

High speed railway principles

Ignacio Barrón de Angoití,
Director High Speed, International Railway Association (UIC)

Professional Conference on High Speed
In the World and in the Czech Republic
Praha, 14 November 2007



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Agenda

High Speed Rail principles
Some facts & figures about High Speed
Impact in traffics
High Speed and the environment
High Speed Rail is safety
The costs of the high speed
Concluding remarks



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High Speed Rail principles



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High Speed Rail: Definitions and requirements

- “High Speed” signifies at least 250 km/h
- Operating at more than 200 km/h requires:
 - special trains (train sets)
 - special dedicated lines
 - in cab signalling
- Upgraded existing lines and “classic” trains (locomotive + cars) enable to operate up to about 200 km/h
- We can also say “High Performances”



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Understanding High Speed Rail

A High Speed Railway is a (very complex) **system**,
comprised by state of the art:

- Infrastructure
- Rolling Stock
- Signalling systems
- Maintenance systems
- Management
- Station emplacement
- Operation rules
- Marketing
- Financing
- ...



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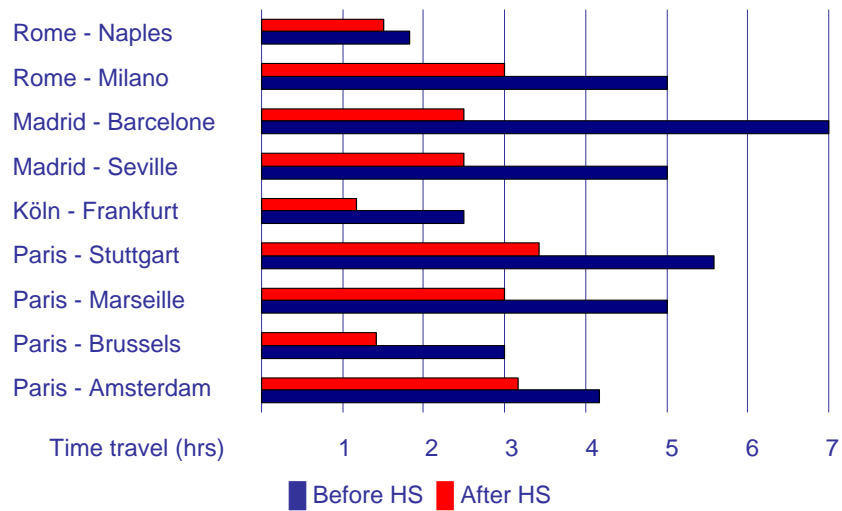
HS performances for customers

- Commercial speed
- Frequency
- Accessibility
- Comfort
- “Freedom”
- Total time of travel
- Reliability
- Price
- Safety
- ...



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Some examples of evolution of time travel



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HS advantages for Society

- Offers high capacity of transport
 - Up to 300,000 passengers per day
 - Reduce traffic congestion
- Helps economic development
- High Speed Rail promotes logical territory structure and helps contain urban sprawl
- Respects the environment:
 - Efficient use of land (1/3 motorway)
 - Energy efficiency (x 9 planes / x 4 cars)



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HS increases capacity

- Introduces more capacity in the transport system:
 - New HS line capacity +
 - Released capacity in classic lines
- But the capacity of new HS lines is very variable



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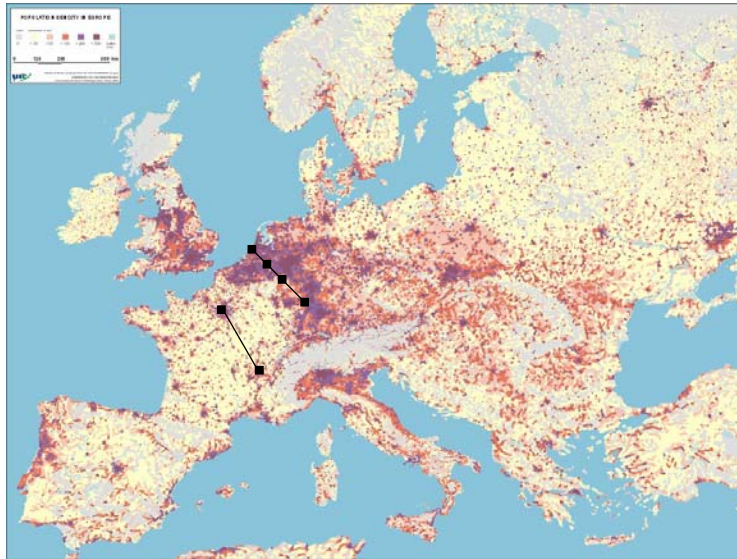
Different concept of HS

