figures

PART I: THE DEMAND

Within the context of the present logistic thinking experts tend to define the SUPPLY Chain Management as an answer to an existing DEMAND. For this reason the following report is structured in those two parts.

0. Introduction

The European transportation system grew into a function as the feeder between different and well-organised processes in factories, distribution centres and consumers. According to the rapidly growing internet- and e-commerce-market, not only the industry but each consumer is getting used to short answering times: ordered yesterday, delivered today to any address.
That is why parcel service is maybe the most rapidly growing transportation market worldwide with new alliances between airlines and parcel companies as well as e-commerce-companies built every month. So far only trucking companies are included in these alliances – but no railway company /1/.
The EC described in their *Directive 96/48/EC, Appendix I* the infrastructure of the trans European High Speed Rail System (EHSR):

a) The infrastructure of the trans-European High Speed shall be that on the trans-European transport network identified in Article 129C of the Treaty:

- those built specially for High Speed travel,
- those specially upgraded for High Speed travel.

They may include connecting lines, in particular junctions of new lines upgraded for High Speed with town centre stations located on them, on which speeds must take account of local conditions.

b) High Speed lines shall comprise:

- Specially built High Speed lines equipped for speeds generally equal to or greater than 250 km/h,
- Specially upgraded High Speed lines equipped of the order of 200 km/h,
- Specially upgraded High Speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed must be adapted to each case /2/.

This was defined in order

- to improve the connections between Europe's major cities and regions;
- to offer a competitive alternative for the use of car and aeroplane on short and medium distances, to reduce congestion on road, thus
- to create a more sustainable transport system.

The network is still under construction, with France and Germany as leading countries. But also in Italy, Spain, Belgium a substantial network has already been realised and further extensions are under construction. In the UK and the Netherlands new lines will be constructed in the near future.

The success of ***high speed train passenger services*** like the TGV in France, the ICE in Germany, the AVE in Spain, the cross border Thalys (Amsterdam-Brussels-Paris) and Eurostar (Paris/Brussels-London) shows that high speed rail transport has a future.

However, (except France) until now the EHRS network is not being used for the ***High Speed Freight (HSF)***. Nevertheless, there are good reasons to consider to do so, since high speed freight transport can lead to:

- possible use of the investments already made for the passengers' network;
- a new, more sustainable alternative for HSF;
- quicker connectivity between the European urban areas for the transport of dedicated cargo;

In a following study it will be shown that there is a market for both high speed cargo trains as well as medium speed trains. Especially express goods, low volume – high density – high value goods, perishable goods and trucked air cargo can be transported by fast cargo trains, as soon as that alternative exists.

A short analysis shows the following trends and speed areas of high speed rail freight:

- Air and similar Cargo already is operated with conventional trains up to **120 km/h** (e.g. the OverNight Express Amsterdam – Milano in a sleeper train since 2000) with conventional freight wagons.
- Express goods are operated in dedicated intermodal trains up to **160 km/h** (e.g. the Parcel Intercity Express (PIC) of DB Cargo since 2000) with adapted wagon technology.
- Only in France dedicated trains (TGV Postal) are operating on high speed lines up to **250 km/h** with adapted high speed passenger train technology and relevant infrastructure (EHSR-network).

This makes an initial definition of HSF-speed areas necessary:

- Conventional: < 120 km/h
- Medium: < 200 km/h
- High Speed:(HSF) ≥ 200 km/h

This study is focussing mainly on the High Speed area. Nevertheless before getting to the EHSR network there are and their will be intermediate rail products, which will be mentioned in the study. The rail transport situation will change in the coming years, due to the introduction of new rail operators and due to increased competition among rail operators.

The market forecasts for HSF are promising due to a favourable ratio between speed/cost reliability, the volumes between the major cities/airports and the interest of private parties; moreover the increasing congestion in road and air transport will make these modes less reliable and more expensive.

Summary:

- ***The opportunities for high speed rail freight are at hand***
- ***The following study will describe the options to be taken by UIC, described as "Action items".***

1. Customer needs for a rail offer

1.1 Market Segments

The High Speed Mix (HSM) project /2/ did a comprehensive analysis about the potential market segments for high speed freight transport by rail. The following freight segments are considered to the most relevant segments for high speed rail transport: One has to keep in mind, that any segmentation will have overlappings because of the dynamic changes in the market.

a) Air freight

This section covers traffic moved by major airlines, whose main business tends to be the operation of scheduled passenger services. Air cargo is moved either as belly hold cargo in scheduled passenger aircraft, in dedicated freighter aircraft or in combi aircraft (freight/passenger). The key players are at present Lufthansa (1,2 Mio. t/year), British Airways (0,7 Mio. t/year), and Air France (0,7 Mio. t/year).
Intra European air-transport seems to be a most promising market for high speed rail. Measured in total transit time, high speed rail would be able to compete with air transport.

Air freight has two modes of operation:

- Freight booked on specific flights
- Customer specifies only the required arrival deadline time at the destination.

Air freight consists not only freight carried in aircraft but also of freight carried to and from airport hubs by road vehicles: It is trucked under a flight number and is called ***Road Feeder Service*** (RFS). The IATA Resolution 507 b gives the following definition:
*„...Routing a Consignment over the first and/or last sector(s) of the route as shown on the face of the Air Waybill by surface means Road Feeder Service“.*80% of this freight is “Intercont”- Freight, the rest O/D[2]-oriented. Trucked air freight has a large share in total continental airfreight transport in Europe:
RFS generally delivers overnight to a main hub airport. For overnight transport from one hub to another a maximum of 9 hours can be used. By road this means a distance of approximately 550 km can be driven. In average 15% - 20% of air freight is truck driven. RFS was analysed in respect to rail by a recent dissertation /3/: the Annex 2 shows the core lines: AMS - FRA, FRA – CGN, MIL – FRA, BUR – AMS, PAR – AMS. Annex 3 shows the hourly distribution volume of –Frankfurt Airport.

[2] Origin/Destination

Considering the unbalanced characteristic of airfreight flows, this type of transport requests a flexible pre and end haulage road transport. RFS is therefore characterised by a considerable imbalance in direction and demand.
Using the European rail network to replace trucks with trains for air transport, forms part of the current combined transport approach of the AFTEI project/5/. Some air operators already use combined transport services to transport their conventional goods. For example, Lufthansa Cargo loads cargo for Italy (Milano) into an intermodal train from the terminal in Mannheim.

b) Integrators

Integrators move generally small parcels and documents, often using the "hub and spoke" system. Integrators are integrating logistic modules to a complete, fully controlled transport system - as far as possible with their own land vehicles and air planes and handling facilities.
The four leaders in Europe are Deutsche Post, UPS, FedEx and TNT. Like the market segmentation , the market shares are changing very fast, too. In 2000 the market leader in turn over was UPS with nearly 50%, followed by FedEx (32%).
"Couriers" are particularly strong in the market for extremely urgent traffic where speed is more important than price. They have been changing focus from their origins in domestic small package / overnight operations into major international operators with sophisticated communication and control systems, providing the basis for on-line booking and tracking systems for customers.
Most integrators and couriers have generally rationalised their use of transport by using air for inter-continental and longer hauls across Europe, and road for short distances.

c) Mail

Mail as a potential for rail transport can be divided into two types based on service and delivery time. The following partition is made in:

- *Domestic postal services*

Domestic postal administration in Europe differs from one country to another. The UK and Germany have next day delivery options covering most of the country while in France this is mainly restricted to the same department as the origin. Most of the European postal administrators offer a low-cost option on road transport. However, where next day delivery service is offered the time window between the despatch and the receive sorting office is of the order of 4 to 6 hours. This restricts the range of road truck movements, and gives rail a niche between road and air.

All of these three countries operate air networks. In the UK a multi-hub air networks conveys about 215 tonnes per night, with payloads typically in the 3,5 to 5 tonnes range. This traffic is in addition to the mail carried by a significant number of dedicated trains. In Germany an air network until recently had a central hub at Frankfurt (with 350 tonnes per night), with a subsidiary hub at Stuttgart. However, this has now changing to a multi hub system, with Frankfurt now carrying 250 tonnes per night.
France has a centralised air hub at Paris Charles de Gaulle airport, with rail being used on the Paris-Lyon-Avignon TGV route only. In Germany mail was shifted back again with the Parcel Intercity Express (PIC), v_{max} = 160 km/h. It is a conventional intermodal train, but with high quality (98% timetable reliability).

- European mail

Priority mail in Europe is normally day C delivery. The pattern is to collect on day A, sort during the night of A, transport to destination on B and sort out during the night, final delivery at destination on day C. Transport is usually during day B, till a maximum distance of 700 km by road. Longer hauls usually are flown. Because of low volumes, the normal practice is to route vehicles via concentration points.
Over longer distances, mail is flown both within Europe and inter-continentally. The flights used tend to be scheduled passenger services or alternatively, space may be booked on scheduled freighter aircraft.
Mail on standard services uses road throughout. The charges are based on road costs, with delivery specifications depending on the length of haul.
Postal organisations have been traditionally strong in the provision of relatively high quality, low cost services. However, those services may not be comprehensive enough to meet all demands emerging in the modern market place, and could lead to diversification to defend national markets from foreign competition, including competition in European domestic markets from integrators. Thus it can be said that the liberalization of the European postal institutions leaves a great uncertainty concerning a “rail volume”.

d) Express road freight

This sector differs from the general freight industry in number of ways. The most important factor is that express road freight services operate between a number of depots, allowing driving changes en route.

According to /4/ the first interest within the total segment of road transport goes to shipments with a relative high value and of perishable goods. This would lead to a relative high demand on speed and reliability, the main assets of high speed rail transport. Major attention should be given to ‘’groupage-transports’’ (collecting goods to ensure high volumes on main routes) within the transport networks of large intra-European transport companies.
Similar to the mail market those road volumes are not yet rail orientated. Moreover their depot structure could only in parts be integrated in an air/rail terminal network.

Fig. 1 shows the market segmentation used in this study: Air freight and Express freight. Other segments like mail and express road freight operate with their own specific depot system.

	AIR FREIGHT		**EXPRESS FREIGHT**
Operators	Airlines, express carriers		Integrators / Postal carriers
Criterias			
▪ time sensitivity	Medium (hours)		High (seconds)
▪ flexibility, reliability	high		
▪ frequencies	severe peaks (weekends)		somewhat balanced
Modes	**Aircraft**	**RFS** (with Flight No.)	Air (hub/hub) / Road (coll./delivery)
Share	60 – 70 %	50 – 80 %	—
Infrastructure	Airport terminals	Airport terminals	Hub /Spoke (air oriented)
Loading Units	AFC	Swap Body/Trailer	AFC/Swap Body (palletised)
Market Leader	LH		UPS

Fig. 1 Market segmentation (criterias) ***/EK/***

1.2 Logistical aspects

- General requirements

The AFTEI /5/ report describes the results of the Swiss Shippers' Council (SSC) air cargo seminar (1999). A survey was made in order to know how freight forwarders *rate to airline's services*. It gives a good impression of the requests a high speed freight service by rail will be faced with. The decisive criterion for a freight forwarder to choose a carrier is **price**, with an average of 23.2% of the cases. In case of a long term partnership, price criteria are in the foreground. The weighing of other criterias are: information/communication (17.6%), services (16.1%), capacities (11.8%), damage/liability (10.3%) and the information technologies available (9.3%). Concerning price, an early notification in case of tariff changes and stable price are more important than the lowest prices. The stability is so important that it is preferred by the forwarders as the achievable gross profit.

The weighing of other criterias are: information/communication (17,6%), services (16,1%), capacities (11,8%), damage/liability (10,3%) and the information technologies available (9,3%).

Handling time, density of flights schedule and the type of aircraft were seen as important, with only a few individual deviations. The type of aircraft was nevertheless seen as non essential by around 25% of the cases.

Additional requirements to high speed freight services by rail, will concern speed and reliability. Air transport has already proved to be fast and reliable in most cases.

Deriving from that *quality* comparison and from estimations concerning the *price* the unique selling position of a HSF rail product can be summarized:

- ***price: "lower" than air***
- ***quality: "higher" than road***

This only could be reached by rail at least by introducing "air" or "integrator" management philosophies.

- Time frame

In DEUFRAKO /4/ a careful query has been made concerning the logistical demand. In a workshop with the integrator (DHL, UPS, FEDEX), airlines (LH, AF) and airports (Paris, Brussels, Cologne and Frankfurt) a typical **time frame** for the PBK (F) line and the 3 integrators was given, see figure 2

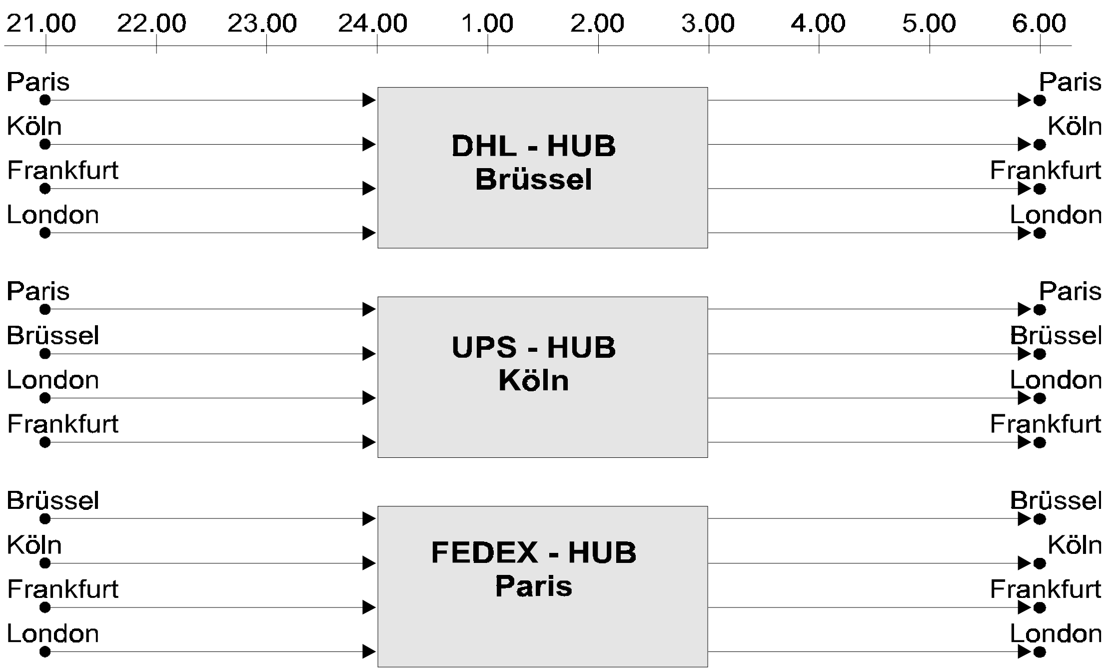


Fig. 2: Mission and time frames of DHL, UPS und FEDEX

Due to the high loading capacities of trains, the different market segments above may use the same train, but the rail offer must aim to meet the transit time requirements of the most time sensitive potential customers, i.e. integrators. It is therefore necessary to describe the integrators' logistical chain and to integrate its time parameters in the train offer.

- Logistical chain

As shown in Figure 3 and Annex 4, the typical integrators' **logistical chain** (in this case DHL) is structured around 2 elements:

⇒ two gateways;

⇒ one central hub.

After the parcels have been collected in the area of the country gateway, they are brought to the gateway where they are sorted and transferred onto the appropriate means of transport. From this moment a very precise time schedule dictates the transport of the goods (see figure 4 at top):

- **3 hours** are allowed for haulage between the first country gateway (collection) and the central hub. Once the goods have arrived at the central hub,
- **3 hours** are allowed for sorting according to their final destination and transferring into the appropriate means of transport.
- When the goods leave the central hub **3 hours** are allowed for haulage between the central hub and the second country gateway (distribution).
- At both of this schedule, the time window allowed for the final collection / distribution is **3 hours**, which includes 1 hour for either pre or final sorting and 2 hours for final drayage.

1.3 Consequences for the Rail Offer

For rail operations, two particular aspects of the integrators' operations have to be taken into account /7/:

most of the integrators use dedicated means – Hubs and aircraft,

different integrators' hubs are located in different cities.

Considering the present hub locations, these are clearly an obstacle to the development of a general rail offer in Europe, because of the lack of opportunity for aggregation of the flow volumes.

This means that a rail offer should be focused on **direct connections** where possible. In any case, in using the rail mode the integrators will in some cases need to adapt the logistical chain that they have developed. The companies have said that they might change their logistics, should the change provide a benefit to them.

In conclusion, 2 options need to be considered when defining a rail offer:

direct connections (gateway / gateway),

hub and spoke structure.

Two different **time windows** derive from these 2 options (see fig. 3) and with this two rail modes:

- a **9-hour option** (“Interregio”-type), in which 9 hours are allowed for the direct connection between the 2 gateways. In this option, the transport haulage takes place between 9 pm and 6 am. Road feeder services for air freight and express road freight very frequently use this time band. Couriers and integrators also tend to use this option more and more frequently, as flows grow and a direct connection between two gateways becomes justified. The RFS consists up to 80% of intercont – freight, the rest is typical O/D-freight.
- a **3-hour option** (“Intercity”-type), in which 2 x 3 hours are allowed for the trips to and from the gateways and the central hub. This option is the core logistics for integrators.

