Conference Vision 2030

Experience from implementation of high speed rail in Italy

Brno, 12th September 2013

Giulia Costagli – Strategic Planning Rete Ferroviaria Italiana
“Ferrovie dello Stato Italiane”

Ferrovie dello Stato Italiane

Trenitalia
RFI
Italferr
Grandi Stazioni
Other companies

100% 100% 100% 60%

Trenitalia
Freight and passenger RU

RFI
IM

Italferr
Railway Engineering

Grandi Stazioni
Management of main stations

FS Logistica
Logistic

Other companies
IM: framework, mission and strategies

RFI has the task of **planning, building, operating and managing** the national railway infrastructure;

→ guaranteeing **safe** circulation on the whole network;

→ assuring maintenance in efficiency;

→ developing systems’ **technology** and

→ assuring the access to the network for RU
The Italian Core Corridors

Core Networks Corridors interesting Italy

- Baltic – Adriatic Corridor
- Mediterranean Corridor
- Helsinki - Valletta Corridor
- Genova - Rotterdam Corridor
RFI: the network

... a great resource

**RFI network:** 16.742 km

- **Double track:** 7.536 km
- **Single track:** 9.206 km

**Electric traction:** 11.959 km (71 %)

- **Passenger stations:** 2.260

**Innovative technologies for safety**

- **SCMT – SSC:** 15.893 km
- **ERTMS:** 650 km
- **GSM-R:** 9.000 km

**Total RFI Staff** *about 27.000*
Volumes evolution and revenues from access charge

32 Railway Undertakings*

40 Contracts
- 21 freight
- 16 Passengers
- 2 Freight test trains
- 1 Rolling stock transfer

* Rus number for 2012-2013 timetable
## Punctuality

<table>
<thead>
<tr>
<th>Service</th>
<th>Within</th>
<th>2012</th>
<th>2013</th>
<th>Volumes: Tr./day 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurostar market</td>
<td>15’</td>
<td>94,5%</td>
<td>94,9%</td>
<td>263</td>
</tr>
<tr>
<td>Universal service</td>
<td>15’</td>
<td>92,7%</td>
<td>89,9%</td>
<td>184</td>
</tr>
<tr>
<td>Regional</td>
<td>5’</td>
<td>90,4%</td>
<td>90,3%</td>
<td>7.082</td>
</tr>
<tr>
<td>Freight</td>
<td>30’</td>
<td>72,1%</td>
<td>72,5%</td>
<td>398</td>
</tr>
</tbody>
</table>

DATA REFERRED TO STANDARD B – TRAINS OF ALL RUs
Contracts with the State

In recent years RFI began an improvement process that allowed economical results of tendential balance with good performance indicators. The macroeconomic crisis, involving the market and the public finance, can result in further improvement margins.

The lack of resources imposes some choices also through:

- Review of the investments portfolio
- Review of availability levels of the managed network

Programme contract / Services

Integrated regulation of maintenance activities (ordinary and extraordinary)
Economically sustainable performances and penalties on performances
«Market oriented» maintenance offer

Programme contract / Investments

Selective concentration with focus on Corridors and on light investments to remove bottlenecks
The investment portfolio of the Programme Contracts is about 206.6 billion, 71.0 of which are already financed. The investments are divided into following classes:

**Mandatory investments (requirement 22.5 billion)**

0. Extr. Maint. (2012-2014) (CdP-S)
   - Allocated (97%) = 4.018
   - Financed = 3.035

1. Ordinary maint. (residual 2007-2011) (table A00)
   - Allocated (98%) = 26.766
   - Financed = 5.248

**Investments for development (requirement 113.1 billion)**

2. Safety and OL (table A01)
   - Allocated (95%) = 7.763
   - Financed = 4.889

3. Technologies (table A02)
   - Allocated (83%) = 3.822
   - Financed = 923

4. Infrastructural Development (tables A04, 05, A1)
   - Allocated (90%) = 164.260
   - Financed = 56.908
The expenditure for investments

Production volumes*

Billion Euros

Provisions of Programme Contract 2012-2016 - part investments

* Included extraordinary maintenance
WHY HIGH SPEED?

