DIOMIS

Developing **I**nfrastructure and **O**perating **M**odels for **I**ntermodal **S**hift

Final report

Work package A5: "Improving the use of available train length".

KombiConsult
beraten planen umsetzen

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Warning

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1 BACKGROUND

1.1 Starting point and objective

One of the findings of the "UIC capacity study"[1] was that the use of the available train length could sometimes be improved. Sub-optimal use of train length is often due to booking procedures, technical parameters and poor operational capacity management. It is evident that inadequate utilization of train length impacts negatively the utilization of infrastructure, prices and thus competitiveness of combined transport. Consequently, for the Capacity Study the general assumption was made that by 2015 the overall use of the available train length will have grown from 70% to 80%.

Thus, the objective of the DIOMIS workpackage A5 "Improving the use of available train length" was to provide examples of methods and features (good practices), which facilitate an improved use of train capacity. As a means of enabling a common learning process, these practices were to be evaluated in the light of their applicability and transferability to other markets.

1.2 Methodology

1.2.1 Talks to intermodal operators

In order to achieve this objective it was decided that discussions of the different approaches were to be held with competent partners among the intermodal operators. Thus, a series of personal expert interviews was carried out.

The consultants' experience and the results of the discussions with the steering committee soon revealed that the approaches towards controlling capacity management are highly dependant on the markets in which the operators work. In this context the question "who bears the capacity risk?" becomes crucial. Thus, the interview partners were selected according to the segmentation presented in table 1.1. A characterization of the different segments is presented in chapter 3.

[1] Study On Infrastructure Capacity Reserves For Combined Transport By 2015

Table 1.1:
Interview partners from intermodal operators per market segment

Segment of intermodal operator	Company	Interview partner	Position
Shipper market	Crossrail	Steffen Hering	Sales manager
	Hangartner	Ueli Maurer	Director Hangartner Terminal AG
	Ambrogio	Livio Ambrogio	CEO
Maritime market	IFB	Wilfried Moons	General Manager Intermodal
	Italcontainer	Dott. Javier Casanas	Responsible for new projects
		Maurizio de Fazio	Responsible Operative and Customer Care
	Transfracht	Maximilian von Haller	Director
	RailLink	Patrick Bourreau	Sales Manager
Forwarder market with line production system	HUPAC	Giorgio Mombelli	Logistics
	Novatrans	Bernard Chion	Commercial Director
Forwarder market with network production system	Kombiverkehr	Konstantinos Papadopoulos	Operations Research

Partly face-to-face, partly by phone, each of the interviews lasting at least one hour treated the following issues:

- Actual use of capacity,
- Factors, which determine the actual use of capacity beyond the realm of operators' influence, and measures to cope with suboptimal use of capacity
- Factors within the realm of operators' influence and measures to cope with suboptimal use of capacity.

Notes were made from each interview and sent to the interview partner for validation.

1.2.2 Talks to railway undertakings

The interviews with the intermodal operators revealed that capacity management by the operators is already done fairly efficiently. But sometimes an efficient capacity management was achieved by transferring the risk (costs) to the railway companies. (e.g. short term cancellation of trains), thus the need for further investigating the railways' perception of the issue.

Table 1.2 shows the railway company representatives who were selected for the interview.

Table 1.2:
Interview partners from railway undertakings

Railway undertakings	Interview partner	Position
B-cargo	Johan de Groot	Intermodal division
	Helga Colpaert	Commercial division
RCA	Erich Rohrhofer	Head of Business Division Intermodal
	Richard Fischer	Combi Cargo
SBB Cargo	Ralf-Charly Schultze	Head Intermodal Traffic
Stinnes Intermodal	Sylke Hußmann	Director Intermodal Transport

These interviews were carried out by phone and covered the following issues:

- The railway companies‘ handling of cancellation or booking of trains at short notice (limitations on free of charge cancellations),
- The railway companies‘ handling of short term adjustments of the wagon set,
- Possibilities and limits for the use of cancelled rolling stock and slots.

Finally the discussions again revolved around the question “Who bears the costs of a flexible adjustment of train capacity?”.

As a conclusion one can say that with this method was successful for collecting a multitude of practices and measures which can help optimize the use of available train length.

2 OVERVIEW OF THE RESULTS

2.1 Features of intermodal operators

The practices and measures collected during the talks to intermodal operators are presented as an overview in table 2.1. Each of them will be described in detail in chapter 3. The different methods have been divided into five sections:

Table 2.1:
Structure of features for improving the use of available train length

1.	Booking procedures, types of services	Last minute prices
		Standby bookings
		Price differentiation for consignments with varying priorities
		Price differentiation in the case of an extended service
		Penalties for late cancellations (no shows)
		Time buffers of one day on long distances
2	Operational procedures	Gateway transports
		Hub system
		Multiple daily departures
		Short-notice booking or cancellation of trains
		“Combination of heavy and voluminous transports“
		Combination of conventional freight wagons and intermodal wagons
		Filling up of trains from maritime transports with continental transports
		Direction-dependent combination of maritime and conventional transports

		Low price trains
		Greater flexibility in pre-carriage
3.	Sharing of risk	Sale of slots
		Sharing of capacity utilisation risk between different operators
4.	Hardware	Availability of capacities in the terminals
		Flexible adaptation of the wagon fleet to types of consignments
5	Fully developed CMS	Computer-aided capacity management system

When examining the segmentation of the intermodal operators (table 1.1) and the structure (table 2.1), it becomes evident that the more complex the organization of intermodal operators is, the more complex methods for capacity management are necessary. At the same time, the applicability is often reduced (cf. figure 3.1 in chapter 3).

The interview partners from the railways stated that they help intermodal operators optimize the use of available train length by offering them

- Periodical (e.g. quarterly) updates of the transport program,
- Graded charges for train cancellations,
- Minimum purchase regulations (i.e. number of trains).

Nevertheless in some cases railway undertakings have to bear the costs for the flexibility, in particular cancelled slots cannot normally be used flexibly at short notice.

2.2 Quantification of the impact of measures

One of the issues discussed during the talks to intermodal operators was their estimation to quantify the impact of the measures on the use of capacity.

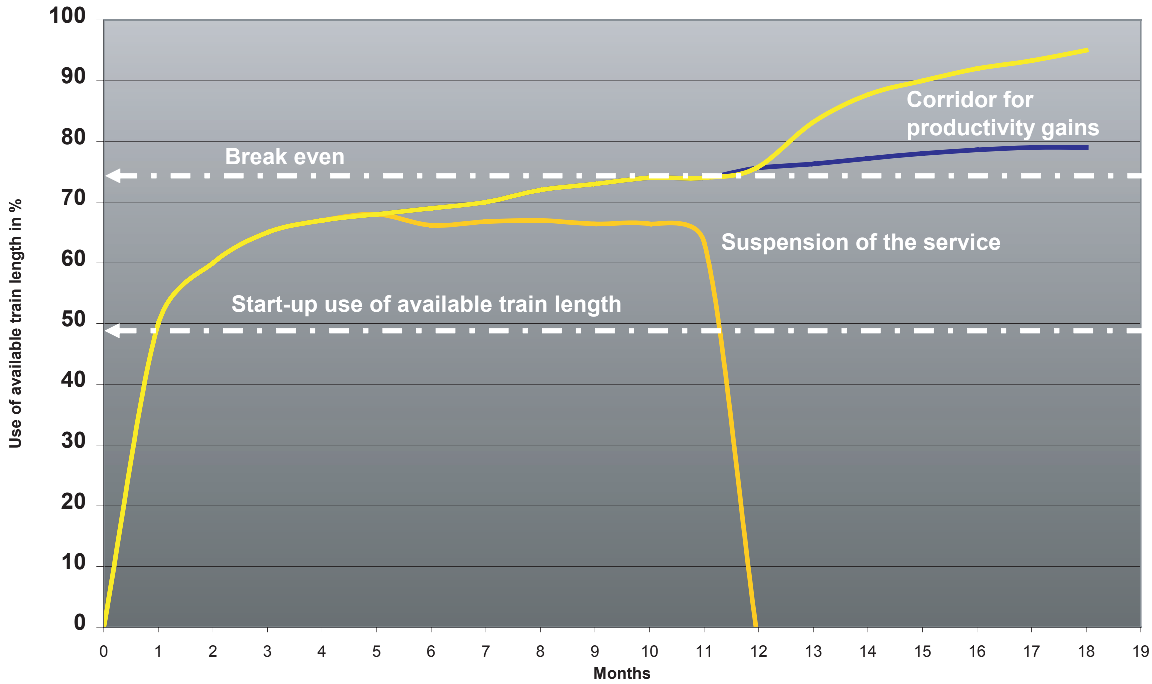
Practically without exception, the operators gave the following figures which represent the simple annual average of the use of available train length:

- to start a new service requires a capacity utilization of at least 50 %,
- after approx one year the break even point should be reached, which is around 75-80 % average use of capacity. If the break even point is not reached, the operators are obliged to adjust the offer (i.e. to suspend the service). In the case the service is an integrated part of a network a suspension is not possible.

