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"Assessment of the Innovative Details of the RailRunner® Bi-modal Technology"

for

RailRunner N.A., Inc.

430 Bedford Street

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Lexington, MA 02420

USA

July 22nd, 2010

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1. Introduction

1.1. Purpose of the Study

RailRunner N.A., Inc. is offering a bi-modal system that enables semi-trailers and chassis to be connected directly to railway vehicle bogies. The system is currently in commercial use in the USA. RailRunner would like to deploy this system as well in Europe.

TUV Rheinland Grebner Ruchay Consulting compiled this study, which describes the innovative details of the RailRunner technology in a comprehensive way and in a relative non-technical language. This study shall contribute to the approval procedure for the use of the RailRunner technology inside the European Union and help in negotiations with public bodies as well as private companies concerning a possible granting of funds. This study is to be seen as a supplement to the study „Analyse und Vergleich der Effizienz von Umschlags- und Transporttechnologien intermodaler Transportketten für den Europäischen Market" of the "Studiengesellschaft für den Kombinierten Verkehr (SGKV) e.V." from January 2010.

Adding to a diversified description of the RailRunner Technology itself, a short view is given into the overall situation of bi-modal transport systems to make the advantages of the RailRunner approach clearer and easier to compare to technologies that have emerged so far. The before mentioned study focused on economic advantages resulting out of the cost reduction potentials in logistic and handling aspects; however this study explores the lower lifecycle costs and environmental benefits, which result from the technical innovations of the RailRunner system itself.

1.2. Former Systems

Bi-modal technologies have been in use in intermodal transport for over 30 years, but only one of the former systems has survived in successful operation in some countries: the Road Railer® technology from the United States. In Europe, Road Railer's entrance into the market was not without technical, economical, and operational problems; therefore the company using the system finally ceased operation. Similar technologies have been operating in Europe, but none have succeeded commercially for a longer period of time. So, the RailRunner technology can be perceived as an advancement of the Road Railer technology.

1.3. Reasons for Not Establishing in Europe

There are many reasons why former bi-modal technologies so far have failed in Europe:

- Rail transport market was still too small and not liberalized, leading to a very high level of competition within the different technologies in various countries
- Former national railways first tried to implement technical solo run solutions
- Technical problems caused disputes between the owners of the bogies and the owner of the trailers/chassis. Not having one owner for both equipment types proved to be disadvantageous for the operability of the system
- The trailers/chassis of former technologies had a significantly higher weight due to the additional components and functions necessary for operating on rail as well as with casted tongues. Additionally, integrating the locking systems into the trailer increased their weight which resulted in reduced payloads
- The operation of the trailers/chassis in the terminals often caused damage on the trailer rear frame and thereby increased maintenance cost
- The trailer/chassis length of former technologies exceeded the nominal vehicle length permissible over the road, which required special assessments and permits in Europe and subsequently lead to worse aerodynamics which required increased energy for transportation

2. Basic Changes in Conditions for Bi-modal Systems

2.1. Political

Conditions changed significantly with the privatization of European state owned railway companies. Formerly driven by public officials, those newly created companies now had to act according to common business principles and a sudden pressure to lower operating costs.

Competition within the European railway market is rising since the political conditions for cross border transports have improved significantly. Currently, block train traffic is possible through whole Europe in contrary to the past when administrative procedures made cross border transports by rail so slow that they were generally not competitive to trucking.

Additional advantages for the whole rail transport sector are the upcoming and already implemented road charges in many European states, making transports by trucks more expensive therefore increasing the willingness of the economy to embrace rail transports.

Furthermore, there are developments of government incentives for companies to reduce energy consumption and green house gas emissions.

2.2. Economic

The recent decrease in international container traffic due to the world-wide financial crisis has been temporary. Currently, the market is developing and growing again. To save transport cost, to reduce energy consumption, and to optimise transport chains, the industry, supported by the EU Commission, is looking for longer trailers and longer container chassis. These longer vehicles would improve economics of road transport, but could no longer be used in the classic European combined transport system (piggy back transports, pocket wagons) on the rail. The existing railway equipment would not fit to these new dimensions.

2.3. Environmental

Awareness to conserving energy and reducing carbon emissions has increased considerably. For new products, noise sensitivity, longer product life cycles, and efficient uses of natural resources are regarded to be important. Environmental damages from transportation are considered to be more critical and favours new developments, which reduce noise, consume less energy, and increase useful life including the wear and tear of components.