- Many different commercial concepts of HS
(including services to customers, marketing, etc.)
- Many different types of operation
(maximum speed, stops, etc.)
- Different ways to operate classic trains
(in particular impact on freight traffic)



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Density of population



Concepts:
«Corridor»
&
«Tunnel»



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Some facts & figures about High Speed



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Some figures about High Speed

World network ($V \geq 250$ km/h) = 9.430 km
 Almost 1.300 high speed trains set in operation
 World speed record (in 2007): 574,8 km/h

Japan: In 42 years = 4 Billion passengers
 Up to 360.000 pass./day in Tokyo-Osaka
 No fatalities during all this time at $V > 200$ km/h

France: In Nov. 2006, passenger 1,3 Billion in TGV

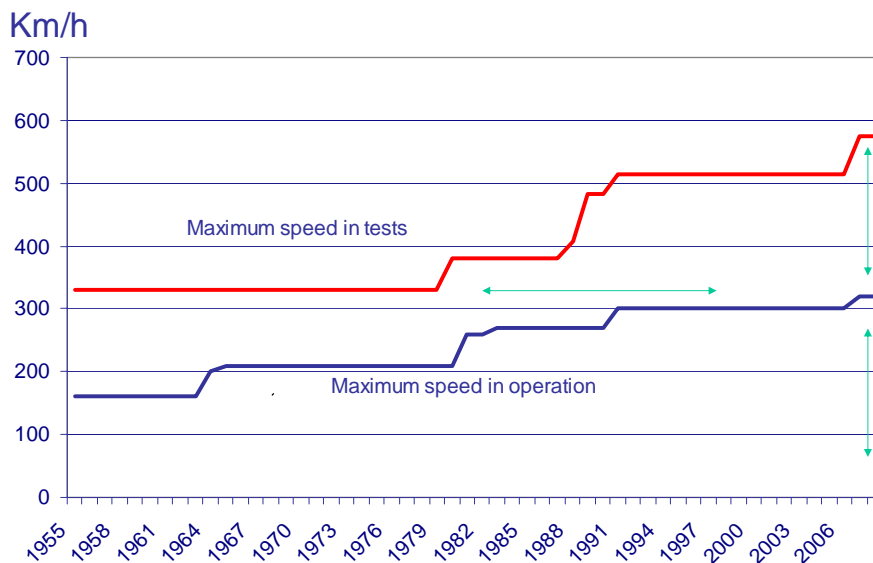
Europe: Average annual growing traffic 10 % (pass.-km)

Korea: More than 100.000 passengers per day
 (50 % rail traffic)

