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**ACTIVITIES AND DEVELOPMENTS IN UNECE MEMBER COUNTRIES OF UNECE
BODIES AND OTHER ORGANIZATIONS OF INTEREST TO THE WORKING
PARTY**

New developments in the field of combined transport in UNECE member countries

Transmitted by Modalohr, France

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Modalohr : The successful rail/road transport solution



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I. The concept

MODALOHR, which permanently monitors the needs of the road sector, has developed a combined rail-road transport concept which meets carriers' and operators' current needs.

The technical solutions selected are simple, suitable for existing railway infrastructures, and above all, with no restrictions for users.

Indeed, this concept is based on the MODALOHR wagon - low-frame and articulated - which **can transport standard road semi-trailers**.

The advantages for the carrier, apart from the possibility of using his standard road equipment, are:

- trucks are loaded horizontally directly with the road tractor, without the need for handling equipment.
- lateral loading of trucks "in a herring-bone pattern" allows simultaneous and fast transshipment: less than 30 min in all for the entire train.
- a very low floor means that trucks up to 4 metres high can be loaded on existing railway gauges (UIC- GB1).
- reliable, trucks are strongly secured on the waggons (details in appendix 1).



The advantages for the rail operator are:

- a wagon with standard bogies and wheels that can be used in the same way as a conventional wagon and with identical maintenance costs.
- a system of articulation and "opening" the waggons which is simple and entirely mechanical, providing real reliability, and independent loading and unloading of one or more vehicles at each intermediate stop.
- a higher average speed: MODALOHR shuttles can travel at a speed of 120 km/h, or even 140 km/h.
- simple transshipment terminals, consisting of an asphalt surface on either side of the tracks (no platforms) and fixed opening systems installed on a level with the track.

II. Pertinence of the Modalohr system

Today there is a consensus among political authorities and transport professionals who recognise that combined transport is the real solution which should, over a reasonable period of time, cause a non-negligible proportion of the growing goods traffic to switch from road to rail freight.

Intermodal transport will therefore serve the areas required by transport organisers, preserving the best ecological balance for local authorities; indeed it allows the longest part of the trip to be made by rail with the terminal parts only by road, for greater efficiency of equipment, service and personnel.

2.1. Accompanied and unaccompanied combine transport

There are two coexisting practices in Europe :

- *Unaccompanied combined transport* : this is the most frequently used method, with about 80% of European combined transport using this system. A tried and tested technique, it ensures that containers, swap bodies or **semi-trailers specially designed** for the purpose (which can be lifted by grabs for vertical transfer in the terminals).

The need for specific rolling stock is a **real obstacle** to the broader development of combined transport, because it assumes that the carrier has made this extra investment.



- *Accompanied combined transport* : still called rail motorway or rolling road, it is fully adapted to carrying standard road vehicles. Unfortunately, to date, it has involved heavy restrictions: mandatory driver accompaniment, need for a wide-gauge railway (does not work with the current GB1 gauge except for trucks less than 3.80m high), use of waggons with small wheels which are difficult and costly to maintain.

2.2. The solutions provided by the MODALOHR system

Compared with current techniques, MODALOHR technology, which has been developed over nearly 10 years of studies and experiments, provides both a higher quality service and greater efficiency with respect to carriers' technical and operating restrictions.

"The characteristics of the MODALOHR waggon allow the development of an innovative combined transport concept, leading to a successful future at the European and international level."

→ UNIVERSALITY

Unlike unaccompanied combined transport, it provides rail transport, not only for containers and swap bodies, but also and above all, for **standard road semi-trailers**.

Unlike the rolling road, it does not require the simultaneous transport of driver and tractor, so that **the carrier can choose** the most appropriate solution depending on customer commitments and operating constraints.

→ FREEDOM

It is the carrier who decides whether his own constraints require his drivers and tractors to be carried over several hundred kilometres of railways, or whether the semi-trailers can be loaded alone on the train, thus optimising the ratio of payload to total weight carried.

In this way he becomes the organiser of an intermodal service

→ CONFIDENCE

Everyone knows that carriers are still hesitating in their strategy to make a definite commitment towards international combined transport for carrying their semi-trailers from point to point.

Because of this, in spite of operators' incessant efforts, the rail link does not appear sufficiently credible in the logistics chain, in terms of quality and durability of service, a risk which it is hard for the carrier to accept.

Flexibility in using the MODALOHR system, which allows an instant return to the road link when the rail link is deficient, should lead to greater flexibility in using combined rail-road transport and thus represent a significant development.

→ A DOUBLE OFFER

The advantage of the MODALOHR system is decisive because the carrier can always choose **between accompanied and unaccompanied transport**.

