

# High Speed Rail: The Big Picture

Iñaki Barrón  
International Railway Association (UIC)

April 2007

# International Railway Association (UIC)

- Founded 1922 to promote cooperation among railways, first European focus, then global
- UIC is the only global rail association:  
170 members from all 5 Continents

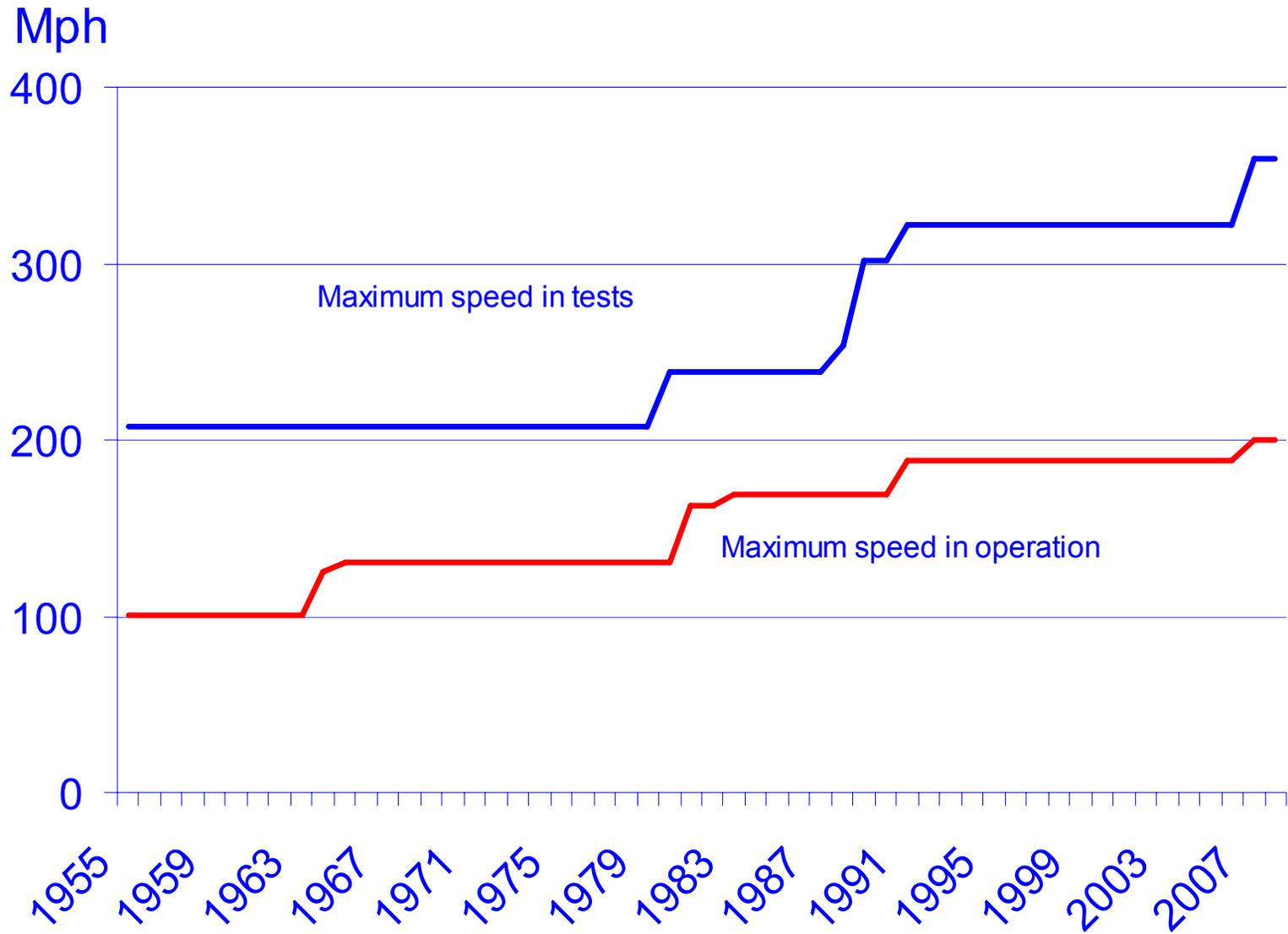
# International Railway Association (UIC)

- Mission: promote rail transport globally to meet the challenges of mobility and sustainable development
- Objectives:
  - Exchange info on best practices
  - Propose ways to improve economic performance
  - Support members to develop new businesses
  - Achieve interoperability
  - Develop Centers of Excellence  
(technology, management, training, etc.)

# High Speed Rail: Definitions and requirements

- “High Speed” signifies at least 150 Mph (250 km/h)
- Operating at more than 125 Mph (200 km/h)  
requires special trains (train sets, instead of locomotive + cars)
- Upgraded existing lines enable up to about 125 mph  
Higher speeds requires special dedicated lines