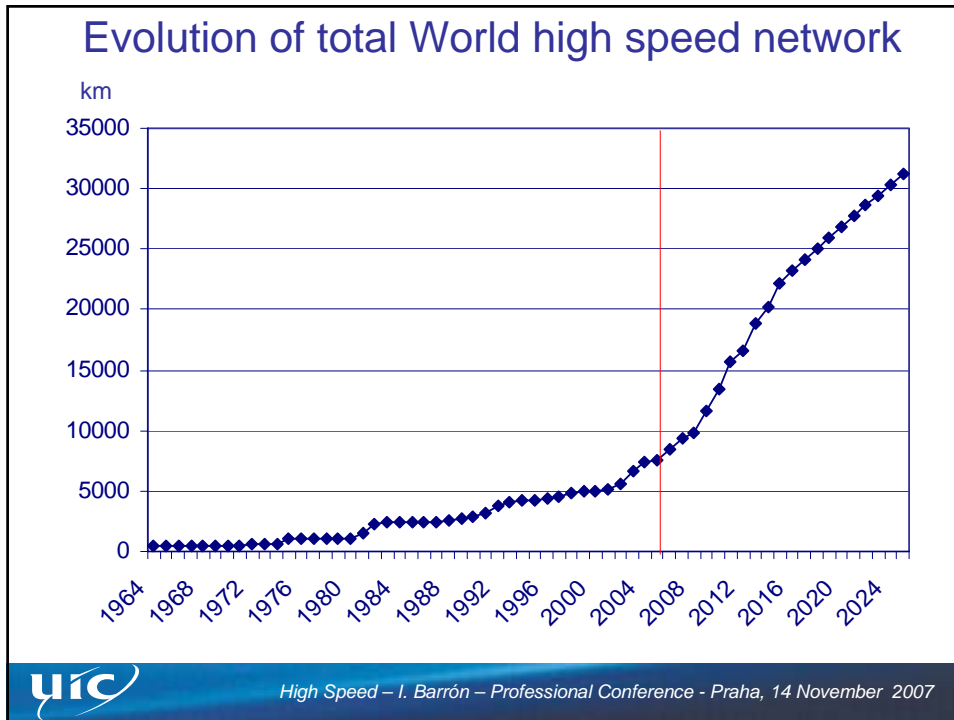
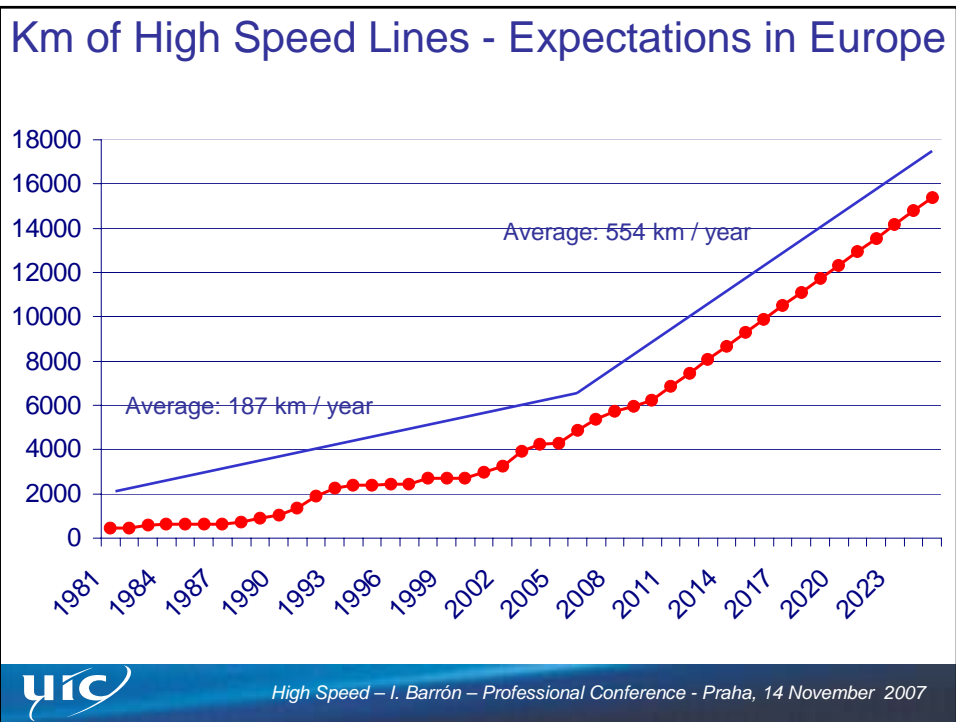


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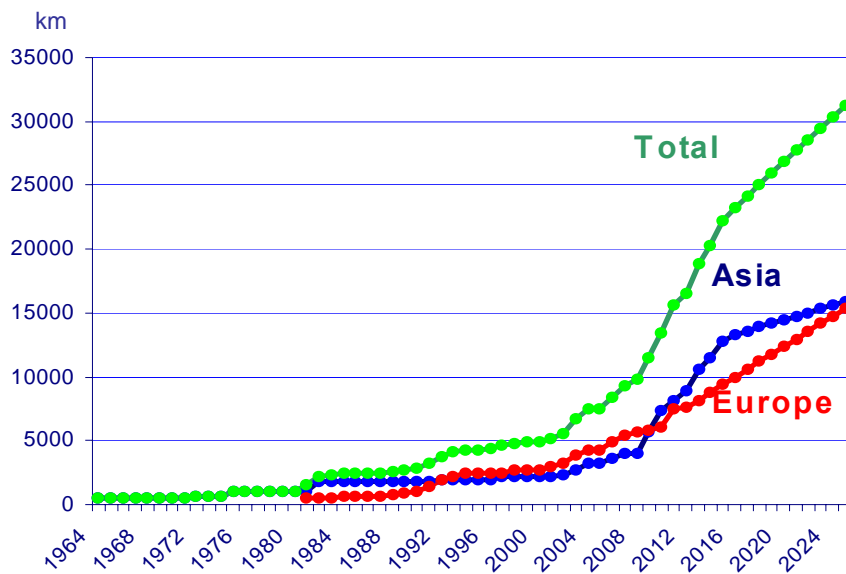
Evolution of maximum speed on rails



