

# **Progress of the Maglev Transportation in China**

**Yan Luguang**

**Institute of Electrical Engineering,  
Academia Sinica, Beijing, China**

**Genoa, Italy**

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 **Introduction**

 **Foundation for Transportation  
Development**

 **Long Distance Application**

 **Intercity and Urban Application**

 **Concluding Remarks**

***Abstract***—The successful construction and operation of the Shanghai high speed maglev Transrapid line and the Nagoya low speed Tobu Kyuryo maglev HSST line indicate that the maglev already entered the transportation development stage. The related progress for transportation development in China is shortly described, including its foundation, long distance, intercity and urban application.

# Introduction

- ❑ **The history of the passenger transportation of the whole mankind is a history of continuous increase of the operational speed. A very important achievement in this area for the 20<sup>th</sup> century is the appearance of the high-speed maglev train. Its development proved that the ground passenger transportation of mankind would reach 500km/h level in the first part and middle of the 21<sup>st</sup> century.**

- ❑ **December 31 2002** the Shanghai maglev demonstration and operation line celebrated its opening ceremony, the world first maglev commercial line born in China. Till the end of May 2005, it operated safely and reliably for 883 days, traveled 1.56Mkm and carried 3.51M passengers. March 2005 the Japanese low speed maglev Tobu Kyuryo line in Nagoya also started its operation. It shows that the maglev transportation as the sixth kind of the mankind transportation system really became realistic and the maglev entered the new stage of its transportation development.
- ❑ **For the future transportation systems in China**, we proposed to work in the near future in two directions, i.e. to promote the long distance application and to promote the application in the intercity and urban transport.

# Foundation for Transportation Development

- China began the research of key maglev technology from the late 80's and the development of maglev train is actively promoted since the middle of 90's. In recent years, we have made considerable achievements. A certain common understanding has been reached that China needs the high-speed maglev train. A 30km long maglev demonstration and operation line linking the airport with the city has been built in Pudong Shanghai by importing the German Transrapid system. The high-speed maglev technology has been included into the National High-tech Research and Development Program (863 Program) as a special technology. Quite good foundation for practical transportation development has been established.

- ❑ **The successful construction and reliable operation of the shanghai demonstration line is the basic foundation for future transportation development.**



**Scheme of the Shanghai demonstration line**



**The Transrapid is running on the switch**



**The maintenance station of Transrapid in Shanghai**



**Transrapid is running in the maximal speed of 430km/h**

**The Shanghai line solved many important problems concerning the practical use of maglev transportation system, mainly:**

- **(1) It has proved that the Transrapid technology is mature and can be put into practical application with good safety and reliability.**
- **(2) Millions people have already experienced by themselves the advantages of maglev transportation.**
- **(3) The construction period is just about 4 years. It is much shorter than that for high speed railway.**
- **(4) The 30km line allows to reaching the test speed of 500km/h. The test base for future high-speed maglev development is established.**

- **(5) The teams for the engineering construction, design, research and development, manufacturing, management and operation were organized and greatly reinforced.**
- **(6) The related research and development work is included in the National High-Technology Program (863 Program).**

**Success of Shanghai line well prepared China to go forward to apply Transrapid system both for long distance and intercity transportation.**

■ In the field of low speed maglev, the National Defense University and the South-West Jiaotong University worked for a long time for the development of the system similar to Japanese HSST. The Beijing Enterprises Holdings Maglev Technology Development Co. together with the National Defense University built a CMS-03 test vehicle and a 204m long test line with minimum radius of 100m and maximum climbing of 4% in 2001 in Changsha. Up to now, the vehicle traveled over 7000km with over 20,000-test run and 40,000 times start and stop operations, its safety and reliability are proved. Recently, based on the test results a new engineering prototype vehicle has been constructed.

■ It is planned to build a 2km test and operation line in Kunming, after all necessary testing is finished. The whole system can be accepted for real urban application in 3-5years.



**The low speed Maglev CMS-03 test vehicle**



**The 204m test line in Changsha**



**Low speed HSST type vehicle developed in China**

# Long Distance Application

The main advantage of the Transrapid system is the high speed. The most advantageous area of its application is the large passenger volume, long distance line between large cities. China has very wide territory, very large population and quite fast developing economy. The practical needs for high-speed long distance transport is increasing significantly. The Beijing-Shanghai high-speed line project is the most attractive national project in the near future.