2.3. Extent of the accessible network

With its extra low floor, only 22 cm above the rails, **well below that of small wheel waggons**, the MODALOHR waggon can easily carry standard 4 metre semi-trailers on UIC GB1 gauge rails, recognised as the French rail network's development objective and as the **minimum European gauge**.

Of course, on the Central and Eastern European rail networks, where the gauge is much wider, the MODALOHR waggon can also carry very tall road vehicles.

2.4. Rail route: flexibility of choice

The MODALOHR system provides the possibility of selectively loading and unloading semi-trailers in a station, in just thirty minutes. This is not the case with competing systems, which require the complete waggon to be loaded and unloaded at each stop.



With MODALOHR, every carrier can build his own routes: he can choose this or that section of railway, as Europe builds a network of MODALOHR transshipment links, on both an East-West and a North-South axis.

This idea of an intermediate stop is fundamental: it means that combinations of sections can be multiplied each time a new platform is opened.



- Actual design GB1 build compatible
- New design 2003-2006 forecast GB1 build compatible
- Missing links
- Design rework needed to be GB1 build compatible.

III. Competitive positioning in economic terms

3.1. Cost and depreciation of wagons

The MODALOHR wagon, which provides both an accompanied and an unaccompanied transport service, more or less optimises the payload carried by rail (depending on the importance of unaccompanied transport).

This possibility distinctly changes the rather fast argument put forward by defenders of small wheel wagons, that it takes 1.5 MODALOHR wagons to carry a complete semi-trailer; everyone knows that economic and ecological requirements will increase daily the proportion of unaccompanied transport compared to accompanied transport.

Note also that market studies have shown that the MODALOHR system, which allows intermediate stops, and hence the organization of long links by combining short links, will lead to a good price level for the final customer.

→ HIGH MILEAGE

Every rail operation aims to optimise its equipment depreciation by covering the highest annual mileage possible.

Today, a standard freight waggon covers 20 000 to 40 000 km/year, and a classic or small wheeled combined transport system about 150 000 km/year.

The MODALOHR waggons used as shuttles can cover 250 000 to 300 000 km/year.

This large difference in useful mileage - for a loaded waggon - has two explanations:

- **The time spent at the station** (complete loading / unloading of a car) is at least 2 hours less: MODALOHR technology allows almost simultaneous loading of all the waggons, instead of the conventional method where the equipment transported is loaded successively.
- **The average speed** of these convoys will be higher: MODALOHR shuttles can travel at 120 km/h, or even 140 km/h, while, with small wheel waggons, such speeds generate prohibitive costs due to wear on the wheels.

→ A HIGHER FILLING RATE

The rate of train set filling using the MODALOHR system can be optimized: indeed, although semi-trailers are given priority, it will also be possible to load containers and swap bodies in addition.

→ FAVOURABLE TECHNICAL DEVELOPMENT

The addition of two factors: high annual mileage and higher set filling rate, completed by natural future development, where it will be much more common to carry unaccompanied semi-trailers, will have a beneficial effect in heavily reducing the **cost of equipment per kilometre**.

3.2. Equipment maintenance costs

There is a clear comparison to be made between the lower maintenance costs of MODALOHR standard bogies and the higher ones of the complex bogies of small wheeled waggons, with more axles.

This old generation equipment also generates costs through the faster wear of rails and points.

This large difference in maintenance costs reverses any hasty conclusions which may have been made on the basis of the purchase price of the equipment alone.

3.3. Cost of terminals

The small amount of experience in constructing terminals suitable for MODALOHR technology is inadequate for us to know whether their role will be limited to transshipment between rail and road, or whether they will provide bases for freight stations or logistics centres, but it seems logical to suppose that they will also be part of the logistics chain.

Their design must be evaluated with respect to both conventional combined transport sites and rolling road terminals, while retaining the idea that they can be added to them or branch off them.

Land costs will therefore be closely linked to the type of configuration chosen - depending on the economic and political considerations governing the decision to develop the site.



It is the terminal which has the equipment to perform loading / unloading manoeuvres, rather than the wagon, for four main reasons:

- safety and reliability of the wagon which will not contain any pressurized hydraulic or pneumatic equipment;
- the same lifting system can be used for several wagons;
- ground maintenance of the equipment is easy;
- lighter weight wagons.

Compared with the equipment on a traditional combined transport site, the cost of ground equipment at a MODALOHR terminal is roughly the same as that of a handling gantry on rails or two auto cranes.

Also, since the MODALOHR technique is based on horizontal vehicle loading, ground resistance does not have to be so great as on sites equipped for vertical handling; this leads to a distinct reduction in the cost of infrastructure work.