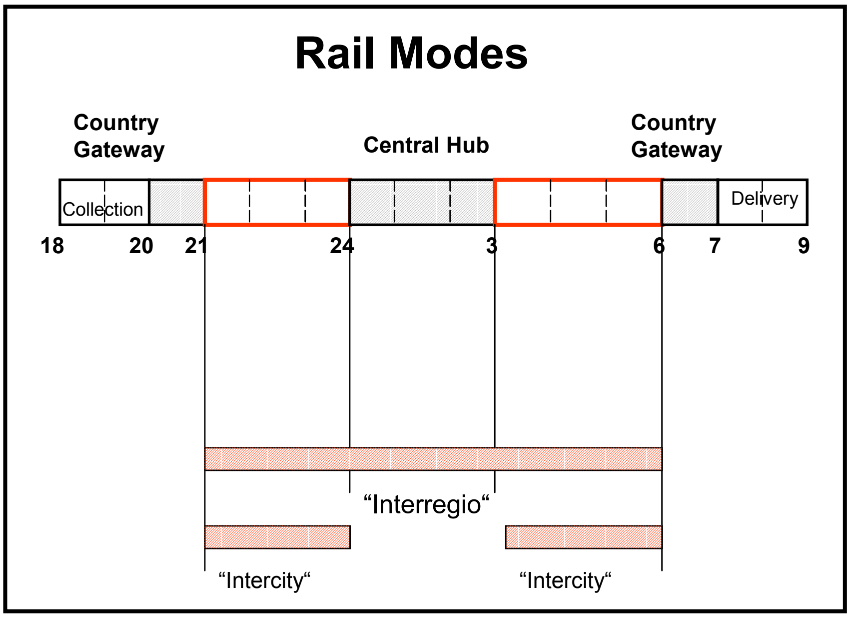


Fig. 3: Rail Modes /EK/

In agreement with most of the studies the following chapters will focus on **two target markets** (due to time windows and hub / terminal structures):

- integrators (express market)
- air freight

In the same context mail will be left out due to quick changing development. With this assumption the following estimations are on the safer side.

Figure 4 summarizes the rail offer criterias for the shift air / road to rail:

	AIR FREIGHT	EXPRESS FREIGHT
▪ necessary volume	main volume	Additional volume
▪ criterias	costs	quality
▪ time window	9 hrs	3/3 hrs
▪ speed (km/h)	< 160	> 200 (TGV-Type i.e. EHRS-based)
▪ terminal type	existing	new air/rail terminals
▪ business profile	"air-management"	
▪ problems	bundling into trains, integration of logistic chains,	

Fig. 4 Rail offer criterias

Summary

- ***<u>The time frame</u> for the integrators and RFS could be generalized (with exceptions):***
  - ***9hrs for direct trains (between country gateways)***
  - ***6 hrs for hub / hub trains***
- ***Unique selling positions for rail HSF:***
  <u>quality</u> (better than road) and price ("better" than air)
- ***Rail has to adapt "air management" in thinking, sales management, operation and contingency management***
- ***<u>Rail target markets</u> are defined as integrator and air freight***
  (incl. road feeder services), because of their hub structures and quality elements.

<u>Action item 1:</u>

Checking and Evaluating the customer's requirements

2. The Traffic Flows

2.1 Rail Potentials

The potential freight for a HSF service on rail will be growing in the near future, this is the main issue in the studies. But why should shippers and forwarders **shift from air or road towards rail**? This question has mainly to deal with the factors reliability, flexibility, transit time, price and bundling processes. In generally operators in the express freight market see rail as being less flexible than road or air and less able to adjust to daily, weekly or monthly fluctuations in demand. They also believe the costs associated with high speed rail are higher than by air. Though rail would be offering greater capacity, this rarely is needed in practice until now.

In order to respond to the demand of the next morning delivery, express operators have built systems designed for overnight operations, but the distance covered clearly depend on modes used (basically road and air). Densest flows are on those axes linking the major European **metropolitan areas**. Hub and Spoke systems are generally used. Although road and air are used at present, operators appear to be interested in the 400 – 800 km distance band or perhaps for longer distances.

One of the most complex processes will be the **bundling** of relevant traffic flows on different levels:

1. time windows of the operators
2. maximum transportation time
3. loading units in operation
4. relevant operator's infrastructure.

Concerning the fourth "bundling level", DEUFRAKO tried to integrate the different infrastructures of the integrators, airports with the future EHSR-network, see Annex 9. The result was the DEUFRAKO core network. Another example (for level 1): between Amsterdam and Frankfurt 80 – 100 AFC (relevant to a bit more than one train load) are transported daily. The bundling into one train fails because of successive time windows of the different operators.

Since the **payload of a train** needs to be much larger than that of an aircraft, the use of rail can be possible only if different competitors agree to aggregate traffic onto the same trains. When asked this question, the companies interviewed, said that they would be prepared to share the same trains.

At present there is **insufficient volume** to justify dedicated high speed trains for serving the hubs of individual integrators. As volumes increase, multi-hub operations are more cost effective and so are becoming more common. **Aggregation** of traffic between the major European metropolitan areas appears to be the way forward, especially when air/rail terminals are developed at airports. The main metropolitan areas between which this would apply are Paris, London, Brussels, Amsterdam, Cologne, Frankfurt, and Milano.

There may also be a market for **national rail freight** services to serve major corridors within some countries, but only a proportion is likely to need high speed rail technology. Examples of these services can be found in Sweden, UK and France on dedicated post and parcel services with speeds of *160 –200 km/h,* while the French TGV Postal service uses HSF technology. Liberalisation of the postal sector in the EU may generate much higher volumes of postal traffic demanding short transit times.

Though volumes appear to be low at present, the rate of increase of traffic carried by integrators has been in excess of 5 - 10% per years. It is expected that this will increase further for the coming 10 years with another 5 - 10%/year. In 2005 every fourth parcel is deriving from E-Commerce sales. This together with **increased air** and **postal traffic** will enhance the potential for high speed rail freight services, let alone the expected restrictions due to congestions and night ban.

Besides potentials of the new high speed freight by rail services, there are different actual developments concerning air and road transport, which could have a positive influence on the market potentials of a high speed rail freight service.

In the short term, the competitiveness of rail transport will increase for certain types of transport operations. This return from competitiveness will come from **road mobility problems**. This road transport will be countered sooner or later, but will also need to be built up through better provision of service[3]. These growing mobility problems in road transport concern a/o congestion, environmental and safety constraints, driving bans and extra costs for transit traffic. The development concerning the night ban on airports could drive another part of freight to rail.

3 Luc Partoune in Liege airport & logistics magazine, may 1999

2.2 Forecasting of Rail Volume

- Bottom up-Method

A number of ways of determining the actual volume of potential traffic for High Speed Freight services were explored in the High Speed Mix Project. A **postal survey** was undertaken to obtain data and to make contact with relevant companies, with a view to subsequently interviewing some of them in order to expand on the original information.

455 questionnaires were sent out to a range of organisations. Unfortunately the response was extremely poor. (It is suggested that in future exercises of this type consideration should be given to an additional or alternative approach using stated preference or modelling techniques)
Due to the lack of response to the questionnaire, the planned interview programme was considerably expanded in order to obtain the information needed. Interviews were therefore carried out with 6 Airlines and Freight Forwarders, 5 Airport Authorities, 3 Postal Administrations, 5 Integrators and Couriers and 7 Express Road Parcels/Groupage Operators. Despite the efforts made to obtain data through the review of the literature, questionnaires and interviews, the information obtained from these sources is **far from complete**. This is due to the commercial nature of the information and the unwillingness of organisations to fill in the questionnaire and, in the interviews, to give hard information. What information has been obtained is also rather unsystematic. The information obtained, although qualitatively good, is general informal, rather than giving specific detail relating to individual market and geographical segments.

- Top down-Method

Because of the lack verified basic inquiries it was necessary in the HSM-study to take a view form a **"top-down"** perspective, see Chapter 3.1: Traffic flows in "number of trains" are extrapolated, and thus demonstrating a feasible volume for a HSF-Network.

2.3 Examples for relevant Rail Flows

In the various studies “no assured” pan European HSF traffic flows could be found. Only some examples could be given:

- **AFTEI** /5/

The objective of this EU-Project was to analyse the intermodal aspects air-road/rail. Therefore it produced reliable datas on airfreight. Figure 5 is showing the number of destinations and frequencies per airport:

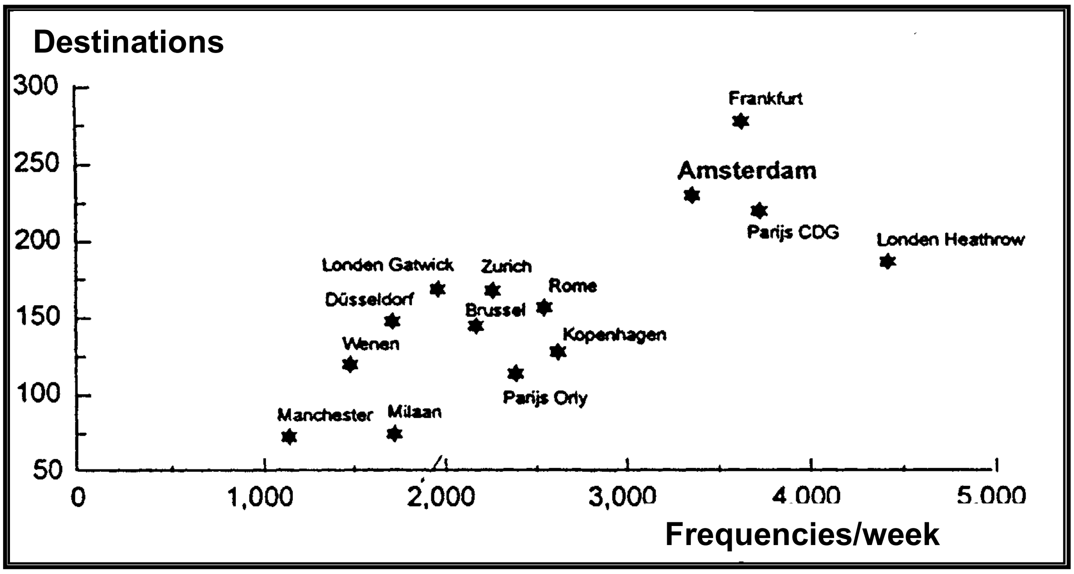


Fig. 5 Airfreight destinations and frequencies /5/

This can be condensed to Amsterdam, Frankfurt, London and Paris concerning the highest frequencies and destinations (figure 6) describing the first approach to a HSF network:

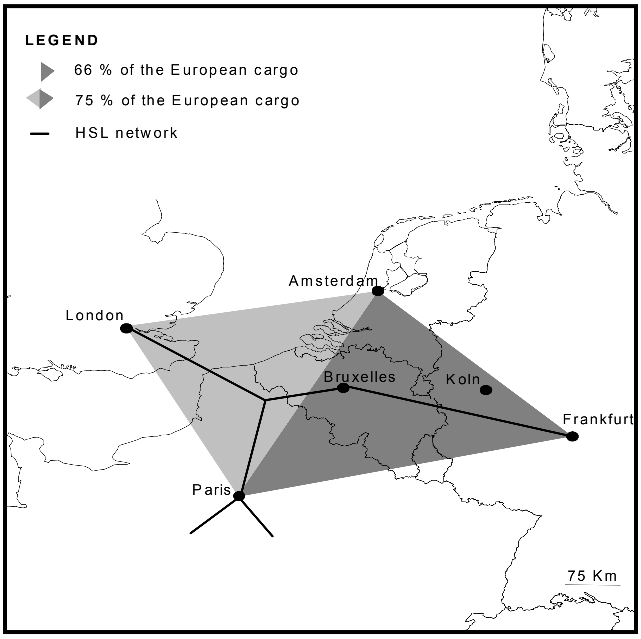


Fig.6: Main Air cargo airport in Europe /4/

- **DEUFRAKO**

In DEUFRAKO /6/ a volume analysis was made (Basis: prognos study) and then a forecast was made for 2005. During that period the volume will double.

	from to	**Frankfurt**	**Cologne**	**Bruxelles**	**Paris**	**London**
1996	Frankfurt	-	62,0	26,5	64,0	12,5
	Cologne	65,0	-	33,7	18,5	18,0
	Bruxelles	25,4	28,2	-	56,0	20,0
	Paris	50,2	16,0	64,0	-	62,0
	London	11,0	16,0	21,5	51,0	-
Prognosis 2005	Frankfurt	-	124,0	53,0	128,0	25,0
	Cologne	130,0	-	67,4	39,0	36,0
	Bruxelles	50,8	36,4	-	112,0	40,0
	Paris	100,4	32,0	128,0	-	124,0
	London	22,0	32,0	43,0	102,0	-

Fig. 7: HSF-volumes (t/day) in 1996 and forecasted for 2005

This HSF-volumes in red describe the double triangle of last figure

- **High Speed Mix (HSM)**

After the derivation of the HSM-network the project calculated speed oriented “traffic flows” in number of trains. These graphs are shown in chapter 3.2.

Summary

- ***HSF-Volume forecast datas are very poor.***
- ***Bottom up datas are not delivered by the operators, i.e. top down forecasting is needed for future planning***

Action item 2:

With the pan European HSF-Market Study the rail oriented HSF flow will be described.

Part II THE SUPPLY

The elements of the Supply side, or of the “Supply Chain” are the

- HSF Network with Terminal links (chapter 3)
- Loading unit (chapter 4)
- Rail operation (chapter 5)
- Terminal operation (chapter 6)
- IT-Service (chapter 7)

3. The HSF-Network

3.1 The DEUFRAKO-Network

With the DEUFRAKO Network another approach was chosen (Annex 9).
As described in 2.3 it was found out, that on the classical PBK (F, A) lines there will be the highest HSF-volume in the future, DEUFRAKO concentrated on the relevant airports (level 1) as a basis. The next structure was consisting of the Hubs of the integrators (level 2) and finally this was transferred to the High Speed line (level 3): The FEX-Core Network. By this philosophy the transportation demand was “covered” by the relevant rail infrastructure.
This core network was the basis for the DEUFRAKO-study. It was also taken by the HSM-study for its Pilot Case.

3.2 *The HSM-Network*

In the HSM project SNCF Fret produced a High Speed Freight network in a very pragmatic way: by extrapolation.

Assumptions

The following assumptions were made:

- the network basis: the EHSS (EU), see figure 8a

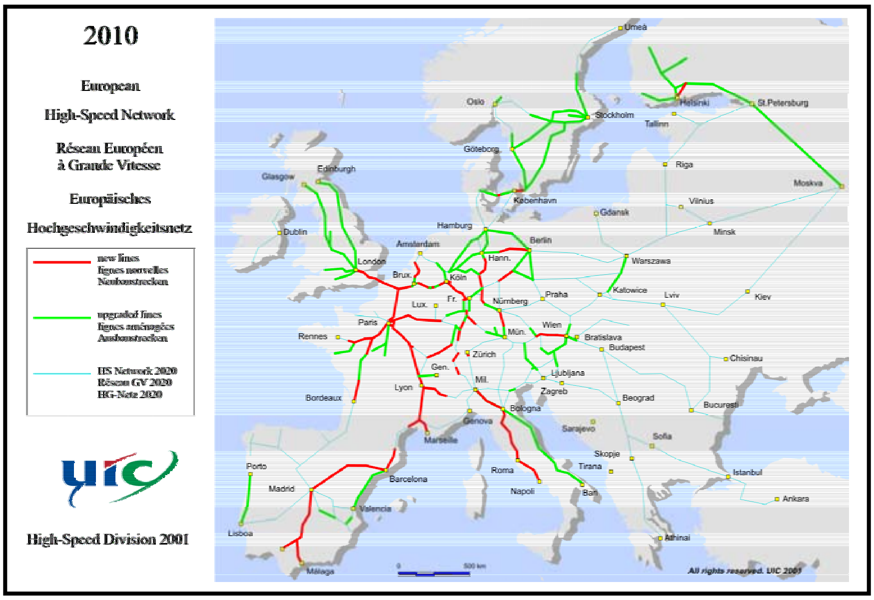


Fig. 8a EHSR Network 2010

- the cities to be served (see Annex 5), are evaluated with
  - their economic weight (assumption: corresponding with population within a radius of 100 km)
  - the presence of an international airport
  - their location near the High Speed Network.

Those are very pragmatic and simple assumptions. A possible follow up study has to use approved forecasting tools.

The derived network

With the above and other assumptions (s. Annex 6) the HSM-study defined its Network (see figure 8b):

Fig. 8b: High Speed Freight Network, 2010

The network coverage

To analyse the coverage of the proposed network the some assumptions were made, see Annex 5. With those criteria the number of feeder trains (for hubs) are calculated (v_{max} = 200) :

Brussels Hub	Year 2005	Year 2010
Amsterdam	2	3
Cologne	2	3
Frankfurt (300 km/h)	1	1
London	2	4
Paris	1	2

Frankfurt Hub	Year 2005	Year 2010
Cologne	8	13
Stuttgart	5	8
Brussels	1	1

Paris Hub	Year 2005	Year 2010
Amsterdam (300 km/h)	1	2
Bordeaux	2	3
London (300 km/h)	2	4
Lyon	4	6
Brussels	1	2

Table 1 – Numbers of trains each day in each direction for feeder connections to different hubs (200 km/h)

It can be seen that rail can provide only a limited number of services in feeder operations to and from hubs. This is because rail can only fulfil the journey time criteria ≤ 3 hours on a relatively small number of connections. (Notice: the Frankfurt – Cologne number of trains seem to be very high.)

The estimated numbers of direct connections between the major centres of population are:

Year	2005	2010
Total number of trains	121	192
200 km/h	88 (73%)	142 (74%)
300 km/h	33 (27%)	50 (28%)

Table 2 – Number of trains each day in each direction for direct connections

In the case of direct connections, it can be seen that rail can provide a large number of the predicted flows, and interestingly, that around 75% of the demand can be met by trains having a maximum speed of only 200 km/h. This is significant since such trains would cost far less to operate than very high speed 300 km/h trains, see Annex 7, 8.

