40 years of Road-Rail Combined Transport in Europe

From piggyback traffic to the Intermodal transport system

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Preface

The development of combined transport road-rail in Europe can be regarded as very impressive. In the decades that have been passed until today, only some minor delays have interrupted the continuous increase of combined transport. Only the global economic crisis in 2008/2009 - that had followed the financial crisis – brought an intermediate downwards development that has meanwhile turned again into growth. Since 1970 the transport volume of combined transport has increased by the factor 20.

History of combined transport road-rail is narrowly connected to the development of UIRR International Union of combined Road-Rail transport companies. The 40 years anniversary of UIRR appeared as an excellent chance to produce this book as a document underlining the contribution of this intelligent transport technique to sustainable mobility and drawing up the conditions of its further development.

Dr. Christoph Seidelmann looks back towards an excellent career that has been dedicated almost entirely to combined transport. So, he was the predestined author for such a book. We are glad that he has accepted this task. The result of the work is this book which is easy to read with all its illustrations.

I hope that you, as well, enjoy your time when reading this interesting study.

Rudy Colle
Chairman of the Administration Council of UIRR
Brussels, October 2010

From zero to 170 million tonnes
A European success story

In the late 1960s certain European railways sought a new market: combined road-rail freight transport, in which goods would be transported over the shortest possible distances by road before and after the main part of the journey by rail.

The best example was the USA, where some railway companies had begun loading laden semi-trailers onto rail wagons and transporting them over great distances by rail. In the destination area the semi-trailers would be driven down an end-loading ramp to road level and taken over by a semi-trailer truck, which would then take this loading unit to the consignee at destination. This process made it possible to reach customers with no connection to railway lines.

However, this transport process could not be transposed one to one into Europe. European semi-trailers are for the most part 4,000 mm high and the loading area of a normal railway flat wagon is generally 1,100 mm above the top of the rail. The rail wagon + semi-trailer unit would thus be 5,100 mm high in total and not fit through most European railway tunnels. To resolve this issue there are in principle four options:

1. Renouncement: Only accept low semi-trailers for this type of rail traffic; however, this would mean losing the major part of the market share.
2. Rolling motorway: Build rail wagons with extremely small wheels and a correspondingly low loading area, and only run on routes where relatively large tunnels and bridges provide a sufficient loading gauge; however, this solution often requires more technical expenditure and increases the cost of operations, although it is simpler to organise than the options set out hereafter.

RoLa train moving forward

3. Pocket wagon: Rather than running the semi-trailers onto the rail wagons, carry out the operation with a crane. In this case the

Semi-trailer on pocket wagon

semi-trailer's running gear is in a pocket, the bottom part of which lies between the rail axles and thus very low over the top of the rails. This option also entails running solely on routes with a generous loading gauge, as well as it being necessary that transhipment machinery capable of lifting a 30-tonne semi-trailer be available at the terminals at either end of the railway route. Moreover, the semi-trailers must be built to be resistant enough not to buckle in the middle during the lifting procedure.

4. Swap body: On the road vehicle, separate the load carrier from the chassis so that only the comparatively low HGV superstructure has to be transhipped. These superstructures are usually 2,700 to 3,200 mm high. They can be transported on most European routes with normal rail wagons. Nevertheless, this option also entails that there be a terminal with transhipment machinery capable of lifting roughly 30 tonnes at each end of the railway route, and the road haulage company must invest in a new system.

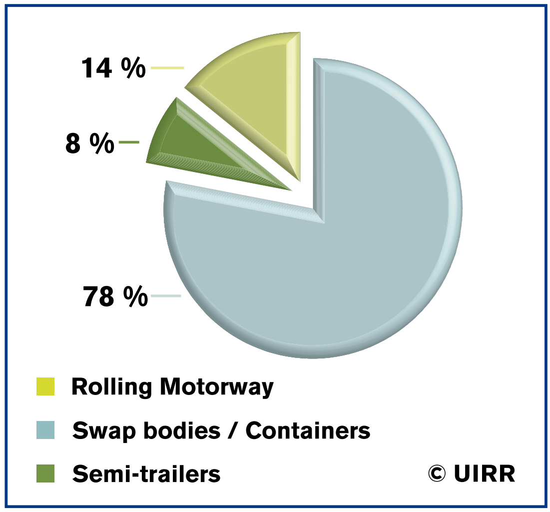
Swap bodies on platform wagon

In the following years option 2, 3 and 4 were implemented and at present (in 2009) combined road-rail traffic among UIRR companies consists of:

- 415,980 truckloads (= 14 %) on rail wagons with small wheels and low loading areas ("rolling motorways")

- 219,800 truckloads in semi-trailers (= 8 %), mostly transported on pocket wagons,

- 2,182,569 truckloads in boxes, i.e. swap bodies or containers (= 78 %), loaded on rail flat wagons.



Market shares of intermodal techniques in 2009

From 1968 onwards, at the same time as the development of combined road-rail transport began the golden age of containers in maritime traffic across the world. In 1982, 16 million 20-foot container units were shipped over oceans and seas across the globe, increasing to over 100 million in 2010 (details on this subject can be found in chapter

3). Experts in international standardisation saw to it that the technologies of container transport and those of European combined transport were to some extent compatible so that both could function in the same system. UIRR companies, which have a dominant position in combined road-rail traffic in Europe, also transport a major part of these containers from sea ports to inland destinations.

The container in intermodal traffic

The term "intermodal" encompasses all transport systems combining at least two different modes of transport, i.e. shipping (sea, inland waterways) and/or rail and/or road. There are two ways of achieving this: either the vehicle part which bears the load is designed to be removable from one vehicle and easily fitted onto another vehicle from another transport mode for further carriage, or the whole vehicle (or a significant part of it) is placed on a load-carrying vehicle in a different transport system to continue the journey by piggyback, so to speak.

Concretely, the first case constitutes a container transport system. The load, that is the objects to be transported, is held in a container approximately the size of an HGV superstructure. An articulated trailer train can carry two containers with around 40 m^3 of loading space each, and a semi-trailer can hold a container with roughly 80 – 100 m^3 of loading space. These types of containers are either ISO containers (see chapter 3) for world trade or European containers or swap bodies (see chapter 4).

Swap body transferred by grappler arm

Transhipment from one vehicle and transport mode to another is nearly always carried out vertically: the container is lifted, moved sideways and set down on another vehicle. Gantry cranes or lifting vehicles carry out this task. Gantry cranes mostly run on rails; however, certain gantry cranes have rubber

Transfer of an ISO container

Crane turning the container by 180°

tyres and can thus be used over the entire transhipment area, provided the bottom attachment can withstand the enormous wheel pressure. This is also valid for the use of lifting vehicles. When such a vehicle grasps and lifts a fully laden container, a load of over

Reach stacker

100 tonnes (=100,000 kg) may be exerted via the front axle on the bottom attachment of the transhipment area. The ground must be suitably resistant.

This necessary transhipment from one transport system to another constitutes the specific issue of intermodal transport systems. HGVs drive from A to B without any transhipment en route, and rail wagons run from siding to siding. Intermodal transhipment en route is thus an additional activity incurring additional costs, which must be offset by other aspects of intermodal traffic if such a transport system is to remain competitive. This is the main reason for which cost reduction, especially through automatisation, is the prime concern in intermodal transhipment.

In intermodal traffic, containers are handled automatically for important procedures: containers have an internationally standardised corner fitting on each of their eight corners, a cubical cast steel component with oval holes on the upper side and the two external sides. The transhipment device drives over the HGV with a container on its loading area. The telescopic framework ("spreader") of the transhipment device is positioned on the standardised container. Rotatable locks come out of the four corners of the framework, fitting precisely into holes in the corner fittings of the container. The framework descends over the container ceiling with small guiding plates ensuring precise positioning, so that the twist locks can quickly be fitted into the holes. The four locks are then turned 90° to fasten crane to container. The 90° turn is carried out hydraulically and lasts approximately one to two seconds.

The framework of the transhipment device and the container are now friction-locked together and the transhipment device can therefore lift the framework with the at

Container Terminal

tached container. The container is then lifted to its destination area and lowered onto it until stationary. The twist locks can now be removed and the spreader pulled back upwards. The transhipment device is now free to be used for other operations. The procedure may seem somewhat complicated, but with well-drilled staff it can be carried out very efficiently. The operational cycle usually lasts approximately three minutes. A crane operator tranships around 20 containers (practically up to 20 truckloads) per hour.

A block train made ready for departure

In transport on inland waterways it is not usually necessary to fasten the loading units in a particular way. Inland waterway vessels only make small longitudinal and lateral accelerations during their journeys, and vertical movement is only caused by swell, which is moderate in inland waterways. The weight of the loading unit is therefore sufficient in keeping it in place. Even empty containers weigh 2 – 3 tonnes each for example, and

Inland waterway vessel loaded with containers

their tare weight alone keeps them secure on inland waterway vessels.

The same does not apply to seagoing vessels. On rough seas a ship moves considerably in

Container loaded on deep water ship

all three directions and the containers on board must be fastened as well as possible. In addition, in their loading area container ships have a cell guide which is dimensioned according to the size of standardised containers. The containers are stacked in the cells to form stacks up to 6 – 9 containers high in the ship. Other containers are stacked on the deck (i.e. over the closed hatch covers). The stacks on deck are fastened particularly strongly.

The cell ship is in principle an efficient solution to the problem of maritime transport, but at the same time it constitutes the weakness of container traffic: if the length or width of standard containers were modified they would no longer fit into the ships' cells. New ships would need to be built, or old cell ships completely renovated. At present over US$ 50 billion have been invested in cells ships, 50 billion reasons not to modify the dimensions of containers, even if potentially better solutions were on offer. However, when loading on decks there is a greater degree of freedom as to the dimensions of the containers, as no cell guide with a fixed length and width is used.

Deep sea container ship

From standardised container to globalisation

Empty containers stacked

The development of container traffic is an economic success story practically unparalleled in the second half of the 20th century. Technical experimentation along with international standardisation brought about a revolution in world trade leading to the new balance among economic powers that we see today.

The history of the container-based transport system is characterised by compromises made by the many players from different sectors in terms of standardisation and technical decisions in the course of their cooperation within the ISO TC 104 standardisation committee.

In the beginning, that is between 1965 and 1970, this committee was facing what seemed like an impossible task: the future ISO container would have to be a transport tool accepted in all industrialised countries in the world while at the same time meeting the requirements of all three transport modes – sea/waterway, road and rail – in equal measure. For example there was the problem of resistance. The container had to be able to withstand all the usual stresses occurring during intermodal transport without becoming heavy and expensive to the point where it would no longer be economically viable. The container is attached to the rail wagon by means of its fastenings, which pass on the stresses caused by rail traffic to the structure of the container. But what are the

Container train made up for departure

stresses caused by rail traffic? In wagonload transport, the greatest stress is without doubt caused by impacts during shunting. However, such impacts vary according to the wagon type used by the railway and what operational programme is being implemented. In 1970 already, there were three different types of operation in the Federal Republic of Germany:

- Deutsche Bundesbahn (DB) transported containers partly on conventional rail wagons without impact absorbers but also on special wagons with long-stroke buffers.
- Some combined transport operators decided very early to develop a combined transport network using block trains or groups of wagons without underway shunting and, accordingly, without such stresses.
- DB Subsidiary Transfracht also provided container transport in wagonload traffic.

The ISO container grew increasingly successful and established itself as a transport concept, consequently its design also became the determining factor in interfaces with other transport systems: ISO experts set a prescription according to which the shunting impact of 7 g commonly applied among European railways in wagonload traffic could no longer be applied to containers. This put great pressure on European railways to adapt, as they could no longer hump shunt rail wagons laden with ISO containers; otherwise they had to ensure that the containers were only transported on wagons with long-stroke buffers. The railways soon embarked on this new course.

Standard dimensions of ISO containers

Nomination	Length		Width		Height	
	feet	m	feet	m	feet	m
20-foot container	20	6,10	8	2,44	8 ½	2,59
30-foot container	30	9,15	8	2,44	8 ½	2,59
40-foot container	40	12,20	8	2,44	8 ½	2,59
40-foot High cube	40	12,20	8	2,44	9 ½	2,89

On the basis of dimensions legally allowed in the 1970s in the USA and many European countries for road transport on HGVs and articulated vehicles, the dimensions of the container were standardised as given in the table.

However, standardised dimensions and resistance did not mark the end of the standardisation process: ultimately, world trade required that the right goods reach the right consignee in the right container, a task made difficult by the fact that all standardised containers looked alike. In order to monitor and manage container transport more efficiently, a system was developed and standardised for allocating an individual identity to each container. The procedure for allocating and managing these individual markings was developed by the International Container Bureau (BIC) in Paris together with ISO TC 104. ISO TC 104 and BIC developed the first worldwide system for identifying loading units in the trans

All containers are marked according to the standard

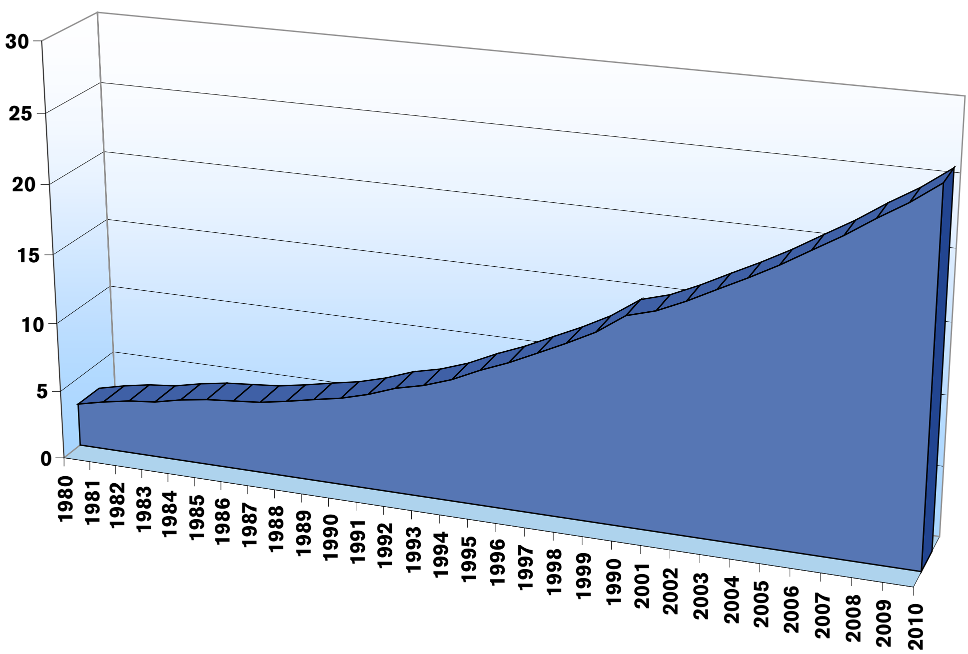
port chain which could function similarly with all carriers involved in intermodal transport. All ISO containers (and usually most non-ISO containers as well) are now marked as per ISO Standard 6346. There are over 20 million containers worldwide nowadays, every single one of which has an individual and unique marking in accordance with the ISO standard.

One problem occurring at interfaces remains as yet unresolved: the worldwide container transport system is not compatible with the European logistics system, which is based on standardised pallet units. The surface area of European pallets measures 0,8 x 1,20 m or 1 x 1,20 m; consequently vehicles carrying pallets must have an inner width of 2,44 – 2,45 m. ISO containers, with their inner width of 2,35 m, are slightly to narrow and are therefore poorly suited to optimum transport of European pallets.

However, it is clear that it is just as economically unfeasible to modify the basic dimensions of the container system as it is to change those of the pallet unit system. Moreover, with an increasing amount of intermingling of international trade flows due to market globalisation, this deficiency is often clearly felt. The European logistics sector therefore developed intermodal loading units which

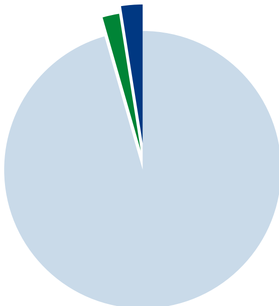
World container stock

In millions TEU (twenty foot equivalent units = the normal container number measurement)



Container stock in 2007

In million TEU



ISO containers	**23,70**
US inland containers	**0,45**
European inland containers and swap bodies	**0,63**

were optimised for the carriage of standardised pallet units with surface areas of 0,8 x 1,20 m and 1 x 1,20 m (details in chapter 4).

The two systems work in parallel. As ISO containers and European loading units use the same components in the transport and transhipment systems, frictional losses can be kept to a minimum.