To compare with an old generation rolling road terminal, economic reasoning must link the cost of MODALOHR ground equipment to that of the waggons.

For example, within the terms of a shuttle using about 250 double wagons (12 sets), the effect of the cost of MODALOHR ground equipment will be about 2 500 to 3 000 Euros per wagon, which is virtually negligible.

IV. Modalohr, the solution to successful combined transport

The three main obstacles which have so far penalised combined transport are:

- **the priority systematically given to passenger transport** over freight in the railway system. This priority is increasingly contested. Major studies have been undertaken to attribute extra means for freight in the near future (new lines, redevelopment of traffic channels, dedicated locomotives, new signalling systems and the programmed introduction of electronic braking leading to significant price drops);
- **the lack of carrier confidence** with respect to the quality of service provided by railway companies; the new MODALOHR offer aims to satisfy them.
- **the obligation placed on carriers to acquire specific rolling stock for combined transport** ; this difficult strategic investment choice, which can be punitive if a reverse decision is made, no longer applies if you use MODALOHR.

Today, carriers are tending rather towards a growing interest in the use of combined transport.

There are many reasons for this:

- strong support from professional organisations;
- scarcity of drivers and major increases in their costs;
- saturation of certain road networks;
- cost price control concerns;
- increasingly elaborate professional logistics organisation, so that depositing and collecting semi-trailers at the terminals can be more clearly envisaged and included;
- carriers' image.



The arrival of the MODALOHR waggon on the market - and the system it leads to - will radically transform the combined transport sector.

It frees carriers from the restricted, irreversible choice of specific equipment and allows them to use combined transport, either durably, via a strategic decision, or simply to absorb traffic peaks.

Any over-investment is avoided and this could, eventually, have a regulating influence on transport price levels.

It considerably increases the potential clientele of combined transport organisers, in the knowledge that it can be used in special shuttles as well as in addition and in extension to a conventional operation, whether this involves a rolling road or vertical handling.

The MODALOHR wagon thus makes an essential contribution to the renovation of rail transport.

Appendix

Securing means for standard semi-trailers on Modalohr waggon

- Securing interfaces for the standard road semi-trailer with the Modalohr waggon are:
 - the triple-axle tyres (pneumatic suspension deflated) ;
 - the landing gear ;
 - the king pin (for attachment in the fifth wheel)
- The blocking system on the fifth wheel built into the wagon stacker, completely blocks the semi-trailer king pin in a horizontal direction.
- The wagon's longitudinal acceleration and deceleration forces are taken up by both the king pin, which is blocked longitudinally by the wagon fifth wheel, and the triple-axle, the wheels of which are braked.
- The wagon's transverse acceleration or deceleration forces are taken up by both the king pin, which is blocked transversally by the wagon fifth wheel, and the triple-axle, the wheels of which are guided between small footpaths along the sides.
- The semi-trailer's vertical forces are taken up by the landing gear and the triple axle. The landing gear can be used as a vertical support for the front of the semi on the wagon during circulation since the king pin is blocked horizontally.

Consequently, the landing gear is not subject to any longitudinal or transverse forces; there is no risk of damaging the landing gear during transport on the train. The usual standard semi-trailer landing gear (e.g. "JOST") is designed to withstand vertical forces significantly higher than those to which it is subject during transport on the train.

Note that, for rear loading a single unhitched (therefore resting on the landing gear) semi-trailer from a platform, using a Fenwick, the vertical (and even longitudinal) forces on the landing gear when the Fenwick and its load are at the end of the semi's front overhang, are significantly higher than those to which it is subject during transport on the Modalohr waggon.

In the worst case, if part of the landing gear should break, the waggon's fifth wheel can take all the front vertical load in a static situation, like the fifth wheel of a road tractor.

All precautions have therefore been taken, on the one hand to secure a standard semi-trailer without any modifications, and on the other, to ensure that there is no risk of damage to the trailer during transport on the Modalohr waggon.

Rail becomes road



More heavy goods traffic on the railways...

coming soon!

The company **MODALOHR** permanently at the service of road transport, has developed a rail-road system that meets today's requirements, with simple technical solutions, suitable for existing infrastructures, constraint free for users and requiring only limited investment:

The concept

MODALOHR is a low-floor articulated railway waggon, specially designed for carrying non-specific road equipment.

It includes:

-
- 1 A very low loading platform enabling 4 metre high trucks to be loaded within the limits of existing railway gauges (UIC GB1)
 - 2 Standard bogies and wheels to keep servicing costs within the range of those of a conventional railway car.
 - 3 Trucks can be loaded horizontally and directly, using the road tractor (no lifting equipment)
 - 4 Lateral 'herring-bone' loading of trucks for simultaneous, rapid transhipment.
 - 5 The fully mechanical system, for articulation and "opening" the waggons, is very simple, providing excellent reliability and low costs.
 - 6 A simple, low-cost transhipment terminal, consisting of asphalted areas on either side of the railway line (no platforms).

