



Programme of the Federal Government to ensure the future application of MAGLEV technology

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MAGLEV – Worldwide High Speed Industrial Developments and Projects

1 Abstract

In the spring of 2000, the German Federal Ministry for Transportation, Construction and Housing commissioned an investigation into the regional use for the maglev technology in Germany for the connection between airports and city centers and conurbations.

The German magnetic maglev technology - originally designed for long distance transportation - will now be adjusted via special further development programs to meet the specific needs of regional transport. The Transrapid test track in Emsland (TVE) will support the implementation of new types of guideway construction and optimized components for vehicle, propulsion and control technology. The running tests are using the Transrapid 08, a prototype maglev vehicle of the newest generation. With a capacity for 125,000 km a year, the maintenance concept and availability for the total system are to be verified. The decision to implement magnetic levitated technology in Germany is expected by the end of 2002.

In the course of international research cooperation, a cooperation contract with experts in the USA was signed in 2001, setting the stage for the joint development of safety, licensing and environmental norms for a maglev system.

In May 2001 a Memorandum of Understanding was signed with the Republic of China on high speed train systems. The German government has guaranteed its support for the technology transfer in the area of high speed travel to China. The cooperation includes mutual tests and trials on both the TVE and, as of 2003, on the demonstration track in Shanghai.

2 Introduction

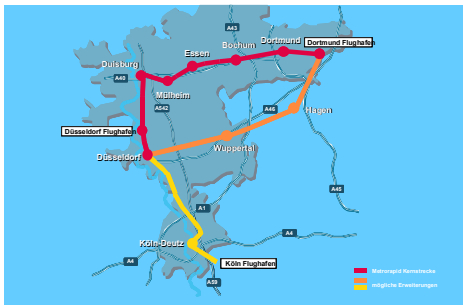
From 1969 to date the German Federal Government has promoted the development of the magnetic levitation system in Germany with federal funds in the amount of approximately DM 2.5 billion (or € 1.28 billion). Around another DM 350 million have been made available by industry. Compared with the development expenditure in the air transport and automotive industries this expenditure is relatively modest, considering the fact that the magnetic levitation system is an entirely new transport system that has been developed up to the stage of operational readiness.

Important milestones of the development programme have been the testing of the maglev system with the Transrapid 05 (1979 International Transport Exhibition), the construction and putting into service of the Transrapid Emsland Test Facility in the first half of the eighties and testing of the experimental trains Transrapid 06, Transrapid 07 and Transrapid 08 at the Emsland Test Facility. Granting of the type approval as long-distance passenger transport system in the year 2000 provided the basis for maglev system applications in long-distance transport services.

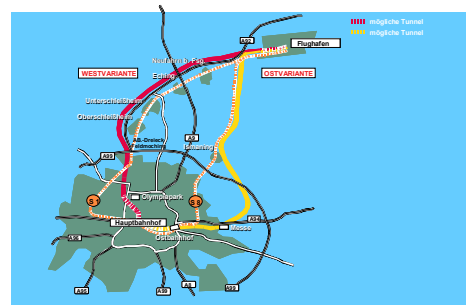
Practical application of the maglev technology is based on two concepts: application at home and marketing abroad. Within the framework of its programme for safeguarding the future of the German maglev technology and for establishing high-speed maglev transport services the Federal Government pledged its commitment to the evolution, testing and application of the system at home and abroad.

2 National maglev projects

In November 2000, the Federal Ministry of Transport, Building and Housing has, in cooperation with the federal states of Bavaria and North Rhine-Westphalia, commissioned a feasibility study the results of which are now available. Accordingly, two magnetic levitation lines are currently being planned in Germany:



an airport link between Munich Hbf (main station) and Munich Airport



the Metrorapid in the Ruhr area and

The Metrorapid between Düsseldorf Hbf and Dortmund provides a rapid and efficient regional link. The double-track line has a length of 78.9 km and interconnects the stations Düsseldorf Hbf – Düsseldorf airport – Duisburg Hbf – Mülheim Hbf – Essen Hbf – Bochum Hbf – Dortmund Hbf in 37 minutes. Most of the route is closely collocated with existing DB AG routes. The Metrorapid forms part of local and regional passenger rail traffic in the Ruhr area and is integrated in the interval timetables of regional services.

