Field of Application for the Maglev System and its requirements from the view point of a Transport Company

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Abstract

Application areas for the Maglev system are derived and necessary prerequisites for the realisation of projects are explained. Furthermore boundary conditions for applications in Germany are specified. The Transrapid was designed and optimised as a long distance carrier. Its utilisation for specific regional train services demand different and mostly more strict requirements. The activities of the DB AG in the high-speed Maglev project are narrated.

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1 Field of Application for the Maglev System

1.1 High-speed services of the DB AG

The German Railway plc (DB AG) is the biggest traffic service organisation in Europe. 30,000 trains run daily to enable 4.5 million passengers to travel. The largest part, i.e. 4.2 million passengers use daily local and regional train services, while around 350,000 are using the conventional long-distance train services. Every day 130.000 travellers are using the high-speed trains ICE. The high-speed trains have almost the same traffic capacity in respect of pasenger-kilometer as the conventional long-distance trains and contribute one third of the turnover in the long-distance train service division.

The 7 times more use of the high-speed trains has been recorded since the beginning of the high-speed train services in 1991. It was in 2002 15 billion passenger-kilometres (Pkm), while 2 billion Pkm in 1991.

A completely new train service was the target of the conception for the ICE System, which ought to differentiate significantly from the conventional long-distance services. Not only the speed, but also the onboard service and comfort were increased considerably. The ICE is well accepted by the customers. The

willingness to pay an extra price is distinctly higher than for the conventional long-distance. The experiences made by the DB AG with the high-speed services are thoroughly positive .

The high-speed rail network of the DB AG is embedded in the Transeuropean high-speed rail networks. The length of this rail track should be 8,000 km in 2010. Meanwhile the technical and operational requirements for the Transeuropean rail networks were standardised in the „Technical Specification for Interoperability“ (TSI). At present in Germany there are approximately 1,900 km high-speed rail tracks for speeds above 200 km/h in operation, another 1,600 km new or upgraded tracks are under construction or planned until 2015.

1.2 Potentials of Maglev in Germany

Complete exhaustion of the growth potentials in the core business of the DB AG means to face competitors of road transportation with better linked train services and by creating new and better services in a certain traffic sector. The improvement of the train services and its expansion are only then interesting and necessary, when the demands in traffic market strongly grow, the capacity of the existing service reaches its limit or a competitor becomes more attractive.

The main competitor „car“ in Germany is due to the decentralised settlements structure very strong. The customer‘s willingness to pay the competing price for a train ticket has to be mainly oriented at the costs for using the car. The effects of the decentralised settlement lead to have the average distance between two stops of 70 km in the long distance train services. Comparison of the costs for infrastructure between high-speed train services and air traffic provides once again reasons for the construction of high-speed train services as substitute to air traffic. Here we have the opportunities and field of application for Maglev as a complementary system to the high-speed wheel and track bound train serves in the German Railway scenario.

As its system nature compels, the high-speed traffic systems are reasonable, if there are sufficient volume of potential passengers, appropriate distances between stops, higher speeds of trains and the approach of the product design and services are focussed on customers need. Thus the field of application of the Maglev system as a high-speed traffic system can be:

a) long-distance and

b) special regional applications.