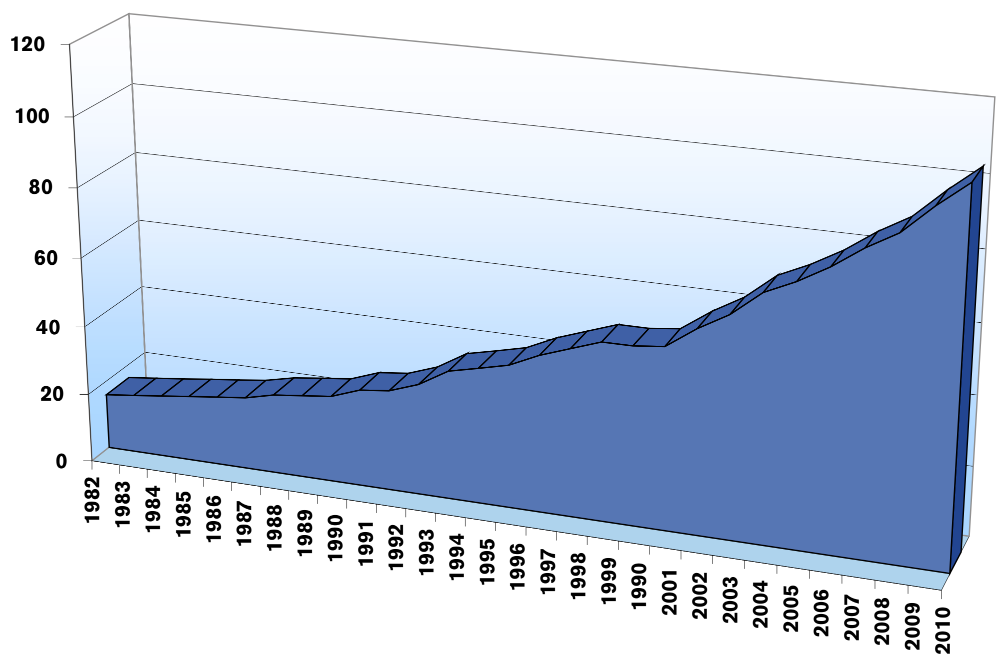
Standardisation led to mass production which in turn led to massive cost saving and productivity gains:

Average price for one 20 ft. container (type fully closed box)
in US$ ex factory in China

Year	US$
1992	2400
1997	1950
2003	1400
2010	2300

World container traffic

In million TEU



The railways also benefited from economies of scale made possible by standardised containers. Insofar as these railways were involved in hinterland traffic carrying part loads to and from sea ports, such consignments were usually transported in wagonloads. At present, the railways have reached a very strong market position in hinterland container traffic. Containers are transported on a network of block trains with a much higher level of productivity than train made up of wagonload traffic.

Container block train

The internationally standardised ISO container loading unit has greatly increased productivity in part load traffic, in turn drastically reducing the cost of transport, especially in international trade. Between 1994 and 2002, freight tariffs on the most important trade routes evolved as follows:

Globalisation, one of the most significant characteristics of current economic development, is therefore based on three main factors:

- drastic reduction of the costs of international telecommunication,

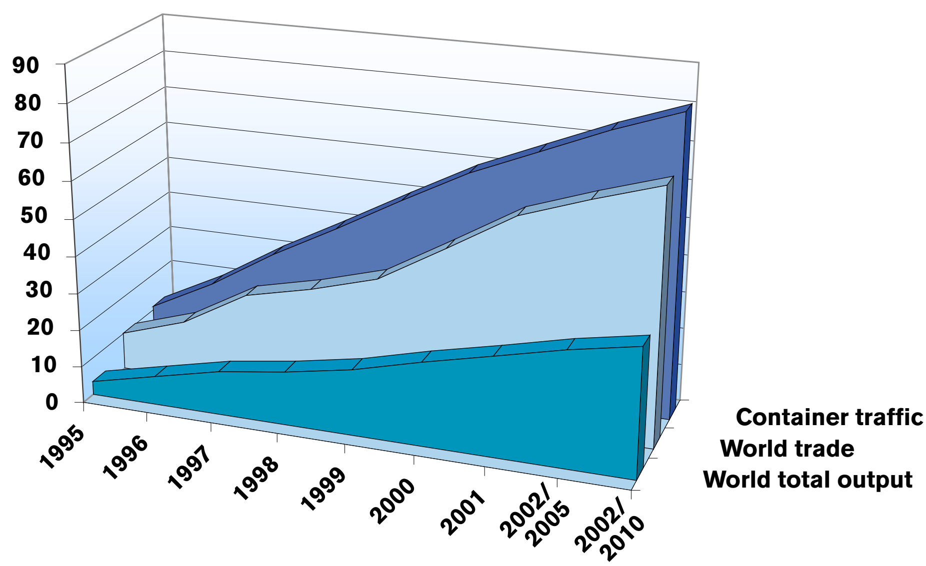
Operation range		Freight rate in US$ per TEU carried
Europe-USA	1994	1250 $
	2002	1150 $
USA – Europe	1994	1450 $
	2002	800 $
Europe – Far East	1994	1100 $
	2002	600 $
Far East – Europe	1994	1650 $
	2002	1100 $

- better management and accounting systems thanks to improved information technology,
- drastic reduction of the costs of international transport thanks to the increased efficiency gained by the container-based transport system with its internationally standardised loading units.

The transition from part load traffic to globally standardised loading units has brought about a significant increase in efficiency, thus stimulating world trade and leading to greater well-being in industrialised and developing countries. We all experience the effects of this in our day-to-day lives.

A 20-foot container can fit roughly 13,000 bottles of wine for a German exporter. Transport from Mainz to Yokohama, including the first leg on the Rhine to Antwerp and transhipment in the ports of Antwerp and Yokohama, should cost approximately US$ 1,500. The cost of transport is thus around US$ 0.12 per bottle – a negligible sum which is unlikely to make a bottle of German wine unaffordable in Japan.

Drivers of Economic Growth, increase in %



A container can transport 3,000 coats or 8,000 shirts from a manufacturer in Asia to Europe. These textile goods are ironed, fully packed for sale and can go straight from the container to the shop shelves. A blouse made in the Far East will have been transported to Europe at a cost of less than € ½ per item.

Unaccompanied intermodal road-rail traffic: European loading units in the logistics system

Block train with European loading units

Unaccompanied intermodal road-rail traffic: European loading units in the logistics system

While the container was developing into the dominant transport unit in world trade, intermodal traffic technologies based on similar principles were being tested in Europe. A removable container laden with goods is designed so that it can be transferred smoothly from a rail wagon without superstructure to an HGV or semi-trailer, also without a superstructure. Technologies enabling such transfer by crane soon prevailed, while lateral transfer technologies proved to be too complicated and costly for everyday operations and were largely given up on. With the former technologies, railways could reach freight customers who did not have their own sidings. Containers and goods are transported by rail to the destination area before being transferred onto an HGV and delivered by road. In 1968, British Rail introduced a similar system. It soon became apparent that the most economically viable process involving block trains was to load the train fully with containers in the consigning region before sending these – without any shunting – to the destination area, where the containers would then be transhipped onto HGVs and delivered.

From very early on, UIRR companies organised intermodal traffic in the same way: intermodal trains were to undergo as few transhipments as possible en route, and the best option in this respect was the block train.

However, this option only works in case of very high-volume transport flows and mar-

Main dimensions of European loading units			
	Length m	Width m	Height m
Conventional 7 m SB	7,15	2,55	2,67
New 7 m WB	7,45	2,55	2,67 - 2,90
Swap body for short coupling road train	7,82	2,55	2,67 - 2,90
Swap body for semi-trailers	13,5	2,55	2,67 - 2,90
European 45-ft. container	13,72	2,55	2,90

kets in which the volumes transported in both directions are sufficient for block trains to run several times a week. For services on smaller goods flows, various concepts were tested in which groups of rail wagons could be transhipped from one train to another en route. Different options exist in this case, the efficiency of which is contested in part.

Beyond the organisation of rail traffic, another important system component was a source of debate: the optimal container. Plans to use the same freight container for this type of operations as the container which had seen so much success in sea traffic – the ISO container – were given up early on. The intermodal organisation of transport along the lines of factory – road transport to terminal – rail transport over long distances – road transport from destination terminal to consignee was facing stiff competition in the form of HGVs and their door-to-door service. If a container is provided for rail transport that had even less space for the goods than an HGV then the customers right from the start lost to the road sector. On principle, containers for European intermodal road-rail-road traffic had to be able to hold as much of a load as HGVs if combined transport were to provide a competitive service.

Swap body transferred by crane

The European road/rail swap body was born of this principle: like all HGV superstructures it is 2,55 m wide and between 2,70 and 2,90 m high. Containers for trailer trains (HGV + trailer) with standard couplings are 2 x 7,45 m long, for those with tight couplings they are 2 x 7,82 m long, and swap bodies for semi-trailers are between 13,50 and 13,72 m long. The standardised European swap body for semi-trailer vehicles has space for 34 standardised pallet loads, exactly the same as a semi-trailer. In terms of space on offer, intermodal road-rail traffic is thus fully competitive against HGV-only transport.

Swap body made ready for transfer

Swap bodies were not expected to cause too many gauge problems when transported on rail wagons. The flat wagon + loading unit would easily fit through most tunnels, under the most overhead catenaries and across most bridges in Europe. In practice however, not all was as simple as planned. To ensure economic viability, freight forwarders wished to place the highest possible volumes in swap bodies. For that purpose the latter had to be at least as high inside as HGVs, leading to external heights of 2,700 to 3,200 mm. Such containers loaded onto flat wagons would fit through some tunnels in Europe, but not all of them. Loading gauges in tunnels were often very small, especially on the railways of Great Britain, southern France and southern Italy, and even already-established swap bodies loaded on standard flat wagons would not fit through. The same was true of some secondary lines in Central Europe. As rail operations lay great importance on safety, precaution had to be exercised in such cases.

On principle all main lines in the European rail network were therefore classified according to their minimum tunnel and bridge profile. The classification corresponded to the coding of swap bodies: each swap body had to be approved for combined transport. In the process it would be measured; the dimensions becoming a code which would determine on which railway lines the swap body could run on a standard flat wagon with a particular loading area height without encountering any

Marking of European swap bodies

Tank containers in stack

problems. UIRR had made a significant contribution to the development of a single European coding system.

Above all, border-crossing traffic was made simpler by this classification and coding system which is now applied uniformly in all of Europe.

Many of these swap bodies are lightly built and can therefore not be stacked upon one another; the transhipment device cannot grasp them at their top corners (as is the case with ISO containers), consequently it must catch hold of them at their more solidly-built bases before lifting them. For that purpose all swap bodies have edges in their underbody structures which enable such handling; the grappler arms of the crane gear can thus lock into place and then lift the swap bodies.

Some ISO container principles have been transposed, above all the standardisation aspect. All swap bodies have the same minimum resistance, the same fastening and transhipment devices, and they are subject to a series of standards applying to their external dimensions. They can thus be used all over Europe.

Nowadays the swap body is the most important loading unit in domestic European traffic: 2/3 of the intermodal traffic volume in Europe is transported in swap bodies.

There is a manifest tendency for the swap body to take on more characteristics peculiar to containers. This especially concerns of the design principle, whereby containers can be lifted by their lower or upper corner fittings, and the fact that they can be stacked on one another. When loading units are stacked close together – which is always the case in sea transport and also in many terminals, especially when they are stacked empty – a transhipment device can only grasp them by their upper corners. Swap bodies without upper corner fittings cannot be handled in such a system.

European 45 ft. container

In many combined transport chains swap bodies are now transported in a gateway system: many trains (often several a day) connect two major terminals internationally. Transport to and from the terminals is not carried out by road, but rather – and especially over long distances – by rail, on so-called “antenna trains”. The loading units are unloaded at the major terminals, where they wait for their connecting train. A great deal of storage place can therefore be saved if these loading units can be stacked upon one another. As this gateway system is constantly increasing its market share, the trend is accordingly one of an increasing use of stackable swap bodies more suited to gateway traffic. European standardisation has followed this trend and initial draft standards have been drawn up for stackable swap bodies.

Semitrailer lifting

Parallel to European swap body traffic, transport services for semi-trailers have also been developed. Originally, semi-trailers were transported on rail flat wagons in the USA, an operation known as Trailer On Flat Car (TOFC). The tunnel profiles on most North American lines enabled the carriage of full-height semi-trailers on standard-height rail flat wagons.

In Europe, pocket wagons are now used practically only when the rail wagon needs to accommodate the bogie of a semi-trailer. The pocket lies in a deep position between the bogies of the rail wagon. However, this only works on routes in which the tunnels have somewhat generous dimensions. This is especially the case in central, eastern and northern Europe.

In any case semi-trailers must be lifted by crane onto rail wagons. For that purpose they must be strengthened to that they can hang fully laden from a crane without breaking. Logistics experts therefore recommend that road carriers add this minor extra degree of resistance to semi-trailers. This provides the freedom to transfer semi-trailers from road to rail at any time if necessary in intermodal traffic.

As most European swap bodies and the semi-trailers cannot be stacked, it is out of the question to transport these in cell-guide container ships. European shipping routes – for instance from Scandinavia or between the British Isles and the continent – are mostly served by roll-on roll-off traffic (RoRo). Ships are built like giant car parks. The loading units are placed on bearing frames with rubber tyres or, like the semi-trailer, they can run on roads anyway. From a car park on the waterfront they are driven over a ramp onto the ship and parked inside. Sometimes even entire road trains or semi-trailers including semi-trailer trucks are loaded onto roll-on roll-off ships. In most cases the drivers also travel on the ship, have their break during the sea journey and can drive to their destination once the ship has docked (after going through customs if necessary). The roll-on roll-off transport system does not have as closely-fitted fastenings as cell-guide ships, which means loading units of all sizes can be transported.

Accompanied intermodal road-rail combined transport: The “rolling motorway”

RoLa train moves towards the Alp passes

In the early 1970s a European wagon manufacturer created a revolutionary new freight wagon for combined road-rail transport: the “rolling motorway” wagon. The principle was similar to that of combined road-rail transport in the USA: each wagon had a loading surface that was low and completely flat so that the entire loading area of the rake of wagons could be driven on. The first HGV would drive up an end-loading ramp at the rear of the train and continue over the coupled wagons until it had reached the head of the train, where it would be maintained in place (generally with its own handbrake), and the driver would disembark. In the meantime the next HGV would board the train, followed by the others, until the entire train was laden. A normal European rolling motorway train can carry 20 to 27 trailer trains or semi-trailer trucks and can be loaded in under 30 minutes.

The transhipment equipment is also simple and inexpensive: all that is needed is a track which is level for the entire train length and an end-loading ramp. Of course, administrative handling facilities are required on top of this: a building or container doubling as an office in which combined transport operator staff sit and take or issue official documents. But this is necessary in every combined transport terminal.

RoLa terminal

Articulated truck drives on to a RoLa wagon


RoLa train on travel

Driving off after arrival

For road haulage companies wishing to use rolling motorways it is just as simple to organise consignments: each road train and semitrailer truck with official approval for road traffic may in principle run on a rolling motorway without any technical modifications. Moreover, most rolling motorway services include a sleeping car in which the driver can rest during the train journey. These sleeping cars accompany the combined transport, which is why this type of transport is also known as "accompanied" combined road-rail transport.

The rolling motorway concept also ensures that the operational model is very simple for the road haulier. Fundamentally speaking, it is not any different from driving on the motorway: drivers collect the load from the consignor, drive to the nearest rolling motorway terminal, board the train and repair to the sleeping car. In the destination area they return to their HGVs, drive down the end-loading ramp to road level and continue on road until they reach the consignee.

This highly simple transhipment and organisational method comes at a price: to ensure rail wagons laden with road vehicles fit through the European tunnel profile, the wheels on the rail wagons must be very small and the loading surface extremely low. These small wheels cause problems in rail operations, especially in terms of braking and load transmission between rail wagon and rail. This increases generally the operational costs for rolling motorway trains, and this may partially offset the cost savings in easier loading and unloading of the train, and the less difficult organisation of operations.

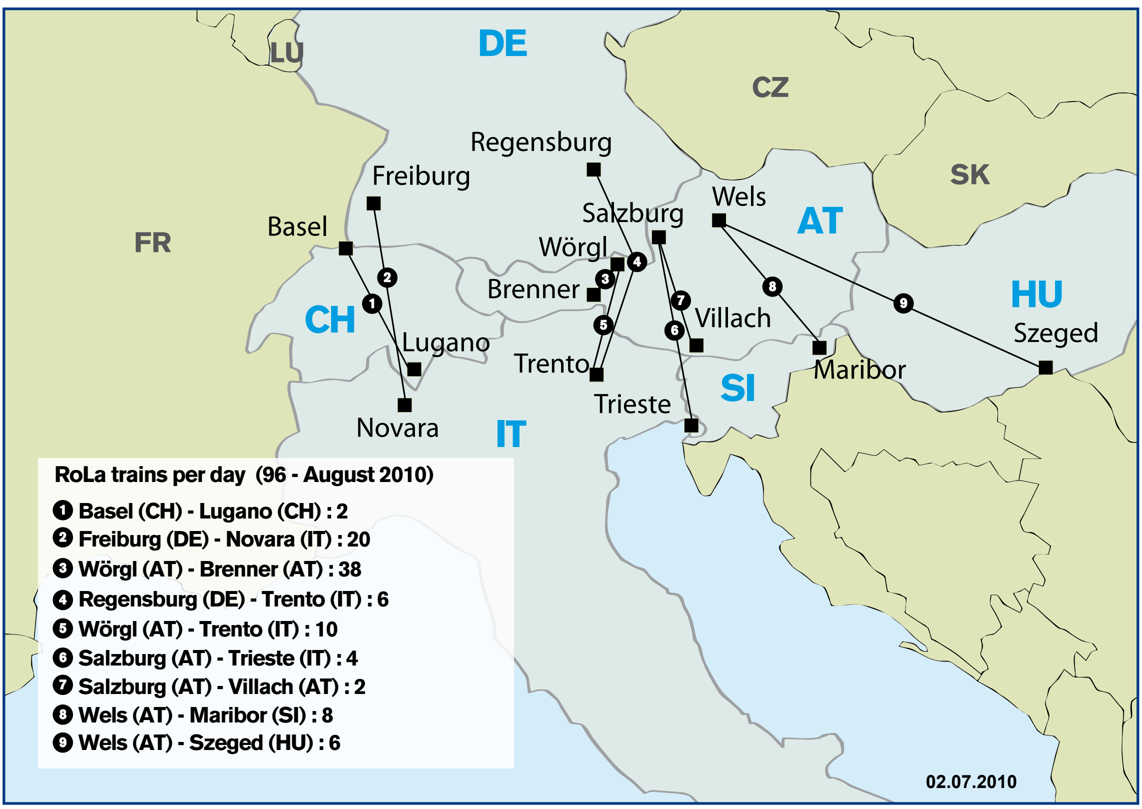
The carriage of payload + weight of the HGV + weight of the rail wagon leads to a less cost-effective relationship between payload and total weight. To put it simply: a train set with container or swap bodies can transport roughly 80 seven-metre swap bodies or 20-foot containers, whereas a rolling motorway train can only carry 20 to 27 trailer trains, depending on the topography. These are laden with 40 to 54 swap bodies – a maximum of 2/3 of what a train with loading units in containers can carry. Correspondingly, the energy consumption values per payload tonne are significantly higher for rolling motorways than other combined transport methods.