All interview partners stated that an average use of capacity of more than 95 % would not be realistic. Consequently, the maximum “corridor” for productivity gains that can be achieved by measures improving of the use of capacity is between 5 – 20 % (cf. figure 2.1).

Figure 2.1:

Typical evolution of the use of capacity and corridor for productivity gains



In addition, the improvement of the use of available train length depends on

- the corridor, since corridors with high traffic offer more opportunities to optimize the use of capacity.
- the organizational level of the intermodal operators (cf. figure 3.1 in chapter 3), since a less complex organizational level offers fewer optimization opportunities (e.g. operators in the shipper market have achieved an average use of the available train length of more than 90 % taking into account the reallocation of empty units).

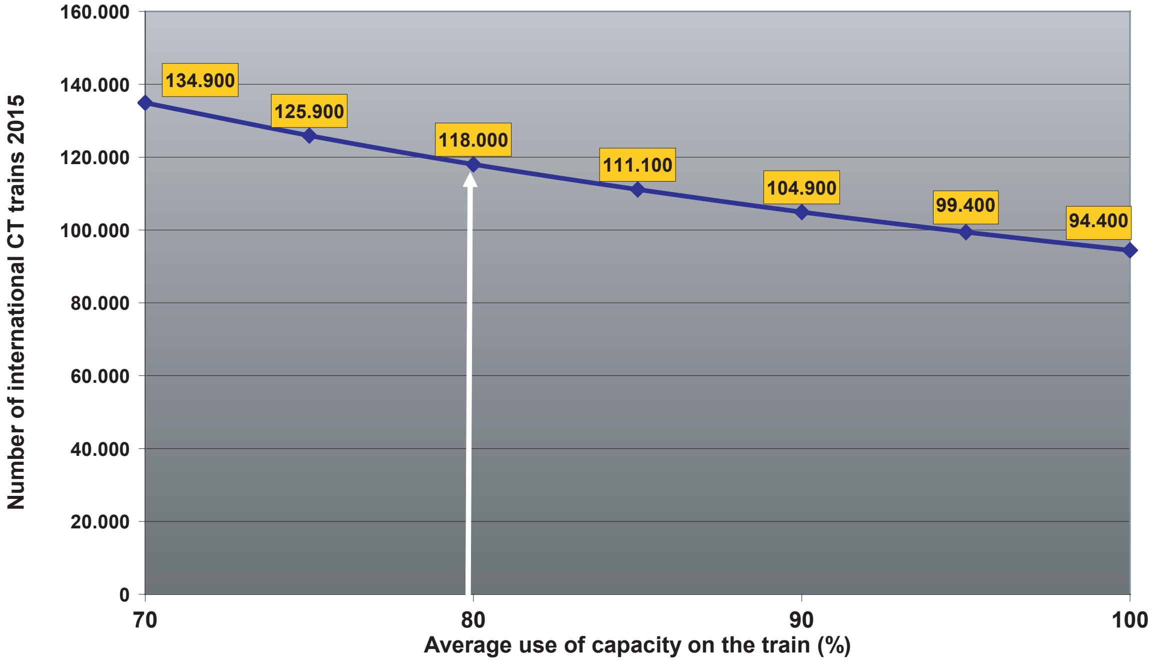
In this context, one has to bear in mind that the spared capacity resulting from the improvement of the use of available train capacity enables …

- ... to reduce potentially the number of trains and thus to relieve capacity bottlenecks on the rail netwsork.
- ... or to spare capacity thus allowing the acquisition of additional volumes by keeping the number of ttrains constant.

The discussion revealed that – with one exception (fully developed capacity management), where evaluations of the investment costs were carried out- it was not possible to quantify the effect on the use of the capacity for each feature. This is due to the fact that practically all features were developed "historically" i.e. by trial and error, with the objective to reduce costs.

A simple calculation carried out on the basis of the results of the UIC capacity study reveals the following (cf. figure 2.2):

Figure 2.2:
Number of international CT trains 2015 as a function of different average use of capacity (source: UIC capacity study)



For this study we assumed for the year 2015 a growth of the overall average use of capacity from 70% to 80%. This represents 118,000 international CT trains in 2015 (white arrow). Another overall growth of up to 95% would result in 99,400 international CT trains in 2015, which represents a spared capacity of approx. 19,000 trains per year or 75 trains per day. On the other hand if the goal of 80 % is not achieved, the railway networks have to bear another 17,000 trains per year (= approx. 67 trains per day).

Since the international CT trains are concentrated on a few major axes the capacity effect is also concentrated on these corridors. A further important capacity effect can be expected from the DIOMIS study module on the growth of domestic CT trains.

3 GOOD PRACTICES

3.1 Specificities of the segments regarding the optimization of train capacity utilisation

As already shown in chapter 2, the practices for optimizing the use of available train length are a function of the organizational complexity of the market in which the operators are active.

Before presenting the good practices identified during the talks to the operators, a description of the various market segments in question seems appropriate.

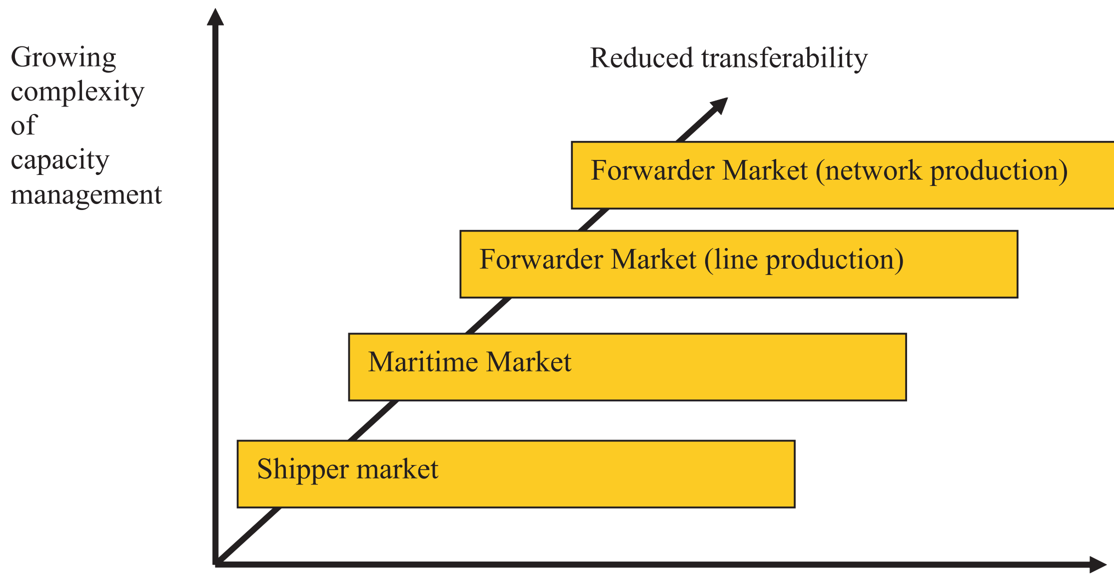
For the operators active in the **shipper market** (e.g. Crossrail, Ewals, Hangartner), the optimization of the use of capacity is of relatively low complexity: More than 50 % of the loadings are regular shipments for the key clients. Free space on the train will be filled with own empty load units. Shipments exceeding the train capacity are rejected.

As concerns the **maritime market** (BoxXpress, IFB, Italcontainer, Transfracht), a distinction needs to be made between merchant haulage and carrier haulage. The latter can be characterized by high volumes concentrated on a few clients (shipping companies). In many cases the capacity risk is bared by the shipping company purchasing a complete train (in some cases parts of a train) from the operator. An appropriate means of managing capacity is to use free capacity on the train for the reallocation of empty containers. The merchant haulage market has similar characteristics than the forwarder market with line production systems, described hereunder.

When regarding the **forwarder market**, one has to distinguish operators with (mostly) line production systems and operators with network production systems. The **line production system** (e.g. Hupac, Novatrans) may be characterized by a concentration on axis with high volumes and –sometimes- standardized products as concerns, for example, loading units accepted. This simplifies the capacity management by adapting the offer to the demand. Contrarily the **network production system** (e.g. Cemat, Kombiverkehr) requires highly complex capacity management systems, since the capacity has to be optimized not only on a train level but also on a service (first origin-final destination) level that may comprise different trains.

To summarize, the more complex the operational organization of the operator is, the more complex capacity management systems are required. At the same time the applicability of these features is reduced. Figure 3.1 illustrates this context

Figure 3.1:
Context between organizational level of intermodal operators, complexity of measures and applicability of measures



In the following all the measures, features and methods, the market segments affected and the conditions for their application are described in detail. Finally, an assessment of the applicability for other operators is carried out.

