Development of High Speed Rail Services: THE SPANISH EXPERIENCE
Spain in figures

- Population: 47.02 millions
- Surface area: 504,645 km²
- Population density: 93.17 people per Km²
- GDP per capita: 30,120 USD

TRANSPORT INFRASTRUCTURE

- Roads: 165,466Km.
  (Motorway / Highway : 15,621 Km)
- Railways:
  - General Interest Network: +13,800 Km.
    (High Speed Lines: +2,000 km)
  - FEVE (narrow metric gauge): 1,194 Km.
  - Other regional railways: 905 Km.
RENFE-Operadora is the main railway undertaking in Spain.

It is a State Company / Public Entity.

It is the only train passengers operator in The General Interest Network and the main freight operator.
Passengers:
• High Speed
• Long Distance
• Regional
• Commuters

Freight & Logistic Services

Manufacturing & Maintenance of Rolling Stock

Corporate centre
STAFF 917

STAFF 7,819

STAFF 1,673

STAFF 3,415

TOTAL STAFF 13,824
# Main Traffic Figures (2010)

<table>
<thead>
<tr>
<th>PASSENGER TRAFFIC:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PASSENGERS / KILOMETRE (Millions)</td>
<td>21,021.6</td>
</tr>
<tr>
<td>PASSENGERS (Millions)</td>
<td>456.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FREIGHT TRAFFIC:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MILLION TONNES / KM (net)</td>
<td>7,417.3</td>
</tr>
<tr>
<td>MILLION TONNES (net)</td>
<td>16.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCTION:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAINS / DAY</td>
<td>~ 5,000</td>
</tr>
</tbody>
</table>
Strategic Infrastructures and Transport Plan 2005-2020 (PEIT)
The Transport Plan 2005-2020 (PEIT)

The development of High Speed Railway

Currently 2,056 km

2020 ~ 10,000 km

50% of the population will have H. S. Stations in their city.

90% of the population will have H. S. Stations within 31 miles.

(Currently 69%)
The High Speed Network: Present Situation and Final Result by 2020

- In service
- Under Construction
- Design
- Preliminary Studies

- Orense-Santiago: 2011
- León: 2012
- Palencia: 2012
- Castelló: 2014
- Barcelona-Figueres: 2012
- Alicante: 2012
- Antequera-Granada: 2013
**Budget of the Plan**

Total budget of the Plan: 250,000 Million euros.

Funding Sources in Railway:
- 81% Publics Funds
- 19% OFF-Budget

Investment in transport infrastructure: 1.8% of GDP every year.

In Spain is today twice in the rest of Europe investment.
## Investment in New Trains

<table>
<thead>
<tr>
<th>(Million €)</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,036</td>
<td>1,208</td>
<td>1,249</td>
<td>1,064</td>
<td>1,216</td>
<td>5,772</td>
</tr>
</tbody>
</table>

The most modern train fleet in Europe by 2010

High Speed Railway Services
First, a success experience: High Speed Madrid-Sevilla
To build a new line Madrid - Sevilla 471 km:
- Three goals,
  - Less distance
  - Less travel time
  - More capacity

GOVERNMENT DECISION    October, 1986

COMMERCIAL OPERATION       April, 1992

Five service factors:
- Travel time
- Comfort
- Quality (on board and in stations)
- Price
- On-time commitment

1991: 570 km 5:10 h.


The beginnings of High Speed in Spain
The result of this success, a new modal distribution

1991
Before AVE

1993
After AVE
Source of Demand: Madrid – Sevilla (First year results)
• Different approach than other countries.
• Three different services using the same infrastructure:

- **High Speed Services. Spanish Model**
- **Long Distance**: Commercial service
  - 3 classes

- **Regional**: Public service
  - Single class

- **Long Distance, Dual Gauge**: Commercial service
  - 2 classes
## Services Included in the Ticket Price.

### High Speed Long Distance and Dual Gauge Trains

<table>
<thead>
<tr>
<th>Service</th>
<th>CLUB (1)</th>
<th>“PREFERENTE”</th>
<th>“TURISTA”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four music channels, radio and earphones</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Video</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Puzzles for children</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Facilities for handicapped</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Nursery</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Catering service (including special menus)</td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Free bar</td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Gourmet menu (including special menus)</td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Access to VIP Lounges</td>
<td>√</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Daily press and magazines</td>
<td>√</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Parking (24 h. single ticket, 48 h. return ticket)</td>
<td>√</td>
<td>√ (2)</td>
<td></td>
</tr>
<tr>
<td>Free access to commuter network (1)</td>
<td>√</td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

(1) Not in Dual Gauge Trains.
(2) Except in Madrid “Puerta de Atocha” station.
The High Quality of Renfe AVE services begins before the customers access the train...

