High Speed Rail: The New Holy Grail

University of Minnesota CTS Research Conference
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Agenda

- Introductions: Dan Krom, MnDOT Office of Passenger Rail, Session Moderator
- International High Speed Rail: Stephanie Eiler, CH2M HILL
- Federal Funding Process: Dan Krom
- Midwest Regional Rail Initiative: Dan Krom
- Minnesota’s Statewide Rail Plan: Dave Christianson
- Questions/Comments: Dan Krom
International High Speed Rail

- Overview
- International Examples
- US Network
Definitions

• **High Speed Rail Definition: International**
  – Super High Speed Trains of running speeds of 280 km/h (174 mph) and over
  – High speed trains of speeds 220 km/h - 280 km/h (137 - 174 mph)
  – “Semi” high speed page (200-220 km/h / 124-137 mph)

• **High Speed Rail Definition: US**
  – 110 mph initially
  – 220 mph future

Source: www.4rail.net/
FRA Definition: 3 Types

• **Express**
  – Relieve air and highway capacity constraints

• **Regional**
  – Relieve highway and, to some extent, air capacity constraints

• **Emerging**
  – Develop the passenger rail market, and provide some relief to other modes

Source: www.4rail.net/
FRA Definition: 3 Types

• **Express:** Frequent, express service between major population centers 200–600 miles apart
  – Few intermediate stops
  – Top speeds of at least 150 mph, complete grade-separation, exclusive right-of-way (shared track in terminal areas)

• **Regional:** Relatively frequent service between major and moderate population centers 100–500 miles apart
  – Some intermediate stops
  – Top speeds of 110–150 mph, grade-separated, with some dedicated and some shared track, positive train control

• **Emerging:** Developing corridors of 100–500 miles with strong potential for future HSR Regional and/or Express service
  – Top speeds of up to 90–110 mph on primarily shared track, eventual positive train control technology
  – Grade crossing protection or separation

Source: www.4rail.net/
Characteristics

Multiple elements:

- Infrastructure (civil engineering work, track, catenary)
- Stations
- Rolling stock
- Signal systems
- Maintenance and operations
- Financing
- Marketing

Source: www.4rail.net/
Characteristics

- Train sets vs. locomotives and cars, and bi-directional
- Infrastructure compatible - special track conditions. Conventional lines, even with major upgrading, are generally unable to operate at very high speeds.
- High level of technology and safety requirements
- In-cab signaling system - line-side signals can’t be observed in time
- Several braking systems
- Aerodynamics
- Land use trade-offs - narrower corridor width than 6-lane freeway, but also requires overhead power lines

Source: www.4rail.net/
Characteristics

- Magnetic levitation (MAGLEV) trains fall under the category of HSR
  - Advanced technology - magnetic forces lift, propel, and guide vehicle over a guideway
  - State-of-the-art electric power and control system - eliminates contact between vehicle and guideway, permits up to 300 mph speeds
  - Cannot operate on conventional railroads - separate classification

Source: www.4rail.net/
Performance = Market Share

• Performance: travel time, frequency, comfort
  – Sit, stand, walk, talk - convenience marketed along with travel

• Well-designed network = increased market share
  – 10% average annual traffic growth in Europe over last 10 years
  – Service kilometers increased 70%, passenger traffic increased 160%
  – 50% of travelers going from Paris to Brussels use HSR

Source: www.4rail.net/
International High Speed Rail

TGV Paris-Sud Est (TGV-PSE) Trains – France’s 1st large scale super HSR line from Paris to Lyon, which covers 281 miles (453 km)
TGV (Train à Grande Vitesse), France

- **Service Operator:** SNCF
- **Route Length:** 1550 km (963 miles)
- **Opening Date:** 1981
- **Max. Line Speed:** 270 – 320 km/h (168 – 199 mph)
- **Primary Manufacturer:** Alstom, with Siemens equipment from Paris to Germany
- **Fleet Total:** approximately 400 units
- **Technology:** Electric powered trains; steel wheel on steel rail
“Two years ago, nearly 90 percent of the six million people traveling between Madrid and Barcelona went by air. But early this year the number of train travelers on the route surpassed fliers, and the trajectory is ever upward” (NY Times)

AVE, Spain

- **Service Operator**: Renfe Operadora
- **Route Length**: Madrid-Seville, 470 km (292 mi) ; Madrid-Bardelona, 550 km (342 mi)
- **Opening Date**: 1992
- **Max. Line Speed**: 350 km/h (220 mph)
- **Primary Manufacturer**: Multiple: Alstom, Talgo, Bombardier, Siemens
- **Technology**: Both electric and diesel electric powered trains; steel wheel on steel rail

ICE (Intercity Express), Germany

• **Service Operator:** Deutsche Bundesbahn (DB)
• **Opening Date:** 1992
• **Max. Line Speed:** 280 km/h (174 mph)
• **Primary Manufacturer:** Siemens
• **Fleet Total:** 154 units
• **Technology:** Both electric and diesel electric powered trains; steel wheel on steel rail

Shinkansen ("Bullet Train"), Japan

- **Service Operator**: Japan Railways
- **Route Length**: Nearly 1,500 miles
- **Opening Date**: 1964
- **Max. Speed**: 300km/h (186 mph)
- **Primary Manufacturer**: Cooperative arrangement b/w Hitachi, Kawasaki, Kinki Sharyo, and Nippon Sharyo
- **Fleet Total**: approx. 300
- **Technology**: Steel wheel on steel rail

Beijing-Shanghai, China

- **Service Operator**: Chinese Ministry of Railways
- **Route Length**: approx. 1,400 km (870 mi)
- **Opening Date**: Proposed 2011
- **Max. Speed**: 300 km/h (186 mph)
- **Primary Manufacturer**: Non-Chinese firms, but fully Chinese products are emerging.
- **Fleet Total**: n/a
- **Other**: China has committed billions to construct HSR. New track investment will result in the need for thousands of vehicles.