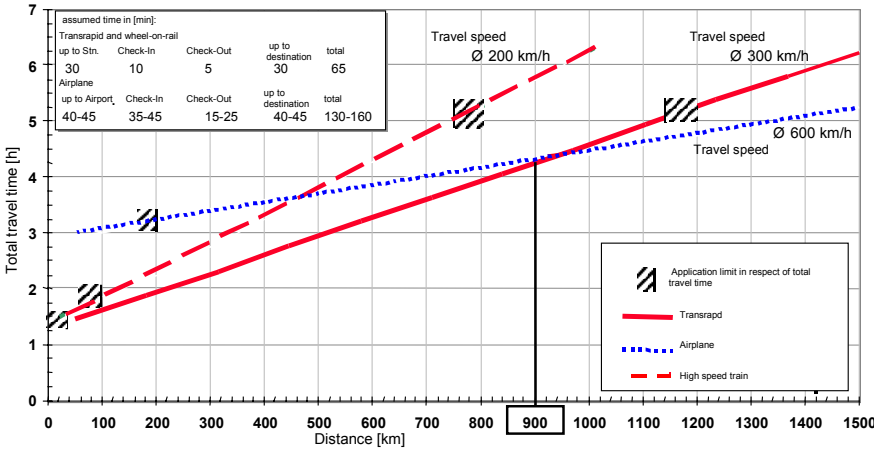

Fig. 1: Comparison of the traffic sectors

One of the market segments are the airport links as a part of regional train services with high volumes of potential passengers, high journey speeds having a distance between two stops more than 30 km and quality of product and service focused on customers desire. Among others one of the specialities of a Maglev System as an independent service system is a lower sensitivity to external influences. There are no overlappings between regional-, long-distance- and freight services. Evidences for the high reliability of independent systems are given in Hamburg and Berlin with its S-Bahn-Systems. Those services guarantee a reliable operation with a high punctuality.

In order to withstand the competition with the wheel-on-rail-system, the high-speed Malgev system has to be at least equal in terms of profitability and overall performance. Calculations show that a surplus of 15% in costs for investment is arguable because of the expected reduced operating costs (especially costs for maintenance and energy) which might result in same costs for the both systems during their lifecycles.

Further potentials for Maglev lie down in the facts, if the Maglev system proves to earn higher revenues due to an improved service (e.g. travel time, time for changing, frequency of availability, punctuality etc.). Thus a higher attractiveness of the traffic system Maglev might lead to a higher willingness of the customers to pay higher prices.

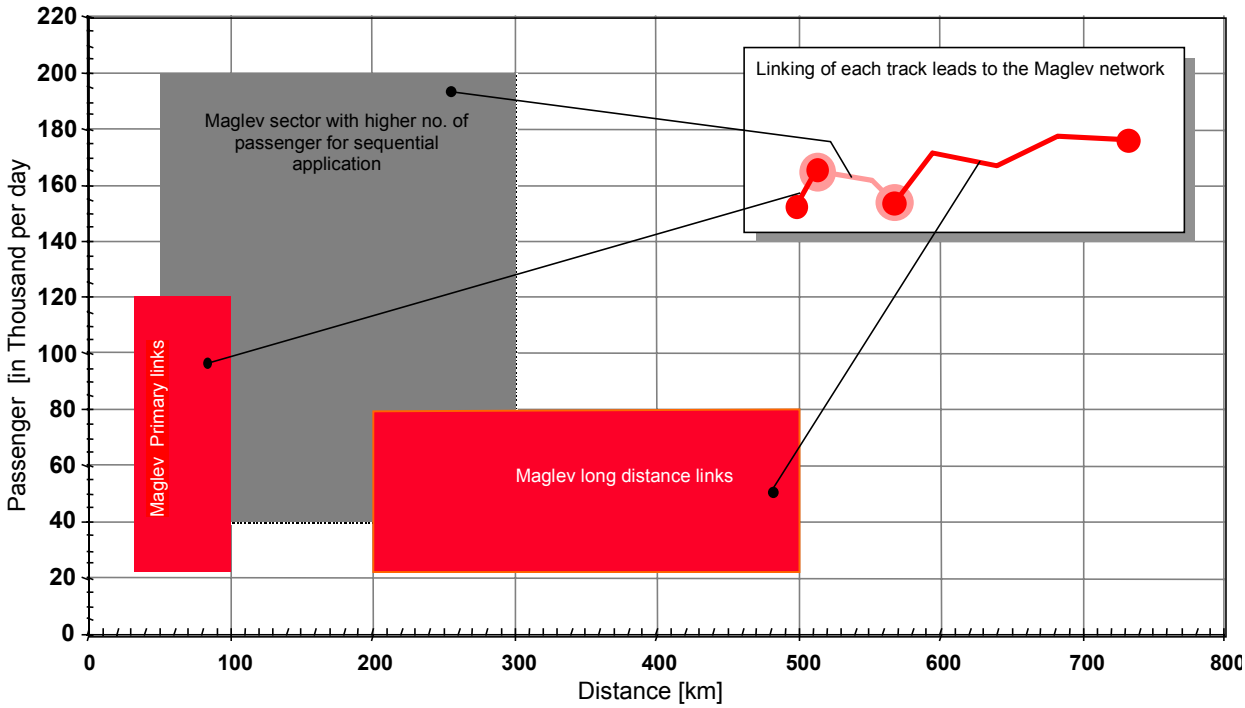

Fig. 2: Field of application and primary links

1.3 Long-distance services

Because of its high journey speed the high-speed maglev system is notably qualified for long-distance services. It can be considered as a fast and quiet alternative to the conventional long-distance rail services and to air traffic. Germany has got a dense conventional rail network and an advanced high-speed infrastructure which will from year to year be densely expanded. Thus the possible applications for high-speed maglev systems are restrained. The construction of a completely new infrastructure for Maglev

accounts for this difficulty, whereas often in the field of wheel-on-rail high-speed systems small additions of existing infrastructures are sufficient.