Technical characteristics

Road equipment accepted by MODALOHR :

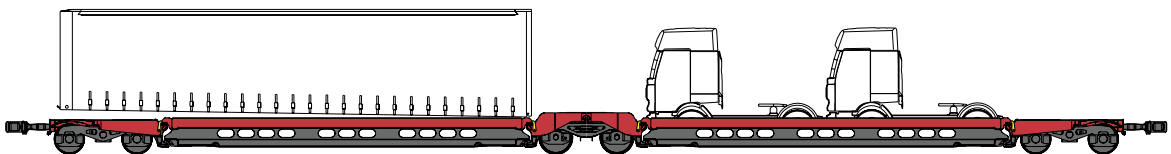
- accepts most standards trailers and trucks without modification
- accepts trailers to a maximum height of 4 m
- doesn't need specific road equipment (Piggy-back trailer, etc.)

MODALOHR can carry:

1. either **complete trucks** (tractor + semi-trailer)

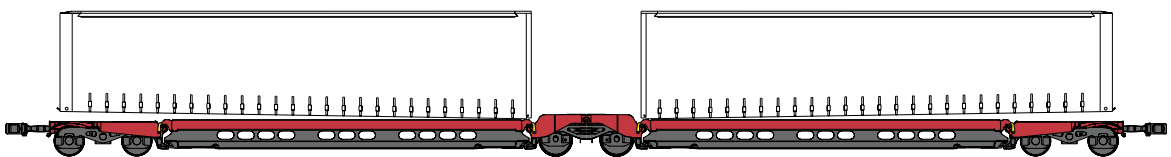
uncoupling the combinations ; the semi-trailer is loaded onto one waggon and the tractor onto the next waggon with another tractor. Drivers have only one simple, fast manoeuvre to complete.

| | |
|----------------------------------|--------------------------------------|
| Max. length of the road convoy : | 16,5 m |
| Max. length of semi-trailer : | 13,7 m (14 metres with cooling unit) |
| Max. length of tractor : | 6,2 m |
| Max. load of road convoy : | 44 t |



2. either **semi-trailers alone**

| | |
|-------------------------------|--------------------------------------|
| Max. length of semi-trailer : | 13,7 m (14 metres with cooling unit) |
| Max. load of semi-trailer : | 38 t |



Technical characteristics of MODALOHR wagons

| | |
|---|---------|
| Length of a double waggon : | 32,48 m |
| Tare weight of a double waggon : | 35,7 t |
| Distance between end frame bogie pivot points : | 14,40 m |
| Maximum speed at maximum load : | 120 kph |

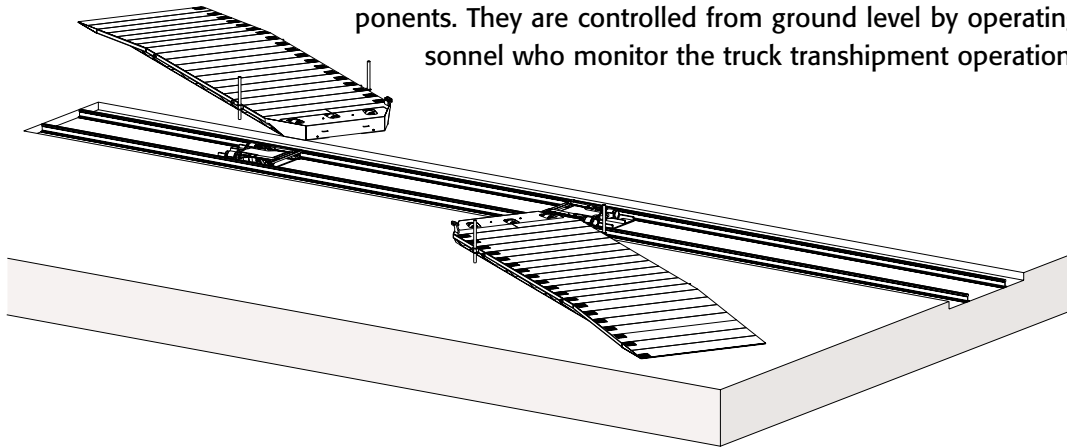
| | | |
|-----------------------|----------------------|-------------------|
| Type of bogie | Y 25 (middle) | Y 33 (end) |
| Wheel diameter | 920 mm | 840 mm |
| Axle wheelbase | 1800 mm | 2000 mm |
| Maximum load per axle | 22,5 t/axle | 17 t/axle |

Waggon opening system

To guarantee reliability and lower purchase and maintenance costs of the rolling stock, there is no power actuator on the waggons. They are just simple mechanical units.