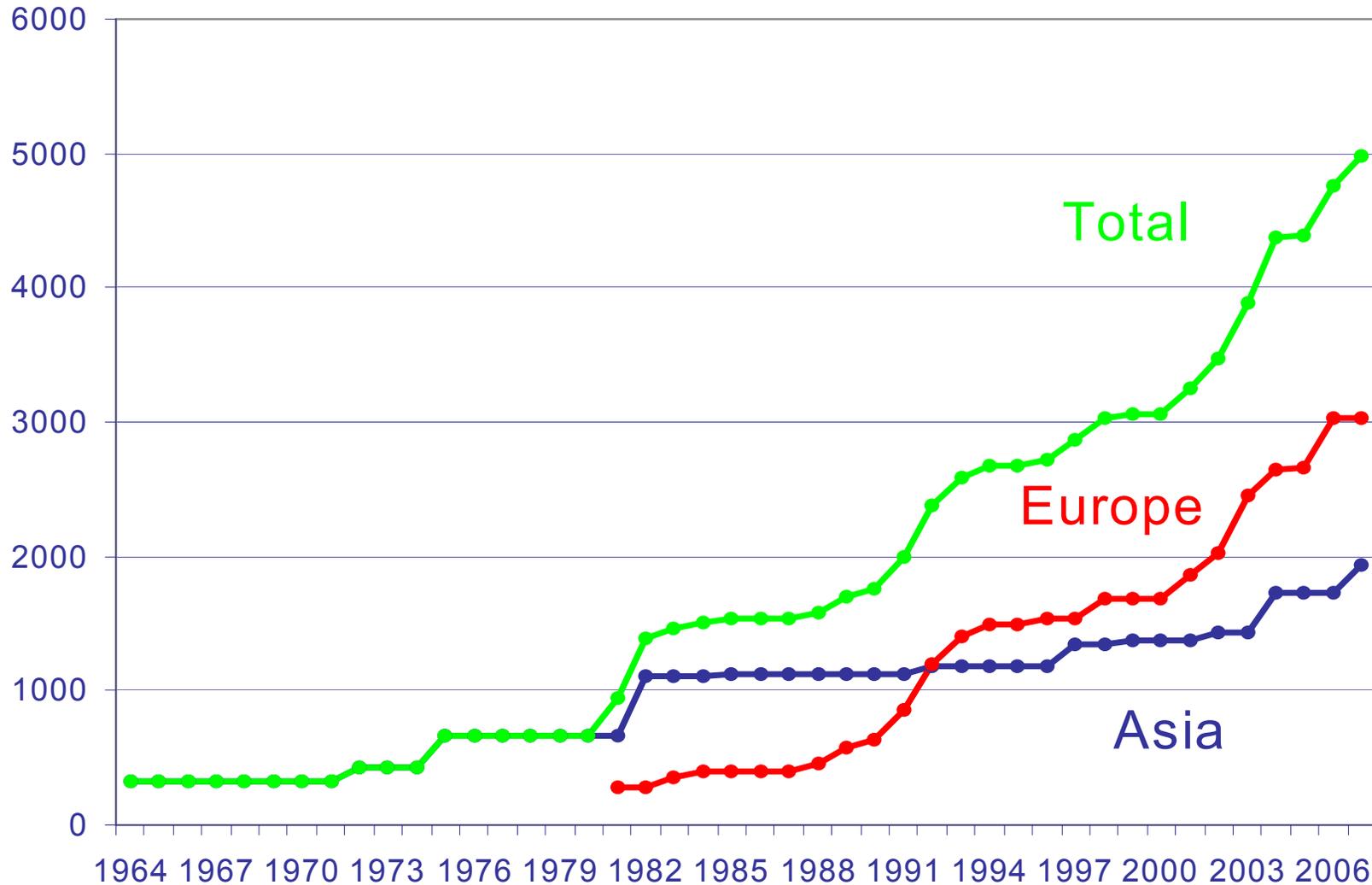
# Evolution of maximum speeds



# High Speed Lines around the World

Miles

Updated 200704



# When and why did European High Speed Rail start?

September 1981: 1st European HS line (Paris to Lyons) was opened, due to:

- Transportation capacity problems
- Technical advances

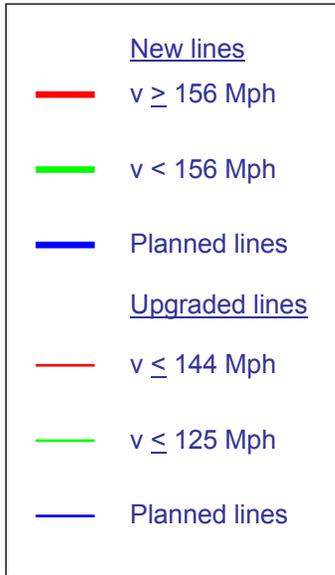
April 2007: 3,034 miles are in operation in Europe

