RAILRUNNER™

# Feasibility on European Rail Itineraries

by

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## Content

# 1 Conditions for Bi-modal Technologies

## *1.1 Introduction*

Bi-modal technologies have been in use in intermodal transport for over 30 years. Nearly every two to three years new solutions try to compete in the transport market, but for over 25 years, none other than the Road Railer® technology from the United States have survived in successful operation. Also, in Europe similar technologies, as later mentioned in this study, have been operating, but none succeeded commercially for a longer period of time. Road Railer's entrance into the European market was accompanied by technical, economical, as well as operational problems and therefore, the company using the system finally had to cease operation. (Chapter 2.4)

Taking the logistical and some of the operational problems into account, a new technology has emerged in recent years which is similar to past solutions, but using a different systems approach. RailRunner™ has asked SGKV to evaluate its new bi-modal solution, as well as its logistic approach and to create a benchmark for comparing the same to other solutions used in the Western and Eastern European intermodal markets. SGKV was also asked to evaluate possible applications for the technology in Europe taking into account the past problems with such technologies.

The major novelties of the RailRunner system are as follows:

- RailRunner developed its system for logistical reasons mainly for intermodal container transport, but it also can be applied to trailer solutions. The RailRunner system is compatible with European Swapbodies.
- RailRunner chassis have one symmetrical receiver box at each end for connecting to the bogie and only one air tube with connectors for the trains braking system, thus adding only about 280 kg of additional weight to the road vehicle. All other train related functions have been designed into the bogie.
- RailRunner uses a simple fool proof connection technology for connecting its chassis to the bogie, which also acts as a draw bar for transmitting the in-line train forces.
- When connecting to the bogie the chassis slides up a ramp onto the bogie, which automatically lifts the axles and wheels for sufficient track clearance.

- RailRunner rail vehicles are the first bogies in freight transport equipped with an air suspension creating an exceptionally smooth and stable rail ride for both the chassis and container, thus allowing for a higher operating speed.
- RailRunner rail vehicles are articulated enabling automatic steering in curves with less friction and wear and tear of the wheels and tracks. As a “light train” system this adds to lower energy consumption and makes it more environmentally friendly.

## *1.2 General Benchmarking of Bi-modal Technologies*

All types of bi-modal technologies have the following systematical advantages:

- Bi-modal systems allow operation with only small terminals being equipped with only limited and very economic equipment.
- The tare (Bogie plus Trailer) to payload (Cargo) ratio is reasonably good when compared to other intermodal rail technologies, but the over-the-road payload for the trailer is lower in comparison to standard allowable commercial road vehicle payloads.
- Considering the rather good tare weight per train length relation, bi-modal systems may have advantages on routes with restricted train length or reduced allowable axle loads.

On the other hand, bi-modal technologies have to address the following obstacles:

- The chassis/trailer has to have means to connect to the bogie and components incorporated to build the train (rail air brake connection).
- The chassis/trailer has to be reinforced to have sufficient rigidity for the required in-line train buff and draft forces.
- The above mentioned requirements increase the tare weight and reduce the payload by approximately 750 kg to 1,000 kg per road vehicle.
- Only specially equipped chassis/trailers can be operated in a closed system (coupling mechanism, rail air brake connection, rigid frame construction, road axles with suspension to be designed for hanging, as it is also the case with lift-axles).

- Road haulage has to be done by trustworthy haulage contractors as the trailer has rail safety related equipment installed, which in case of failure could bring the train to a stop.
- If no balanced transport volume is available,
  - either the trailer has to run empty in one direction, which is the case with every system, or
  - the bogies have to be carried from one terminal to those terminals lacking sufficient quantities for the next loop operation. (Management of bogies in addition to the trailer; existing solution: Coda-E)
- Bi-modal transport is suitable for closed loop operations or for point-to-point unit train connections. Intermediate stops are complicating the operation, as detaching chassis/trailers out of a complete train composition requires either the attachment of another chassis/trailer or the removing of a bogie from the track with a forklift.
- Terminal storage space of non-stackable trailers is bigger than those of stackable containers and swap bodies.
- Different operational features require separation of bi-modal terminals from lift-on-lift-off terminals, as bi-modal trailers cannot be transloaded vertically. Bi-modal systems have to attract their own sufficient transport volume, which has to cover the cost of its own terminal – being a niche solution at the beginning it cannot share infrastructure and therefore costs with other technologies of intermodal transport.
- Due to the characteristics of bi-modal vehicles specific rules for train operations are required. (Bi-modal vehicles need reduced train longitudinal forces and special interface bogies to be coupled with locomotives or regular standard railcars, as marshalling is not allowed).
- A brake trial test has to be exercised after each attachment of the chassis/trailer to a train.
- Characteristics of the American railway system are quite different from the European railway system, specifically distances, train frequencies, speeds, weights allowed, train characteristics and railway rules.
- In Europe the chassis/trailer requires road and especially rail approval in all countries where intended to operate.

## 1.3 Benchmarking of RailRunner

When comparing RailRunner to past and alternate bi-modal technologies one should take the following findings into account:

- As mentioned above, since the RailRunner system is designed for containers it eliminates problems of special vehicles because the container is a standardized box, while the bogie and chassis act as a rail vehicle. Contrary to a typical rail vehicle, the chassis is roadworthy and can be used as a container chassis like all other chassis with the exception of being slightly heavier than a standard chassis. Additional advantages are:
    - the bogie/chassis combination can be operated in standard intermodal container terminals as containers can be lifted vertically with cranes or separated horizontally by de-ramping the chassis rendering additional flexibility in draying and positioning,
    - RailRunner, with the use of containers, can be organized as an open-loop system, although the unit train with the rail vehicles (chassis and bogies) can be operated like standard container unit trains,
    - RailRunner is compatible with the European swap body system,
    - containers and swap bodies can be stacked as usual in the terminal and the chassis may be stored vertically or on top of each other like any other chassis, thus saving space,
    - bogies are designed with special fork-lift pockets so they can easily be taken off the track, if required.
- In America, the in-line train forces are much higher because of the longer allowable train length of up to 3,000 meters. However, the actual forces never exceed the values of 400,000 lbs. buff & draft. In Europe, with reduced train length of only 700 meters, it might be possible to reduce the rigidity and thus, save some of the additional weight now inherited in the design.
- With the RailRunner design the trailer axles do not require to be lifted as it is the case with other bi-modal systems. The axles automatically lift-up when positioned in rail mode and the chassis/trailer is pushed up the bogie ramp. This advantage can be used to reduce the total height of the chassis and container when connected with the bogie, as it is the

case with lift-axles trailers on pocket-railcars where the suspension is flattened. For the same reason no manual cranking of the landing gear is required. RailRunner receiver boxes necessary for connecting to the bogie are symmetric (as is Multitrailor). The chassis/trailer construction is less complicated than those of most competitors.

- In some cases, namely longer than 40' chassis, the rear underride protection device (bumper) has to be moved to the "up" position before coupling to the bogie. Additionally, while the rear underride protection device (bumper) is in the upper position, it also functions as an anti-theft device blocking the doors from opening.
- The RailRunner trailer has less additional weight as bi-modal vehicle than Road Railer. Road Railer can also not be used as container chassis.
- Unit length with RailRunner 45' containers is 7% shorter measuring 97' than two 45' containers on a 104' six-axle railcar. While a 104' "TWIN CAR" weighs about 2 x 35 tons, e.g. 70 metric tons, the RailRunner double unit only weighs 21 tons for the three bogies plus 10 tons for the two chassis, i.e. 50% less.
- RailRunner bogies are the first regular bogies equipped with an air suspension system for use in freight transport. When ramping up the chassis/trailers onto the bogie it is part of the operation to inflate the air bags in order to additionally lift the chassis wheels above track. Simultaneously, the brake test is conducted allowing for a very fast and effective assembly cycle, which can be kept to about four minutes per unit. This does not require more personnel as in a container terminal where one additional man has to supervise the crane loading operation on the ground.
- Also, RailRunner is beneficial for system changes, e.g. if one wants to transfer from standard track width to wide track or from rail to ferry and back to rail, thus avoiding an expensive rail transfer. In combination with RO/RO ferries, RailRunner requires more bogies, namely one set at both ends. However, in case of a rail ferry, chassis can be stored up to 30% more densely than railcars, rendering additional savings to compensate for the extra bogie investment. The same is true for track changes where expensive cranes and additional set of railcars can be avoided.
- A solution could also be a combination with barge transport (e.g. rail transport with RailRunner in Germany to Passau, switch to barge heading to Bulgaria with distribution on road to Greece, Turkey and further on as already exercised).

- When RailRunner is used as an intermodal solution with chassis and bogies for the transport of containers and swap bodies, the chassis should be made stackable as it is proposed by the Coda-E technology. Bogies may be moved by chassis like for instance with special collapsible flats. These flats when empty can be transported in stacks. This makes it rather easy to deal with unbalanced transport and unused chassis and bogies can be transported by return trip to a new loading point or in case of damage to a central repair shop.

Conclusion:
RailRunner is the most advanced bimodal technology. Nevertheless it has to compete with LO/LO-technologies which are state-of-the-art in the current European intermodal network. If it is used for container transport there are several advantages compared to operation with traditional flat or skeletal wagons. RailRunner train compositions can be operated in hub terminals as ordinary trains, but may transfer to road transport even on low cost terminals in the hinterland. RailRunner may perfectly contribute to the strong growth of world container transport, as it may cover faster and with less investment a much bigger area than the existing overcrowded hinterland hub terminals.

# 2. Comparison with Other Competing Technologies

This chapter not only lists the earlier and current bi-modal technologies, but also other technologies for the transport of semi-trailers and/or containers via rail. The current technologies are stated to help to identify the actual market situations. Not listed, but to be taken into account is the alternative of the transport of 45' swap bodies on 104' long six-axle articulated wagons. Although mainly developed for the transport of today's standard trailers, this new railcar might also be a successful way to operate domestic, as well as international containers.

## *2.1 Bi-modal Technologies*

Concerning the general coupling technology, in the past, two bi-modal systems have been developed, namely having a trailer coupling (Road Railer) and having an adapter coupling (all others):

- **RoadRailer®** from Wabash National, USA

  The technology has been used for several years by BTZ (Bayrische Trailerzug), who went bankrupt in 2003. The equipment has been sold mainly until 2005 by the auctioneer Hufnagel. 410 trailers have been purchased by TruckStore in the Netherlands and 233 intermediate and 38 end bogies by VTG in Hamburg). RoadRailer has technically tested successfully in Switzerland, but unsuccessfully in Austria. In France, RoadRailer bogies have been produced by Bombardier and trailers by

Wabash and Balloy, which have been used by CNC (meanwhile bankrupt subsidiary of SNCF, 30 trailers and 35 bogies can still be purchased from AMLog Consult http://www.amloQ-consult.de). Similar technologies have been tested as Carro Bimodale by FERROSUD in Italy, as Trailer Train in Britain and Transtrailer by Transfesa in Spain. The front end of the trailer is connected to the rear end of the next trailer, of which is coupled to the bogie. Therefore, the adapters are not symmetric.

- **Kombitrailer™** from Ackermann-Fruehauf and Talbot, Germany
  Prototypes had been built in Germany and tested in several European countries (e.g. in Norway by NSB) In France a similar system named "Semirail" from Remafer Marly Industrie existed. Both technologies later were joined to the Kombirail system, which is no longer in service. The trailer had been approximately 900 kg / 2,000 lbs. heavier than a standard road trailer.

- **TransTrailer™** from Tafesa, Spain
  Commercial test running had been realized between Spain and Germany. Service ended due to insufficient commercial results in transit through France.

- **"Rail-Trailer"** from Sambre et Meuse and Kaiser, France
  The trailer had to be fixed by corner castings and twist locks on the bogie. It did not enter into service.

- **Multitrailor** from Tabor (http://www.tabor.com.pl)
  The bi-modal system had been developed by the Institute for Rail Vehicles "Tabor" in Poznan (Poland). The adapters are symmetric. A prototype has been tested up to 120 km/h / 75 miles/h. No customer has been attracted so far.

- **Coda-E**
  The system was designed in 1991 by Stork Alpha Engineering in the Netherlands in cooperation with NS Netherlands Spoorwegen (Dutch Railways) and SJ Swedish Railways. The air suspension of the trailer is used to raise and lower the trailer for coupling. The system has been designed for trailers on bogies, but alternatively for the use of stackable intermediate platforms/frames on the same bogies. The bogies could be transported on the intermediate frames. The development has not yet been realized for commercial service.

- **Combitrans** from Intermotra, France
  Designed in 1993, Combitrans is a trailer which attaches to two identical end bogies and together they become a single wagon. Several hydraulic lift cylinders on the rear road axles push the trailer frame up when in road mode to allow coupling. A prototype had been build, but no service has survived.

## 2.2 Technologies for Non-Liftable Trailers (Roll-On/Roll-Off)

- **Modalohr** (http://www.modalohr.com; http://www.lohrJr/rail-route.htm)
  The technology was developed 15 years ago by the subsidiary of the French trailer manufacturer LOHR. Either the single trailer or two trucks can be transported on a revolving platform. It is used as a rolling-road connection ("Rollende Landstrasse") between France and Italy through the Alps. A connection is planned between Luxemburg and Perpignan in southwestern France, a distance of 1000 km 1 620 miles. However, special equipped terminals and wagons are needed. The underside of the loading platform is just 80 cm above rail, so it meets the limited requirements of the European loading gauge.

- **Flexiwaggon** ( http://www.flexiwaggon.se )
  An immovable prototype has been built in 2000. The wagon frame can be revolved around both bogies so that unloading and loading of the trailer with tractor can proceed always forward. No customer has been attracted so far by the Swedish company.

- **CargoBeamer** ( http://www.cargobeamer.de )
  A concept for an automatic platform loading system has been developed. Special loading ramp equipped terminals and highly specialized wagons are needed. Transshipment has to be proceeded in two steps (trailer to platform then platform to wagon). No prototype realized or customer has been identified by the German company.

- **WTT** (Wechseltrog-Transport-System http://www.wtt-rail.com )
  WTT, in principle, is similar to CargoBeamer. The advantage of WTT is the loading track can also be used for other purposes as the loading machinery can be rolled aside and side ramps are not needed. A functional model has been built in Soltau (Northern Germany). No customer has been attracted so far.

- **CargoSpeed** ( http://www.cargospeed.net )
  The technology has been developed in 2004 within a European research project by a British consortium. A lifting device raises the platform, turns it and lowers it down to the side ramps so unloading and loading can occur. A functional prototype has been built in Chesterfield (UK). No customer has been attracted so far.

- **Tatravagonka basket wagon** ( http://www.tatravagonka.sk )
  About 60 basket wagons of the Type Sdgnss has been built by the Slovakian company Tatravagonka and used by the Hungarian Railways, but are no longer in service. The basket, which is equipped with grapple arm recess, accommodates the trailer and has to be lifted out of the wagon for unloading and loading procedures.