3.2 Booking procedures and types of services

The features described in this chapter refer to different possibilities of booking procedures and offers from operator to the customer. All these features refer to the relation between operator and customer.

3.2.1 Last minute prices

Description of the problem/method

Just like in the airline industry, space which is still available only a few hours before train departure can be sold at more favorable conditions. One operator for example offers this service for empty containers at a price reduction of 30 %.

The problem with this method is that important customers who reserve space on the train in the long term pay more for the transport than customers who might only send a few consignments occasionally. This will result in dissatisfaction on the part of the major customers as well as a general price pressure, since the regular customers will attempt to achieve a lower price.

Most operators therefore clearly reject this method.

Market segment currently affected

At present this method is only being used for empty containers in sea port hinterland transport.

Conditions / necessary boundary conditions for the application of this method

No particular conditions are required.

Assessment of the transferability to other operators

Due to the clearly negative attitude of most operators, a significant extension of the use of last-minute-bookings is not to be expected.

3.2.2 Standby bookings

Description of the problem/method

Standby is particularly used for empty containers and consignments with a very low priority. The loading units are stored very close to the terminal. The loading units are used to fill up empty spaces on the train which means that a load factor of up to 100 % can be achieved. In most cases the customer and the operator have agreed on a timeframe within which the loading units have to be sent off.

Several operators said that they used this method on individual services and sometimes also during specific periods with peaks of empty containers.

Market segment currently affected

This method is used in all the market segments of intermodal transport.

Conditions / necessary boundary conditions for the application of this method

In order to employ this method, there has to be a sufficient volume of consignments with a very low priority or empty load units. In addition, storage space for these loading units would have to be available very close to the terminal.

Since operators can only charge a lower price for standby consignments than for consignments with a normal priority, these are not suited for services with a permanently high capacity utilization as it is more lucrative to fill up the train with nor-mal-priced consignments.

The interviews showed that these conditions can only be found on individual services. Thus this method which is relatively simple to implement is only employed on individual services.

Assessment of the transferability to other operators

If the above-mentioned conditions are fulfilled, the standby method can be used by all operators.

3.2.3 Price differentiation for consignments with varying priorities

Description of the problem/method

As already described, intermodal services – like almost all other services in freight transport – are subject to significant fluctuations in volume. As a result, the often used shuttle trains with wagon sets, which mostly cannot be adapted to the volume fluctuations at short notice, sometimes run with an insufficient capacity utilization and sometimes with a maximum capacity utilization. In that case consignments even have to be rejected.

By offering different prices for different transport days and goods with different priorities, the peak demand could be leveled off and the consignments could be distributed evenly across the week. Fridays, for instance, often witness a high demand, whereas demand at the beginning of the week is usually quite low. If customers were charged more for the Friday departure than for the Monday departure, those customers with less urgent consignments would use the price advantage of the Monday departure. Customers could also decide in advance whether their consignment is to be sent on the next possible departure or whether the operator can postpone the consignment to a later departure when required. The operator achieves a greater flexibility and therefore a better control of the capacity utilization of his trains. This, in turn, leads to advantages in production costs and the customer is rewarded with a price reduction for granting this greater flexibility.

However, almost all interviews with operators revealed that this price differentiation – as is also well-known in passenger air or rail transport – is not used for various reasons.

Firstly, the operators fear that the different prices will result in a general price pressure and that the large customers will insist on paying only the lower price for urgent freight although this price is reserved for less urgent freight – cf. non-enforceability of penalties for short notice cancellations of consignments.

Another important factor which speaks against the introduction of a price differentiation is the additional pressure on the terminals, which would arise because of the additional work processes connected with a price differentiation.

If already de-livered loading units which are to be sent on a later departure have to be stored in the terminal, it automatically involves additional work when the loading units are moved into and out of their waiting position. In addition, one has to calculate the costs of the additional storage space.

One operator explained that a price differentiation would most likely result in a better control of the capacity utilization and that serious investigations of this matter had been carried out. However, it had become clear that the effort and costs would outweigh the advantages of the price differentiation.

Market segment currently affected

All market segments of intermodal transport.

Conditions / necessary boundary conditions for the application of this method

General improvement of the efficiency in the terminal operation

Assessment of the transferability to other operators

As explained above, it’s unlikely, that operators will use this method.

3.2.4 Price differentiation in the case of an extended service

Description of the problem/method

A special type of price differentiation was described by an operator when existing services are extended to protect existing trains and to quickly improve the capacity utilization of new trains.

This method, which is only used during a certain period of time, is illustrated by the following example: Between the terminals A-city and B-city there are two departures per day and direction with a transit time of day A – day B. The trains have a very high capacity utilization and excess consignments even have to be rejected. The customers therefore demand a third daily departure.

However, there is a risk that the introduction of a third departure could result in a significant drop of the overall capacity utilization of the service. Therefore the third departure is introduced with a lower quality standard (transit time day A – day C), which allows more favorable production costs (slots with lower priority at less attractive departure times, wagons with a lower maximum speed limit, …).

As the production costs for the additional service are lower, a more favorable price can be offered and this where the price differentiation comes into play.

Since many of the customers depend on the shorter transit time, they stay with the original service, despite the comparably higher price. Some customers switch to the new and more favorable service. These customers are balanced out on the old service by the excess consignments which so far had to be rejected. The new service achieves its capacity utilization through customers from the old service, through new customers from the former excess consignments who do not have high-priority consignments as well as through completely new customers with low-priority consignments who are attracted by the low price.

Since the third departure is significantly different from the existing service in terms of transit time and price, the existing service is protected against a "cannibalization effect".

Market segment currently affected

This feature is currently used by Novatrans which operates in the forwarder market with line production systems.

Conditions / necessary boundary conditions for the application of this method

In order to employ this method, there has to be an excess of consignments on an existing service which had to be rejected because of lacking train capacity. Secondly, it must be possible to introduce an additional service with a longer transit time which is cheaper than the existing service because of lower production costs. Additionally, there have to be customers who depend on the faster and more expensive service as well as customers who prefer the slower but cheaper one.

Assessment of the transferability to other operators

If the above-mentioned conditions are fulfilled, this method can be used by operators active in the forwarder market.

3.2.5 Penalties for late cancellations (no show)

Description of the problem/method

In many cases booked consignments are cancelled at short notice or the consignments fail to reach the terminal for various reasons. As is often the case the reserved space cannot be filled with other consignments and remains empty.

In order to compensate the operator for the incurred financial damage and to discourage customers from repeatedly failing to deliver their consignments, it would seem logical for the operator to impose a penalty to the customer.

However, all interviews carried out revealed that this is almost impossible to implement. In particular major customers refuse to pay for late cancellations of bookings and threaten to switch to other operators or to road transport.

One of the operators explained that he monitored the amount of his customer's no shows. If the ratio of no shows becomes too high, the operator talks to the customer about the reasons for the no shows. In general, however, on a basis of trust it is assumed that in a case of no show the customer is not to blame, e.g. that the pre-carriage could not be carried out within the planned time because of the road conditions.

Naturally the no shows which cannot be replaced by ready consignments at short notice have a negative effect on the overall capacity utilization of the trains in intermodal transport.

Market segment currently affected

All market segments of the intermodal transport are affected by no shows.

Conditions / necessary boundary conditions for the application of this method

No necessary boundary conditions.

Assessment of the transferability to other operators

As explained above, it's unlikely, that operators will use penalties to reduce the number of no shows.

3.2.6 Time buffers of one day on long distances

Description of the problem/method

For example in transports between Germany and Italy it is possible to offer a day A – day B service. Many consignments, however, are not that time-critical and the customers can accept a day A – day C service. In this case – provided that the train has a daily departure – the operator is flexible when he collects the consignment from the forwarder on day A as to whether or not he sends off the consignment on the same day or waits until the next day. In both cases the customer can be offered a day A – day C service and the operator has gained an additional flexibility for the control of his capacity utilization. He will attempt to transport all goods on the same day. If he has excess consignments, these can be put on the train the next day and will thus raise the capacity utilization of this train. This way it becomes relatively easy to balance out weekly fluctuations in volume.

Market segment currently affected

This method is currently being used in continental transports with swap bodies in the forwarder market with line production system.

Conditions / necessary boundary conditions for the application of this method

This method requires the existence of train running times of maximum A – B as well as daily departures. Furthermore a large part of the customers has to accept A – C services despite the theoretically shorter transport times.

Assessment of the transferability to other operators

Provided the above-mentioned conditions are fulfilled, this method can be applied by other operators without any difficulties.

3.3 Operational procedures

The features in this chapter refer to different operational procedures, organized by the operator.