The tunnel profile and bridge clearance is another source of problems: rolling motorway operations with HGVs measuring 4 m at their top corners (which is usually the case in Europe) is only possible on European routes with particularly generous tunnel profiles. This is the case for many main lines in northern, central and eastern Europe. Rolling motorway operations have limited potential in Great Britain, France, Spain, Portugal, south Italy and on some of the lines crossing the Alps. However, some east-west axes in Central Europe and part of the Brenner line have highly successful rolling motorway services.

It is not simple to set up a commercially viable rolling motorway service: in principle a road haulier is only prepared to pay the amount saved through rolling motorway transport for rolling motorway use. That includes fuel costs, tyre wear and motorway tolls. However, the total amount mostly does not cover the operational costs of rolling motorway traffic. The model only proves worthwhile when motorway tolls are uncommonly high or when other specific restrictions apply to transit by HGV.

There are also cases in which the state is so committed to reducing HGV traffic that it will subsidise rolling motorway operations. This kind of subsidy lends itself to such politically-motivated changes of course in transport, as combined traffic is extremely easy to organise on rolling motorways: whoever is crossing a country by motorway can also do so by rolling motorway.

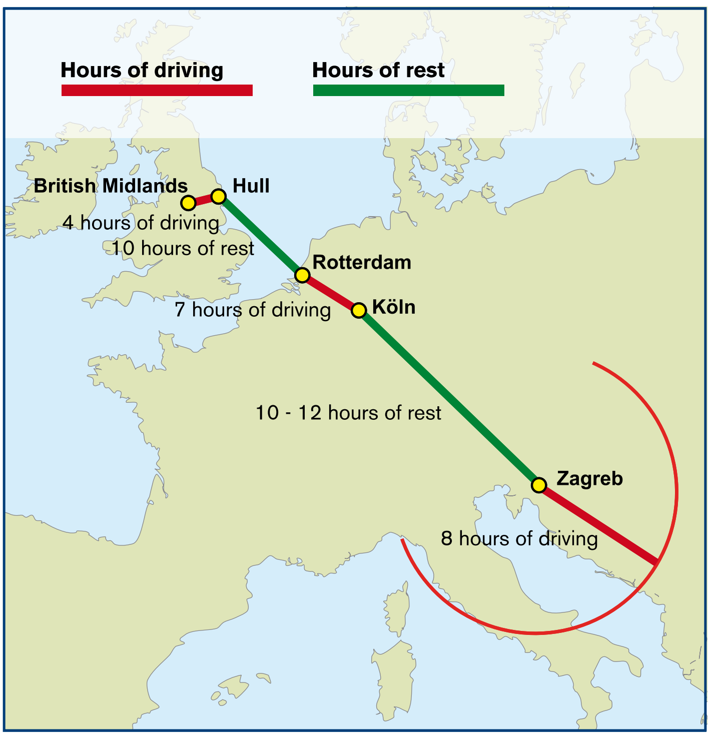
Rolling motorway transport is of particular interest on certain transit routes on which



a single driver cannot drive from origin to destination by road alone without infringing on the legal prescriptions governing driving and resting hours. Indeed, time spent by a driver on a rolling motorway counts as a period of rest, which means significant gains in productivity can be achieved on certain routes by incorporating a rolling motorway section into a long-distance HGV route. In this case a whole series of questions need answering: what would the cost of an additional driver amount to per shift if the journey were solely taking place on the motorway? What operational costs and fees could be spared by using a rolling motorway, what additional costs would be incurred? Would it not be more cost-effective to flout regulations on driving and resting hours and pay the fines on the few occasions when one is caught?

British freight forwarders worked out a particularly interesting illustration of the advantages of rolling motorways:

After loading in the East Midlands, drive in the afternoon to a port on the North Sea coast (= 4 hours of driving), cross overnight with the ferry to Rotterdam or Rozenburg (= 10 hours of rest). Continue the following morning on the motorway to Cologne-Eifeltor (7 hours of driving). In the early evening, take the rolling motorway from Cologne to Zagreb in what was then Yugoslavia, with the driver in the sleeping car (= 10-12 hours of rest and no transit problems with Austria). On the following morning in Zagreb, the driver returns to the wheel and can – fully legally – drive the remaining 8 hours to the destination in south-eastern Europe.



Today, Rolling Motorway services are normally not offered on such very long itineraries for economical reasons.

Nevertheless, today some Rola operations are offered with a travel on rail duration of 8 to 9 hours to enable the truck driver to spend a full resting cicle during the Rola travel.

Intermodal transport companies and their business model

Inland terminal for containers and swap bodies

Intermodal transport is economically attractive and efficient in two different cases:

- Transport chains to and from overseas destinations involve a section on water and several sections overland. Intermodal transport technology, with its easy transfers from one transport system to another, is particularly efficient in this case. Transhipment of an intermodal transport unit, a 40-foot container for example, enables a load of almost 80 m^3 to be transferred from a ship to an HGV or rail wagon in a single operation lasting 3 minutes. Conventional transhipment as it was carried out in the past, with each package being lifted from the ship and loaded onto another vehicle, would take several hours.

Container discharge in sea port

- Over long distances, especially in land transport, the numerous individual consignments can be gathered together into a large consignment at the beginning of the journey, divided once again in the destination area and distributed to the consignees. For example, loading units are carried by road to a transhipment facility where they are transhipped onto a block train and transported to a destination terminal. They are then transhipped onto road vehicles and sent onwards. A block train can transport some 80 seven-metre swap bodies on most European railways, which means it can carry the same load as 40 trailer trains to a destination area in a more cost-effective and energy-saving fashion.

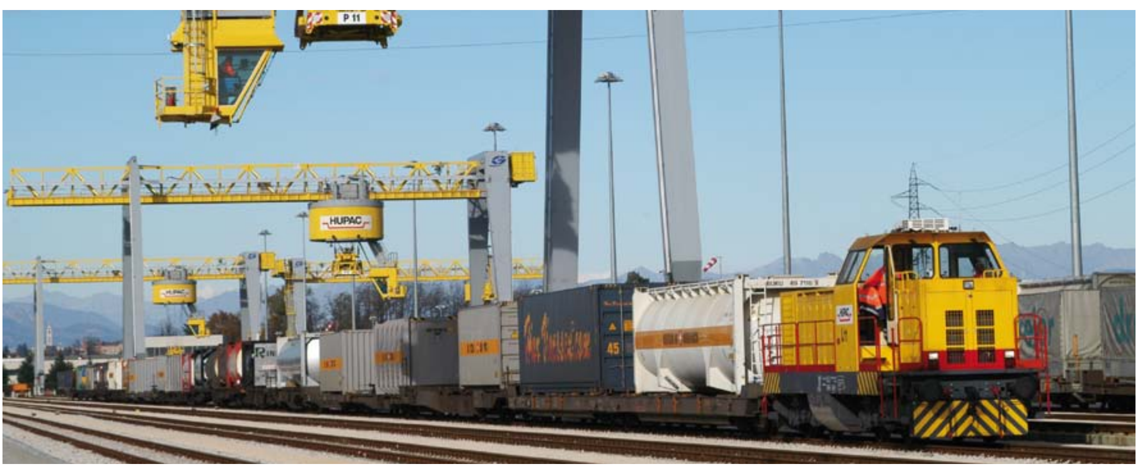
Block train with swap bodies

These two different forms of intermodal traffic also have their different business models:

the major players retain their traditional role when intermodal traffic is used to organise transport chains to overseas destinations rationally and efficiently. Shipping companies

Head quarters of Hapag-Lloyd in Hamburg

organise sea transport, port transhipment companies take care of container transhipment in the sea port, and hauliers and land transport companies carry the container from the port to its hinterland destination. However, in the course of containerisation, the companies involved have organised themselves into worldwide businesses, especially in terms of sea transport and transhipment in ports. The

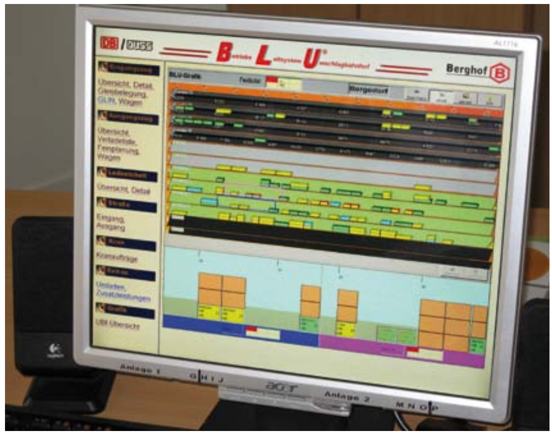


Block train with European loading units

intermodal traffic system has been successful mainly through cost degression and increased operational scale. Correspondingly, the size of the companies involved has increased dramatically. Medium-sized service providers only exist alongside major railways and their subsidiaries in container transport from sea ports to the hinterland.

The second intermodal traffic model, which involves grouping many individual loads together into large transport units, created a new type of business, the combined transport operator, which in a sense works as a consolidator company. In the past, many railways in the USA and Europe also carried out intermodal traffic through their own subsidiaries. At the same time, freight forwarders and road freight companies founded their own businesses together to organise combined transport. These companies would purchase the capacity of an entire block train from a rail company and sell it on to hauliers and goods transport companies space by space. They usually also assumed the risk in terms of train capacity utilisation in these intermodal operations. As the railway leading operations made a significant contribution to the success (or failure) of an intermodal transport service through the quality (or distinct lack of quality) of its performance, operators try to ensure, as much as their market power allows them, that their contracts with railway companies make sure the latter would strive towards transport quality.

On top of transport over a route per se, combined transport operators must provide a full range of other logistics services to be successful on the market. These are partly purchased, partly self-produced. The important service in this respect is to provide constant logistical information: the customer must be kept up to date on any irregularity in transport – a delay caused by snowfall in the Alps;

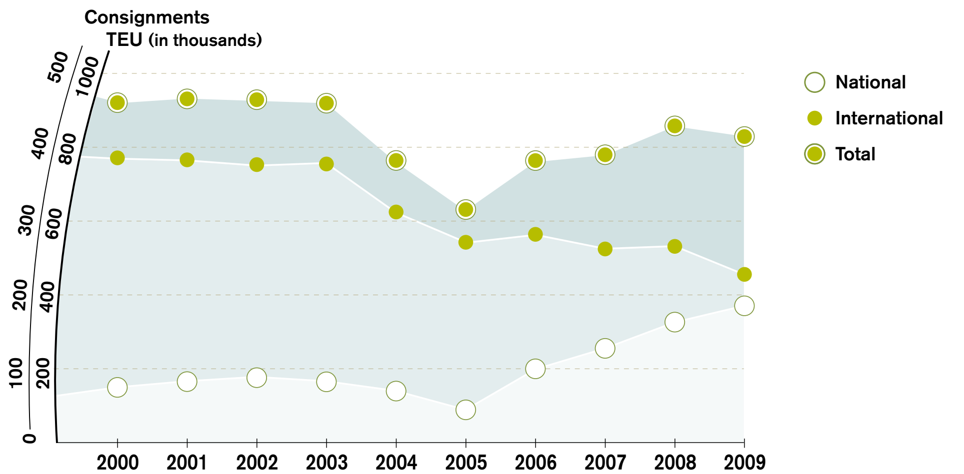


Terminal Management Software

a train cancellation because of strikes affecting one of the railways involved, i.e. making intermodal transport impossible; a minor delay caused by a disruption in signalling, albeit one which is likely be made up for. This information must be passed onto the customer as quickly as possible. Of course, a significant part of internal scheduling depends on such information systems: if a train is delayed, the operational schedule in the destination terminal must be modified. Wagon and locomotive turnaround time must be adapted and further action must be taken.

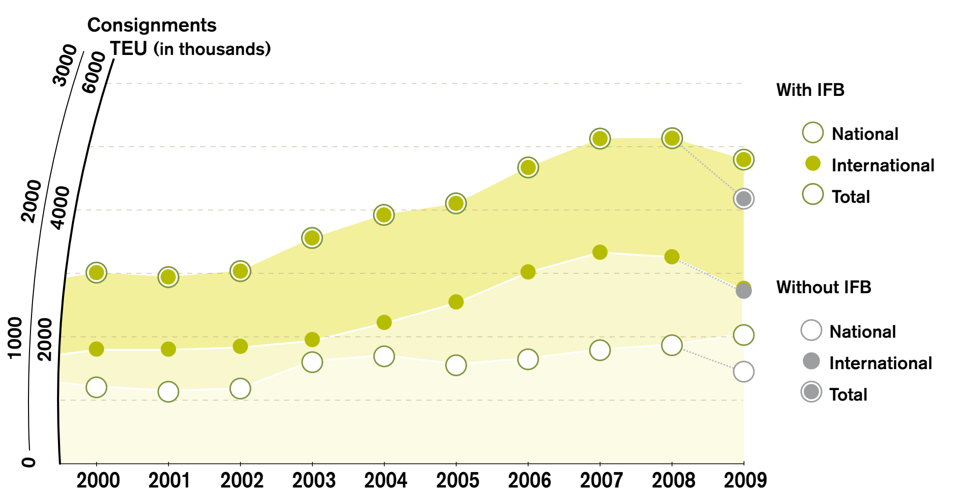
Finally the combined transport operator must also carry out long-term market and capacity planning. Intermodal trains must be organised in a way which corresponds to the timetable and route demands of customers. They must be flexible in their responses to changes. All these tasks have become so challenging that the combined transport operators which began by operating as wholesalers and purchasing cooperatives 40 years ago, have become the “market powers” of today, accounting for the lion’s share of intermodal traffic within Europe. They have turned the niche product that was intermodal road-rail transport into one of the most important branches of the European rail freight sector.

Development of combined transport volume in Europe – accompanied



In the meantime, some of the main customers of combined transport operators have developed a logistics network primarily based on the performance characteristics of combined transport, and on which combined transport now represents the main form of carriage. This is especially the case for liquids and bulk goods, which are transported non-packed and in special containers to destination areas, where they are then prepared for the end user. The tank haulier Hoyer has developed a business model in which Ger-

Development of combined transport volume in Europe – non accompanied



A tank container operated by Hoyer

man beer is no longer bottled or barrelled at the brewery, but rather transported in special containers to the destination area, where it is then transferred into smaller containers. Similarly, other companies such as Bertschi AG no longer load chemicals into drums which are then placed in a container, but rather fill special bulk containers with the basic chemical materials This model does not only imply a different organisation of loading and carriage at the customer's premise. The right special containers must be found and their usage cycles (often with an empty run) organised. In addition, the containers must be cleaned and inspected after use. The empty containers must be brought to the filling plants on time. The ambient temperature must be monitored – many materials transported in these tank containers or bulk containers do not tolerate freezing conditions, or they must be heated up before emptying, etc.

Nowadays, a significant proportion of chemical goods are transported by combined traffic in Europe. This eases the burden on roads and contributes to traffic safety, as accident rates are around 40 times lower (!) on rail and many of these chemical products are dangerous and may lead to considerable problems in case of accidents.

A bulk container operated by Bertschi

Transport policy in the European Union supports intermodal transport

Europe

The integration of European countries within the European Union was a great boost to economic growth in Europe, especially when the trade between the partner states within the community greatly increased. Goods transport between European States naturally followed the same course as trade in general, growing to an extent that no one would have initially expected. Transport infrastructure was not prepared for such expansion and this led to critical bottlenecks.

These newly-developed goods flows are organised under logistical conditions which traditional rail wagon traffic can no longer provide. The publisher of a newspaper in Milan determines how many copies will be issued a few days before publication, the printing plant calculates how many rolls of paper will be required and orders the printing paper from a paper mill in southern Germany for delivery on the evening before printing takes place (overnight). In wagonload traffic the rolls of paper would take at least four days to reach their destination, too long to be of any use in such a short-notice planning process.

The winner in goods transport within Europe is road freight, which best meets the logistical requirements of

- speed,
- flexibility,
- reliability, delivery on time

for most high-value goods on the continental corridors.

This development is no source of satisfaction to European transport politicians. Road space, especially in international traffic, is already scarce as people's mobility rises along with increasing prosperity. An increasing number of people wish to travel by car and want free-running motorways rather than lines of HGVs. There is increasing political pressure to transfer part of freight traffic onto the railways.

In addition, issues of long-term development have arisen: road freight's sole energy source is petroleum products; it is thus dependent on a resource whose availability is not certain in the long term.

Trucks consume diesel fuel

On top of this, growth in road freight traffic is the source of many other problems: CO_2 emissions per tonne of transported goods are generally much greater than with other transport modes; highly-used roads cause surface cracking; increasing road traffic causes noise pollution in the vicinity of the roads, accidents and other external costs.

Trucks contribute greatly to highway congestion

Consequently a majority of politicians are in favour of curbing the growth of road freight.

Railways should therefore play a greater role in European goods transport. However, in their traditional form they cannot satisfy customers' demands, which is where combined road-rail transport may offer the solution: the goods are initially collected and ultimately delivered by HGV – flexibly, quickly and reliably. Over the long distances between collection and delivery, the goods are transported by block train, an equally fast or even faster and more efficient form of transport, as mostly electricity-powered trains run uninterrupted between departure terminal (collection point) and destination terminal (distribution point) and do not require shunting en route.

Combined transport makes it possible to carry goods by rail for the main part of the journey while still meeting the logistical requirements of manufacturers. This is why

Combined transport block train on German Rail

European transport policy was very quick to support combined transport. The task was not so simple however, as transport politicians in each country initially sought to develop combined transport on a domestic level to ease the burden on their own road networks. The sector soon hit an economic stumbling block: in most cases combined transport is only economically viable over reasonably long routes. For instance if paving stones need to be transported from a quarry to road-works 45 km away, there is no point driving to a transhipment station and carrying out part of the journey by rail. Over such short distances the goods are transported by road the whole way.

