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THE CASE STUDY OF THE CARGOBEAMER SYSTEM USE IN RAIL TRANSPORT IN SLOVAKIA

Summary. The railway transport of goods was in past the most used type of transport. After the collapse of the Soviet Union, the performance of this mode of transport was reduced. At present, international trade is expanding in the direction of Asia–Europe. For economic and, above all, ecological reasons, it is appropriate to move the transport operations back to rail transport. The article focuses on progressive systems of railway transport of freight in the East–West direction, namely the use of the CargoBeamer system.

CargoBeamer system (hereinafter referred to as CB) is an innovative technology for the transport of road semi-trailers and containers CBoXX specially designed for the CB system. The main advantage of this system is to support the transport standard road semi-trailers, which will be implemented in 70% of shipments in road transport in the EU. The CB system is largely automated, especially for horizontal loading and unloading or when changing the gauge.

The CB system allows to lower the shipment time significantly, thanks to automatisation of loading and unloading processes and gauge change. The benefits of the CB system are presented by an example of the necessary manipulation operations by a China– Russia– Europe goods shipment. The possibilities of the Slovak Republic participation on the planned railway Silk road project from China to Europe is also discussed.

1. INTRODUCTION

The analyses of international trade show that the international trade with selected business partners from East Asia and East Europe grows. These analyses also demonstrate that the biggest partner over the past years is China. These strong business relations are the very reason for which China exerts much effort in building the "Silk Road". The path of this business road, nevertheless, circumvents the territory of the Slovak Republic, therefore it is necessary to build up an infrastructure which would increase the attractiveness of the territory of Slovakia in transporting goods in the direction from the East to the West. Table 1 present international trade between China and some state of the European Union.

Table 1

International trade between China and some states of the European Union v mld. €

State/Year	2008	2009	2010	2011	2012	2013	2014	2015	Summary
Germany	40,241	35,794	51,244	54,852	53,816	50,700	54,695	62,358	403,700
Great Britain	24,517	22,427	29,194	31,677	35,998	38,353	42,988	53,755	278,909
Netherlands	31,209	26,302	37,431	42,718	45,797	45,409	48,846	53,721	331,433
Italy	18,100	14,516	23,455	24,191	19,950	19,390	21,636	25,092	166,330
France	15,971	15,496	20,979	21,715	21,146	20,288	21,801	24,381	161,777
Spain	14,149	10,094	13,690	14,161	14,183	14,253	16,175	19,729	116,434
Belgium	10,107	7,796	10,771	13,622	12,733	11,714	12,952	14,615	94,310
Poland	6,144	5,422	7,107	7,854	9,631	9,467	10,725	12,925	69,275
Czech Rep.	3,736	3,602	5,363	5,506	4,917	5,148	6,013	7,412	41,697
Slovakia	1,336	1,003	1,475	1,804	1,884	2,322	2,128	2,518	14,470

The article sets out proposals for measures to increase the performance in freight rail transport in the East–West direction.

2. RAILWAY TRANSPORT IN SLOVAKIA

The analysis of the transport infrastructure within the territory of Slovakia documents that its low level provides opportunity to neighbouring countries to carry out transportation of goods through their territories. In this case, the direct competitor is the Polish Republic, which disposes with a developed network of logistic centres, highways, terminals and rail lines [4]. A higher level of logistic centres in the Polish Republic is based on their size and modality, since more than half of the selected logistic centres have access to the road as well as rail transport infrastructure [10].

Commodities, which are transported by the international road transport include products of mining industry representing a share of 25%. This is the very type of commodity suitable for transport by railways. The analysis also shows that almost 43% of the goods transported by road is transported on pallets. Results of the analysis of commodities transported on rail document a high dependency of rail transport performances on the metallurgy industry, since the most frequently transported commodities from the East to the West in the transit mode through the Slovak territory include iron ore and metals. A great part of the implemented transport represents also the transport of wood, chemistry and crude oil products. There is also a potential for transportation of units of the intermodal transport, which, as regards the direction from the East to the West takes place mostly through the southern part of the territory of Slovakia [6].