The waggon opening systems are part of the fixed equipment at the terminals. This is in line with economic logic because there are many more waggons than terminals. It is also much easier to maintain equipment fixed in one place than systems fitted to waggons.

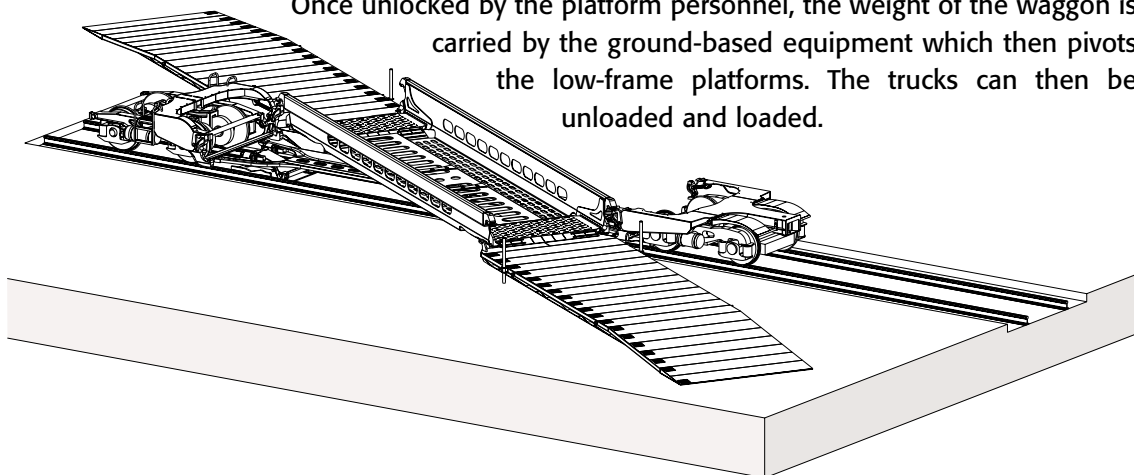
These opening systems consist of simple, tried and tested, reliable components. They are controlled from ground level by operating personnel who monitor the truck transshipment operations.



Each waggon is fitted with a secured lock which guarantees that the waggon stays closed while moving along the tracks.

As soon as the train stops, the waggons are recentered on the position with respect to the opening systems.

Once unlocked by the platform personnel, the weight of the waggon is carried by the ground-based equipment which then pivots the low-frame platforms. The trucks can then be unloaded and loaded.



To close the waggons, the operation is repeated in reverse order.

Truck loading operations

After passing the entrance of the terminal, where it has been identified and inspected (weight + dimensions), the truck goes to the position bearing the number indicated, and waits for the train to arrive.

Once the train has stopped, the truck to be loaded waits until the truck already on the corresponding wagon has been unloaded, before driving on board.



Unloading trucks which have arrived by train.
Departing trucks wait



Simultaneous loading of departing trucks



After uncoupling the semi-trailers, the tractors are loaded onto adjacent platforms



Train closed and locked, ready to go

MODALOHR has the further advantage of being able to unload or reload one or more trucks in the middle of the train without having to move the others. Intermediate stops can thus be planned giving drivers greater flexibility and optimizing train filling. Connections can even be organized between **MODALOHR** trains, exchanging trucks.

This loading method reduces the rail operator's running costs:

- The time for which trains are stopped in terminals can be very short, and the efficiency ratio is high because they are moving during 80% of the time they are in service.
- Since transshipment is horizontal, it can take place on a line using catenaries (1m space room). Trains can reach the **MODALOHR** terminal directly using the normal electric locomotive, without having to be uncoupled.
- Since the trucks are loaded directly and easily by their drivers, very few personnel is required in the terminals.