2010: 1,711 more miles are scheduled to start operating

2020: An important European HS network will be in operation

# European HS Network

Network in April 2007



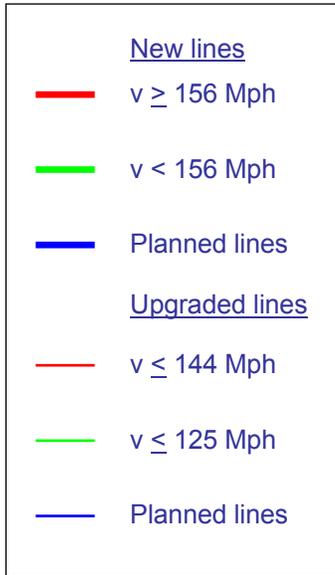
Information given by the Railways

UIC - High-Speed  
Updated 04.2007 – OG/IB



# European HS Network

Forecast for 2010



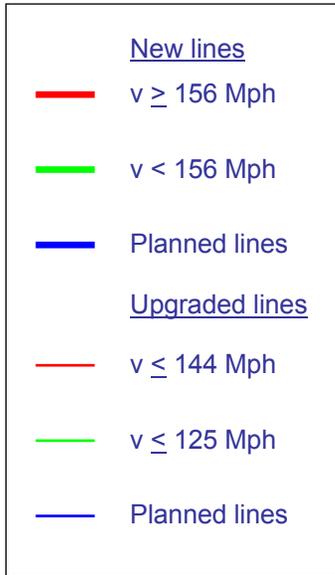
Information given by the Railways

UIC - High-Speed  
Updated 04.2007 – OG/IB



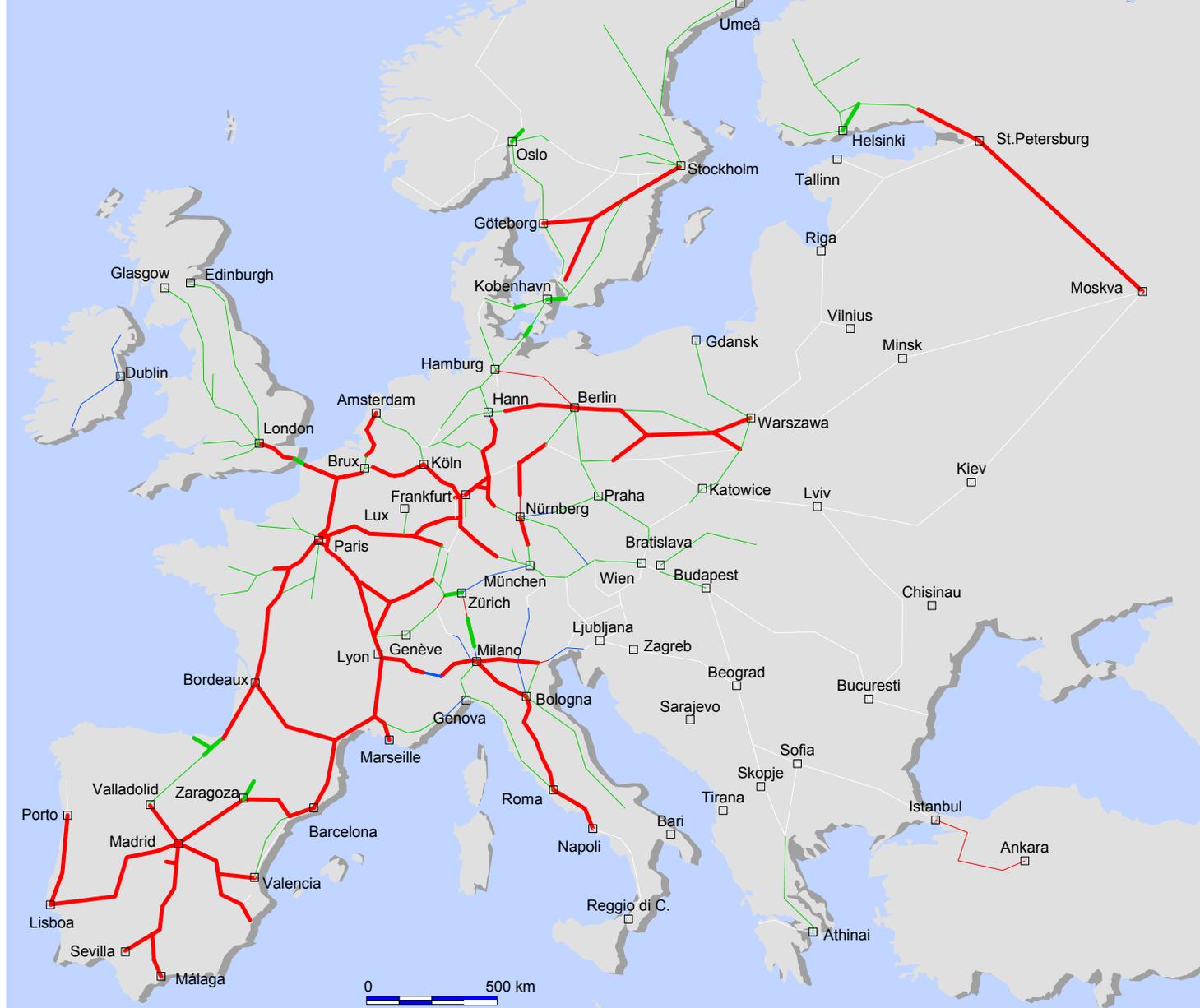
# European HS Network

Forecast for 2020

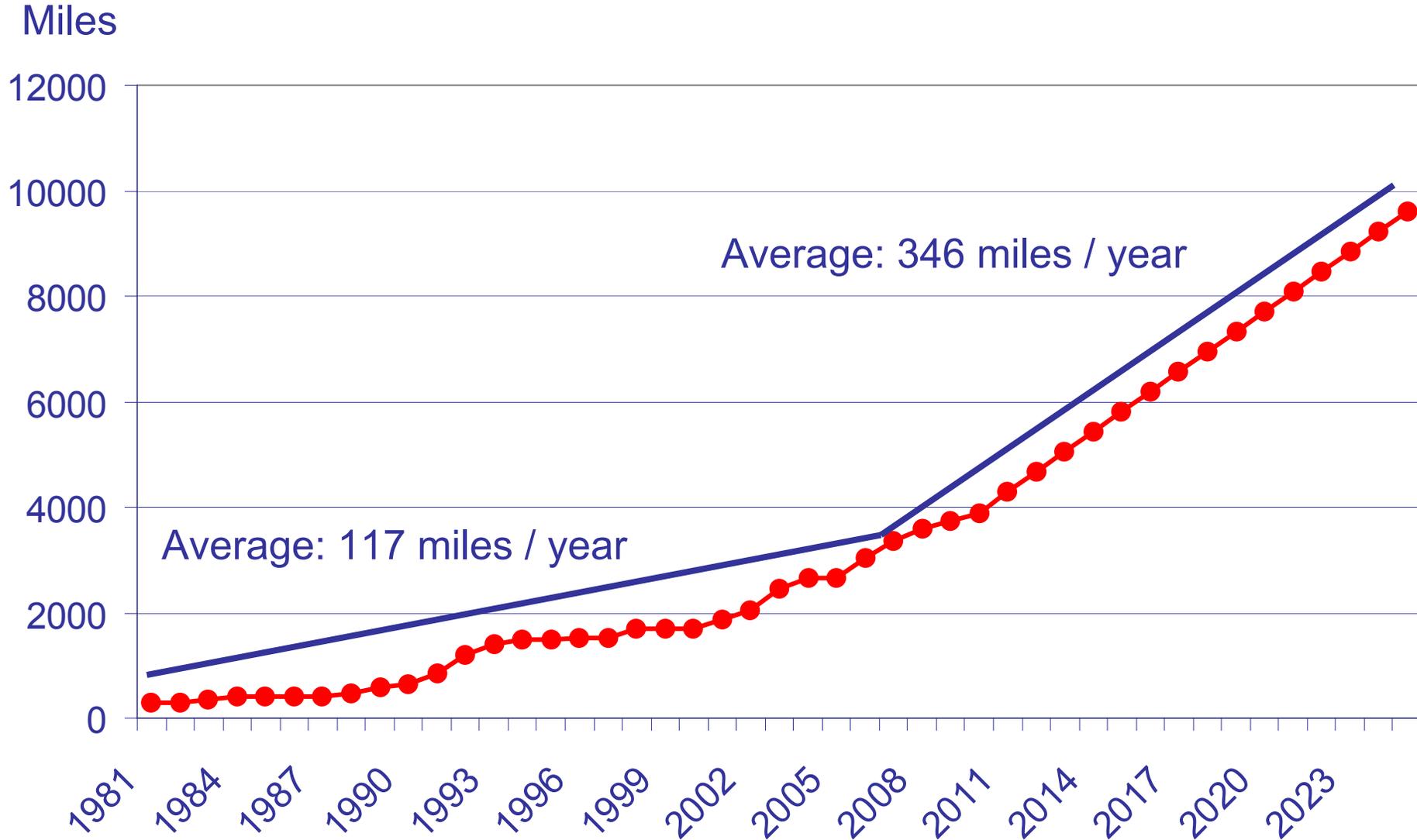


Information given by the Railways

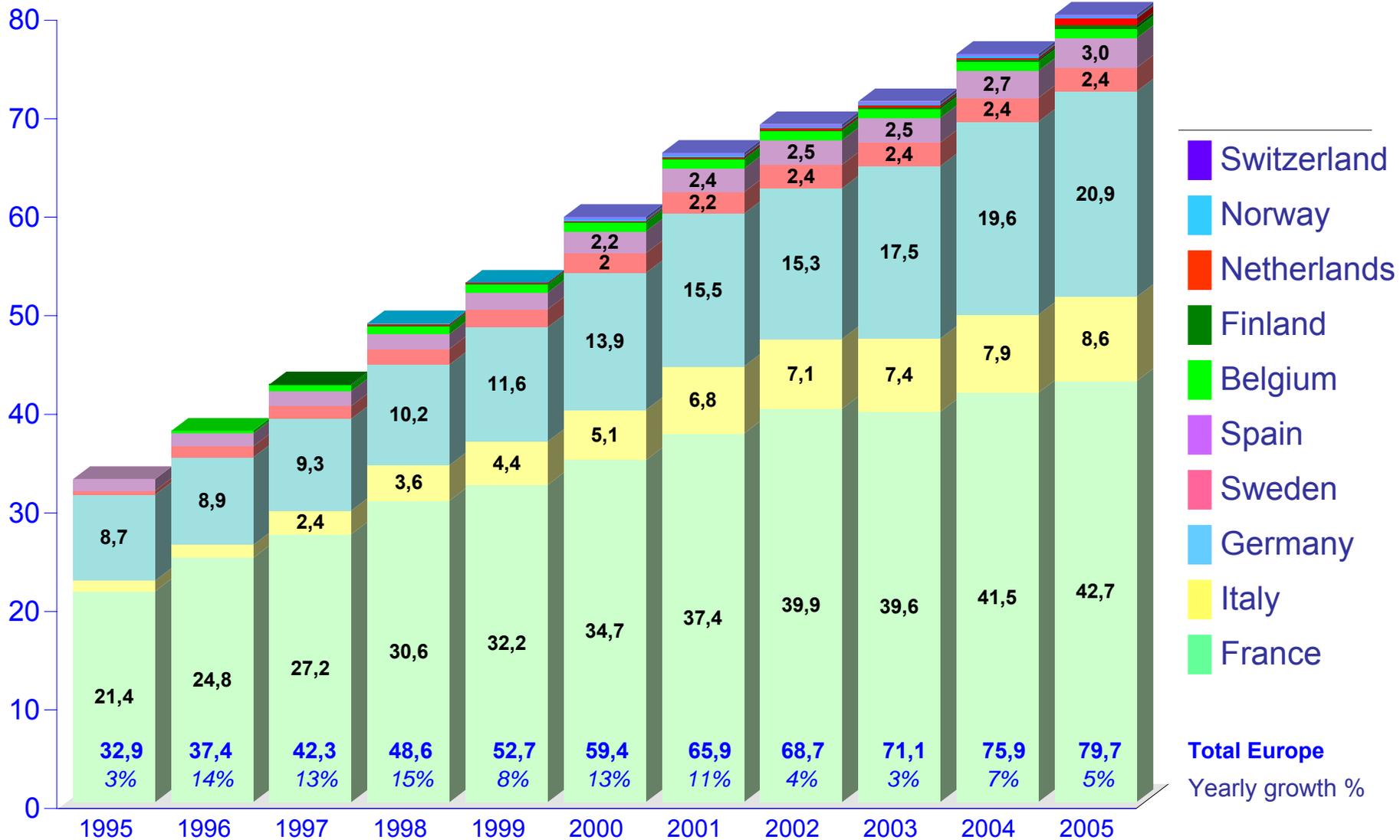
UIC - High-Speed  
Updated 04.2007 – OG/IB