The analysis of the price for transport shows that the most flexible mode of transport is the road transport. Based on the results of these analyses, the use of the CargoBeamer system is reasonable.

3. POSSIBILITIES OF THE CARGOBEAMER SYSTEM USE IN RAIL TRANSPORT

The CargoBeamer system (hereinafter only CB) is an innovative technology in the rail transport designed for transportation of semitrailers and CBoXX containers specially designed for the CB system. The main benefit of this system is that it supports the transportation of standard road semitrailers, which represent 70% of the whole-road transport in the EU. The CB system is mostly automated, namely in the horizontal loading and unloading, or in case of change of the track gauge [1].

Loading operations, be that loading or unloading, are carried out in special automated terminals. The CB automated terminals are not demanding as regards necessary investment, since it represents

approximately one-third of the investment costs necessary for conventional terminals, which use cranes or other handling equipment for handling of intermodal transport units. From the point of view of land use, the construction of a terminal for the CB system necessitates just about a quarter of the area needed for the conventional terminal. An illustration of such CB system terminal is shown in Figure 1.

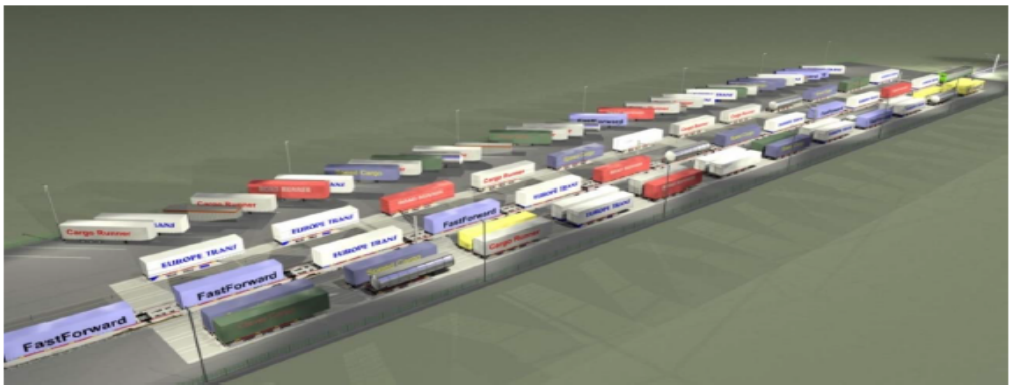

Fig. 1. Automated CargoBeamer Terminal [3]

Such terminal contains at least a parking area for semi-trailers, an area for special equipment, i.e. pallets designed for loading and unloading, as well as a handling rail track. The terminal arrangement is flexible and it can be adapted to local conditions, for example in such a way that the handling module can work only in one direction. The train consisting of CB system wagons can have up to 36 wagons with an overall length of 700 m. The loading and unloading takes place concurrently and namely by means of special pallets placed on modules enabling automated horizontal handling. In such an automated terminal, the loading and unloading can be managed within less than 15 minutes, whereas the handling in the conventional terminal would take approximately more than 4 hours [2]. This system not only reduces the time of handling operations, but also the labour costs. The handling pallet of the CB system has been shown in Figure 2.

Fig. 2. A handling pallet of the CB system [3]

Technical characteristics of this pallet enable that the pallet can be handled by a crane equipped with a reach stacker, which enables handling also in the conventional terminal. In this way, it is possible to set up a train that can be handled in the automated CB terminal. The CB system can also operate in extreme weather conditions, which increases especially its reliability [7]. This system can be used also for an efficient transportation of different types of goods from Asia to Europe on the "Silk Road", which has been confirmed by the contract between the company Cargo Beamer and the Chinese companies Atop Pekinga Zhongche Group.

Fig. 3. CBoXX Container [3]

The decision on cooperation between these companies originated on the basis of preferences of Volkswagen, which uses this system in supplying its companies. Volkswagen classified the supplying by CB system as one of its ten best logistic methods. This recognition was due to the specially designed container CboXX thanks, in particular, to its technical features. The CBoXX container has been graphically shown in Figure 3.

