AGS Feasibility Study

PLT Meeting 9

March 14, 2013

Agenda

- Introduction to the Meeting
- Public Comment
- Presentation of Preliminary Alignment
- Update on Stations/Land Use Meetings
- Presentation on Maglev Performance
- Funding & Financial Task Force Update
- AGS/ICS/Co-Development Project Coordination
- Conclusion, Final Remarks and Next Steps

Introduction to the Meeting

- Meeting Objectives
  - Present preliminary alignments to PLT
  - Update on Stations/Land Use Meetings
  - Answer PLT's questions about Maglev Performance
  - Update on Funding & Financial Task Force Progress
  - Update on AGS/ICS/Co-Development Project Coordination

Introduction to the Meeting

- Review and Approve Meeting Minutes from Last Meeting
- Review Action Items from Last Meeting
- Website Update
- Media Outreach

Preliminary Alignments

- Alignments should be considered very preliminary
- Adjustments will be made as design progresses & station locations are identified
- Four Main Alignment Designs Provided
  - Wholly inside I-70 ROW – Low Speed Maglev
  - Greenfield Alignment – High Speed Rail (HSR)
  - Greenfield Alignment – High Speed Maglev
  - Hybrid Alignment – Various Technologies
- Presented to Technical Committee on 3/11

Preliminary Alignments

- Greenfield Alignment – High Speed Rail (HSR)
  - 100.8 Miles from Golden to Eagle County Regional Airport
  - 64.6 Miles in tunnels
  - Longest tunnel is 19.6 miles

Preliminary Alignments

- Greenfield Alignment – High Speed Maglev
  - 122.0 Miles from Golden to Eagle County Regional Airport
  - 39.9 Miles in tunnels
  - Longest tunnel is 5.1 miles

Preliminary Alignments

- In I-70 Alignment – Low Speed Maglev
  - 116.8 Miles from Golden to Eagle County Regional Airport
  - 1.5 Miles in tunnels
  - Longest tunnel is 1.3 miles

Preliminary Alignments

- Hybrid Alignments – Low Speed Maglev
  - Base Case – Improves in I-70 Alignment by increasing radii and taking some shortcuts
  - Alternative 1 – Alignment through Keystone, South End of Dillon Reservoir and south edge of Frisco
  - Alternative 2 – Alignment through Keystone, South End of Dillon Reservoir and south edge of Frisco with less tunneling
  - Alternative 3 – Alignment through Keystone, Breckinridge and Copper Mountain

Preliminary Alignments

- Hybrid Alignment – Low Speed Maglev, Base Case
    - Improves in I-70 Alignment by increasing radii and taking some shortcuts

Preliminary Alignments

- Hybrid Alignment – Low Speed Maglev, Alternative 1
  - Alignment through Keystone, South End of Dillon Reservoir and south edge of Frisco

Preliminary Alignments

- Hybrid Alignment – Low Speed Maglev, Alternative 2
  - Alignment through Keystone, South End of Dillon Reservoir and south edge of Frisco with less tunneling

Preliminary Alignments

- Hybrid Alignment – Low Speed Maglev, Alternative 3
  - Alignment through Keystone, Breckinridge and Copper Mountain

Alignment Design

- Next Steps
  - Refine alignments
  - Develop speed profiles
  - Present alignments to PLT at March 13 Meeting
  - Environmental screening of alignments (using PEIS data)
  - Finalize alignments (by mid-April)
  - Begin cost estimating
  - Update ridership based on alignments/speed profiles

County Workshops

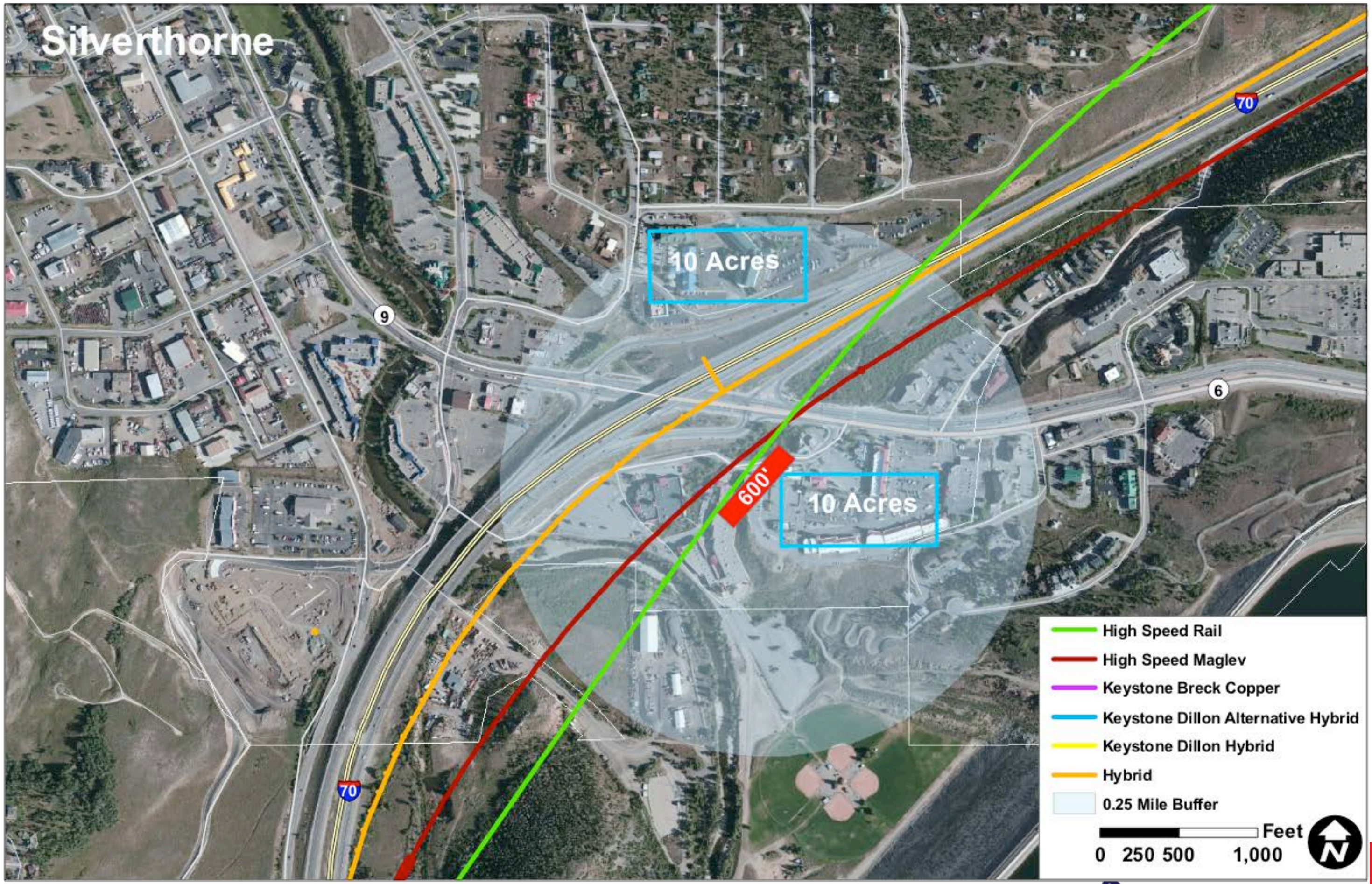
Summit County – Monday, March 11th

Jefferson County – Tuesday, March 12th

Clear Creek County – Thursday, March 14th

Eagle County – Monday, March 25th

Alignments and Possible Station Locations



CONCEPT STATION #1

10 acre site

1 acre/4 story parking structure- 600 spaces

Transit/passenger drop-off below platform

CONCEPT STATION #2

22 acre site

2 acre/6 story parking structure – 1500 spaces

Transit/passenger separate

AGS Objective: Refine Station Locations

1. Evaluation Criteria – Developability, Infrastructure capacity, transportation connectivity/access

2. Alignment and Technology Options/Constraints

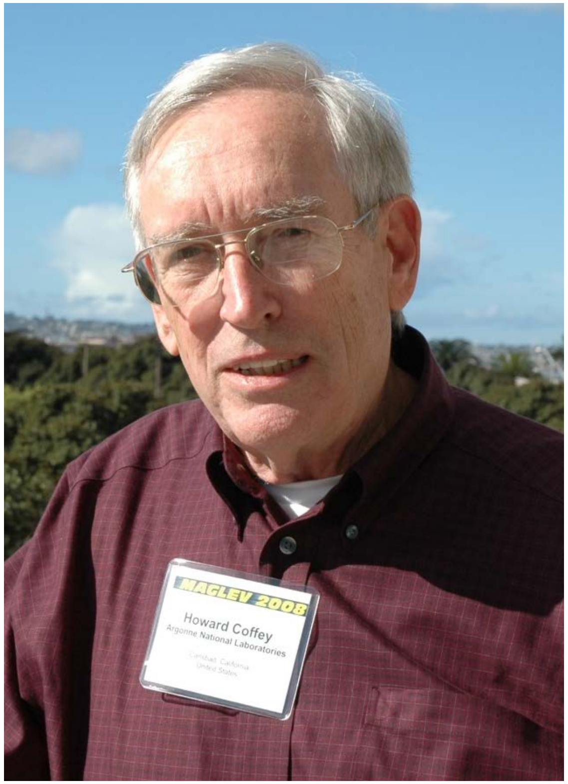
3. Ridership Estimates

AGS Feasibility Study

Maglev Technology Review

Basic Maglev Technology Facts

- *Maglev* – short for magnetic levitation (coined by Dr. Howard Coffey, Argonne National Laboratories, circa. 1968)
- Maglev allows high-speed transport with no increase in maintenance
- Maglev technology replaces wheels & bearings for support & alignment
- One size does not fit all (speed profile is predetermined by design)
- All maglev technologies are not created equal (i.e., initial capital cost & performance can vary greatly depending on technical approach)



Dr. Howard Coffey

Basic Maglev Technology Facts

- Maglev technologies are in various stages of development
  - Some are in the conceptual stage
  - Some are in the R&D stage
  - Some are mature, deployable, and certified for passengers
- Majority of maglev expertise lies overseas due to high levels of sustained governmental support – like the U.S. did for NASA
- Maglev transport is not rocket science – <u>it is beyond rocket science</u>
- Maglev *technology transfer* can launch new U.S. transportation infrastructure projects, eliminate weather-related transportation disruptions, & create lots of new, hi-tech American jobs

Some Maglev Technology History

A History of Magnetic Levitation Transportation Technology

1922
Hermann Kemper contemplates an electromagnetically levitated train (the principle of levitation using electromagnets in the track).