“...Imbalances in terms of disproportionate mobility by road, excessive traffic and congestion, uncoordinated infrastructure planning as well as inefficient use of existing transport capacity are symptomatic for the transport market. Present trends in road and air transport are all leading towards even greater inefficiency, congestion, pollution, waste of time and value, damage to health, danger to life and general economic loss.”

(Council of European Communities, 1993)
WHY HIGH SPEED?

A NEED AROSE FOR THE CREATION OF A NEW WAY (SAFE, FAST AND ENVIRONMENTALLY SOUND) TO MEET THE MOBILITY NEEDS OF PASSENGERS AND FREIGHT, MAKING AT THE SAME TIME BETTER USE OF EXISTING TRANSPORT INFRASTRUCTURE.
THE ITALIAN CHOICE

1991

START-UP OF THE “HIGH SPEED” PROJECT, MEANT AS A NETWORK FOR A FAST TRANSPORTATION OF PASSENGERS

1997-98

REVISION INTO “HIGH CAPACITY” PROJECT MEANT AS A SYSTEM INTEGRATED WITH THE EXISTING NETWORK, ABLE TO IMPROVE THE PERFORMANCE OF BOTH LONG-DISTANCE AND REGIONAL TRAFFIC
THE ITALIAN CHOICE

Since 1991, a special purpose Company, TAV (Treno Alta Velocità), is responsible for the design and the implementation of the High Speed/High Capacity Project.

TAV has been under the control of RFI (Rete Ferroviaria Italiana), the Italian Rail Infrastructure Manager.
**Highlights - Project evolution**

**Start up:**
- **1986** State General Transport Plan foresees the realization of HS Lines
- **1991** Establishment of TAV S.p.A (SPV) - 40% FS e 60% Private sector
- **1991** TAV - General Contractor agreement to plan and realise the HS Lines

**Definition of Planning Phase:**
- Approval process with local authorities: started in 1992 and lasted 13 years with relevant impact on project definition
- Opening of 1° construction works on Rome-Naples Line in 1994
- Total ridefinition of project from High Speed to High Capacity: an integrated network with conventional lines designed also for freight trains
- Revision of TAV- General Contractor agreements.

**Consolidation Phase:**
- Significant investment production with opening of first Line Rome-Naples in 2005
- Completion of HS/HC Lines in 2009
Evolution of financing model
(Turin-Milan-Naples HS/HC system)

1991

State

40% Equity in TAV through FS

Private sector

60% Equity in TAV

1998

(TAV 100% controlled by FS)

State

40% Investments and 100% interests in construction phase through grants

Private sector

60% Investment through Loan

2000

(Hubs 100% State)

State

100% Hub investments, 40% Line Investments and 100% interests in construction phase through grants

Private sector

60% of only Line Investments through Loan

2003

(ISPA - public institution to support the funding of infrastructural projects)

State

100% interest in construction phase, State intervention during the operational phase as contribution to refund the debt service

Private sector

From year 2004 100% of funds in construction phase to be raised on the financial market through Ispa intermediation

2007 - nowdays

State

State taking over of ISPA debts and funding ~ 85% of HS/HC investment costs

Private sector

The remaining investment to be financed by project cash flows through private loans
The High Speed / High Capacity system

In order to extend the network of the destinations served by HS services the new lines have been designed for a close interconnection with the traditional lines.

- **Milano-Bologna**
  - Operating 12/08

- **Reggio Emilia**
  - 2013: New HS Station

- **Bologna**
  - 2013: New HS Station

- **Bologna-Firenze**
  - Operating 12/09

- **Firenze**
  - 2018: New HS Station

- **Gricignano-Napoli**
  - Operating 12/09

- **Roma-Napoli**
  - Operating 12/05

- **Napoli Afragola**
  - 2014: New HS Station

- **Novara-Milano**
  - Operating 12/09

- **Torino-Novara**
  - Operating 02/06

- **Treviso-Brescia**
  - Work ongoing (2016)

Further investments aims to upgrade the main international corridor.
The modal share

Milan – Rome (% modal share)