Business economists in the field of transport have calculated that the minimum distance required for combined road-rail-road traffic to be economically viable – depending on circumstances – is 300 to 450 km. The greater the distance, the more profitable is combined transport. In Europe however, route distances of over 450 km are mostly only achievable in international traffic.

Consequently national combined transport operators have begun to develop international cooperation in Europe to organise transport services for long international routes and bring them onto the market. The most important instrument of cooperation has been UIRR, the international union of combined transport operators. It has maintained pressure on regulators and legislators in Brussels to take into account the specific features of combined transport in European transport provisions and regulations.

To name an example, in many European countries freight transport in HGVs – those used for long-distance routes – is forbidden at the weekend. The economy has to a large extent adapted to this policy. Since most factories are closed at the weekend anyway, goods do not need to be delivered or collected then. The situation is different in international combined transport: goods manufactured on Friday are loaded on Friday evening and the combined transport train arrives at the destination terminal on Saturday or Sunday morning. As the major part of the journey takes place on the more environmentally-friendly railways, exemption from the weekend driving ban is granted for the short collection and delivery route sections by road.

Long distance freight operation is better by rail

These specific features of combined transport and the corresponding regulations are sometimes a little complex and inaccessible to the layman at first glance. With this in mind, combined transport operators, UIRR and European legislators must work together towards developing regulations which protect public interest while leaving enough scope for combined transport's economic development. The alternative would be goods distribution in Europe entirely carried out by road, which would suit no one.

On top of these exemptions which road-rail combined transport requires to be economically viable, a series of further measures have been taken in the European Union to promote this form of transport. For example, the promotion of combined transport technology and research is a top priority. Moreover, as part of the Marco Polo programme, significant funds are provided in the form of fast-start financing to boost combined transport.

Furthermore, European transport politicians look to it that combined transport operators are not forced to pay up twice for route costs – once in the form of full road taxes for the HGV, and once more in the form of transport costs for using the rail network. The tax breaks required for this purpose are regulated separately in individual European countries.

Nevertheless, a disadvantage exists in principle in rail traffic and well-meaning transport policy has only increased it. The European Commission has constantly taken great care in ensuring transport markets are in turn ruled by competition. The principles of European transport policy are to liberalise market access, refrain from price control and set an adequate tax burden which aims to offset the costs of infrastructure use and recover social costs. The road freight sector has seized this opportunity and developed a highly productive network of international transport connections in cooperation with hauliers operating internationally.

Combined road-rail transport contributes to relieve roads

An HGV driver with a Bulgarian licence and an HGV manufactured in Germany and officially approved in Bulgaria may drive from Sofia to Rotterdam anytime, without needing specific authorisation. This is not the case with railways: the administrative set-up of most state railways is an obstacle to the development of international business. In rail transport, the locomotive and driver must be replaced at almost every border in Europe, and if any malfunction occurs in the process, the whole consignment, i.e. a train with 80 containers, is delayed by several hours if not days.

UIRR has often decried the cases where over half the trains on a combined road-rail transport main line are significantly delayed. At present, numerous measures are being taken at European level to bring the efficiency and quality of border-crossing com-

Often the locomotive has to be exchanged at the Italy/Austria border

To give an illustration of the disastrous situation in Europe, here is an example of what used to happen regularly only a few years ago: a combined transport operator had organised a connection from Germany to Spain. The train carrying the load was to leave from Ludwigshafen in Germany at 8 pm. However, a crane malfunction occurred in Ludwigshafen, and the train left with a delay of one hour. On the way to Saarbrücken-Forbach it had to run onto a holding siding to let an international express train with passengers past. It reached the French border station of Forbach with a delay of three hours. In the meantime the French railways had withdrawn the locomotive and driver they had provided for the journey as they were unable to determine precisely when the delayed connecting train would be arriving. At that point many telephone calls were made in eastern France to determine where a replacement locomotive and driver could be found. Ultimately the search was successful and the goods train continued its journey towards a nodal point in Metz. In that city all connecting trains towards the south had already left. The delay was now of 24 hours. Once such a point has been reached, opportunities are rife for further incidents: the locomotive and driver must be replaced at the Spanish border, and on the way many other problems may arise, such as technical breakdowns, drivers being ill or strikes being planned at short notice. Once the train finally makes it to the Spanish border in Port Bou, the loading units have to be transhipped in a special terminal from standard gauge European wagons to wide gauge Spanish ones. The terminal is very small and located in a narrow valley which does not allow for extension works. However, Spanish traffic is increasing, which spells out as capacity overload and further delay, even in case of minor irregularities. Similar circumstances may be identified on other combined transport main lines.

bined transport up to a level where it achieves similar punctuality to road transport, thus becoming fully competitive. The European Commission has also taken measures to improve technical approval and safety inspection in rail traffic within Europe. However, it will be difficult to make up for lost ground in liberalisation vis-à-vis international road freight.

The (more or less) uniform European regulations on dimensions and weights for road vehicles have been of particular importance to the efficiency of combined road-rail transport by enabling combined transport throughout Europe to be dealing with the same dimension and weight categories. National exceptions are rare. A combined transport wagon with a load length of just 15 m can accept everything running on European roads in optimum conditions: two swap bodies measuring 7.45 m each from an articulated trailer train, one semi-trailer measuring 13.5 m or a European container measuring 45 feet – 13.7 m.

Unfortunately, since 2008 there have been plans to increase the maximum authorised vehicle length and weight in road traffic. This would lead to several thousand combined transport wagons, which are currently perfectly tailored to suit combined road-rail traffic, becoming unusable overnight, as the newly-increased length of the trucks and semi-trailers would no longer allow for optimum handling. The consequences for combined transport would be dire, and significant transport volumes would shift back from rail to road. Due to the devaluation of combined transport wagons, barely any financiers would be prepared to invest in new wagons of that type. Many studies have been carried out to date to assess by means of complex calculations the economic advantages and disadvantages of long road vehicles. However, most of the calculations underestimate the fact that, for a start, increasing the length of HGVs would lead to the ruin of the combined road-rail transport sector. Moreover, a major part of the 170 million tonnes currently carried in combined transport would return to the roads, and transport safety would be affected.

European Directive for combined road-rail transport:

Exemptions from weekend traffic ban European Directive 92/106

The supply of goods which must be available on Monday morning in factories and trade centres is transported to the destination area by combined transport trains over the weekend. The goods must then be brought to the consignee's loading dock on Sunday evening. For that purpose, exemption from the driving ban has been granted in most European countries: loading units which have reached the destination area by combined transport (i.e. by rail) may be delivered on Sunday despite the HGV ban, that is to say from the nearest suitable combined transport terminal to the consignee. Similarly, goods transport is authorised from the consignor's loading dock to the nearest suitable combined transport terminal.

European Directive for combined road-rail transport:

Higher load limit for HGVs with combined transport loading units
European Directive 96/53

A 40-foot container may have a gross weight of up to 30.5 t. These loading units cannot be transported on road vehicles within the load limit of 40 t. Therefore European Directive 96/53 stipulates that road vehicles transporting a 40-foot container in combined transport may have a total weight of up to 44 t. This advantage granted to combined transport only constitutes a competitive advantage in countries where the total load limit on roads is 40 t, for example Germany, France and Austria.

Fast-start financing for combined transport: the European Commission's Marco Polo programme

A significant disadvantage of combined transport lies in its major advantage, namely the ability to group consignments together and carry them efficiently across the transport network: a combined transport service will only really be viable if a block train is running. In Europe its capacity usually corresponds to the capacity of around 40 HGVs. In order to organise the combined transport service to suit the demands of European logistics it is necessary to offer a departure three to five times a week in each direction. The amount of road freight on many European corridors shows that such a service could be used to full capacity. But: if a combined transport operator begins offering a daily combined transport train service on a particular route from 1 June onwards, road carriers will not suddenly change their service on 2 June and use rail rather than road. For a start there will be a check on whether the combined transport trains run on time and whether the timetable meets the requirements. Subsequently calculations will be made on what the effects of reorganisation would be in the short and long term. Meanwhile the combined transport operator must prove its reliability and run the combined transport train even when it is only half full. Later, when the new service is used to the full (in other words, when the train utilisation rate corresponds to roughly 75 – 80% of the capacity), the combined transport operator will no longer be making any losses. However, he cannot achieve profit that can cover the losses made in the earlier processes – price competition with road transport is too stiff. For this kind of situation the European Commission has set up the "Marco Polo programme". This programme enables starting losses regularly made in promising new transport services to be covered in part or completely by the European Commission in order to encourage combined transport operators to develop additional services.

Marco Polo subsidies are available to all alternative transport modes, i. e. besides rail to inland waterway and short-distance sea transport. However, since the combined road-rail transport network is becoming increasingly dense, it will be increasingly difficult to propose new services that will be exclusively competing against the road sector rather than offering alternatives to the alternatives already in place. It would be difficult to remain neutral in this case. Therefore, after two decades of successful promotion in the form of PACT and the Marco Polo programme, new methods are being sought to support environmentally-friendly forms of transport without harming competition.

Transport policy tasks facing the European Union in the patchwork that is Europe

Whereas the most important markets for combined road-rail transport are on international corridors, Europe is a patchwork of regulations, infrastructure restrictions and prescriptions which came into being over the past centuries in each individual country.

In the rail sector, the core networks of Spain, Portugal, Russia, the Baltic States and the Ukraine have different gauges from the rest of Europe. Overhead lines for electric traction have different voltages and alternating current frequencies. Signal electronics vary from one country to another.

Loading units must be transhipped from Central European wagons to Spanish ones at the Franco-Spanish border due to the gauge difference. On top of that, the maximum train length is lower in Spain than in France. Therefore a combined transport train with 80 loading units cannot be transhipped one to one, as all these loading units would not fit onto a single Spanish train. Transport by train in Spain must be completely reorganised.

Framework legislation for international road transport follows a similar pattern. Countries in the periphery of Europe have interests that are different from those in the core area. The primary concern of manufacturers in Portugal, Greece or Ireland is to reach the major markets at the heart of Europe at the smallest possible financial cost. From a short-term point of view they can achieve the lowest cost by loading the goods onto an HGV and getting a driver from their own country to drive into the core area of Europe. The HGV will have left its own country after a few kilometres; it then crosses the road networks of neighbouring countries, often enough without paying usage fees; drivers fill the fuel tank in their home country, where the fuel tax will also be paid (a normal HGV tank can contain approximately 1,000 l of fuel, which should cover 2,000 km).

This road freight model appears significantly less cost-effective to countries in the core area of Europe, who bear the lion's share of the burden – stresses on infrastructure, accidents and emissions. If they increase the tax burden on fuels and vehicles it only affects domestic operators. Transport companies operating internationally can for the most part elude that burden. Consequently, the countries in the centre of Europe are the ones which are the most forceful in pursuing the policy of transferring long-distance freight from road to combined transport, while some countries at Europe's periphery confine themselves to voicing support rather vaguely for combined transport.

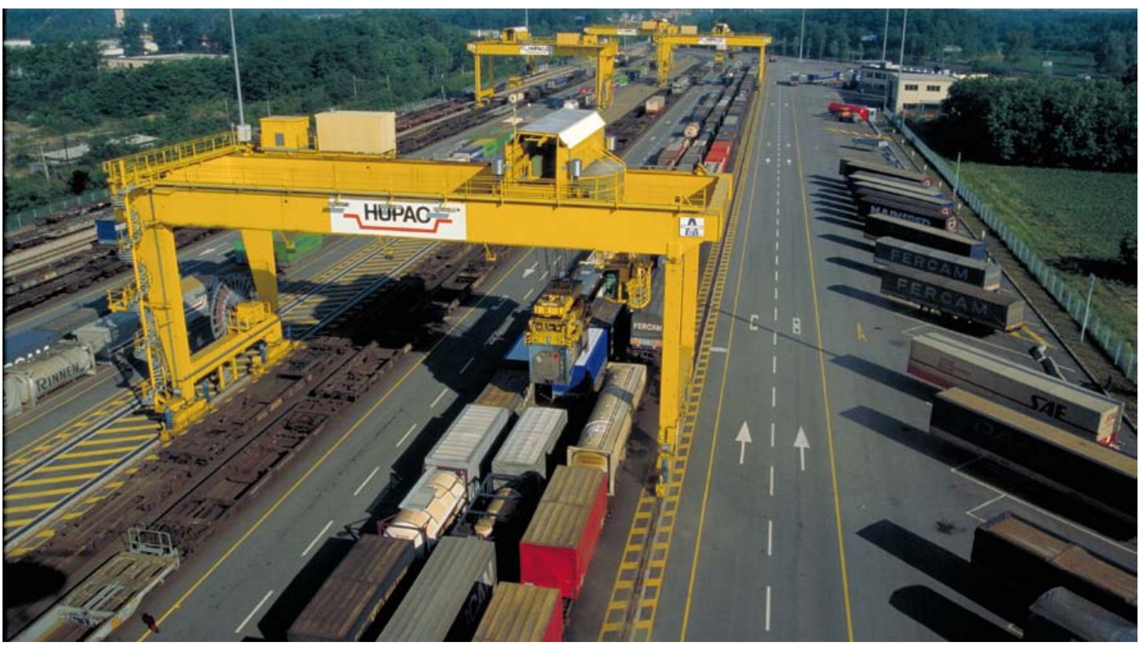
This inclination is clearest to see in Switzerland and Austria, through which all the consignments towards Italy transit on the roads and railways. Correspondingly, both countries – especially Switzerland – have set their transport policy on a course towards transferring the main traffic flows to the railways (see chapter 9).

From the combined transport operators' perspective, this patchwork of European policies is the source of concrete inconsistencies and insufficiencies:

- Taxation of road traffic: the attitude towards road traffic taxation varies from one country to another, as do the tax breaks for HGVs mainly used in combined transport (thus practically not using the road infrastructure). For the most part, only domestic operators can hope to obtain tax rebates for HGVs mainly running in combined transport at a reasonable bureaucratic cost. The tax rebate procedure (if it even exists) is too complicated for foreign operators.

- Diesel fuel taxation: every country applies different taxation for diesel fuel. As an HGV can run for over 2,000 km on a full tank, the transport company can identify the cheapest countries for refuelling on the route through Europe and get the driver to fill the tank there. This situation has reached grotesque proportions in Germany, where diesel is subject to an additional tax with a view to protecting the environment. While railways have to pay this tax for their environmentally-friendly operations using diesel locomotives, HGVs operating internationally can refuel in the less taxed refuelling stations in neighbouring countries. The most environmentally-friendly transport mode pays the green tax while the more harmful one can simply evade it!

- Maximum working hours for driving staff and how they are monitored: normally the driver of a locomotive or an HGV, should work for maximum eight hours then have a break. There is legislation to this effect in all European countries – the laws were coordinated within the European Union. Observance of this legislation is meticulously monitored in the railway sector. Checks are carried out less often on HGV drivers. Indeed, why should the Portuguese police check an HGV driver setting off from Porto to the Rhineland with a wine consignment? In France or Germany, who is supposed to check where and when the driver stopped



Right side of picture: Semi-trailers are prepared to be loaded on an intermodal train and rested? Manifestly, the electronic trip recorder can easily be tampered with. The driver can tell the French police in Alsace that he slept overnight in Lyon, where he relieved his colleague, and had thus only been driving for five hours. Only recently has the European Union begun trying to monitor these aspects more precisely. This is not only necessary for the sake of road safety, but also with regard to the competitiveness of combined transport, for which all these prescriptions must be painstakingly observed.

- Many rules laying down restrictions foreign vehicles with foreign drivers make no sense in combined transport, yet still have to be observed. One of the major combined transport terminals in Upper Bavaria lies on the other side of the border between Germany and Austria, namely in the federal state of Salzburg. When a Bavarian freight forwarder's HGV picks up a container there this constitutes cabotage (i.e. a transport service on a section which takes place exclusively in a country foreign to the vehicle) even though the foreign stretch is actually only 3 km long. Such Carbotage traffic underlies specific restrictions. Turkish semi-trailers are shipped from Istanbul to Trieste on a roll-on roll-off service. After disembarkation they are transported to Germany via Italy and Austria with Turkish semi-trailer trucks and Turkish drivers. What regulation applies in this case?

It is clear that European decision makers still have a lot on their plate regarding combined transport. The subject matter is complex and often the suitable decision can only be made with knowledge of the actual situation. It is therefore important that combined transport operators keep track of decision making in European bodies and give their expert advice.

There are some rules which benefit combined road-rail transport, which is characterised by a short route section on the road before transhipment in a combined transport terminal, then a long-distance section by rail followed by transhipment in the destination area and the final short section by road. To have a clearer understanding of what was meant by road transport sections before and after shipment by rail, European regulators set a specific distance limit, namely 50 km as the crow flies. However, it then transpired that a highly successful transport service existed by road between the western Ruhr and a terminal on the Franco-Belgian border, where French combined transport trains subsequently ran over nearly 1,000 km to southern France before a short section on the road again. The prior section on the road amounted to somewhat more than 100 km. Of course no one in the European authorities wished to transfer this entire service back to the roads. However, no one had any idea that on occasion it could be altogether useful to have a longer initial route section by road. Combined transport players informed the regulators of this situation and the specification of "nearest suitable terminal" initially planned was dropped.

Transit across the Alps via Switzerland: Combined transport is granted constitutional status

Alpine transit is the most important market of European combined transport

HGVs crossing the Alps have quickly become a special problem in Europe. Italy has developed into one of the main trading partners of its neighbouring countries, and transport volume has increased accordingly. Everything that is transported between Italy and its neighbouring countries must run through Alpine passes; this has led to the goods transport being concentrated on a few mountain passes and motorways, which represents a great burden on inhabitants nearby but also the environment in the narrow surrounding areas. The pressure to remedy this situation is great.