Henceforth comparisons of costs for investment often come to conclusions in favour for wheel-on-rail systems. From the DB AG‘s point of view, the application of a high-speed Malgev system as a long-distance service should be examined if the capacity of the existing high-speed rail infrastructure is exhausted and appropriate potentials of growth have been identified. This approach has been chosen for the Japanese Maglev project.

If there is no infrastructure for the high-speed rail, the Maglev technology competes with the high-speed rail-on-wheel technology. In this case the obvious advantages of the Malgev system is a gain of journey speeds 100 to 150 km/h more than on wheel-on-rail systems and due to its low noise emission the opportunities are there to run the Maglev system at a speed up to 300 km/h in densely populated areas have to be regarded.

1.4 Regional applications and airport links

The airport link is an especial interesting application sector within the field of regional applications. This application generates a new and growing market segment, because future airports will likely be build outside of the cities. Private and business travellers represent the target group of airport links and they expect a noticeable reduction of the journey time as well as a comfortable and customer focused service concept.

The high-speed Maglev system with its system- and service related advantages in acceleration and travelling comfort is significantly suitable to meet market requirements. Passengers which are travelling with modern long-distance services like the ICE via hubs from main railway stations to the airports will find a standard, which is equal to the long-distance trains and aeroplanes. Thus the quality of the whole journey is improved from the beginning to the final destination - whether it is a business trip or a holiday trip. Thereby supply of continuous information to the passenger is as important as one single ticket system for the whole trip, the management of thoroughly integrated luggage transport despite of manifold changing during the journey or improvements of connecting individual transport (e.g. park & ride).

The Malgev system suits as regional application or as an airport link, if the distance between the stations is more than 30, ideally 50 km. These prerequisites are fulfilled in both projects in Munich and Shanghai. At shorter station-distances, e.g. 10 km, the specific costs for the long-stator propulsion system at present are far too high.

Concepts of Maglev systems with station distances below 30 km and using the long-stator technology can not be placed on the world market yet, because wheel-on-rail offers significantly cost-efficient alternatives having almost the same services – unless a service like this becomes the core cell of a long-distance service.

2 Munich airport link

2.1 Product and services

An ideal precondition for realising a new train service offers the airport link to the rapidly growing airhub Munich. The Traffic to the airport Munich grew on an average of 3,5% per year for the last ten years. The future growth is expected at the same rate. As the existing airport service „S-Bahn“ will reach the limit of

its capacity in the future and available highways shall not meet the raising requirements, the search for solutions to improve the situation is still in progress since 1999.

After investigation all of the possible alternatives, the additional linking via a Maglev system has been preferred. The airport can be reached from the central railway station with a non-stop link within 10 min and on a frequency of every 10 min. Thus the airport becomes a „city-near“ airport again and vice versa the central station becomes the long-distance station of the airport. The possibility for airline passengers to check in and register the luggage at the Munich central station will increase the comfort of the customers additionally. The airport link will be an addition to the existing and remaining S-Bahn services which serve all other stations between the airport and the central station.

Comparing the performance of the other airport links (Fig. 3) in relation to the speed and to the maximum capacity in dealing with the passengers the advantages of the Maglev service appear to be very clear.

Through a significantly higher travel speed a much more higher service can be offered.

the market. A basic requirement for this is to reach at least the standard of comforts as it is offered by the ICE-system. The DB AG will investigate the affordable fare that the future customers might willingly pay. Thus the Maglev service can be placed in the market and meet the customer demands ideally.