- **2008**
  - Train: 12
  - Air: 2
  - Cars: 36

- **2009**
  - Train: 50
  - Air: 1,5
  - Cars: 10,5

+400/500 K passengers/year

- **2008**
  - Train: 50
  - Air: 1
  - Cars: 8

+300/400 K passengers/year
The High Speed /High Capacity System

HS/HC NETWORK 1000 km

Con la realizzazione della linea AV/Ac Milano-Venezia, il 75% della popolazione italiana sarà servita con linee ad alta velocità

TRAVEL TIMES ON ETR TRAINS

<table>
<thead>
<tr>
<th>Lines</th>
<th>TO-MI</th>
<th>MI-BO</th>
<th>BO-FI</th>
<th>RM-NA</th>
<th>RM-MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>1:00’</td>
<td>1:02’</td>
<td>35’</td>
<td>1:08’</td>
<td>2:55’</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>no stop</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2:40’ MI Rogoredo RM Tiburtina</td>
</tr>
</tbody>
</table>

FUTURE

<table>
<thead>
<tr>
<th>RM-MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:30’</td>
</tr>
<tr>
<td>no stop</td>
</tr>
<tr>
<td>2:15’</td>
</tr>
<tr>
<td>MI Rogoredo RM Tiburtina</td>
</tr>
</tbody>
</table>

RFI
RETE FERROVIARIA ITALIANA
GRUPPO FERROVIE DELLO STATO ITALIANE
The High Speed /High Capacity connections

Two competitors

High traffic volumes

→ 204 tr/day

→ 3,68 milion tr*km

21,2 mil on lines equipped with ERTMS
## Innovation: the new High Speed stations

<table>
<thead>
<tr>
<th>Station</th>
<th>Progetto</th>
<th>Superficie</th>
<th>Costo</th>
<th>SAL: avanzamento lavori al %</th>
<th>Attivazione</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torino Porta Susa</td>
<td>Gruppo AREP</td>
<td>47.500 mq</td>
<td>40 mln€</td>
<td>75% (Passante: interramento e quadruplicamento binari) e 47% (Fabbricato Viaggiatori)</td>
<td>set. 2011 (esercizio parziale F.V.); dic. 2011 (ultimazione F.V.); dic. 2012 (Passante)</td>
</tr>
<tr>
<td>Firenze Belfiore</td>
<td>Norman Foster &amp; Ove Arup</td>
<td>48.700 mq</td>
<td>410 mln€</td>
<td>2011 lo scavalco; in corso realizzazione Lotto 2 (passante e stazione)</td>
<td>lug. 2015 (passante e stazione)</td>
</tr>
<tr>
<td>Napoli Afragola</td>
<td>Zaha Hadid Architects</td>
<td>20.000 mq</td>
<td>104 mln€</td>
<td>12%</td>
<td>2013</td>
</tr>
<tr>
<td>Bologna Centrale</td>
<td>Ove Arup &amp; Partners</td>
<td>42.000 mq</td>
<td>435 mln€</td>
<td>62%</td>
<td>Giugno 2013</td>
</tr>
<tr>
<td>Roma Tiburtina</td>
<td>ABDR (Paolo Desideri)</td>
<td>50.000 mq</td>
<td>322 mln€</td>
<td>(di cui 196 mln €la sola stazione)</td>
<td>dicembre 2010 (lato Pietralata); dicembre 2011</td>
</tr>
<tr>
<td>Reggio Emilia</td>
<td>Santiago Calatrava</td>
<td>8.000 mq</td>
<td>79 mln€</td>
<td>avviati i lavori a marzo 2010</td>
<td>Giugno 2013</td>
</tr>
</tbody>
</table>
Torino Porta Susa

Quadruplying Torino Porta Susa – Torino Stura

The new station
HIGH SPEED LINES

High speed lines respect the requirements of the Technical Specification of Interoperability

➤ Speed
  • Maximum speed: 300 km/h
  • Speed on up-down lines connections: 160 km/h
  • Speed on junctions: 160 km/h, 100 km/h
  • Speed on overtaking branches: 60 km/h

➤ Maximum axial load
  • Passenger HS Trains: 170 kN
  • Freight Trains: 225 kN
The ETCS/ERTMS level 2 system

Goals

- Realization of a standard signalling system;
- Realization of a standard set of operations rules;
- Establish common safety targets;
- Define common rules for validation and homologation (certification).