Customer service offices → personalized service
Services in stations
We guarantee the right to travel to people with reduced mobility, through our service “Atendo”

People with reduced mobility assisted in our trains:

- December 2010: 26,946 assists
- In 2010: 293,998 assists (*)

(*) Representing an increase of 24.80% compared to 2009.
Madrid Puerta de Atocha - AVE Club Lounge
Valencia Joaquín Sorolla - AVE Club Lounge

NEW CONCEPT

- Warm & welcoming environment
- Avant-garde furniture
- Innovative lighting
AVE Trains - Service on board
**High Speed - Long Distance**

**300/350 Km/h**

- Three classes
- High level of service
- Market price
- Profitable
- No government compensations

---

**SUMMARY JANUARY 2011:**

- **92** trainsets in operation
- **4** trainsets being manufactured
- **117** daily services
- **42,697** daily seats offered

---

**Longest High Speed service in the World:**

1,121 km

**Average service:**

555 km
AVE Serie 100 R

Manufactured by: ALSTOM
(In operation since 1992)
(Refurbished in 2007/2009)

Gauge: 1,435 mm
Maximum speed: 300 Km/h
Number of trains: 24
Length: 200 m
Number of seats: 332
Number of seats for people with reduced mobility (PRM): 2
TALGO Serie 102 / 112

Manufactured by: TALGO
(In operation since 2005)

Gauge: 1,435 mm
Maximum speed: 330 Km/h
Number of trains: 16 / 26 (+ 4)
Length: 200 m
Number of seats: 316 / 365
Number of seats for people with reduced mobility (PRM): 2
AVE Serie 102 - Business Class

AVE Serie 102 - Tourist Class
AVE Serie 102 - Toilet
AVE Serie 102 – Other details
ICE 350 Serie 103

Manufactured by: SIEMENS
(In operation since 2007)

- Gauge: 1,435 mm
- Maximum speed: 350 Km/h
- Number of trains: 26
- Length: 200 m
- Number of seats: 405
- Number of seats for people with reduced mobility (PRM): 2
High Speed - Regional
250 km/h

- Public service fares, approved by the government
- Single class
- Functional train
- Economic compensations negotiated on a multi-year basis

SUMMARY JANUARY 2011:
- 35 trainsets in operation
- 27 trainsets being manufactured
- 96 daily services
- 24,016 daily seats offered

Average service: 154 km
HS-MD Train Serie 104

Manufactured by: ALSTOM
(In operation since 2004)

Gauge: 1,435 mm
Maximum speed: 250 Km/h
Number of trains: 20
Length: 107 m
Number of seats: 237
Number of seats for people with reduced mobility (PRM): 1
HS-MD Train Serie 114

Manufactured by: ALSTOM
(In operation since 2009)

Gauge: 1,435 mm
Maximum speed: 250 Km/h
Number of trains: (13)
Length: 105,5 m
Number of seats: 237
Number of seats for people with reduced mobility (PRM): 1
Train serie 104/114
HS-MD Train Serie 121

Manufactured by: CAF
(In operation since 2009)

Dual Gauge: 1,435 mm
1,668 mm

Maximum speed: 250 Km/h

Number of trains: 15 (+14)

Length: 107.4 m

Number of seats: 281 Tourist

Number of seats for people with reduced mobility (PRM): 1
Conventional Lines
High Speed lines
Average service: 570 km

Long Distance, Dual Gauge Services
- Speed 250 km/h using High Speed Lines.
- Up to 220 km/h using conventional lines.