- **Arbel Fauvet Rail basket wagon** ( http://www.a-f-r.fr )
  A basket wagon has been developed in 2005/2006, which is more or less a further development of the above mentioned Tatravagonka basket wagon. The underside of the loading platform is just 80 cm above rail, so it meets the limitation requirements of the European loading gauge. One wagon with a length of 20 m can carry one trailer of 13.7 m, which is a use of total train length of just 68%.

All technologies for non-liftable trailers need special constructed wagons for the roll-on/roll-off transshipment, which are mostly heavier than flat or pocket wagons.

## *2.3 Technologies for Liftable Trailers*

The Megatrailer pocket wagon from Ferriere Cattaneo in Switzerland ( http://www.ferrierecattaneo.ch ) represents state of the art technology for rail transport of liftable trailers in Europe. A prototype of the wagon has been developed within the European research project SAIL. The approval procedure of the Federal Railway Authority (EBA) is expected to be finished within the next few months. Quite a number of the six-axle articulated wagons are already ordered as "T3000" by Kombiverkehr, as "T5" by Hupac and as "Twin" by AAE, at least. The trailer has to be equipped with grapple arm recess.

## *2.4 Reasons for Failure of BTZ with the Road Railer System*

The following reasons for the bankruptcy of BTZ in 2003 have been published:

- Punctuality of trains was insufficient.
- Planning procedure for new train routes and connections lasted too long.
- Too low a capacity utilization rate, at least in one direction, where balanced load is necessary.
- Reduced push factor due to delayed introduction of the German road toll system (MAUT, which at last was introduced in January 2004) was lamentable.
- Judging by the total transport time, especially in comparison with direct pure road transport, had been long. The reason is that the trans-shipment, especially at the intermediate stop in Munich, had been time consuming.
- Splitting of the train for the climbing on the steep Italian ramp to the Brenner Pass was time consuming, complicating the operation and therefore, proved costly.

### *2.5 Reasons for Failure of Bi-modal Technologies in Europe*

In our opinion, bi-modal technologies failed in Europe generally because too many technologies competed in a too small and not yet liberalized rail transport market. This also occurred because each national railway company tried to introduce its own special technical solution. Trailers and bogies often had been in different ownership, which causes conflicts in case of technical problems and interoperability.

## 3. Intermodal Inland Terminals - Standard Costs

A standard terminal for a capacity of 100,000 intermodal transfers per year is normally realized in an area of 500 x 100 m (1,500 x 300 ft). It will consist of four parallel rail tracks (each of it has 400 m length, i.e. taking 1/2 block train). A gantry crane foundation and two gantry cranes will run alongside the entire length and span over these four rail tracks, a double lane for road driving in both directions and three lanes to accommodate temporarily loading units. Possibly, two more rail tracks will be set outside the crane to accommodate empty railcars.

The crane will straddle at a width of 40 m (120 ft.); the total width of the unit will be 65 m (195 ft.).

| The costs for such a unit will be approximately | | Million € |
|---|---|---|
| Estate purchase: 50,000 $m^2$ at 50 € each | | 2.5 |
| 1,600 m rail track | | 0.6 |
| Switches | | 0.4 |
| 25,000 $m^2$ fixing depot area crane track | 1.0 | |
| Two gantry cranes | 5.0 | |
| Planning, survey, misc. | 2.0 | |
| Subtotal | 8.0 | |
| Total | | 11.5 |

Such terminals result in a cost figure of 35 - 50 € per box transferred.

The current market price for a transfer between road and rail in a German terminal is 18 - 22 €. Such prices can be only be achieved if the terminal operator receives the normal German Government subsidy of 50% - 85% of the total investment, i.e. some 10 million € subsidy and some 2 million € commercial funding.

Normally, such terminals transfer up to 30 - 40 boxes per hour.

If a large depot business has to be served in addition to the above mentioned functions and estimated costs, another 2.5 - 5.0 million € will be needed to purchase and fix the depot area and an additional 350,000 € for a Reach Stacker.

# 4. Intermodal Trains - Standard Costs

## *4.1 Costs for Intermodal Train Operation on Short Distances: 220 miles, 360 km*

| | | |
|---|---|---|
| Cost per railcar: | 60 ft. railcar | 19.00 € = 24.00 $ per day + 10% overhead |
| | 90 ft. railcar | 32.50 € = 40.00 $ per day + 10% overheads |

| | |
|---|---|
| Cost of train operating (incl. rail slots, traction, energy, railcars) | 19.75 €/km |
| or | 25.67 $/km |
| Per mile | 15.45 $/mile |

In addition, a lump sum cost of 600 € or $750 per train operated as overhead cost (this includes cost for train administration, track rights, invoicing, e.g.) has to be calculated.

The actual handling cost in an intermodal terminal in Germany is approximately €2 x 20 ($25) per box handling. (This considers German subsidies for intermodal terminals; the actual cost outside of Germany is often double that cost)

## *4.2 Costs for Intermodal Train Operation on Longer Distances: 770 miles, 1230 km*

| | |
|---|---|
| Train operation (slot, traction) | 7 - 14 € per km or 5.50 -11.00 $ per mile |
| Railcars per set (low platform specials) | 5 x 90 ft + 12 x 60 ft. = 212,000 € per year |
| Transfer and agency costs | 45.00 € per box |
| Administrative overheads | 35.00 € per box |

### 4.3 Costs for Operation of RoLa Trains in Central European Networks

An Appendix with values is attached This Annex is based on a RoLa Due Diligence check made in the 1990s. Furthermore, we refer to the report "Chancen des Systems Rollende Landstrasse" – (Schlussbericht) - from December 2003 in German language. A complete copy of this report has been delivered to RailRunner during the summer of 2006 by Studiengesellschaft fuer den Kombinierten Verkehr eV via e-mail.

## 5. Rail Safety Approval in European Networks

### 5.1 National Approval - European Approval

Any rolling stock that is intended to operate on European rail networks has to be approved for safety and compatibility reasons. In the past, this approval has been granted by the National railway undertaking. As privatization of railways progresses, the approval procedure has been removed from the commercial units for rail transport and shifted into a National Railway Approval Administration. These administrations co-operate in a very differing degree with the National railway undertaking(s). In some countries they are rather closely interlinked and exchange their personal and experts. In other countries, such as Germany, they are definitely separated. The German Federal Railway Authority, the Eisenbahn-Bundesamt (EBA), operates completely independently and has a reputation for being especially tough when the traditional State Railway asks for an approval.

Any of such authorities may grant approval, but only for their specific national network. How far such an approval is accepted as valid for a neighbor network is a question that seems to be solved on a case by case basis. One such famous case is the ICE, the German design high speed passenger train. Even after proof that this train operates safely and reliably on the German, the Swiss and the Austrian network, the French Approval Authority needed almost four years of tests and charged some 30 million € to the producer to grant French approval. Rail vehicle producers published costs for the approval of an electric locomotive of up to 8 million €.

Insofar, an approval in several European networks can be a costly and time consuming procedure, or it can be rather easy when some national approval authorities take over and believe in the results of the neighbor country authority.

### 5.2 European TSI Regime

For many years, the European Commission has worked on legislation and standardization to possibly create a European approval. Unfortunately, (for our case) such endeavors have been concentrated on high speed passenger train approvals (directive 96/48/EG).

Meanwhile, a European directive, 2001/16/EG and in consequence the technical specification for Interoperability (TSI) has been published. The European Commission adopted on 28 July 2006 a decision C (2006)3345 concerning the technical specification of interoperability relating to the subsystem "rolling stock - freight wagons", which will operate as follows:

> The manufacturer asking for approval is directed to the national administration that has been selected for his specific case. This authority conducts the tests and certifies the approval for all European networks. With this European approval in hand, the manufacturer (or owner of the equipment) can apply to any European network for a "start-up approval" which should be easily granted and on short term.

Further Information on registration procedures as proposed by the European Railway Agency in a report to be confirmed by the European Commission can be found at their web site: http://www.era.eu.inUpublic/interoperabilitv/CR%20TSI%20-%200%20-%20 Default. aspx and on TSI at the European Commission web site on interoperability: http://ec.europa.eu/transporUrail/interoperabilitv/tafen.htm.

The new TSI regime will come into force in Germany on 1 February 2007 and will be managed by a certification service (http://www.eisenbahn-cert.de). The approval given by the federal railway authority will be based on the certificate. The TSI regime will replace the national regimes.

### 5.3 Current German Regime

Currently in Germany, all approvals for the national railways (Deutsche Bahn AG) and the foreign railway companies intending to run their rail vehicles are administered by the Eisenbahn-Bundesamt, which has the address:

Eisenbahn-Bundesamt, Vorgebirgsstrasse 49 in 53119 Bonn, Germany
http://www.eisenbahn-bundesamt.de

Within the EBA, the unit ("Referat") 32 deals with approval questions.

The legal source for the procedure has been defined in the Eisenbahn-Bau- und Betriebsordnung (EBO = Railway Building and Operating Rules) and the related administrative regulation for the approval of rail vehicles ("Verwaltungsvorschrift fuer die Abnahme von Eisenbahnfahrzeugen gemaess § 32 Abs. 1 EBO im Zustaendigkeitsbereich des EisenbahnBundesamt (VwV Abnahme § 32 (09.2006)"), an enumeration of the later document and its attachments requested can be found in: http://www.eisenbahn-bundesamt.de/Service/ref3x/s3.html.

Furthermore, the railway undertaking has to check its wagons for the use on the public network of DB NETZ AG. The technical specifications for the use of the infrastructure in Europe are mentioned in the network statement, which must be published by all infrastructure companies. Also, DB Netz AG in Germany describes the conditions for access of goods wagons on their tracks in their network statement ("Schienennetz-Benutzungsbedingungen", regulations concerning goods vehicles are just mentioned in the German text, incomplete English version:

http://www.db.de/site/bahn/en/business/infrastructure energy/trackinfrastructure/networkstatement/conditionsofaccess.html).

Once all necessary documents have been provided, the EBA should decide on the approval of the first wagon of a type of construction within a time frame of six to 10 weeks. The administration charges costs of 80 € per expert hour. This would mean that the EBA would charge for one expert working some eight weeks on an application 25,000 € ($32,000USD) work-force fee. The exact costs depend on the quality and complete delivery of the documents to be presented and on the complexity of the validation according to the design of the wagon.

## *5.4 Companies Involved in the Process*

The railway company is legally obligated to build and run rail vehicles in a save manner (§ 4 paragraph 1 AEG - Allgemeines Eisenbahngesetz - general railway act), but keepers are equated (§§ 31 und 32 AEG). Therefore, normally the railway company applies for approval (VwV Abnahme § 32), but also owners/operators can do so as well. Even if it is not directly stated in the acts (EBO, AEG), the manufacturer also has the right to produce such an application for approval (see Attachment 3 of regulation "VwV Abnahme § 32"). The Federal Railway Authority gives the approval to the manufacturer if the vehicle will be operated on the German national railway network operated according to EBO legislation.

However, if the manufacturer intends to operate the equipment later within a rail network that is operated according to state regimes (so called Private Rail Companies "Nichtbundeseigene Eisenbahnen - NE-Bahnen") the appropriate authority will be a State Administration ("Landesbehoerde").

According to Attachment 3 of the regulation "VwV Abnahme § 32", the manufacturer must, before he formally applies, declare on which system he intends to later operate. Without such a declaration, the approval might not be processed, or, if proceeded, become later marked invalid.

The approval is given for all items that later on are produced to this exact technical specification that has been approved.

Preconditions for the manufacturer are that he has to have a quality management system, that he present a declaration that he keeps to the state of the art technology according to §2 EBO and that he deliver any selected technical description to enable the validation. The manufacturer has to present guidelines for the operation, maintenance and repair of the vehicle to be approved, which the keeper or railway company has to have considered in such a way that the vehicle can be operated in a save manner.

### *5.5 Approval Recommendation*

Studiengesellschaft fuer den Kombinierten Verkehr eV. recommends starting with suggestion 1 in February 2007 with the European approval procedure. If requested, Studiengesellschaft fuer den Kombinierten Verkehr eV. can watch for and follow the future issues of new or modified regulations and standards.

If RailRunner decides to immediately start the approval process, it is recommended to check with www.eisenbahnbundesamt.de/Service/ref3x/s 3.htm for the necessary procedural details. Again, Studiengesellschaft fuer den Kombinierten Verkehr eV. will in case additional questions do arise or if language problems occur be available for possible help and/or render its offices if a German local address might be required.

## 6. Operational Recommendation

The busiest and fastest growing intermodal transport market in Europe is currently the hinterland transport of containers. Most ports are afraid that the ever increasing number of containers landed in their terminals will create future road congestion. So they consider promoting hinterland transport on rail and by inland waterway transport.

An interesting example for these intentions is the Port complex of Rotterdam. They receive and dispatch containers through numerous terminals at the mouth of the lower Rhine river. None of these terminals are well connected to rail.

A simple operation would be:

- to truck RailRunner flat trailer/chassis into the various terminals of Rotterdam port,
- to load containers by lifting equipment in these terminals onto the trailers,
- to assemble the returning trailers at an appropriate railhead to a RailRunner train,
- to operate this train to a major inland hub, e.g. Duisburg (with some 700,000 TEU p. a. transfer),

- to continue vice versa.

The main advantages of RailRunner supplying fast light-weight transport, requiring only small terminal areas with minimal investments can be fully utilized, because several terminals might be required. The high guaranteed volumes of incoming and outgoing containers promises excellent economics.

ANNEX A

**Combined transport by ROLA between KISKUNDOROZSMA and WELS**

(Study prepared by SGKV several years ago for the comparison of the “Iron Highway” concept versus standard intermodal transport)

When comparing the results for this system it can be found that the RailRunner technology is more economical than the “Iron Highway”. Costs of transport are significantly lower even when using special RR trailer. The main advantage of ROLA is its independence from any special vehicle. This can be overcome by the RailRunner “Container Concept”.

# COMBINED TRANSPORT BY ROLA BETWEEN KISKUNDOROZSMA AND WELS

**Final Report**

## 1

## The Economics of Road Traffic Operation and Combined Transport by ROLA Compared

*Note: This study uses the term „Rola" for a type of combined transport road/rail operation that moves the road vehicles completely on board of a rail-car with a extreme low platform; the transfer between road and rail is executed in roll-on/roll off technique using a circus ramp. The driver remains during the operation in the train, resting in a couchette rail-car that forms a part of the train.*

As long as the commercial offer of a Rola operation in its schedule, its organisation and its transport policy fringe conditions are similar to those of road transport, we might assume that the decision between Rola or road transport will be taken only on basis of a commercial comparison.

Basis of this comparison is a calculation as follows: The fee for the combined transport rail movement plus some additional costs that might be incurred by this type of transport (eventual additional mileage to arrive at the terminal) must not exceed the savings that are created by the use of rail. With other words: The amount of costs that are saved by the movement over rail fixes the upper limit for the charge for the combined transport rail segment; otherwise the Rola will not be used.