Switzerland was able to stave off this road freight traffic overload for many years as the Swiss did not permit HGVs on their road network. For HGV journeys within and passing through Switzerland the total weight permitted (vehicle + load) was 28 tonnes, whereas most other European countries allowed 40 tonnes or more. This made it more profitable for road freight to avoid transiting through Switzerland and effectively circumvent the country via France or Austria. Switzerland had solved its own problem to a certain extent, but at the price of a greater problem in other Alpine countries.

On top of that, railways transiting through the Alps were having great difficulty offering a service that could compete against road transport. Rail traffic through mountain passes runs over high-gradient sections and through helical tunnels and tunnels across mountains. This limits train weight and running speed, and some tunnels are so narrow that high loading units do not fit through them on standard rail wagons. Residents near the mountain motorways were thus hardly going to believe transport politicians if they claimed that traffic could be transferred to the railways. At the same time Switzerland was pressured by its neighbouring countries into giving up on its restrictive provisions and accepting that a major part of freight traffic transit on its road network. For that purpose it first of all had to authorise 40 t HGVs to run on its transit motorways.

Ultimately the Swiss discussed and devised a transport policy which has so far remained unsurpassed in Europe:

- Due to EU pressure, HGVs would be allowed to transit through Switzerland. However, these transiting HGVs would have to pay a high fee and the amount of traffic running through Swiss Alpine tunnels would be regulated.

Intermodal train climbing up for the tunnel passage

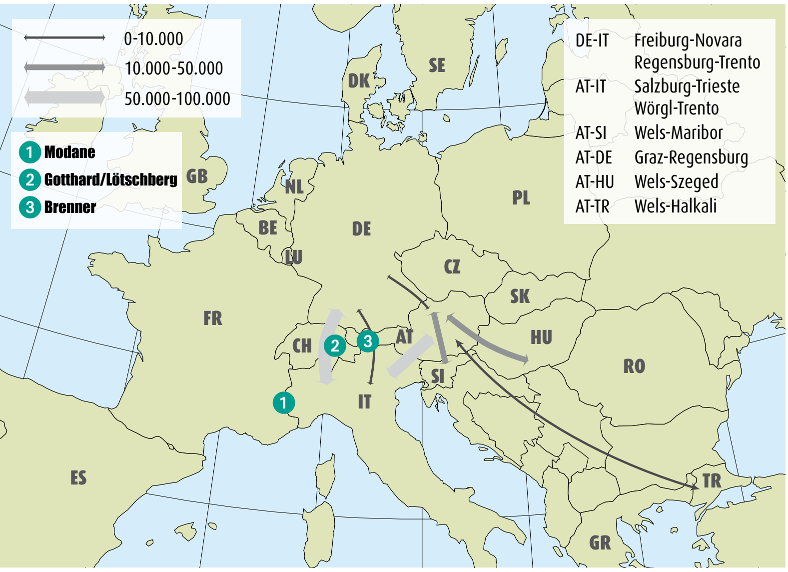
- Combined road-rail transport would be promoted in particular as an important alternative to road transit.

Work on the new Gotthard tunnel has considerably progressed

- A set of rail tunnels through the Alps would be financed (inter alia thanks to the special fee for HGVs) and built. The tunnels would especially enable highly productive rail freight traffic to run through Switzerland in the north-south direction.

- An article was added to the Swiss constitution setting the restriction of road freight across the Alps as the government's task.

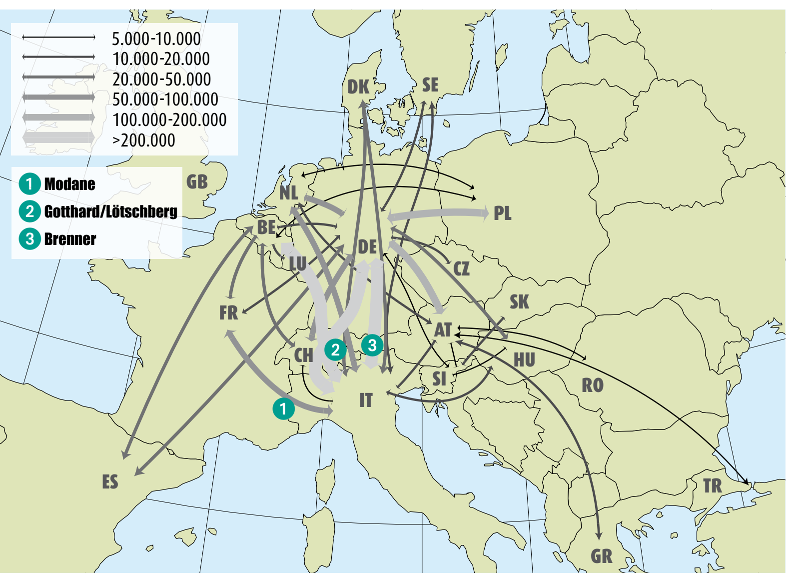
All of these measures have since been launched. One of the new tunnels through the Alps has been completed, namely the Lötschberg tunnel from the Bernese Oberland to the Rhone valley. Construction of the main tunnel through the St. Gotthard mountain is in progress and it should be open to traffic in 2015 approximately.



Alpine transit by accompanied combined transport

These measures are being financed by the special fee for HGVs. There is a special programme to promote combined transport.

In spite of all these measures to strongly restrict undesired heavy goods traffic on Alpine roads, Switzerland has only partly succeeded in preventing HGV traffic from strong increase. However, the set of measures has shown that an integrated concept of infrastructure development and cautious traffic transfer can ease the burden significantly, and that combined transport is capable of taking over a major proportion of long-distance road freight. Nevertheless, as a "stand-alone" country, Switzerland does not have to take into account the concerns of neighbouring countries to the same extent as members of the European Union do. If the European Union had put as much energy as Switzerland has into restricting long-distance road freight, European combined transport volumes would surely be higher than they are today. However, for many European countries connections to European markets far away are more economically viable by road. The road usage and environmental costs are then mainly borne by the neighbouring countries.



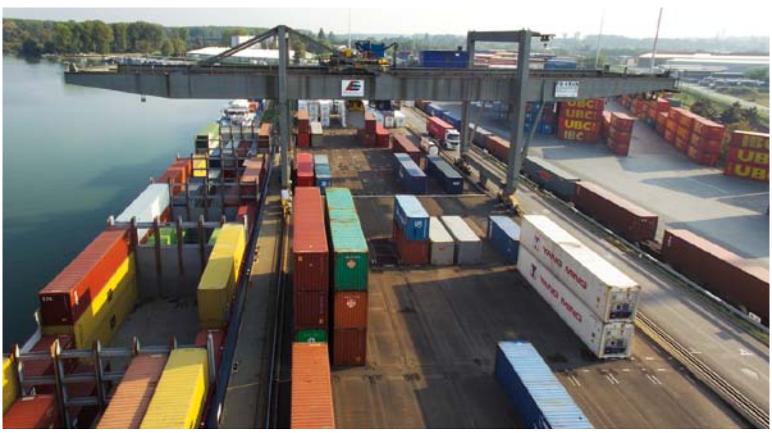
Alp mountains transit by non-accompanied combined transport

The European combined transport network shows that traffic between Central Europe and Italy accounts for practically half the combined transport volume. These markets have seen a strong development of combined transport, and their success on this corridor is also linked to the fact that a consistent transport policy was developed to promote combined transport.

Combined transport terminals: An emerging European network

Intermodal transfer from one transport mode to another – for example from road transport to rail transport – requires special transhipment locations: combined transport terminals. In international trade such transhipment locations have been well known for centuries as transport nodes: for example, to transfer goods from sea transport to a land-based transport carrier a port is required.

Combined transport terminals for road-rail transhipment are a more recent development. They have been established all over Europe, mostly as a feature of the public transport infrastructure. They were frequently built by the railway concerned, as in the beginning railways saw combined transport primarily as an opportunity to offer their services to customers with no connection to railway lines. In many cases there were also state grants for construction: states wanted to help their national railway hold its own in the market and thus supported road-rail combined transport.



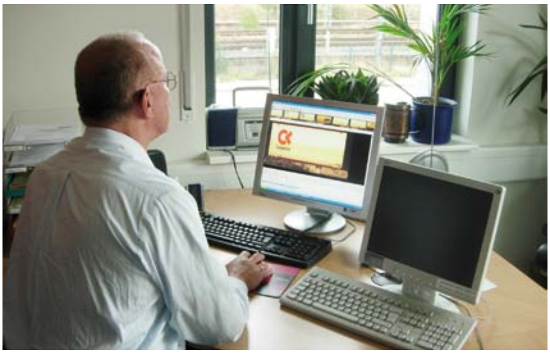
The inland terminal Germersheim combines road, rail and inland waterway

As the role of the railways has been evolving and they have had to compete on the transport market as private players, the role of combined transport terminals has also been noticeably changing: they are no longer predominantly a freight transport marketing tool for the railways, but are now becoming nodal points in the network of public transport infrastructure. As former state railways have been divided up into an infrastructure manager and various railway undertakings for rail freight services on the network, combined transport terminals have mostly been assigned to the infrastructure manager.

Combined transport terminals are often managed by regional infrastructure companies, such as Port Authorities as well as by railway networks. Local politicians have understood that a combined transport terminal can help provide their region with a growth spurt in logistics and freight transport. Logistics has become ever more a growth industry in Europe. Logistics today means more than rows and rows of HGVs in a traffic jam and jobs for strong men hauling boxes. In many places this has also been taken into account by policy, and European nodal points are being used to strive towards competence and infrastructure for logistics.

A combined transport terminal for road-rail transhipment is generally made up of four components:

- Administrative handling facilities, in which transport company staff process official documents, check the safety of the load, assign vehicles and suchlike;



Travel documents are checked

- Loading tracks for freight wagons and loading road sections for HGVs, parallel to one another;

Gantry cranes are the main transfer equipment in bigger terminals

- Transhipment machines – crane or heavy-duty fork lift – which tranship loading units between HGV and freight wagon;

Gantry cranes are also used for train-to-train transfer of loading units

- Holding area where loading units can be stored until their connecting train or HGV is ready to take them.

Container in stack waiting for the connecting train

Loading tracks must be closed off from the rail network, and loading road sections from the road network. For the most part both will require a preceding buffer zone (holding siding or parking area) in which temporarily unnecessary vehicles can be parked.

Van carriers take over the containers from delivery truck

The loading process at a combined transport terminal is in principle always the same:

the HGV with the combined transport loading unit drives up to the handling desk and hands over the transport documents. The staff at the desk check whether there is a confirmed reser-

Major terminals handle more than 200 000 loading units per year

vation for a transport slot on a combined transport train, whether the loading unit is undamaged and correctly loaded, and if necessary whether the requisite details for dangerous goods and other particularities are correctly applied. They download the loading plan from their computer, showing the loading track at which the combined transport train that will transport the loading unit is positioned and the wagons to be loaded, and direct the HGV driver in that direction. They also inform the crane operator that he has a transhipment task.

Before the departure of the combined transport train a rail company employee once again checks whether all loading units are loaded correctly and have been attached to the freight wagon. Then he gives the train driver the go-ahead for departure.

At the destination terminal the HGV driver's authorisation to collect a shipment is checked. Then he is instructed as to where exactly his loading unit is positioned on the train or in the storage yard. He lines up there, waits for the crane which then lifts the loading unit onto his HGV and drives to the exit of the combined transport terminal. At that point a final check is carried out to verify that the HGV has been provided with the correct loading unit, then the exit barriers are lifted.

A fundamental problem for all combined transport terminals is their stochastic nature: HGVs do not arrive according to a strict schedule, instead their arrival times are distributed randomly. For incoming combined transport trains, however, there is a timetable, but occasionally this timetable cannot be observed and certain trains may have unexpected arrival times. This results in an accumulation of tasks in a particular area of operations, which raises the issue of operational priority.

A combined transport terminal is an interface, and can organise its priorities according to three different principles:

- The terminal operator attempts to carry out the task of transhipment as economically as possible and does not tolerate overcapacity of machines or staff. Consequence: wherever there is an unexpected bottleneck, the operational chain affected must stop and wait.

- The terminal operator tries to process road transport customers as a priority. Dispatchers are assigned to the handling desk for standby staff, and crane drivers are instructed to immediately load or unload every HGV that drives onto the site.

- The terminal operator tries to service railway undertakings as a priority. As soon as an empty train enters the terminal loading begins. All of the terminal's resources are concentrated on this task so as to ensure that the combined transport train will be able to leave the terminal at its scheduled departure time.

In reality there must always be a compromise when it comes to priorities. Ultimately a transport terminal will always be required to adapt flexibly to changing events. In this respect combined transport terminals are not neutral intersections within the infrastructure of intermodal transport. The terminal's work has a considerable effect on the quality of the overall intermodal transport chain. For this reason there are many players endeavouring to gain influence over proceedings in combined transport terminals, for example by buying a share in the operating company.

Depending on the configuration of a combined transport terminal and the needs of the particular intermodal transport chain the decision has to be made between

- direct transhipment: the recipient HGV drives onto the loading area next to the incoming train, parallel to where its particular load unit is positioned, the crane moves into place, and the loading unit is transhipped directly from the rail wagon onto the HGV,

- and indirect transhipment: the incoming loading unit is unloaded from the train by the crane and either left to one side or transferred by further transhipment machinery to a holding area. When the recipient HGV arrives, the driver is told where the loading unit has been placed and a loading device tranships the parked loading unit.

The principle according to which operations are managed in a combined transport terminal depends on the circumstances of the operational management.

Gateway transport terminals receive loading units, which are brought in from the wider area by so-called "antenna" trains, at the entrance and set them down on the loading track. A short while later an international combined transport train will be dispatched. It collects the loading units that have previously been delivered by the antenna trains as well as the loading units that have been delivered by HGV from the region.

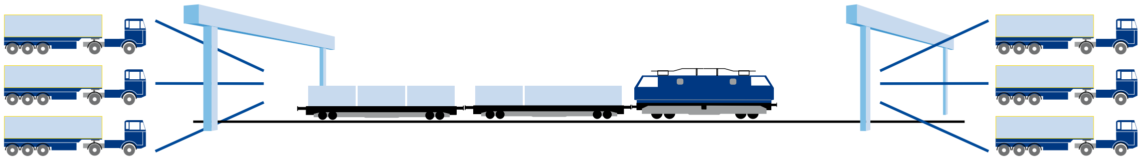
Road transport: competitor and partner for combined transport

Today, road transport is the most important transport mode in all developed countries. This is above all true for local transport, for which there is practically no alternative to HGVs (with the possible exception of horse-drawn carts). Thus we find in almost all industrialised countries that over short distances (i.e. less than 150 km) almost all freight is transported by road. At these kinds of distances combined transport is barely able to offer a competitive service.

The business model of continental combined transport is to function as an alternative to road transport for longer distances: goods and loads are collected from the surrounding area and carried over a short distance to a transport terminal by HGV. Here a large transport unit, such as a block train or an inland waterway vessel is prepared. The goods and loads then travel via this consolidated transport mode over the long-haul section of the journey to their destination area. Here the loading units with the transported goods inside are transferred back onto road transport and delivered to the surrounding area. This generates additional costs: transhipment in both the consignment and destination terminal costs money, and occasionally there are also detours: the appropriate terminal is not always situated on the exact transport route, meaning that for combined transport to be possible a detour is inevitable.

Check-in of trucks in a US inland terminal

Road transport is once again the competitor to this business model, in this case end-to-end HGVs which do not deliver goods and loads to a terminal but instead directly to the destination. This saves in the first instance the transhipment expenses. On the other hand it is of course expensive to deliver each load individually with one or two drivers on board for the full distance. A European block train can carry up to 40 HGV loads in one consignment, an inland waterway vessel even more. Instead of 40 HGV drivers the train only requires one train driver. Further savings can be made in energy consumption. A study by UIRR together with the Association for the Study of Combined Transport (SGKV) has shown that a block train working at good capacity, loaded with containers and swap bodies, uses half as much energy per load as the equivalent road transport in individual HGVs. CO_2 emissions are proportionally even more reduced. In theory the model of combined



Collect by road – carrying by rail over the long distance – distributing by road: these are the basic elements of combined transport

transport could be further developed so as to achieve zero emissions – if the railway's electrical power supply were to be appropriately organised.

There are further advantages when stresses on infrastructure are considered: 40 HGVs on the motorway undoubtedly cause greater stress on the infrastructure than a single block train on the rail network. This is another important factor in why many states are promoting combined transport. The state owns the infrastructure, and promoting a transport system that satisfactorily tackles the task of freight transport while reducing stress on infrastructure in the process is a welcome policy.

However, in support of the policy claims are often made that a large-scale shift of freight to combined transport could lead to road transport and road construction being largely dispensed with in the future. This is only partly true. What is relevant for long-haul transport does not hold true for short-haul transport. Short-haul freight transport requires roads and this aspect of freight transport cannot be replaced by combined transport. Moreover terminals for combined transport need to be connected to an efficient road network. The first and last sections of a loading unit's journey are almost always carried out by road transport.

There are also, however, comparatively short-distance routes on which combined transport could constitute a commercially interesting offer which would be worth considering. This is one of the advantages presented by antenna trains. There are, for example, locations which regularly receive combined transport loading units like containers, swap bodies and semi-trailers, but only in comparatively limited numbers, so that it would not be worthwhile regularly dispatching a block train a few times a week to a particular destination. However, such a location could often be easily linked to combined transport. Combined transport trains travel a few times a week from Kiel to the Hamburg-Billwerder terminal, where loading units from Kiel are unloaded and divided onto the many trains heading south. Using this system of antenna trains a smaller location like Kiel can be connected to the combined transport network and for the larger location, Hamburg, transport revenue is increased.