SUMMARY JANUARY 2011:
- 66 trainsets in operation
- 7 trainsets being manufactured
- 80 daily services
- 23,551 daily seats offered

- The Dual Gauge services extend the benefits of the high speed lines to conventional network
- Two classes
- Full service
- Market price
- Globally profitable
2nd Generation Dual Gauge (Train-set)

Alvia Serie 120
Manufactured by: CAF
(In operation since 2006)

Dual Gauge: 1,435 / 1,668 mm
Maximum speed: 250 Km/h
Number of trains: 22 (+6)
Length: 107 m
Number of seats: 238
Number of seats for people with reduced mobility (PRM): 1
Alvia S-120 Tourist Class

AVE Serie 120 – Tourist Class

Alvia S-120 Cafeteria

AVE Serie 120 – Business Class
2nd Generation Dual Gauge (Train-set)

Alvia Serie 130

Manufactured by: TALGO
(In operation since 2007)

Dual Gauge: 1,435 / 1,668 mm
Maximum speed: 250 Km/h
Number of trains: 44 (+1)
Length: 181 m
Number of seats: 299
Number of seats for people with reduced mobility (PRM): 1
Interior Detail - Talgo Serie 130
Changers of track gauge network

TRACK GAUGE AND CHANGERS

- National track gauge (1,668 mm)
- UIC track gauge (1,435 mm)
- Changer track gauge - Talgo
- Changer track gauge - CAF
- Changer track gauge - (freight)
Changer of track gauge
Puigverd (Lleida)
Changer of track gauge
Roda de Bará (Tarragona)
Changer of track gauge
Santa Ana (Málaga)
The High Speed Services in Spain  
**AVERAGE 2010**

<table>
<thead>
<tr>
<th>HIGH SPEED SERVICE:</th>
<th>FLEET</th>
<th>TRAINS / DAY</th>
<th>SEATS / DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IN OPERATION</td>
<td>MANUFACTURING OR RECEPTION STAGE</td>
<td></td>
</tr>
<tr>
<td>LONG DISTANCE</td>
<td>92</td>
<td>4</td>
<td>117</td>
</tr>
<tr>
<td>REGIONAL</td>
<td>35</td>
<td>27</td>
<td>96</td>
</tr>
<tr>
<td>DUAL GAUGE</td>
<td>66</td>
<td>7</td>
<td>80</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>193</td>
<td>38</td>
<td>293</td>
</tr>
</tbody>
</table>
# The Spanish High Speed Rolling Stock Fleet

<table>
<thead>
<tr>
<th>CLASS</th>
<th>100 R</th>
<th>102 / 112</th>
<th>103</th>
<th>130</th>
<th>120</th>
<th>104 / 114</th>
<th>121</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANUFACTURER</td>
<td>Alstom</td>
<td>Talgo</td>
<td>Siemens</td>
<td>Talgo</td>
<td>Caf</td>
<td>Alstom</td>
<td>Caf</td>
</tr>
<tr>
<td>UNITS</td>
<td>24</td>
<td>16 / 26 + 4</td>
<td>26</td>
<td>45</td>
<td>22+ 6</td>
<td>20 + 13</td>
<td>15 + 14</td>
</tr>
<tr>
<td>MAXIMUM SPEED Km/h</td>
<td>300</td>
<td>330</td>
<td>350</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>SEATS</td>
<td>332 (2 PRM)</td>
<td>316 (2 PRM)</td>
<td>405 (2 PRM)</td>
<td>299 (1 PRM)</td>
<td>238 (1 PRM)</td>
<td>237 (1 PRM)</td>
<td>281 (1 PRM)</td>
</tr>
<tr>
<td>GAUGE</td>
<td>1,435 mm./1,668 mm.</td>
<td>1,435 mm.</td>
<td>1,435 mm.</td>
<td>1,435 mm./1,668 mm.</td>
<td>1,435 mm./1,668 mm.</td>
<td>1,435 mm.</td>
<td>1,435 mm./1,668 mm.</td>
</tr>
</tbody>
</table>

**TOTAL FLEET:** 231 TRAINSETS (in operation + manufacturing)

Integration of different technologies.
## Evolution of Passenger Numbers

### HS Long Distance
- 1992: 1,176
- 1993: 1,875
- 1994: 1,936
- 1995: 2,087
- 1996: 2,207
- 1997: 2,369
- 1998: 2,568
- 1999: 2,805
- 2000: 3,036
- 2001: 3,236
- 2002: 3,394
- 2003: 3,479
- 2004: 2,063
- 2005: 3,289
- 2006: 5,559
- 2007: 11,461
- 2008: 11,251
- 2009: 10,851

### HS Medium Distance
- 1992: 135
- 1993: 903
- 1994: 977
- 1995: 1,088
- 1996: 1,189
- 1997: 1,270
- 1998: 1,306
- 1999: 1,342
- 2000: 1,412
- 2001: 1,504
- 2002: 1,504
- 2003: 1,534
- 2004: 1,480
- 2005: 2,063
- 2006: 3,289
- 2007: 5,559
- 2008: 11,461
- 2009: 11,251