Waggon stopped with respect to the ground system, then the low-frame platform is unlocked



The low-frame platform is rotated by the ground opening system



The truck is loaded onto the waggon by simply driving in a straight line



The truck crosses the platform until the tractor reaches the other side



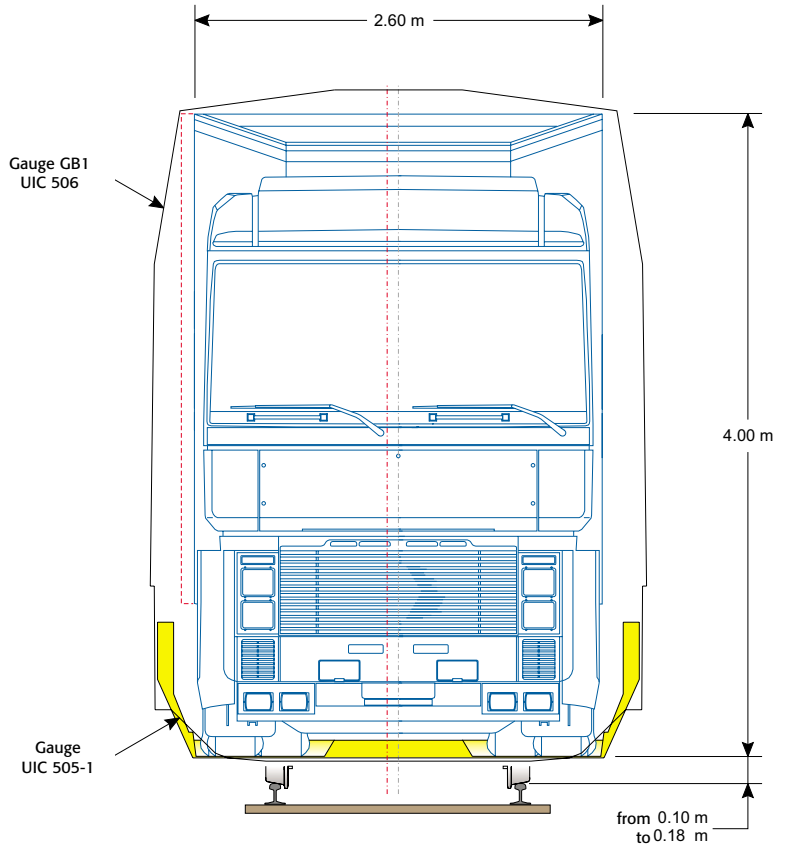
After uncoupling, the tractor is loaded onto the adjacent platform if the whole convoy is travelling on the train, or leaves the terminal if the semi-trailer is travelling alone



The waggon is closed using the ground system, then locked and the waggon is ready to leave

Railway dimensions compatibility

MODALOHR
can transport trucks
4 metres high on
UIC GB1 gauge rail-
way lines



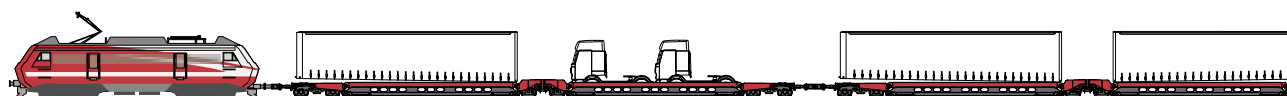
- Lines on GB1 gauge at present time
- New GB1 gauge lines are envisaged for 2003-2006
- Missing links
- Lines needing work to meet GB1 gauge



Optimal use of MODALOHR : the rail motorway

The aim of the Rail Motorway concept is to offer to the road hauliers a rail service which is comparable to a section of motorway, in terms of cost, transport times and accessibility, thus providing in the mean time a real alternative to road travel. **MODALOHR**'s technological innovations and performance make the implementation of the system possible under good economic conditions.

Conventional combined systems provides transport only for a small number of the trucks of the congested motorways, because they require special road equipment (Piggy back trailers, swap bodies, etc.). With this new technology, **MODALOHR** makes it possible for almost any existing model of truck to be carried and nearly all the trucks using major motorway routes can also use the train.



The great truck transport capacity is given by the organisation of regular shuttle trains between terminals (e.g. one train every two hours or every hour). This frequency gives road hauliers great flexibility: the rail service access is available at almost any time, without reservation.

The shuttle trains are fixed in composition and can carry semi-trailers alone or complete trucks. A comfortable restaurant/sleeping car enables drivers to follow their trucks while taking time to eat and sleep.

These trains maintain a permanent shuttle service between terminals in the same way as the truck-shuttle does in the Channel Tunnel, but over longer distances. With **MODALOHR** technology, intermediate stops "en route" can be proposed to improve the rate of filling the shuttles and optimize traffic.

The shortest advantageous distance for road hauliers is 350 km between two terminals (equivalent of 4 1/2 hours driving on the road). This minimum distance can be further reduced for crossing obstacles (Alps, Channel...).