The study also found out that of the possible 231 links between the 22 cities comprising the modelled network, 117 connections might be made by rail within the criteria rail ≤ 9 hours and road > 9 hours.

Summary

- ***The present data basis does not allow to define a consistent HSF-network***
- ***Essential "items" are missing, such as***
    - ***Expected traffic HSF flows in general***
    - ***A consolidated and feasible rail volume***
    - ***Rail transfer points at logistic nods/hubs for the rail target markets***

Action item 3:

With the traffic flow forecast a HSF-network can be created

3.3 The Terminal location

- General aspects

The DEUFRAKO Study did a general distinction for the locations concerning (figure 9a):

- the High-Speed Network and
- the airport

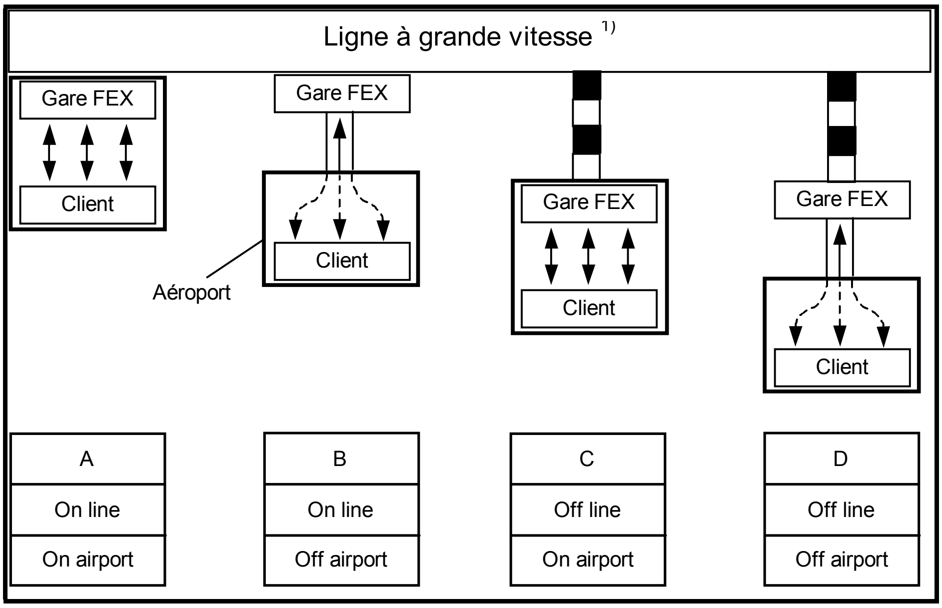


Fig. 9a Terminal location types /6/

DEUFRAKO also studied that there are different possibilities in terms of implementation of rail infrastructures. As far as air freight terminals are concerned, they could be online (directly situated on a high speed track) or off line. In this latter case the logistics chain includes an additional segment between the terminal and the high speed track or railway station. A second case concerns the implementation of the terminal regarding the airport. It could be located on airport or off airport. The off line option causes a loss of time in the logistic chain.

[1] Ligne a grande vitesse = High Speed Network
Gare = Terminal
Client = customer

Despite the fact that option A (on line/on airport) seems to be the most ideally location for an air-rail terminal, the AFTEI project mentions a deviating development for the next years. Due to scarcity of space in the airport areas, as well as to the expansive cost of this space, agents will find it cheaper to establish their hubs next to well served airports, but not necessarily within the airport area strictly speaking. It could be in multimodal freight areas, close to the airport and well-equipped for pre and end haulage, including a railway terminal if it offers prompt services to and from the region. Not only the off airport location is reducing costs, it could also enable to mix an air cargo with other types of cargo on the train. In this point of view, the location of an air rail terminal has to be carefully studied:

Given the characteristics of **air freight** by road, intermodality for this type of freight is more or less similar to conventional combined transport. First and foremost, this involves replacing trucks with trains. Intermodality for this type of airfreight does not necessarily require the development of new infrastructures, provided that the capacity available for combined transport is within a reasonable distance of the airport. Nevertheless, combined transport services have to be improved to be attractive for airfreight operators.

For **integrators**, the time constraint is more important and justifies a location close to their hub. The characteristics of express freight lead us to propose intermodal air and rail transport based on the air process (sale and management of capacity, routing, loading/unloading, contingency management, etc.), which involves, in particular, a terminal location on/at the immediate vicinity of the airport.

- Present situation

Based on the four possibilities for the location of an air-rail terminal the actual situation is shown on figure 9b:

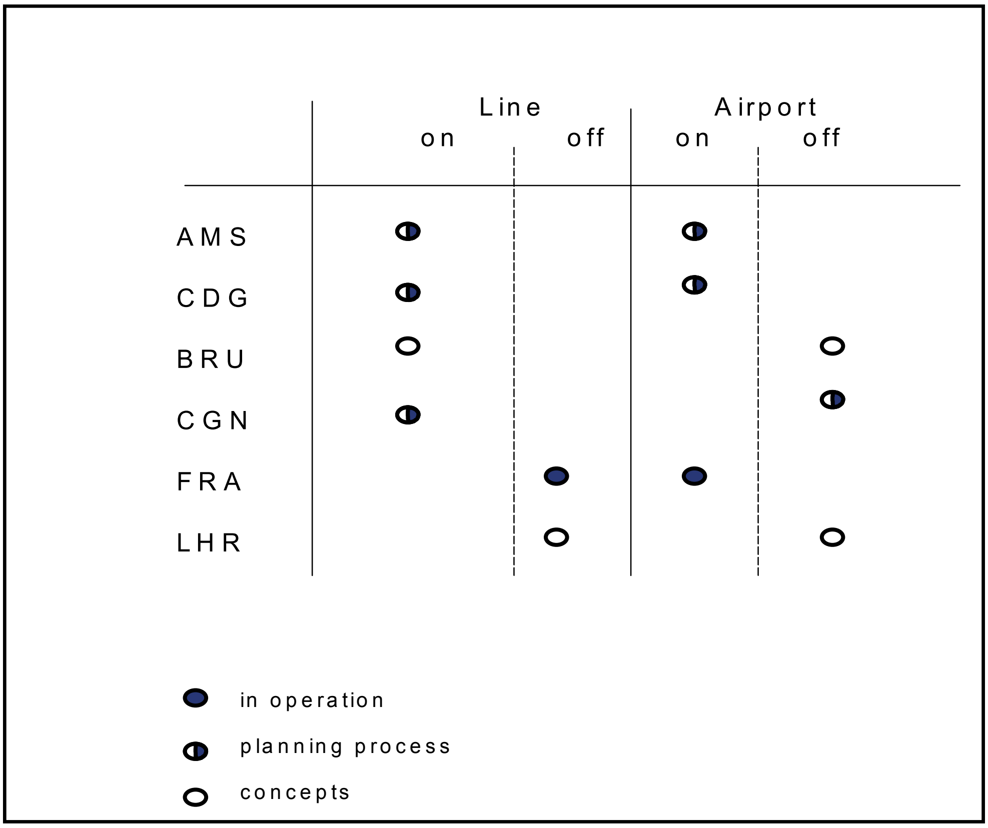


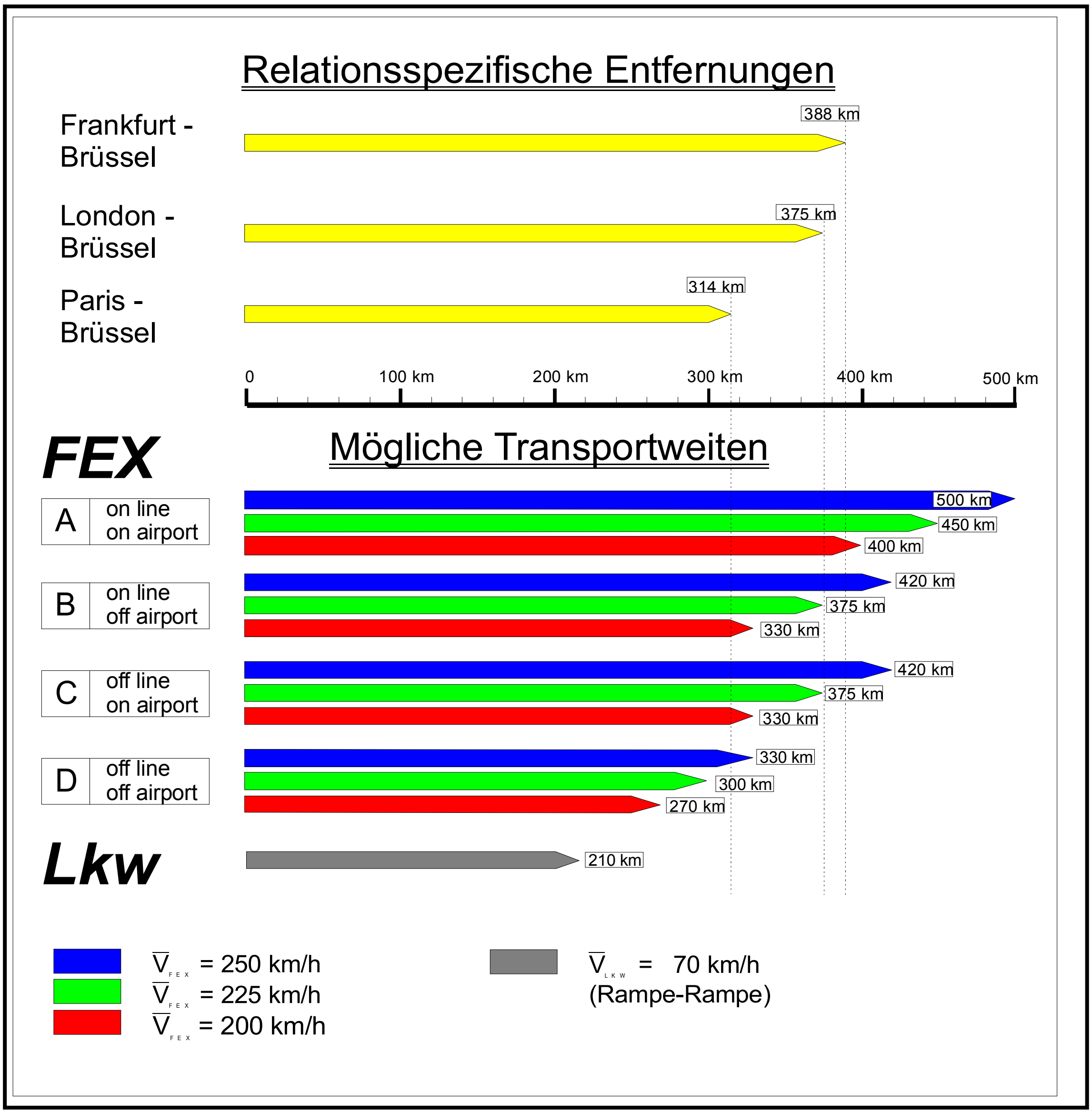
Fig. 9b Air / Rail terminals - state of the art (2000) -

Most of the air / rail terminals are in a concrete planning phase. This demonstrates the important interest of the national governments and regional authorities in such an intermodality. The location on / off airports only can be evaluated with concrete logistical chains.

- Reachable distances

DEUFRAKO also calculated the reachable distances by HSF-trains compared with road, see figure 10. This picture demonstrates quite clearly: rail only may overcome its infrastructure dependency (feeder lines) by *high speed*. Even worst case D (off line / off airport) can already be compensated by v_{max} = 200. This means: highspeed gains time for collecting and delivery.

Fig. 10: Reachable distances by HSF-trains[4]



[4] Translations:
Relationsspezifische Entfernungen = reachable distances
Mögliche Transportweiten = possible transportation length
LKW = lorry

Summary

- ***The Terminal location: THE problem of rail HSF, i.e. the realization of***
  - ***the rail link to the airport and***
  - ***the air / rail terminal itself***
- ***Only HIGH speed of HSF trains will compensate the loss of transportation time on the feeder lines and will gain time for collections time for road collecting/delivery***
- ***The HSF product will not be able to finance the terminal and its feeder infrastructure.***
- ***If bundling for one train load requires it, the integraton of connection types might arise technical and space problems***

Action item 4:

A state of the art analysis has to describe the European air / rail terminal situation and define national investment measurements.

With the above network as a basis the parameters of the logistical chain could be described. Figure 11 gives a synopsis, whose elements will be described in the next chapters:

Market Segment	Air Freight		Express Freight	
1. Loading Unit	Trailer	Swap Body (Container)	AFC[1]	
2. Train ▪ Types (s. fig. 13)	FEX O	FEX 1	FEX 2	FEX 3
▪ Traction	Diesel / electr. loco		Hybrid-SPU	
▪ Rolling Stock	Flat-Wg.	Adapted Wg.[4]	Hbis	EMU[3]
▪ Operation	Direct Train (freight only / mixed)	SPU[2]	Shuttle Train	
3. Transfer System	Classical Intermodal		“Airport oriented”	

Fig. 11: HSF logistical elements */EK/*

1) Air Freight Container (Standardized: 8 feet: B 747, 10 feet: MD 11 (special)
2) Self Propulsion Unit (Diesel, Hybrid)
3) Electrical Multiple Unit (one floor, double stock)
4) For example: with roller beds

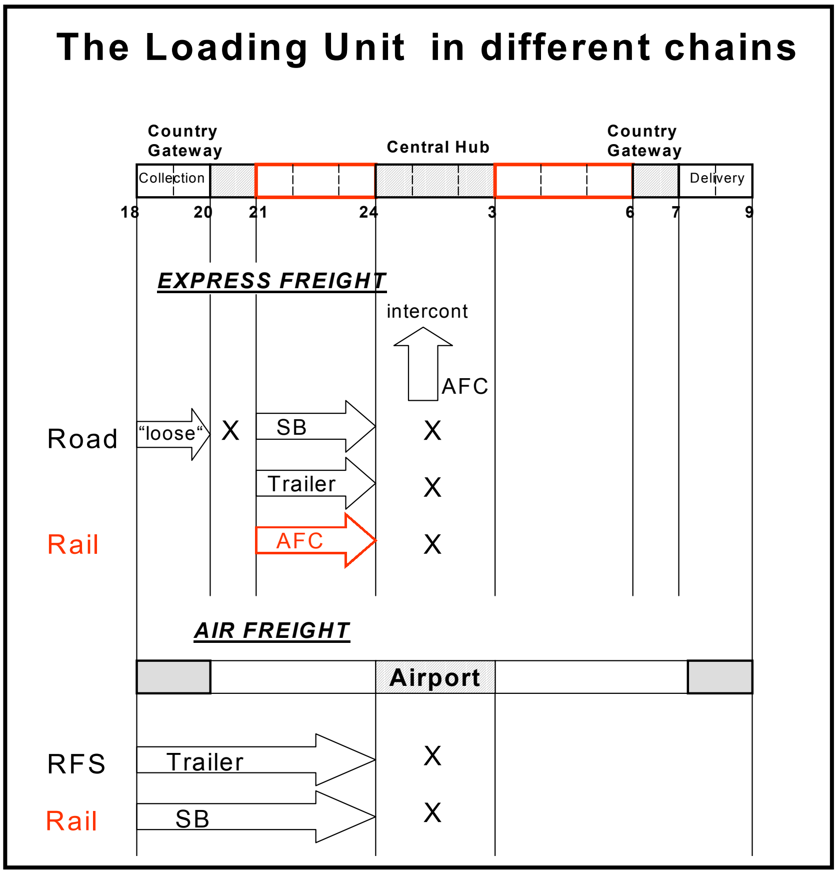
4. The Loading Unit

The selection of the Loading Unit (LU) is made by each operator – as said above – due to his specific consignment and logistic structure. The operator will decide on calculations based on the feasibility of each alternative of the logistic chain. Fig.12 (next page) shows only the incoming freight (outgoing is functioning vice versa):

In the *Express market* the operator has to decide before defining rail operation and the transfer system the loading unit to take. It could not be decided the other way round, as the dimensions of the (incoming) AFCs represent the dimensions, which cannot be "adapted" (Annex 11 is showing the mostly used AFC-types). For the express segment most of the studies tend to select the AFC as a basic LU. In /5/ an alternative is being described: a special "HST container". That is consisting of a "frame container" to consolidate pallets in high speed trains. In the road mode many different LUs could be found corresponding to the operator's philosophy. The consolidation always takes place in the relevant Central Hub.

It is quite clear that a swap body in a HSF type of train will not pay (Siemens calculated the adaptation of the ICE wagon construction something about 35 Mio Euro).

For the *Air Freight* Market, there are trailer and swap bodies already in use. In the road mode mostly trailers are in use. The rail mode is being operated in the intermodal frame, that means terminal to terminal operation on rail, mostly with Swap Bodies, examples: the LH-Train Mannheim – Milano, and the AF Euro Shuttle.



/EK/

Fig. 12: Loading Units in different chains

X:	consolidation
AFC:	Air Freight Container
SB:	Swap Body

Summary:

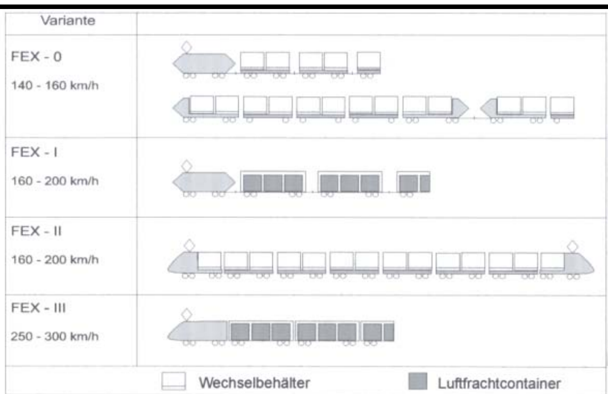
- ***For RFS classical <u>intermodal</u> units are already in operation***
- ***For HSF-trains the <u>AFC</u> will be the feasible solution***

5. The Rail Operation Schemes

5.1 Train types

In /6/ an intensive study on train types and their operation was made, see figure 13.
This took into account, that

- Intermediate steps would be needed to realise a HSF-version on a relevant new infrastructure (EHSR), so that
- The synopsis (figure 13) is speed dependant and
- The Loading Unit question has to be kept customer oriented.