This rail transportation charge may not be necessarily in a connection to the real costs of operating a Rola train. But we have to know these costs before we can decide on this type of operation. Therefore, we must calculate these costs.

We shall execute this calculation using, as an example, the operation on the axis Szeged/Kiskundorozsma in Hungary and Wels in Austria, for a road transport operation on the transport corridor between Central Europe and South East Europe.

After the calculation of the costs we shall evaluate the transport policy fringe conditions that are result of the fiscal policy of the countries concerned; these fringe conditions may influence the competition between road transport and combined transport greatly.

We shall calculate the costs for a road operation, afterwards for the road and Rola operation from the point of view of a road haulier, followed by the calculation of any taxes and public fees that must be paid; this will form the basis for a cost comparison; this comparison will furthermore take into account factors such as kilometres moved and operation time needed.

### 1.1 Costs of over the road operation

The height of cost savings - which form the later decision criteria - may vary considerably. This depends from the way of calculation and from the different cost level of transport enterprises in different countries.

- Operational costs, variable per km

Normally we calculate the operational costs at a general cost level of the European Union States for a 40 t road train or articulated unit at 0,398 ECU for each km moved. This includes positions such as

50 % of the total depreciation of the vehicle,

fuel and oil consumption

tyre use

repair

miscellaneous (see Annex 1).

We might easily assume the many operators and transport enterprises in South East European countries are not fully aware of all these costs, possibly do not calculate them fully and may be subject to fatal consequences in the long term due to this wrong calculation. These enterprises will not calculate any depreciation in relation to operational vehicle usage but only those parts of the depreciation that are time dependent. We have normally to include into the calculation operational depreciation / usage at a rate of 0,069 per km moved.

The level of repair costs is mainly decided by the personal costs, and will be rather low for vehicles operated in South East Europe. Therefor we reduce the normal repair cost value by

33%; so we calculate them at 0,079 ECU per km moved (compared to 0,116 ECU at Central European conditions).

It is not possible to calculate a certain unique value for fuel costs. The fuel costs are in Germany at about 0,97 DEM (= 0,508 ECU) per litre (VAT not added), Hungary has rather the same price level. Bulgaria offers much cheaper fuel prices, but currently with a quick raising price level. The calculation is heavily influenced by questions such as

where does the operation originate,

where has the fuel been purchased,

how much fuel may cross the border in a vehicle tank.

The Rola between Kiskundorozsma and Wels is part of a longer corridor, and we shall calculate fuel purchase costs per litre at an average of 0,447 ECU.

As we had reduced the repair costs, the amount of variable costs may decrease from 0,398 ECU to 0,361 ECU per km moved. (Annex 2)

- time dependent costs

When the use of Rola results in a change in operation time schedule for the road vehicle, we need a calculation of eventual increase or decrease of costs incurred by this feature. Here again we must modify our initial calculation scheme to take account of the special condition for an operation in South East Europe. Enterprises in this country may not calculate cost elements for garage (over the night shelter of vehicle) or for business administration. There is only a minor vehicle tax (if any) in those countries that give the most potential clients for the Rola service such as Romania, Bulgaria, Turkey. So we do not calculate this as a cost element. When officially asked by the German Road Transport Union, only the Republic Turkey has stated that they charge a vehicle tax.

Annex 2 shows the modified km dependent and time dependent costs:

| | |
|---|---|
| for each km moved: | 0,36 ECU |
| for each day in operation | 115,59 ECU. |

For the corridor segment Szeged - Wels we calculate 648 km and costs of 648 x 036 ECU = 233,28 ECU.

If we finally drop as well the costs for depreciation for usage and include this cost element in the normal over the time depreciation, we arrive at the following cost values:

| | |
|---|---|
| costs per km moved | 0,291 ECU |
| cost per day in operation | 115,59 ECU |

- driver costs

Most drivers of road vehicles that operate on this corridor come from countries with a rather low salary level. In Hungary those costs for a truck driver per month are at 636,27 ECU. Romania driver are paid at 424,18 ECU per month as far as we had been informed. If we base the calculation on 20 working days per month we arrive at costs per day of 31,81 or 21,21 ECU. We assume that per diem costs for driver from Turkey and Bulgaria are not higher than these values.

- Road transit costs

The road transit through Hungary is regulated, as usual, by bilateral agreements concerning road traffic. Foreign states have certain contingents for transit, partly free of charge, partly against transit fees.

The transit fee depends from the actual road vehicle weight, i. e. the tare weight of the vehicle plus the weight of the cargo carried. The fee amounts at 3 HUF per km and per ton, all weights rounded up.

Our study on statistics of road vehicles moved by the Rola operation Kiskundorozsma - Wels has resulted in the following specific values:

| | |
|---|---|
| average tare per road vehicle | 14,77 t |
| average cargo per road vehicle | 14,97 t |

Under these circumstances we calculate 30 t as the normal value for all road vehicles that move on the Szeged - Wels segment of this corridor, both for road operation and for Rola operation.

The transits fee calculation is based on the Hungarian segment for the axis Kiskundorozsma - Wels that amounts a distance of 355 km. The road transit fee for foreign vehicles with average cargo operating on this corridor would be for the Hungarian segment

30 t x 355 k x 3 HUF = 31950 HUF = 231,71 ECU.

Road vehicles using the Rola service Kiskundorozsma Wels do not underlay any obligation for transit licenses or transit fees in Hungary.

Transport movements in transit through Austria are charged with ATS 240 (= 18,22 ECU); this payment is due both for Rola based (segment from Wels to the West Austrian border) and road only (total road transit through Austria) operation. A generous transit regime has been made for vehicles of European Union nationality for an interim period. (After this period EU vehicles should enjoy complete freedom to move.)

The transit of non-EU vehicles is regulated and limited by contingents free of charge; if this contingent has been fully used, the operator can try to get an additional exception contingent; this needs the payment of a fee of ATS 1100 (= 83,50 ECU); this fee is that high that normally nobody asks for such an exception contingent.

If the Republic Hungary introduced, additionally to transit fees, a road toll, this would have to be included into the calculation. Currently such road tolls are planned; the new segments of the highway M 1 will be privately financed and the return of investment shall come from road tolls on this segment.

### 1. 2 Costs of a Rola operation

The un-accompanied piggy-back transport shows an operation feature with a very large trunk haul over the rail and considerably short pick-up and delivery runs over the road.

Rola operation that are accompanied by the driver normally show another feature. The movement over the Rola is viewed as a segment in the total road movement. The Rola operation is a part segment in this operation. The operation patterns are completely alien to those of un-accompanied piggy-back operations.

Any un-accompanied operation depends of an efficient organisation on both ends of the rail trunk line, and regular and balanced traffic flows. This basic feature occurs often only with large forwarding and transport enterprises who are able to make efficient use of the advantages of combined transport.

The normal road operation is, due to its flexibility, able even to meet irregular and unbalanced traffic flows. The driver goes, without any fixed schedule, from A to B, and if he does not find any return cargo at B he goes empty to place C, takes over cargo and continues home to A.

This traffic and transport patterns are home of the many 1 truck + 1 driver companies or of transport enterprises with only few vehicles. This type of enterprise will use Rola services only if the combined transport segments fits into the over the road run and if this offers commercially an interesting alternative.

The Rola service must be situated rather similar to a road operation; the terminals must be on the way, or at least the access to the terminals must be possible without a too large deviation. The time schedule of the Rola services must fit roughly into the circulation planning of the road operation. A shuttle service with many daily departures certainly fits much better than a one departure per day scheme.

If we compare the Rola service schedule with the normal over the road operation, we have to take into account that all drivers are legally obliged to interrupt driving for a minimum rest period, and that normally any border crossing will incur delays. Normally, a driver must rest 8 hours between two lengthy driving cycles. Most European states and the EU have made a specific legislation towards these rest periods to avoid that tired drivers keep on driving their 40 tons vehicles and affect the traffic safety.

Most national regulations recognise Rola operation period as a rest period (*the driver will rest in a couchette rail-car during rail transit in this type of operation)*. All transport enterprises that usually care for the legal implications of their activities get an additional advantage out of transit on Rola service: Normally they have the choice either to go for continuos operation and employ two drivers per truck in move, or they have to interrupt their vehicle circulation in 8 - 12 hours intervals to achieve an 8 hours break for the driver. Both features add considerably to the costs of truck operation. In theory, the Rola service could provide a considerable cost advantage for those who are able to insert the Rola movement into their normal circulation in a way that it fits into the rest time cycle of the driver.

Unfortunately, reality gives another picture. All experts with practical experience agree that the operators on the corridor into South East Europe do not care about legal drive and rest cycles. Some of them come from countries where such administrative legislation is practically not obeyed; so they not care, and their usual working cycle defines the price and service level for all competitors, those of Central Europe as well. The Central and West European operators either have to adapt to these bad habits, or they loose their market position. It is easy to disregard such legislation when the operation crosses many borders. Experience tells that the control of drive and rest cycles is difficult and practically non-existent on multi-nations corridors.

Under these circumstances the Rola advantage that drivers can meet their rest period requirements when going by Rola cannot be transferred into commercial utility that could make enterprises pay extra amounts.

An acceptable Rola service needs a railway tunnel gauge that allows for carriage of all regular trucks.

The Rola service offered on the segment Kiskundorozsma -Wels fulfils the following conditions:

- the position and the road access of the terminals is acceptable.
- Transport enterprise structure on this corridor is favourable.
- Three daily departures give a good schedule.
- The distance between departure and arrival terminal is adequate for this type of service.
- Duration of Rola transit and possible rest cycle requirements of drivers can be co-ordinated.
- The rail tunnel gauge on this axis allows for all regular trucks moved on Rola railcars.

- Costs of special railcars

The basic amounts for our cost calculation are as follows (all amounts in ECU):

| | |
|---|---|
| purchase price per 8 axle piggy-back low platform railcar | 129 905 |
| purchase price per front adapter | 16 967 |
| depreciation period 15 years | |
| maintenance and repair per railcar and per year | 37 720 |

*(This amount has been told by Companies that operate such railcars.)*

72 railcars - 4 train sets with 18 railcars each, 8 of those railcars with a head adapter - are operated on the segment Kiskundoroszma - Wels, as far as MAV reports. This leads to cost figures as follows:

| | |
|---|---|
| 72 railcars at 129 904,56 ECU each | 9353 128 |
| 8 head adapter units at 16967,13 ECU each | 135 737 |
| total | 9488 865 |

| | |
|---|---|
| Costs | |
| 7 % p. a. interest | 664 221 |
| depreciation | 632 591 |
| repair and maintenance 72 x 10604,45 | 763 521 |
| total | 2060 333 |

The schedule on this axis foresees 17 trips in each direction per week, and the operators tell that they stay in service on 50 weeks per year. This results in 1700 trips per year.

| | |
|---|---|
| Cost per train trip composed of 18 railcars | |
| 2060333 : 1700 | 1211,96 |
| Cost per vehicle accommodation offered | |
| 1211,96 : 18 | 67,33 |

Currently, the railcars operated on the itinerary Kiskundorozsma - Wels are provided by Ökombi. These railcars are moved to Ingolstadt for the regular maintenance works. This means a distance of 2 x 275 km to be covered, and creates severe additional costs. Ökombi operates 571 Rola railcars. 446 railcars out of this stock are in commercial operation, and 125 are in repair and maintenance (average values). If we transfer this relation into our railcar cost calculation, we must increase the cost per railcar (= per vehicle accommodation offered) by the factor 1,28 and arrive at

| | |
|---|---|
| costs per vehicle accommodation offered | 86,19 |

Now we assume that a more efficient repair and maintenance scheme could be realised. The intermodal operator HUPAC who offers Rola service in transit through Switzerland has realised a ratio of railcars in commercial operation to railcars in repair and maintenance that would allow for an increase factor of only 1,11. If we take this value (not realised in Hungary transit, but the operator could arrive at such a factor if they can establish an appropriate organisation) we arrive at

| | |
|---|---|
| cost per vehicle accommodation offered | 74,74 |

The costs per railcar have to be accounted independent of the fact whether these railcars operate with a vehicle loaded or when empty. We shall now introduce various degrees of capacity use

Cost per vehicle accommodated in relation to various repair and maintenance schemes and various degrees of capacity use.

| capacity use in % | factor 1,28 | factor 1,11 |
|---|---|---|
| 100 | 86,19 | 74,74 |
| 80 | 107,73 | 93,43 |
| 75 | 114,91 | 99,66 |
| 70 | 123,12 | 106,77 |
| 65 | 132,60 | 114,98 |
| 60 | 143,65 | 124,57 |

Note: In 1994, the average capacity use had been 80,9 %, and each train had been composed of 23 railcars.

- Costs of couchette railcar

The Rola service between Kiskundorozsma and Wels operates 7 couchette railcars to accommodate the drivers during rail transit. These couchettes have been leased by MAV from the Czech Railways at a rate of 50,37 ECU per day and per car *(amount as told by MAV representatives)*.

This gives additional costs per trip and per vehicle accommodation offered to be calculated as follows:

costs per trip :

50,37 ECU x 365 days x 7 cars = 128 695 ECU

128 695 ECU : 1700 annual trips = 75,70 ECU per trip

75,70 ECU per trip : 18 vehicle accommodation offered = 4,21 ECU per vehicle accommodation offered as additional costs for the couchettes.

MAV has told that they intend to rebuild own railcars to serve in future as couchettes. This would incur costs per railcar rebuilt of 159 067 ECU, for 7 cars 1 113 468 ECU. This results in costs as follows:

| | |
|---|---|
| depreciation (10 years period) per year | 111 347 |
| 7 % interest | 77 943 |
| 5 % p.a. repair and maintenance | 55 673 |
| total | 244 963 |

Costs per trip:

244 963 : 1700 = 144,10 ECU

Additional couchettes costs per vehicle accommodation offered:

144,10 : 18 = 8,01 ECU

The real costs depend, as in the previous Rola railcar calculation, from the degree of capacity use. So we arrive at costs as follows:

| capacity use % | leased car | rebuilt car |
|---|---|---|
| 100 | 4,21 | 8,01 |
| 80 | 5,25 | 10,01 |
| 75 | 5,60 | 10,67 |
| 70 | 6,01 | 11,44 |
| 65 | 6,47 | 12,32 |
| 60 | 7,02 | 13,25 |

- costs for traction, rail network and terminal transfer

The costs for traction, network use and terminal transfer are given by the railways in a lump-sum amount that amounts between 0,35 and 0,70 ECU per railcar and km. Ökombi reports that the segment Kiskundorozsma - Wels is operated at a charge of 0,419 ECU per railcar and km, MAV reports an almost identical amount of 0,45 ECU.

It is completely unknown how the railways calculate this amount, and which overhead cost elements they include in their calculation. Third parties are unable to judge whether the railway costs incurred with the Rola operation Kiskundorozsma - Wels have been exactly ascertained and allocated to the operation. Furthermore, the question whether this amount covers the direct costs + a contribution to the overheads, or any other calculation feature, must remain open.

We assume that this charge covers the direct costs of the operation and gives a contribution to the overhead costs.