1934
14. August 1934
On, Hermann Kemper receives a patent for the magnetic levitation of trains (DPR 643 316).

1969
The HSB study group (Bölkow KG, Strabag Bau AG, Deutsche Bundesbahn) begins investigating the development and application of high performance, high speed rail systems under contract to the Federal Ministry of Transport. The high performance, high speed rail study (HSR study) is completed in 1972.

1971
Presentation of the first person-carrying ... vehicle by MesserschmittBölkow-Blohm (MBB) on the 660 m (0.4 mile) long test track at the company facilities in ... Manching.

Commissioning of the Transrapid 02 by Krauss Maffei.

Both vehicles utilize electromagnetic (EMS) levitation and guidance systems with ... asynchronous ... motor for propulsion.

1971

TR-02 (EMS) Propulsion - Asynchronous short-stator motor

1972
Commissioning of the Transrapid 03, an alterna... air cushion vehicle, by Krauss Maffei.

Development begins on an electrodynamic levit...n system (EDS-repulsive system) using superconducting coils b... project group consisting of AEG-Telefunken, BBC, and Sieme... Construction of a 900 m (0.6 mile) long,

1974
Thyssen Henschel and the Technical University of Braunschweig begin the development work on longstator propulsion for magnetic levitation systems.

Construction and commissioning of the unmanned component test unit (KOMET) by MBB continues at the company facilities in Manching.

1975
Development, commissioning, and operation of the first functional facility for longstator maglev technology begins with the test platform HMB 1 at the company facilities of Thyssen Henschel in Kassel.

1976
Commissioning of the Test Vehicle EET 02 at the Erlangen round test track. The vehicle utilizes electrodynamic (EDS) levitation with a synchronous motor for propulsion.

Commissioning of the world's first passenger-carrying, longstator test vehicle HMB 2 at the company facilities of Thyssen Henschel in Kassel.

1977
After extensive comparative analysis the Federal Minister ... Research and Technology (BMFT) decides in favor of the electromagnetic levitation system (EMS) with longstator linear motor propulsion. The research on the electrodynamic (EDS) levitation system (Erlangen Test Vehicle) is stopped.

1977

German Federal Minister of R&T decides in favor of EMS with long stator linear motor propulsion

1978
The "Magnetbahn Transrapid" consortium is formed (MBB as lead company, Thyssen, AEG, BBC, Siemens, Dynidag, and Krauss Maffei) and definition work begins on the Transrapid Test Facility ...

1979
Operation of the world's ... maglev ... propulsion (Transrapid 05) ... for passenger transportation occurs at the International Transportation Exhibition (IVA 79) in Hamburg. During the three weeks exhibition, the Transrapid 05 carries more than 50 000 passengers in scheduled operation.

1979

TR-05 Licensed to carry passengers. Transports 50,000 at 3-week exhibition.

1980
Construction begins on the guideway at the Transrapid Test Facility in Emsland (TVE) and on the test vehicle Transrapid 06.

1981
The Versuchs- und Planungsgesellschaft für Magnetbahn... Munich. The parent companies today are the Deutsche B... Lufthansa (LH). The MVP is owner and operator from the TVE being subcontracted to the Industrieanlagenbetriebsgese...

1983
Commissioning of the Transrapid 06 begins.

The vehicle consists of two sections with a total length of ... weight, 192 seats, electromagnetic levitation and guidance system, propulsion using a synchronous longstator linear motor, power generation for the on-board supply using linear generators, and 400 km/h (250 mph) design speed.

1984
Completion and commissioning of the first portion of the Transrapid Test Facility in Emsland (TVE).

... The Transrapid 06 achieves a speed of 355 km/h (220 mph) on the portion of guideway available at the Test Facility.

Work on the second portion of the TVE guideway begins. The southern loop has a length of approx. 10 km (6.2 miles) and is built with Thyssen Henschel as general contractor.

1987
Construction and commissioning of the southern loop of the Transrapid Test Facility is completed. A closed circuit with two loops and a total length of 31.5 km (19.6 miles) is now available for long-term operation under conditions similar to actual applications.

December 1987
The Transrapid 06 reaches a speed of 392 km/h (244 mph).

Integration work on the Transrapid 07, the prototype application vehicle designed for speeds of up to 500 km/h (310 mph), begins at Thyssen Henschel in Kassel.

1988
January 1988
The Transrapid 06 surpasses its own design speed on numerous runs and sets a new world record of 412.6 km/h (256 mph) for passenger-carrying, maglev vehicles.

Long-term operating tests under near-application conditions begin with the Transrapid 06 at the TVE.

The Transrapid 07 is presented for the first time in public at the International Transportation Exhibition (IVA 88) in Hamburg. The vehicle is subsequently put into long-term operation at the TVE.

The Transrapid 07 consists of two sections with a total length of 51 m (167 ft), 92 t vehicle ... n using a synchronous ... neration for the on-board ...) operating speed.

1991
November 1991
After extensive tests and analyses, the Deutsche Bundesbahn in cooperation with

Some Maglev Technology History

renowned universities approves the technical readiness for application of the Superspeed Maglev System Transrapid. This achieves the prerequisite for inclusion of this new train system in the Federal Transportation Master Plan and allows planning and approval work for application routes in Germany to begin. With this certification, the basic development of the superspeed maglev system is considered to be completed.

1992

15 July 1992

The Federal Government decides to include the Transrapid maglev system route Berlin-Hamburg in the Federal Transportation Master Plan. The nearly 285 km long connection between Germany's two largest cities had shown itself to be particularly attractive in an extensive investigation of potential routes. The use of the maglev system will reduce the travel time to less than one hour (with three intermediate stops).

1993

Spring 1993

The Magnetschnellbahn Berlin-Hamburg GmbH is formed by Daimler Benz AG/AEG AG, Siemens AG, and Thyssen Industrie AG, to realize the Transrapid maglev route Berlin-Hamburg.

10 June 1993

Under normal operating conditions, the Transrapid 07 achieves a new world speed record of 450 km/h (280 mph) at the Transrapid Test Facility. Just a few days earlier, the Transrapid achieves a non-stop distance of over 1 664 km (1034 miles) during a series of endurance runs. This is equivalent to a trip from Hamburg to Rome.

December 1993

The Magnetschnellbahn Berlin-Hamburg GmbH in conjunction with renowned banks, presents the "Concept for the Financing and Private Sector Operation of the Transrapid Maglev Route Berlin-Hamburg" to the government. For the first time in German transportation history, this financing concept proposes the financing of a major infrastructure project without significant impact on the public budget. The concept foresees a private sector operation of the route and a reimbursement of the government's investment for the guideway through leasing payments by a private Operations Company.

1994

2 March 1994

The government approves the realization of the Transrapid Maglev Route Berlin-Hamburg based on the financing concept proposed by the private sector partners.

September 1994

The Maglev Systems Planning Law is passed by the Federal Parliament which establishes the legal prerequisites required for the official planning of the Berlin-Hamburg Project. This law defines the planning process required for maglev routes in Germany and is thereby analogous to the existing planning laws for highways and railroads.

13 October 1994

The Maglev System Planning Company is formed in Schwerin. Government and private industry are equally represented in the company. The Planning Company will coordinate the legal planning and approval process of the world's first Transrapid route between Berlin and Hamburg.

1995

April 1995

Revenue operation begins at the Transrapid Test Facility in Emsland with visitors paying DM 20 per person for the opportunity to experience the world's fastest train ride (open to the general public). To meet the growing visitor demand, an expanded schedule is introduced with up to 8 visitor rides per day, 6 days a week.

October 1995

Transrapid International GbR is formed by Daimler-Benz AG/AEG AG (later through the fusion with ABB, the name is changed to Adtranz), Siemens AG, and Thyssen Industrie AG, to promote and coordinate the world-wide marketing and project activities of the Transrapid.

1996

February 1996

The Executive Board of Deutsche Bahn AG (German Railways) officially approves the participation of DB AG in the project as an equity shareholder (DM 300 million) in the Operations Company and as the future operator of the Transrapid route.

May 1996

The Planning Company officially presents its recommendation for the Transrapid route alignment between Berlin and Hamburg. This alignment, chosen from 13 alternatives (including the alignment used for the financing concept), will be the preferred alignment for the public legal planning process. The selection was based on a detailed investigation of all route alternatives including alignment difficulties, environmental impact, city entrances/exits, station locations, ridership, investment/operating costs, and revenue potential.

The preferred alignment consists of 292 km of double track (55% at-grade, 45% elevated), 5 stations, and 11 propulsion system substations. A one hour trip time (with intermediate stops), a maximum revenue speed of 450 km/h, and ridership volume 23% higher than the original financing concept route are anticipated. With the preferred alignment, the preliminary planning phase is completed (map scale 1:25 000).

May/June 1996

The German Parliament overwhelmingly passes the General Maglev Systems Law and the Maglev Systems Requirements Law, the second and third pieces of legislation required to implement the Transrapid Project Berlin-Hamburg. The General law covers theoperating and safety regulations for maglev systems as well as the regulating authorities and the Requirements law defines thenecessity of the maglev system for the route, the premises upon which the decision was based, and the procedures for the public legal planning process at the town and county level.

July 1996

The Regional Planning Process phase (ROV: Raumordnungsverfahren) officially begins. In this first phase of the public legal planning process, the project and route are scrutinized on a regional level by the government, state, and local departments and authorities involved in infrastructure projects (map scale 1:5 000).

1997

April 1997

Thyssen presents a full size model of the newest Transrapid generation at the Hannover Fair. The Transrapid 08, a 3-section, passenger train similar to those foreseen for the Berlin-Hamburg route, will be built on pre-production tooling in the Thyssen Transrapid System GmbH plant in Kassel. It will commence operation at the Test Facility in Emsland in 1999 and be used to achieve the type approval certification required for the Berlin-Hamburg Project. Designed for 550 km/h operation, the new train will be lighter, more aerodynamic, quieter, and more economical than its predecessor, the Transrapid 07.

25 April 1997

German Transport Minister Wissmann announces that the first of the two project economic viability evaluations has successfully been completed and that the government fully supports the continuation of the project. Included in the evaluation were new ridership/revenue estimates as well as revised investment and operating cost estimates based on the preferred alignment and the current project layout and planning.

To compensate for lower ridership and revenue figures, the operations concept for the route is revised and the initial delivery contents downsized to reflect the lower figures. At the same time, a marginal rise in the investment costs reflect the longer preferred alignment, the current planning level, and the updating of project costs from 1993 to 1996 DM. Overall, the investment costs now total DM 9.983 billion with DM 6.269 billion for the guideway infrastructure and DM 3.713 billion for the trains, propulsion/energy supply, and supporting equipment and facilities. A restructuring of the original 1993 public/private financing concept is required before the German Government pledges its continued political and financial support.