3. Advantages of the RailRunner Solution

3.1. General

RailRunner N.A., Inc. is an innovative rail products and services company bringing a new Road-Ready Intermodal Rail product to shippers worldwide. RailRunner's patented trailer or container-carrying bi-modal system is designed to easily shift chassis and container to and from highway to rail quickly, simply and efficiently. With RailRunner's low-investment Terminal Anywhere® technology, no flatcars, well cars, huge cranes, high-value equipment or expensive terminals are involved. Road-Ready chassis and/or trailers extend container services to markets and locations not previously reachable through rail operations, improving shipping efficiency, lowering fuel costs, and reducing traffic congestion and air pollution. RailRunner is a bi-modal system for container chassis and highway trailers (20' to 53' - adaptable to various vehicle lengths up to 60').

As a result of the innovative elements developed and being part of the RailRunner technology this bi-modal system promises to be successfully implemented in Europe.

Last but not least, the high payload to gross weight ratio has to be mentioned as a major advantage.

3.2. Economic

The RailRunner Bogie

The most important and valuable innovation of the RailRunner technology is the bogie. RailRunner bogies incorporate several features uniquely enhancing this bi-modal technology:

a) The bogie has two articulated lower frames connected to each other which allows for self-steering of each of the axles, reducing the curve resistance of the wheels moving over track and thus reducing friction as well as wear and tear. Less friction between wheel and track reduces energy consumption and noise.

b) Less wheel friction also reduces the wear of the wheel, saving maintenance cost because of less frequently required wheel reshaping, thus increasing wheel useful life.

c) The load carrying upper frame which connects the road vehicles to the bogie rests on an air suspension system. This primary air-spring system renders a passenger-train-like smooth ride reducing vertical forces and allows the transport of sensitive cargo with less packaging requirements. A secondary mechanical suspension is applied in the case of a malfunction of the primary air suspension.

d) The combination of articulation and air suspension with additional shock absorbers and dampeners also reduce rock and roll of both the bogie and trailers/chassis allowing for higher speed, because of less swaying and its smooth ride capability.
RailRunner bogies have been tested for 170 km/h and are approved for 112 km/h.

e) As an additional advantage of the air spring system the reduction of the vertical accelerations and dynamic forces can be seen. This may be advantageous in case of increasing the axle loads when using 840mm wheel sets.

f) Unlike conventional rail trucks, RailRunner bogies are equipped with fork-lift pockets, which allow the vehicle to easily be taken off the track. During slow traffic periods, this can become a significant cost saving as equipment owners can avoid parking fees for valuable track space (EURO 2.00 to 4.00 per railcar /per day).

Bogie articulation is comparable in its characteristics to the so called "Scheffel" bogie design. For this type of bogies there exists reliable data documenting the reduction of track and wheel wear. Traditionally, rails in curves with a radius of 300 to 500 meters had to be replaced after an average use of 70 million gross tons with conventional three-piece bogies at 18.5 tons axle load. However, on one coal line, which runs predominantly at 26 tons axle load using the Scheffel self-steering bogie, the rails are only replaced after about 1600 million gross tons in similar curves. The life expectancy on straight track is 2000 million gross tons.

The Scheffel bogies are known for their "track friendly" behavior and low maintenance requirements. If these bogies are used and kept within the given specification, no flange wear is experienced; therefore hollow wear is minimized due to the low creep forces between wheel and rail.

It can be assumed that the use of the RailRunner technology will have similar effects with reduced wear on tracks and wheel sets. This leads to major cost reductions: more operating time, less unproductive time spent in maintenance workshops, less maintenance costs, and less spare part consumption.

Future toll fees for the use of track infrastructure will be related to the wear caused to the tracks and thus, significantly increase the competitiveness of the RailRunner technology.

The RailRunner Container Chassis and Trailer

RailRunner container chassis and trailers are designed as conventional road vehicles, which can be used like regular road vehicles in non-bi-modal applications in highway moves to mitigate freight or asset imbalances.

Since the vehicles are used as a railcar during the train operation, they need to have a stronger frame structure, electric wiring (for possible refitting of an electro pneumatic brake or end of train detection), and air pipe running from the front to the rear and fitted with standard pneumatic coupling devices for air supply (brake and air-ride suspension). In Europe, the vehicles need a separate independent air brake pipe line.

At either end of the road vehicle "receiver boxes" are incorporated in the frame structure, which serve as receptacles for coupling the bogie tongue or drawbar to the chassis/trailers. Once connected, all units in a RailRunner train form a uniform slackless rail vehicle.

These additions, combined with weight optimization measures in the design, result in a limited approximate extra weight of only 680 to 780 kg or about 3% of the payload in road transport.

Because of the higher allowable gross weight for intermodal road vehicles in Europe of 44 versus 40 metric tons, this additional weight is offset by additional 4 tons of gross load when compared to conventional trucking.

Of equal importance, when connected to the bogie, the road vehicles are so closely positioned to each other that the small intra-unit gap reduces aerodynamic turbulence which saves even more energy when compared to conventional intermodal trains (Aerodynamic RailRunner trains may use up to 15% less locomotive power and fuel when compared to conventional piggyback or intermodal trains).