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Evolution of World high speed network



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High Speed Rolling Stock - Situation in the World

In June 2007, at the World level,

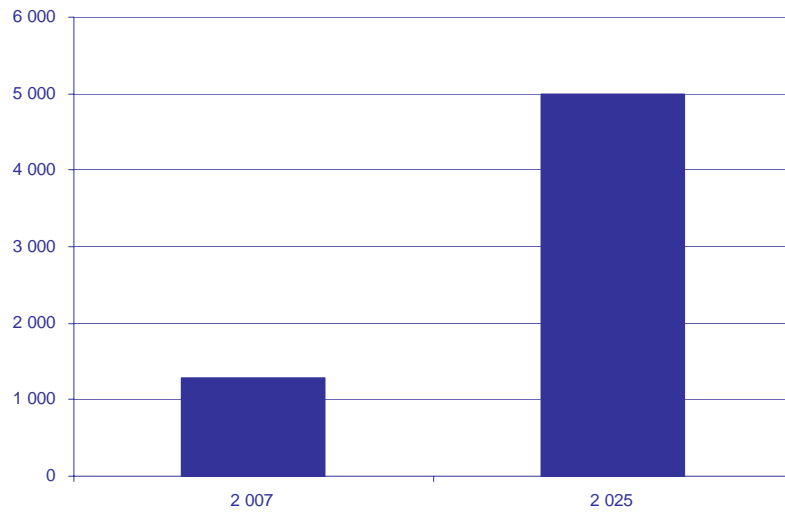
1.290 HS train sets in operation ($V > 250$ km/h):

- Europe: 800
(1.355 HS train sets if $V > 200$ km/h)
- Japan: 330
- Korea: 50
- China: 60
- China Taiwan: 30
- USA: 20



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Forecasting evolution World high speed train sets



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High Speed impact on traffics

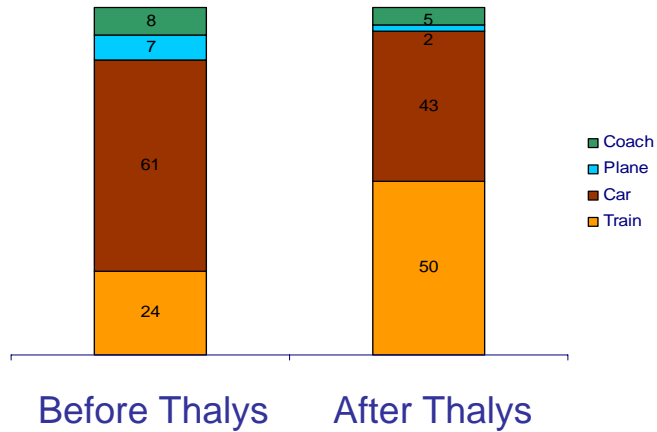


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Effects in modal split

Paris - Brussels (320 km / 1h25min.)

All modes

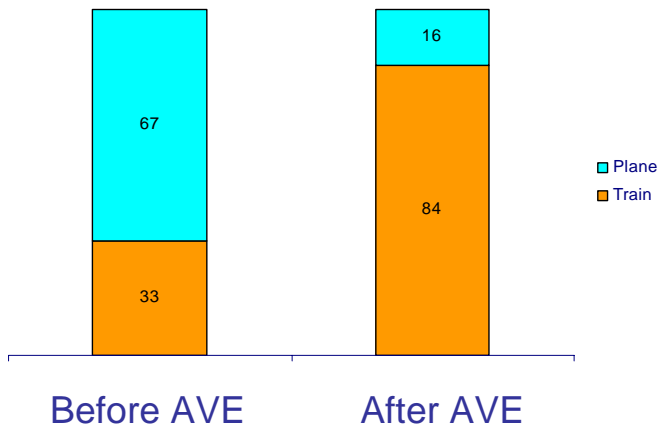


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Effects in modal split

Madrid - Seville (471 km / 2h15 min.)