In this restructuring, Adtranz, Siemens, and Thyssen continue as equity partners in the financing consortium and Deutsche Bahn AG (DB AG) replaces the three construction companies previously involved in the project. In addition to its original role as operator of the Berlin-Hamburg route, DB AG will also serve as general contractor for the guideway infrastructure and stations. The Government will continue to finance the guideway infrastructure with an interest-free loan to DB AG. A private financing consortium with Adtranz, Siemens, and Thyssen as main partners will fund the remainder of the project. The public and private investors will be reimbursed for their contributions by DB AG over the course of the financing period.

June 1997

With the submittals of the states of Berlin and Brandenburg, the Regional Planning Process phase (ROV) is officially completed. Together with the reports of the states of Mecklenburg-Vorpommern (January), Hamburg (March), and Schleswig-Holstein (April), the planning now enters the Concept Design Planning phase (REP: Rahmenentwurfsplanung). In this phase, the planning documents will be scrutinized internally by the authorities for technical and economic issues.

July 1997

The German Parliament passes the Maglev Systems Ordinance which defines the requirements for the construction and operation of maglev systems as well as designates the Federal Railway Administration (Eisenbahn Bundesamt) responsible for overseeing and certifying the required activities. Divided into three parts, the law includes ordinances for construction and operation, for noise protection standards, and for noise protection measures. With passage of this law, the legal framework required for the realization of Transrapid routes in Germany is completed.

August 1997

The total Transrapid „mileage" at the Test Facility in Emsland surpasses the 500 000 km (310 000 miles) mark. Since 1991, over 156 000 passengers have taken the opportunity to ride the Transrapid at speeds up to 420 km/h (260 mph) with many times that number visiting the facility.

1998

5 May 1998

Transrapid International GmbH & Co. KG (TRI) is formed in Berlin as a joint company of Adtranz, Siemens, and Thyssen. TRI will be the primary customer contact and provide system engineering, project management, marketing, and maintenance support services for the Transrapid Maglev System.

Summer 1998

The Concept Design Planning phase (REP) for the first route segments is completed and they move into the last planning phase, the Plan Determination Process phase (PF: Planfeststellungsverfahren, map scale 1:1 000). All planning segments are expected to enter this final phase by the end of the year. Only after completion of this phase can construction permits be granted for a given segment.

September 1998

The ground breaking ceremony for the new Lehrter Train Station occurs in Berlin. This multi-modal station will serve as the end station for the Transrapid in Berlin as well as being a hub for ICE, regional, and suburban (S-Bahn) trains.

October 1998

The newly-elected "Red Green" coalition Government officially pledges its commitment to the Transrapid technology and the Berlin-Hamburg Project. This commitment reaffirms the original commitments as defined in the "Key Points Paper" signed by the project partners in April 1997. In this agreement, each side committed to financing their portion of the costs - DM 6.1 billion from the Government for the infrastructure (via DB AG) and DM 3.7 billion from the private sector partners for the operating system (supporting equipment and trains).

Some Maglev Technology History

TRI forms Transrapid International-USA (TRI-USA), a wholly-owned subsidiary in the United States. Based in Washington DC, TRI-USA will be the local partner for all projects involving Transrapid technology in the US. Its primary activities will include marketing, government relations, and project and planning support. The formation of this subsidiary reflects the growing interest in the US to realize transportation projects using the Transrapid technology, as demonstrated by the inclusion of the Maglev Deployment Program in the 1998 TEA-21 infrastructure law.

In December, the total Transrapid „mileage" at the Test Facility in Emsland surpasses the 600 000 km mark. The number of paying passengers now totals over 220 000.

1999

Late Spring 1999
The Berlin-Hamburg Project contract negotiations between the German Federal Government, DB AG, and TRI resume (they were broken off in Summer 1998 due to the upcoming federal election). These contracts will regulate all aspects of the procurement,construction, operation, and financing of the project (including guarantees, responsibilities, risk assessment, etc.). In preparation for these negotiations, all investment, operating, and maintenance costs are updated to reflect the changes in the project since the last economic viability evaluation (1997). The signing of these contracts will clear the way for construction to begin in the year 2000.

Spring Summer 1999
Installation of new equipment at the Transrapid Test Facility continues. These improvements will support the final type approval certifications required for the Berlin-Hamburg Project. These include a second propulsion system substation in the northern loop, an upgrading of the operation control system with new equipment, antennas along the route and softw and improved guideway switch control equipment.

April 1999
Commissioning begins on a new 3-way guideway switch at the Thyssen Transrapid Sy plant in Kassel. This 78 m long, low speed switch with 100 km/h turn-out speed, utilize flexible, steel guideway beam with rack and pinion drives. Designed to access three different tracks, it will be used extensively in the Berlin-Hamburg Project. It will underg approx. 6 months of controlled-environment testing in Kassel in preparation for the typ approval certification work.

August 1999
The Transrapid 08 (TR08) is delivered to the Transrapid Test Facility. This 3 section, pre-production, Berlin-Hamburg train is 79.70 m long, weighs 188.50 t, and has first and second class seating for 190+ passengers. Designed for 550 km/h operation, the TR08 carries Deutsche Bahn colors and has all of the amenities found on a modern high speed train (including toilets, overhead baggage racks, and pressure-sealed passenger compartments). Commissioning of the TR08 is completed in late Fall 1999. The TR08 has been built primarily for the type approval certification work for the Berlin-Hamburg Project as well as being an attraction for the World Expo 2000 Exhibition in Hannover in Summer 2000.

10 August 1999
On 10. August, a new hybrid (concrete/steel) beam is installed into the canal (straight) portion of the Test Facility. This new combination concrete and steel beam resulted from the Berlin-Hamburg guideway bidding process and holds promise of becoming the third beam type available for project use (after pure steel and pure concrete). The 62 m long, double span beam weighs approx. 350 t and has a pre-stressed, post-tensioned, reinforced concrete body and bolted-on, steel cantilever areas (functional surfaces). It will undergo extensive testing during Fall 1999 with the ultimate goal of type approval certification in the year 2000.

November 1999
The Chinese Ministry of Science and Technology" and Transrapid International sign a „Letter of Intent" with the goal of selecting an appropriate Transrapid route in China as well as investigating its implementation from technical and economic viewpoints.

2000

January 2000
The plan determination process record of decision for the first planning segment of the Berlin-Hamburg route is released (required for the approval of construction permits).

5 February 2000
On 5. February, German Government, Deutsche Bahn AG, and the industrial partners sign an Agreement to cancel the Berlin-Hamburg Project. The decision to cancel the project came after months of negotiations between the partners and numerous attempts to improve the project's financial viability did not bring the desired effect. The cancellation was ultimately due to the lack of political will and to difficulties in the financing of the publicly-financed portion of the project. At the time of cancellation, the project was less than 6 months away from start of construction. Revenue service was planned to begin in 2006.

Spring 2000
During the Spring, an intensive search begins to identify regional transportation projects appropriate for the Transrapid technology and to determine their viability. Five projects are identified and feasibility studies are conducted:

- Berlin Lehrter Train Station Berlin Schönefeld Airport (28 km / 17 miles)
- Munich Main Train Station Munich Airport (37 km / 23 miles)
- Düsseldorf Main Train Station Düsseldorf Airport Duisburg Essen Bochum Dortmund (all train stations) (78 km / 48.5 miles) with extension to Dortmund Köln/Bonn Airport ("Metrorapid")
- Frankfurt Airport Hahn Airport (108 km / 67 miles) with extension to Frankfurt Main Train Station

Chinese begin construction of Shanghai maglev line using TR-08 technology

Transrapid Test Facility and ride the Transrapid 08 at 400 km/h (250 mph).

June October 2000
Between June and October, the Transrapid Test Facility is a satellite exhibition center for the World Expo 2000 in Hannover. The Transrapid 08 carries 67 000 paying passengers on 566 trips, traveling a total of 43 600 km (27 100 miles).

July 2000
In July, the total Transrapid „mileage" at the Test Facility in Emsland surpasses the 700 000 km (435 000 miles) mark. The number of paying passengers now totals over 250 000.

23 August 2000
An Agreement is signed by the German Government, Deutsche Bahn, and the industrial partners for the retention and optimization of the Transrapid technology for use in a future application. This agreement commits Government funding for personnel, technology work related to regional applications, and the Test Facility for two years until a new revenue application is approved in Germany.

10 October 2000
The German Minister of Transport, Reinhard Klimmt and the US Secretary of Transportation, Rodney Slater sign a Memorandum of Cooperation (MOC) for the Transrapid maglev technology. The intent of the MOC is to foster cooperation between the two countries on safety and environmental standards for the operation of the Transrapid maglev system and an information and experience exchange to facilitate the near-term implementation of the Transrapid in revenue operation in both countries. The MOC provides additional support for the US Maglev Deployment Program. This program, created in 1998 by the US Congress, budgets one billion dollars for the planning and construction of one or more maglev projects. The Transrapid technology is foreseen for six of the seven projects currently in planning.

27 October 2000
The German Minister of Transport, Reinhard Klimmt and the Ministers-President of Bavaria, Edmund Stoiber and of North Rhine-Westfalia (NRW), Wolfgang Clement sign an agreement for in-depth studies of the Munich and NRW Metrorapid projects. These two projects were chosen for further planning with the goal of implementing one or both projects. The studies are ... final decision on the project(s) ... is expected in Summer 2002.

2001

2001

18 January 2001
The US Secretary of Transp... announces that the Baltimore-W... Pennsylvania Projects have b... planning/engineering phase (... receive approx. US$10.5 million to complete the ...ironmental Impact Statement (EIS) and preliminary ...work foreseen in this two year phase.

23 January 2001
The construction contract for the world's first commercial high-speed maglev route, the Shanghai Airport Link is signed. The 30 km (19 miles), double track route extends from a subway station on the East side of Shanghai to the Pudong International Airport. Construction will begin in February with demonstration operation foreseen in January 2003 and commercial operation foreseen inearly 2004. The project partners are the City of Shanghai and the German industrial consortium consisting of Siemens, ThyssenKrupp, and Transrapid International. The Chinese will supply the guideway infrastructure, stations, and operating facilities and the German industrial consortium will supply the Transrapid maglev technology (vehicles, propulsion, operation control system, and individual guideway components).

January 2001
The German Government releases preliminary planning contracts for the NRW Metrorapid and Munich Airport Link Projects.

The total Transrapid „mileage" at the Test Facility in Emsland surpasses the 728 000 km (450 000 miles) mark. The number of paying passengers now totals over 330 000.

February 2001
Construction begins in Shanghai on the construction road along the route.