### TOTAL
- 1992: 1,311
- 1993: 2,778
- 1994: 2,013
- 1995: 3,175
- 1996: 3,396
- 1997: 3,639
- 1998: 3,874
- 1999: 4,417
- 2000: 4,448
- 2001: 4,740
- 2002: 4,989
- 2003: 5,013
- 2004: 5,263
- 2005: 6,183
- 2006: 8,167
- 2007: 9,135
- 2008: 16,302
- 2009: 16,903
- 2010: 16,700

### Increase
- 1992: 4.9%
- 1993: 9.0%
- 1994: 7.0%
- 1995: 7.2%
- 1996: 7.0%
- 1997: 6.5%
- 1998: 7.0%
- 1999: 7.2%
- 2000: 6.6%
- 2001: 6.8%
- 2002: 3.3%
- 2003: 5.0%
- 2004: 4.878
- 2005: 4.876
- 2006: 5,559
- 2007: 11,461
- 2008: 11,251
- 2009: 10,851

### Comments
- The increase in passenger numbers has been consistent over the years, with a significant rise in the early 1990s and a more gradual increase thereafter.
- The HS Long Distance has shown a steady increase, while the HS Medium Distance has been more variable but also showing growth.
- The TOTAL passenger numbers reflect the combined growth of both distance categories.

### Graphical Representation
- The graph shows the evolution of passenger numbers over the years, with a clear trend line indicating the increase in numbers.
Demand Train / Plane in three main corridors
Market Share Madrid - Sevilla

ON APRIL 21, 1992
THE FIRST HIGH SPEED SERVICE ARRIVES TO SEVILLA
Market Share Madrid - Barcelona

ON FEBRUARY 20, 2008
THE NEW HIGH SPEED SERVICE ARRIVES TO BARCELONA
Market Share Madrid - Málaga

ON DECEMBER 27, 2007
THE NEW HIGH SPEED SERVICE ARRIVES TO MÁLAGA
Market Share Madrid - Valencia

On December 19, 2010, the new high-speed service arrives to Valencia.
Length of High Speed Lines in Operation

SPAIN FIRST IN EUROPE & THIRD IN THE WORLD

Source: UIC JANUARY 2011 Statistics.
World Ranking of High Speed Rolling Stock Fleet
In operation + manufacturing

RENFE THIRD IN THE WORLD

Source: UIC MARCH 2009 Statistics.
Average Commercial Speed of High Speed Trains
World Ranking

Spain First in the World

Km/h

Spain: 221.1
Japan: 218.8
France: 216.0
United Kingdom: 180.0
Italy: 172.5
South Korea: 153.2
Germany: 145.0
Punctuality World Ranking of High Speed Trains

SPAIN SECOND IN THE WORLD

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan Railways</td>
<td>99,0%</td>
</tr>
<tr>
<td>Renfe Spain</td>
<td>98,5%</td>
</tr>
<tr>
<td>Korean Train Express</td>
<td>93,7%</td>
</tr>
<tr>
<td>TGV France</td>
<td>92,5%</td>
</tr>
<tr>
<td>Eurostar France-U. Kingdom</td>
<td>91,6%</td>
</tr>
<tr>
<td>Eurostar Italy</td>
<td>87,0%</td>
</tr>
<tr>
<td>Acela Express USA</td>
<td>79,6%</td>
</tr>
<tr>
<td>Intercity Express Germany</td>
<td>79,0%</td>
</tr>
</tbody>
</table>
Quality Commitments
Rail Services Attributes

Rail services attributes:
- Safety
- Comfort
- Competitive Journey Time
- Punctuality
- High Quality Service
- Environmental & Friendly

RENFE-Operadora’s Initiative

New Specific Commitments to Clients
1st Stage: High Speed Punctuality

- **Date:** September 11, 1994
- **Product:** High Speed Trains

- **Commitment:**
  
  Total ticket price refunded if a train arrives at its destination with a delay of five minutes or more

  The price is refunded in cash
On-time commitment success on AVE trains led to:

- On-time commitment gradual implementation in other products:
  - Long Distance
  - Regional

- RENFE-Operadora undertakes new quality commitments:
  - Video / Audio, Air-conditioning, WC, Meal service at seat, Restaurant/cafeteria
### On-Board Services: Economic Compensations for lack or deficiency