**Proposed Beijing-Shanghai high-speed railway scheme**  
**1370km, 300-350km/h, 6-7h**

**The use of Maglev instead of high-speed railway to enhance the velocity to 500km/h for Beijing-Shanghai line has obvious advantages, so we actively suggested to make a decision that Beijing-Shanghai Line should adopt the maglev concept and to make serious and overall arrangement for the work of the next step. However, as a major and important project of the world's attention after the Three-Gorge Project, there are still different opinions concerning the option selection of Beijing-Shanghai Line. The Central government leaders pointed out that it is important to “hear different opinions, make ample discussions, conduct scientific comparison and selection and present a plan”. We need to work more for deeper scientific comparison and selection.**

- **To strengthen the scientific comparison and selection, it is suggested to build two short operation lines of 200-300km long respectively for high-speed railway and for high-speed maglev. It will lay a reliable foundation for comparison and selection. Based on the construction and realization of these practical operational lines, scientific basis will be obtained concerning the technical performances under different operation speeds, the construction cost required, the costs of operation and maintenance, international cooperation and local production etc.**
- **As this kind short maglev operation line, a proposal for constructing the Shanghai-Hangzhou Line is worked out. The following figure shows the scheme of the proposed line. It has total length of 175km, starting from the existing Longyang Road station of the Shanghai demonstration line till the Hangzhou City Station.**



**Scheme of the proposed Shanghai-Hangzhou Maglev Line**  
**175km,450km/h,27.5min**

- **The Proposal is waiting for approval from government, after approval it will be the biggest national maglev project for the next five years. The Shanghai-Hangzhou Line will effectively meet the high-speed transportation needs between these two important cities, promote greatly the maglev equipment industrialization process and create solid basis for future long distance and intercity application.**

# Intercity and Urban Application

- Although maglev has main advantage for high-speed, long distance transportation, the needs for long distance lines in the world and China are limited. From other side, the needs for high-speed intercity and urban rail transport are much larger. For example, the three large megalopolis areas in China (the Yangtze River, Zhujiang, and Beijing-Tianjin-Tangshan Triangle areas) already have their plan to develop their high-speed intercity transport very fast in the near future. The plan from some cities in China for near future urban rail transportation development requires more than thousand km to be build in the next 5-10years.

# Some City Plan Requirements for Urban Rail Transportation in China

City Name	Number of Lines	Length (km)		
		Plan	Constructed	Construction Required
Beijing	13	408	55	353
Shanghai	21	780	65	715
Guangzhou	5	129	19	110
Tianjin	3	75	7	68
Shenzhen	13	362		362
Wuhan	7	212		212
Nanjing	12	300		300
Chongqing	1	18		18
Chengdu	1	23		232
Hangzhou	2	50		50
Xi'an	1	20		20
Haerbing	1	17		17
Changchun	1	12		12
Dalian	2	50		50
Zhenzhou	1	12		12
Shenyang	5	183		183
Wenzhou	3	50		50
Total		2701	146	2555