“Tilting Trains”

- Sweden developed a network designed on a tilting technology beginning in the 1980s.
- China is using this technology in development of their HSR system; Great Britain is also considering this technology.
Innovative HSR Trains – Russian Sapsan ("Peregrine Falcon")

- **Siemens Velaro**
  - Started up in late 2009 between Moscow and St. Petersburg.
  - Withstands temperatures of -58° Celsius (-72° Fahrenheit) due to specifically manufactured steel, rubber, plastics.
  - Electric motors attached to all wheels.
  - Maximum speed 125 mph due to poor track conditions, but could be upgraded to operate at 205 mph.

Source: [www.railway-technology.com](http://www.railway-technology.com); [www.4rail.net](http://www.4rail.net); and “Siemens Fills Russia’s Need for High-Speed Train, New York Times, Sept. 25, 2009."
Train Manufacturers

- **Alstom (French)**
  - In use in France, Great Britain, the Netherlands, Spain, and South Korea; on order for Italy
  - Introduced AGV – the TGV replacement in 2008; will attain safe speed of 225 mph vs. TGV’s 200 mph.

- **Bombardier (German)**
  - New Zefiro, very high speed train, will be ready in 2012; will be the world’s fastest @ 235 mph on new tracks between Beijing and Shanghai, China
  - Primary producer of Germany’s fast trains. Contracted to provide new high-speed trains in Spain, Austria, the Netherlands, China
  - New Velaro, Siemens’ answer to Alstom’s TGV, on order for Spain, Russia, China, and Germany

Train Manufacturers

- **Japan, Multiple Manufacturers**
  - Elected not to compete with each other: recent HSR trains manufactured under cooperative arrangement between Hitachi, Kawasaki, Kinki Sharyo, and Nippon Sharyo
  - Individual companies pursuing international work

- **China, Emerging Chinese Manufacturers**
  - Investment in billions of dollars for construction of new tracks will result in need for thousands of vehicles - fully Chinese products emerging

Train Manufacturers

- **Siemens (German)**
  - Primary producer of Germany’s fast trains. Contracted to provide new high-speed trains in Spain, Austria, the Netherlands, China
  - New Velaro, Siemens’ answer to Alstom’s TGV, on order for Spain, Russia, China, and Germany

Train Manufacturers

- **Talgo (Spanish)**
  - High-speed currently operates only in Spain
  - Avril train in development, top speed of 236 mph
  - Wisconsin:
    - Bought 2 trainsets for the Chicago-Milwaukee route
    - Talgo to manufacture & assemble vehicles in Wisconsin – expand with more U.S. contracts
    - Low-speed trains can also be upgraded to high-speed in future as tracks are upgraded

US High Speed Rail


CH2M HILL
Amtrak Northeast Corridor

- Boston, Massachusetts to Washington DC via NY, Philadelphia and Baltimore
- Speed averages 68 mph (109 km/h) for the entire distance, briefly reaching 150 mph (240 km/h) in some segments
- Tilt-train technology; Bombardier, Alstom equipment
Why HSR for the US?

- Vision is built upon a series of strategic transportation goals:
  - Building a foundation for economic competitiveness
  - Ensuring safe and efficient transportation choices
  - Promoting energy efficiency
  - Environmental quality, and
  - Supporting interconnected, livable communities
$8 Billion American Recovery and Reinvestment Act (ARRA) Funding

- The High Speed Intercity Passenger Rail (HSIPR) Program has generated enormous interest and excitement across the country.
- Funding flows through State Departments of Transportation.
- Conceptually 50% economic recovery, 50% infrastructure reinvestment.
US DOT/FRA Focus

- Initial investments focused on three key areas to deliver transportation, economic recovery and other public benefits:
  - Building new high-speed rail corridors that will fundamentally expand and improve passenger transportation in the geographic regions they serve
  - Upgrading existing intercity passenger rail services, partnering with AMTRAK
  - Laying the groundwork for future high-speed passenger rail services through smaller projects and planning efforts
US DOT/FRA Focus

• AMTRAK partnership:
  – Building new high-speed rail corridors that will fundamentally expand and improve passenger transportation in the geographic regions they serve
  – Upgrading existing intercity passenger rail services
  – Laying the groundwork for future high-speed passenger rail services through smaller projects and planning efforts
In total, 79 applications from 31 States were selected for funding in 13 corridors:

- California: $2.3B (multiple corridors)
- Florida: $1.25B (Tampa-Orlando-Miami)
- IL-MO: $1.13B (Chicago-St. Louis-Kansas City)
- IL-MI: $244M (Chicago-Detroit)
- WI-MN: $823M; (Chicago-Milwaukee-Madison-Minneapolis/St. Paul)
- WA-OR: $590M (Eugene-Portland-Seattle-Vancouver BC)
- NC-VA: $630M (Charlotte-Raleigh-Richmond-Washington DC)
- Ohio: $400M (Cleveland-Columbus-Cincinnati)
- Northeast Region: $1.2B (multi-state corridor)
- Iowa: $17M
- Texas: $4M
Future Directions

Future annual appropriations will be necessary – $1.5B added by Congress in FFY 2010

Goal is to achieve a fully developed passenger rail system that complements:

- Highway
- Aviation, and
- Public transit systems
Federal Funding Process
Minnesota’s Role in MRRI
Minnesota State Rail Plan
Q/A
• UIC – Union Internationale des Chemins de fer