3.3.1 Gateway system

Description of the problem/method

A Gateway system links different services to a network and offers the possibility for transshipments of consignments between long distance trains. This offers options for a flexible re-routing of consignments.

For example, if it's not possible to ship a consignment with a direct train from A to B, due to a lack of capacity it can be rerouted with a train from A to gateway C and from there with another train to the destination B. So the opportunity is opened up to balance volumes and capacities within a network – particularly, if a capacity management system is used (cf. chapter 3.6.1). Finally, this will result in a reduction of the production costs. More precisely, the capacity utilization of the train is improved considerably and/or the number of trains needed is reduced.

One disadvantage of the Gateway system compared to a shuttle train is the additional handling costs, which is why some operators have chosen to concentrate exclusively on shuttle train transports.

Market segment currently affected

The Gateway system is used both in the continental and the maritime segment.

Conditions / necessary boundary conditions for the application of this method

The market situation has to allow for the additional handling costs.

Assessment of the transferability to other operators

Gateway systems are widely applicable but require additional efforts for capacity management.

3.3.2 Hub system

Description of the problem/method

A star-shaped arrangement of different services is created around a hub. A hub allows for bundling shipments from different origins to one destination, the operator is thus able to offer regular services on relations even with less important volumes. Talks to operators revealed contradictory views about the benefits of hub systems. While some pointed out the failure of the hub system in France for example, others insisted on the advantage of the hub system they are using (IFB, Ambrogio, and Transfracht). It seems that well organized hub systems as an element of a well organized transport chain my help to improve train capacity utilization.

A specific example is the hub in the port of Antwerp. It links all services between the hinterland terminals in Belgium and the hub in Antwerp with all terminals in the port of Antwerp. In this case the extended catchment area for every service has also resulted in a greater and thereby more economic capacity utilization.

Market segment currently affected

The hub system currently is mainly used in the maritime market and in the shipper market.

Conditions / necessary boundary conditions for the application of this method

A sufficiently large terminal or shunting yard in a suitable position of the network is needed to operate a hub system. The amount of consignments in this system has to justify the expensive operation of such a hub.

Assessment of the transferability to other operators

The huge operational costs for a hub make it a very unlikely operation for many operators. Lately we have even seen operators closing their hub operation.

3.3.3 Multiple daily departures

Description of the problem/method

On services with an especially high volume multiple daily departures are possible. For example, one operator runs 5 shuttle trains per direction on work days between Köln-Eifeltor and the Milano area.

Balancing out capacity can be achieved with multiple daily departures since it is not relevant for most customers on which of the trains their goods are carried. If a loading unit is sent on a later departure than planned, the operator merely has to inform the forwarder who is responsible for the on-carriage in time.

Market segment currently affected

Mainly continental market.

Conditions / necessary boundary conditions for the application of this method

This method can be employed on axes with very high volumes which warrant several daily departures.

Assessment of the transferability to other operators

On axes with a high volume and several daily departures the balancing out of capacity between the trains is already in use and it’s no problem at all for each operator to use this feature.

3.3.4 Short-notice booking or cancellation of trains

One way for operators to react to fluctuations of the demand is to book or cancel at short-notice traction (engine and engine driver), wagons and slots. This option and its consequences for the railway undertakings are described in more detail in chapter 4.

3.3.5 A combination of heavy and voluminous transports and a combination of conventional freight wagons and intermodal wagons

Description of the problem/method

Often the used capacity of the train is limited due to the reason that the consignments consist of extremely heavy goods. This situation was described by several operators. As an example, trains transport export goods from regions in Italy with a significant ceramics production to the ports. These trains quickly reach their maximum weight without transit to full capacity. Normally there are no voluminous consignments available to fill up this train. In contrast, other trains run with light, voluminous consignments which do not reach a possible higher hauled load.

Within the conventional wagon load transport a solution to this problem has been found which in some cases might be applied to intermodal transports. A German company from the salt industry uses wagon load transport for very heavy consignments. If trains are made up of only these wagons, they quickly reach the maximum hauled load with only a short length. The price per wagon is relatively high for the customer. If a customer is prepared to couple his wagons in smaller groups onto trains with voluminous consignments – in which case these trains reach a maximum both with regards to length and weight – he will be offered a much more favorable price.

A private railway company has already combined intermodal trains with heavy tank wagons. A combination of heavy intermodal trains with light empty wagons from the conventional freight transport is also conceivable.

Market segment currently affected

At the moment this is only done occasionally.

Conditions / necessary boundary conditions for the application of this method

Bringing together the wagons from the conventional transport with intermodal trains is often difficult and therefore often too expensive. It always involves shunting. If the terminal and the marshalling yard and/or the works siding of the consignee or consignor are not close to each other, transportation of the conventional wagons is necessary. In addition, heavy freight trains often have to observe low speed limits which could result in an unacceptable prolonging of the transport time for intermodal trains.

A good combination would be intermodal trains and ferries, e.g. Germany - Scandinavia, which can be coupled with conventional wagons which are also transported by ferry.

Although this method does not result in an improvement of the capacity utilization in intermodal transport, it does lead to an overall increase in the efficiency in rail freight transport.

Assessment of the transferability to other operators

The described combination of intermodal trains and – depending on the situation – wagons from conventional freight transport with heavy or voluminous loads or empty wagons is only feasible in a few cases with particularly favorable conditions.

3.3.6 Filling trains from maritime transports with continental transports (and v.v.)

Description of the problem/method

Owing to the terminals served and the intermodal freight cars used, there is usually a distinct difference between the services of the continental and those of the maritime intermodal transport.

By loading continental consignments onto trains which primarily operate within maritime transport, the capacity utilization of the trains can be raised.

The loading or unloading of the continental consignments can either be carried out directly in the port or in the hub terminal which lies off the port.

One operator stated that the continental consignments even constituted the constant load for his trains to the sea ports and that to a certain extent the trains were filled up with mostly less time-critical maritime consignments. The ratio of continental to maritime consignments is approximately 50 to 50.

Market segment currently affected

All market segments.

Conditions / necessary boundary conditions for the application of this method

This solution requires the existence of a suitable access for the continental units in the port terminal or the existence of a suitable hub terminal for both maritime and continental units close to the port.

Assessment of the transferability to other operators

If there's a demand of continental transports between the port and the hinterland terminal this combination of consignments is easy to carry out. Only the shipment of trailers could be difficult because of the requirements of pocket wagons.

3.3.7 Direction-dependent combination of maritime and continental transports

Description of the problem/method

In contrast to the previously described methods, there is a clear dependency between the type of freight and the transport direction. Railink explained that from the hinterland to the ports, i.e. in export, the trains are loaded with approx. 80 % maritime shipments. The remaining 20 % are filled with empty continental loading units. In the opposite direction, however, up to 80 % are filled with continental loading units, in this case chemical products. The remaining 20 % are filled with empty maritime containers to the extent possible.

Unpairing of transports, which has an effect on the wagon stock, is leveled off by employing special trains (spot trains).

Market segment currently affected

A combination of maritime and continental transports

Conditions / necessary boundary conditions for the application of this method

The method described can only be applied if a paired combination of maritime and continental transports is possible. In the above-mentioned case there are chemical industrial companies very close to the port which deliver their products to regions from which the export for the sea transport comes. In addition, there is an empty container depot for maritime and continental containers very close to both the port terminal and the inland terminal.

Assessment of the transferability to other operators

The demand of continental transports from the hinterland to the port is in many cases very reasonable, because in the area around nearly all ports there are huge areas of industry.

3.3.8 Low-price trains

Description of the problem/method

Interviews with Ambrogio and IFB revealed that a high degree of standardization of wagons and load units help reduce costs and improve the use of capacity on the train.

The interview partner of IFB described the basic idea and the advantages of the system they are using:

In particular on shorter distances – up about 500 km – intermodal transport has a difficult market position compared to freight transport by road because of its cost structure. Consequently, it is very difficult to reach a cost-effective capacity utilization.

By introducing a "low-cost system", it is in some specific cases possible to offer the customers a relatively low transport price and thus achieve a cost-effective capacity utilization of the trains on short distances.

The low price is mainly secured by the use of a standard wagon fleet consisting of relatively old wagons with low depreciation costs.

The disadvantage of this system is that only standard containers can be transported and that a transport of high-cube containers or trailers for instance is not possible.

Market segment currently affected

The system described is currently being used in seaport hinterland transport of up to 250 - 300 km (IFB).

Conditions / necessary boundary conditions for the application of this method

A requirement for this system is a sufficiently high volume of standard containers and/or shipments fitting to standardized load units.

Assessment of the transferability to other operators

If there's a market for standard containers in the "short distance" hinterland traffic, the systems can be adopted easily.

If the goods to be transported fit with standardized load units the system is easily applicable as well.