## **For intercity and urban application:**

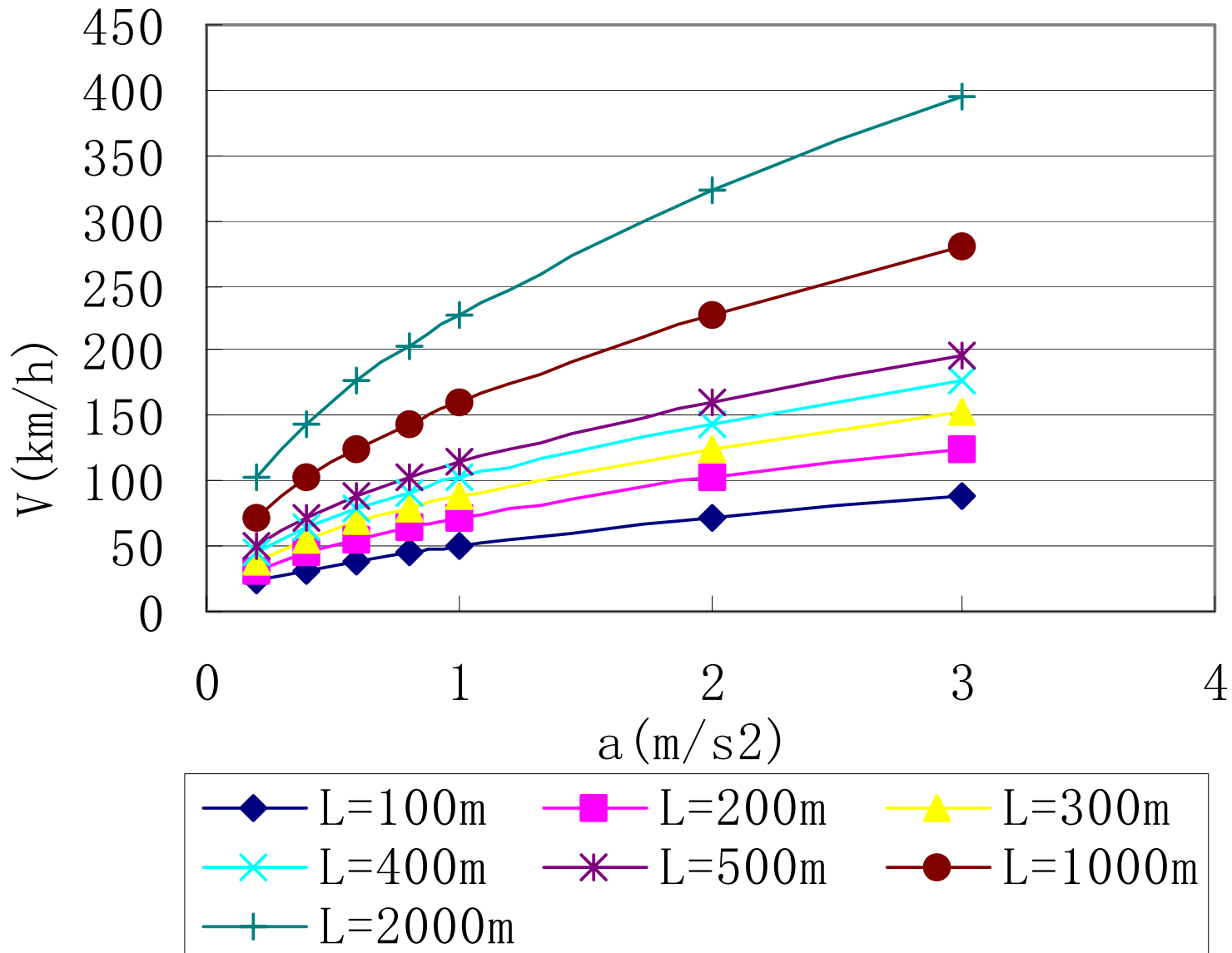
- **(1) The low noise and high acceleration advantages of the maglev could lead to higher operation and travel velocity for the same distance between stations.**
- **(2) The small bending radius (50-70m) and high climbing capability (7-10%) make the maglev especially suitable for areas with small space and high roughness.**
- **(3) The maglev velocity is usually lower than 200km/h, a new system development from the initial research till practical application does not need long period and large funding. Different cities can use different systems, so urban application encourages the competition development of different systems.**

## Noise Comparison between Maglev and Railway

Operating Velocity (km/h)	Railway <sup>(1)</sup>	Maglev <sup>(2)</sup>
100	72	---
160	79	74
200	83	77.5
250	88	---
280	89	---
300	91	84.5
400	---	92

Note: (1) Measured by Germany Noise Institute

(2) Measured at Shanghai Demonstration Line



**Operational Velocity  $V$  in Dependence on acceleration  $a$  for given acceleration distance  $L$ ,  $v = \sqrt{2aL}$**

- **Based on the above-mentioned advantages, it is important to promote the intercity and urban application of maglev to occupy its corresponding position in the city comprehensive transport system.**

**For intercity and urban application in the near future in China, the efforts will include:**

- **(1) the use of Transrapid system with reduced velocity for selected practical projects;**
- **(2) as soon as possible to construct 2 km low speed HSST-type maglev test line and conduct the whole system test to 150km/h, then to build the first operation line in some cities;**
- **(3) encouraging the research and development of the new systems.**

- **(4) Since the intercity and urban application is just at the starting stage, it is also important to conduct some studies on the maglev strategic position in the city comprehensive transport system, on the allowable highest acceleration from the view point of safety and comfort, on the requirement of overload capability and on the economic performance etc.**

# Concluding Remarks

- **After about 40 years continuous technology development, the maglev already entered a new stage of transportation development. Quite good foundation for practical transport application has been also established in China. Based on the past achievements and the practical needs of the national transport development, the efforts will be concentrated on promoting the application both for long distance and for intercity and urban transportation. Hopefully more success will be achieved in the near future.**

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***Thank You!***