The maglev system between Munich Hbf and Munich airport will interconnect the two stations over a distance of 37 km in about 10 minutes. It is a special “air link product” and includes check-in and baggage transport service at Munich Hbf without extra charge. The line is planned as double-track route and will run parallel to existing motorways, on rapid transit lines that are no longer used and through tunnels in the city centre, Feldmoching and the airport.

According to the result of the feasibility study finalized in spring 2002, both inter-regional lines are technically, economically and financially practicable. The Federal Government is convinced that in both long-distance and regional traffic the Transrapid will have systems-specific advantages over the competing wheel-on-rail technology.

Federal subsidies will amount to a total of € 2.3 billion, which will be allocated to the two projects in proportion to calculated total investments / discounted profit/losses over a 25-year period (5-year planning period and 20-year operation phase).

This means that Bavaria will receive € 0.55 billion (investment volume € 1.6 billion for a line of 37 km) and € 1.75 billion will be allocated to North Rhine-Westphalia (investment volume of € 3.2 billion for a line of 78.9 km). Planning and funding is the responsibility of the two federal states concerned, which now have the task of developing cogent overall funding concepts for construction and operation, by including also private investors.

The future implementation of the project will involve the following steps for the two lines:

- establish for each line concerned the operator specifications for construction and operation, with participation of Deutsche Bahn AG as potential operator of the maglev system and in cooperation with the federal states North Rhine-Westphalia and Bavaria and the Federal Railway Office.
- determine the cost reduction potential by the systems industry involved in construction and the guideway manufacturers as an important contribution to implementing the magnetic levitation system.

3 Adaptation measures for the Transrapid system as regional means of transport within the framework of the German programme of further development

In order ensure that the initial commercial applications of the maglev system in regional services in Germany are successful a programme of further development is conducted to adapt the technology and profitability of the magnetic levitation system to the new conditions of operation in regional traffic. For this purpose, the Federal Government has appropriated a total of € 71 million for the period 2001 to 2005.

The programme of further development contains only application-oriented developments and studies. Since early 2002, more detailed information has been available on the following subjects:

- definition of the operational concept
- location and data communication by radio transmission
- effects under winter conditions
- temperature-dependent deformation of guideway beams
- automatic inspection of the guideway
- guideway failure management

- system for determining the life cycle costs (LCC)

At the moment, the following focal issues are being dealt with under the programme of further development for applications in Germany and China:

- vehicle:
 - optimization of the levitation/guidance system for the operation of regional services, studies concerning the use/storage of the braking energy, studies of alternative concepts of non-contact on-board power supply, studies concerning the coupling of vehicles,
- guideway:
 - determination of the potential of optimizing different types of guideway beam, guideway beam bearing and tunnel construction, study of vehicle movement dynamics to determine travel comfort criteria, study of commercial production processes, reduction of maintenance costs by means of a special maintenance beam,
- propulsion system
 - standardization of current converter and traction control, optimization of section change, type approval for feeder rails for different types of guideway,
- operation control system
 - studies of the traction system in the case of short headways on transitional motor sections, clarification of approval procedures for the operation control technique according to CENELEC.

4 Operational testing of the magnetic levitation system on the Transrapid Emsland Test Facility (TVE)

The programme of the Federal Ministry of Transport, Building and Housing also covers the operation and maintenance of the Transrapid Emsland Test Facility (TVE). It is financed from user fees paid by industry and DB AG, and from federal subsidies. Permanent tests serve the purpose of recognizing and using any further potential for optimizing details and reducing costs. An overview of the operational data achieved with the TVE test vehicles Transrapid 06, Transrapid 07 and Transrapid 08 is given in the table following below.

Operational data for TR 06, TR 07, TR 08 on the Transrapid Emsland Test Facility (TVE)	Period	Total mileage in km	Passengers carried
Operation TR 06	1984 to 1989	64,770	17,000
Operation TR 07	1989 to 1999	587,599	296,269
Operation TR 08	1999 to April 2002	142,238	102,619
Total operation TR 06 + TR 07 + TR 08	1984 to April 2002	794,607	415,888

On the one hand, the operation on the TVE has the objective of enabling industry to guarantee operational safety and availability of the Transrapid system for the Shanghai project on schedule as of 1 January 2003. On the other hand, the present system is to be optimized, by fully exploiting the cost reduction potential for regional transport applications of vehicle, guideway and operation control system.

5 Cooperation agreement with USA

On 10 October 2000, the Secretary of Transportation of the United States of America and the Federal Minister of Transport, Building and Housing of the Federal Republic of Germany signed a Memorandum of Cooperation on the Application of the German Magnetic Levitation Technology as an Innovative Transport System.