# Expansion of Europe's High Speed Network

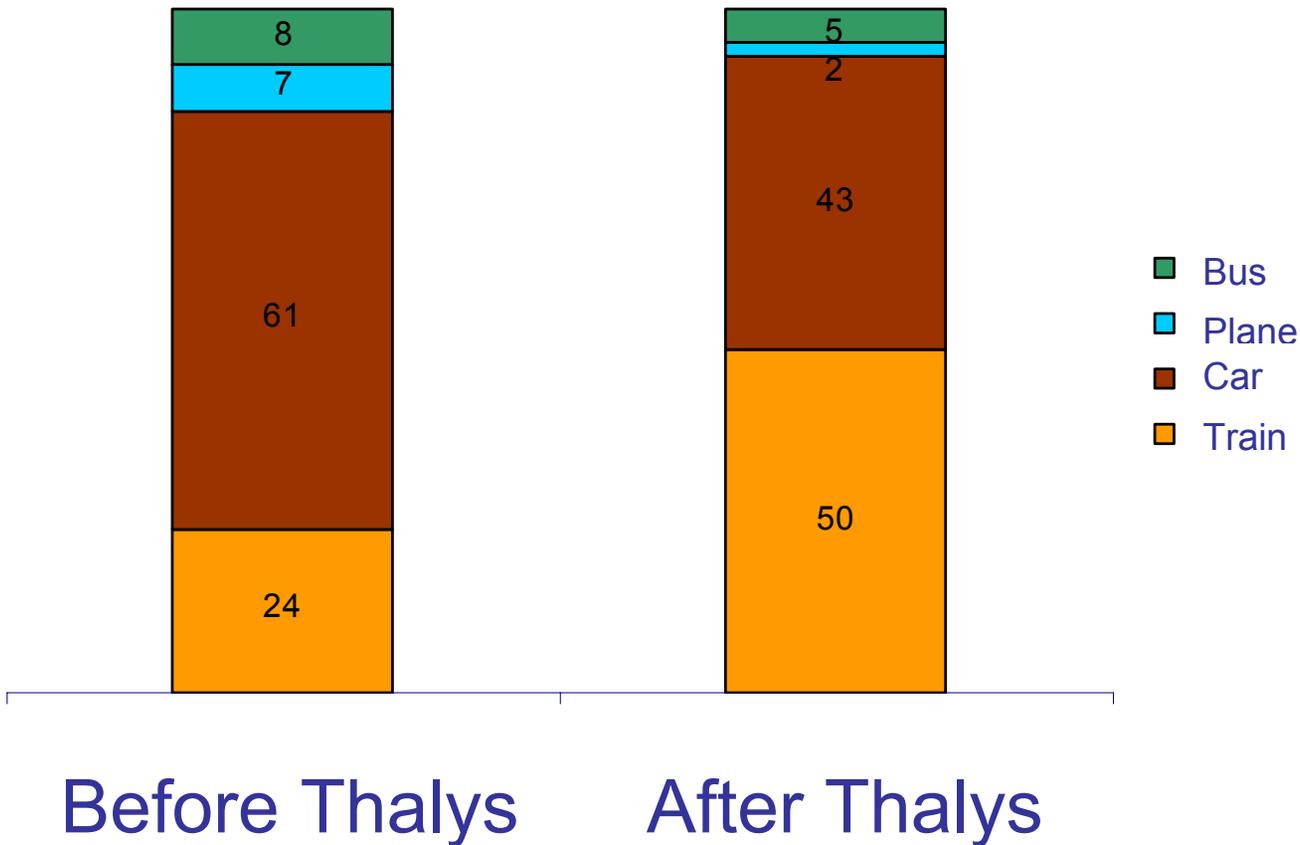


# High Speed Passenger Volume Growth – Europe



# Impact of HS rail on transport market shares

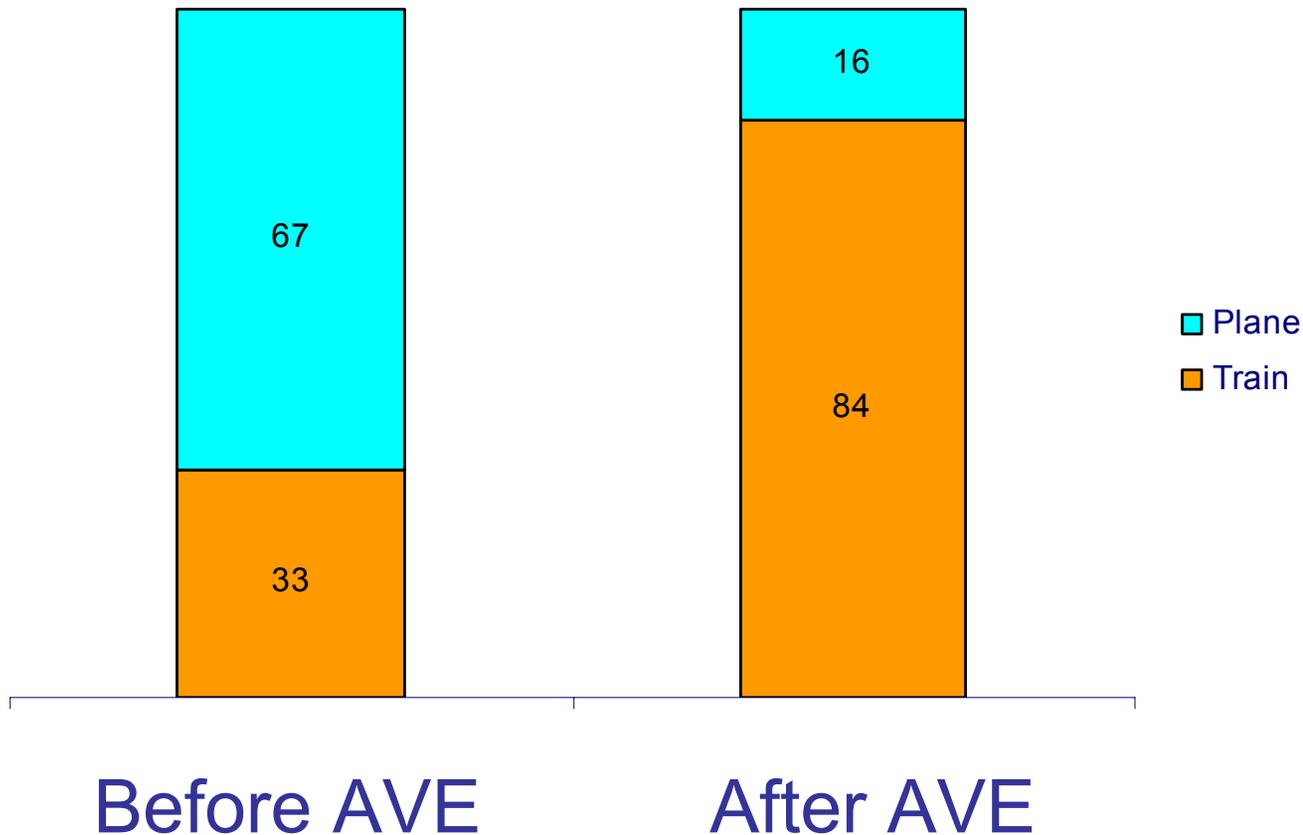
Paris - Brussels (194 miles / 1h25min.)



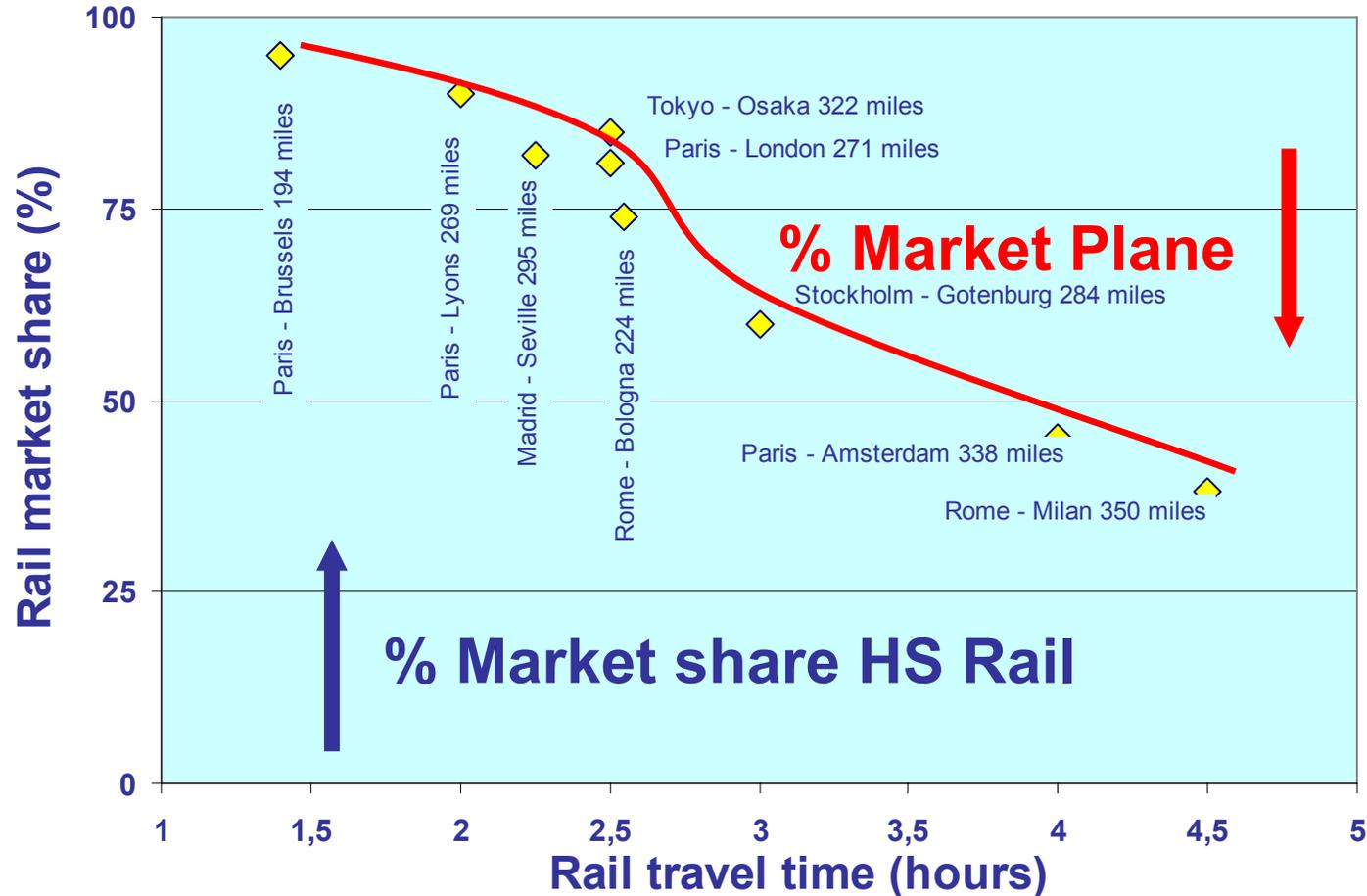
# Impact of HS rail on transport market shares