Basically we have to understand that a very large and complex enterprise such as a railway administration has severe problems to install an exact cost calculation scheme; additionally they will have to decide which service may tolerate a larger or a smaller part of the overhead costs to be included in the market price. Once such a deliberation has been made, the overhead cost distribution to certain services may be decided. If railway administrators go this way, and if they allocate moderate shares of general overhead costs to the Rola service, this might be justified from a pure commercial point of view, and certainly is justified when taking environmental and transport policy arguments into account.

The railway takes over a part of the risk of less than full capacity use: They only charge for those railcars that move laden. This is certainly a positive feature from the point if view of business development. But, as cost calculation is concerned, this introduces another variable which creates further problems for an exact calculation scheme.

If we now take those 0,43 ECU per laden railcar per km as cost elements for traction, network use and terminal transfer, we arrive at the following costs for a road vehicle transported between Kiskundorozsma and Wels (any direction):

648 km x 0,43 ECU = 278,64 ECU per trip

- costs per road vehicle carried on the Rola service

The costs per road vehicle carried consist of

cost of Rola railcar,

cost share for couchette,

cost for haulage and for dispatch service.

These cost elements have been described in Annex 3, 4, 5 and, taking account of variables such as

differing train capacity use,

increase factor for repair and maintenance either 1,28 or 1,11,

differing values for leased or own rebuilt couchettes.

Annex 3 shows costs

- at cost increase factor for repair and maintenance of 1,28
- for leased couchettes.

In this case, the costs are between 367,99 ECU at 100 % capacity use and 437,25 ECU at 60 % capacity use for each vehicle transported between Kiskundorozsma and Wels.

This cost level represents the conditions that are currently observed in this operation.

Annex 4 shows costs

- at increase factor 1,28
- owned rebuilt couchettes.

These costs are between 380,79 ECU (100 % capacity use) and 443,59 ECU (at 60 %).

Annex 5 shows a cost distribution scheme

- increase factor for repair and maintenance 1,11
- leased couchettes

The costs per road vehicle trip are between 365,54 ECU (at 100 % capacity use) and 418,17 ECU (at 60 % capacity use).

Annex 6 shows a cost scenario

- increase factor 1,11
- couchette owned and rebuilt

Here we arrive at costs between 369,34 ECU and 424,51 ECU for a road vehicle moved.

The cost increase factor of 1,11 should be realised by introducing a repair and maintenance in vicinity of the terminals and well organised.

As reported, the present state of the leased couchettes is not acceptable. So we understand that the higher costs for owned rebuilt couchette railcars are justified.

Therefore we recommend to base the analysis on the scenario as given in Annex 6 and the cost distribution shown in this Annex 6.

## 2 Cost Comparison

### 2. 1 Comparing basis operation features

Not only cost values, but as well differing operation features of Rola service versus over the road operation have to be included in the comparison.

The distance is similar when road and rail operation is compared, both 648 km. Both terminals are optimal located and create only - if any - very small additional mileage for deviation.

The rail carriage lasts 12,5 hours; we have to add rather 1,5 hours for waiting and administrative activities at the dispatch terminal, so we arrive at a total transit time of 14 hours. If we assume that the over the road operation goes at an average speed of 60 km/h, this would need rather 13 hours. The border waiting time at the Hungary/Austria border has to be added. This may be rather short, but at certain times may last some hours. On the other side, the arrival time at the dispatch terminal cannot be planned by the minute, so that we might have rather differing waiting periods there. This could be improved if we operate shuttle trains in 2 hours intervals.

Generally we may assume that the duration of a Rola operation compared with a trip over the road will be rather similar. In consequence, we must not include any adjustment in the time dependent cost scheme for the road vehicle. Perhaps we should include the advantage feature that on very long international transit routes normally 2 drivers are needed to achieve a continuos operation. In such cases, the Rola operation could include a rest cycle, and this could lead to an operation scheme where only one driver is needed. But since on this corridor obviously all legal requirements concerning driving and resting cycles are completely neglected, we do not include this advantage in our purely commercial calculation.

## 2. 2 Cost Values Compared

We have already made the case that the cost level of a Rola transportation depends, amongst others, from the capacity use. If we assume a capacity use of 80 % - this value has been achieved in 1994 average - we come to a cost comparison as follows - all values in ECU -:

| | calculation scheme | |
|---|---|---|
| | annex 3 | annex 6 |
| cost of Rola per vehicle | 399,59 | 390,03 |
| variable costs per vehicle saved | 233,28 | 233,28 |
| subsidy needed per laden trip | 166,31 | 156,75 |

If the over the road transit is free of charge, a successful shift from road to Rola would need a subsidy of rather 160 ECU per trip and vehicle.

If we understand that the transit is only possible when paying the foreseen transit fee, we arrive at the following result

| | annex 3 | annex 6 |
|---|---|---|
| cost of Rola service | 399,59 | 390,03 |
| variable costs per vehicle saved | -233,28 | -233,28 |
| transit fees saved | -231,71 | 231,71 |
| savings achieved | 65,40 | 74,96 |

In this case the over the road operation will be more expensive that the use of the Rola service (the Rola service calculated at cost level).

But we have to state that a capacity use of 80 % in regular scheduled traffic services normally cannot be achieved. Normally, a scheduled liner service can arrive at a capacity use level of 65 %. If we introduce this point, the difference between Rola costs and costs of over the road operation paying transit fees is reduced.

Calculation assuming a 65 % capacity use of Rola

| | annex 3 | annex 6 |
| --- | --- | --- |
| Rola service costs | 425,66 | 413,89 |
| variable costs saved | 233,28 | 233,28 |
| subsidy needed | 192,38 | 180,61 |

and including the payment of transit fees:

| | | |
| --- | --- | --- |
| Rola service costs | 425,66 | 413,28 |
| variable vehicle costs saved | 233,28 | 233,28 |
| transit fees saved | 231,71 | 231,71 |
| Rola service cost advantage39,33 | 51,10 | |

If we introduce a more realistic 65 % capacity use figure, the advantage of Rola compared to a over the road operation paying full transit fees further decreases.

*Note: Currently the Rola service charges for a one-way only trip 460 ECU, for a two way return trip 820 ECU.*

### 3 Evaluation of Results and Recommendations

- Cost Comparison

The analysis of Rola service cost shows very clearly, that a profitable operation is not possible if road vehicles may transit over the road without any license fees, road or transit tolls. The road operator will compare his cost savings with the piggy-back operation charge, and only shift to combined Rola transport if this incurs a cost saving. If a Rola service has to be calculated at cost level, the operational savings of the road operator are clearly never that large to make him shift to combined Rola transport.

When transit licenses are given only at considerable fees, and if such fees are that high as currently for transit through Hungary, we arrive at a rather balanced cost comparison; the savings by Rola service may rather as high as its charge. In this case, some other factors may decide, possibly individual preference of operator or drivers. Practical experience tells that operators and drivers hesitate to shift to Rola services if the cost advantage of Rola is only very small.

- Transit licenses

If no transit licenses are available on an important corridor, the use of Rola service may become a must. This will be illustrated by a rather simple calculation. If we wish to achieve an 80 % capacity use for our Rola service offered, this would need some 25 000 vehicles per year asking for a Rola trip. If we expect a total transit volume of 80 000 vehicles per year, we may grant transit licenses for 55 000 trips. (We shall not cover the question how these licenses may be distributed free of charge and how many against a charge.)

If we reduce the Number of transit licenses further, we may expect more traffic on the Rola service.

This example refers to the transit figures of 1993; in this year some 80 000 commercial road vehicle transit trips through Hungary have been (unofficially) estimated. In this year 1993 Turkey had considerable high imports. Meanwhile the import value has been decreased considerably (obviously in consequence of the economic crisis in 1994). But if we expect another economic boom in the European countries in the years to come, we may expect another boom in road transit through Hungary as well.

Furthermore, we have already mentioned that the willingness to use Rola service depends mainly from the amount that is charged for a road transit license. From a point o view of the Hungarian national economy, these transit fees charges are limited by two factors: If they exceed a certain value, transport will be so costly that external trade fades away. The other limit relies to the current monopoly position of Hungary on the South East Europe corridor. Hungary has achieved this position mainly because the Yugoslavian Federation has been dissolved, and a conflict had followed that blocks the transit ways through this area. If other countries in those area learn that high transit fees give the chance to earn much cash, they will certainly try their best to open additional corridors.

Another alternative has already been installed by the Turkish Road Federation: A small fleet of Ro/ro ferry boats has been launched to serve the trade route between Turkey and the port of Trieste in North Italy. The Turkish trucks can move over the Italian highway network (which charges road tolls) to the South East Austrian border at Kärnten. Obviously Italy does not care very much to limit such transit operations. Then the Turkish truck needs a transit license to move through Austria to the Austria/Germany border at Salzburg. Such transit licenses are handed out by the Turkish Road Federation for those clients that are using their ferry service. Turkish Road Federation is, by the way, the receiving address for all „reward transit license“ that are issued by the Austrian Government as additional licenses to reward the use of their Rola transit services.

Any calculation scheme for transit fees and transport costs has to take into account that all movements on the South East European Corridor run through several countries, and that all these countries fix their individual transit conditions including road usage charges very individually, and may change their attitude towards road transit on short term. Some exterior trade relations may use a broad selection of different transit corridors, while other trades have obviously no chance to avoid the transit through Hungary and Austria. This certainly makes a calculation towards maximum transit charges and traffic shifts caused by such transit fees very difficult.

This leads us to the conclusion that each country certainly has the sovereign right to fix a certain amount the a charge for use of road infrastructure. Free trade does not mean free use of infrastructure. This includes the right to charge transit traffic for the use of infrastructure. The political problem of non-discrimination occurs only when a country charges higher fees for foreign vehicles than for domestic ones.

- Continuos traffic flow in Rola service

Rola service use may become very discontinuous if the transit license are given in a block for all the year. This would lead to a situation where, for the first 8 months, almost nobody uses Rola (because there is ample supply of individual licenses available), and from autumn onwards over-demand tries to get on Rola services because the licenses have run short. Therefore it is strongly recommended to give such licenses in a continuos flow, and to limit the use of such licenses over a time period, e. g. in a scheme that an individual license given on 01 August is only valid until 15 September.

Such a scheme would lead to a smooth traffic flow on the Rola service, a good average capacity use, and in consequence to lower operation costs.

Current Rola schedule

The moving time for the Rola service from Kiskundorozsma to Wels is about 12,5 hours. This represent an average speed of 52 km/h. The EuroCity passenger service operating on the same route goes at a speed of 81 km/h, i. e. in rather 8 hours.

We assume that technical and organisational barriers create this slow move of Rola service compared to scheduled passenger service.

For the time being, 3 daily departures in both directions are offered, and 7 sets of Rola trains are needed to realise this offer. If the railways could reduce the circulation time to approximately 9 hours for one transit trip, better circulation figures could be achieved an the current schedule could be realised with one Rola train set less needed than today.

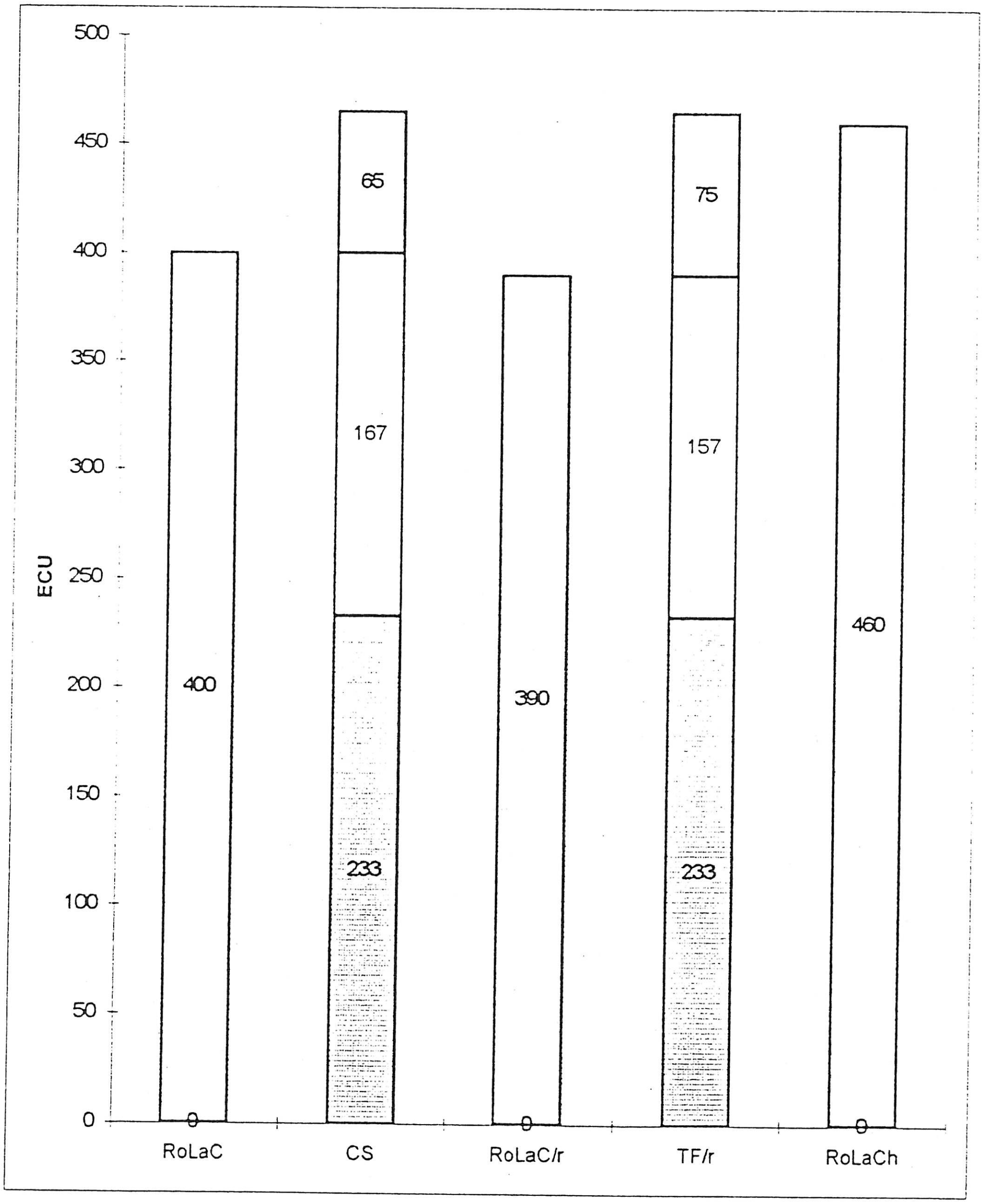
This improvement has three effects:

- The cost per vehicle accommodation offered are lower because of a better circulation figure and better capacity use.
- Better competition patterns against road transport that cannot improve its speed figures on that transit route would be achieved.
- The drivers would very much welcome shorter Rola transit times. We have experience reported that drivers accept a Rola transit of 8 hours with drivers resting or being idle, but resist to longer duration without being allowed to drive. By the way, these 8 hours anyway completely fulfil the legal requirement for rest cycle.