As an additional advantage, it can be assumed that the trailers/chassis will be available for longer life cycle utilization due to the modal split in transport. The road equipment is utilized more in rail use and less on the road.

While most of the aforementioned economic advantages develop their effects during utilization of the system, there is one decisive factor for cost savings even before the start of operations. The minimal surface space and less heavy pavement that is needed for the terminals and the absence of the need for heavy lifting equipment all reducing the required investments in infrastructure significantly.

3.3. Further Advantages of the System

Further advantages of the RailRunner technology will result in an increase of competitiveness, but are harder to measure in monetary terms:

The superior redundant spring system, consisting of coil springs and air springs, enhances the operating safety while running on the track. Additionally, security for the transported cargo is enhanced due to the reduced gap between vehicles as a result of the chassis and bogie connection which makes it impossible to open the container or trailer doors.

Because of the air bags separating upper and lower frames and the design of an articulated bogie, both wheel friction noise and general noise development are mitigated.

Necessary rail adaptation of the chassis/trailer design is minimal; no special design changes are required for being adaptable to lifting equipment and to regular and wide track axle width. The RailRunner system is adjustable to longer trailers and container chassis. Trailers and chassis can be transported in "mixed trains" independent of their length. More and heavier road vehicles can easily be added to longer trains and/or included in combined transport chains.

It would even be possible to operate the RailRunner system "under the wire." It would no longer be necessary to maintain terminal areas without electrical wire and to be obliged to use diesel shunting locomotives. No locomotive change in front of terminal areas would be required. This is particularly advantageous for refrigerated transport where services require uninterrupted door-to-door transport.

RailRunner provides an uninterrupted cold chain over long distances (>5 days) with a continuous power supply, on road, rail or both. Customers are not burdened with the need for extra chassis, gensets or multiple refueling stops. Optional GPS enables seamless event tracking and cargo monitoring. A special security pack and door immobility during transport provides a high security transport and offers peace-of-mind to customers concerning cargo theft, parts pilfering or manipulation of the power supply.

Similar advantages apply to 'just-in-time' (JIT) distributions as in the automotive market. If a shipment is needed immediately, an alternative to rail, namely trucking 'urgent hot loads', is a significant logistical benefit to the customer. Advantages and availability of both systems – rail and road – could be used with more flexibility also for bypassing temporary bottle-necks.

4. Certification and Approval Process According to TSI WAG

Currently the approval process of the RailRunner is very difficult. This is mainly due to the fact that the TSI WAG was designed for conventional rail freight cars and therefore its specifications and requirements do not apply to bi-modal systems. Non-compliance with the TSI would lead to a case by case assessment of non-compliance in every single member state of the European Union and thus would be tremendously expensive and time consuming. Different time spans for the national approvals could essentially delay cross border traffic with the RailRunner system.

To avoid all of these problems, there has been research performed about how to enable a quicker and European-wide approval process. In conversations with the European Rail Agency ERA, there is a coordinated approach for a prompt approval and certification of the RailRunner technology. Subsequently, the RailRunner technology can be compared and possibly approved to the requirements of the former UIC specification 597. Necessary changes have to be made to the UIC specification in order to make the RailRunner technology complying and identified.

The result of this process will be used to form an application towards the ERA, pleading for integration of the UIC specification 597 and its requirements for the approval of bi-modal technologies into the TSI WAG.

Also, there could be a TSI assessment performed by a Notified Body. If successful, field testing could start immediately. A key point within the TSI approval procedure is the use of interoperability components. For the RailRunner system it would be necessary to use wheel sets with an axle load of 22,5t and a diameter of 840mm as interoperability components. A wheel set with these characteristics is presently undergoing the certification process.

5. Summary and Outlook

The combination of all of the above features including the significantly lighter weight of a RailRunner train represents an environmentally friendly product that reduces energy use, curtails carbon emissions, and lowers noise and vibration excitation (impact sound) of the running equipment. This is accompanied by the outstanding cost saving potentials offered by the RailRunner technology:

- Lesser wear and friction combined with superior aerodynamics lead to 15% less fuel or energy consumption
- Maintenance and spare parts cost are potentially reduced up to 30%
- More operating time increases profitability of the entire fleet compared to conventional transports
- Future track fees which depend on the degree of wear and noise will make RailRunner even more competitive in the future

The auspices in politics and the economy for alternate technologies in the railway sector are good, especially for a system taking account all the major aspect that politics and the population demand for environmentally friendly and noise reducing advances. As far as the approval of the system in the European market is concerned, it can be summed up that in cooperating with the ERA and Luxcontrol and a selected Notified Body like TÜV Rheinland InterTraffic the outlook for a prompt approval of the RailRunner bi-modal system in the European market must be considered as good.

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