3.3.9 Flexibility in pre-carriage

Description of the problem/method

In the opinion of one large operator it would be possible to improve the capacity utilization of intermodal trains if the pre-carriage could be handled in a more flexible manner.

If shortly before departure it becomes clear that a train will not be able to run at a maximum train capacity, the operator will contact some of his customers and inquire whether additional loads are available. In many cases there are additional loads available so that the train capacity could actually be utilized more effectively. However, the actual loading of these additional units cannot be carried out because there is no capacity available for the pre-carriage. The goods which would improve the train capacity utilization are available but cannot be brought to the train.

If more capacities could be made available in the pre-carriage at short notice, the capacity utilization of trains with a low utilization rate could clearly often be improved.

Currently there is no solution to this problem. Attempts would have to be made to handle the pre-carriage in a more flexible manner which would facilitate the availability of capacities at short notice.

Market segment currently affected

This problem was reported by an operator who mainly carries out continental transports.

Conditions / necessary boundary conditions for the application of this method

Sufficient capacities in pre-carriage can be made available at short notice (within a few hours).

Assessment of the transferability to other operators

Principally the situation described above applies to all operators and all bigger terminals.

3.3.10 Precise preplanning and monitoring of the entire transport chain of maritime consignments

Description of the problem/method

At the moment maritime transports do not involve any precise preplanning of the transport chain of every single consignment with regard to time. When a container is unloaded from a ship, it has not been decided in advance onto which train it will be loaded.

According to experts, the shipping companies tend more and more towards a meticulous planning of the transport chain of every single maritime consignment. This would mean that when a container is loaded onto a ship, maybe even prior to that, it has already been determined on which train it will be loaded on arrival at the destination port.

This trend would facilitate a planning of the train capacities at a much earlier time and altogether simplify it. This, in turn, would lead to an improved capacity utilization of the trains.

Market segment currently affected

The ideas discussed above refer to maritime transports.

Conditions / necessary boundary conditions for the application of this method

Every single maritime consignment has to be precisely planned with regard to time.

Assessment of the transferability to other operators

All sea port hinterland transports would be affected by the development described above.

3.4 Risk sharing

The following two examples refer to the question of the sharing of the financial risk for the operation of the train.

3.4.1 Sale of slots

Description of the problem/method

Some operators sell fixed slots on the trains on individual services. This means that a fixed part of the train has been sold to a customer for a longer period of time. This customer also carries the capacity utilization risk for this part of the train. Of course a customer is only likely to buy such a slot, if he is relatively certain that he is capable of filling this part of the train to its full capacity.

The problem for the operator with regard to these slots is that consignments which were intended for this slot might be delayed during pre-carriage. Whereas a train without slots which is loaded with existing consignments according to the first-in-first-out principle could be loaded and then depart, a train with sold slots has to wait for the delayed consignments. Consequently, the operational flexibility is partly limited.

When slots are sold, the capacity utilization risk for a part of the train is transferred from the operator to the customer. Since the customer has a more direct access to the consignments than the operator, the sale of slots can result in an improved capacity utilization of the trains.

Market segment currently affected

The sale of slots is currently used in the continental and maritime segments.

Conditions / necessary boundary conditions for the application of this method

To be able to sell slots, there has to be a customer with high and regular volumes who is prepared to take on a part of the capacity utilization risk – and in return receive a more favorable transport price.

Assessment of the transferability to other operators

If such a customer can be found, the sale of slots can be used by all operators.

3.4.2 Sharing of capacity utilization risk between different operators

Description of the problem/method

In order to reduce the risk which an individual operator of an intermodal train has, the marketing of trains is sometimes shared out between several operators. In addition to reducing the risk – while reducing the chances of profit at the same time – it is possible to balance out the capacity utilization between the different operators. If an operator cannot fill his part of the train, there is a chance that one of the other operators has excess consignments or is capable of acquiring consignments at short notice. Since there are several operators to acquire freight for the train, the likelihood of a satisfactory capacity utilization is greater than in the case of only one operator.

Market segment currently affected

At the moment the sharing of trains between several operators is mainly done in maritime transports.

Conditions / necessary boundary conditions for the application of this method

This method is suitable for services with a less heavy demand. Because of the reduction in risk, it is also particularly suited for the establishment of new services on weak markets or even “niche-markets”.

Assessment of the transferability to other operators

The shared operation of trains seems expandable in particular on services with less demand.

3.5 Hardware

The two features described below refer to the lack of capacity in many terminals and to the problem of harmonization between different types of wagons on the one hand and different types of swap bodies and containers on the other hand. For these problems, no real solutions currently exist.

3.5.1 Reducing overload of terminals

Description of the problem/method

According to the operators the overload of terminals often results in sub-optimal use of train capacity. In case of terminal congestion, a complete unloading and loading of the train might no longer be possible within the set timeframe. Consequently, it might not be possible to load all scheduled units onto a train. These problems mostly occur at the terminals during peak hours – early in the morning.

Apart from the possibility of extending the terminal facilities, which would be an expensive measure, one operator described a system that would rectify the road and loading related problems of the terminals. In a big terminal a bonus-malus system was introduced for the collection of intermodal units. For a collection within the first three hours after the time of availability a high bonus was given, for collection between 3 and 24 hours a lower bonus was given. The aim of the system was to have consignments collected as soon as possible. In many cases intermodal units arriving during the off-peak hours by train are collected during the peak hours the following morning. Thanks to this bonus-malus system the peak could be leveled off and the capacity bottlenecks in the terminal were relieved.

A collection by night, which in the case described is rewarded with a bonus of 26 €, also has a positive effect on the capacity of the terminal.

Market segment currently affected

The system described above to relieve terminal capacity is being employed by an operator mainly involved in international continental transports.

Conditions / necessary boundary conditions for the application of this method

The above-mentioned method is suitable for terminals which are working close to their capacity limit. A collection by night is only feasible for terminals which are not situated near residential areas and also have a sufficient volume to warrant night time operation.

Assessment of the transferability to other operators

Although an introduction of a bonus-malus system for the collection of loading units in the terminal leads to slightly more administrative work, it does appear to be a relatively simple method of reducing peak loads.

3.5.2 Flexible adaptation of the wagon fleet to types of consignments

Description of the problem/method

The large variety of consignments in intermodal transport call for a variety of intermodal freight cars. (e.g. trailers require pocket wagons). Different sizes of intermodal units require intermodal freight cars of a varying length to secure an efficient use of the train length.

The need for different intermodal freight cars complicates the loading of the train. If, for example, there are many freight cars for high-cube containers in the train set, these will incur considerably higher costs than standard wagons (rental charges twice as high as standard intermodal freight cars). In addition, the payload of freight cars for high-cube containers is lower than standard freight cars, which is why heavy consignments might have to be rejected.

Because of the different wagon types required, the capacity utilization risk is split into different parts of the train and thereby increased.

Apart from the problem of wagon provision at different places, many operators also use the time when the shuttle trains are not running to exchange wagons, e.g. a short-term exchange of a standard intermodal freight car for an intermodal freight car for high-cube containers. This can only be done if the required intermodal freight car for high-cube containers can be taken from another train set or is being stored in the terminal.This requires a fleet management process and available rolling stock but seems difficult due to the general complexity of fleet management and the cost associated to unused rolling stock.

Other operators have decided to specialize in specific types of consignments (cf. low-price trains).

Apart from the possibility of changing the train set at short notice there is – at least in theory – the option of employing or developing a versatile intermodal freight car.

As regards the high cube issue, there might be also the long-term possibility on specific axis of making the use of the expensive wagons for high-cube containers superfluous by extending the loading gauge.

Market segment currently affected

All market segments in intermodal transport

Conditions / necessary boundary conditions for the application of this method

One can see different options to deal with this problem

- Availability of the required wagon at the right place, shunting vehicles with personnel, sufficient time slots for the shunting, suitable infrastructure for the shunting in terminal.
- The development of versatile intermodal freight cars.
- The long-term extension of the loading gauge on at least the most important axes of intermodal transport.

Assessment of the transferability to other operators

The first option can principally be employed by all operators. The other options are very cost intensive and can only be applied in specific cases.

3.6 Fully developed capacity management system

Description of the problem /method

The only known computer-aided system for capacity management was developed by Kombiverkehr and was just about to be put into operation when the interviews for this report were being held.

Kombiverkehr sees itself as the operator of a complex intermodal train network which serves more than 400 terminals with approx. 120 trains on a daily basis. By connecting trains in different terminals about 6,000 different services can be offered every day. The network could be extended to more than 68,000 services with the existing trains.

In order to optimize this complex network, a computer system was developed to enable the operator, when applying different optimization options:

- to provide the customers with reliable information on the transport time,
- to improve the reliability of the service,

- to reduce buffer times and thus to be able to offer more attractive transport times and
- to use the existing vehicle resources in a more optimal way, i.e. transport more shipments with the same amount of trains and wagons.

