



Operating Costs Profitability of the System of Semi-trailers Transportation by Rail

Jaromír Siroky

University of Pardubice, Jan Perner Transport Faculty, Studentská 95, 53210 Pardubice 2, Czech Republic

ABSTRACT

This paper is focused on systems which enables transportation of semi-trailers by rail. The selected systems are evaluated from the economical point of view. The main objective of this article consists of the operational costs calculation and their comparison. The selected systems are CargoBeamer, Modalohr, ISU and Megaswing.

KEYWORDS : semi-trailer, reloading, profitability, rail

Introduction

The number of alternatives to road transportation is nowadays still increasing, as well as the quality of these technologies. There is no need to mention the systems, which are still in the beginning of their development or which have hardly any chance to stack up against the competition. The most progressive systems of the last years were:

- CargoBeamer,
- Modalohr,
- ISU,
- Megaswing.

In the following part of paper the selected systems are compared according to the operation profitability. As an evidence of the competitiveness, the systems' economic models are outlined. The operation consists of reloading costs, traction costs, operating costs and administrative costs. Considering the differences in number of reloading (depending on the number of semi-trailers), the costs were converted to the costs per one train. The way of costs calculation is derived from the source [1].

Reloading costs – the final sum is the price of reloading converted to the 1 km of the travelled distance of the whole train (full capacity). The optimal distance of the line between terminals is 1000 km.

$$C_{Rkm} = \frac{C_{reload} \cdot n_{trailer}}{d_{line}} \left[\text{EUR}/\text{km} \right] \quad (1)$$

In the case of Modalohr: 60 EUR x 40 (number of semi-trailers per 1 train) = 2 400 EUR/train (2 400 EUR/1 000 km = 2,40 EUR/km).

In the case of CargoBeamer: 60 EUR x 32 (number of semi-trailers per 1 train) = 1 920 EUR/train (1 920 EUR/1 000 km = 1,92 EUR/km).

In the case of ISU: 100 EUR x 30 (number of semi-trailers per 1 train) = 3 000 EUR/train (3 000 EUR/1 000 km = 3,00 EUR/km).

In the case of Megaswing: 60 EUR x 42 (number of semi-trailers per 1 train) = 2 520 EUR/train (2 520 EUR/1 000 km = 2,52 EUR/km).

1. Operational results

The operational result shows the total costs converted to the costs per 1 km. It is comprised of traction costs, acquisition and maintenance costs of the wagon, reloading costs, operational costs and administrative costs.

For the better expressing of the systems' economic, the author quoted calculations of gross profit depending on the train capacity utilization (the number of transported semi-trailers).

Calculated costs entries according to the source [1]:

- Traction costs for the 750 m long train with the total weight of 1850 t: 9 EUR/km - 11,50 EUR/km;
- Acquisition and maintenance costs of the wagon if the operational utilization is 340 days/year, the average speed is 70 km/hour, the loading and unloading times are shortened, the total coverage is

250000 to 300000 km per year and the assumed acquisition cost amortization is more than 15 years: 4 EUR/km/train;

By the acquisition costs of the system device for loading and unloading, the interest-free share of 80% is considered. The total reloading costs cover the remaining 20%;

- Reloading costs in Europe (including the Central and Eastern Europe) are in the case of loading by medium portal cranes approximately 20 EUR. Because of the additional costs, which could arise in the pilot phase, the sum is increased to 30 EUR. The considered total reloading cost in both terminals (where the unit is loaded and unloaded) is 60 EUR, except of the case of ISU, where these costs are higher.

Modalohr system:

Costs per train = traction costs 11,50 EUR/km + wagons' acquisition and maintenance costs 4,00 EUR/km + reloading costs (loading and unloading) 2,40 EUR/km + operational and administrative costs 2,00 EUR/km = 19,90 EUR/km.

If the presumed revenue is 34 EUR/km (40 semi-trailers x 0,85 EUR/km; 100% train capacity utilization), the gross profit is 40 % of the revenue. In the case of 90% train capacity utilization the gross profit is 33 %. The minimal profitability (i.e. "zero profit") is covered by the 60% train capacity utilization (i.e. 24 semi-trailers per train).

CargoBeamer® system:

Costs per train = traction costs 11,50 EUR/km + wagons' acquisition and maintenance costs 4,00 EUR/km + reloading costs (loading and unloading) 1,92 EUR/km + operational and administrative costs 2,00 EUR/km = 19,42 EUR/km.

If the presumed revenue is 27 EUR/km (32 semi-trailers x 0,85 EUR/km; 100% train capacity utilization), the gross profit is 28 % of the revenue. In the case of 90% train capacity utilization the gross profit is 19 %. The minimal profitability (i.e. "zero profit") is covered by the 70% train capacity utilization (i.e. 23 semi-trailers per train).

ISU system:

Costs per train = traction costs 11,50 EUR/km + wagons' acquisition and maintenance costs 4,00 EUR/km + reloading costs (loading and unloading) 3,00 EUR/km + operational and administrative costs 2,00 EUR/km = 20,50 EUR/km.