Madrid - Seville (295 miles / 2h15 min.)

Train / plane



# How train travel time influences market share



For travel times of 4 hrs or less, HS rail captures 50+% of combined air/rail traffic on a route

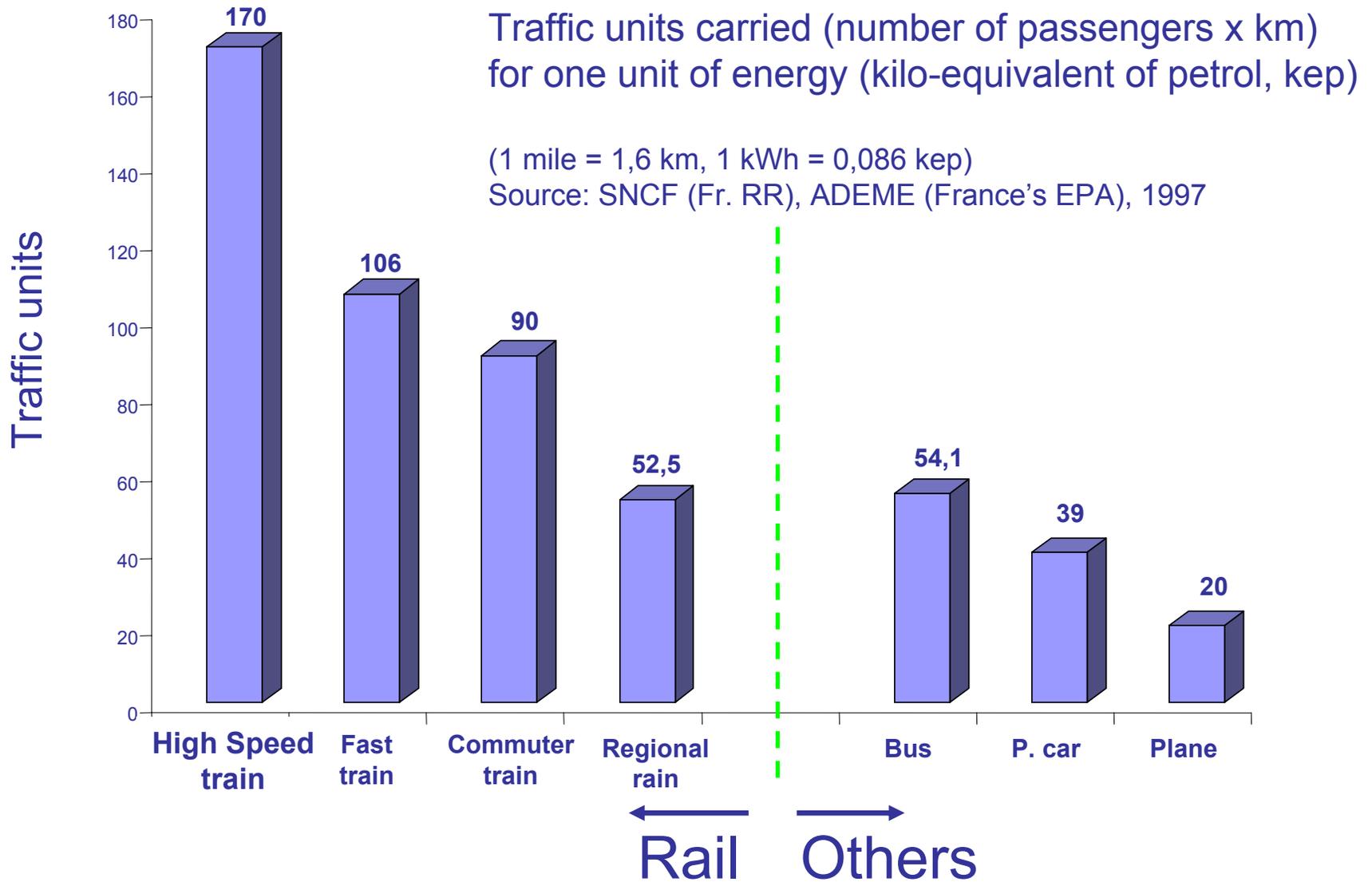
# HS advantages for society

- High capacity: up to 300,000 pax/day
  - Reduces traffic congestion/wasted time
  - Boosts economic development in areas served
- Minimal environmental impact compared to air/road transport:
  - Uses 1/3 land area of motorway
  - Uses 1/9 energy of planes
  - Uses 1/4 energy of cars
- High Speed Rail helps contain urban sprawl