March 2001
Construction begins in Shanghai on the guideway beam factory located mid-way along the route. This 1.8 km (1.1 mile) long factory will produce approx. 2600 hybrid guideway beams with a rate of 10 beams/day over the one year production period. Approx. 1700 workers will be employed on 16 production lines. The first production prototype beam is foreseen for July.

April 2001
The parent companies of Transrapid International, Siemens, ThyssenKrupp, and Adtranz reach an agreement to allow Adtranz to formally withdraw from the joint company. Long anticipated, this action was precipitated by the DaimlerChrysler's sale of Adtranz to Bombardier.

2002

January 2002

Some Maglev Technology History

Transportation Research Board annual meeting attendees get update on Shanghai project and see photos of a maglev route in the advanced stages of construction. Project is on schedule and expected to be conducting test trials fall of 2002, with operations to begin January of 2003.

February 2002
German Transport Minister, Kurt Bodewig, announces selection of two sites for Transrapid maglev construction: Düsseldorf to Dortmund in Rhineland-Westphalia, and an airport connector in Munich, Bavaria.

December 2002
At 10:10 am local time on New Year's Eve, German Chancellor Gerhar[illegible]ins Chinese Premier Zhu Rongji, along with other dignitaries and jo[illegible]eremonial debut run of the Transrapid Shanghai Project. The three-sectio[illegible]ches its design speed of 430 km/h (267 mph) during the round-trip between L[illegible] Road Station and Pudong Internationa[illegible]

2003

October 2003
At part of scheduled testing [illegible] the Shanghai maglev system reaches a record speed of 471 km/h (293 mph) [illegible] -section trainset. To date the project has carried over 170,000 pa[illegible] passengers since public demonstration runs began in January.

2003

November 2003
O[illegible]vember 12, a five-section Transrapid vehicle sets a new speed record of 50[illegible] km/h (311 mph) [illegible] part of scheduled testing in Shanghai. The speed is the hi[illegible] reached by the Shanghai proje[illegible] top speed for the Transrapid system.

Nov. 12, 2003 TR-08 Achieves Top Speed of 501 K/hr (311 mph) on 19-mile Shanghai line

Dec. 2, 2003 Central Japan Railway's Superconducting EDS Maglev Achieves Railway World Speed Record of 581 K/hr (360 mph)

2004

January 2004
The Shanghai project commences revenue service seven days per week.

April 2004
The Sh[illegible] Transrapid System achieves final acceptance, officially ending the co[illegible]issioning period and beginning full commercial service.

2005

2005

February 2005
[illegible] Transrapid system in Shanghai continues successful revenue operations. To date, the sys[illegible] has carried over 2,500,000 paying passengers and traveled over 1,287,000 km (800,0[illegible]iles).

HSST "Linimo" line begins 9-station 5.6-mile service in Nagoya, Japan to launch 2005 World Expo - carries 10 million passengers in first three months of operation without incident

PLT Maglev Technology Questions

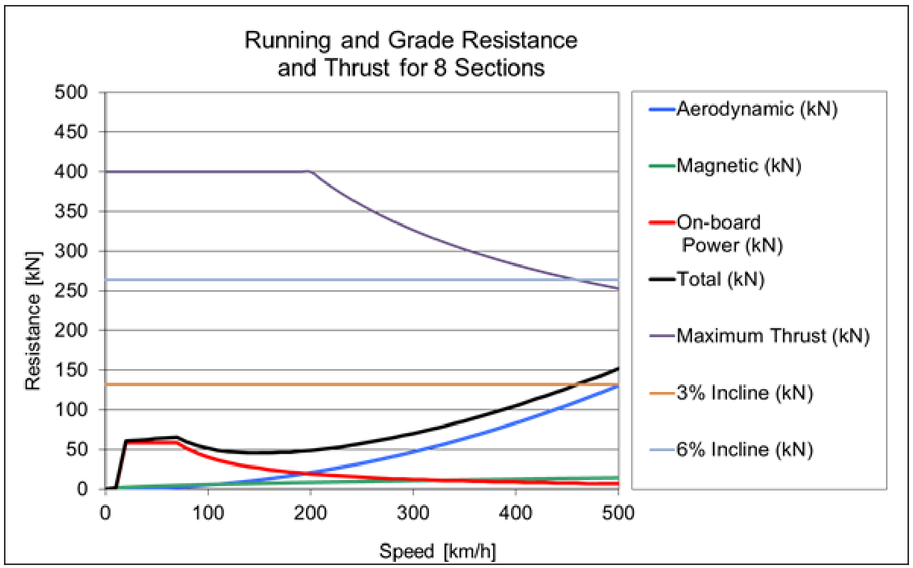
- 1. What assurance or proof do we have that a maglev system can operate on the grades in the I-70 corridor (maximum 7%)?
- 2. Do snow and ice impact maglev operation?
- 3. Will large changes in temperature affect maglev operation (i.e., guideway expansion and contraction?
- 4. Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail? And, can we quantify the costs on a per mile basis?
- 5. What are the pros/cons of a so-called smart track-dumb vehicle and dumb track-smart vehicle? What are the implications regarding weight, grades, speed, need for overhead catenary, etc. ?
- 6. What are the steps needed to be able to receive some level of safety certification for a maglev system? How long will it take? Who will lead?

1. What assurance or proof do we have that a maglev system can operate on the grades in the I-70 corridor (maximum 7%)?

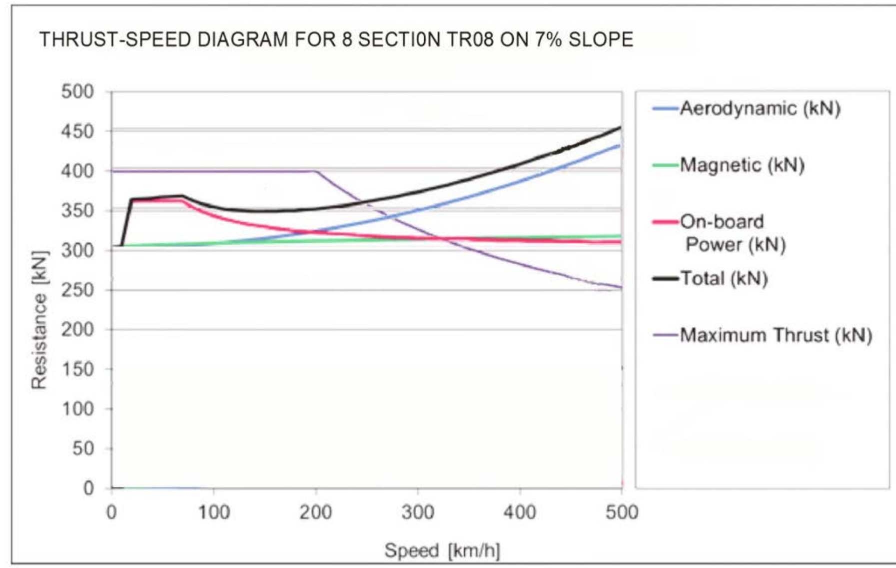
- Grade climbing ability is a function of motor torque or, in the case of maglev motor technology, thrust. Einstein proved that acceleration at 0.1gees was the sensory equivalent of climbing a 10% grade in the early 1900's.
- I asked Dr. John Harding, the last former Chief Maglev Scientist at the FRA, to analyze the data provided by various technology providers being considered for the AGS. GA, AMT, and TRI demonstrated and independently verified that their motors had sufficient thrust to climb the 7% grades in the corridor, which is about the incline limit for passenger comfort.
- However, he emphatically points out that only Transrapid and HSST have demonstrated vehicle stability at speeds above 35 mph – stability at high speeds cannot simply be extrapolated from low speed data. For the last ten years, the TR-08 has operated daily in Shanghai at two different top speeds, 185 mph and 267 mph, depending on the schedule. The Nagoya HSST runs daily at 60mph since 2005. Both have demonstrated on time – to the second – reliability of 99.97% in all weather conditions.

1. What assurance or proof do we have that a maglev system can operate on the grades in the I-70 corridor (maximum 7%)?

Example Of Data Provided By TRI



Data Verified By
Dr. John Harding
FRA Chief Maglev Scientist (Retired)

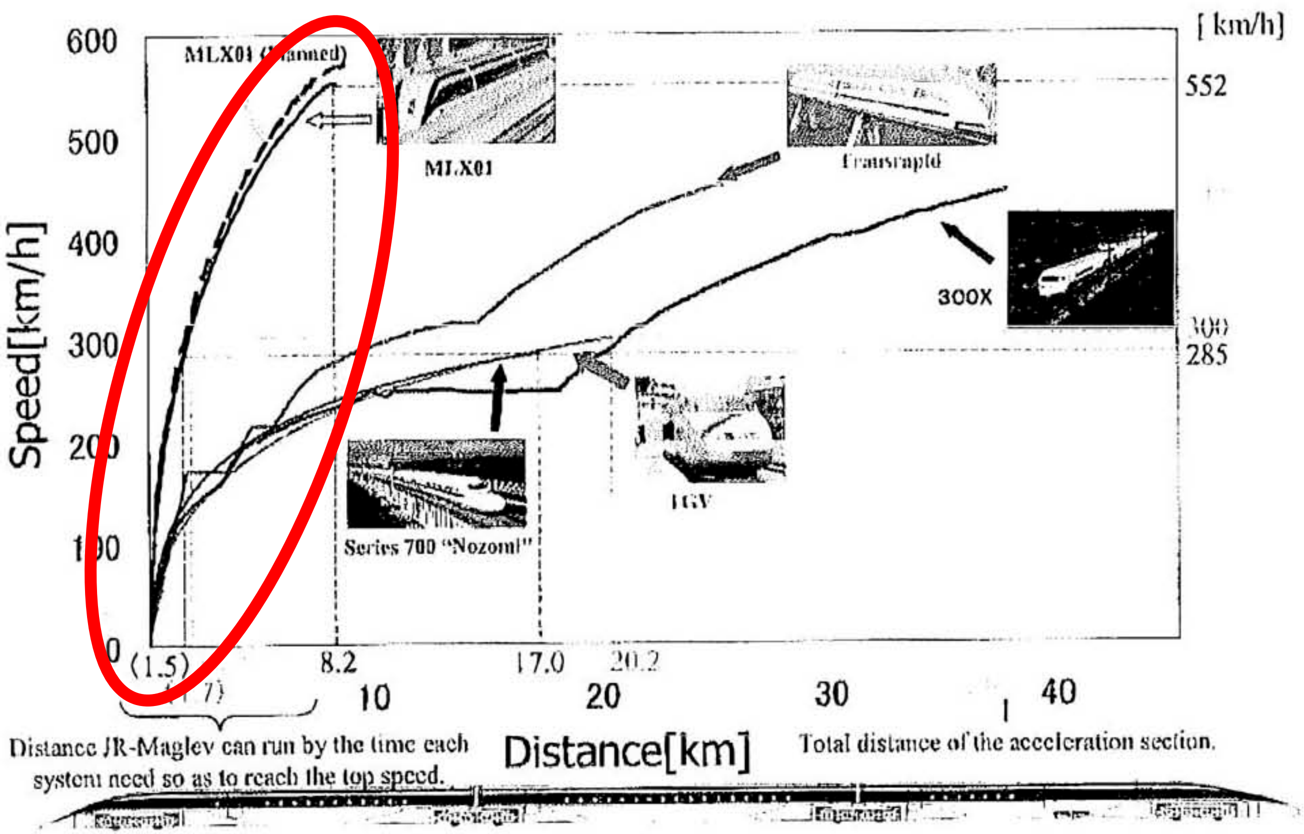


***"These charts show the maximum steady speed of TR08 on a 7% slope. I was able to move the train resistance plots up to the 7% level @305 km/h to show the intersection with the "max thrust" (purple plot) with the "total kN" (black plot)," Dr. John Harding*.**