If the presumed revenue is 22,5 EUR/km (30 semi-trailers x 0,85 EUR/km; 100% train capacity utilization), the gross profit is 19 % of the revenue. In the case of 90% train capacity utilization the gross profit is 9 %. The minimal profitability (i.e. "zero profit") is covered by the 80% train capacity utilization (i.e. 24 semi-trailers per train).

Megaswing system:

Costs per train = traction costs 11,50 EUR/km + wagons' acquisition and maintenance costs 4,00 EUR/km + reloading costs (loading and unloading) 2,52 EUR/km + operational and administrative costs 2,00 EUR/km = 20,02 EUR/km.

If the presumed revenue is 35,7 EUR/km (42 semi-trailers x 0,85 EUR/km; 100% train capacity utilization), the gross profit is 43 % of the revenue. In the case of 90% train capacity utilization the gross profit is 34 %. The minimal profitability (i.e. "zero profit") is covered by the 57% train capacity utilization (i.e. 24 semi-trailers per train).

2. Evaluation

The inputs of all the operational system parts (traction, administration, reloading, etc.) were compared in order to evaluate the systems' economical advantageousness. Considering the different capacities of the systems, the calculation of the total cost per train was converted to the cost per 1 semi-trailer unit. The Table 1 shows the comparison of costs and maximal profit of the systems, as well as the necessary train capacity utilization for the minimal profitability achievement.

Table 1: Costs and profits evaluation

	Modalohr	CargoBeamer	ISU	Megaswing
Total costs per 1 train [EUR/km]	19,90	19,42	20,50	20,02
Train capacity [number of semi-trailers]	40	32	30	42
Costs per 1 semi-trailer [EUR/km]	0,498	0,607	0,683	0,477
Maximal profit from revenue (100% train capacity utilization) [%]	40	28	19	43
Minimal profitability [train capacity utilization] [%]	60	70	80	57
Minimal profitability [number of semi-trailers]	24	23	24	24

Source: author

Conclusion

In this paper, the Modalohr, the CargoBeamer, the ISU and the Megaswing system's operating costs were described and compared from the economical point of view. Although there are some differences between these systems, all of them represent the possibility of costs reducing, as well as the reloading time reducing. The CargoBeamer® system and the Modalohr system are nowadays successfully in operation, while the Megaswing and the ISU have not been put into operation yet - they are still in the developing phase.

Besides the line between Orbasan (ITA) and Aiton (FRA), the company of Lorry Rail, which operates the Modalohr system, has lengthened the line between Bettembourg (LUX) and Le Bolou (ESP) to the Catalonia (ESP), Madrid (ESP) and Valencia (ESP). In the near future the parallel line from Lille (FRA), via Paris (FRA) to Irún (SPA) would be introduced. The lengthening of the line between Bettembourg and Malmö (SWE) and between Bettembourg to Poznan (POL) is also planned. Later the parallel lines from Paris to Lyon and to the Aiton could be connected. The company of CargoBeamer established in 2009 the trial terminal for 3 wagons, where the trial tests of semi-trailers reloading and the real simulations of particular reloading were performed. The advantage of the system is the fact that it is possible to transport just single wagons as well as groups of them. It involves specially designed equipment, which can carry semi-trailer. These parts are fitted to wagons but can slide sideways to allow trucks to drive on and off at terminals.

Both of these systems are meant for the transportation of semi-trailers, which do not have to be designed for vertical reloading. The reloading of semi-trailers is being performed horizontally. Systems are not aimed at competing against the system of container transportation. It is a new logistic intention, the issue is also marketing. It is supposed that the single car cargo wagons or the whole car cargo trains in convention wagons would be less offered in the future. The mentioned systems could become as it's alternative. The bigger involvement into transport chains would substantially reduce the negative effect of the road vehicles on the environment.

Acknowledgement:

This paper has been supported by the project "Support networks of excellence for research and academic staff in the field of transport" (CZ.1.07/2.3.00/20.0226) on Jan Perner Transport Faculty, University of Pardubice, Czech Republic.



REFERENCES

- [1] Nové systémy pro přepravu sedlových navesů [online]. [cit. 2010-11-22]. (<http://logistika.ihned.cz/c1-20220810-nove-systemy-pro-prepravu-sedlovych-navesu>). | [2] Novák, J., Cempírek, V., Novák, I., Šíroky, J.: Kombinovaná přeprava, Institut Jana Pernera, o.p.s., 320 s., Pardubice, 2008, ISBN 978-80-86530-47-5. | [3] Modalohr [online]. [cit. 2013-11-22]. (<http://www.lorry-rail.com/>). | [4] Megaswing [online]. [cit. 2013-10-17]. (<http://www.kockumsindustriier.se/products/freight/Intermodal/Megaswing.htm>). | [5] CargoSpeed, The road to rail revolution [online]. [cit. 2010-02-22]. (www.cargospeed.net). | [6] CargoBeamer [online]. [cit. 2010-02-22]. (www.cargobeamer.de). | [7] Šíroky, J., Cempírek, V., Gašparík, J. Transport Technology and Control, monograph, Tribun EU Brno, 238 pages, ISBN978-80-263-0268-1.