Train Type	Loading Unit	Transfer	Availability
Loco with flat wagons	SB/AFC?	Conventional Inter-modal	At hand
Loco with adapted wagons	AFC	Specific terminals	Short-/medium
CargoSprinter with hybrid traction	SB/AFC	Conventional inter-modal	Medium
ICE/TGV technology	AFC	Specific terminals	Later than 2005

Fig. 13: Traintypes

„Wechselbehälter" = Swap Body
„Luftfrachbehälter" = AFCI

If one looks at the first express services in Europe, the following allocations to fig. 13 could be made (in 2001):

- PIC-Train (DB Cargo), LH-Train Mannheim – Milano: FEX O
- SERNAM-Trains (SNCF): FEX 1
- Cargo Sprinter (DB / Hellmann): FEX 2
- TGV-Postal: FEX 3
  (with available HSF - Infrastructure Paris - Lyon and "on-line depots")

Two specific types have to be added in the meantime:

- *OverNight Express* (Railion) *or Mail Express* (RoadRailer trailer coupled with Amtrak trains) /9/

Those types are combining the speed and quality of service of passenger trains with the transportation of Loading Units in a mixed train.

- *Duplex wagons*

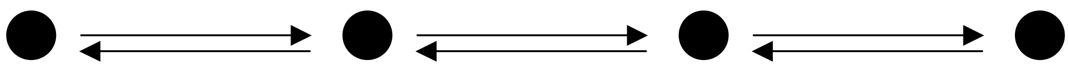
Another study /10/ took into consideration the design of double level wagons, see Annex 13.

5.2 Operation Types

There are generally speaking two types of operation:

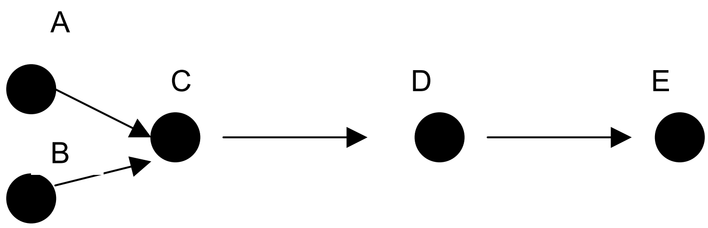
- The Direct Train (liner train)

The train operates between final points with intermediate stops for changing the loading units:



It enables a flexible vehicle usage, as several missions could be offered. This of course enforces high tech transfer solutions, which assure a change of the loading units in 15 – 30 Minutes. The transfers have to be “on line”, in order to get no access time delay. And: the whole line has to be able for high speed throughout. The vehicles moreover have to have large volume capacities as a buffer function, see figure 19.

A sub-group is represented by the *Train Coupling / Sharing system* (CargoSprinter):



Wagon groups A and B are coupled in C. Thus a full trainload between C and E could be reached.

- The Shuttle Train

This train type is operating between final points without intermediate stops for loading / unloading. Shuttle trains can afford special access lines to the terminal, because it is on their direct way to/from the final stop. The vehicle adaption to capacity could be reached more easily, as no proactive unit change plan and buffer capacity is needed.
The evaluation of shuttle versus direct trains was made in the DEUFRAKO-study. On its core network the costs of direct trains with stops in Bruxelles, and of shuttle trains Paris – Bruxelles and Bruxelles – Frankfurt were compared with the alternatives Swap Body and AFC (based on DHL-volume). The “winner” turned out to be the shuttle version with AFCs. (The investments into the EMU-trains took more than 50% of the total process chain costs).

5.3 Traction system

Generally three types can be defined:

- Loco driven (Diesel / Electrical)
- Self Propelled Unit (Diesel / Hybrid): SPU
- EMU (TGV-/ICE-type)

The selection depends of the availability of infrastructure (conventional / EHSR):

- Diesel operation is a starting operation, because most of the interconnection lines to the terminals are not electrified. But concerning trunk haulage electrical traction will be more feasible.
- With the diesel version the first prototypes were tested in a pilot operation with two freight forwarders, see figure 14. The hybrid version is being developed, as a “final” solution, combining medium speed on trunk lines and Diesel traction on the terminal feeder lines.

Fig. 14: CargoSprinter

EMU (see fig. 15): this high speed version is required for speeds above 200 km/h, because of aerodynamic and rail / vehicle dynamics reasons.

Fig. 15: TGV-Postal

With this train type modules are possible being coupled and decoupled. In /6/ and /8/ design studies concerning dimensions of the wagon units were made.

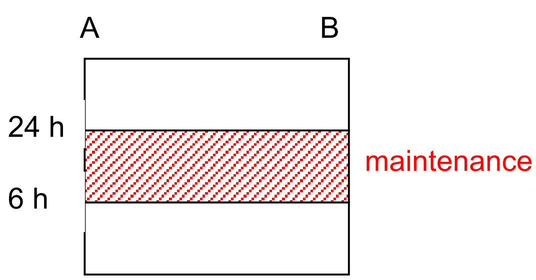
5.4 Time table integration

- General situation

As described above, the HSF traffic usually is operated during the night. Operation up to 160 / 200km/h (PIC-trains, SERNAM-trains) path allocation will face no problems like every “normal” train. But turning to **speeds over 200 km/h** the path allocation will face problems in two areas:

NIGHT BAN

Some High Speed Lines on the EHSR network are closed during the night for maintenance reasons:



This refers to SNCF and SNCB policies. The Cologne – Frankfurt line (to be opened 2002) is also an one mode (passenger) line, but with slab track, i.e. less maintenance.

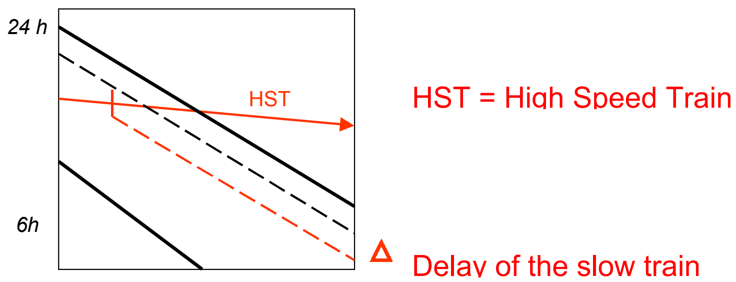
The actual operation on high speed lines shows a positive reality: the TGV-Postal is operating on the Paris – Lyon line (at first one train, and then because of higher demand: two train pairs!) in the night. On the Cologne – Frankfurt line a HSF might be possible, based on an actual inquiry, see Annex 12

SLOW TRAIN DISTURBANCE

This is specially valid for 2 cases (mostly concerning German infrastructure):

Case 1: New lines / conventional network

During the night HSF-trains disturb bunches of conventional DB Cargo trains (mostly v_{max} = 90 km/h). Such a high speed train could “stop” for example 3 trains on the Cologne – Aachen line. This problem could turn out as a most serious problem: either an HSF-operation is not possible at all, or it would be priced by the IMs in such a way, that rail is not a feasible alternative (One solution could be seen for the German infrastructure: the separation of slow and fast trains with the “Netz 21” program.)



Case 2: Nods

Especially in the morning (from 6 o’clock on) HSF trains could be slowed down by passenger trains (intercity and regio) with fixed interval time tables. (This turned out to be one of the biggest problem for the IC-Business-Train “Metropolitan”). This situation is based on national rules due to EU 91/440.

- *Pilot Case DEUFRAKO*

Based on the missions and time windows of the integrators (figure 2) and the PBK-F volumes (figure 7) the different demand profiles were integrated in one scheme, see figure 16:

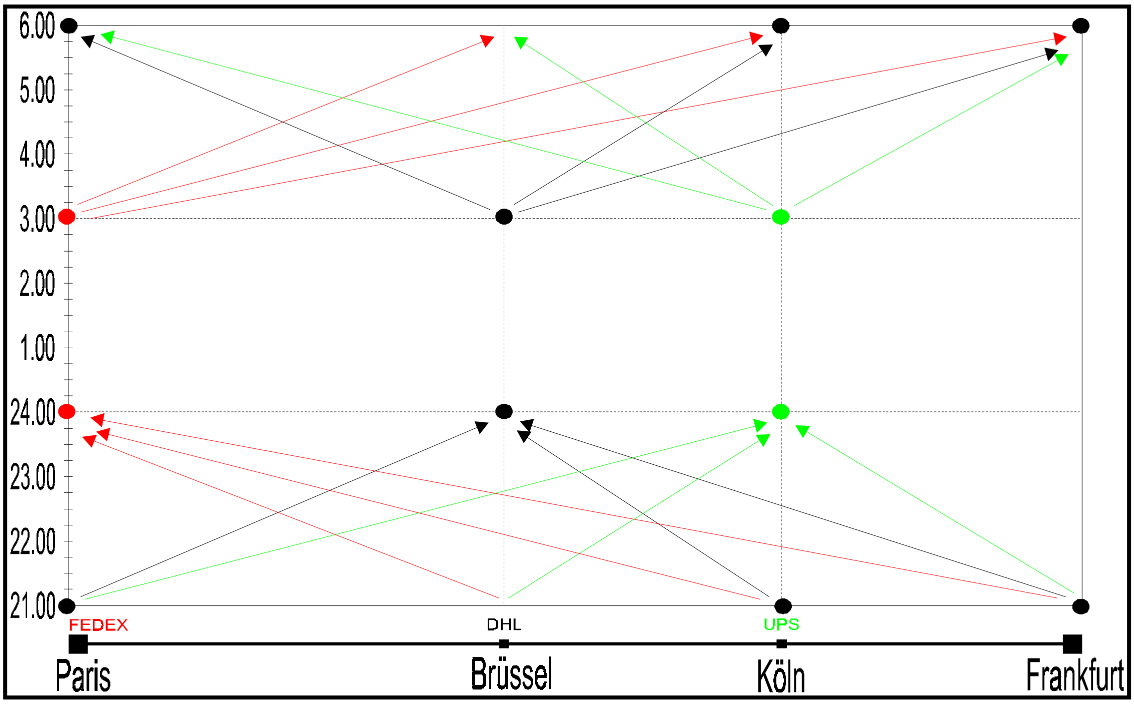


Fig. 16: Missions of the Integrators /6/

In following steps the transfer of those volumes into shuttle or liner trains were based on the available EHSR of the year 2005. Getting the trains into the time tables demonstrates the above mentioned problem areas (as an example):

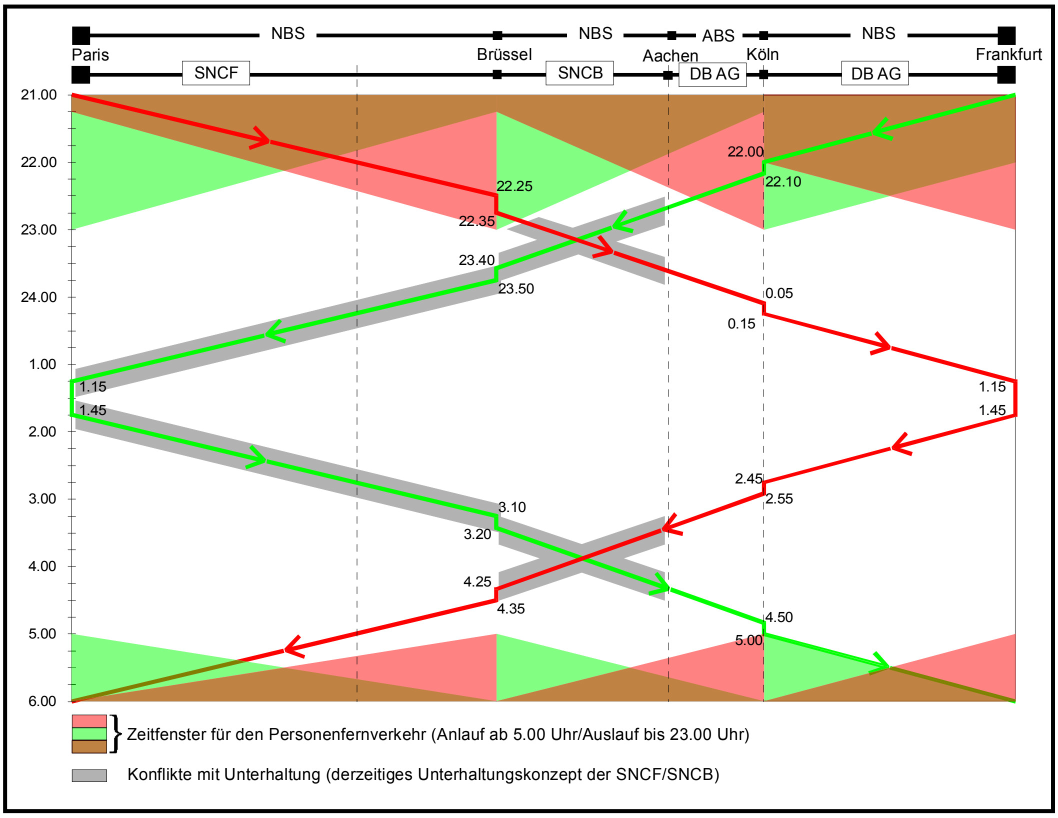


Fig. 17: Integration of liner trains[5]

It shows:

- If FEX trains operate in the coloured areas (at the beginning and end of their running), they are in the time window of TGV / Thalys / ICE – Trains. That means: operation of “wind shadow” (block distance) passenger trains should be possible.
- Starting from and getting to Brussels shows possible conflicts with conventional trains
- Serious problems could arise with the grey marked runnings: they are a matter of the “night ban” due to maintenance procedures. Solution: to get an agreement with the relevant Infrastructure Managers (IM) like the TGV Postal operation.

[5] translation:
NBS = New lines
ABS = conventional lines $\leq$ 200
Zeitfenster für den Personenverkehr = time window for passenger trains (5:00 – 23:00)
Konflikte mit Unterhaltung = conflicts with track maintenance (SNCF/SNCB)

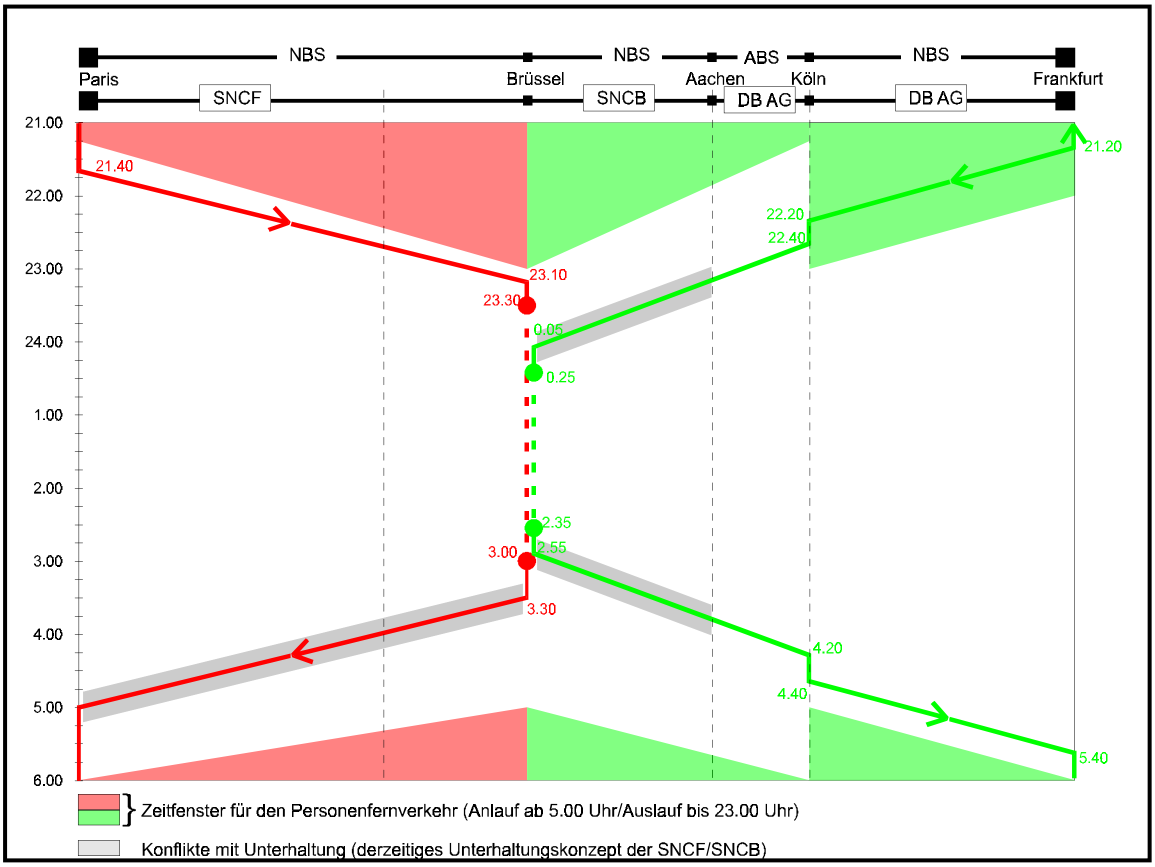


Fig. 18: ***Integration of shuttle trains***

It shows:

- Generally: Shuttle trains are more flexible in slot allocation than liner trains. The customer (especially DHL in this case) is able to negotiate with the relevant IMs the time windows with some flexibility.
- One great advantage in this case: no operation between 0:00 and 3:00 because of consolidation processes in the hub (Brussels).
- *Paris – Brussels Shuttle*: no problem, as integration with TGV trains should be possible. The return trip causes serious problems with track maintenance (grey area).
- *Frankfurt – Brussels Shuttle*: on the new line up to Cologne no serious problem, till Aachen integration with conventional traffic necessary. From Aachen to Brussels and the way back problems will arise with maintenance by SNCB.