CJR Superconductor Maglev Acceleration To Top Cruising Speed

Characteristics of Superconducting-Maglev

CJR MLX01 Superconducting Maglev's Superior Acceleration



1. What assurance or proof do we have that a maglev system can operate on the grades in the I-70 corridor (maximum 7%)?

Now for a brief video of a low speed (60 mph) in action

2. Do snow and ice impact maglev operation?

- The video clip clearly shows the non-impact of ice and snow on maglev.
- Frequent operations on any commercial maglev line are expected to keep the line open because each passing vehicle will physically clear the guideway as well as generate heat in the guideway stator packs and side rails.
- Also, ice build up of 5mm is allowable on Transrapid's lateral guideway surfaces that interact with magnets (half the 10mm clearance on each side) and 5mm is allowed on the vertical mating surfaces (under the guide stator packs). 10cm of snow can accumulate on guideway surface with no impact.
- In extreme situations, the new modular Boegl Guideway can be heated (rated at 130 watts per meter) to clear ice from the guideway active surfaces.
- Snow removal vehicles can be used for the removal of heavy overnight accumulations if the line is ever shut down.

2. Do snow and ice impact maglev operation?

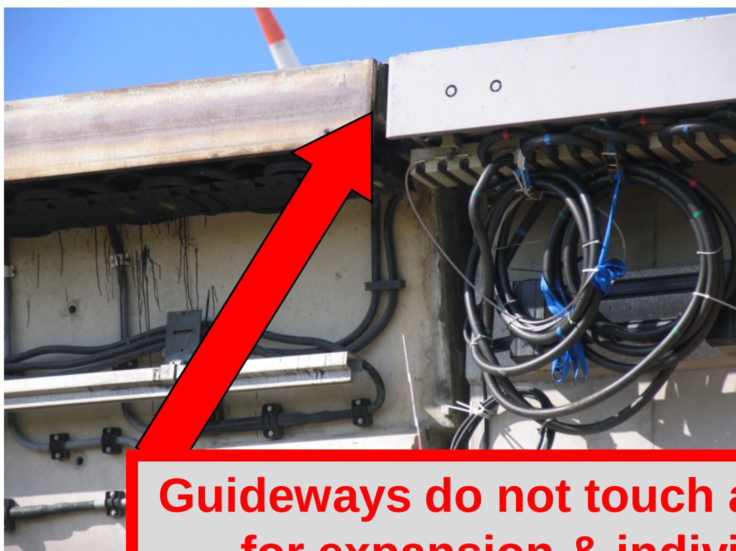
Specs On Boegl Guideway Ice Clearances

12 cm clearance on deckplate

5 mm guide rail (each side & underneath)

3. Will large changes in temperature affect maglev operation (i.e., guideway expansion and contraction?

- Decades of testing have shown that maglev guideways of various designs do maintain their structural integrity and specification envelope. In other words, maglev systems can operate in very cold and very hot conditions, which was certainly the case at the German test track (TVE) in Emsland, Nagoya (HSST) & Yamanashi (MLX01), Japan, and in Shanghai.



Guideways do not touch allowing for expansion & individual adjustment to set alignment

4.a Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail?
4.b Can we quantify the costs on a per mile basis?

- The whole point behind the decades old pursuit of maglev transport technology was to discover a way to travel faster, safer and with little or no "***speed/maintenance penalty*. "** This has certainly been born out by all the maglev research & development activity.
- One need only look at the chart on the next page to see the severity of the problem.

4.a Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail? YES!

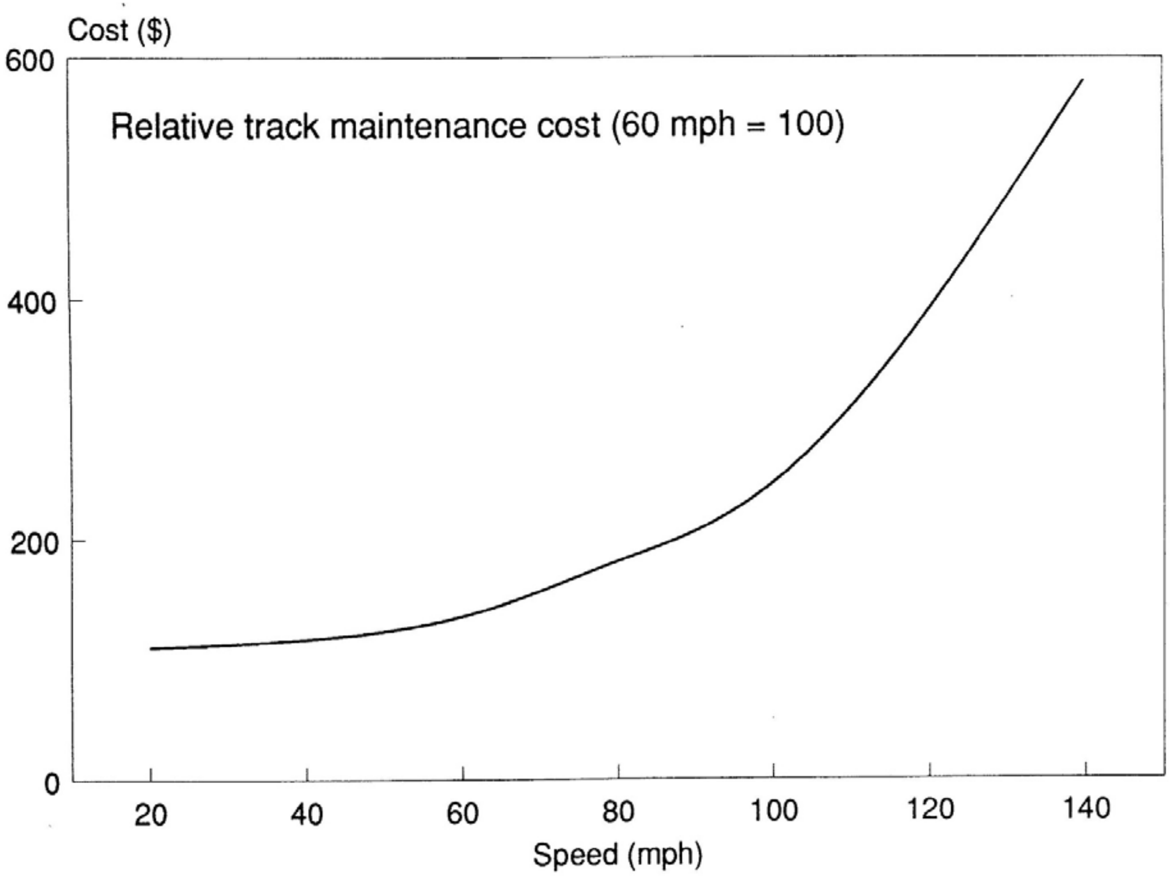
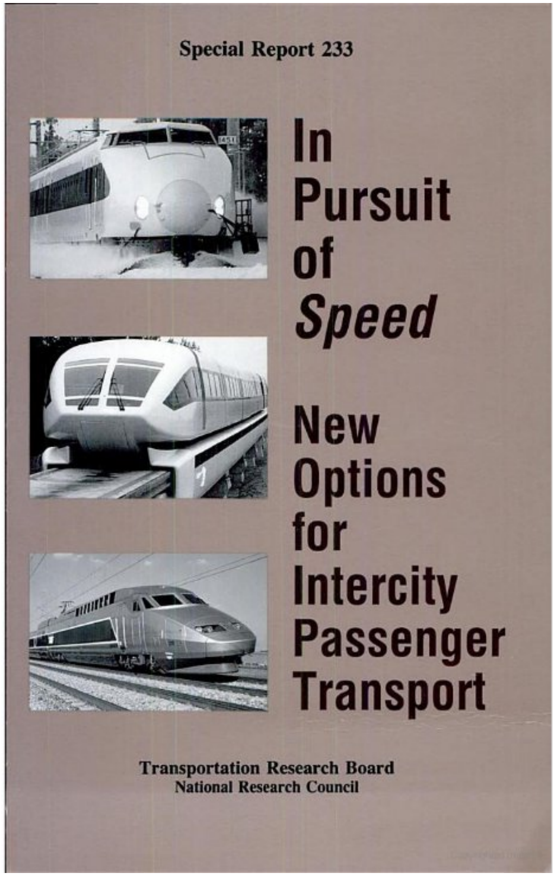