This invites for the conclusion that the competition patterns of Rola service on the Kiskundorozsma - Wels axis does not only have to rely on political assistance. There are improvement figures in the hand of the operators as well.

## Cost comparison between RoLa Kiskundorozsma/Wels and road traffic

| | | |
|---|---|---|
| RoLa capacity use: | 80% | 80% |
| Railcar use factor: | 0,72 | 0,89 |
| Couchette cost: | leased | re-built |




Legend:

| | |
|---|---|
| RoLa C/r: | RoLa cost per vehicle accomodation 400/390 |
| CS: | Cost savings of road vehicle 233 |
| TF/r: | Transit fees 232 (167 + 65/157 + 75); savings achieved 65/75 |
| RoLaCh: | RoLa charge 460 |

## Cost comparison between RoLa Kiskundorozsma/Wels and road traffic

| | | |
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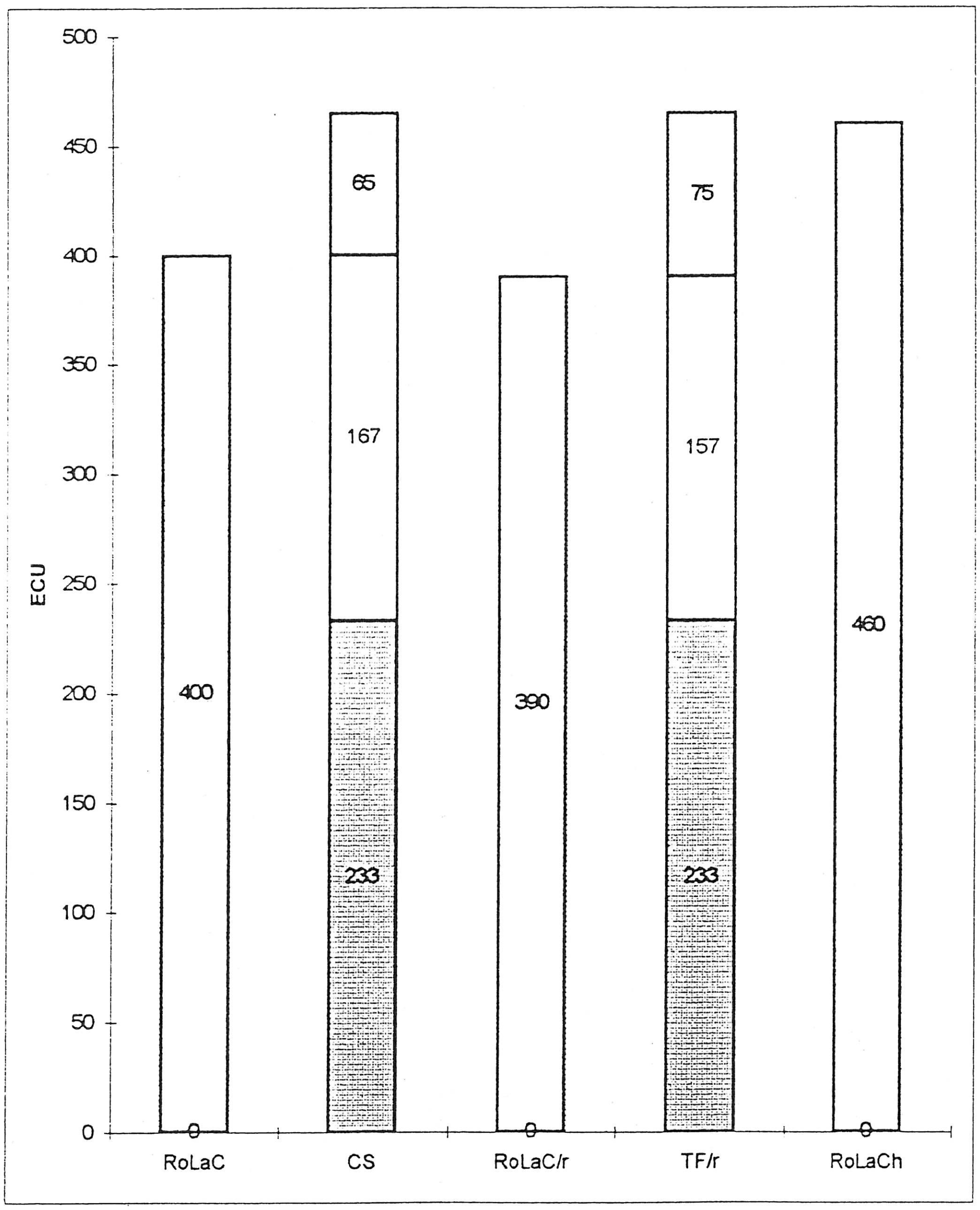


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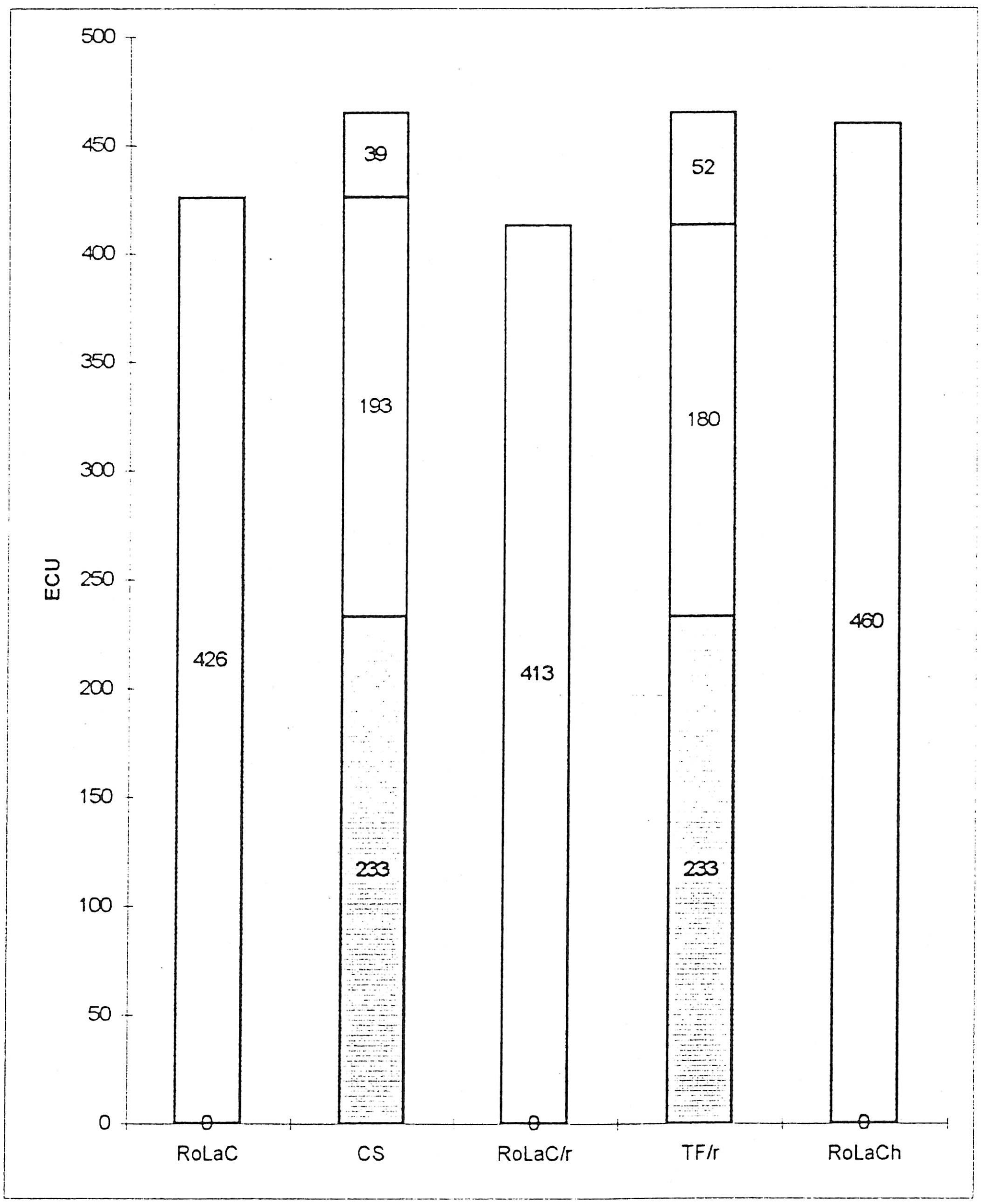
| CS: | Cost savings of road vehicle 233 |
| TF/r: | Transit fees 232 (167 + 65/157 + 75); savings achieved 65/75 |
| RoLaCh: | RoLa charge 460 |

## Cost comparison between RoLa Kiskundorozsma/Wels and road traffic

| | | |
|---|---|---|
| RoLa capacity use: | 65% | 65% |
| Railcar use factor: | 0,72 | 0,89 |
| Couchette cost: | leased | re-built |

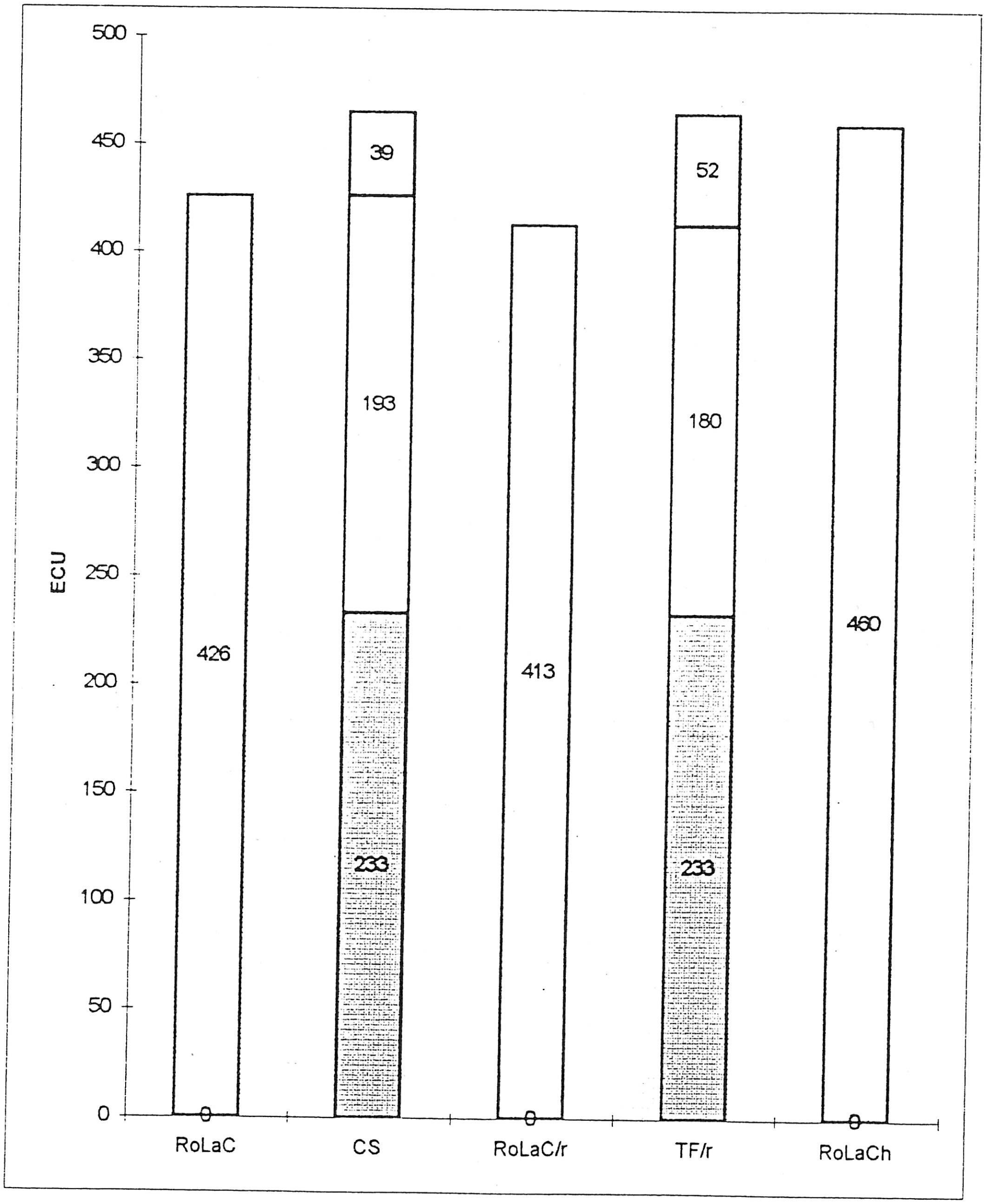



Legend:

| | |
|---|---|
| RoLa C/r: | RoLa cost per vehicle accomodation 426/413 |
| CS: | Cost savings of road vehicle 233 |
| TF/r: | Transit fees 232 (193 + 39/180 + 52); savings achieved 39/52 |
| RoLaCh: | RoLa charge 460 |

## Cost comparison between RoLa Kiskundorozsma/Wels and road traffic

| | | |
|---|---|---|
| RoLa capacity use: | 65% | 65% |
| Railcar use factor: | 0,72 | 0,89 |
| Couchette cost: | leased | re-built |




Legend:

| | |
|---|---|
| RoLa C/r: | RoLa cost per vehicle accomodation 426/413 |
| CS: | Cost savings of road vehicle 233 |
| TF/r: | Transit fees 232 (193 + 39/180 + 52); savings achieved 39/52 |
| RoLaCh: | RoLa charge 460 |

ANNEX B

**89’ Flat car versus RailRunner analysis**

(Comparing container transport with RailRunner bogies versus the use of 89’ Flat cars for an US application using 40’ containers over a distance of 300 miles back and forth. Comparison cost include train operational cost, investment in railcar & chassis equipment as well as investments into terminal infrastructure and equipment.)

RailRunner proves to be lower in cost per transported unit up to quantities of over 50,000 FEU per year. Particular cost advantages prevail at smaller yearly transport quantities what makes RailRunner attractive for starting businesses only having to make minimal investments.