The technical characteristics of this container enable more efficient use of the loading weight and loading volume when compared with the regularused units of the intermodal transport [5]. The CBoXX container disposes with a loading weight bigger by up to 80% and a loading volume bigger by up to 57% than that of the conventional ISO IA container. Another benefit of this system is not only the automated loading and unloading of the CBoXX containers by the loading modules onto the CB wagons, but also the automated loading and unloading of goods into these containers. The possibility of such handling enables the door-to-door transportation also with the use of the rail transport. The automated loading or unloading of the goods in the CBoXX containers is subject to a corresponding technical base designed for such activities, located at the beginning of the whole chain in production and at the end in the recipient's storage. The duration of the goods transportation from Asia to Europe is impacted by the change of the track gauge. The current procedure of such transport has been illustrated in Figure 4.

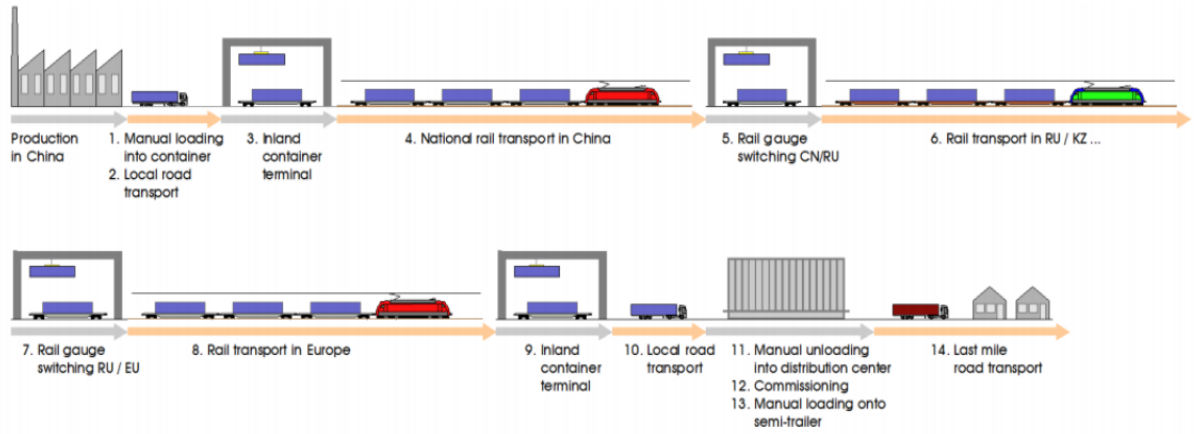

Fig. 4. Procedure of goods transportation on the route from China to Europe without the CB system application [9]

Figure 4 demonstrates that without the CB system application, prior the rail transport, the intermodal transport units must be manually loaded and transported to the terminal where they are consequently loaded onto the wagons with the help of the handling equipment. In case of transportation between China and Russia, there is a need of changing the track gauge, whereas this process takes about 2 days. Figure 4 shows that this process is implemented twice, namely at the point of track gauge change between China and Russia and then between Russia and Europe. In the final stage of transportation, the intermodal transport unit is transloaded onto the road semitrailer combination, which transports the goods to the distribution centre. The goods are then transported from this centre to the customers. For the sake of comparison, Figure 5 illustrates the procedure of transportation from China to Europe with the use of the CB system.