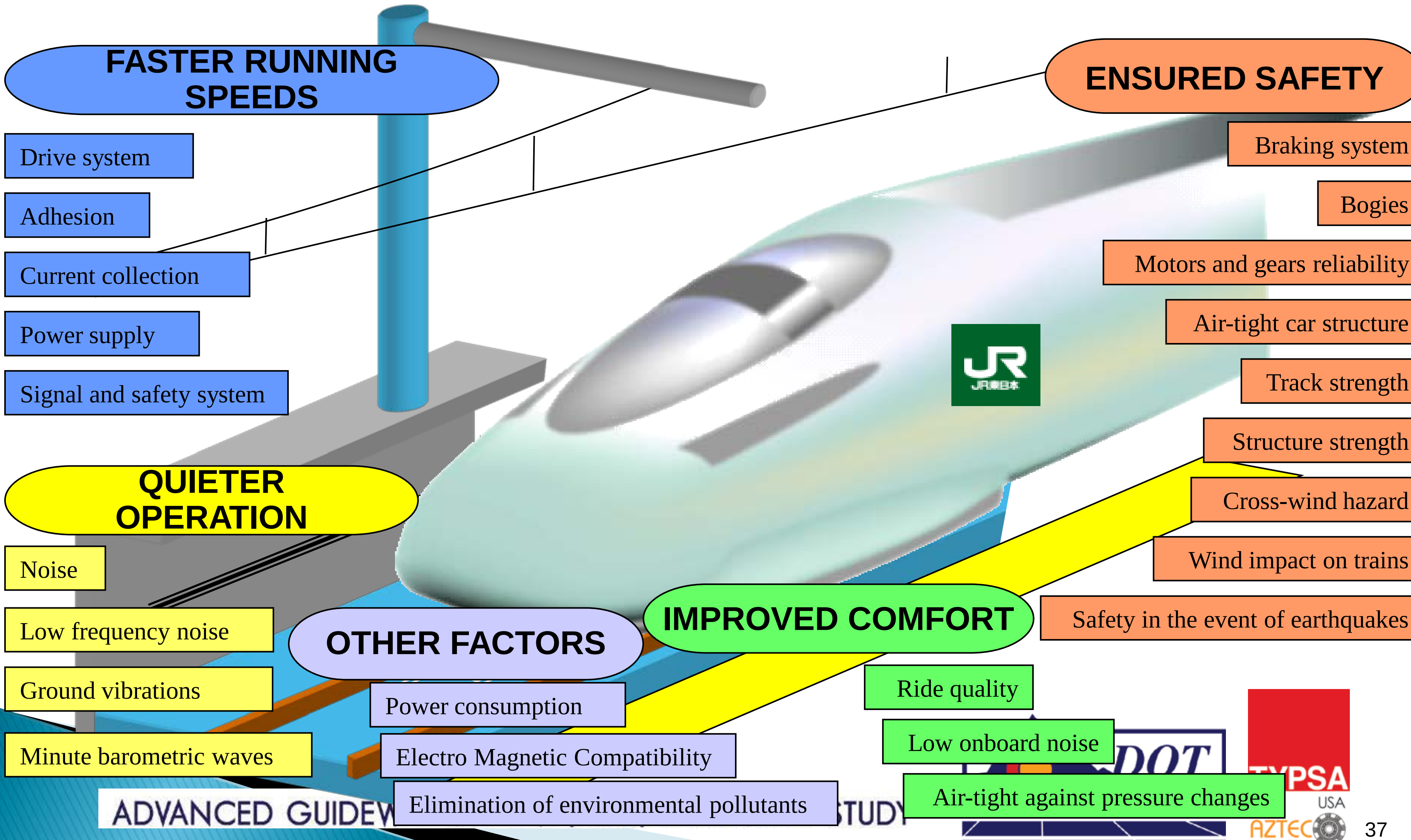
FIGURE 3-1 Rail maintenance costs as a function of operating speed. (Reproduced with permission from *Technology Review*, © 1986.)



Transportation Research Board 1991

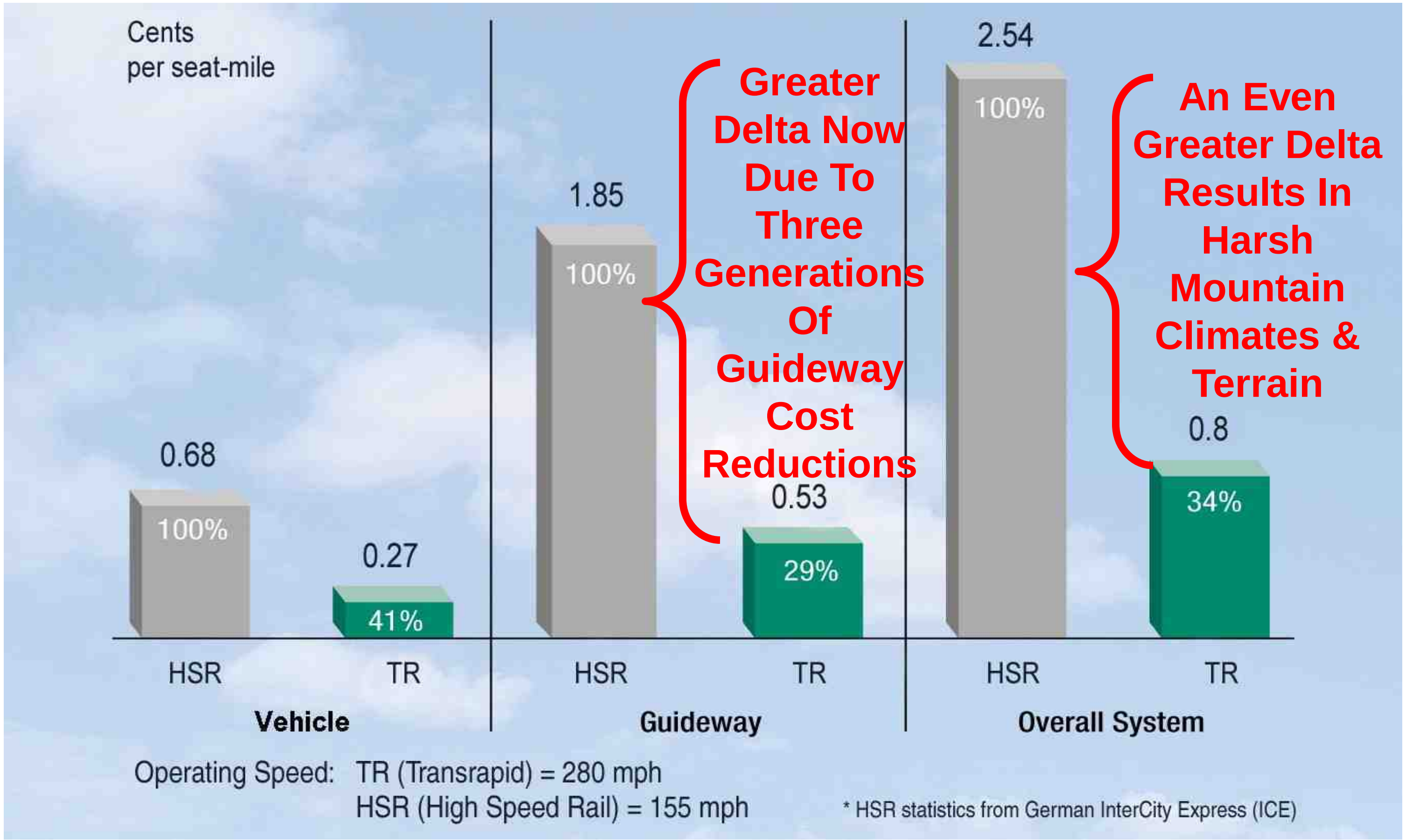
4.a Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail? YES!

Many Factors Behind The High Costs Of 220 Mph HSR



4.a Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail? YES!

No Moving Parts = Much Lower Maintenance



4.a Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail?

Lower Maintenance = Higher Reliability

Modular electronics allow for quick and simplified repair and replacement

4.a Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail?

From: samson
Sent: Thursday, March 07, 2013 8:08 AM
To: kc
Subject: Re: Question for you

Hi, Kevin,

I have to confess that you have a good memory of what Dr. Zeng told you that day. Actually, **not only the energy consumption but also the noise emission are the same case that 300km/h high speed rail way equals 430km/h Maglev.**

With regard to the maintenance of the track, there is no need for maintenance every day but some routine check is already enough, which really cost very little during daily operation and maintenance.

As for the **maintenance of the vehicle**, the **only thing we should do every day is to replace failed pcbs in case of alarm which means very less manpower and time resulting in of course high availability of the vehicle. Those high pcbs share high MTBF (mean time between failures), so the failure rate is very low.**

Best regards,

xujuchuan

4.a Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail?

Xujuchuan was the CFO of the SMTDC. He also told me that the guideway has undergone **only two weeks' worth of maintenance in the last ten years.** One week for adjusting support bearings on one column, and one weeks' worth for another. This is for a system that runs 115 consists per day at 185mph and 267mph.

Compare this with the **CJR's Tokaido Shinkansen Line between Tokyo and Osaka** which runs 309 trains daily up to 167mph**. Each night, between midnight and 6:00am, 3,000 workers attend to successive 12 mile sections of the line for repair and maintenance.** If a repair takes longer than the 6 hour window, the next day's schedule is thrown into disarray. Tracks are typically replaced every three to four years, according to the Japan's **Railway Technical Research Institute and CJR**. This is a major reason that the **CJR is deploying its superconductor maglev on the new Chuo Shinkansen line from Tokyo to Nagoya, 80% of the 220-mile , 45-minute trip will be in tunnels.**

4.a Is there conclusive evidence of maintenance being lower for maglev than conventional steel-wheel-on-steel rail?

U.S. Track Classes

In the United States, the Federal Railroad Administration has developed a system of classification for track quality.[6][7] The class of a section of track determines the maximum possible running speed limits and the ability to run passenger trains.

Track type	Freight train	Passenger
Excepted [us 1]	<10 mph (16 km/h)	*not allowed*
Class 1	10 mph (16 km/h)	15 mph (24 km/h)
Class 2	25 mph (40 km/h)	30 mph (48 km/h)
Class 3	40 mph (64 km/h)	60 mph (97 km/h)
Class 4 [us 2]	60 mph (97 km/h)	80 mph (129 km/h)
Class 5 [us 3]	80 mph (129 km/h)	90 mph (145 km/h)
Class 6	110 mph (177 km/h)	
Class 7 [us 4]	125 mph (201 km/h)	
Class 8 [us 5]	160 mph (257 km/h)	
Class 9 [us 6]	200 mph (322 km/h)	

4.b And, can we quantify the costs on a per mile basis?

- The simple answer is “**NO.**”
- Here’s why…

4.b And, can we quantify the costs on a per mile basis?

From: samson
Sent: Monday, March 04, 2013 8:50 PM
To: kc
Cc: zengguofeng
Subject: Re:Question for you

Hi, Kevin,
You send us a list of questions regarding comparison between Maglev and High speed railway. Actually, i don't know how you will do the comparison. Base on our experience, **it is very hard to compare the two technology without a specific project. And you cannot simply compare by per kilometers because it is a system and the cost varies from one scenario to another**.
If you want have a rough idea about the comparison of both technology, we can give you a brief idea that **the cost of Maglev is half or two thirds of High speed railway.**
With regard to the number of personnel needed for Shanghai Line, **about 100 persons needed for daily operation and maintenance.**
With regard to **energy consumption**, it varies also from one project to another. **Because different speed curve and different alignment will result in different energy consumption.**
As a summary, **it is difficult to make comparison by general means.** The advantages of maglev against high speed railway is well known to the public or at least in the web.
If you have further questions, please don't hesitate to contact us.
Best regards,
xujuchuan

5.a What are the pros/cons of a so-called smart track-dumb vehicle and dumb track-smart vehicle? 5.b What are the implications regarding weight, grades, speed, need for overhead catenary, etc. ?