# 89’ Flat Car vs. RailRunner Economic Comparison

Prepared for Dr Seidelmann

November 20th, 2006

Strictly Confidential

# Content

- Objectives
- Terminal Assumptions
- Unit Rolling Stock Assumptions
- Capital Costs
- Rail Costs
- Rail Rate Graph
- Total Cost Graph
- Accumulative Benefit

# Objectives

- Compare costs of RailRunner operations with conventional 89’ Flat car operations.
- Compare terminal costs for a volume of 5,000 to 50,000 containers per annum
- Compare rolling stock costs
- Compare rail operating costs
- Assumptions
  - 300 Miles one way
  - Two day turnaround
  - Origin and destination terminals designed for 50,000 containers
  - 40’ Containers used as unit standard

# Terminal Assumptions
## (Assumptions for each terminal)

| 89' Flat Car | RailRunner |
|---|---|
| • Initial Equipment<br>– 2 Reach stackers<br>– 1 yard hostler<br>• Stacker pad 1,188,000s.f. (100 ton/axle)<br>• Storage 85,478s.f<br>• Track space 13,200ft<br>• Sec. track 6,000ft<br>• Train length 6,000ft | • Initial Equipment<br>– 1 winch<br>– 2 yard hostlers<br>– 1 fork lift<br>• Ramp pad 27,630s.f. (16 ton/axle)<br>• Storage 273,158s.f<br>• Track space 13,299ft<br>• Train Length 6,045ft |

- General
  - 50,000 Design Capacity
  - Terminal volume from 5,000 to 50,000 payloads per year

# Unit Rolling Stock Assumptions – 89’ Flat Car

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RT Miles | 600 | | | | | | | | | | | |
| RT Time in Days | 2 | | 4,992 | 9,984 | 14,976 | 19,968 | 24,960 | 29,900 | 34,944 | 39,936 | 45,136 | 49,920 |
| Finance Rate | 10% | | Annual Units | | | | | | | | | |
| | | | 5,000 | 10,000 | 15,000 | 20,000 | 25,000 | 30,000 | 35,000 | 40,000 | 45,000 | 50,000 |
| | Price/Unit | Life Yrs | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY |
| Units/Train | | | 48 | 48 | 48 | 64 | 60 | 58 | 56 | 64 | 62 | 60 |
| Consists | | | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| Loads Per Train | | | 96 | 96 | 96 | 128 | 120 | 115 | 112 | 128 | 124 | 120 |
| Trains Per Week | | | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 | 7 | 8 |
| Design Capacity P/L | | | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Rolling Stock | | | | | | | | | | | | |
| Bogies | [redacted] | 20 | | | | | | | | | | |
| Chassis | [redacted] | 7 | 96 | 96 | 96 | 128 | 120 | 115 | 112 | 128 | 124 | 120 |
| Flat car | [redacted] | 20 | 48 | 48 | 48 | 64 | 120 | 116 | 112 | 128 | 186 | 180 |

**- RT = Round trip**
**- 50,000 Design Capacity.**

# Unit Rolling Stock Assumptions – RailRunner

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RT Miles | 600 | | | | | | | | | | | |
| RT Time in Days | 2 | | 5044 | 10088 | 15132 | 20124 | 25168 | 30160 | 35256 | 40248 | 45136 | 50336 |
| Finance Rate | 10% | | Annual Units | | | | | | | | | |
| | | | 5,000 | 10,000 | 15,000 | 20,000 | 25,000 | 30,000 | 35,000 | 40,000 | 45,000 | 50,000 |
| | Price/Unit | Life Yrs | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY |
| Units/Train | | | 97 | 97 | 97 | 129 | 121 | 116 | 113 | 129 | 124 | 121 |
| Consists | | | 1.00 | 1.00 | 1.00 | 1.00 | 2.00 | 2.00 | 2.00 | 2.00 | 3.00 | 3.00 |
| Trains Per Week | | | 1.00 | 2.00 | 3.00 | 3.00 | 4.00 | 5.00 | 6.00 | 6.00 | 7.00 | 8.00 |
| Design Capacity P/L | | | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Rolling Stock | | | | | | | | | | | | |
| Bogies | [redacted] | 20 | 97 | 97 | 97 | 129 | 242 | 232 | 226 | 258 | 372 | 363 |
| Chassis | [redacted] | 10 | 194 | 194 | 194 | 258 | 363 | 348 | 339 | 387 | 496 | 484 |
| Flat Car | [redacted] | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**- RT = Round trip**
**- 50,000 Design Capacity.**

# Capital Cost – 89’ Flat Car

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Equipment | | | | | | | | | | | | |
| Yard Hostlers | $90,000 | 7 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 |
| Reach Stackers | $450,000 | 4 | $1,800,000 | $1,800,000 | $1,800,000 | $1,800,000 | $1,800,000 | $1,800,000 | $1,800,000 | $1,800,000 | $1,800,000 | $1,800,000 |
| Fork Lift | $90,000 | 7 | | | | | | | | | | |
| Tools | $10,000 | 7 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 |
| Cranes | $3,500,000 | 20 | | | | | | | | | | |
| Facilites & Infrastructure | | | | | | | | | | | | |
| Office | $40,000 | 30 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 |
| Power | $75,000 | 20 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 |
| Water & Sewer | $150,000 | 30 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 |
| Telecom | $20,000 | 10 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 |
| Repair Shed | $50,000 | 30 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 |
| Security & Fire Safety | $150,000 | 10 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 |
| Switch Heating | $20,000 | 15 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 |
| Brake Testing | $75,000 | 30 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 |
| Transport Surface | | | | | | | | | | | | |
| Train Length | | | | | | | | | | | | |
| Access Roads | $5 | 15 | | | | | | | | | | |
| Main Rail Track | $132 | 20 | $3,484,800 | $3,484,800 | $3,484,800 | $3,484,800 | $3,484,800 | $3,484,800 | $3,484,800 | $3,484,800 | $3,484,800 | $3,484,800 |
| Secondary Rail Track | $132 | 20 | $1,584,000 | $1,584,000 | $1,584,000 | $1,584,000 | $1,584,000 | $1,584,000 | $1,584,000 | $1,584,000 | $1,584,000 | $1,584,000 |
| Track Grading | $120 | 20 | | | | | | | | | | |
| Reach Stacker Pad | $20 | 10 | $47,520,000 | $47,520,000 | $47,520,000 | $47,520,000 | $47,520,000 | $47,520,000 | $47,520,000 | $47,520,000 | $47,520,000 | $47,520,000 |
| Ramping Pad | | 10 | | | | | | | | | | |
| Storage Pad | $6 | 10 | $1,025,741 | $1,025,741 | $1,025,741 | $1,025,741 | $1,025,741 | $1,025,741 | $1,025,741 | $1,025,741 | $1,025,741 | $1,025,741 |
| Utility Road | $3 | 15 | $39,600 | $39,600 | $39,600 | $39,600 | $39,600 | $39,600 | $39,600 | $39,600 | $39,600 | $39,600 |
| Crane Track | $244 | 30 | | | | | | | | | | |
| Rolling Stock | | | | | | | | | | | | |
| Bogies | [redacted] | 20 | | | | | | | | | | |
| Chassis | [redacted] | 7 | $960,000 | $960,000 | $960,000 | $1,280,000 | $1,200,000 | $1,150,000 | $1,120,000 | $1,280,000 | $1,240,000 | $1,200,000 |
| Flat Car | [redacted] | 20 | $4,368,000 | $4,368,000 | $4,368,000 | $5,824,000 | $10,920,000 | $10,556,000 | $10,192,000 | $11,648,000 | $16,926,000 | $16,380,000 |

# Capital Cost - RailRunner

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Equipment | | | | | | | | | | | |
| Yard Hostlers | $90,000 | 7 | $360,000 | $360,000 | $360,000 | $360,000 | $360,000 | $360,000 | $540,000 | $540,000 | $540,000 | $540,000 |
| Winch | $60,000 | 15 | $120,000 | $120,000 | $120,000 | $120,000 | $120,000 | $120,000 | $120,000 | $120,000 | $120,000 | $120,000 |
| Fork Lift | $90,000 | 10 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 | $180,000 |
| Tools | $10,000 | 7 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 |
| Cranes | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Facilites & Infrastructure | | | | | | | | | | | | |
| Office | $40,000 | 30 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 |
| Power | $75,000 | 20 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 |
| Water & Sewer | $150,000 | 30 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 |
| Telecom | $20,000 | 10 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 |
| Repair Shed | $50,000 | 30 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 | $100,000 |
| Security & Fire Safety | $150,000 | 10 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 | $300,000 |
| Switch Heating | $20,000 | 15 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 |
| Brake Testing | $75,000 | 30 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 | $150,000 |
| | | | | | | | | | | | | |
| Transport Surface | | | | | | | | | | | | |
| Train Length | | | | | | | | | | | | |
| Access Roads | $5 | 15 | $66,495 | $66,495 | $66,495 | $66,495 | $66,495 | $66,495 | $66,495 | $66,495 | $66,495 | $66,495 |
| Main Rail Track | $132 | 20 | $3,510,936 | $3,510,936 | $3,510,936 | $3,510,936 | $3,510,936 | $3,510,936 | $3,510,936 | $3,510,936 | $3,510,936 | $3,510,936 |
| Secondary Rail Track | $132 | 20 | | | | | | | | | | |
| Track Grading | $120 | 20 | $221,040 | $221,040 | $221,040 | $290,160 | $272,880 | $262,080 | $255,600 | $290,160 | $279,360 | $272,880 |
| Reach Stacker Pad | $18 | 10 | | | | | | | | | | |
| Ramping Pad | $5 | 10 | $276,300 | $276,300 | $276,300 | $362,700 | $341,100 | $327,600 | $319,500 | $362,700 | $349,200 | $341,100 |
| Storage Pad | $6 | 10 | $3,277,890 | $3,277,890 | $3,277,890 | $3,277,890 | $3,277,890 | $3,277,890 | $3,277,890 | $3,277,890 | $3,277,890 | $3,277,890 |
| Utility Road | $3 | 15 | $39,897 | $39,897 | $39,897 | $39,897 | $39,897 | $39,897 | $39,897 | $39,897 | $39,897 | $39,897 |
| Crane Track | | 20 | | | | | | | | | | |
| | | | | | | | | | | | | |
| Rolling Stock | | | | | | | | | | | | |
| Bogies | [redacted] | 20 | $5,820,000 | $5,820,000 | $5,820,000 | $7,740,000 | $14,520,000 | $13,920,000 | $13,560,000 | $15,480,000 | $22,320,000 | $21,780,000 |
| Chassis | [redacted] | 10 | $4,462,000 | $4,462,000 | $4,462,000 | $5,934,000 | $8,349,000 | $8,004,000 | $7,797,000 | $8,901,000 | $11,408,000 | $11,132,000 |
| Flat Car | [redacted] | 20 | | | | | | | | | | |

# Rail Cost – 89’ Flat Car

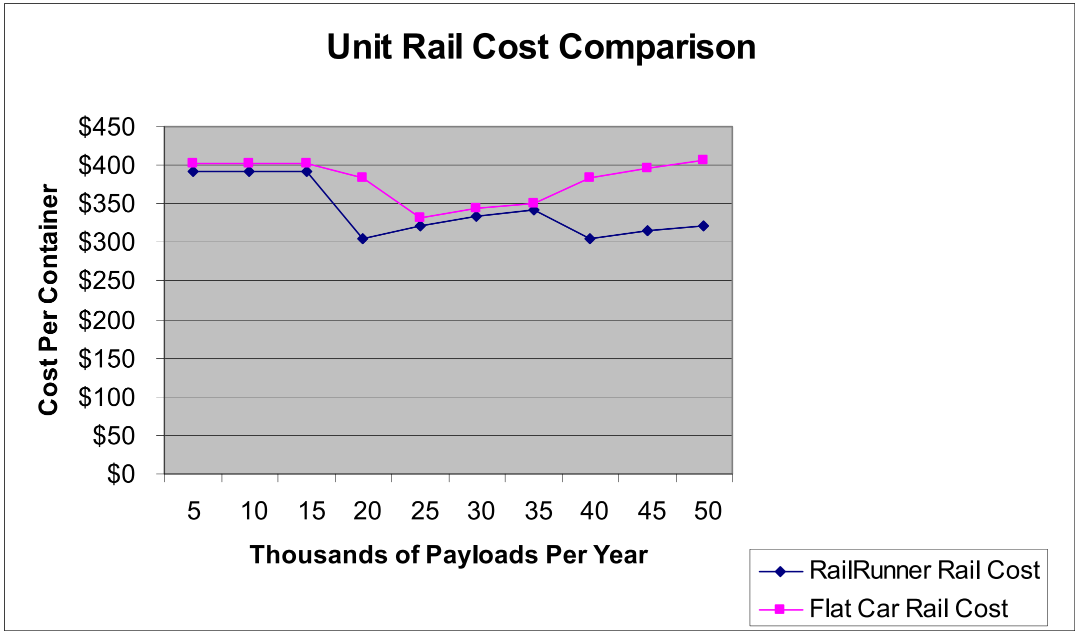
| | Units Per Year | **4,992** | **9,984** | **14,976** | **19,968** | **24,960** | **29,900** | **34,944** | **39,936** | **45,136** | **49,920** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Train Parameters** | | | | | | | | | | | |
| Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin |
| Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination |
| Miles One Way | Miles | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| Miles/Hour | MPH | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Hours One Way | Hrs | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Total Route Hours | | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 |
| Switching Hours | Hrs | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Total Cost One Way or Round Trip | RT | RT | RT | RT | RT | RT | RT | RT | RT | RT | RT |
| Total Trip Miles | Miles | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| Car Type | 89' Flat Car | 89' Flat Car | 89' Flat Car | 89' Flat Car | 89' Flat Car | 89' Flat Car | 89' Flat Car | 89' Flat Car | 89' Flat Car | 89' Flat Car | 89' Flat Car |
| Car weight | Tons | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| Number of Cars | | 48 | 48 | 48 | 64 | 60 | 58 | 56 | 64 | 62 | 60 |
| Number of Payloads | | 96 | 96 | 96 | 128 | 120 | 115 | 112 | 128 | 124 | 120 |
| Payload Weight | Tons | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |
| Trailing Tonnage | | 4464 | 4464 | 4464 | 5952 | 5580 | 5394 | 5208 | 5952 | 5766 | 5580 |
| Engine Power | HP/Ton | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| Engines | HP/Locomotive | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| Engine Weight | Tons | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| Number of Engines | | 2.00 | 2.00 | 2.00 | 3.00 | 2.00 | 2.00 | 2.00 | 3.00 | 3.00 | 3.00 |
| Train Weight Total | | 5264 | 5264 | 5264 | 7152 | 6380 | 6194 | 6008 | 7152 | 6966 | 6780 |
| Fuel Gallons/Mile/Engine Unit | Gallons | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Fuel Cost/Gallon | USD | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 |
| | | | | | | | | | | | |
| Rail Operator Cost/Train | | $19,791.39 | $19,791.39 | $19,791.39 | $25,223.26 | $20,380.64 | $20,282.43 | $20,184.22 | $25,223.26 | $25,125.05 | $25,026.84 |
| Rail Operator Cost/Unit | | $ 412.32 | $ 412.32 | $ 412.32 | $ 394.11 | $ 339.68 | $ 349.70 | $ 360.43 | $ 394.11 | $ 405.24 | $ 417.11 |
| Rail Operator Margin | | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% |
| Rail Operator Rate Per Train | | $ 29,687.09 | $ 29,687.09 | $ 29,687.09 | $ 37,834.88 | $ 30,570.96 | $ 30,423.65 | $ 30,276.34 | $ 37,834.88 | $ 37,687.57 | $ 37,540.26 |
| Fuel Surcharge % | | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| Fuel Surcharge $ Amount | | $ 8,906.13 | $ 8,906.13 | $ 8,906.13 | $ 11,350.47 | $ 9,171.29 | $ 9,127.09 | $ 9,082.90 | $ 11,350.47 | $ 11,306.27 | $ 11,262.08 |
| Rail Operator Total Rate | | $ 38,593.21 | $ 38,593.21 | $ 38,593.21 | $ 49,185.35 | $ 39,742.25 | $ 39,550.74 | $ 39,359.24 | $ 49,185.35 | $ 48,993.84 | $ 48,802.34 |
| Rail Operator Revenue/Unit | | $ 804.03 | $ 804.03 | $ 804.03 | $ 768.52 | $ 662.37 | $ 681.91 | $ 702.84 | $ 768.52 | $ 790.22 | $ 813.37 |
| | | | | | | | | | | | |
| Rail Operator Revenue/Payload | | $ 402.01 | $ 402.01 | $ 402.01 | $ 384.26 | $ 331.19 | $ 343.92 | $ 351.42 | $ 384.26 | $ 395.11 | $ 406.69 |