The system is capable of taking the following parameters into consideration:

- reservations and bookings,
- type, dimension and weight of the consignments,
- train timetables,
- location and type of wagons used,
- plans of action of the different wagon groups,
- possible loading scheme of the wagons,
- maximum length and weight of trains.

The following aspects are optimized:

- Capacity utilization of the network, i.e. active control of every single consignment in the network from the terminal of origin to the terminal of destination including a consideration of different possible routes. Every consignment is allocated a capacity in the network at the time of the booking.
- Capacity utilization of the wagon fleet. The objective is to provide the optimal wagon composition (number, type of wagon) which is best suited to the different consignments for every train.
- The loading of the trains, i.e. the distribution (among a large number of possible options) of the different consignments on the different types of wagons on a train which allows the greatest possible capacity utilization.

The system has to take into consideration that a train might not run with the same wagon set all the way and that groups of wagons can be booked or cancelled. For this purpose a train journey which serves several terminals is split up into production legs between two terminals. Every production leg is then allocated different wagon types within a train with information on type and loading options.

During the booking the system checks every production leg used by every con-signment for availabilities by means of the capacity corridor and available capacities are then booked for this consignment. If there are no availabilities on the direct route or on the fastest service, the system will look for alternative routes. If, for instance, a consignment is to be sent from Hamburg to Verona, this can be done directly or via Ludwigshafen. The system will trace the possible services, check the transport times as well as availabilities. The important aspect is to be able to supply the customer with reliable information in advance as to when he can expect his consignment to arrive. Based on this information, the customer can decide whether or not to send his consignment by intermodal transport. The system information has to be so reliable that the consignment will arrive neither too late nor too early[2].

Another use for the system is the control of the entries to a gateway. For example from different directions in the north (e.g. Duisburg) wagon groups on trains run towards the terminal Wels. In Wels the wagon groups are bundled with trains to Vienna. Already when the customer in Duisburg makes his booking, the capacity of the production leg Wels – Vienna is checked and reserved to avoid a situation in which the consignment is transported from Duisburg to Wels on time but then has to be stored aside since the train Wels – Vienna is already booked out.

Based on regular estimates of consignment volumes, the system is capable of optimizing the supply of the different wagon types for a number of different trips. On the basis of the annual train timetables and the demand estimates, a revised production plan is created every 4 to 6 weeks to ensure that the required amounts of wagons and types of wagons are on the right round trip at the right time. This, in turn, will guarantee that the greatest-possible number of consignments can be transported with an optimal capacity utilization of the wagon fleet.

To conclude, the system is capable of adapting the production to the demand. This is done by taking the market economy into account. The proceeds from the transport of the consignments are compared with the costs incurred by the supply of resources. The production can then be optimized with a view to reach the highest possible proceeds.

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[2] In particular in the case of maritime consignments storage charges will have to be paid if a consignment reaches the terminal earlier than expected.

Market segment currently affected

Kombiverkehr intends to employ this system mostly for continental transports as these are very sensitive with regard to transport time, but also for maritime transports.

Possible improvement of capacity utilisation

The operator of the system assumes that approx. 5 to 10 % more consignments can be transported on the same amount of trains. The increase in productivity depends on the extent to which the system is integrated to a network and on the consignment volume on the corridor in question. The denser the train network – i.e. the more possible routes there are for an origin-destination link –the greater the consignment volume and the greater the increase potential for the capacity utilization of the entire system.

Conditions / necessary boundary conditions for the application of this method

The advantages of the computer-aided capacity management system only play a role if a network system is to be controlled. In particular the option of sending consignment via different routes makes a capacity management system useful.

Assessment of the transferability to other operators

Since a lot of intermodal operators appear to be tending towards shuttle trains (line production system) rather than close-meshed train systems, the use of such a computer system or a comparable one by other operators is not to be expected in more than a few individual cases.

Nevertheless, specific components of the capacity management system can be applied to various operators with different types of production systems (e.g. wagon management system can also be applied on shuttle services).

4 IMPACT OF CAPACITY MANAGEMENT FEATURES ON RAILWAY UNDERTAKINGS

One way for operators to react to fluctuations in demand is the short-notice booking or cancellation of

- traction (engine and engine driver),
- wagons,
- slots.

Which of the above can be cancelled at short notice depend on whether or not the operator is working with his own or rented vehicles and whether or not these vehicles have been ordered from the railway company.

If for example the operator uses locomotives, which he has leased himself, it is not possible to cancel the traction at short notice. The fixed costs for the locomotive also arise when the train is cancelled and only the personnel and energy costs can be saved to certain extend. For an operator who has ordered the entire traction from the railway company a cancellation makes itself financially much more felt.

Most operators are using their own or long-term rented wagons. In these cases a short-notice cancellation is usually not reasonable. In the opposite case of a shortcoming of wagons they rent additional wagons for a short period of time for short-term demand peaks, if available.

Slots can always be cancelled – on the terms described in detail further below – if the demand for a train is too low. Conversely, so-called slots on demand can be booked for an additional train – if these are available at the time of the booking. Or a train is used operatively for a short period, i.e. it runs without a pre-planned slot.

Who pays the costs of flexibility?

The question is, of course, who is going to pay the costs of the short-notice bookings and cancellations of the different components. Will these costs be borne by the operator and therefore the customers in the end, or will a part of the costs remain with the railway company or the infrastructure company.

As already described above, when discussing this question one has to differentiate between the three components traction wagon and slot.

If an operator employs his own, leased or long-term rented locomotives and/or wagons, he himself carries the risk for the capacity utilisation of these vehicles. Thus he also carries the fixed costs which are incurred whether or not the train actually runs.

Most of the large operators, on the other hand, order the traction from railway companies. In fact there is growing tendency among operators to put out a tender for traction services. One operator, for example, puts out a tender for every train in a timetable period and therefore purchases traction from different railway companies.

If an operator withdraws a train and therefore cancels the traction, it is important for the railway company to find out whether or not it can sell this traction to some-one else.

As regards the use of the slots, it is considerably more difficult. In short term, usually the cancelled slots cannot be reallocated to other trains.

Most of the railway companies try to charge differentiated cancellation fees to the operator (cf. example in table 4.1 below).

Table 4.1:
Example for differentiated cancellation fees

Cancellation	Fee (% of train costs)
>= week	no fee
< 1 week; > 72 h	10 %
< 72 h; > 48h	30 %
< 48h; > 24h	50 %
< 24h	100 %

In the course of the interviews with the railway companies it became clear that the procedures concerning cancellation of services are not uniform both as regards the railway companies but also as regards the customer.

Most interview partners stated that the applicability of cancellation fees depends on

- the market position of the customer,
- the relation (e.g. international services require harmonized cancellation fees and application rules),
- the responsability for the cancellation (e.g. if a cancellation of an outbound train is necessary due to the delay of an inbound train),

A number of railway companies admitted that at least in some cases the costs incurred because of a cancellation cannot be fully passed on to the customer, i.e. the operator. One representative of a railway company stated that "the decision to charge cancellation fees to an operator has to be seen under the light of the wider commercial relationship with the customer. Thus, in many cases the railway companies bears the costs of the flexibility.

Short-term and long-term programmes

In most cases the railway companies and the operators agree on an annual time-table which is updated through monthly to quarterly programmes. In an annual timetable the different fluctuations in volume can only partly be taken into consideration. Instead these are taken into consideration through monthly to quarterly updates or through additional bookings or cancellations at short notice.

When asked about the frequency of short-notice cancellations, the answers of the railway companies varied between "less than 10 %" (especially for shuttle trains) and "15 % - 20 %".

Volume commitment

In order for the railway companies to be able to calculate the risks of possible cancellations, haulage contracts for international combined transport trains often contain a commitment from the operator to run a certain number of trains per year.

Railway companies very often surcharge operators for booking services additionally at short notice. On the one hand they do so in order to compensate for the increased availability of resources required from them as well as for the lower capacity utilisation reliability. On the other hand, they do so also to prevent customers from underestimating their needs and yet placing large additional orders in the longer run. To a certain extent it prevents the customer passing the capacity risk back to the railway.

One railway company admitted that many operators still enjoy a number of established rights from the time where the railway was a state-owned company and that this enabled operators to cancel services at very short notice and with favorable conditions. The railways are trying to "organize" cancellations and only accept cancellations without penalties if they are asked within an acceptable timeframe, this being often laid down contractually.

Differences between continental and maritime transports

All railway companies interviewed replied that there was no significant difference between continental and maritime transports with regard to the frequency and time-frame of cancellations of services.

Result

The interviews revealed that the costs of a cancellation are – in theory - mainly passed on to the operators. However, a part of these costs also remain with the railway companies or infrastructure companies.