Short-haul combined transport can also be commercially interesting for container transport. In this case combined transport trains working in export traffic frequently drive directly into the port terminal. There is thus no expensive distribution by road at the end of the transport route; the containers are unloaded from the train and then set alongside the ship. If there is an even higher volume of cargo, which would regularly fill a block train, then combined transport is also worthwhile over short distances. Examples of this method of container transport can be found in England between the London area and Southampton port, and in Italy between Milan and La Spezia.

However, combined transport's bread and butter is transport over greater distances; long-haul transport covering 450 km and more. It is here that combined transport on large, high-volume corridors is almost always competitive.

Rail transport: combined transport revitalises the railways

Since the middle of the 20th century rail has been the main loser in industrialised countries' logistics markets. One explanation for this is the decline in coal mining and steel production – important rail customers using the railways to transport coal and iron ore - in the majority of these nations. These industries were important rail customers, using the railways to transport coal and iron ore. Although most rail transport companies managed to retain the remaining shipments of this nature on the rails, employing block train services, wagonload shipments largely shifted from rail to road.

Thanks to the accelerated construction of road infrastructure and the rigid defence mentality of railway undertakings, newly founded road haulage companies were capable to offer a better service in many instances.

Flexibility: the customer in Paris unexpectedly does not have the usual 20 t load for Lyon on Thursday, but rather only 9 t. The road haulier is able to react on the same day: he calls his colleague who regularly drives to St. Etienne and asks him to take the 9 t as an extra load and make a slight detour via Lyon to deliver the load. The railway cannot react so quickly: on Thursday morning an empty wagon with a 24-t load capacity was already positioned on the consignor's siding in Paris and now they have to decide whether to carry the wagon with a paying load of only 9 t or to reject the shipment because it is not financially viable.

Overnight shipment: when processing the till scanner data at its superstore in Regensburg on Thursday evening, the wholesaler can see which goods need topping up on Friday for the weekend. The central warehouse is in Haiger in northern Hesse. The orders for various superstores arrive there on Thursday at around 5 pm and the deliveries by HGV are organised for restocking. These HGVs depart late in the evening and deliver their loads in southern Germany the next morning before the store opens. No railway could offer this level of service. A wagonload service would probably require two to three days for this journey.

Protection of transported goods: in wagonload traffic the wagons are joined together to form long trains, reorganised into new trains along the way and finally shunted into the consignee's siding. When shunting, a gravity hump yard is used; when a wagon rolls down this gravity yard via the set of points and then couples with the new train there is a significant shunting impact, in which delicate goods may be damaged. Suspension also plays a role – a number of years ago road freight operators changed to using vehicles with air suspension. This is particularly beneficial for the cargo in terms of avoiding damage. Rail freight wagons still use leaf springs.

Rail freight traffic of these types of consumer goods subsequently diminished, particularly in wagonload traffic, where single wagon loads are transported between sidings. Several railways managed to maintain their market share in block train traffic with grain, coal, iron ore and mineral oil products, or supply of large industrial plants with semi-finished components, but they lost market share in the transport of finished goods, capital goods and smaller volumes of semi-finished goods.

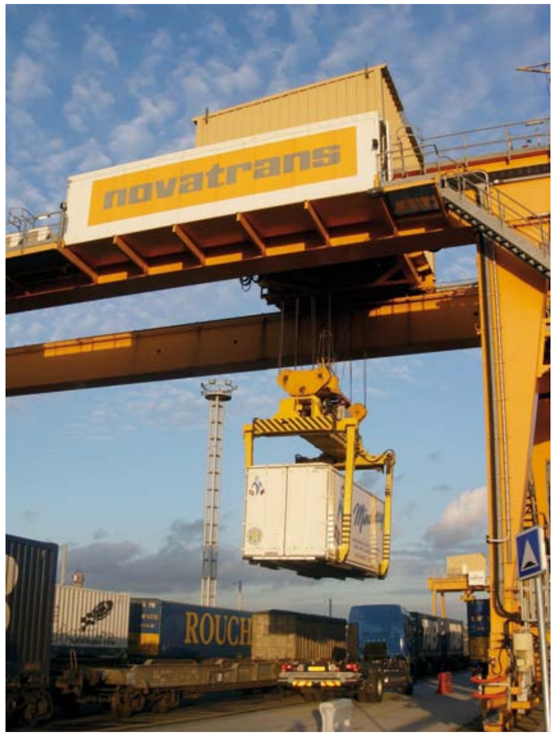
Combined transport, which came into being in the late 1960s, literally brought about a turning point in rail freight traffic. For the first time a new freight transport market emerged where rail was able to increase volumes and market share. From the start, rail gained two market segments:

- export and import container traffic between points of loading and unloading inland and at sea ports;

Alpine transit is the most important market in combined transport

- long distance transport of consumer and capital goods – i.e. the traditional home turf of road transport – between locations and regions in continental Europe.

Hinterland traffic with sea ports is mostly operated autonomously by railways' specialist subsidiaries. In contrast it is predominantly freight forwarders and road hauliers that have taken the initiative in continental freight traffic. And this makes perfect sense: at the start the premium logistics services



Handling swap bodies

which had become standard in the European traffic market were simply not required in container traffic to sea ports. If an import container from Japan arrived in Rotterdam or Hamburg on Tuesday following a three week sea journey it was not that important whether it continued its journey inland on Wednesday or Thursday and whether it took one or more days to arrive in Stuttgart. If a container is laden with very important goods with a fixed deadline – for example Christmas lights arriving from China on 18 December – it can be picked out in the port and fast tracked inland by road. Most containers, however, are in no rush and railways can collect them in their terminals until a train is relatively full before setting off.

In contrast, continental logistics operators have no time to waste. In this market the HGV determines the minimum quality which must be on offer. And that means on shorter, mostly domestic routes of up to 600 km the journey must be made overnight; the consignor loads the goods late in the afternoon and they are delivered to the consignee the next morning. For longer international routes of 800 – 1000 km or more the service offered must usually depart on day 1 and arrive on day 3. There are also day 1 – day 4 shipments for even longer distances in Europe. This transport speed can only be achieved by avoiding major train reorganisation en route. Combined transport operators have introduced block trains which travel at least the same speed as HGVs, or even faster. Block train traffic did exist previously, for example for coal shipments from the colliery to the power station. Block train traffic for manufactured goods is, however, a new phenomenon. It has been first introduced in combined transport.


Double traction is needed to climb up the mountain passage

But it is not possible for operators to directly transpose the established rules for block train traffic developed over the last 150 years of rail traffic to the new logistics trains. For a block train carrying coal it is almost always insignificant whether the train arrives at the power station on Wednesday or Friday: it is carrying 1,400 t of coal which upon arrival will be tipped onto the heap, which already represents a considerable supply. From this point of view a combined transport train is completely different: it is loaded with three swap bodies on Wednesday evening which contain car tyres to be fitted to the wheels of cars at the automotive plant in Ingolstadt on Thursday. If the swap bodies were not to arrive until Friday, this would cause a great deal of problems. Freight forwarders have not only had to introduce block trains, they have also had to create a whole new concept of rail freight transport quality.

These new services, "block train with top-quality rail logistics", revolutionised rail freight transport. The railways regained business which had been almost completely lost – specifically the transport of consumer and capital goods over long distances offering high quality logistics, providing:

- sufficient flexibility,
- a high level of punctuality,
- a smoother journey (no shunting impacts which could damage goods).

Rail-road combined transport operators tapped into another decisive market: cross-border freight traffic in Europe with high quality logistics services. Here, once again, HGVs set the quality benchmark to be matched. And here again, conventional wagonload traffic could not provide the required level of service and new standards had to be developed in terms of reliability, meaning keeping to agreed delivery times. At the beginning that was really difficult because the European market in the 1970s and 80s was dominated by state owned railways. They did offer international transport services, but always in cooperation with one another. One railway would transport the wagon to the border station and it was then transferred to the railway of the neighbouring country. No one was really responsible for the overall quality of the service or the cross-border provision of information to the customer. Over a number of decades combined transport companies worked to gradually improve this system so that today very reliable logistics trains are also offered in cross-border traffic.

Development moved up a gear with the liberalisation of rail freight traffic. Smaller rail service providers appeared on the market and, thanks to their flexibility, offered services which seemed almost impossible from the point of view of the large state railways. The major players in the market tended to collaborate and together state that punctuality could not be guaranteed and no compensation would be paid in the event of a delay. Then private operators arrived on the scene and provided a guarantee and promised to pay compensation. Diverse logistics services which the large players were not willing or able to offer were suddenly available on the market.

The new service providers' preferred market was road-rail combined transport, with its clearly arranged market structures: shipping company groups required hinterland services for containers and large combined transport hauliers required combined transport on international corridors.

This is why road-rail combined transport both supported and benefited from the liberalisation of the rail freight market. It may be true that since the start of the new millennium the major rail companies have started to systematically buy up the new small operators and combined transport operators, but it has yet to be seen whether these acquisitions will be detrimental to rail's new-found flexibility or whether the major railways will learn from their new subsidiaries.

The development from conventional rail freight traffic to high quality transport services was fostered by freight forwarders and their combined transport companies. The liberalisation of rail freight transport also offered a helping hand. This development is not yet over. Discussions between combined transport companies and railways regarding further quality improvements – particularly in cross-border traffic – are ongoing. But rail transport has reasons to celebrate: the European railways are no longer the eternal losers in freight traffic. Combined transport means they have gained in terms of transported volumes, market share and service quality.

UIRR: from liaison office to European player

The UIRR member companies

Europe is a patchwork of different countries and travelling a few 100 km in any direction usually results in crossing a border or two. Road-rail combined transport's role lies in carrying long distance shipments. Cross-border shipments form one of the largest and most important parts of the European combined transport market.

When it started, however, combined transport in Europe was dominated by national transport policy: in the UK "Freightliner" was founded as a subsidiary of British Rail to coordinate the transport of containers on the British railway network. In France there was the Compagnie Nouvelle de Conteneurs, partly owned by the railway and partly by hauliers, which organised container traffic in France. For container traffic in Germany there was Transfracht, a 100 % subsidiary of Deutsche Bundesbahn, which was essentially responsible for sea port hinterland traffic and for other national routes Kombiverkehr in Germany and Novatrans in France, a joint venture between freight forwarders, the national railway and several transport syndicates. These companies were all supported by the relevant national governments, notably because the latter had spotted an opportunity to halt the decline of the state railway companies using combined transport.

Many of the companies mentioned above were founded as national state railway subsidiaries. Those responsible for national transport policy initially imagined that only railway specialists would be in a position to set up this new container transport market.

At the same time, however, freight forwarders and road haulage companies were actively working on long distance routes. They recognised an opportunity for an alternative to the established way of working for a significant part of their market in cross-border European freight traffic (and domes tic freight traffic for long distances within the larger European nations): instead of long lines of HGVs – each staffed with one or two drivers – longer distances would be covered by rail. The Netherlands founded Trailstar as early as 1964, Belgium followed suit in 1965 with TRW, France in 1966 with Novatrans, Germany and Switzerland in 1967 with Kombiverkehr and HUPAC respectively.

In the late 1960s it was generally recognised that the concept of combined transport was commercially much more attractive in international traffic, and CT companies offered European cross-border services, generally working together. This type of cooperation, initially bilateral, grew into international cooperation within international organisations. The International Union of combined Road-Rail transport companies (UIRR) was founded in 1970. Initially only CT companies of which the business models were predominantly led by freight forwarders were represented in UIRR. The founding of the organisation also reflected the mentality of road hauliers: unnecessary costs were to be avoided first and foremost. UIRR thus came into being as a loose Association without any full-time staff, effectively managed on the side by CT operator managers.

Logo of UIRR

From 1976 UIRR companies and the railways of the relevant countries worked together in the “Comité Mixte”. This committee was later renamed Interunit.

It did not include companies such as Transfracht, CNC and Freightliner (which essentially acted as railway-owned sales agents). UIRR was only interested in members whose business models were based on freight forwarding and road haulage companies’ initiatives and not companies which were simply a further subdivision for railway marketing.

Initially the most important task of UIRR was to facilitate cooperation between CT companies by developing common standards, terms and conditions of business, information systems etc. Part of this work later moved to the European Committee for Standardization, CEN, where UIRR now plays a leading role. However, a great deal of UIRR’s work in the field of joint processes continues today in areas less suited to the CEN.

Several of the technical standards concern the interface between commercial CT operators and their most important freight carriers – the railway companies. This concerns wagon technology (maximum load, load distribution, transport stress, dimensions, markings) and transhipment methods as most CT terminals were built and are still operated today by railway companies. The coordination of technical components in road-rail combined transport takes place in Interunit, where most of the larger railway companies are members alongside CT companies.

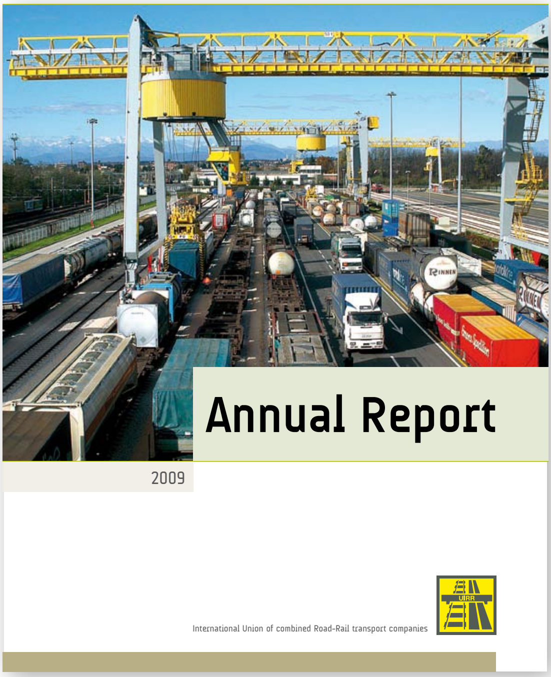
Over time, however, the functional division at UIRR, which essentially meant that only those CT operators run by freight forwarders and road hauliers could become members, was challenged. The liberalisation of rail freight in many European states brought

UIRR also acts as an information and discussion forum

with it a large number of newly founded companies and the reorganisation of existing ones which wanted to offer rail freight services. A number of them are also active in road-rail combined transport. As time went by several of these companies were bought by state railways (which now also operate as private companies), and are operated as autonomous subsidiaries. Furthermore some state railways have strengthened their position in combined transport which resulted in reduced influence of road hauliers. It has yet to be seen whether this will benefit combined transport. Regardless of this UIRR cannot ignore the fact that former state railways have a majority share in many CT companies.

After a number of years, in addition to cooperation on technological matters, joint lobbying at European level became one of the organisation's most important tasks. In com

In combined transport loading units are loaded onto HGVs. This combination weighs slightly more than an HGV with a fixed superstructure. If the maximum weight limit of 40 t is also applied to combined transport this would mean that less weight can be loaded because the vehicle weight (HGV and loading unit) is higher than for conventional road vehicles. That would mean road freight could offer higher loading capacity and the sector would revert to road traffic, particularly for heavy cargo. To avoid this situation many European countries permit a maximum weight of 44 t for HGVs transporting combined transport loading units between the consignor or consignee and the closest suitable CT terminal. This largely eliminates combined transport's weight disadvantage. UIRR has been lobbying the European regulators since the 1990s to achieve a regulation of this nature for all European Union members.



The UIRR annual report offers up-to-date information

bined transport specialist advice is required for the decision makers in ministries and parliaments because they are not particularly aware of the specific features of combined transport operations. Advice is particularly provided to regulators in Brussels as this is where most framework regulations for European freight traffic are drawn up.

In order for combined transport to flourish, in addition to standards and coordination, decision makers in ministries and parliaments must be provided with specialist advice as they are less familiar with specialist logistics processes in combined transport. This particularly concerns regulators in Brussels. As combined transport's role differs greatly between European countries there are also large differences between countries in levels of awareness and support for combined transport. UIRR plays a particularly active role in this context and organises recommendations, background knowledge and commitment.

Both the maximum number of hours an HGV driver can work and the minimum length of the subsequent rest period prior to continuation of the journey are clearly defined in European and national legislation concerning road transport in Europe. In the case of accompanied combined transport, with the rolling motorway system for example, work is arranged slightly differently: the HGV driver may be on the road for three hours transporting the empty HGV to the consignor, waits for the HGV to be loaded and then drives to the rolling motorway terminal. There he might wait for a further hour for his HGV to be handled and loaded onto the train. Once this has taken place the driver boards the couchette coach included in the train and reads a book, sleeps or plays cards with colleagues on the same train. Following an eight hour rolling motorway journey by rail he has arrived at the destination station. The driver gets back into his cab, delivers the shipment to the recipient, drives to the next collection point, accepts the next shipment and returns to the RoLa terminal. Now the legislator must determine how much of this time can be classed as working time in the sense of the Directive on drivers' working hours, and how much is rest time. Afterwards the French inspector must also be aware of this if a portion of the road journey passes through France; but in France there is no rolling motorway traffic or any authorities familiar with this special case. Such regulations therefore require the involvement of combined transport specialists; otherwise the result is often illogical regulations.

It is typical of all processes in road-rail-road combined transport that the road haulier plays the role of freight forwarder for the customer even though the lion's share of the journey is undertaken by rail. Most states try to recover a portion (or the entirety) of road network construction and maintenance costs by taxing road freight traffic. However, in doing so most tax systems do not reflect the fact that, in the case of combined transport, most of the journey is undertaken by rail, not using or causing wear to the road. And the price for the use of the tracks is already included in the price that the railway charges the CT operator. The tax systems in individual nations must therefore be adapted to the specific features of combined transport. This is not always simple for the experts in the national ministries of finance and the politicians responsible for tax in the national parliaments. They are usually involved in establishing the details of tax assessment and not with the particular features of any type of freight transport operations. The presence of an organisation to represent the sector with specialist knowledge to provide recommendations, including background information demonstrating their necessity, is key in such cases.