# Rail Cost - RailRunner

| | Units Per Year | **5044** | **10088** | **15132** | **20124** | **25168** | **30160** | **35256** | **40248** | **45136** | **50336** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Train Parameters** | | | | | | | | | | | |
| Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin | Origin |
| Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination | Destination |
| Miles One Way | Miles | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| Miles/Hour | MPH | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Hours One Way | Hrs | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Total Route Hours | | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 |
| Switching Hours | Hrs | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Total Cost One Way or Round Trip | RT | RT | RT | RT | RT | RT | RT | RT | RT | RT | RT |
| Total Trip Miles | Miles | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| Car Type | RR Bogey | RR Bogey | RR Bogey | RR Bogey | RR Bogey | RR Bogey | RR Bogey | RR Bogey | RR Bogey | RR Bogey | RR Bogey |
| Car weight | Tons | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 |
| Number of Cars | | 97 | 97 | 97 | 129 | 121 | 116 | 113 | 129 | 124 | 121 |
| Payload Weight | Tons | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Trailing Tonnage | | 3831.5 | 3831.5 | 3831.5 | 5095.5 | 4779.5 | 4582 | 4463.5 | 5095.5 | 4898 | 4779.5 |
| Engine Power | HP/Ton | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| Engines | HP/Locomotive | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 |
| Engine Weight | Tons | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| Number of Engines | | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Train Weight Total | | 4632 | 4632 | 4632 | 5896 | 5580 | 5382 | 5264 | 5896 | 5698 | 5580 |
| Fuel Gallons/Mile/Engine Unit | Gallons | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Fuel Cost/Gallon | USD | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 | $1.88 |
| | | | | | | | | | | | |
| Rail Operator Cost/Train | | $19,457.43 | $19,457.43 | $19,457.43 | $20,124.82 | $19,957.98 | $19,853.70 | $19,791.13 | $20,124.82 | $20,020.54 | $19,957.98 |
| Rail Operator Cost/Unit | | $ 200.59 | $ 200.59 | $ 200.59 | $ 156.01 | $ 164.94 | $ 171.15 | $ 175.14 | $ 156.01 | $ 161.46 | $ 164.94 |
| Rail Operator Margin | | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% | 50% |
| Rail Operator Rate Per Train | | $ 29,186.15 | $ 29,186.15 | $ 29,186.15 | $ 30,187.24 | $ 29,936.96 | $ 29,780.54 | $ 29,686.69 | $ 30,187.24 | $ 30,030.82 | $ 29,936.96 |
| Fuel Surcharge % | | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% | 30% |
| Fuel Surcharge $ Amount | | $ 8,755.84 | $ 8,755.84 | $ 8,755.84 | $ 9,056.17 | $ 8,981.09 | $ 8,934.16 | $ 8,906.01 | $ 9,056.17 | $ 9,009.24 | $ 8,981.09 |
| Rail Operator Total Rate | | $ 37,941.99 | $ 37,941.99 | $ 37,941.99 | $ 39,243.41 | $ 38,918.05 | $ 38,714.71 | $ 38,592.70 | $ 39,243.41 | $ 39,040.06 | $ 38,918.05 |
| Rail Operator Revenue/Unit | | $ 391.15 | $ 391.15 | $ 391.15 | $ 304.21 | $ 321.64 | $ 333.75 | $ 341.53 | $ 304.21 | $ 314.84 | $ 321.64 |
| | | | | | | | | | | | |
| Rail Revenue Per Payload | | $ 391.15 | $ 391.15 | $ 391.15 | $ 304.21 | $ 321.64 | $ 333.75 | $ 341.53 | $ 304.21 | $ 314.84 | $ 321.64 |

# Railcar Economic Comparison

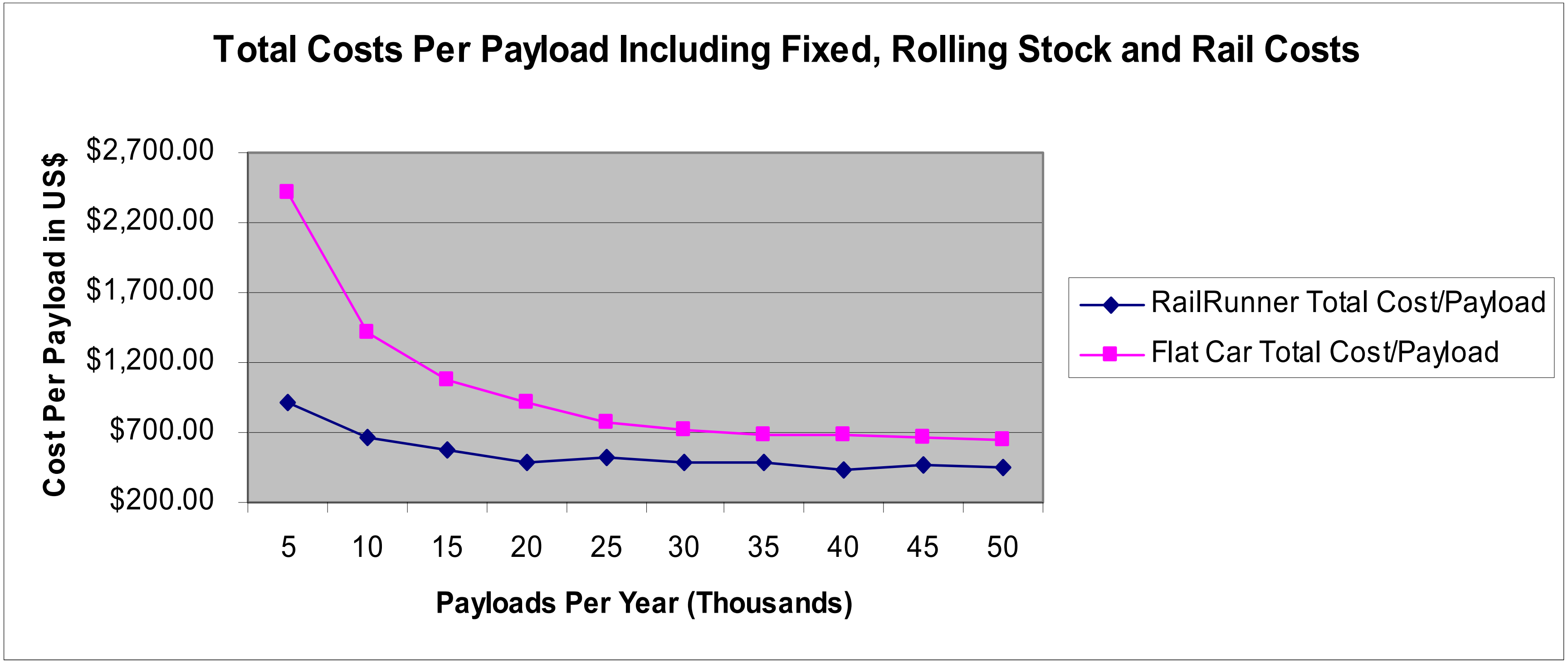
## 89’ Flat Car vs. RailRunner




**50,000 Design Capacity**
**Rail costs are comparable**

| Volume | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Flat Car** | | | | | | | | | | |
| Trains/week | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 | 7 | 8 |
| Railcars | 48 | 48 | 48 | 64 | 60 | 58 | 56 | 64 | 62 | 60 |
| Locos | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 |
| **RailRunner** | | | | | | | | | | |
| Trains/week | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 | 7 | 8 |
| Railcars | 97 | 97 | 97 | 129 | 121 | 116 | 113 | 129 | 124 | 121 |
| Locos | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

# Railcar Economic Comparison
## 89' Flat Car vs. RailRunner




**50,000 Design Capacity.**
**RailRunner remains more viable than the 89' Flat Car throughout range**

# Special Notes

- **Equipment:** Capital lease, amortized at 10% over useful life.
- **Rolling Stock:** Capital lease, amortized at 10% over useful life.
- **Transport Surfaces:** Capital lease, amortized at 10% over useful life.
- **Direct Labor and O/H:** $20/hr; 50 O/H, estimated to actual men and hours of time per payload.
- **Terminal Models:** RailRunner developed. Costs modeled at capacity of 50,000 containers per year. No cranes employed at terminal, only reach stackers.
- **Rail Rates:** FIRE model for short haul intermodal.
- **General:**
  - All analyses (equipment, rolling stock, surface prep, and labor) are presented in terms of cost only. No gross margins or profits are added. Rail costs include a 50% GM for rail operators
  - No maintenance cost for rolling stock has been assumed.

Annex C

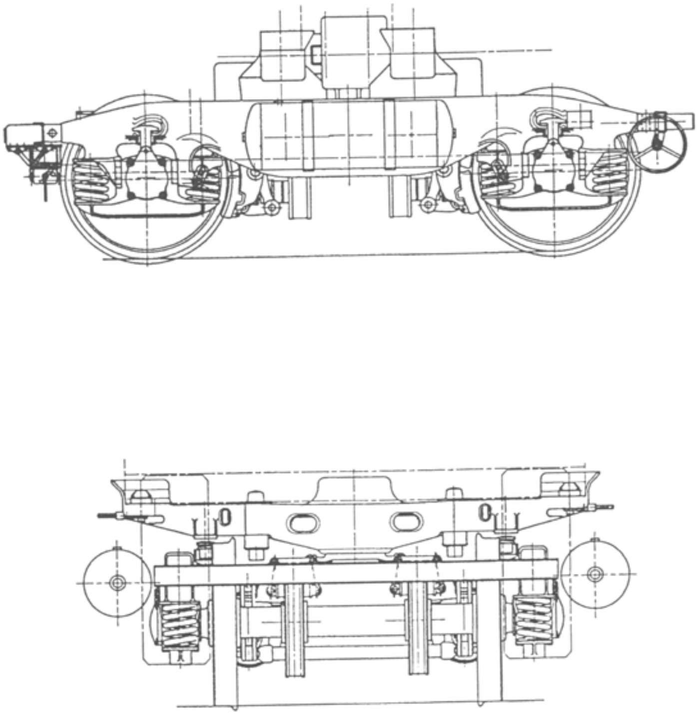
**Pictures and drawings of existing bi-modal and RO/RO technologies.**



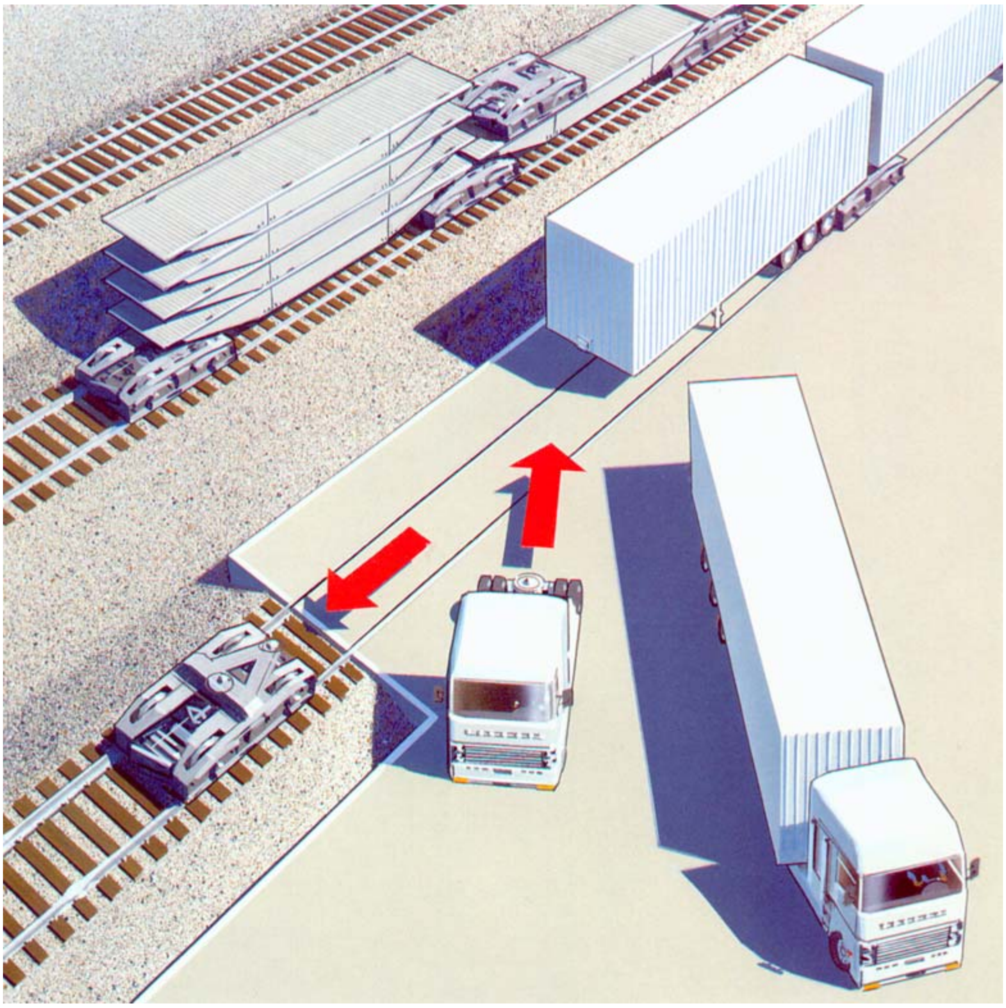
Roadrailer as used by Bayrische Trailerzug (BTZ) until 2003


RoadRailer by CNC / SNCF (stored in Soltau, Germany 2005)