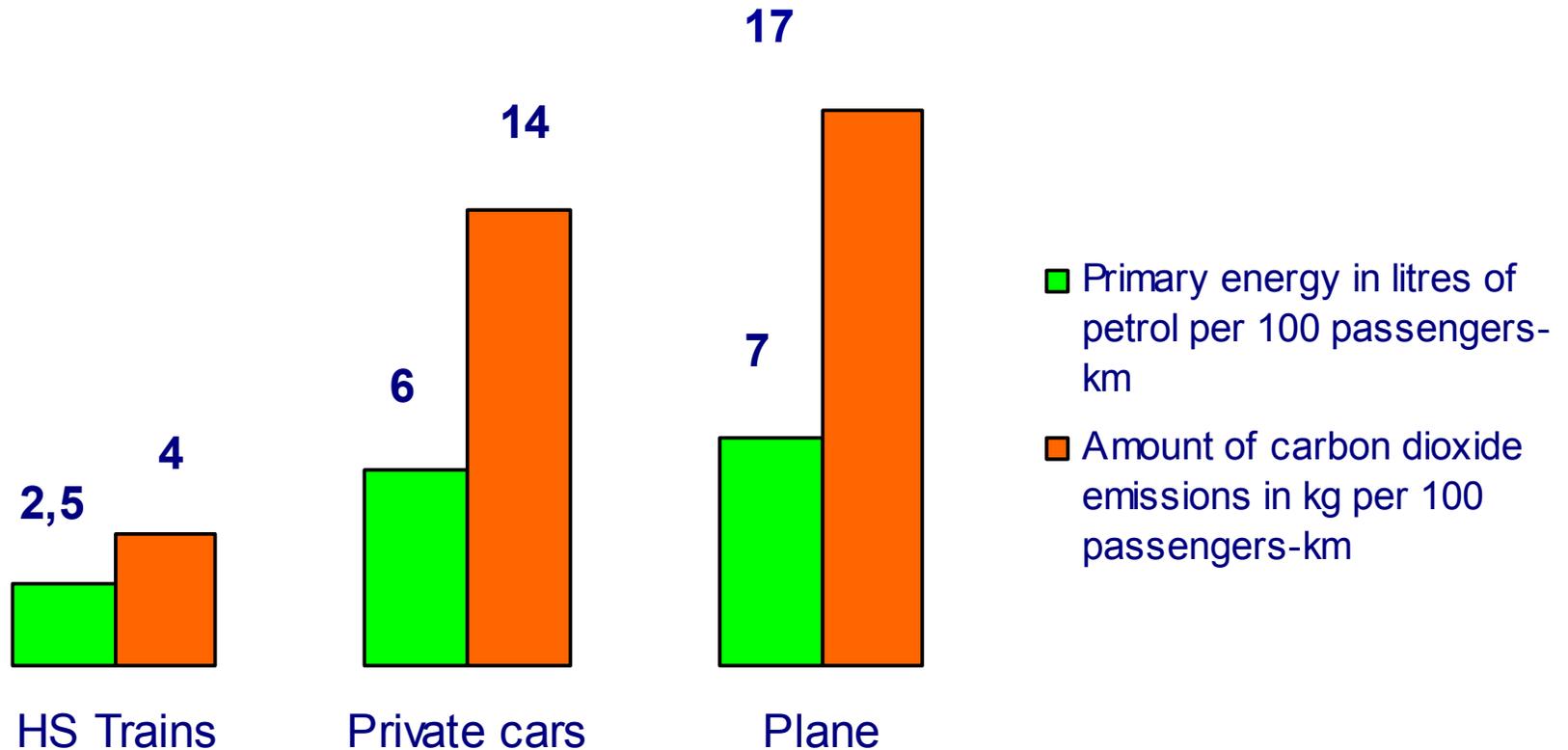
# Land required

HS Railway	Motorway
Double track 75 ft 12 trains per hour & direction 666 passengers / train Capacity = 8.000 passengers / hour	2 x 3 lanes 225 ft 4.500 cars per hour & direction 1,7 passengers / car Capacity = 7.650 passengers / hour