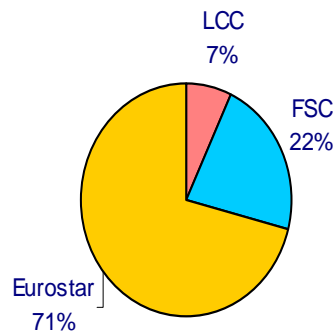
Train / plane



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Effect of "Low Cost" air companies

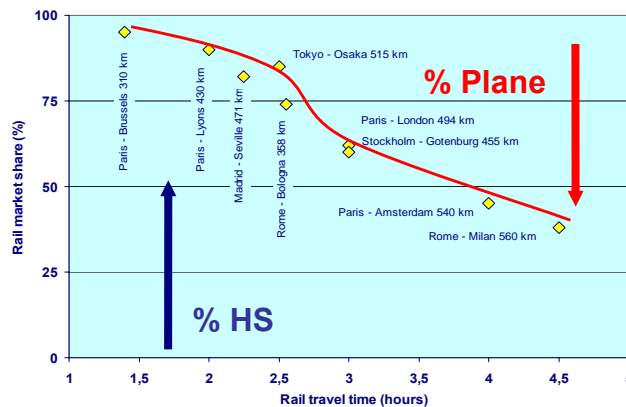
París – London (2h 40min.)



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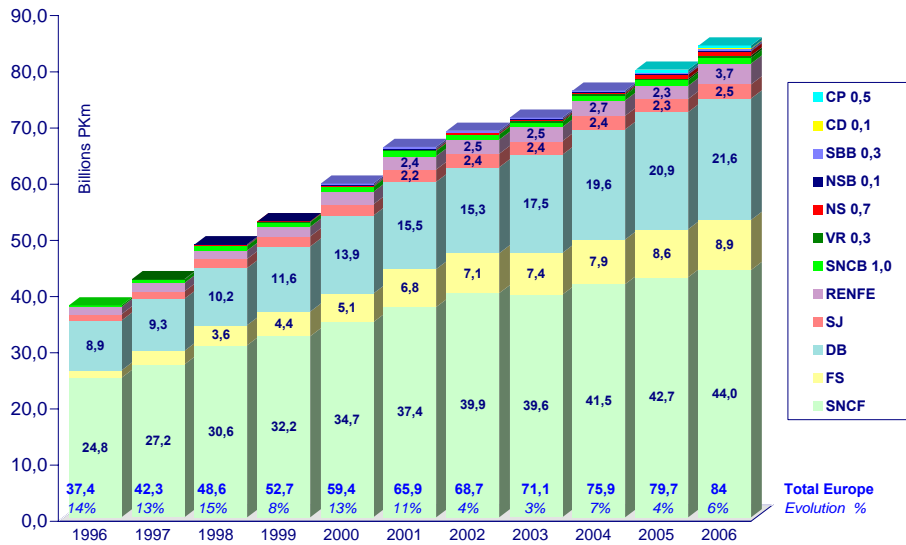
Curve of the rail / air modal split

(distances between 300 and 600 km)



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High Speed Traffic - Evolution in Europe



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High Speed and the environment



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Land occupancy

Some ratios on land occupancy in Germany:

- High speed line Hanover - Würzburg 3,0 ha/km
- High speed line Mannheim - Stuttgart 4,0 ha/km
- Average 3,2 ha/km
- Average motorways 9,3 ha/km

Parallel layout with a motorway:

- Paris - Lyon 60 km
- Paris - Lille 135 km
- Cologne – Frankfurt 140 km



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Parallel layouts



HS Line Paris – Lille (TGV Nord)



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Parallel layouts



HS Line Cologne - Frankfurt



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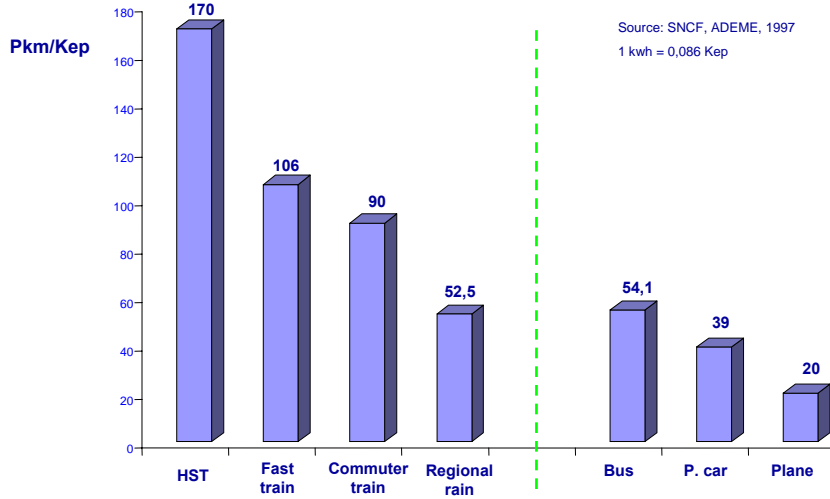
Comparisons in land occupancy