Kombitrailer (Norwegian prototype) from Talbot

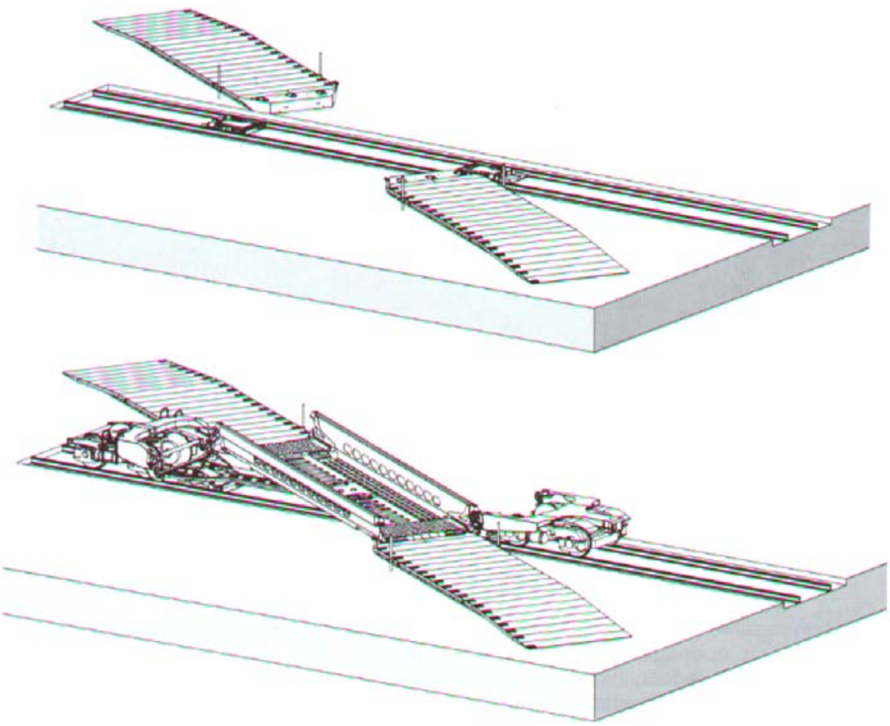


Rail-Trailer from Sambre et Meuse and Kaiser, France

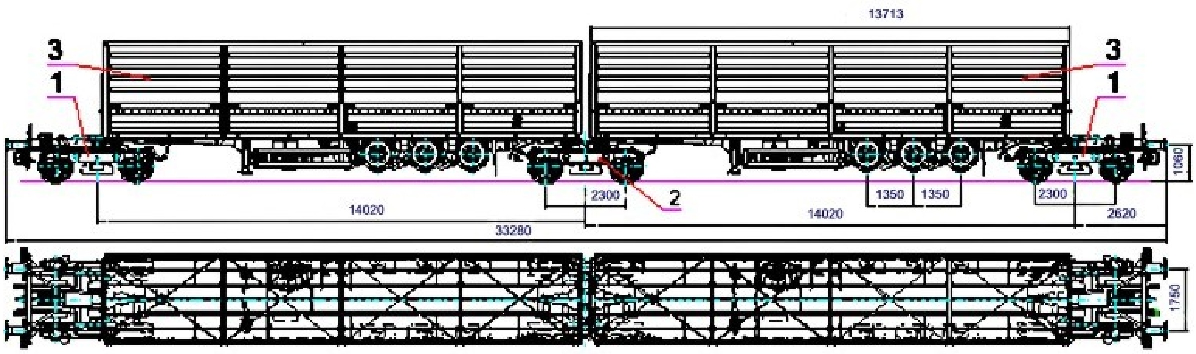


Coda-E (Netherlands and Sweden)

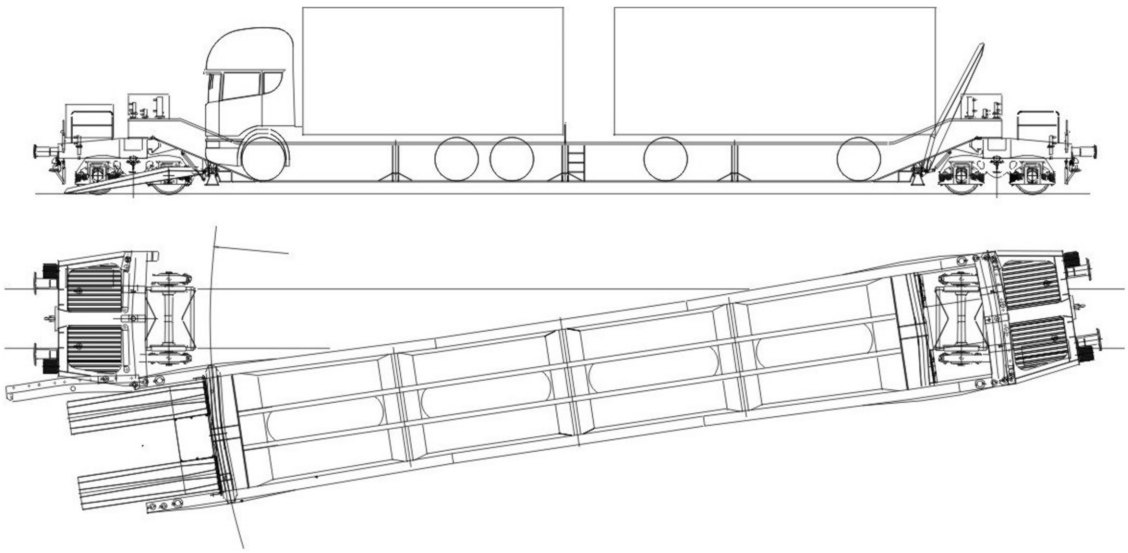
Combitrans (France)



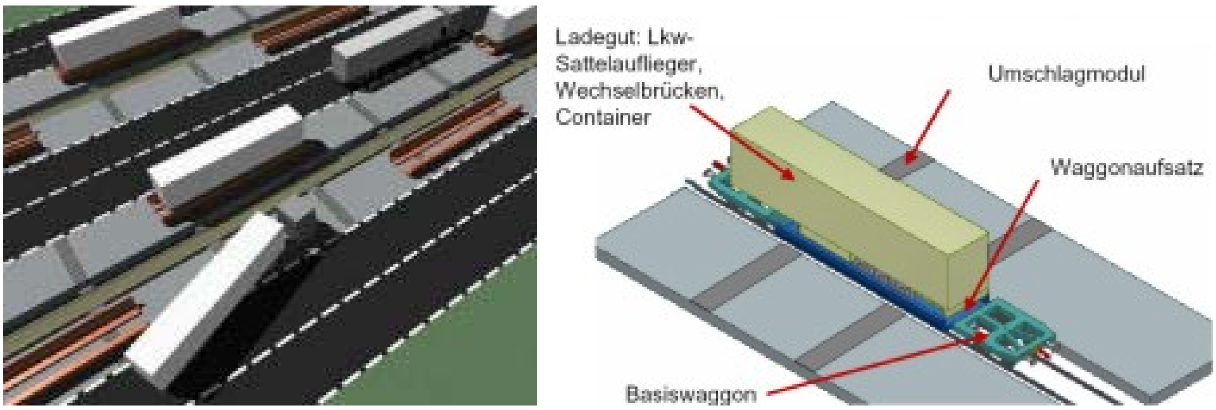
Modalohr France




Multitrailor, Polen

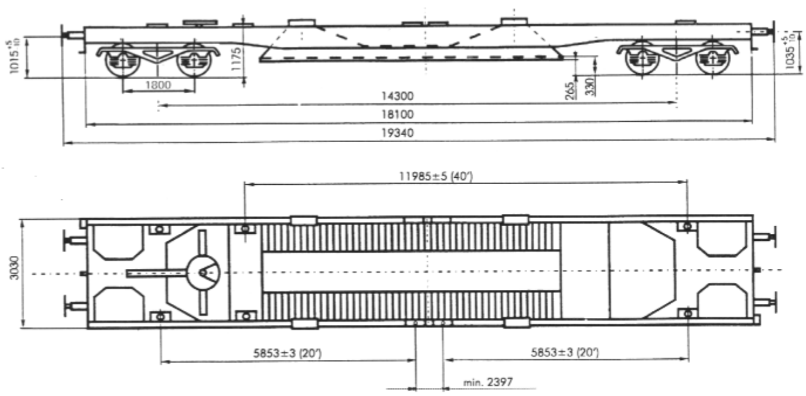


Flexiwaggon, Sweden

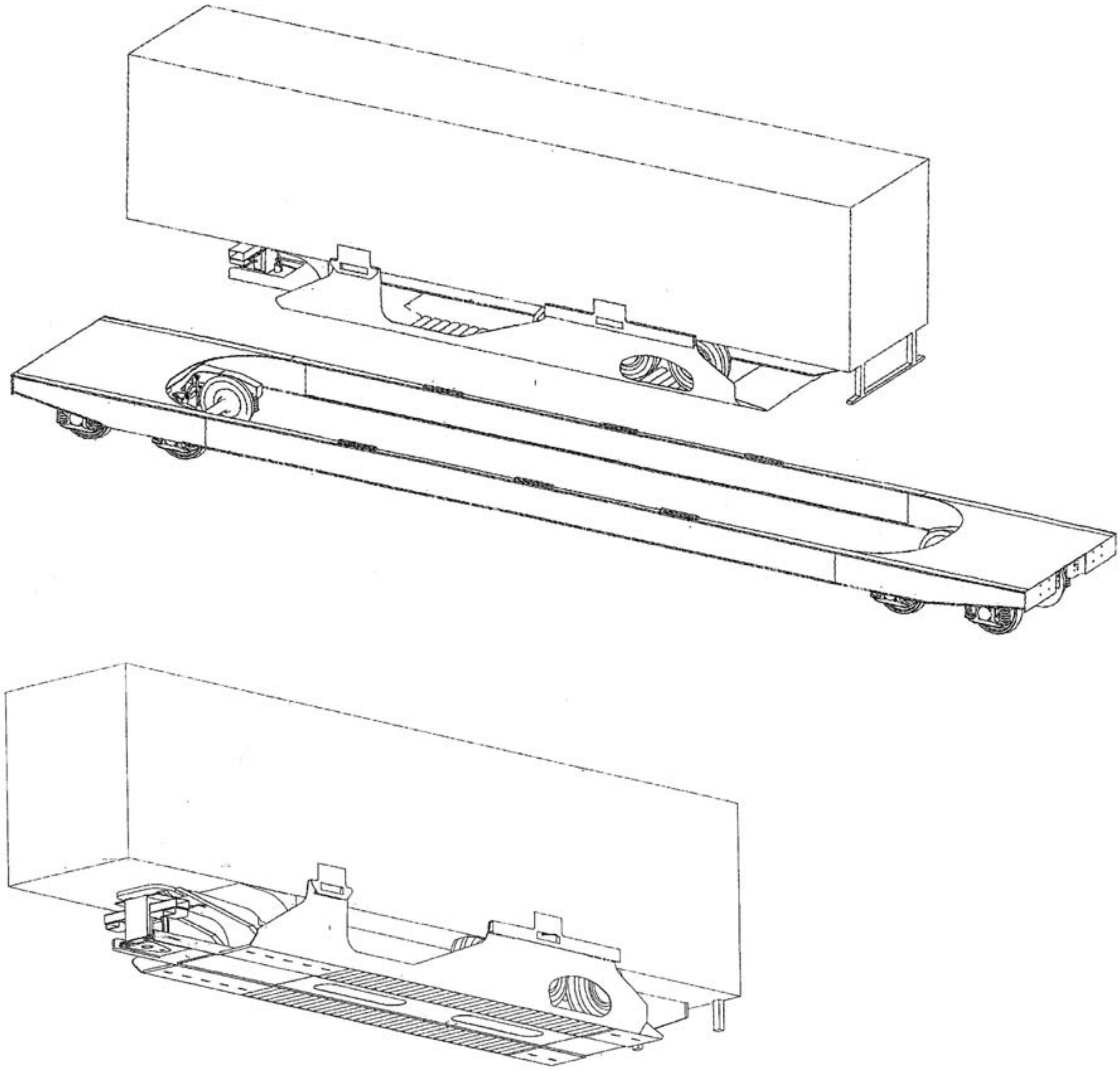



CargoBeamer, Germany


WTT Wechseltrog-Transportsystem

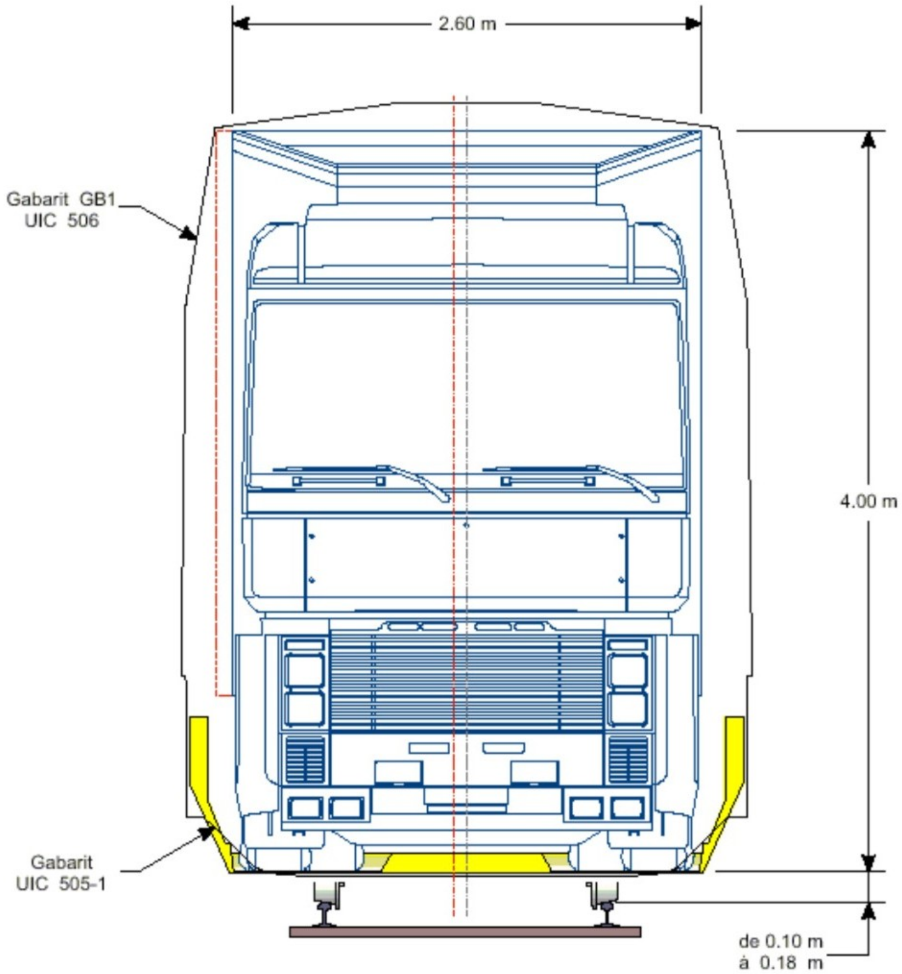



basket wagon Tatravagonka, Slovakia



basket wagon Arbel fauvet Rail France


Megatrailer pocket wagon (Ferriere Cattaneo, AAE), Switzerland




conflict with gauge (example Modalohr)

45’ swap bodies on 104’ articulated 6-axles wagons