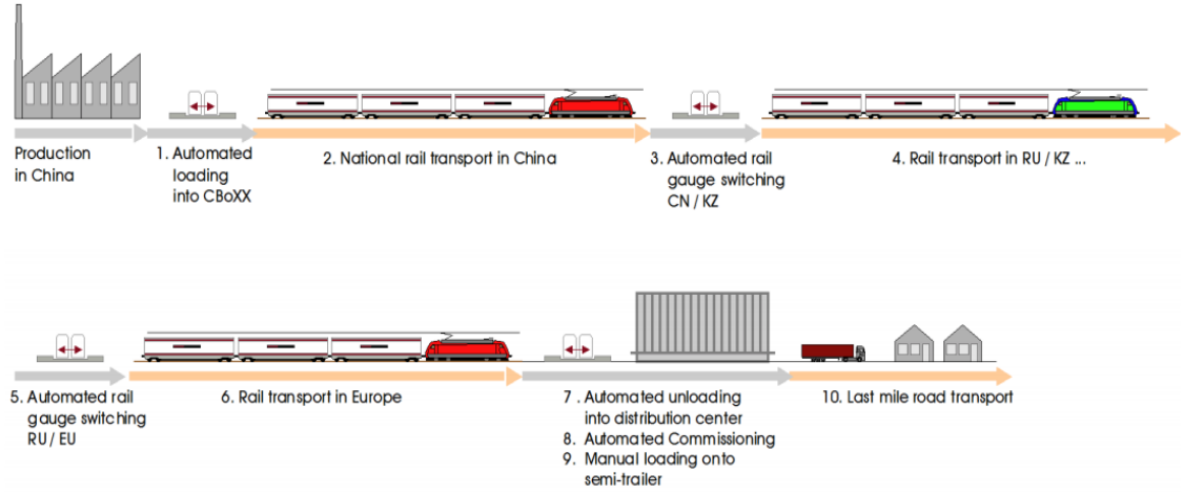

Fig. 5. Procedure in case of goods transportation from China to Europe using the CB system [9]

Using the CB system, the CBOXX containers loading is done automatically and specifically directly at the production company in China. In case a terminal for loading of CB wagons is also situated in the company, there follows the automatic loading and transportation by rail. At locations where it is necessary to make the change of the track gauge, there are established automated terminals, which will transload the handling pallets onto the wagons of the appropriate track gauge within 2 hours. In transporting goods from China to Europe, it is necessary to change the track gauge minimally twice; the overall duration needed for these processes will be shortened from 4 days to 4 hours [8]. This fact considerably reduces the time of transport and concurrently increases competitiveness of the rail transport over other modes of transport. The issue arises when setting the route of the Silk Road. The use of the CB system on the Silk Road has been graphically shown in Figure 6.

Fig. 6. The use of the CB system on the Silk Road [9]

Figure 6 demonstrates that the plan of using the CB system does not assume transportation through the territory of Slovakia. The only point in Slovakia considered is Čierna nad Tisou, where the change of track gauge would be executed and the transport would continue through the territory of Hungary to Southern Europe. The route of goods transportation in the direction from the East to the West has been planned through the territory of Ukraine to Poland, probably to the terminal in Slawkow. At this terminal, the train track gauge will be changed and the train will then continue to Western Europe. Figure 6 also implies that according to the plans, a CB logistic centre should be established in Vienna. This fact provides a possibility to divert the route of goods transportation in the direction from the East to the West. Diversion could be implemented by construction of the planned broad-gauge railway from Haniska pri Košiciach to Vienna. This approach would eliminate the need of changing the track gauge, since the track gauge of wagons would be changed only at the borders of China and Russia. Such action would increase rail freight transport services, utilization of the broad-gauge railway and the route of the Silk Road would officially go through the territory of Slovakia, which would increase the trade as well as promote relations with China. Higher performance of goods transportation from the East to the West could be also achieved by increasing the level of services provided by the logistic centres located in the territory of the Slovak Republic.

4. CONCLUSION

The CargoBemaner system provides for saving of costs and reducing the transportation time. Cost saving is ensured through an efficient use of the loading space of special CBoXX containers, which are used in the CargoBeamer system transport. Reduced costs are also due to elimination of costs needed for the physical labour, since the system enables automatic loading and unloading of special CBoXX containers. Economic assessment has shown that the transportation in the CBoXX containers is by EUR 500 economically more convenient than the transportation in the conventional ISO IA containers. Calculation of the unit price per I ton has demonstrated that the economic convenience of this system is even more significant, since the unit price per ton of transportation in the ISO IA container is EUR 150 and the price in case of the CargoBeamer system transportation is EUR 70.

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