An evaluation of the 2 operation types will be shown by figure 19 (with quality criterias only):

Criterias	Liner train	Shuttle train
Productivity	**++**	**O**
Demand reaction	**O**	**+**
Terminal (access, efficiency)	**–**	**+**
Slot integration	**–**	**O**
Introduction	**–**	**+**

Fig. 19: Evaluation of operation types

++ very good performance
+ good performance
O low performance
– bad performance

At a first approach the shuttle train embodies more advantages. A final evaluation has to analyse the cost structure of the whole logistic chain (figure 11).

Summary:

- ***Train types, operation types and traction system fully depend on the operator's strategies***
- ***The time table integration of HSF-trains could arise problems***
  - ***with track maintenance procedures at night***
  - ***passenger trains in the morning and evening and***
  - ***freight trains on new lines at night***
- ***Each train path has to be evaluated by the IMs separately, BUT a general HSF strategy of the IMs is necessary***

Action item 5:

The Infrastructure Managers should define a common policy towards the slot integration of HSF-trains

6. The Terminal Operation

As described before there are two types of HSF Terminals:

- *Classical intermodal terminal*

  Such a terminal will be feasible for air freight business.
  Innovative solutions are needed for

- *Air / rail terminals*

  In /5/ the specifications were analysed, they are summarised:

  - rapid transhipment
  - simultaneous loading and unloading
  - limit workforce
  - minimize the area used

  Since the unit load devices will partly be air containers, the transhipment systems have to be equipped with roller beds, technology adapted to the handling of air containers, which is implemented in planes, dollies and trucks. Therefore it is assumed in this section that the platforms as well as the high-speed trains are equipped with roller beds to move the containers.
  When the available surface areas are rare at airports, the terminal surface area has to be minimised and nevertheless large enough for the positioning of forwarding vehicles and containers. The terminal must be sheltered so that the loading/unloading system is protected and working conditions are legal. Moreover, it should be possible to extend the terminal easily. The AFTEI-study describes the following four systems:

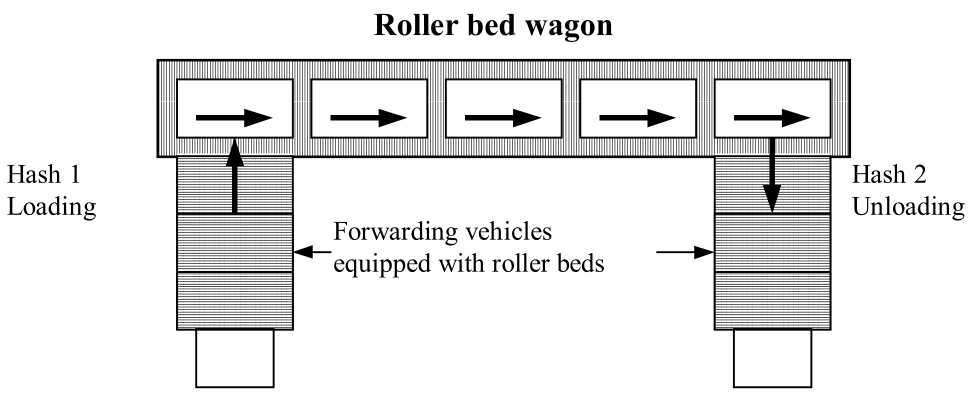
  1. ***Direct transshipment system (without loading dock) with positioning of the forwarding vehicles (System 1)***

     With this system the containers are directly transhipped from the forwarding vehicles onto a wagon and conversely. Thus, it is necessary to have both special forwarding vehicles and HSF specific wagons. For this system to work there must be at least two loading doors located on either side of the wagon.
     The recommended system for the HSF, similar in design to that already existing for aircraft, is an electronically controlled, roller bed system to move the containers in the wagon and position according to the loading plan. One of the doors is assigned for loading and the other for unloading. The vehicles are backed up to the HSF for the load-

ing/unloading of the containers. So that the transhipment is horizontal, the floor height of forwarding vehicles must be the same as the floor height of trains.
The *advantage* of this system is to introduce only one load break in the terminal.
There is also no need for a loading dock. The *disadvantages* are

- the extreme rigidity in the positioning of the forwarding vehicles:
  To limit the conflicting movements of vehicles in the terminal, a vehicle should be assigned to a coach, which means that the containers loaded onto the same vehicle would have to be loaded onto the same coach. The loading of forwarding vehicles would be therefore deeply linked to the loading plan, which would make the task harder for the forwarding agents.
- the assignment of two forwarding vehicles per wagon : one for the loading and one for the unloading (as many times as necessary and according to the wagon's capacity)

Functions



Areas

One zone per track, per wagon for the circulation and positioning of the forwarding vehicles and easy accesses to these zones:

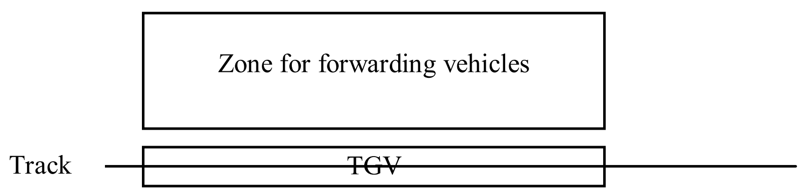
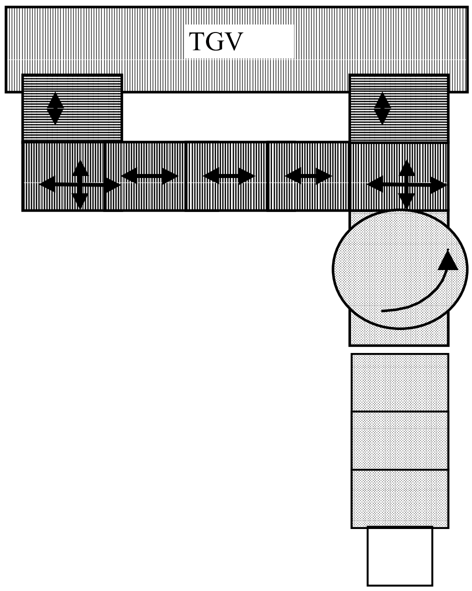


Fig. 20: Terminal system 1

2. *Transshipment system via loading dock(s), with positioning of the forwarding vehicles (System 2)*

Systems 2 given as illustrative example in the Mc Clier study conducted for Metz airport (near the PSE-line), guarantees the loading/unloading of a wagon in 10 minutes, providing the vehicles are in position when the train approaches.
This system is as rigid as system 1 because the forwarding vehicles have to be loaded according to the loading plan. But with system 2, to each wagon corresponds a roller-loading platform where the containers can be left while others are loaded or unloaded.
In comparison with system 1, this system needs more facilities (a roller platform for each wagon) less forwarding vehicles per wagon. This means an increase in investment cost but a reduction in operating cost.

Functions:



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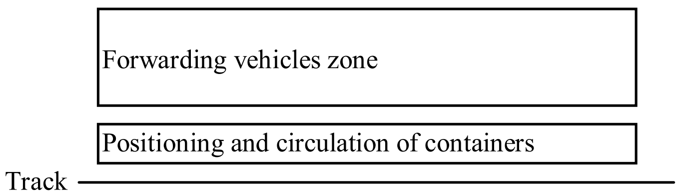


Fig. 21: ***Terminal system 2***

The terminal consists of (per track, per wagon):

- one zone for the forwarding vehicles' circulation and positioning, with easy access
- one container roller platform

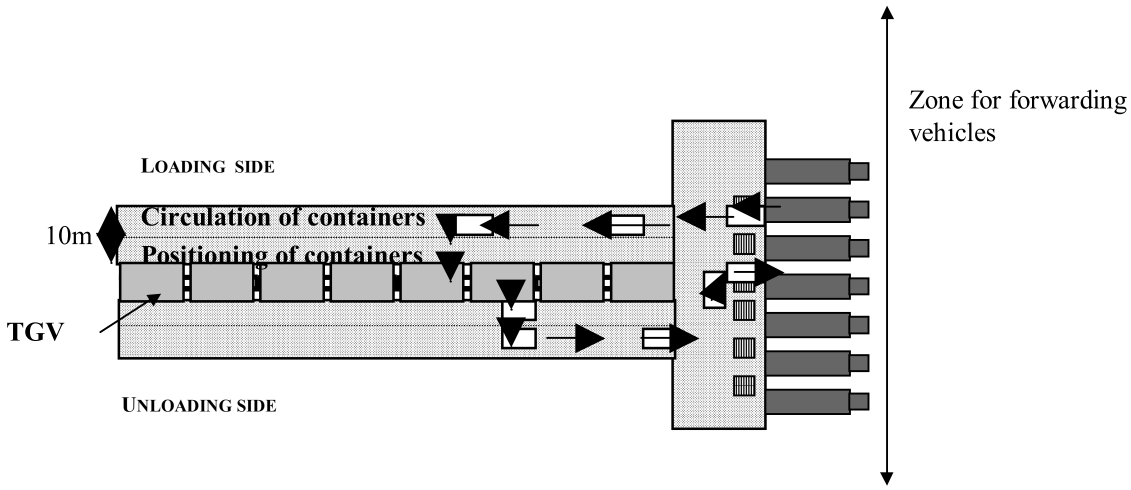
3. *Transsshipment system via two loading docks, with the positioning of the containers along the train (system 3)*

This system is not suitable for a pass-through station.

The containers are unloaded from the forwarding vehicles on a platform perpendicular to the tracks. There, they are "checked in" and coded according to the position indicated by the loading plan. Once indexed, they are put on a second platform, parallel to the track, where they automatically roll until they reach the coded position. As soon as a container reaches the good position it is automatically pushed onto a third platform, parallel to the track where it stays until the train arrives. So when the train arrives the containers are ready to be loaded onto the train. While these containers are loaded on one side of the train, the containers that have to be unloaded are being unloaded on the other side and forwarded back towards the vehicles' platform on a symmetrical roller bed system.

The process is quicker if there is a hatch for each container position on the train on each side of the train but the system also works if there is only one hatch on each side per wagon providing that the train has an automatic roller bed floor.

Functions:



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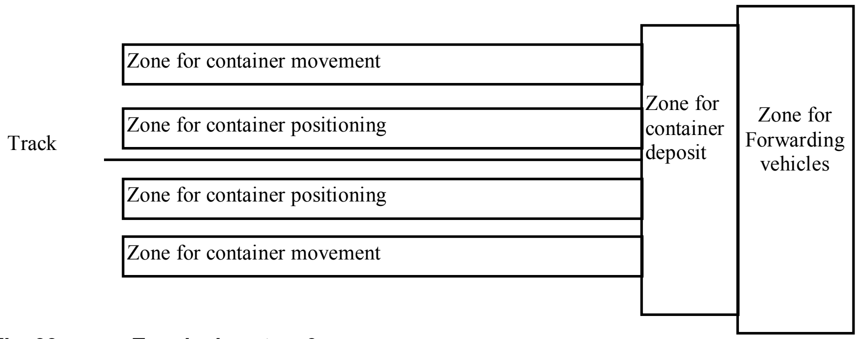
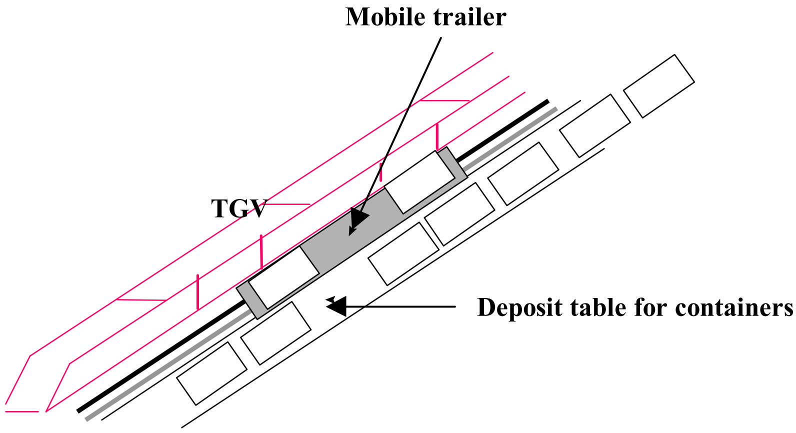


Fig. 22: Terminal system 3

4. *Transshipment system via a mobile trailer - system 4*

The containers are unloaded from the forwarding vehicles onto a platform parallel to the track independently from the position they must have in the train. Then, when the train arrives, the trailer picks up the containers from the platform and brings them in the wagons according to the loading plan. The trailer also collects the containers that have to be unloaded and put it on the platform so that they can be loaded back on the forwarding vehicles. (This system was also proposed in /6/.)

Functions:



Areas:

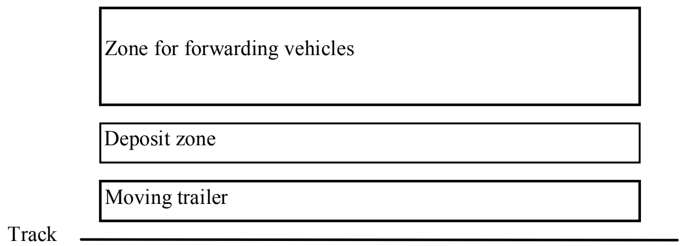


Fig. 23: ***Terminal system 4***

For all these systems, in case there are intermediary stopping points, it should be easily possible to guide a container to the exit to unload it. It implies that the container to be unloaded is well located in relation to these that have to stay in the wagon until the next stop, which is an additional constraint for the loading plan and makes the loading process complicated.

- *Interoperability*

There are no interoperability criterias available at present. Annex 13 gives a first approach.

Summary

- ***The intermodal type represents actual technology***
- ***For the air / rail terminal four systems could be adapted to regional needs***
- ***If bundling for one train load requires it, the integration of terminal types might arise technical and space problem***
- ***No interoperability criterias are available***

Action item 6:

General interfaces and standards for air / rail terminals have to be developed.

7. The IT-Service

In the recent studies /3/ /4/ /5/ it was pointed out, that rail has not the capability to inform the customer about the consignment status, incl. Position, delay and ETA (Expected Time of Arrival). This benchmark is set by road. The technologies and systems are at hand (except ETA), so it's "only" a question of doing. Functions to fulfil:

- booking and reservation (allotment)
- procedure of document
- freight and Loading Unit Management (incl. Tracking / Tracing
- physical consignment procedures
- billing

Summary

- ***Rail has to offer Tracking and Tracing informations and***
- ***Generally rail has to fit into air management tools***

PART III FUTURE PROSPECTIVES

8. The Environmental Aspects

The environmental aspects were scarcely mentioned in the analysed studies.

- Oecological Evaluation

Similar to /11/ it can be said that high speed rail *freight* operation will represent the more sustainable transportation mode. Figure 24 evaluates (in a first approach) with oecological criterias the different modes road, air (classical) intermodal and HSF rail transport. As expected, HSF-rail is THE oecological alternative. But in freight that doesn't sell at present., consistency and reliability influences the mode decision.

Aspect	Road	Air	Intermodal	HSF
Safety (environment)	-	+	++	++
Space requirement	+	+	-	+
Efficient Use of Infrastructure	--	-	+	++
Energy efficiency	-	--	++	+
Noise emission	+	--	+	+/-
Emission of Pollutants	-	--	+	+

Fig. 24 Oecological comparison competing modes, macrolevel /4/

- Future congestion aspects

In the long termed strategic discussion congestion_aspects turns out to be THE issue. Especially for the Integrators strategic planning needs alternatives, rail is one for them. Figure 25 shows the present and medium termed situation, concerning the restrictions to be expected for the different modes and the 0 – 24 duration.

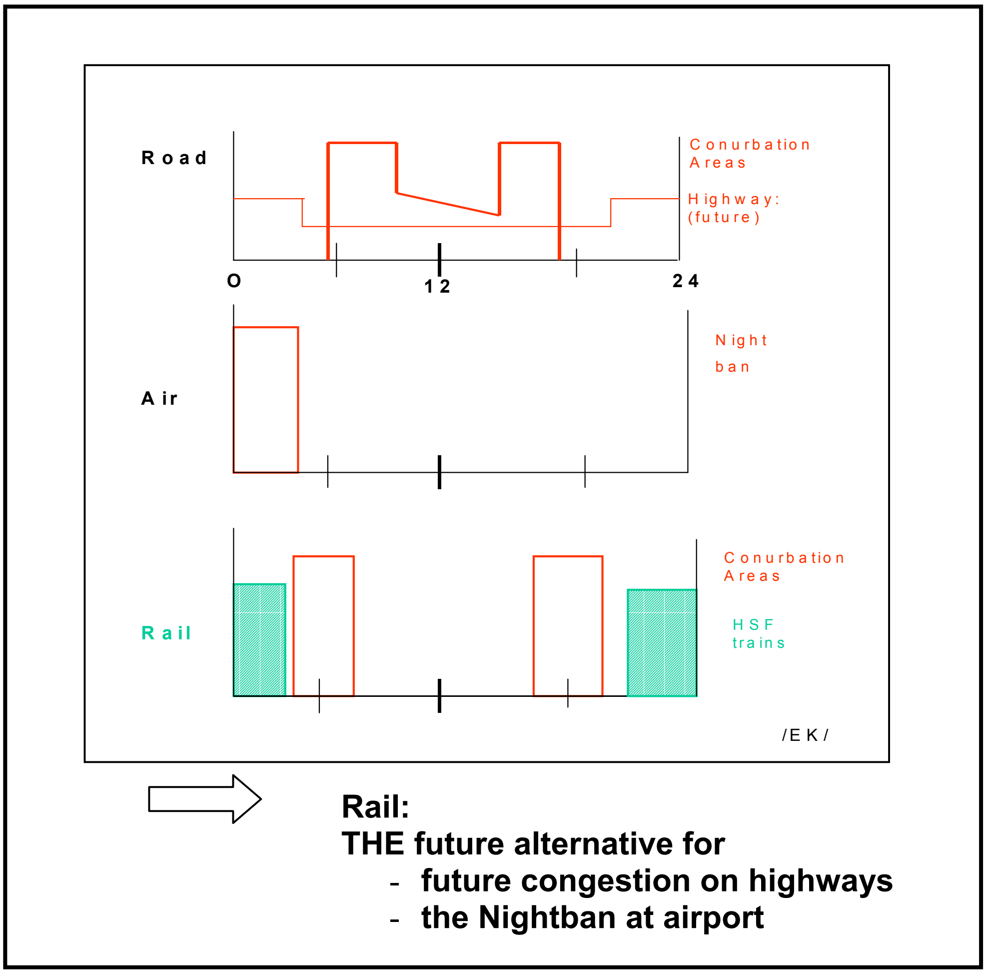


Fig. 25 Rail: The Alternative for road / air restrictions

In details:

- Road (Highways)
  Generally speaking congestion situations will occur not so much in short / medium terms. At present the right lane of the European highways is occupied – if at all - by lorries only during the night. When additionally a second lane is congested at night, rail will be the option – at least for the Integrators.