5 EVALUATION OF FEATURES IN TERMS OF APPLICABILITY, TRANSFERABILITY AND IMPACT ON NETWORK CAPACITY

The following tables present for each of the described features under Chapter 3 a standardized assessment of their applicability and transferability and a qualitative assessment of their impact on the network capacity. All features are briefly described as concerns the basic idea, the expected effect and the conditions required. The assessment is based on the following criteria:

- Assessment of the **applicability** of the feature to the market. “Low” applicability means that this feature was discussed with the intermodal operators as a theoretical model, but due to practical reasons the applicability was felt to be low (cf. 3.2.3 Price differentiation for consignments with varying priorities), whereas “high” applicability means that this feature could be easily applied if the conditions are fulfilled (c.f. 3.3.4 Short notice booking or cancellation of trains).
- Assessment of the **transferability** of the feature to other markets or operators “Low” transferability means that the feature requires very specific conditions (cf. 3.3.7 Direction-dependent combination of maritime and continental transports), whereas “high” transferability means that this is a common feature more or less independent from the market/operator and could easily be transferred if the conditions are fulfilled (cf. 3.3.3 multiple daily departures).
- Assessment of the **impact on the network capacity.** “Low” impact means that this feature impacts the use of capacity in general in a positive way but the quantitative effect on the rail network is relatively low at least in short term (cf. 3.2.5 Penalties for late cancellations (now show)). An example of a “high” impact could be the direction-dependant combination of maritime and continental transports (cf. chapter 3.3.7).

As pointed out in chapter 2, it was not possible to quantify for each feature its impact on network capacity. Thus, in the following a qualitative assessment was carried out. It is evident that every qualitative approach has its inherent weaknesses; nevertheless we found that such an approach seems worthwhile with respect to a possible ranking of the features by the operators willing to implement some of the features.

5.1 Features concerning booking procedures and types of services

Last minute prices Cf. chapter 3.2.1		
Basic idea:		Similar to air traffic, remaining space on the train could be sold at a low price at short notice
Expected effect:		Higher use of capacity on an existing train
Conditions:		No particular conditions required
Applicability:	Low	In theory small customers using last minute prices pay less than high volume customers
Transferability:	High	No specific conditions required
Impact on the network capacity	Low	Feature may help to raise the use of capacity on an existing train that runs in either case

Standby bookings Cf. chapter 3.2.2		
Basic idea:		Load units stored close to or in the terminal will be shipped if empty space on the train is available
Expected effect:		Higher use of capacity on an existing train, especially at off-peak days or seasons
Conditions:		Regular flows with high volumes or very low priority Storage capacity in the terminal area
Applicability:	Medium	If conditions are fulfilled, the feature can easily be applied
Transferability:	Medium	If conditions are fulfilled, the feature is independent from the market and the operator
Impact on the network capacity	Medium	Feature helps to avoid cancellation of trains at off-peak periods (hours, days, seasons) The feature helps to avoid spot trains to ship the overflow of load units

Price differentiation for consignments with varying priorities Cf. chapter 3.2.3		
Basic idea:		Offering different prices for different departures of shipments with varying priorities
Expected effect:		Peak demand could be leveled off and the use of capacity of the departures during a week could be distributed equally
Conditions:		Customers are willing to prioritize their shipments Storage capacity in the terminal area
Applicability:	Low	Relatively complicated to implement Requires additional space in the terminal
Transferability:	Medium	If conditions are fulfilled, the feature is independent from the market and the operator
Impact on the network capacity	Medium	Feature helps to avoid cancellation of trains at off-peak periods (hours, days, seasons) The feature helps to avoid spot trains to ship the overflow of load units

Price differentiation in the case of an extended service Cf. chapter 3.2.4		
Basic idea:		Inhabitant risk in the case of service extensions is the cannibalization of the existing services. Operator offers an additional departure at a lower quality and a lower price
Expected effect:		Clients depending on shorter transit time stay with the original service Exceeding load units will be shipped with the low price service New clients with less priority shipments are attracted by the lower price After the start up phase the low price/low quality service will be upgraded
Conditions:		Shipments with different priorities Regular exceeding demand on the existing services below break-even for an additional service Possibility to implement an additional service at a lower price and quality
Applicability:	Medium	Requires specific conditions
Transferability:	Medium	If the conditions are fulfilled, the feature could be advantageous for intermodal operators present at the forwarder market
Impact on the network capacity	High	The feature helps to level off peaks in the utilization of the network capacity The feature helps to avoid spot trains

Penalties for late cancellations (now show) Cf. chapter 3.2.5		
Basic idea:		Penalties for no show or cancellation at short notice
Expected effect:		Compensation for the incurred financial damage of the operator Discourage the customer from repeatedly failing to deliver its consignment
Conditions:		No particular conditions
Applicability:	Low	In practice, almost impossible to implement
Transferability:	Low	Problems to implement independent from market
Impact on the network capacity	Low	The feature helps to avoid suboptimal use of the capacity on the train that runs in either case

Time buffers of one day on long distances Cf. chapter 3.2.6		
Basic idea:		The transit time is A/B, but the operator offers a A/C service to his client
Expected effect:		Additional flexibility for the operator
Conditions:		Daily departures with day A/day B service Clients accept day A/day C services
Applicability:	Medium	Requires specific conditions
Transferability:	High	If the conditions are fulfilled the feature can be applied by other operators
Impact on the network capacity	Low	The feature helps to avoid suboptimal use of the capacity on the train that runs in either case

5.2 Features concerning operational procedures

Gateway systems Cf. chapter 3.3.1		
Basic idea:		In Gateway terminals shipments are transferred between services
Expected effect:		Gateway systems help to bundle shipments on a service Via Gateway systems it is possible to offer a network to the client
Conditions:		The Gateway systems requires a terminal network The market situation has to allow for additional handling costs
Applicability:	Medium	Requires specific conditions
Transferability:	High	If the conditions are fulfilled the feature can be applied by other operators
Impact on the network capacity	High	Gateway systems allow regular services with sufficient use of capacity on the train Gateway systems help to balance peak and off-peak periods

Hub systems Cf. chapter 3.3.2		
Basic idea:		In hubs, shipments are transferred between services
Expected effect:		Hubs help to bundle shipments from different origins on a service to one destination and v.v. Via hubs it is possible to offer a network to the client
Conditions:		Sufficient large terminal or shunting yard The amount of consignments shipped via a hub has to justify the expensive operation
Applicability:	Low	Hubs require specific conditions
Transferability:	High	If the conditions are fulfilled the feature can be applied by other operators
Impact on the network capacity	High	Hub systems allow regular services with sufficient use of capacity on the train

Multiple daily departures Cf. chapter 3.3.3		
Basic idea:		Like a conveyor belt, consignments can be loaded on the next free space on the train. On services with high volumes and multiple daily departures load units can be shipped on different trains.
Expected effect:		Multiple daily departures offer the greatest flexibility to the operator
Conditions:		Sufficient volumes on an axis
Applicability:	High	If the conditions are fulfilled the feature can be easily applied
Transferability:	High	If the conditions are fulfilled the feature can be applied by other operators and/ or in other markets
Impact on the network capacity	High	Multiple daily departures on high volume axis allow for maximum use of the capacity on the train, but require sufficient capacity on the network

Short notice booking or cancellation of trains Cf. chapter 3.3.4		
Basic idea:		Operators react to short term fluctuations in demand with short notice booking or cancellation of trains
Expected effect:		Greater flexibility
Conditions:		Existing regulations with railway undertakings
Applicability:	High	All operators are using this feature
Transferability:	High	All operators are using this feature
Impact on the network capacity	High	

A combination of heavy and voluminous transports and a combination of conventional freight wagons and intermodal wagons Cf. chapter 3.3.5		
Basic idea:		By combining heavy and voluminous transports and/or conventional and intermodal wagons operators look to reduce short trains
Expected effect:		Reduced use of capacity on the network
Conditions:		Combining heavy and voluminous goods requires additional organizational efforts in the terminals Terminals for intermodal traffic and sidings for conventional traffic must be close to each other
Applicability:	Medium	If the conditions are fulfilled the feature can be easily applied
Transferability:	Medium	If the conditions are fulfilled the feature can be applied by other operators and/ or in other markets
Impact on the network capacity	High	The feature avoids intermodal trains with low use of capacity due to weight restrictions By combining intermodal and conventional traffic the number of trains can be reduced

Filling up of trains from maritime transports with continental transports (and v.v.) Cf. chapter 3.3.6		
Basic idea:		Free space on trains will be filled with load units from the other market
Expected effect:		Improved use of capacity
Conditions:		Suitable access to the terminals for both types of units
Applicability:	High	If conditions are fulfilled the feature is easily applicable
Transferability:	Medium	The feature requires specific conditions
Impact on the network capacity	High	One full train instead of two trains with a suboptimal use of capacity.