Presentation of a new platform wagon

It is also important to remember that combined transport in Europe is a relatively new concept. The path of development has been long from national railway companies to transalpine block trains with swap bodies and semi-trailers. Commercial developments and technical innovation play a key role in combined transport. The majority of European research projects therefore include projects developing and testing further improvements and innovations in combined transport. UIRR has a number of scientists at its disposal (as well as the cumulative specialist knowledge of all of its members) and is active in European research on combined transport. In its work UIRR is striving to ensure that such research projects are approached in a competent manner firmly anchored in what happens in practice.

At present UIRR's activities focus on three areas and tasks:

- guidance for European legislators and regulators on the market and technical aspects of combined transport,
- coordination and standardisation in combined transport (together with the Interunit railways),
- involvement in European research projects to develop combined transport.

By means of this approach UIRR is influencing the development of combined transport on a significant scale.

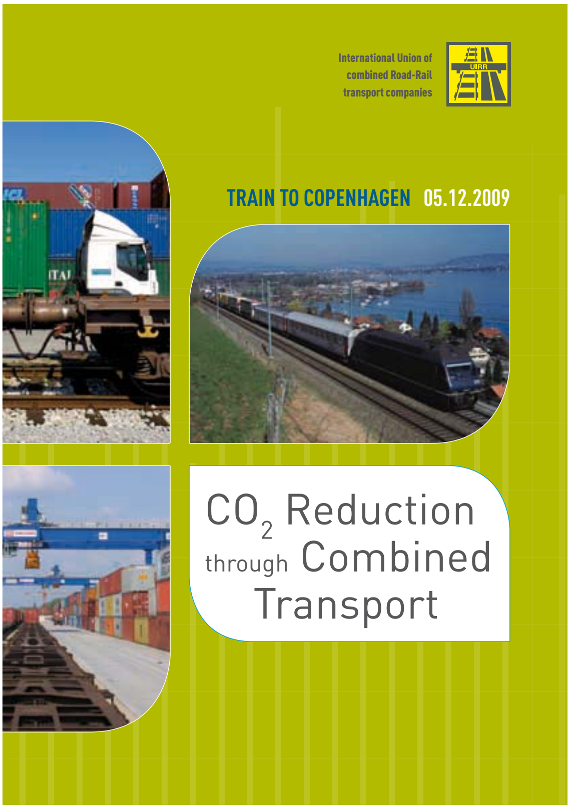
Combined transport's contribution to environmental protection

Freight traffic consists in moving goods, which consumes energy. This energy is often obtained by burning fossil fuels and using the energy released for traction. The process causes the release of carbon dioxide (CO_2) inter alia, an increasing cause for concern at present. It is argued that unintended changes are being caused in the earth's atmosphere by the excessive release of CO_2 which lead to climate change, the scale of which cannot yet be estimated, but which will unquestionably have a notable affect on society and the economy.

Global trade is growing and freight traffic and CO_2 emissions are growing with it. Ways and means of limiting the emissions of freight transport are therefore being discussed so that this sector can also make its contribution towards reducing the atmosphere's exposure to CO_2.

Road-rail-road combined transport offers opportunities in this context, in two respects:

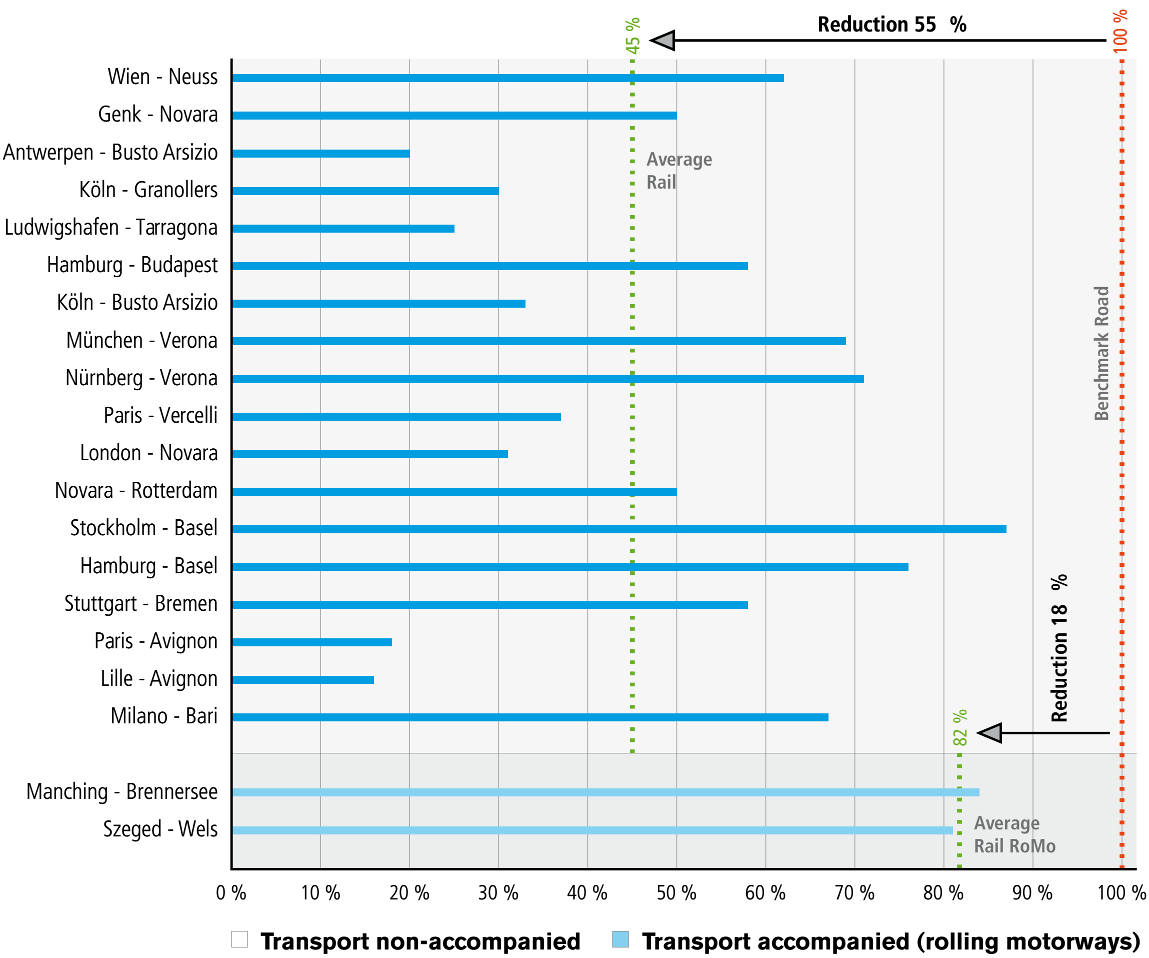
Road-rail-road combined transport replaces road transport with rail on the long section of the journey. At present road freight almost exclusively uses diesel engines for traction. This involves the combustion of oil derivatives. In contrast, on the main European railway lines (which are where most CT trains travel) locomotives with electric traction are used. In some countries this electrical energy is predominantly produced by nuclear or hydro-electric power stations (which effectively produce no CO_2 emissions) or by natural gas power stations (which produce



Combined transport contributes to environment protection much less CO_2 per energy unit than coal or oil power stations). Recently there has been increasing use of renewable sources such as wind, geothermal and solar energy.

Only with road-rail-road combined transport is it possible for freight transport to change to a different transport mode which fits in with efforts by industry and politics to reduce CO_2 emissions. Based on current technology, concepts such as switching long-distance road haulage to electric drive systems are only utopian dreams, whereas rail freight traffic already uses almost solely electric power.

CO_2 Emissions of road versus CT chain



There is further energy to be saved in combined transport, in addition to the shift from oil-powered engines to electric traction systems. A combined transport block train carries a payload of 800 to 1,200 t and in doing so uses much less energy per payload tonne than a chain of 40 HGVs and trailers each carrying between 20 and 25 t. This is partly related to the physical nature of rail transport – much less energy is used when moving a steel wheel along a steel rail than moving a rubber wheel on asphalt.

In a scientific study undertaken in cooperation with the Association for the Study of Combined Transport (SGKV), UIRR enumerated the actual conditions concerning energy use and CO_2 emissions in freight transport. This entailed taking representative block train journeys on European routes using various different load factors according to real conditions on the market. It showed that a CT train laden with containers or swap bodies can halve the energy use per payload tonne. This is the result of increased energy efficiency when large shipments are gathered on one train rather than being transported individually by road.

Much greater energy savings in terms of greenhouse gas emissions are achieved by using electrical energy to power the train. This differs from country to country. The electrical energy for rail operations in Switzerland and Austria for example is solely produced using renewable energy (particularly hydroelectric and wind genreation). This means that the portion of combined transport carried by rail would be included in the calculation with zero CO_2 emissions. Other countries have power stations which use coal or oil to produce greater or smaller portions of their energy supply and these CO_2 emissions are then included proportionally in the calculation – nevertheless the levels are far lower than for comparable transport by road. In Europe a number of years ago CO_2 savings averaged around 60 %. Increasing the use of renewable energy sources in electricity production for the railways could, however, reduce emissions to almost zero in a number of years.

Energy savings differ depending on combined transport methods and load factors. They are highest in the transport of containers and swap bodies and slightly lower for the transport of semi-trailers by rail. A train's load factor also plays a role here. In this respect the following principle applies: the higher the load factor of the CT train, the higher the energy saving per unit and the lower the CO_2 emissions per unit. This is also in the commercial interest of the CT operators: the higher the load factor of a CT train the more likely it is to be competitive. CT operators are therefore working particularly hard to move in this direction.

As energy savings and reduction in CO_2 differ depending on the route, technology used, load factor and other elements, the current players in road-rail combined transport have developed a model by means of which these effects can be calculated for a concrete case. It can be downloaded free of charge from the internet site www.ecotransit.org.

Electric locomotives

Combined transport's contribution to improved security in freight traffic

Originally, in most European countries the "safety" issue was only discussed in the context of avoiding traffic accidents. In this respect the emphasis was on road traffic. The topic's scope was expanded on 11th September 2001 following events which opened discussions on security from criminal or terrorist attacks. Prior to this day the fact that politically and religiously motivated extremists had concentrated their efforts on disrupting passenger air transport meant that countermeasures had served to protect passenger air transport. Freight transport was not prepared for any kind of attack. There were no disruptions caused by terrorist activities in freight traffic, only theft, which has existed in sea ports since the time of the Phoenicians' Mediterranean trade.

Containers offer a neutral outside image

In terms of theft, combined transport has already brought about improvements: from the outside it is not possible to tell what a container or swap body contains. In the past wooden boxes transported by ship often had the name of the consignor marked on the box, for example "Scotch Whisky Distillery", meaning that a thief with a thirst for whisky would know straight away which box to steal. Today the markings on the container simply show the container number and the shipping company. Anyone wishing to know what is in a specific container either has to break it open and look inside or hack into the freight forwarder's information system and try and find the loading declaration based on the container number. The fact that containers are now anonymous creates security.

The difference between security in road transport and inner European combined transport is very similar: HGV drivers transporting freight by road must stop regularly at borders and declare what they are transporting at the customs border and deliver a customs declaration. Once a customs official knows what the shipment contains it will not take long for criminals to find it out if they have established good connections with certain customs officials. Then they can pick and choose which HGVs they want to steal from. Or the information can be obtained from a staff member of the consignor.

In the case of combined transport it is often true that the contents of a swap body is only notified of during the customs procedure at the destination terminal, and from there it is often only an hour's drive to the importer. In this context the danger of theft is much lower than in conventional traffic undertaking the long journey by road.

Combined transport has therefore made a significant contribution to fighting theft in international traffic. However, a new problem has arisen following the terrorist attacks on planes and skyscrapers in New York: it has become increasingly evident that international trade and freight traffic is also vulnerable to attack and that this could entail significant damage. This topic was particularly discussed in the USA due to the enormous flow of laden containers entering the country, which sees itself as a particular target for terrorists. All the containers are completely sealed when they cross the border and most of them are only opened once they have travelled some distance into the country. European import countries are essentially facing the same threat, even if there is less public discussion on the matter.

In the USA there has been a series of studies and investigations into possible threats and a series of hypothetical issues concerning their repercussions have been analysed:

- undesirable persons may be in the containers and illegally enter the country in that manner.
- the container may contain arms or explosives which could enter the country illegally to be used by domestic criminals.
- containers may be being used to smuggle nuclear explosives or radioactive material. Detonation of the container upon arrival in the port would cause severe damage and potentially put the port out of service for decades.

Countries have worked together at global level to implement a series of measures to improve safety in freight nodes: incoming and outgoing loads are inspected in all sea ports; the persons present in the port (who could tamper with the load or the loading units) are also checked. Export containers with a final destination in the USA in particular are subject to checks starting when the container is loaded in the export country and continuing along the container's international journey. Special seals on the containers ensure that any unauthorised opening of the container door is visible.

CT operators in Europe have adopted many of these monitoring and inspection measures. Indeed they are mostly active in sea port hinterland traffic so they are transporting containers carrying shipments destined for the USA which are subject to certain regulations regarding inspection. The inspections which are now also undertaken at terminal facilities are similar to the mandatory inspections at sea ports. The transport and transhipment of dangerous goods are subject to particularly severe inspection measures.

In addition to these physical checks that improve safety in freight transport, there is a further network in combined transport, invisibly spread across all processes: transport planning and monitoring by computer. In combined transport all loading units and their movements are compiled and planned electronically and any deviation from the plan or unexpected occurrence shows up in the information system: the exporter books an export shipment with his freight forwarder and an empty container to be delivered to his loading dock at a specific time. The delivery is registered at the plant entrance. If a different empty loading unit is received than planned or if the loading unit arrives on a different day then an enquiry is immediately sent. This process of constant checks continues along the entire transport chain: the terminal is notified of the shipment of the loading unit as well as its identification number, and it is booked on a specific CT train. In the event that an ill-intentioned person succeeds in changing the course of the container and covertly changing some of the load, the container would automatically arrive later than planned, which would immediately lead to an enquiry. The entire transport process is so tightly planned and monitored that any unexpected event immediately becomes plainly obvious in the information system.

Every container is marked with an owner code so it is possible to find out who is responsible for any container at any time. A database of the addresses of all owners and container operators worldwide has been compiled by the Bureau International des Containers (BIC) and is available online in real time to all customs authorities. CEN and UIRR are currently in the process of setting up a similar system for swap bodies and semi-trailers.

As combined transport today is already very well monitored, many players recommend combined transport, particularly for shipments requiring surveillance.

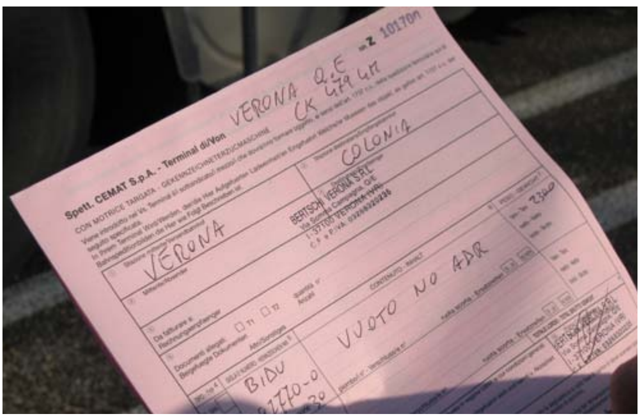
The fact that combined transport is so well monitored has led to some quite bizarre results in terms of transport policy. In a study of freight transport for example, the authors recommended that future regulations not require goods transported internationally by road to be monitored – because monitoring is simply not possible. In combined transport it was recommended that monitoring be increased because combined transport is suitable for it. As a result an HGV travelling from central Sweden to the Rhineland (Germany) would not be monitored or inspected, in spite of the fact that on its journey south it would pass through the city of Malmö, then via a bridge and tunnel to Denmark, via the large city of Copenhagen, then over the strait bridge to Jutland and into the large city of Hamburg via the Elbe tunnel. If the same load were transported by swap body, travelling by ferry from the port of Trelleborg to Lübeck and from there by CT train to Cologne, it would be subject on three occasions to very stringent checks, investigations of potential risks and safety measures, although the potential danger is clearly inferior to the parallel road freight traffic.

Safety and monitoring systems for international freight transport are currently being investigated and optimised. Most of the requirements under discussion are already fulfilled by combined transport it its current form. However, the combined transport sector and its representatives will have to work hard to avoid measures being introduced in the name of safety which inhibit the economic viability of the transport mode without actually increasing safety, while combined transport's competitors are spared these expensive obligatory precautions.

Poster campaign led by the UIRR within the „INSECTT"* project supported by the Marco Polo programme of the European Union.
(* Intermodal Security for Combined Transport Terminals)

Combined transport: catalyst for modern information systems in freight transport

Efficient combined transport requires excellent organisation. Intermodal loading units, a transhipment system, road and rail vehicles – it is not simply a matter of being compatible (which is ensured through standardisation in combined transport, see chapter 3 and 4). The organisation of service schedules and capacity must also be linked. If there are 55 loading units a day to be transported it is not economically viable to transport them on a CT train with enough capacity for 80. However, this does not only entail coordinating capacity – vehicle turnaround must also be planned and optimised. And all these production factors must be monitored to enable the identification of issues straight away so that countermeasures can be initiated.



Paper documents still carry important information

Combined Transport has promoted digitalisation of transport data

In comparison, coordination in international road transport is simpler: an HGV and a driver are required; the drivers is told where to collect the goods for export, which papers he needs to present at the border and where he must deliver the goods. Furthermore, the HGV virtually has a return guarantee – as soon as the driver has delivered the shipment he wants to return home and the easiest way to get home is to drive the HGV back. In contrast, combined transport constantly raises the issue of how best to return the empty loading units. In most cases combined transport providers endeavour to offer their services primarily on routes where they can find loads to be transported in both directions. This is, however, not so easy because not all transport axes are balanced. For example deliveries into large administrative centres such as Paris, London or Milan always outnumber deliveries out of these cities, meaning some loading units have to be transported empty.