- Road (Conurbation areas)
  THE problem in the morning and evening for consignment and delivery: HSF trains will be an alternative by arriving earlier in the country gateway in the morning and vice versa.

- Air
  More and more airports in the metropolitan areas will suffer from night bans. For example: Frankfurt airport will only get its third runway, if the airport stops operation during the night.

- Rail
  When Infrastructure access problems at night will be solved, rail (HSF-trains) will be the alternative mode for road and air. But when planning operation one has to take into consideration: the noise emission of high speed lines were agreed upon with the communities in the region. HSF-trains must not surmount e.g. 60 dB (A) in Germany.

- External Costs

The EU contracted in 2000 a study to estimate the external cost of traffic /12/. Figure 26 shows the costs per t/km of the different modes. *Rail* produces (like the ship mode) the lowest cost rates. Those estimations focus on conventional rail freight. The impact of HSF trains has to be specified, of course. *Air* eternal costs are 10 times higher because of the high percentage (2/3) of influences on climate change (based on 135 €/t/CO_2). Reads external costs are mostly influenced by air pollution (2/3). They are based on opportunity costs on health, material and the biosphere.

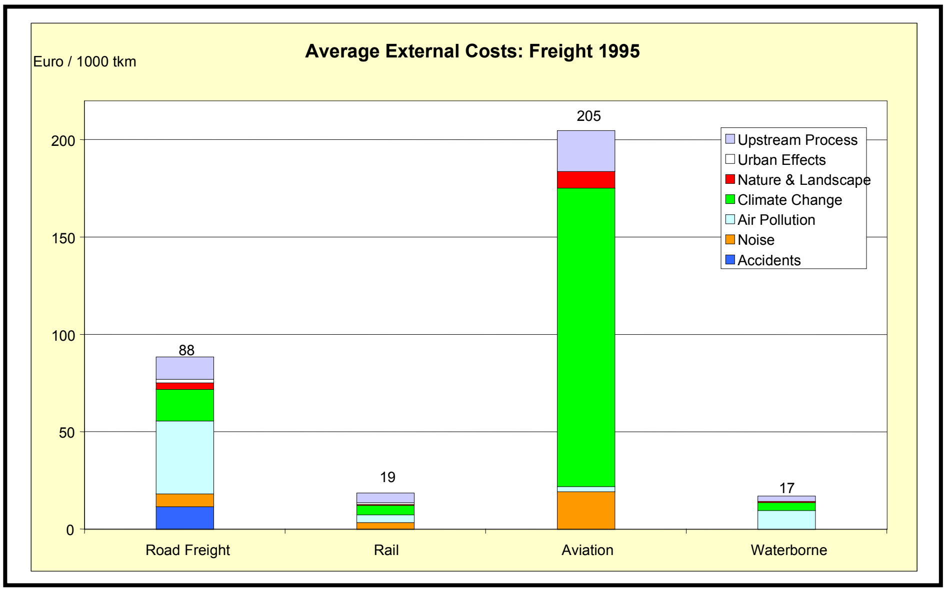


Fig. 26: External costs Freight 1995 ***/12/***

> ***Summary***
>
> - ***<u>No study</u> evaluated the <u>oecological</u> aspects of HSF-trains up to now***
> - ***Rail could be a <u>sustainable alternative</u> for congestion problems on road or night bans for air traffic (medium to long termed)***

<u>Actions item 7:</u>

A study has to evaluate the quantities and qualitative oecological aspects of HSF-trains.

9. Business Approach

The *success stories* like TGV Postal, PIC-Express were based on the

- competitive advantage of the rail product
- infrastructure availability (including the terminals)
- service quality (98% of the PIC-trains are on time)
- available rolling stock
- the "integrated" approach (cargo **+** infrastructure)

Those HSF activities, which remained only **concepts** had problems (in the range above 160 km/h) with the

- slot price (e.g. Euro-Shuttle in Germany)
- availability of feasible rolling stock
- cooperative approach to create and operate a HSF-train, that means with necessary commitments.

Thus: what about the **financing** of HSF projects? There are two areas:

- Conventional operation (around 160 km/h)

The preparation of such a projects takes place in a rather "conventional" rail environment, in respect to the technical and operating and investment schemes, as well as the product selling.

- "Real" HSF operation (above 200 km/h)

Such an operation requires another philosophy: operation and sales management has orientate towards air / integrator management. And last but not least, the financing has to cover

- High tech rolling stock (ICE, TGV etc.)
- Innovative terminals and new feeder lines
- (the financing of the EHSR is mostly done via funding by the national governments).

Concerning the above two areas there are several financing models:

- For the new *terminals* with their feeder lines: three models are thinkable:
    - Governmental financing, especially the rail feeder lines, as a part of the high speed lines.
    - "Private" financing, e.g. by the airport authorities
    - public, private, partnership: this could possible for the terminals and the feeder lines

The relevance of each model will turn out to a national / regional decision process

- For the *rolling stock* there are two concepts:
    - The adaption of high speed trains, like TGV Postal.
    - The rebuilding of "used" high speed trains

Those two concepts depend on a cost comparison and on the availability of "used" trains. When analysing the business case an independent HSF-Company as an **Rail Undertaking (EU rule 91/440)** might be more capable and quicker in the decision making process. In Germany two years ago some stakeholders tried to start such an approach: founding a new, dedicated HSF-Company. Possible shareholders were invited, such as integrators, airlines, airports and railways. A HSF-Company would have many advantages:

- most important: obligation to earn money
- customer oriented management
- 1 company, 1 product
- quicker customer response
- lobbying towards politicians authorities etc.

Unfortunately a common approach was not successful. Rail as a HSF-option, its readiness and the necessity to create an alternative to air and road could not yet have been seen. Despite that result we think that only a dedicated HSF-Company could create and push a European HSF concept in the next year: a "Cargo Thalys"?

Summary

- ***the terminals and the rail feeder lines will be financed <u>national / regional sources</u>. A HSF-Masterplan will give the framework***
- ***for the financing of the rolling stock a <u>HSF Company</u> is a favoured solution***

Action item 8:

The UIC should organize a hearing with EU and national authorities, as well as future customers to announce their Masterplan (see "Recommendations") and to initiate national planification procedures.

10. Summary

In the following the summary is drawn per each chapter:

Customer needs for a rail offer

- The time frame for the integrators and RFS could be generalized (with exceptions):
  - 9 hrs for direct trains (between country gateways)
  - 6 hrs for hub / hub trains
- Unique selling positions for HSF on rail:

  quality (better than road) and price ("better" than air)
- Rail has to adapt "air management" in thinking, sales management, operation and contingency management
- Rail target markets are defined as integrator and air freight (incl. road feeder services), because of their hub structures and quality elements.

Traffic flows

- HSF-Volume forecast datas are very poor.
- Bottom up datas are not delivered by the operators, i.e. top down forecasting is needed for future planning

HSF Network

- The present data basis does not allow to define a HSF-network
- Essential "items" are missing, such as
  - Expected traffic flows in general
  - A consolidated and feasible rail volume
  - Rail transfer points at logistic nods / hubs for the rail target markets

- The ***Terminal location***: THE problem of rail HSF, i.e. the realization of
  - the rail link to the airport / hub and
  - the air / rail terminal itself
- Only high speed trains will compensate the loss of transportation time on the rail links

  and will gain time for road collection / delivery
- The HSF product will not be able to finance the terminal and its feeder infrastructure.
- If bundling for one train load requires it, the integration of connection *types might arise technical and space problems*

The Loading Unit

- For Road Feeder Service classical intermodal units are already in operation
- For HSF-trains the AFC will be the feasible solution

Rail Operation Schemes

- The time table integration of HSF-trains at night could arise problems with
  - track maintenance procedures
  - passenger trains in the morning and evening and
  - freight trains on new lines at night
- Each train path has to be evaluated by the IMs separately, BUT a general HSF strategy is necessary

Terminal Operation

- The intermodal type represents actual technology
- For the air / rail terminal four systems could be adapted to regional needs
- No interoperability criterias are available.

IT-Service

- Rail has to offer Tracking and Tracing Informations and generally
- Rail has to offer tools which are used in air management

Environmental Aspects

- No study evaluated the oecological aspects of HSF-trains up to now
- Rail could be a sustainable alternative for congestion problems on road or night bans for air traffic (medium to long termed)

Business Approach

- The terminals and the rail feeder lines will be financed national / regional sources.
  A HSF-Masterplan will give the framework
- For the financing of the rolling stock a HSF Company is a favoured solution

OVERALL CONCLUSION:

IT IS TIME TO ACT!

(An action plan for the UIC is described next chapter)

11. Recommendations

Preparing this study it became quite clear: the market e.g. (the express operators) are waiting for the railways to offer their selling position: their high speed network.. That means: UIC should a prepare a high speed “offer” for freight, similar to the “UIC-High Speed Network”, which led to the EHSR. With this step rail assures at first for possible HSF – Operators reliability for their investment

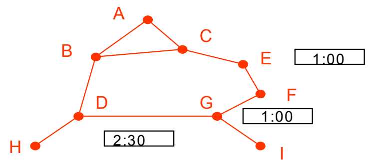
11.1 HSF-Masterplan

Summarized we propose a HSF Masterplan of the UIC (figure 27):

UIC **EU**

HIGH SPEED FREIGHT MASTERPLAN

1. Basis EHSR (EU 96/48)
   Time horizon 2010
2. HSF Network
   (Key links with mission times for 200/300 km/h)



3. Interoperability (present / to be defined)
   - infrastructure
   - rolling stock

---

4. Air / Rail Transfer point
   - at nods near A – I
   - availability (incl. Interconnections)
   ➔ Basis for national infrastructure planning
5. Infrastructure access („HSF-Ways“)
   - conditions
   - restrictions (slots,nods)

Fig. 27 The HSF-Masterplan

This Masterplan should be a joint activity of UIC and EU. UIC should embed that plan in general capacity considerations (freight <u>and</u> passenger). The integration with EU will demonstrate a political willingness (based on the White Paper 2001) and an indication for the national government to secure their investments in air / rail terminal and the intercon-nection between the high speed network and the air / rail terminals.

11.2 Steps to the HSF-Masterplan (figure 28)

We recommend an Action Plan which is based on Action No. 1 – 7 in the study

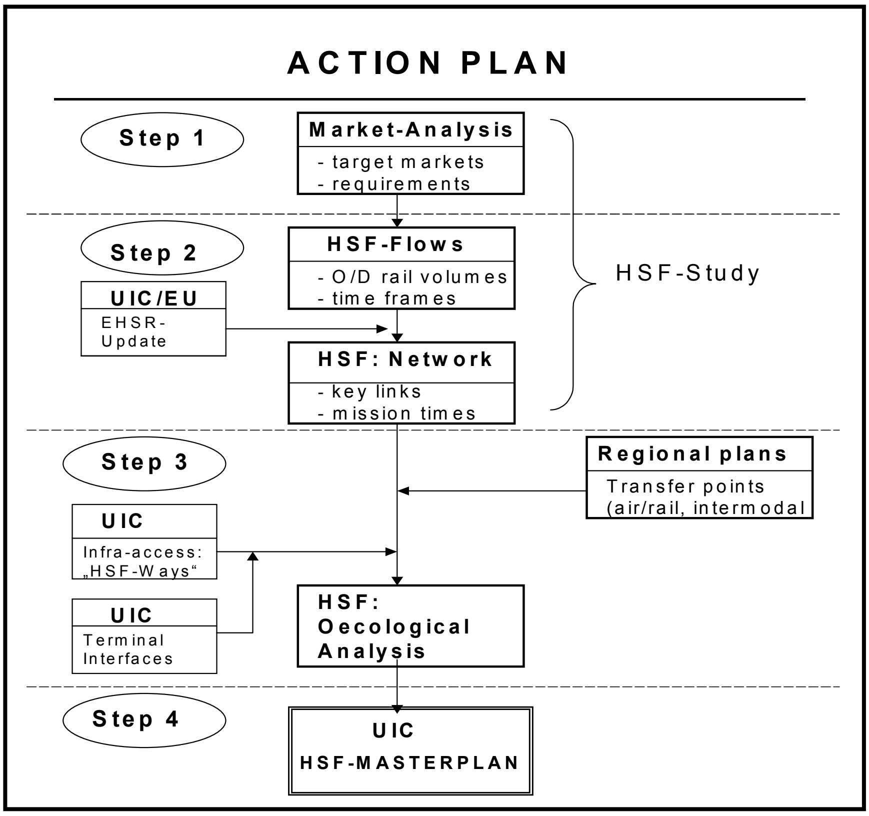


Fig. 28 The HSF-Action Plan

Step 1 and 2 are representing the "HSF Study". It is being described in its necessary steps and input with Annex 14.

Step 3 is integrating all necessary informations, statements, and rules to fulfil the oecological analysis leading to step 4: The HSF Masterplan.

If the UIC is agreeing on this approach, we recommend

- a <u>HSF presentation for the EU</u> (DG TREN), goal: co-financing of the HSF-study?
- A customer <u>workshop</u> with the potential customers (Action No. 8). This workshop should include the integrators, airlines and airports; the UIC and EU responsible persons. The Goal should be the customer orientation for the HSF-Masterplan.

After this the usual procedures for a call for tender of the HSF-Study should be taken.

11.3 Perspectives

Thirty years ago express freight mean “rail”. Then road took over continuously (except in the UK), because of its flexible door to door capability, and no needs for bundling volumes to train loads. But, the TGV Postal, and recently the SERNAM and the PIC trains prove: *rail can deliver*. More and more competition on rail with new Rail Undertakings will promote this process and prepare a “double” use of the EHSR network = passenger <u>and</u> freight. The basis for this will be the HSF-Masterplan, thus using rail as an possible alternative for a sustainable express freight transportation.