Direction-dependent combination of maritime and continental transports Cf. chapter 3.3.7		
Basic idea:		Balance direction to make up for unbalanced goods flows
Expected effect:		More than 90 % use of capacity both ways, even though flows are completely imbalanced
Conditions:		Sufficient volumes of continental and maritime shipments in opposite directions Terminals for intermodal traffic and sidings for conventional traffic must be close to each other
Applicability:	Medium	The feature requires specific conditions
Transferability:	Low	The feature requires specific conditions
Impact on the network capacity	High	Optimal use of capacity on the network

Low price trains Cf. chapter 3.3.8		
Basic idea:		Standardization on each level (services, wagons, load units) allows for a low price offer
Expected effect:		High use of capacity Opening medium distances for intermodal transports Efficient organization of intermodal transports
Conditions:		Sufficiently high volumes of standardized units
Applicability:	Medium	Only for operators shipping standard load units
Transferability:	Medium	Feature is only applicable on maritime markets and shipper markets with own load units
Impact on the network capacity	High	If the conditions are fulfilled, the feature allows nearly 100 % use of capacity

Flexibility in pre-carriage Cf. chapter 3.3.9		
Basic idea:		A filling up of free space on a train is often impossible due to the non-availability of trucks for the pre-carriage
Expected effect:		Higher availability of truck capacity at short notice could improve the use of capacity on the train
Conditions:		Availability of trucks for pre-carriage at short notice
Applicability:	Low	Feature requires a certain stock of trucks for flexible use
Transferability:	High	Feature is independent of the market
Impact on the network capacity	Low	Feature helps to improve the use of capacity on trains that run in either case

Precise preplanning and monitoring of the entire transport chain of maritime consignments Cf. chapter 3.3.10		
Basic idea:		The use of capacity on the train could be improved by monitoring shipments from the very beginning
Expected effect:		More time for capacity planning allows for a better use of the capacity
Conditions:		This feature requires information and planning procedures and tools
Applicability:	High	If the conditions are fulfilled the feature can easily be implemented
Transferability:	Medium	The feature is only applicable on the maritime market
Impact on the network capacity	Medium	The feature could improve the use of capacity on trains in the maritime market, which in most cases don't suffer of suboptimal use of capacity

5.3 Features concerning risk sharing

Sales of slots Cf. chapter 3.4.1		
Basic idea:		Transfer of the capacity risk to the customer
Expected effect:		Suboptimal use of capacity doesn't lead to financial losses for the operator in the short term.
Conditions:		Customers willing to share the risk
Applicability:	High	If such customers could be found
Transferability:	High	This feature is independent from the market of the operator
Impact on the network capacity	Low	This feature helps the operator reach the break even point for an existing service

Sharing of capacity utilization risk between different operators Cf. chapter 3.4.2		
Basic idea:		Different operators share the capacity on one train
Expected effect:		Balancing the use of capacity on a train
Conditions:		Operators willing to share the risk
Applicability:	Low	This feature requires customers with the same interest
Transferability:	Low	This feature is used so far mainly in the maritime market
Impact on the network capacity	Low	This feature helps each operator to reach the break even point for an existing service

5.4 Features concerning the hardware

Reducing overload in terminals Cf. chapter 3.5.1		
Basic idea:		Suboptimal use of capacity is often due to the overload in terminals, when load units can not be loaded on time. With a bonus-malus system operators set incentives to collect load units as soon as possible
Expected effect:		The feature helps to avoid having units on handdue to capacity bottlenecks
Conditions:		Terminals working at the capacity limit Terminals located far from non residential areas (for overnight collection)
Applicability:	High	If conditions are fulfilled the feature is easily applicable
Transferability:	High	This feature is independent from the market of the operator
Impact on the network capacity	Low	This feature helps to improve the use of capacity on trains that run in either case

Flexible adaptation of the wagon fleet to types of consignments Cf. chapter 3.5.2		
Basic idea:		A suboptimal use of the capacity on the train is sometimes due to the mismatch between unit and wagon.This feature enables to rearrange the wagon set
Expected effect:		Avoid empty slots on the train
Conditions:		Availability of wagons, engines for shunting and engine drivers , suitable infrastructure for shunting
Applicability:	Low	The feature needs specific conditions The feature complicates intermodal traffic
Transferability:	High	The feature is independent of the market
Impact on the network capacity	Medium	The feature helps to improve the use of capacity on the train, but requires additional use of rail capacity in the terminal area

5.5 Fully developed capacity management system

Fully developed capacity management system Cf. chapter 3.6		
Basic idea:		With a fully developed EDP-supported capacity management system (CMS) it is possible to • to provide the customers with reliable information on the transport time, • to improve the reliability of the service, • to reduce buffer times and thus to be able to offer more attractive transport times and • to use the existing vehicle resources in a more optimal way, i.e. transport more shipments with the same amount of trains and wagons.
Expected effect:		The operator assumes that approx 5 – 10% more consignments can be shipped with the same amount of trains
Conditions:		Availability of an EDP supported CMS tool
Applicability:	Medium	The system requires specific conditions
Transferability:	Medium	The system requires important investments
Impact on the network capacity	High	The system allows for an almost 100% use of capacity

6 ANNEX 1: SYNPOTIC OVERVIEW OF THE FEATURES

In the following table all features, described in the chapters above, are presented in a synoptic overview. Where

- Column 1 = Chapter, where the feature is described in detail
- Column 2 = Feature
- Column 3 = Conditions/necessary boundary conditions for the application of this method
- Column 4 = Market segments currently affected
- Column 5 = Assessment of the **applicability** of the feature to the market.
- Column 6 = Assessment of the **transferability** of the feature to other markets
- Column 7 = Assessment of the **impact on the network capacity**.

1 Chapter	2 Features	3 Conditions	4 Market segment currently affected	5 Applicapability "3" = high "2" = medium "1" = low	6 Transferability "3" = high "2" = medium "1" = low	7 Impact on network capacity "3" = high "2" = medium "1" = low
	Features concerning booking procedures and types of services					
3.2.1	Last minute prices	No particular conditions required	All segments	1	3	1
3.2.2	Standby bookings	Sufficient volume of consignments with low priority Suboptimal use of capacity on particular trains	All segments	2	2	2
3.2.3	Price differentiation for consignments with varying priorities	Efficiency in the Terminal operation	All segments	1	2	2
3.2.4	Price differentiation in the case of an extended service	Lacking capacity on existing services Overflows not sufficient for a extension of existing services	Forwarder market with line production system	2	2	3
3.2.5	Penalties for late cancellations (no show)	No particular conditions required	All segments	1	1	1
3.2.6	Time buffers of one day on long distances	Daily services with day A - day B quality Customers acceptance of day A - day C quality	Forwarder market with line production system	2	3	1
	Features concerning operational procedures					
3.3.1	Gateway system	Market situation has to allow for additional handling costs	Maritime market and forwarder market	2	3	3
3.3.2	Hub system	Sufficiently large terminal or a shunting yard in a suitable position	Maritime market and shipper market	1	3	3
3.3.3	Multiple daily departures	High volume axis	Forwarder and maritime market	3	3	3
3.3.4	Short-notice booking or cancellation of trains	Regulations with railway undertakings	All segments	3	3	3
3.3.5	A combination of heavy and voluminous transports and a combination of conventional freight wagons and intermodal wagons	Terminals for intermodal traffic and sidings for conventional trafic must be located close to each other	At the moment this is only done occasionally	2	2	3
3.3.6	Filling up of trains from maritime transports with continental transports and v.v.	Suitable access to the terminals for both types of units	All segments	3	2	3
3.3.7	Direction-dependent combination of maritime and continental transports	Sufficient volumes of continental and maritime shipments in opposite directions Terminals for maritime trafic and sidings for conventional trafic must be located close to each other	All segments	2	1	3
3.3.8	Low price trains	Sufficiently high volume of standard units	Maritime market	2	2	3
3.3.9	Flexibility in pre-carriage	Sufficient capacities for the pre-carriage	All segments	1	3	1
3.3.10	Precise preplanning and monitoring of the entire transport chain of maritime consignments	Sufficient planning tools	Maritime market	1	2	2
	Features concerning risk sharing					
3.4.1	Sale of slots	Customers willing to share the capacity utilization risk	All segments	3	3	1
3.4.2	Sharing of capacity utilization risk between different operators	Operators willing to share the capacity utilization risk	Maritime segment	1	1	1
	Features concerning the hardware					
3.5.1	Overload of terminals	Terminals working at the capacity limit Terminals far from residential areas	All segments	3	3	1
3.5.2	Flexible adaptation of the wagon fleet to types of shipments	Availability of wagons, engines for shunting and engine drivers, suitable infrastructure for shunting	All segments	1	3	2
	Fully developed capacity management system					
3.6	Fully developed capacity management system	Availability of an EDP supported CMS tool	Forwarder market with network production system	2	2	3

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