HS Railway	Motorway
Double track 25 m	2 x 3 lanes 75 m
12 trains per hour & direction 666 passengers / train	4.500 cars per hour & direction 1,7 passengers / car
Capacity = 8.000 passengers / hour	Capacity = 7.650 passengers / hour



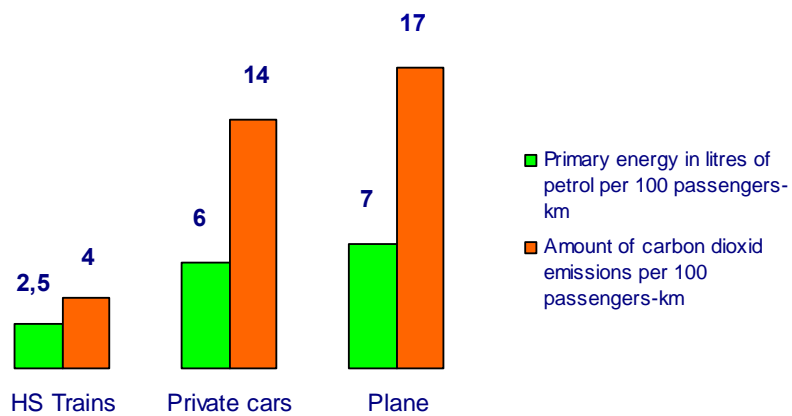
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Energy Efficiency - Passenger



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Primary Energy and CO2 Emission



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CO2 emissions

In a medium distance corridor (400 - 500 km)
10 flight per day represents the emission of
6.700 t. of CO2 per year to the atmosphere