ANNEXES

List of Annexes

1 SNCF HSF operations

2 Road Feeder datas

3 Temporal distribution of road feeder services

4 DHL transportation frame

5 Cities of the HSM-network

6 Assumptions for the HSM Network

7 HSM: number of trains for 2005

8 HSM: number of train for 2010

9 DEUFRAKO Network (development)

10 Duplex wagons

11 AFC-types

12 Actual slot example Aachen Frankfurt

13 Air / Rail Terminal Interfaces

14: HSF network study study

SNCF-Fret: High Speed Freight

Customer	**Destination (Source: Paris)**	*Goods*	*Train type*	*Axle load*	^{v}max	*FF/kg*
1. La Poste	Macon (PSE)	Letters	TGV	?	250	5,5 (express freight) 7,0 (airfreight)
2. La Poste	Cavaillon (PSE)	Parcels, Media	TGV	?	250	
3. La Poste	Cavaillon (PSE)	Parcels, Media	TGV	?	250	
4. SERNAM	Cavaillon (PSE)	General expr. freight	9 (-12) Wg/Train	18	200	
5. SERNAM	Bordeaux/Toulouse	General expr. freight	9 (-12) Wg/Train	18	160	

Status 21.06.2001

Annex **1**

Road feeder service volume 2002

Volume [t]

From \ To	AMS	BRU	CGN	CPH	EMA	FRA	HAM	LON	LUX	MAN	MIL	MUC	PAR	ZRH	TOTAL
AMS	X	37.000	10.000	4.000	0	27.000	9.000	25.000	9.000	4.000	12.000	6.000	24.000	4.000	**171.000**
BRU	30.000	X	11.000	1.000	0	11.000	2.000	7.000	1.000	0	0	2.000	11.000	5.000	**81.000**
CGN	10.000	6.000	X	0	[illegible]	[illegible]	0	1.000	2.000	0	0	0	2.000	0	**58.000**
CPH	6.000	4.000	0	X	0	[illegible]	2.000	0	1.000	0	0	0	4.000	0	**34.000**
EMA	0	0	0	0	X	0	0	24.000	0	2.000	0	0	0	0	**26.000**
FRA	26.000	11[illegible]	[illegible]	[illegible]00	0	X	24.000	6.000	15.000	0	6.000	24.000	9.000	19.000	**186.000**
HAM	6.000	2.000	2.[illegible]	0	0	12.000	X	0	0	0	0	0	4.000	0	**26.000**
LON	20.000	11.000	1.000	0	26.000	10.000	0	X	1.000	31.000	0	0	14.000	0	**114.000**
LUX	9.000	1.000	2.000	1.000	0	14.000	0	1.000	X	0	1.000	1.000	0	0	**30.000**
MAN	1.000	0	0	0	0	0	0	21.000	0	X	0	0	2.000	0	**24.000**
MIL	20.000	2.000	2.000	0	0	27.000	0	10.000	4.000	0	X	0	14.000	26.000	**105.000**
MUC	6.000	2.000	0	0	0	22.000	0	0	0	0	0	X	1.000	2.000	**33.000**
PAR	27.000	15.000	0	4.000	0	12.000	4.000	20.000	2.000	5.000	6.000	0	X	4.000	**99.000**
ZRH	6.000	6.000	0	0	0	12.000	0	2.000	0	0	6.000	4.000	5.000	X	**41.000**
TOTAL	**167.000**	**97.000**	**67.000**	**17.000**	**26.000**	**201.000**	**41.000**	**117.000**	**35.000**	**42.000**	**31.000**	**37.000**	**90.000**	**60.000**	**1.028.000**

37.000

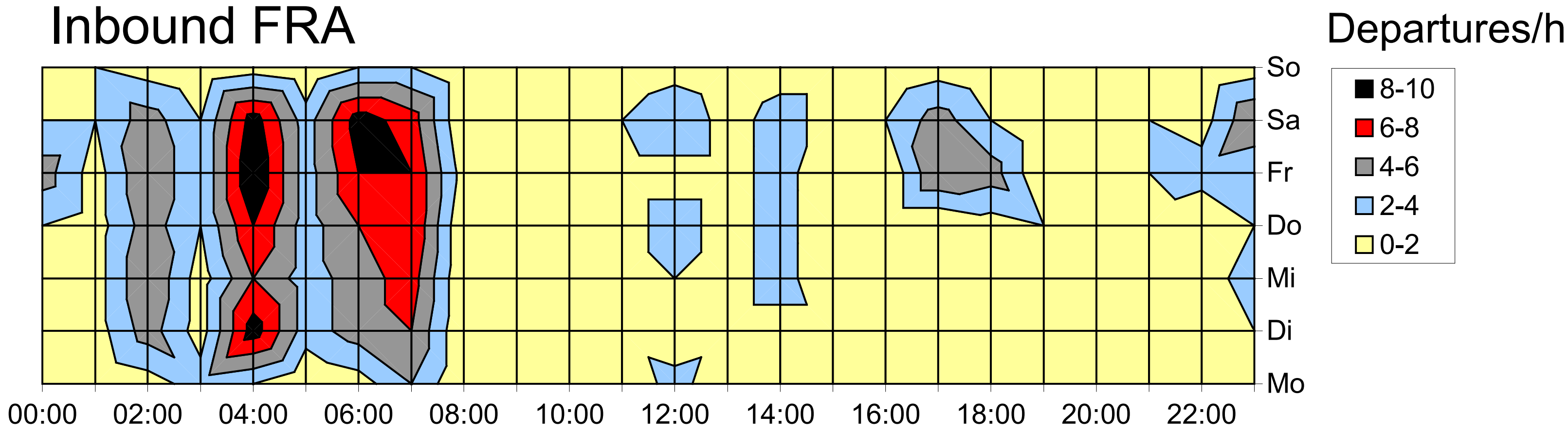
39.000

≈ 115 Trips / week
≈ 16 Trips / day

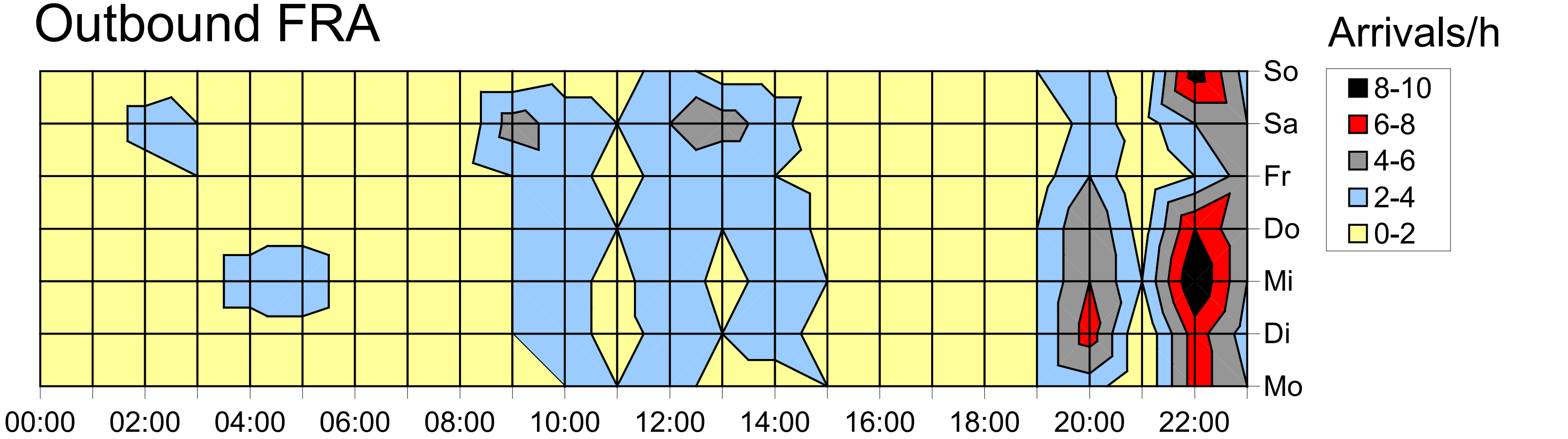
Annex **2**

Temporal distribution of road feeder services (1997)

Inbound FRA



Outbound FRA



DHL: Logistic chain

1. General

In general, traffic collected in the country of origin up to late afternoon, 17:00 hrs, must be dispatched from that country's gateway by 21:00 hrs for next day delivery. The maximum time to a European central hub is about three hours, allowing two or three hours for sorting, then three hours for onward transport to the destination country. Pressure on the hub can be reduced by short distance trunk movements arriving early, and high volume routes having early and late departures.

2. Time window for transportation

A three-hour transit window gives each mode of transport a maximum operating radius around an integrator's hub. The radii are follows:

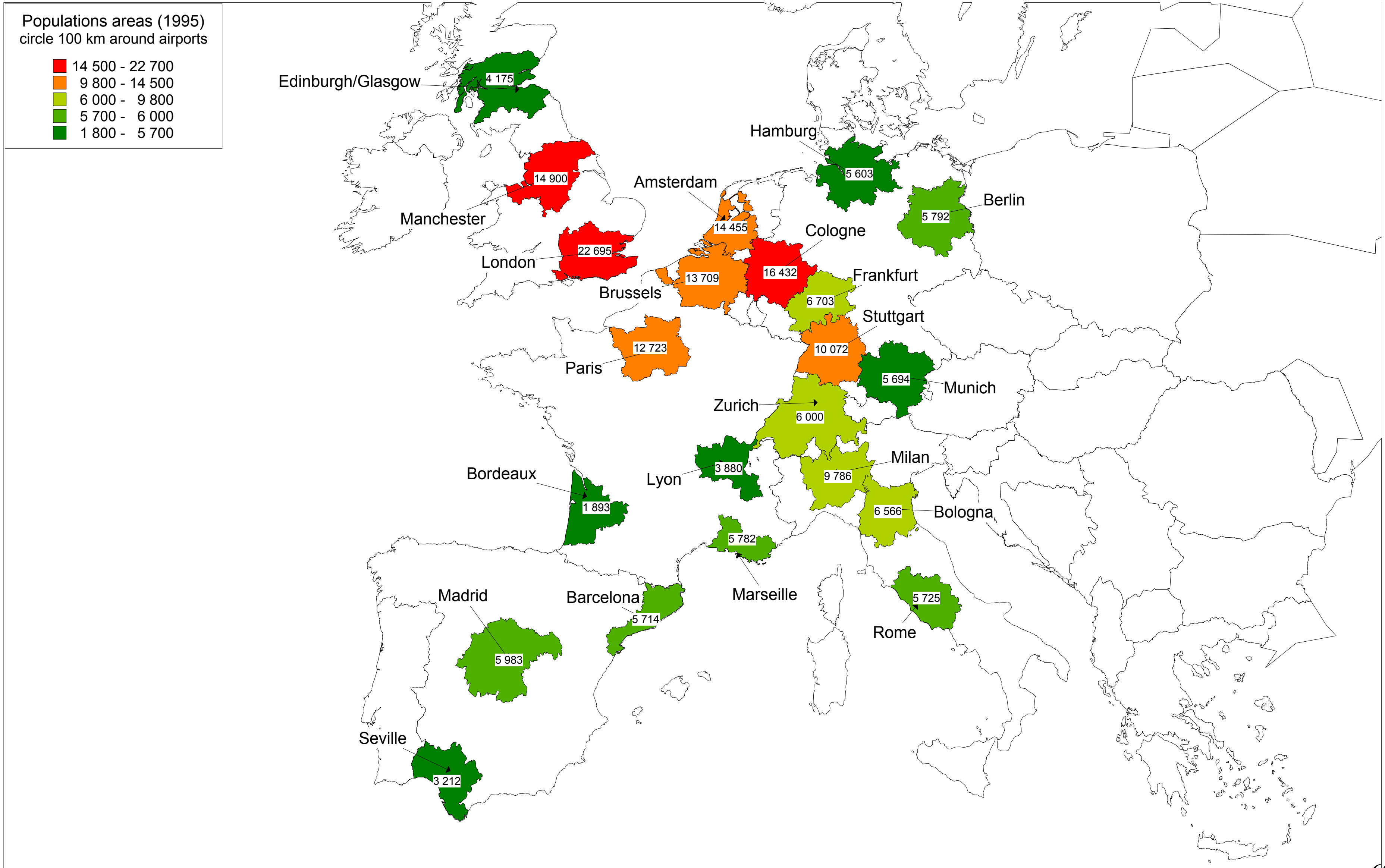
- Heavy Goods Vehicle (truck) 250 km
- Light Goods Vehicle (van) 300 km
- Rail (conventional) 240 km
- Rail (high speed) 250 – 600 km (transfer time dependent)
- Air 300 – 1400 km (covering all Europe)

City pairs with sufficient volumes between them are often served directly by road, or in some cases air, *to avoid the cost for a movement via a hub*. In these cases the transit time window between origin and destination can be some 9 hrs. Depending upon the distances covered this may also allow the use of conventional rather than very high speed rail technology.

3. Central Hub

DHL have the largest volume and have changed to a multi-hub system. The original hub at Brussels was estimated to handle 1000 to 1300 tonnes per night. Other hubs (as well as those of other operators) are believed to handle between 400 tonnes and 700 tonnes per night (but the operators would not confirm these figures). However, depending on the degree of automation, investment in a hub can only be justified on a throughput of several hundred tonnes per night.

Map of the cities and Catchment Areas involved



Annex 5

Assumptions for the HSM-Network

- only direct trains were taken into account. Thus it can be said: the demand is representative of the real geographic flows. Therefore the flows are underestimated, as it can be assumed that shippers also accept shared train load.
- The number of trains (NT) will be calculated by a gravitation model

$$NT_{AB} = f\ (Population_A,\ Pop_B)$$

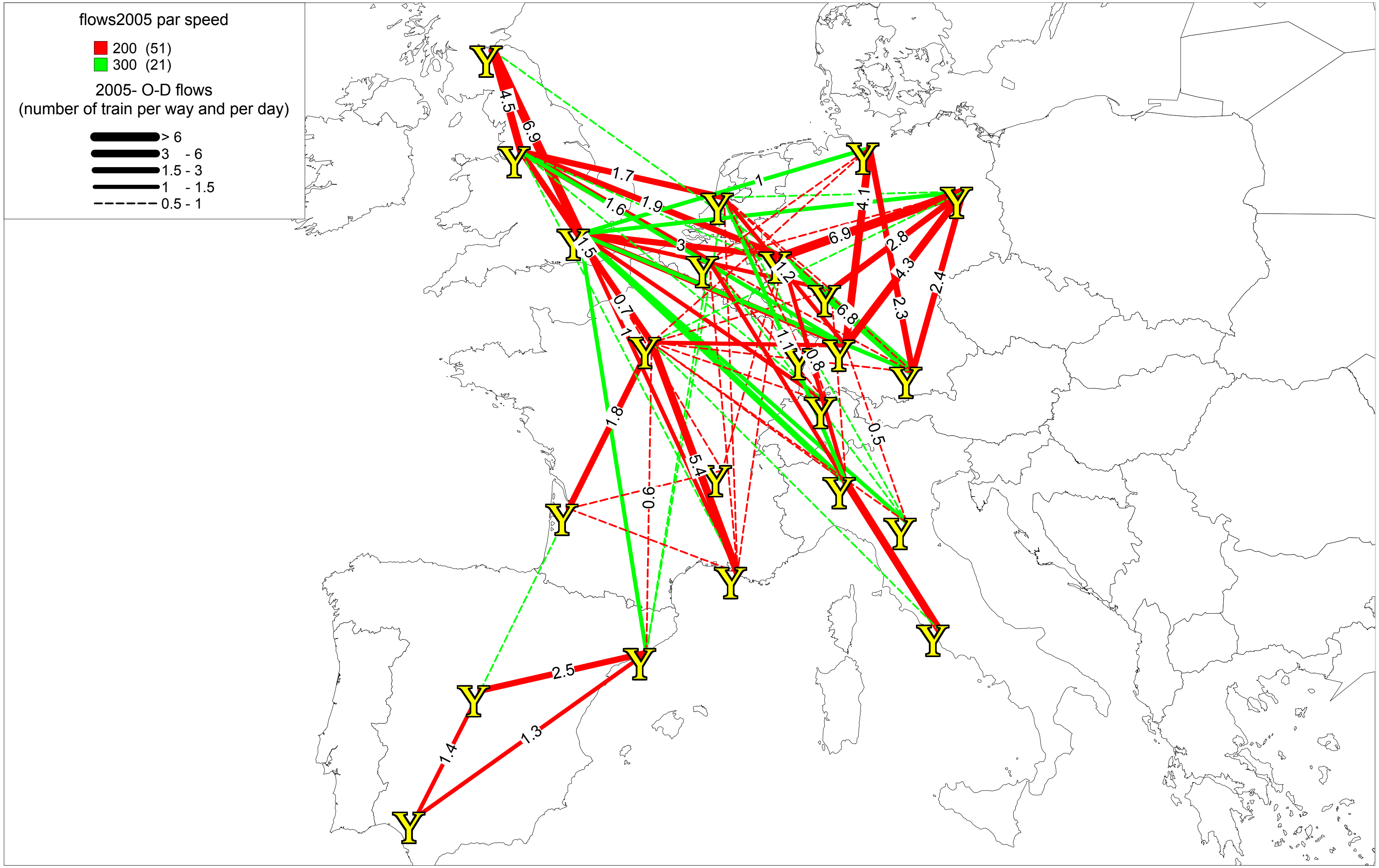
(with different coefficients for national and international traffic)

- Model Parameters

Type of logistic chain	– Hubs: Paris, Brussels, Frankfurt – Direct links
Maximum speed limit of trains	– 200 km/h – 300km/h
Average speed of trucks	– 60 km/h
Type of network	– 2005 network
Market growth (10%)	– 1997 horizon – 2005/2006 horizon – 2010/2011 horizon
Localization of a rail gateway Typical combined average	– off airport: 10 minutes – off high-speed line: 10 minutes – 20 minutes

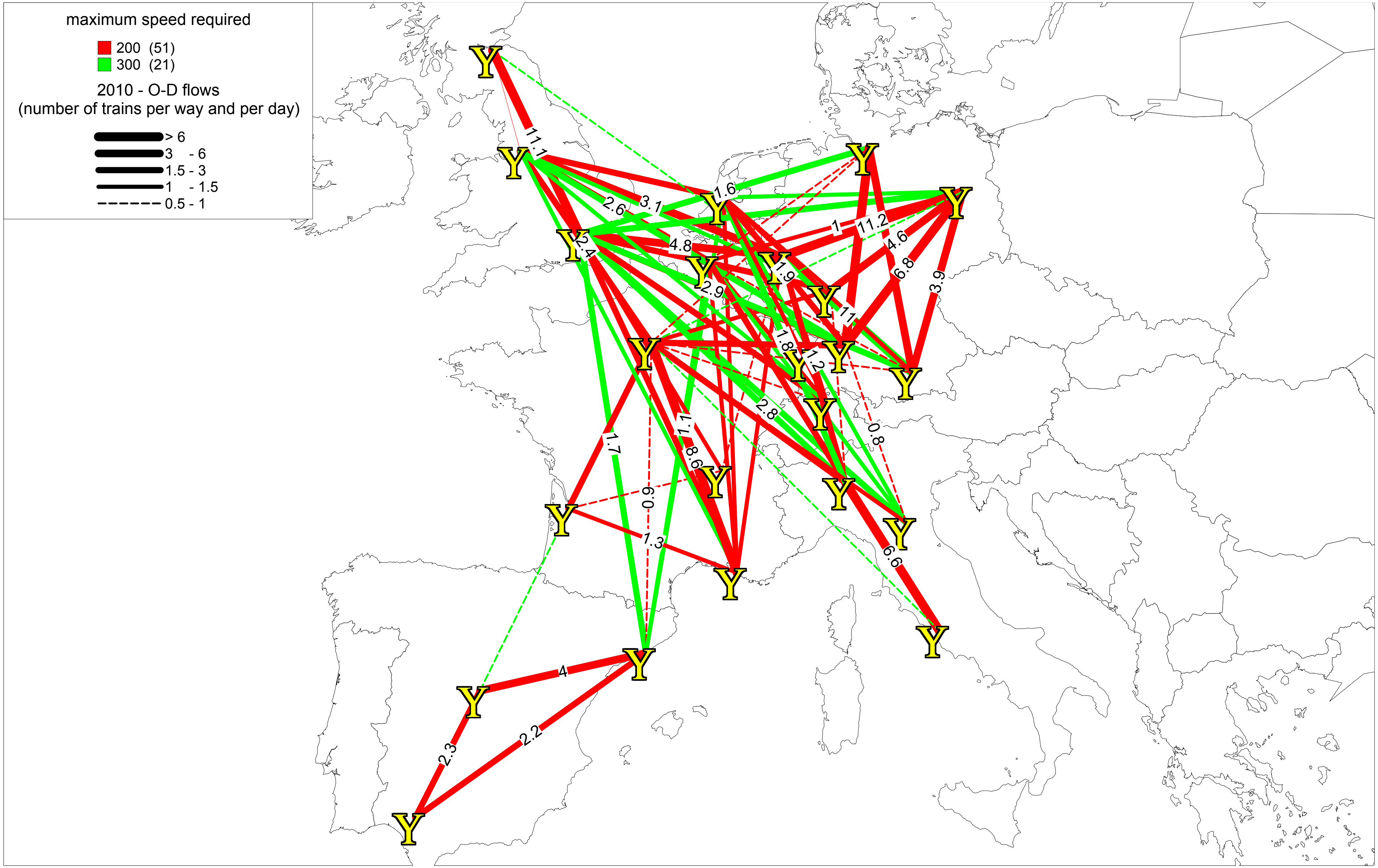
It was concluded from the study of the premium freight market that the main services that might be offered by high speed rail would be feeders into and out of hubs, or direct overnight services between gateways, or major centres of population, where volumes justified. Such operations demand either, journey times of 3 hours or less for feeders, or 9 hours or less for direct services. In addition, for the purposes of estimation potential rail traffic, it was proposed that if the same journey could be achieved by road within these time constraints, then, based the lower costs of road operation, it is likely that the traffic would go to road, and not to rail. Furthermore, for a train service to be counted as viable, the estimated volume of traffic had to be sufficient to fill at least half a potential train per day.