5.a What are the pros/cons of a so-called smart track-dumb vehicle and dumb track-smart vehicle? 5.b What are the implications regarding weight, grades, speed, need for overhead catenary, etc. ?

Low-Speed Maglev Hot Rail

5.a What are the pros/cons of a so-called smart track-dumb vehicle and dumb track-smart vehicle? 5.b What are the implications regarding weight, grades, speed, need for overhead catenary, etc. ?

Since maglev systems are actually long electric motors, a more accurate way of describing these systems is "*vehicle as stator and track as rotor*," or "*vehicle as rotor and track as stator*."

The "***vehicle as stator and track as rotor***" approach was first attempted over 40 years ago. Engineers soon discovered that higher speeds required vehicles (stators) and power equipment to increase in size correspondingly with speed, which led to vehicles being too heavy for practical use as high-speed transport. Increased speed also created problems with dynamic stability and the power delivery system (i.e., pantograph).

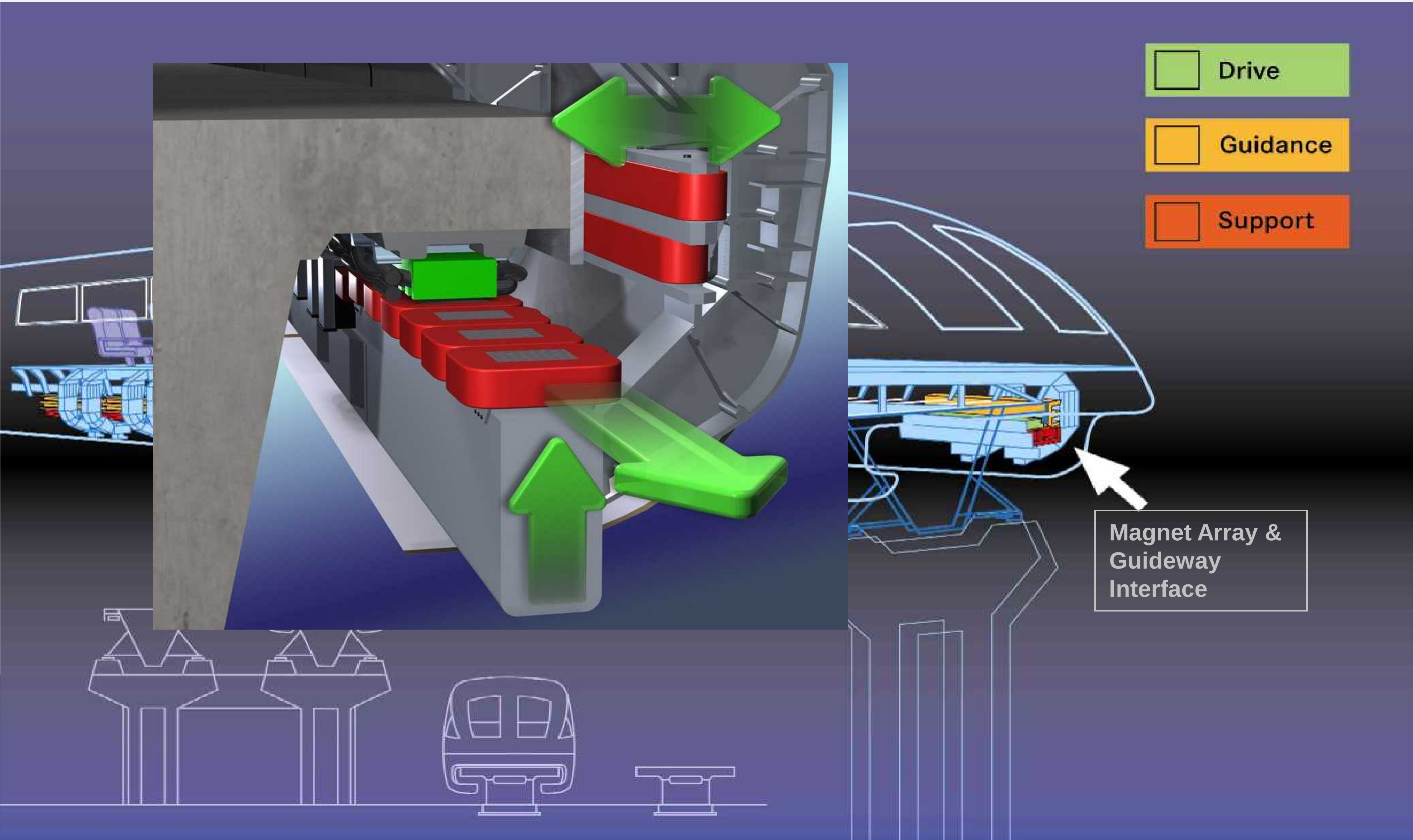
5.a What are the pros/cons of a so-called smart track-dumb vehicle and dumb track-smart vehicle? 5.b What are the implications regarding weight, grades, speed, need for overhead catenary, etc. ?

To achieve higher speeds, engineers in Germany and Japan decided on the reverse approach of "***vehicle as rotor and track as stator***" (TRI and CJR).

This allowed for higher speeds by keeping vehicle weights constant regardless of system speeds. The lower vehicle weight allowed active guidance magnets to be introduced to control dynamic stability issues. In addition, this design allowed the design and use of onboard non-contact linear generators, which eliminated the frequent failure rate and high maintenance costs associated with power delivery systems (pantographs).

5.a What are the pros/cons of a so-called smart track-dumb vehicle and dumb track-smart vehicle?

2 Different Propulsion & Suspension Systems



6.a. What are the steps needed to be able to receive some level of safety certification for a maglev system? 6.b How long will it take? 6.c Who will lead?

Final Programmatic Environmental Impact Statement

DOT/FRA/RDV-00/02

DOT-VNTSC-FRA-00-04

Maglev Deployment Program

Volume I

April 2001

excerpt

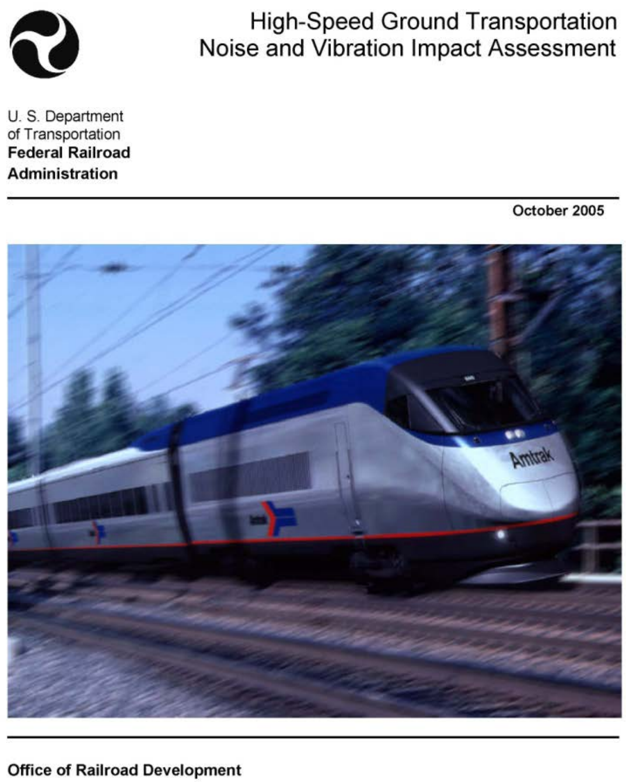
3.16.1 Systems Safety

The Federal Railroad Administration (FRA) has jurisdiction over all aspects of the safety of Maglev systems in the United States. In the past, when confronted with a proposed railroad system, such as a Maglev system or a high-speed steel-wheel-on-steel-rail system, having characteristics not addressed or not adequately addressed by FRA's existing regulations, FRA has undertaken to issue a rule of particular applicability covering that proposed system.

For example, when a Transrapid Maglev was proposed in Florida, **FRA undertook to develop a rule of particular applicability governing the safety of that system. A significant body of work was completed before that Maglev project was terminated, at which time FRA ceased to work on the safety rule. The last draft was dated March 1993.**

If a Maglev system is built under this program, FRA may develop a rule of particular applicability covering that system only or a rule of general applicability covering all Maglev systems of the same type wherever they may be located or a rule of general applicability covering Maglev systems of all types. Any such rule would cover, among other things, the guideway, the vehicles, the signal system, the communications system, intrusion detection, a system safety plan, qualification and training of employees, operating rules, software reliability, guideway maintenance worker safety, and emergency preparedness. FRA's existing rule on the use of alcohol and drugs would apply.

6.a What are the steps needed to be able to receive some level of safety certification for a maglev system? 6.b How long will it take? 6.c Who will lead?


High-Speed Ground Transportation
Noise and Vibration Impact Assessment

U. S. Department
of Transportation
Federal Railroad
Administration

October 2005

Office of Railroad Development


DOT/FRA/RDV-00/02
DOT-VNTSC-FRA-00-04

U.S.Department
of Transportation
Federal Railroad
Administration

Final Programmatic Environmental Impact Statement

Maglev Deployment Program
Volume I
April 2001

Office of Railroad Development
Washington, D.C. 20590

Prepared By:
John A. Volpe National Transportation Systems Center

6.a What are the steps needed to be able to receive some level of safety certification for a maglev system?
6.b How long will it take? 6.c Who will lead?

The major obstacle facing maglev deployment in the U.S. under the auspices of the FRA is that all the experienced maglev scientists and engineers at the agency have long ago retired or passed away.

Finding qualified personnel at the FRA with the appropriate expertise to certify maglev technology for passenger service will likely be problematic, but not impossible. The FRA could hire new experts from abroad or accept a foreign governments' (China, Germany, Japan) maglev certification for passenger transport.