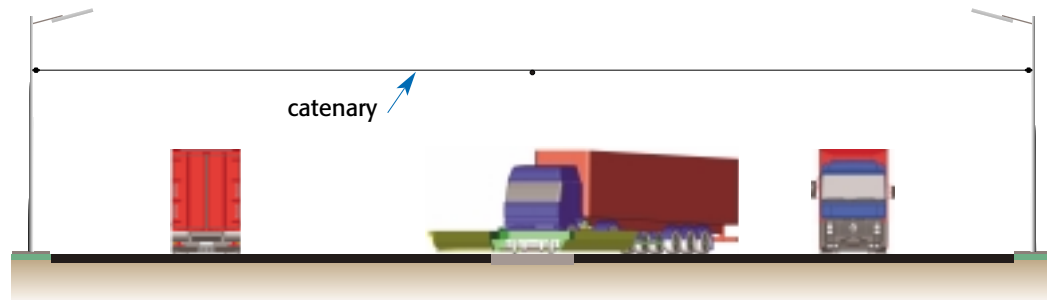


Terminal

Loading and unloading trucks on **MODALOHR** rail cars needs a special transshipment terminal to be constructed. In view of the quantity of truck traffic using these terminals, it is preferable to build new installations outside urban areas, close to motorway interchanges.

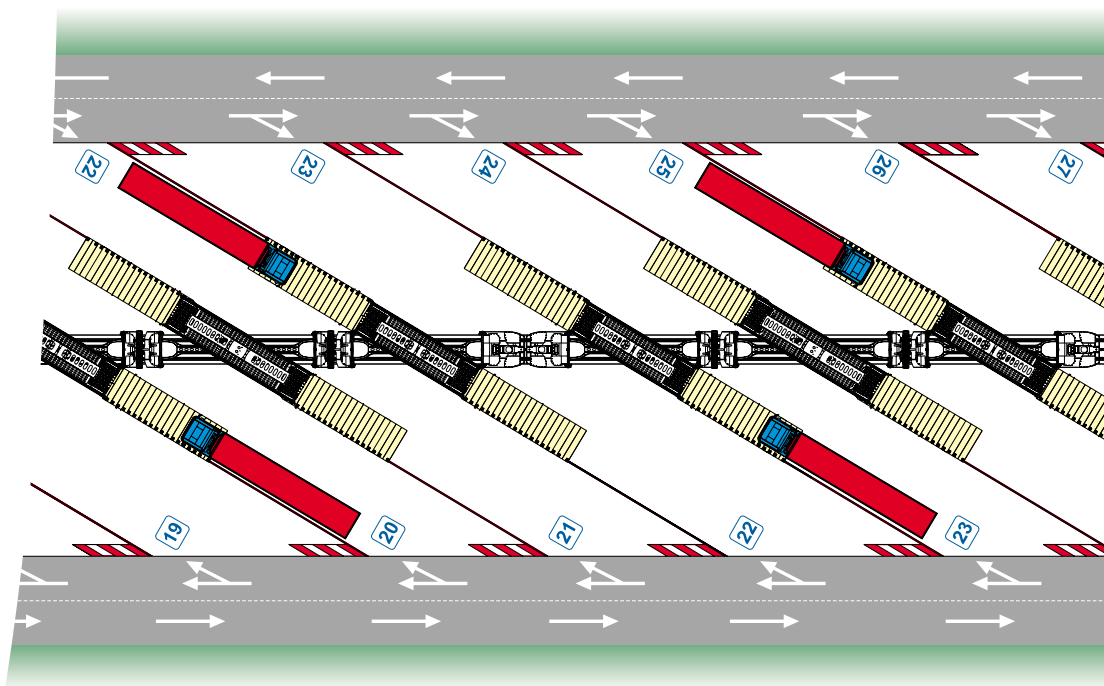
A **MODALOHR** terminal is very simple and economical, because it consists simply of a railway line with an asphalted surface on each side, at almost the same level as the rails.

There is no need for gantries or lifting equipment to be installed. The loading floor of the waggons is very low and the trucks can be loaded "under their own steam".



Using lateral loading in herring-bone mode, trucks can be transhipped totally independently of the other trucks.

All the trucks can be loaded or unloaded at the same time so that 30 trucks can be loaded as quickly as one. The manoeuvres that the driver has to accomplish (driving straight line) are also very easy and fast.



A **MODALOHR** waggon can be fully loaded and unloaded in an half of an hour.