Train flows for year 2005

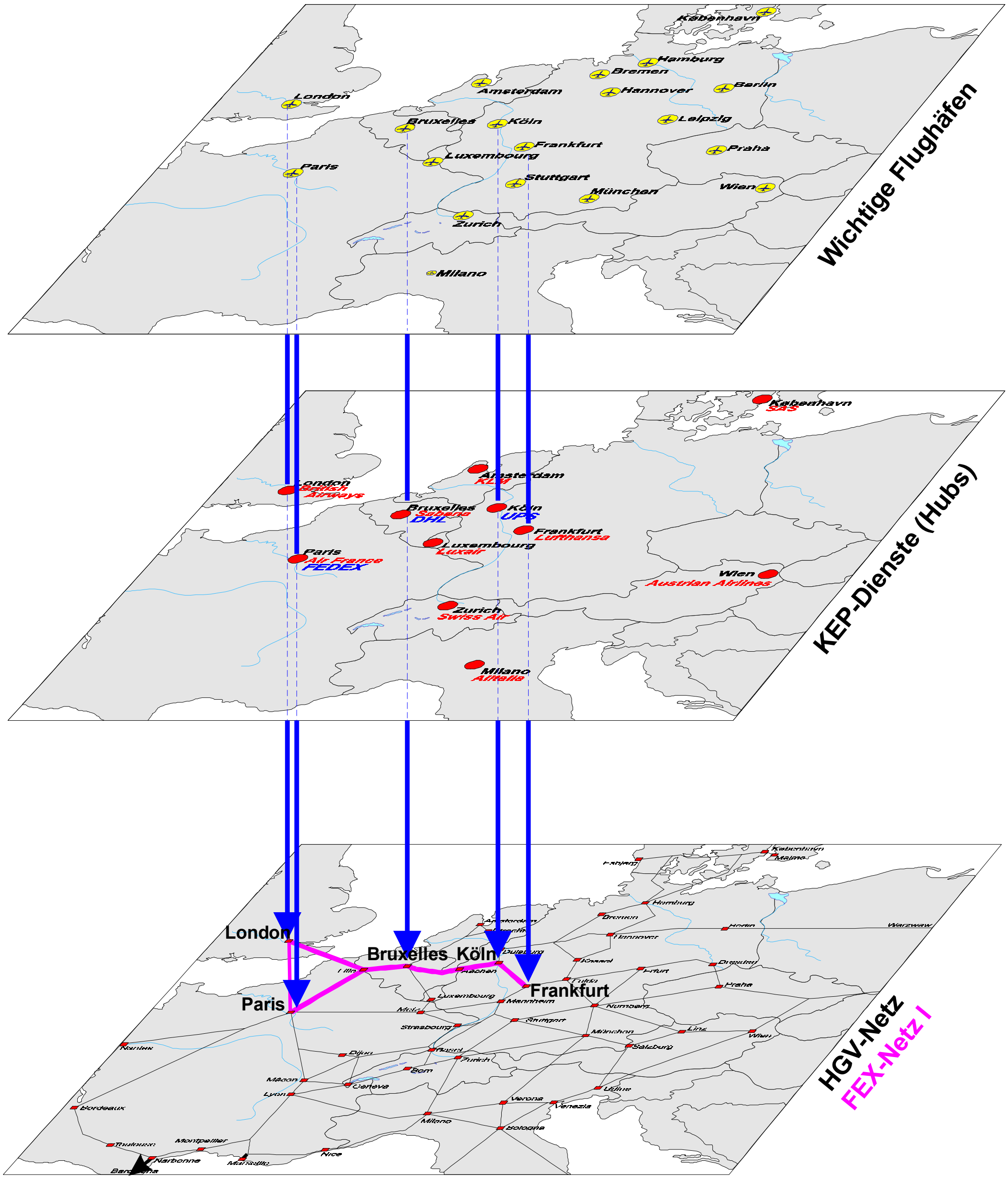


Annex 7

Train flows for year 2010



DEUFRAKO (FEX)-Network

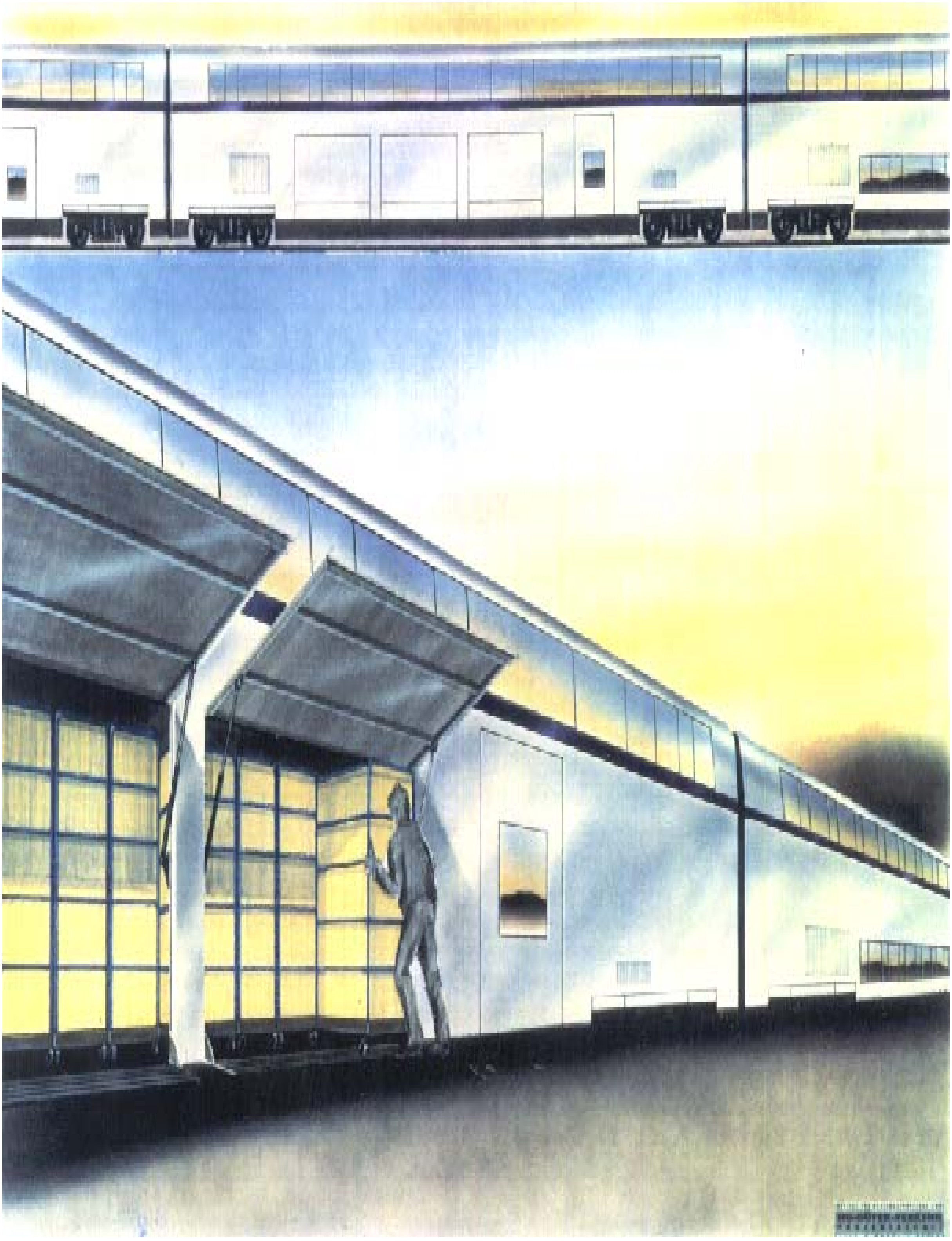


Translations:

Wichtige Flughäfen:	Important airports
KEP-Dienste	Express-services
HGV-Netz	FEX-Network (based on EHSR)

Annex **10**

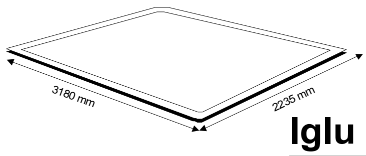
Double stock High Speed Wagons



AFC-types

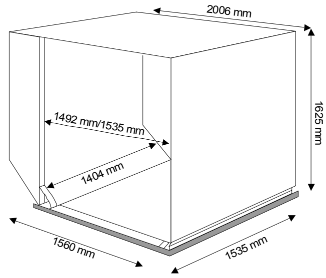
88“ x 125“ Palette

Volumen im Netz	10,5 m³
Eigengewicht	125 kg
Max. Zuladung	4.535 kg



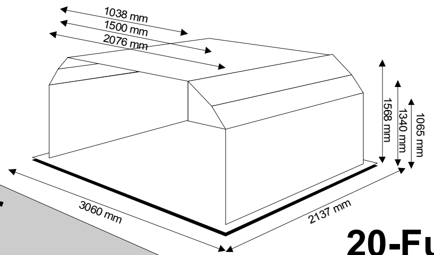
LD 3-Container

Volumen (innen)	4,1 m³
Eigengewicht	85 kg
Max. Zuladung	1.495 kg



Iglu Kontur A4 (LD 7)

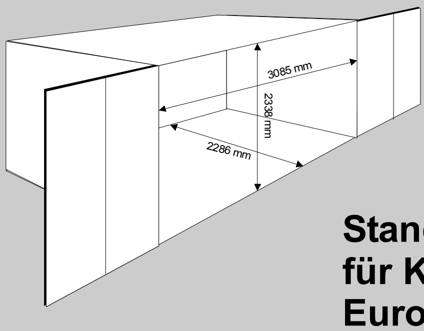
Volumen (innen)	10,5 m³
Eigengewicht	225 kg
Max. Zuladung	4.310 kg



10-Fuß-Container

(Bungalow-Container)

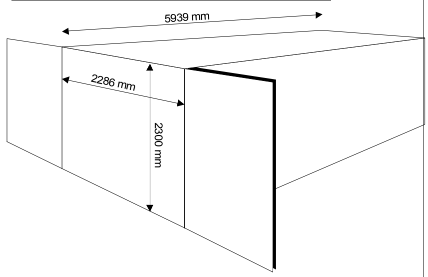
Volumen (innen)	17,4 m³
Eigengewicht	485 kg
Max. Zuladung	6.315 kg



Standard für KEP in Europa

20-Fuß-Container

Volumen (innen)	33 m³
Eigengewicht	1.000 kg
Max. Zuladung	10.350 kg



Actual slot example Aachen - Frankfurt

Background: possible verification of described problems in chapter 5.4

Basis: timetable of the shuttle trains (fig. 18)

Response of DB Netz: on September 10th, 2001:

- Realization of infrastructure concerning

  New Line Frankfurt – Cologne:

  Start of operation at the end of 2002 with ICE 3 trains

  Air / Rail Terminal Cologne

  Realization still depending on the planification process;
  access only possible via the new line, i.e. not via the two conventional lines along the Rhine river.
- Vehicle specifications

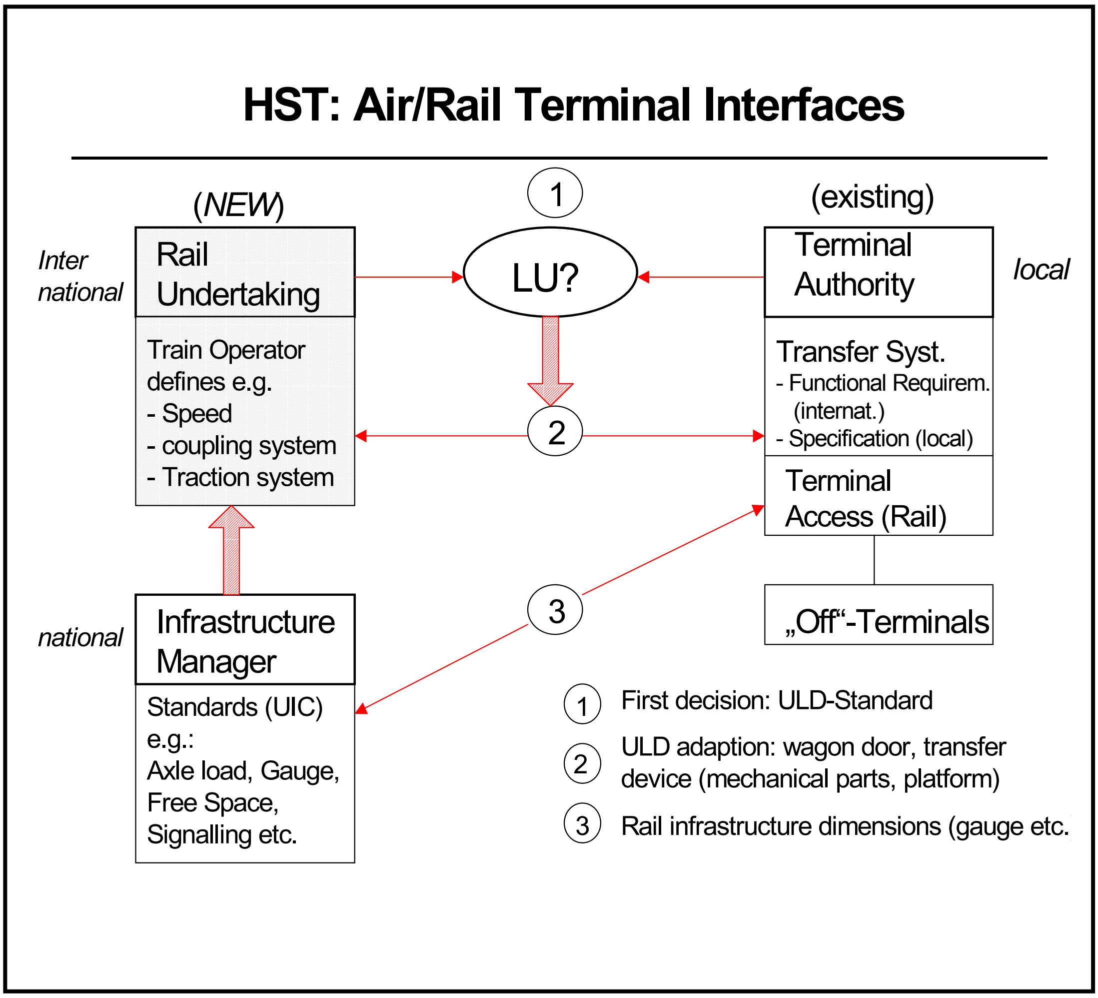
  Special trains control devices, such as LZB + CIR ELKE II Software,
  above 200 km/h the linear eddy current brake, for the wagon units a sealed wagon frame with a "bypass" for the emergency brake is obligatory.
- Time table (fig. 18)

  Frankfurt – Cologne

  Planned transportation time with v_{max} = 300 km/h possible, incl. The access to Cargo Süd terminal at FRA airport (precondition: electrification Walldorf – Cargo Süd).

  Cologne – Aachen

  Possible problems with conventional freight trains during the night, but DB Netz pointed out to be ready for dealing each specific path inquiry based on a "formal letter".


HST: Air/Rail Terminal Interfaces
(NEW)
Inter national
Rail Undertaking
Train Operator defines e.g.
- Speed
- coupling system
- Traction system
1
LU?
2
(existing)
Terminal Authority
local
Transfer Syst.
- Functional Requirem. (internat.)
- Specification (local)
Terminal Access (Rail)
„Off"-Terminals
national
Infrastructure Manager
Standards (UIC) e.g.:
Axle load, Gauge, Free Space, Signalling etc.
3
1 First decision: ULD-Standard
2 ULD adaption: wagon door, transfer device (mechanical parts, platform)
3 Rail infrastructure dimensions (gauge etc.

EK/

HSF Network study