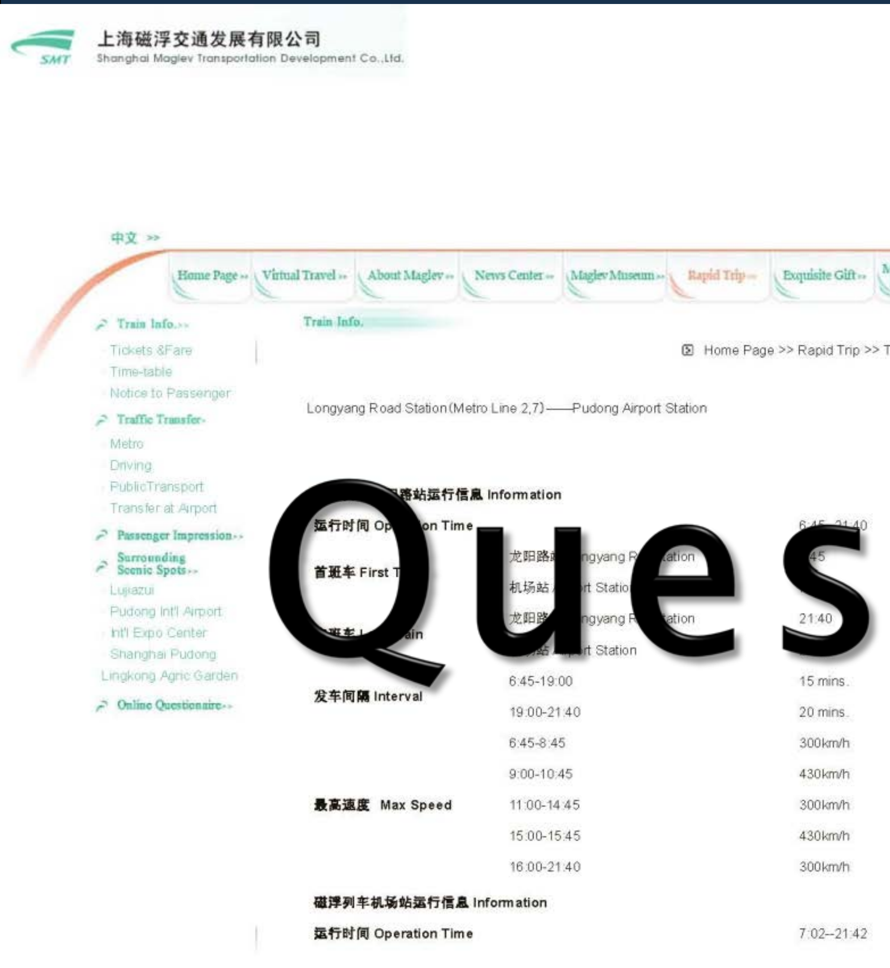
It is certain, based on previous experience, that the FRA will not pursue certification unless there is a bona fide maglev project moving forward somewhere in the country.

Maglev Deployment Evaluation Matrix

Factors To Consider For Earliest Deployment	Maglev Technologies				
	TRI	GA	AMT	HSST	CJR
Ready For Deployment Today	YES	NO	NO	YES	YES
Mature Tech. Ready For DOT Passenger Certification	YES	NO	NO	YES	YES
Achieved Final Vehicle Design	YES	NO	NO	YES	YES
Tested & Deployed Advanced Working Guideways	YES	NO	NO	YES	YES
Record Of Regularly Transporting Passengers	YES	NO	NO	YES	YES
In Commericial Passenger Operation	YES	NO	NO	YES	?
Safely Achieved Designed Top Speed	YES	NO	NO	YES	YES
Fully Tested Operating System At All Speeds	YES	NO	NO	YES	YES
High Speed Capable (> 150 mph)	YES	NO	NO	NO	YES
Fully Tested And Deployed Switch Designs	YES	NO	NO	YES	?
Ran Vehicles Through Switches At Speed	YES	NO	NO	YES	NO
Operated With Passengers In All Weather Conditions	YES	NO	NO	YES	YES
Operating Experience In Snow & Ice Conditions	YES	NO	NO	YES	YES
Known Initial Capital Costs	YES	NO	NO	YES	YES
Known Maintenance Costs (Parts/Labor)	YES	NO	NO	YES	YES
Known Operational Costs (Energy/Personnel)	YES	NO	NO	YES	YES
Established Emergency Procedures/Equipment	YES	NO	NO	YES	YES
Can Closely Parallel I-70 Corridor At Speeds >65mph	YES	NO	NO	NO	NO
Known Life Cycle Of System Parts	YES	NO	NO	YES	YES
Demonstrated Passenger Comfort	YES	NO	NO	YES	YES
Known Energy Efficiency For Operations	YES	?	?	YES	YES
Known System Operational Reliability	YES	?	?	YES	YES
On-time Schedule Reliability	YES	?	?	YES	YES
Fully Automatic Operation	YES	YES	YES	YES	YES
Parts Availability	YES	NO	NO	YES	YES
Able To Climb 7% Grade at Speed (60 mph or more)	YES	?	?	YES	YES
Urban Station Compatibility	YES	YES	YES	YES	YES
No Additional R&D Required Before Deployment	YES	NO	NO	YES	YES
Test Track Facility	Closed	YES	YES	YES	YES

KEY: YES / NO / ?

Questions?



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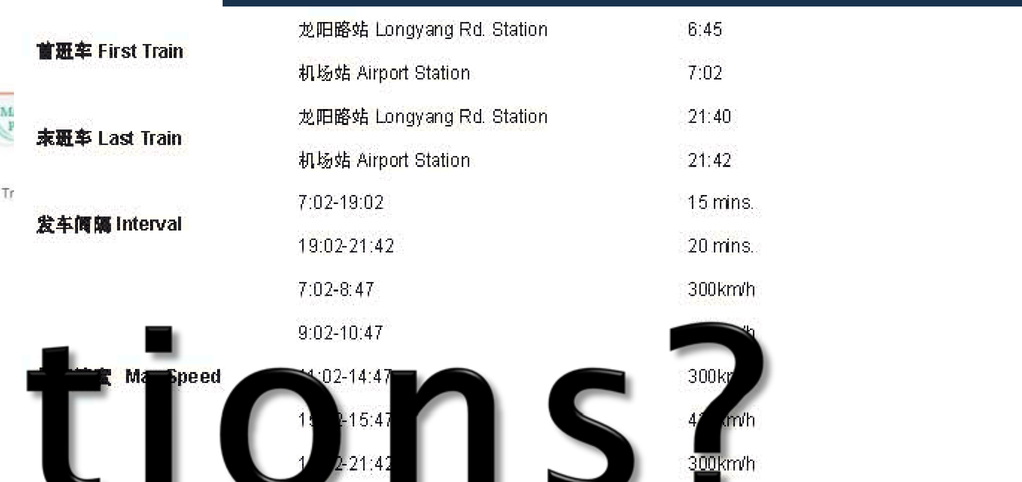
Time-table
Notice to Passenger
Traffic Transfer
Metro
Driving
PublicTransport
Transfer at Airport
Passenger Impression
Surrounding Scenic Spots
Lujiazui
Pudong Int'l Airport
Int'l Expo Center
Shanghai Pudong
Lingkong Agric Garden
Online Questionnaire
Train Info.
Home Page >> Rapid Trip >> Tr
Longyang Road Station(Metro Line 2,7)——Pudong Airport Station
发车间隔 Interval
6:45-19:00 15 mins.
19:00-21:40 20 mins.
6:45-8:45 300km/h
9:00-10:45 430km/h
最高速度 Max Speed
11:00-14:45 300km/h
15:00-15:45 430km/h
16:00-21:40 300km/h
磁浮列车机场站运行信息 Information
运行时间 Operation Time 7:02--21:42



首班车 First Train
龙阳路站 Longyang Rd. Station 6:45
机场站 Airport Station 7:02
末班车 Last Train
龙阳路站 Longyang Rd. Station 21:40
机场站 Airport Station 21:42
发车间隔 Interval
7:02-19:02 15 mins.
19:02-21:42 20 mins.
7:02-8:47 300km/h
9:02-10:47
300km/h
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Funding/Finance Workgroup Update

- Meeting #2 held March 13
- Agenda included:
  - Discussion of timing of release of Request for Financial Information (RFFI)
  - How to determine financial feasibility?
  - Specific involvement/role of AGS & ICS PLTs in Workgroup
  - Review funding options

Funding/Finance Workgroup Update

- Discussion of Timing of Release of Request for Financial Information (RFFI)
  - Ridership results are critical component of the RFFI
  - Ridership results not expected until late April
  - RFFI will be issued in early May

Funding/Finance Workgroup Update

- Financial Feasibility
  - One or more long term financing scenarios that demonstrate sources are available to meet all uses?
  - Assume operations & maintenance costs covered by fare box with no excess?
  - Determine feasibility across a range of project costs or select a "most likely" project cost?
  - Assume single financing scenario such as a long term 50-year concession or multiple financing scenarios?
  - What level of "endorsement" is necessary to reach reasonable comfort level for new revenues?
  - Is it worthwhile to spend time on calculating small revenues such as shared use of guideway by utilities, development rights, advertising, freight revenue, etc.?

Funding/Finance Workgroup Update

- What level of specific involvement or role should AGS & ICS PLT play in F&F Workgroup?
  - Representation on F&F Workgroup?
  - Attendance at F&F Workgroup meetings?
  - Report out by CDOT/Consultants on monthly basis?

Funding/Finance Workgroup Update

- Funding Options
  - What is a reasonable assumption level for federal funding?
  - What should be assumed for the date when funding options must be in place? ROD requirement of 2025 means funding should be in place by 2018.
  - If a vote is required, what improvement options
  - should be included? AGS only, ICS only, AGS + MOS ICS, HSIPR + Highways?
  - Are modifications to revenue calculations needed to cover the possible improvement options?

Funding/Finance Workgroup Update

- Funding Options
  - What is the correct period of availability for funding options?
  - What level of capital costs shall be assumed? $5B, $10B, $15B, more?
  - Should another revenue source be a fuel sales tax?

Revenue Sources Summary
for discussion only

Sources	*Increase / Change*	*Revenues Generated (2011 M$)*	*Revenues Generated (2035 Population in M$)*
User Fees			
Farebox Revenues	TBD	TBD	
Motor Fuel Purchase Tax	$.25 per gallon	$447	$715
VMT Fees	$.01 per mile	$393	$629
Vehicle Registration Fees	$100 per vehicle	$391	$626
Utility Fees	$15 per month per household	$294	$470
General Revenues			
State Sales Tax	1%	$572	$915
State Property Tax	4 mills	$200	$320
State Income Tax	1%	$1,044	$1670
Lodging Tax	1% of current statewide lodging spending	$27	$43
Lottery Tax Allocation	Reallocation of 10% of lottery program profits	$11	18
Value Capture Mechanisms			
Development Fee	$10,000 per residential unit and 1% fee on the value of commercial development	$169	$270
Total		$3,548.0	$5,676

AGS/ICS/Co-Development Coordination

- ICS Progress
  - PLT Meeting #4 held February 26
  - Developing initial model runs for each RMRA station pairs
  - Capital cost estimating complete
  - Draft service plans being finished
  - Ready to launch model runs for ICS scenarios
- Traffic & Revenue Study RFP issued. Proposals due April 5, 2013
- I-70 Peak Period Shoulder Lane (Empire Junction to Twin Tunnels). RFP has not yet been issued.

Conclusions, Final Remarks & Next Steps

- Next PLT meeting
  - April 10, 2013