5.1 Objectives of cooperation

The intent of the German/US Agreement has been to cooperate very closely in research areas of the railways, such as safety, environment and certification, with the aim to develop safety standards for the operation of the German magnetic levitation system, to exchange information and experience on the implementation of the German MAGLEV system as well as on technical and ecological feasibility studies and economic analyses.

This cooperation is to facilitate the exchange of information and evaluation of opportunities to implement the German MAGLEV system in revenue operation in Germany and the USA.

5.2 Experience / Results

A Working Group for Safety, Environment and Legal Affairs has been established to assist the Federal Railroad Administration in rounding out and updating its knowledge of the Transrapid technology in preparation of rule-making initiatives.

At present, in-depth studies are being carried out for two MAGLEV lines:

The line Greensburg – downtown Pittsburgh – Pittsburgh International Airport, which has a length of 76 km with four stations.

The line Washington, DC – downtown Baltimore via Baltimore/ Washington International Airport, which has a length of 64 km with three stations.

6 Cooperation agreement with China

6.1 Support for technology transfer within the framework of project-related development aid for high-speed traffic

The successful implementation of the Transrapid project in Shanghai was an important signal for implementing the German projects. The Shanghai project for the first time offers the opportunity to gather experience in realizing a commercial project. Germany's and China's mutual wish for an exchange of experience in a spirit of trust has been specified in detail in a Memorandum on the initiation of bilateral cooperation, which was signed on 23 May 2001 by Federal Minister Bodewig and the Chinese Minister for Science and Technology, Mr Xu Guanhua.



The Federal Republic of Germany moreover supports the People's Republic of China by granting development aid for the transfer of high-speed rail technology. Together with the competent technical ministries (Federal Ministry of Economics, Federal Ministry of Finance, Foreign Office) and the Development Loan Corporation, untied development aid was granted to provide the financial support promised by Federal Chancellor Schröder. Accordingly, the Federal Government granted the People's Republic of China untied financial aid in the amount of € 102.3 million for the transfer of high-speed rail technology within the framework of development policy cooperation. China decided to use this aid for maglev technology contracts.

6.2 Contents of cooperation

Cooperation between the Federal Republic of Germany and the People's Republic of China for the application of the German maglev technology is focused on:

- the reciprocal exchange of experience and regular information on the state of play as regards the maglev projects in the Federal Republic of Germany and the People's Republic of China.
- the identification of areas of cooperation to implement maglev projects in both countries, inter alia for establishing a maglev technology centre.

6.3 Substantial results of the first two meetings in November 2001 / March 2002

As agreed upon by the MAGLEV commissioners of both countries in 2001, mutual information is exchanged on the status of planning and projects as well as on the concretization of projects to intensify joint tests and studies for advancing and optimizing the maglev system, especially by using the Shanghai demonstration line for real-life operating tests.

At the first two meetings of the MAGLEV commissioners essential areas of cooperation have been defined as follows:

- German support in testing the safety of the Transrapid system in Shanghai
- exchange of information to compare the wheel-on-rail and Transrapid technologies
- joint study to reduce capital and operating costs of the Transrapid transport system
- identification of projects the further development of which is considered necessary by both sides
- Mutual information on currently planned long-distance Transrapid projects in China, Europe and the USA.

6.4 Résumé

After only one year of cooperation between the Federal Ministry of Transport, Building and Housing and the Ministry of Science and Technology it can be said that the involvement of the SMTDC and the intermediary role of the Federal Ministry of Transport, Building and Housing between the German systems industry and the Chinese partners of contract also helped to make good progress with the Shanghai project and valuable knowledge could be gathered by the Federal Ministry of Transport, Building and Housing in respect of the projects to be implemented in Germany.

Cooperation also covers the involvement of the Ministry of Science and Technology and the SMTDC in the programme of further development of the Federal Ministry of Transport, Building and Housing and in the tests and trials on the Transrapid Emsland Test Facility and, reciprocally, the involvement of the German systems industry in the tests and operational trials on the Shanghai demonstration line.

A systems comparison between the maglev and wheel-on-rail technologies has made an essential contribution to objectifying the discussion on the advantages and disadvantages of the different rail systems, as has become obvious during a seminar held in Peking in early summer, and thus provides a basis of decision-taking for planning other routes of maglev application in China.