<table>
<thead>
<tr>
<th>Lack / Deficiency of:</th>
<th>Compensation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video / Audio</td>
<td>15%</td>
</tr>
<tr>
<td>Air conditioning (total)</td>
<td>100%</td>
</tr>
<tr>
<td>Air conditioning (partial)</td>
<td>50%</td>
</tr>
<tr>
<td>Toilet</td>
<td>100%</td>
</tr>
<tr>
<td>Meal service at seat</td>
<td>50%</td>
</tr>
<tr>
<td>Cafe / Restaurant</td>
<td>25%</td>
</tr>
</tbody>
</table>
Evolution of Rolling Stock Manufacture and Maintenance by Renfe
Prior to the acquisition of AVE trains in 1992, the railway fleet in Spain consisted only on conventional rolling stock.

- Rolling stock was manufactured by external companies and basically all maintenance was carried out at RENFE depots.
- The technological development of rolling stock hardly experienced any changes during this time.

\[\text{CONVENTIONAL ROLLING STOCK:}\]

- Manufacturing ...........0%
- Maintenance ...........100%
The introduction of High Speed services, supposed a major technological change in the Spanish railway scenario.

To begin with, own company depots were not able to meet the challenge of maintaining the new rolling stock. Renfe outsourced these services to the manufacturing companies.

The progressive reduction of conventional rolling stock led to over capacity at depots.

**CONVENTIONAL ROLLING STOCK:**
- Manufacturing ........0%
- Maintenance ..........100%

**HIGH SPEED ROLLING STOCK:**
- Manufacturing ..........0%
- Maintenance ..........0%

1992 (beginning of the high speed service) – 2004
AFTER 2005

Strategies:

* Establish alliances with the private sector, both for the manufacture of trains and for internal and external maintenance.

* Technological update of Renfe-Operadora depots.

* Modernization and upgrading of installations.

<table>
<thead>
<tr>
<th>EXISTING CONVENTIONAL ROLLING STOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance ................100%</td>
</tr>
<tr>
<td>Refurbishment ...........100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEW ROLLING STOCK:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(High Speed, Long Distance, Regional, Local Trains)</td>
</tr>
<tr>
<td>Manufacture ..............20%</td>
</tr>
<tr>
<td>Maintenance .............50%</td>
</tr>
</tbody>
</table>
### Joint ventures Renfe – Private Sector

<table>
<thead>
<tr>
<th>Company A</th>
<th>Company B</th>
<th>Establishment Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siemens</td>
<td>NEKTUS</td>
<td>March 12, 2002</td>
<td>Established on March 12, 2002 Capital increase to incorporate new High Speed Projects (Train class 103)</td>
</tr>
<tr>
<td>Vossloh</td>
<td>erion</td>
<td>January 24, 2007</td>
<td>Established on January 24, 2007</td>
</tr>
<tr>
<td>CAF</td>
<td>actren</td>
<td>May 14, 2007</td>
<td>Established on May 14, 2007</td>
</tr>
<tr>
<td>Bombardier</td>
<td>BTREN</td>
<td>November 28, 2007</td>
<td>Established on November 28, 2007</td>
</tr>
<tr>
<td>Alstom</td>
<td>IRVIA</td>
<td>January 21, 2008</td>
<td>Established on January 21, 2008</td>
</tr>
<tr>
<td>Talgo</td>
<td>Tarvia</td>
<td>June 03, 2008</td>
<td>Established on June 03, 2008</td>
</tr>
<tr>
<td>Albatros</td>
<td>Albatros</td>
<td>February 26, 2002</td>
<td>Established on February 26, 2002</td>
</tr>
</tbody>
</table>
10 train hotel (in partnership with Talgo)
18 dual gauge trains S-130 (in partnership with Talgo-Bombardier)
30 high speed trains S-102 (2nd series) (in partnership with Talgo-Bombardier)
10 high speed trains S-103 (2nd series) (in partnership with Siemens)
40 commuter trains CIVIA III (in partnership with Alstom)
30 commuter trains CIVIA IV (in partnership with Alstom)
40 commuter trains CIVIA III (in partnership with CAF-Siemens)
30 commuter trains CIVIA IV (in partnership with CAF-Siemens)
29 dual gauge trains S-120 (2nd series) (in partnership with CAF-Alstom)
13 trains S-104 (2nd series) (in partnership with Alstom-CAF)
107 new trains for Regional (in partnership with CAF)
100 locomotives S-253 for Freight (in partnership with Bombardier)
Thank you for your attention.