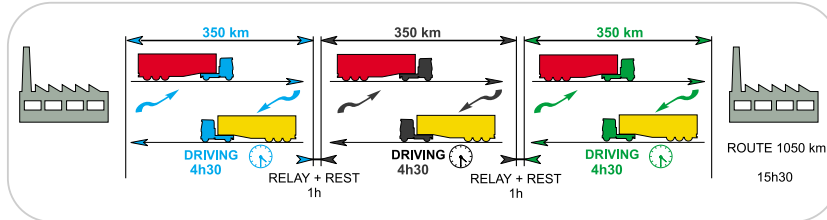
Advantage of MODALOHR service for road hauliers

The rail motorway is essentially intended for medium and long distance road hauliers. In this type of transport, there are two categories:

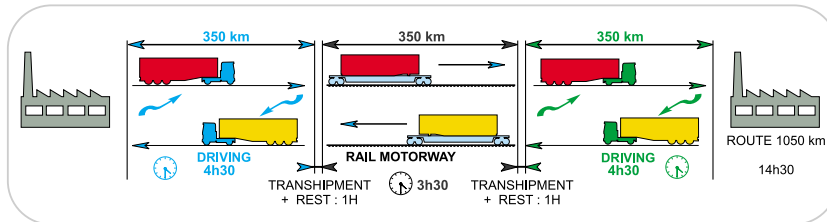
1. either **regular routes** and **large road** transport companies

Medium and long distance transport is often organized with relays of drivers and tractors. Freight is thus no longer dependent on drivers' rest times and they can go home every evening.

→ 100% road route with relays



→ Route using MODALOHR Rail Motorway

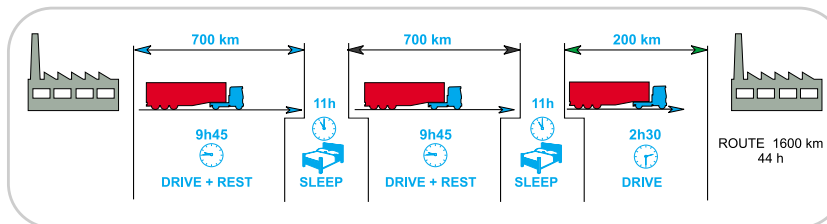


In this case, using the rail motorway with trailers only, traction by road tractors is replaced over the central section, and is faster and cheaper (saving cost on tractors).

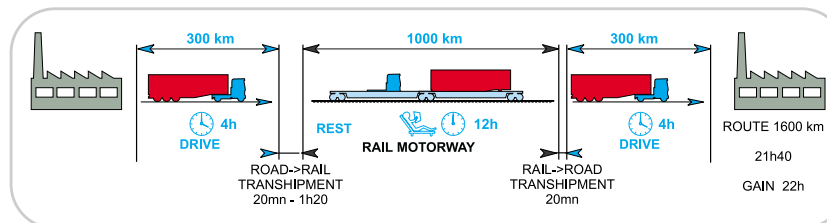
2. either **occasional or irregular routes** and **small road** transport companies

In this category, medium and long distance routes are covered using trucks and drivers making long journeys from one end of the route to the other.

→ 100% road route with one driver



→ Route using MODALOHR Rail Motorway



Using the rail motorway to load the complete truck and driver allows the driver to rest in the train rather than in a carpark, while the train covers several hundred kilometres.

For medium distances (400 km), the rail motorway provides a small time saving, but mainly increases the distance of operation that one driver can cover in a day.

For long distances, the rail motorway saves 11 to 22 hours at a price equivalent to road travel. For example, for a trip from DORTMUND (D) - BARCELONA (E), a whole day is saved!

Avantages

For road hauliers:

- **No investment in special transport equipment** for access to combined transport
- **Standard 4 m high trucks can be loaded**
- **No load splitting between road and rail** because transshipment is direct using the road tractor and transfer time is very short
- **Fast, easy loading** for the driver (straight line)

For rail operators:

- **Uses existing lines** (GB1 gauge): no new lines needed
- **Low maintenance costs for waggons** comparable to those of conventional waggons, because the system uses bogies and standard wheels and the opening mechanism is simple and doesn't need actuators on the waggon
- **Low cost transshipment terminals**
- **Very short transshipment time** so that only a few lines are needed per terminal
- **Low running costs** because of:
 - highly efficient waggons and locomotives due to the short stopping time for transshipment
 - lateral, horizontal transshipment can take place under catenaries and without uncoupling the road convoy
 - very few personnel needed at the terminals because the drivers load the trucks by themselves
- **Very fast lateral loading of trucks** independent of each other, so that intermediate stops can be made, improving the service offered and above all, the percentage of train filling.

For local authorities:

- Helps to reduce the number of heavy goods vehicles in transit on major motorways, leading to:
 - **less pollution and noise**
 - **lower risk of accidents**
 - **extra capacity available for passenger cars**
- **No longer requires public subsidy for operation** because of low running costs.

THE LOHR GROUP 4 SECTORS OF ACTIVITY

...**MODALOHR**... is a LOHR Group subsidiary

INDUSTRIAL VEHICLES MANUFACTURER



Car Transporters



Public Transport



Combined Rail/Road Transport



Defence Logistics Transport