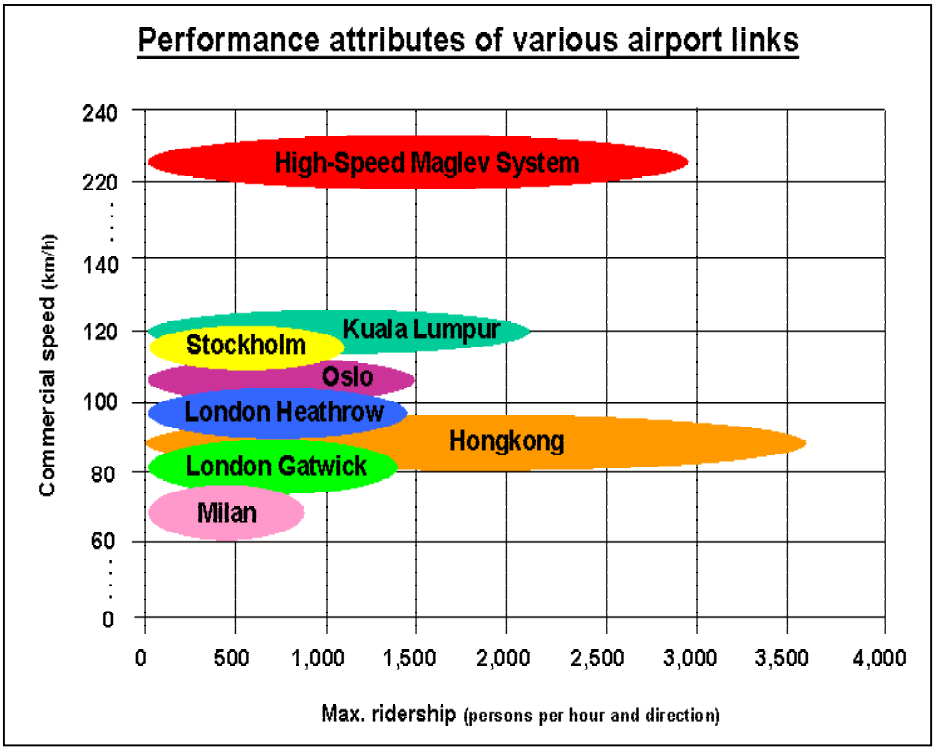

Fig. 3: Comparison of modern airport links

2.2 Financing

The Government in Germany is responsible for the financing of infrastructure projects for the public. This holds good for highways, new high speed rail lines as well as for the Maglev system. The revenue collection of the German railway in case of the long distance train services can cover the costs for operating and for the train investment while in the case of the short distance train services the revenue may cover only 60% of the operation costs. Financing and depreciation of the investment. From the authors point of view the highly discussed public private participation models (PPP-models) are hardly practicable for huge infrastructure projects. The implementation of such models is suitable only for small projects with good predictable number of passengers and revenues having no competitors. Particular elements of these models, like the guarantee for system availability by the industry, coupled with a guarantee of cost for maintenance, can meaningfully be introduced.

2.3 The involvement of the DB AG in the Maglev project

The DB AG posses know-how in the planning, research and development of wheel-on-rail and Malgev system for many years. There are about 60 expert employees working in the field of Maglev systems within the DB AG corporate group and in its related subdivisions. In combination with the wheel-on-rail and with the Maglev systems, the DB AG has got the highest know-how in planning, construction and operation.

For the Munich project a broad functional requirement document for Maglev systems has been worked out and placed into a databank. All topics related to the product (comfort, air-conditioning, interior noise, etc.), reliability, availability, capability, safety, profitability and safety of operation are described using functional requirements. With little changes, the requirement document can also be suitably applied for long-distance traffic services. This functional requirement document will be the basic foundation for all further project activities in the field of Maglev system. The industry has been asked to work out the specification sheet so that requirements for the Munich project will be fulfilled.

3 Conclusion

- The Maglev system competes world-wide with wheel-on-rail systems. Applications of Maglev for airport links, for high-speed long-distance services – can be found, if the specific advantages of the Maglev system are used in the right way.
- The higher performance of Maglev by reducing the travel time and increasing the quality of service should not lead to over proportionally higher investment costs.
- The Maglev system must bring forth an noticeable higher value added to its customers compared with other alternative wheel-on-rail systems.
- The Maglev system must reach at least the standard of comforts offered by wheel-on-rail systems and decrease the travel time as well.

List of abbreviations:

DB AG :Deutsche Bahn Aktiengesellschaft

ICE : Inter City Express

PPP : public private participation