At an early stage CT operators started to set up complex transport planning and monitoring on combined transport corridors. They were the first rail freight transport users to effectively introduce transport booking across the board: customers – freight forwarders and road hauliers – book space on CT trains for their loading units. These bookings mean that they have a guaranteed means of transporting their loading units if they bring them to the departure terminal in time. At the same time the CT operators can use these bookings to plan capacity on the international corridors: if 64 seven-metre swap bodies are booked on the CT train departing at 9 pm from Ludwigshafen in west Germany to Busto Arsizio in northern Italy then the train requires 32 wagons, each with a capacity of two swap bodies. However, this does not mean that the planning and optimisation are over: the next step is to enquire in Busto Arsizio how many loading units there are for the northward return journey. If there are bookings for 70 swap bodies at that terminal then the return train will require 35 wagons, i.e. three more than the outward journey. Do the colleagues in Italy have the corresponding reserve of wagons? Or will the CT train have to carry three empty wagons to ensure sufficient capacity for the return journey? What would happen if one of the wagons had a hot box on the way and had to be taken out of the consist for repairs?

Combined transport operations require complex planning as well as quick reactions to any incidents, which are bound to occur now and again and disrupt the planned schedule – even if it is simply unexpected snowfall.

In these circumstances it comes as no surprise that CT operators started very early to set up computer-based information systems, by means of which they could optimise their planning and which could help minimise the disruption caused by incidents.

As many international transport corridors function on the basis of cooperation be-

Internet is the most common way for bookings in combined transport

tween several CT operators the information systems must also be compatible and able to exchange information. A loading unit from Sweden, for example, is shipped by ferry to Lübeck (a slot must be booked with the shipping company) and there it is loaded onto a CT train to Cologne-Eifeltor station (the connection must be booked with the train operator Kombiverkehr); the next journey is from

Cologne to northern Italy on an international CT train (where connecting transport must be booked) and in northern Italy it is transferred to a domestic Italian train going south (which has to be booked with CEMAT in Milan). The loading unit may not arrive as planned in southern Italy, whereby the branch of the haulier there would wonder: what happened? Will the shipment arrive the following day? Or has it got stuck somewhere along the way? Who can we contact?

CESAR: a multi-company information system in combined transport

For complex transport chains such as this one, some large CT operators have set up a joint transport monitoring and information system together with UIRR which has been operating under the name CESAR for many years. CESAR monitors all the important transport corridors on the north-south European axis and processes data for each individual shipment, starting with booking and ending with delivery of the loading unit at the destination terminal.

As soon as a customer of one of the member companies of this data network books a place on a train, a data folder is created for the journey. All future events (such as the arrival of the loading unit at the departure terminal, loading onto the CT train, arrival at the destination terminal of the CT train carrying the loading unit etc.) are reported in the CESAR system by the responsible CT or terminal operator and saved in the same folder. The ordering party can access this data network directly and see all the information in real time either via the booking reference number or the unique number of the loading unit. Many CT customers – primarily European hauliers – have set up a direct electronic data exchange between the CESAR system and their in-house information systems.

Since the network was established almost 500 customers have joined and 2/3 of all CT journeys on the European network are now saved and monitored in this information system. Every working day the CESAR system issues more than 55,000 reports on the status of the loading units currently being carried by the European CT operators connected to the system.

To a certain extent combined transport in Europe has made a virtue out of the necessity to monitor complex transport processes and established freight transport's only cross-company and cross-border information system.

For combined transport to grow, infrastructure must grow

Road-rail-road combined transport requires infrastructure: road links from industrial sites to terminals, CT terminals, connecting rail lines between terminals in the long distance network, another terminal in the destination region and road links there as well. In many cases this infrastructure has yet to be built, which leads us to the age-old problem in combined transport: who is responsible?

The authority responsible for state transport infrastructure usually has a department for road building, one for the rail network and one for waterways. Which of these is then responsible for CT terminals?

In some states the points were clearly positioned at an early stage: a combined transport department was set up in the transport authority to deal with aspects affecting more than one area. The Federal Republic of Germany came first when it approved a state “Programme to promote combined transport and private siding traffic” in 1968. The programme entailed subsidies of 250 million German marks which were paid to all those who, with the help of combined transport or private siding traffic, shifted traffic from road onto rail. A network of combined transport terminals was built in the context of this programme. Other states such as France, Italy, the Netherlands, Austria and Switzerland chose similar paths and supported the construction of CT terminals. In almost all of these cases, funding was connected to the hope that freight transport on the road network would be reduced (leading to savings in infrastructure expenditure) and volumes would increase on the state railway network (reducing their deficit).

Since then new problems have arisen for road-rail-road combined transport as it has consistently grown: international container traffic has streamlined, improved and reduced the costs in the global goods trade to such an extent that world trade has grown dramatically – the past 12 years have seen annual growth of:

- 3-4 % in the global social product,
- 6-10 % in international trade,
- 9-11 % in container traffic.

This new, rapidly growing container traffic does not only require new specialised port facilities. Most containers must also be transported inland from the port. Road transport is usually used in this context for short journeys in Europe, and rail-road combined transport for longer distances (and transport via inland waterway where a suitable network is available).

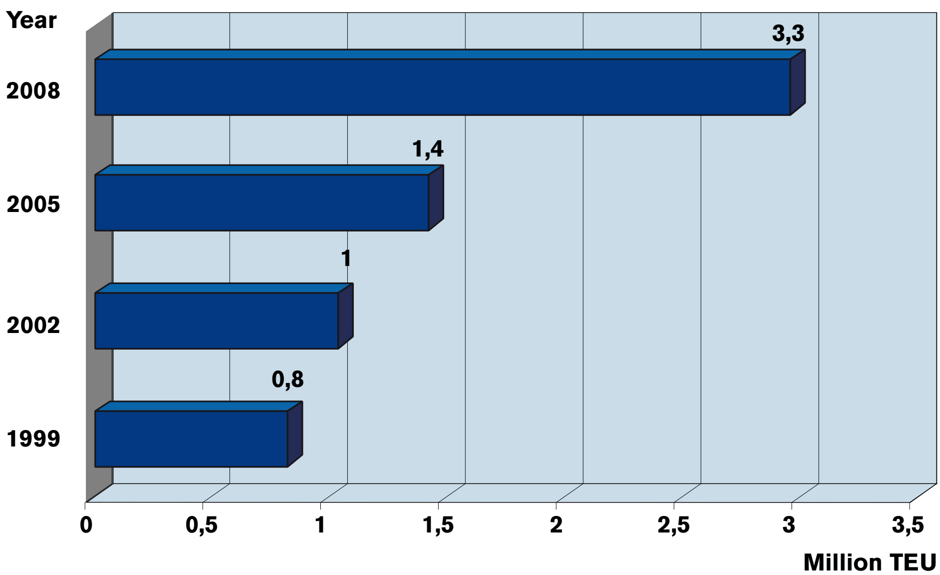
Regardless of what reserve capacities can be freed up, an annual increase in volume of 9-11 % can only be handled if considerable investment is made. This kind of state investment in combined transport in Europe does occur, but not always at sufficient levels. One obstacle in this respect is political concerns:

Investment and technical developments in passenger rail transport are usually more beneficial than freight transport to politicians. Voters value the benefit of a new rapid transport link more than an improvement in the logistical situation in freight traffic. Media interest consequently also concentrates on these improvements.

Concerning investments in rail freight transport, politics often prescribes "equality": investments should, as far as possible, benefit all regions equally. However, combined transport's efficiency is derived from pooling shipments, establishing strong traffic flows on long distance corridors. Combined transport cannot be efficient in sparsely populated regions with little industry, and any investments made in this system in such regions are effectively lost. Some countries have taken action on this basis and moved the construction of CT terminals away from central infrastructure programmes emanating from political decisions. CT terminals are then chiefly built where investors can be found in the region to finance a portion of the project. This is only possible where there is sustained demand for combined transport capacity.

There was a unique difficulty with combined transport and related investment at the end of the last century: the large European railways suspected combined transport of undermining the apple of their eye in freight transport – wagonload transport. It was deemed preferable to use investment funds to expand wagonload operation facilities to reverse the downward trend in this sector. Expensive semi-automated marshalling yards were planned (and some of them also built)

Non accompanied combined transport has increased by almost five-fold since 1999



Transport volume growth increases

and special wagons were ordered for wagonload traffic. This meant there was less money available for CT terminals and container traffic, which was booming, regularly complained of a lack of wagons.

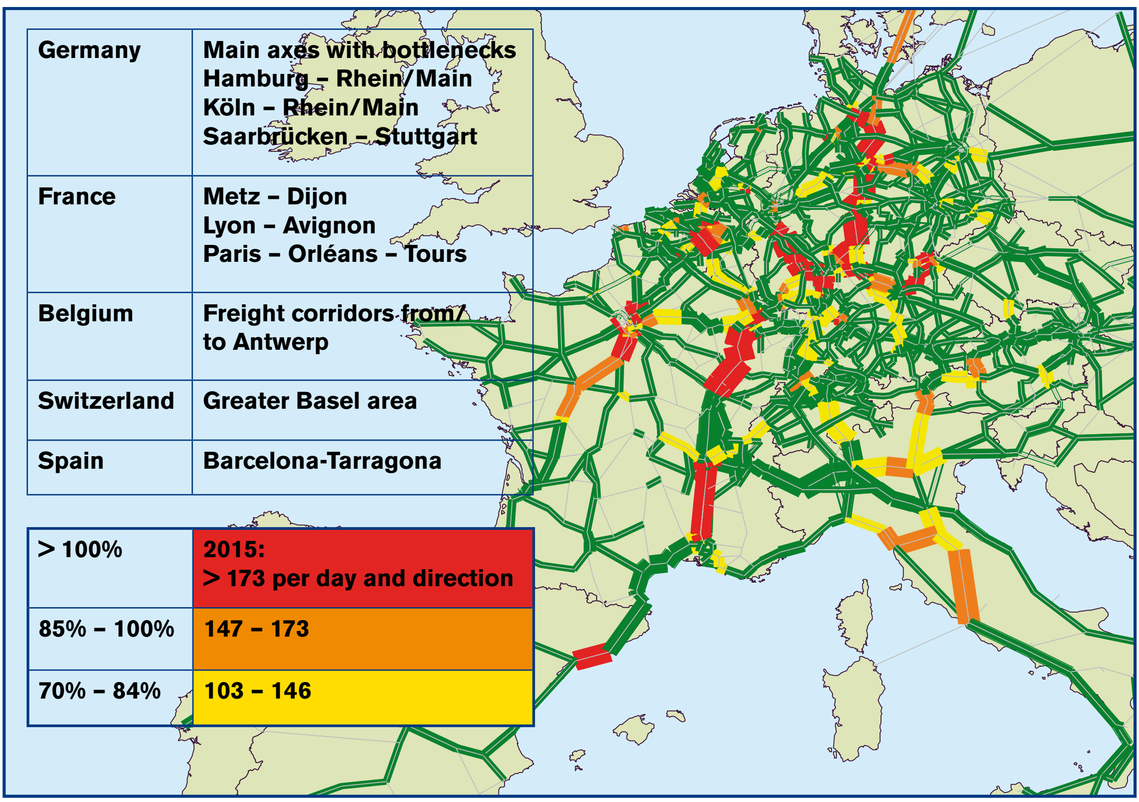
Since that time the large players in the combined transport market and their associations have presented a study showing the expected growth rates in combined transport and the corresponding expansion in infrastructure required:

In Europe in 2007 more than 1,700 CT trains were on the tracks every working day, transporting combined transport loading units. On domestic routes in 2007, a total of almost 100 million tonnes were transported in combined transport, a further 70 million tonnes in international (inner-European) transport. A fall in volumes was seen for the first time in 2009 due to the recession. However, most experts are convinced that the rapid growth of combined transport will continue following the interruption in growth caused by the crisis in 2009. Forecasts expect volumes of

- 206 million tonnes in 2015,
- 258 million tonnes in 2018.

2003-7 study of UIC Combined Traffic Group: Capacity utilisation 2015

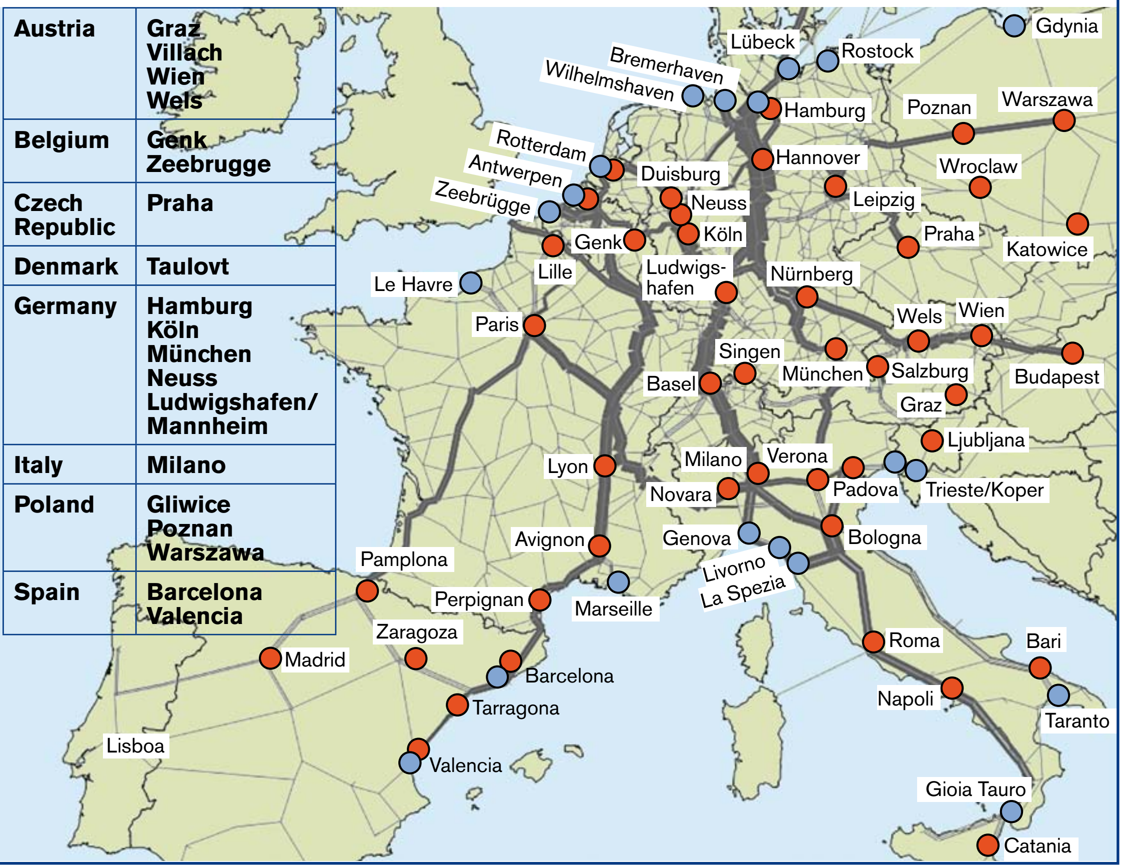
Capacity constraints will limit future CT growth as early as 2015



Combined transport terminal will, as well, show bottlenecks by the year 2015: In addition to the enlargements already planned, further tranfer capacity for some 3.4 million units per year is needed.

Transport areas with additional capacity need | **Sea and ferry port transport areas** | **Inland transport area**

Austria	**Graz Villach Wien Wels**
Belgium	**Genk Zeebrugge**
Czech Republic	**Praha**
Denmark	**Taulovt**
Germany	**Hamburg Köln München Neuss Ludwigshafen/ Mannheim**
Italy	**Milano**
Poland	**Gliwice Poznan Warszawa**
Spain	**Barcelona Valencia**



The reliability of these optimistic forecasts has already been seen in early 2010: the recovery, in comparison to the previous year, was so unexpected that some railway companies simply did not have sufficient wagons to meet increasing demand.

An additional 3.4 million loading units are expected to be handled in 2015 in the CT terminal network. In the same year experts at the railway association UIC are expecting considerable capacity bottlenecks in the European rail network primarily caused by the main driving force in rail traffic growth: combined transport.

The Future

The development of combined transport road-rail in the recent 40 years represents a story of success. It startet with small traffic, and trial operations, und it has increased to a network that moves today more than 1700 block trains per working day.

The story in North America is rather similar: In this region, combined transport became one of the most important commodities in rail freight transport (next to coal and grain).

In the devloping countries in Asia railway companies install networks for combined transport trains.

In Europe, rail carries today 170 million tons p.a. in combined transport. If such volume would be carried in road transport, Europa would have an increase of some 40 000 trucks in long distance road traffic each day.

Combined transport road-rail contributes greatly

- to save mineral oil based fuels,
- to reduce CO_2 emissions in rail freight,
- to reduce road traffic.

In addition, combined transport has opened a new window to success for the railways in Europe. Combined transport has created new models for commercial operation and organisation in the railway industry. Combined transport has driven modernisation of rail freight, and it continues to drive modernisation. After heavy losses in transport volume and in economic importance, rail has become a new key player in freight transport thanks to combined transport.

Combined transport continues its growth: Today it carries 170 million tons, and the prognosis says that it will grow to 258 milion tons in the year 2018.

About the author:

Christoph Seidelmann, Dr. rer. pol., Diplom-Volkswirt, has been Managing Director of Promotion Association for Combined Transport (SGKV), a German non-profit association of shippers, forwarders, transport enterprises and the Federal Ministry of Transport for promotion of combined transport in the years 1980 until 2008. In these years, Christoph Seidelmann has been, as well, engaged in international activities: He acted as president of Bureau International des Containers in Paris, as Chairman of European Standardisation Committee 119 Swap bodies for intermodal transport, as Chairman of ISO TC 104 Freight containers Sub-Committee 4 Marking, identification, communication.

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