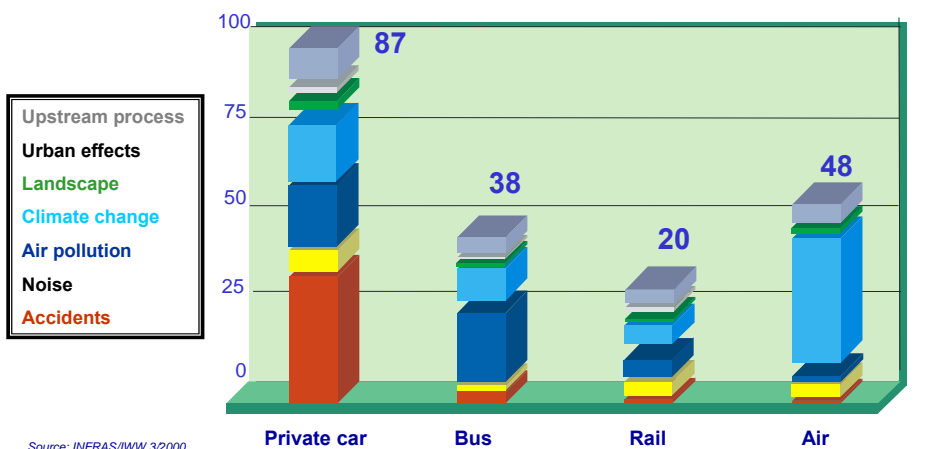


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Average External Costs

Without congestion Passenger Traffic 1995

Euro / 1000 Pkm



Source: INFRAS/IIWW 3/2000



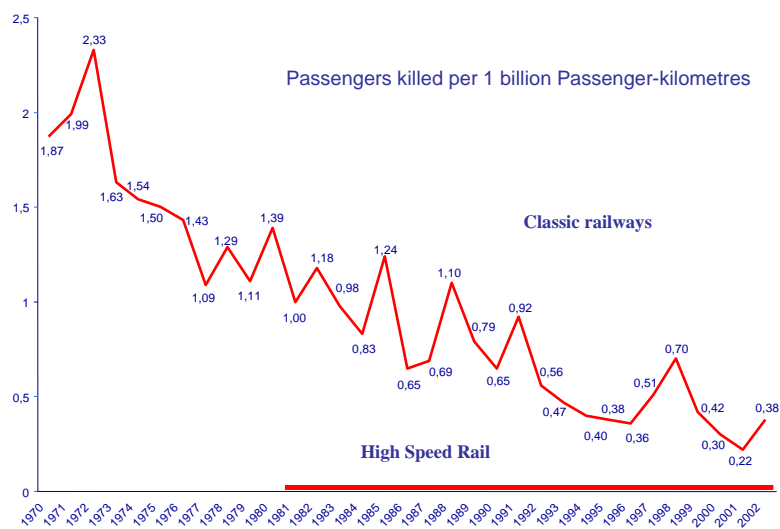
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High Speed Rail is safety

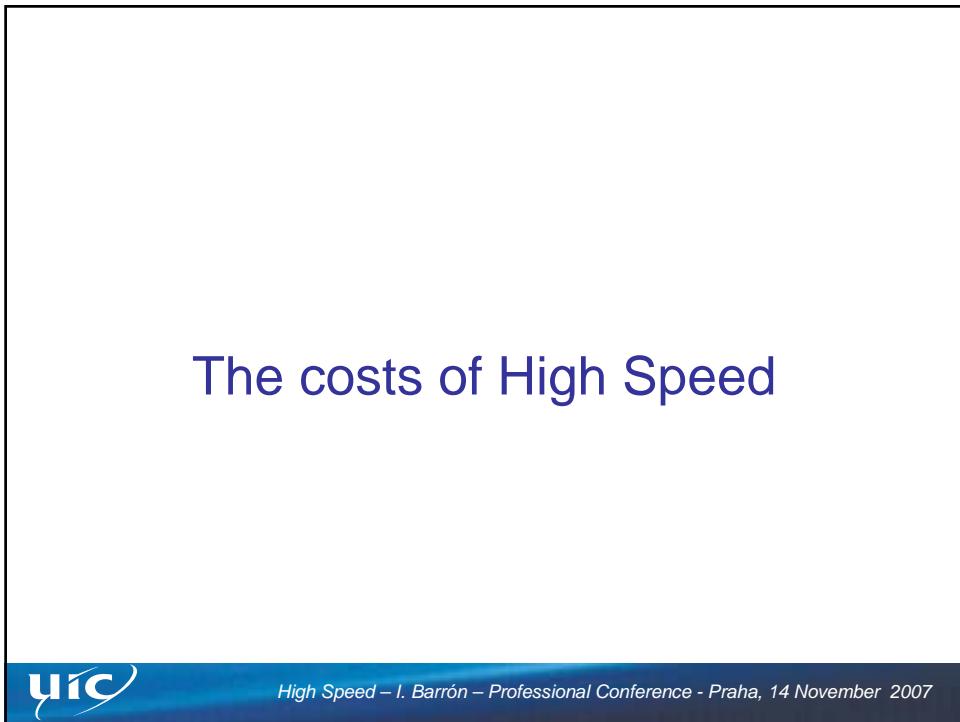
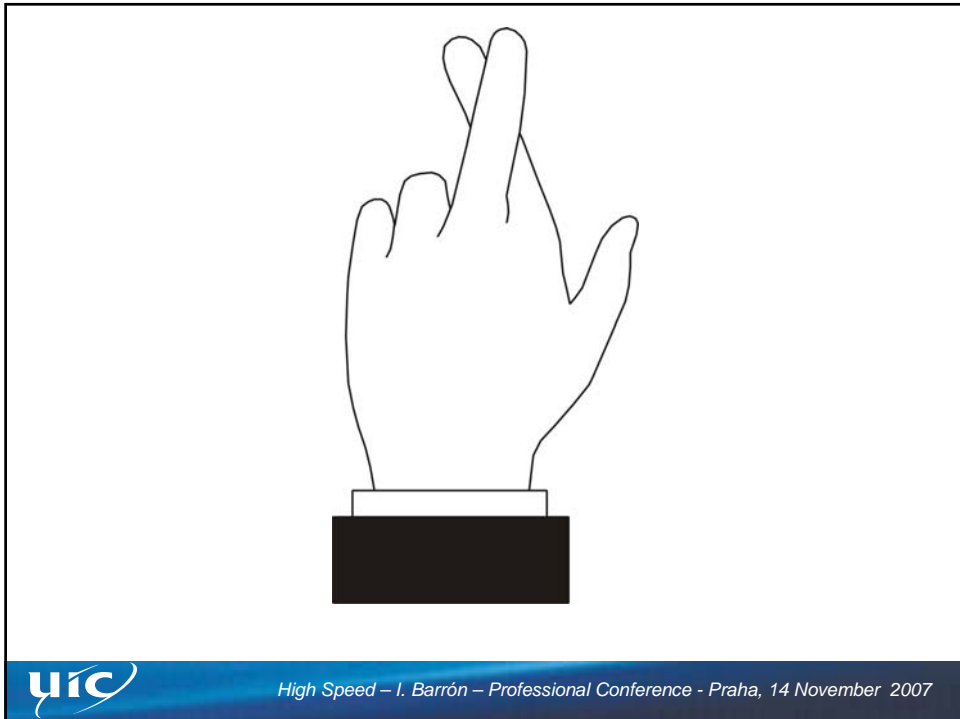