# Energy Efficiency Comparison

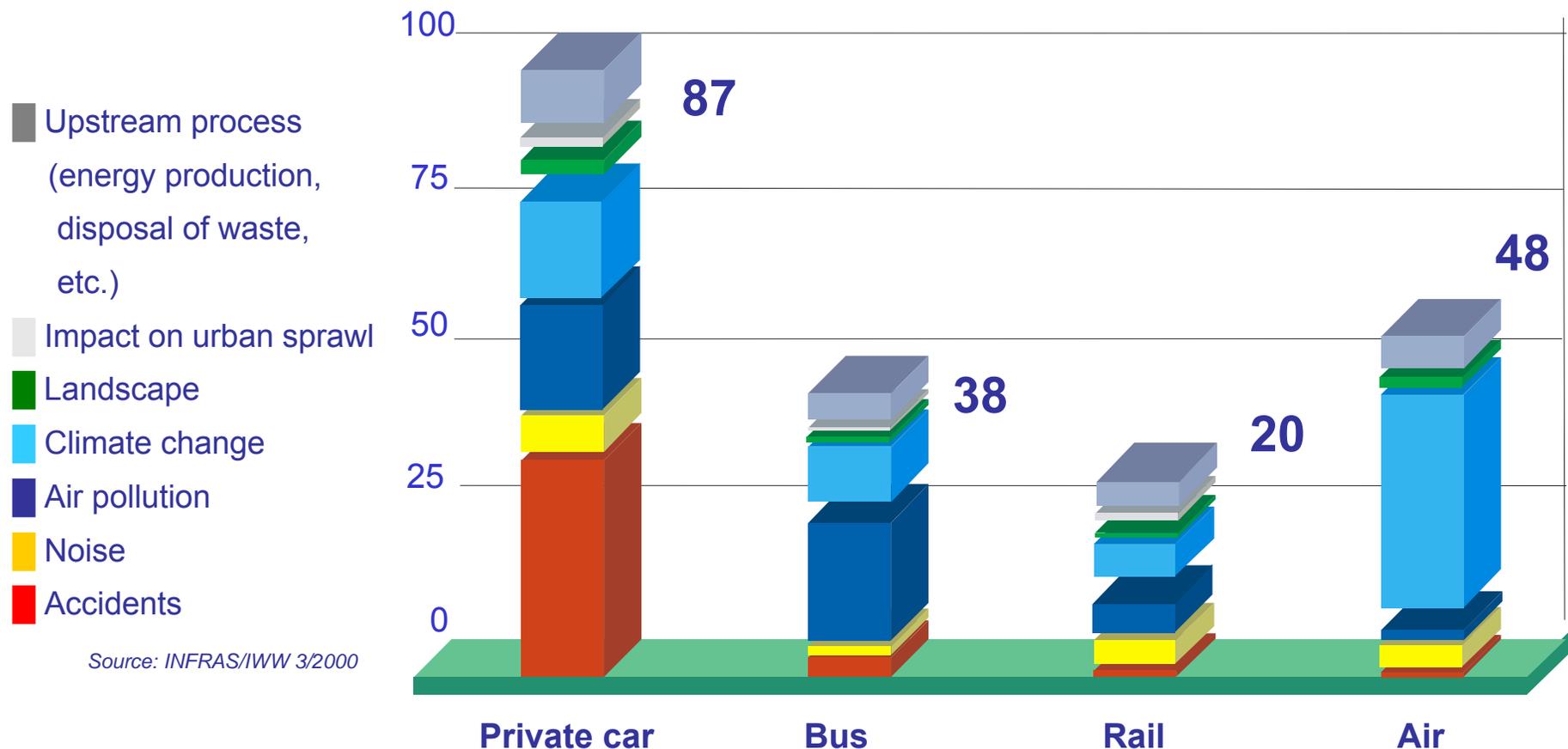


# Primary Energy and CO2 Emission



# Average External Costs

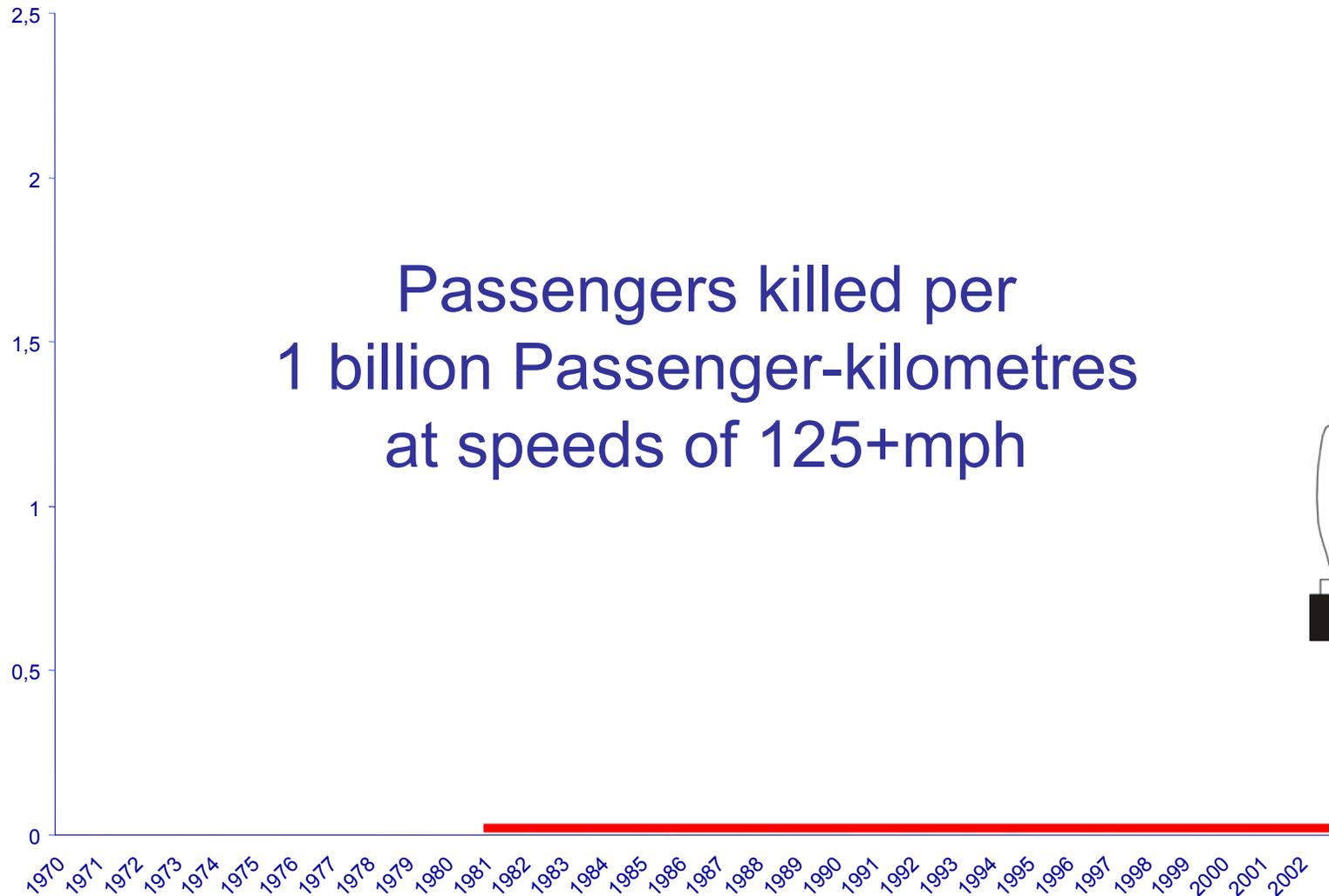
External costs = indirect costs not covered by ticket or gas paid by each traveler



Source: INFRAS/IWW 3/2000

Comparison between modes in a medium-distance corridor, non-rush hour and without considering congestion (costs in € per 1000 passenger km)

# Safety record of High-Speed Rail (EU)



In USA, 40,000 Passengers per year killed in road accidents

# Different concepts of High Speed Rail

There is no uniform approach to High Speed Rail

- A variety of marketing concepts
- Many different models of operations  
(maximum speed, number of stops, etc.)
- Different models of accepting mixed traffic  
(e.g. freight)

Each country must define what HS model needs

# Key performance factors for successful HS railways

- Commercial speed
- Frequency
- Accessibility
- Comfort
- Flexibility
- Total travel time
- Reliability
- Price
- Safety

# 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**)

# HS system average costs

Cost per mile of new HSL:	\$25 M
Maintenance per mile HSL:	\$90,000/yr
Cost of one HS train (350 seats):	\$30 M
Maintenance of a HS train:	\$1.5 M/yr

Usual rolling stock ratio: 15 trains per 100 mi.HSL

1 HS train travels an average 315,000 mi./yr

# 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

# Cost examples: France TGV East

## Paris – Strasbourg

200 miles, 200 mph operating speed

11.5 million passengers/yr expected

Total investment \$4.8 billion

### “Classic financing”

French State	31 %
European Union	8 %
State of Luxembourg	3 %
4 involved regions	19 %
RFF (Infrastructure owner)	17 %
SNCF (Main operator)	22 %

# Cost examples: France-Spain link

## Figueres - Perpignan

28 miles, 185 mph operating speed

3 million pax + 3 million ton freight/yr expected

Total investment (infrastructure)      \$1.3 billion

Concession, 50 years

French and Spanish Govts      54 %

Private investment      10 %

Bank financing      36 %

# Cost example: Taiwan

## Taipei - Kaohsiung

215 miles, 185 mph operating speed

55 million pax/yr expected

Total investment \$ 9 billion

Built Operate Transfer (BOT) at 35 years

Private investment & bank financing

Taiwan Government guarantee

For more information, comments and proposals:

Iñaki Barrón de Angoiti

*Director High Speed*

International Railway Association (UIC)

*barron@uic.asso.fr*

*www.uic.asso.fr*