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Evolution of Railway Safety in EU



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Funding/Calculating Costs

- High Speed requires significant investment, including public funding
- Consequently, need detailed studies on traffic forecasting, costs and benefits
- Examine all impacts, positive and negative (including calculating **costs of not doing it**)



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Magnitude Costs of HS systems

Minimum costs in Europe

<u>Construction of 1 km of new HSL:</u>	12 M €
Maintenance of 1 km of new HSL:	70.000 €/ year
Cost of an HS train (350 places):	20 M €
<u>Maintenance of a HS train:</u>	1 M €/ year
(2 €/ km - 500 000 km / train & year)	



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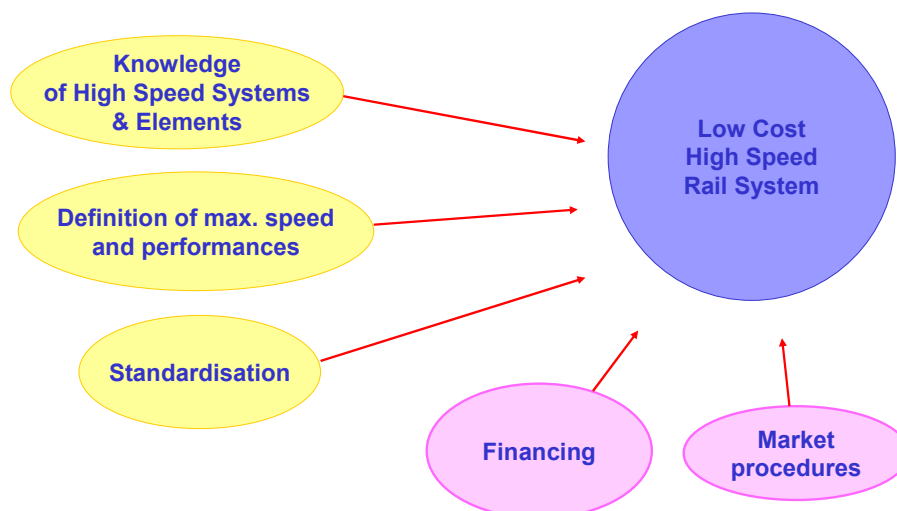
Funding Costs

- High Speed costs are generally paid with public funds (Japan, Europe, Korea)
- The trend is to share funds and responsibilities between different public entities (French TGV)
- In some cases, private funding can be attracted for part of total investment
- PPP (Spain – France link) or BOT (Taiwan) are two possibilities to combine public and private resources:
 - Private obtains ROI
 - Public ensures social benefits



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Key elements to reduce costs



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Concluding remarks



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Concluding remarks

- High Speed is an **highly beneficial transport system for Society**
- High Speed is a “**complex system**” and its conception is **not unique**; it must be adapted to each case and each country
- **High Speed always needs public funds** (at least, public guarantee)



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UIC High Speed activities

- World Congress in HS (“Eurailspeed”):
Next one The Netherlands, 17 – 18 Mars 2008



- “Training in HS Systems”:
Next one 16 to 21 June 2008



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For more information, commentaries and proposals:

Iñaki Barrón de Angoit

Director High Speed

Union Internationale des Chemins de fer (UIC)

barron@uic.asso.fr

www.uic.asso.fr



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Thank you very much
for your attention



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