Functioning principles:

- System based on continuous radio transmission
- The train runs after receiving a Movement Authority
- MAs are processed by RBC and issued through GSM-R
- The train sends its position report to RBC
- Trackside system is equipped by audiofrequency track circuits
- The confidence interval is verified by on-board odometric system relying on eurobalises detection
- Optional lateral signals
High speed line

Standard section in tunnel

Standard section on viaduct
8 REGIONS, 18 PROVINCES AND 200 MUNICIPALITIES OF VARYING SIZES, DENSITY OF POPULATION AND DEVELOPMENT CHARACTERISTICS ARE INVOLVED IN THE ITALIAN HIGH SPEED/HIGH CAPACITY PROJECT
The High Speed/High Capacity system will transform the way in which people and goods are moved between cities, offering clients the choice of driving, flying or using high speed trains.

Two sets of benefits are to be considered:

- short term benefits generated during the construction stage
- medium-long term benefits accruing during the operational stage
THE BENEFITS OF HIGH SPEED

BENEFITS DURING CONSTRUCTION:
INCREASE IN ECONOMIC GROWTH

These benefits are related to the activity generated by firms directly receiving the construction spending, by intermediate purchases and by the spending of increased worker incomes on consumer items.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average yearly capital expenditure:</td>
<td>1.5 billion Euro</td>
</tr>
<tr>
<td>Increased yearly gross production:</td>
<td>5.2 billion Euro</td>
</tr>
<tr>
<td>Increased yearly added value:</td>
<td>2.8 billion Euro</td>
</tr>
<tr>
<td>Induced direct and indirect employment:</td>
<td>56.4 permanent and temporary job opportunities per 1 million Euro investment (around 75,000 people/year on average)</td>
</tr>
</tbody>
</table>
THE BENEFITS OF HIGH SPEED

BENEFITS DURING OPERATION:
NON USER BENEFITS DUE TO THE DIVERSION OF TRAFFIC FROM ROAD TO RAIL (1)

These benefits refer to those people indirectly affected by the project implementation. They are generated by the diversion of traffic from road to rail and result from the reduction of external costs associated to the provision of transport services.

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Air pollution impacts of passenger transport by transport mode

- Nitrogen oxides
- Sulphur oxides
- Carbon monoxide

Air pollution impact of freight transport by transport mode

- Nitrogen oxides
- Sulphur oxides

---

0
0.2 0.4
0.6
0.8
1
1.2
1.4
1.6
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
gr/tonne-km
gr/passenger-km
Rail/Road comb.
Rail
Road
THE BENEFITS OF HIGH SPEED

BENEFITS DURING OPERATION:
NON USER BENEFITS DUE TO THE DIVERSION OF TRAFFIC FROM ROAD TO RAIL (2)

Average number of deaths per billion passenger-km in the EU by transport mode

<table>
<thead>
<tr>
<th>Transport Mode</th>
<th>Road</th>
<th>Rail</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger</td>
<td>15</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Freight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average social costs of accidents in EU by transport mode

<table>
<thead>
<tr>
<th>Transport Mode</th>
<th>Road private</th>
<th>Road public</th>
<th>Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro per 000 pass-km or tonne-km</td>
<td>35</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Euro per 000 pass-km or tonne-km</td>
<td>10</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

Euro per 000 pass-km or tonne-km

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<th>Transport Mode</th>
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</tr>
<tr>
<td>Euro per 000 pass-km or tonne-km</td>
<td>10</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>
THE BENEFITS OF HIGH SPEED

BENEFITS DURING OPERATION:
USER BENEFITS DUE TO THE IMPROVED PERFORMANCE OF TRANSPORT SERVICES

These benefits relate to the time savings that will be experienced by travellers along the different routes served by High speed trains.

<table>
<thead>
<tr>
<th>Section</th>
<th>Length</th>
<th>Travel times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roma - Torino</td>
<td>Km.722</td>
<td>5’55” ⇒ 4’05”</td>
</tr>
<tr>
<td>Roma - Milano</td>
<td>Km.569</td>
<td>4’10” ⇒ 2’55”</td>
</tr>
<tr>
<td>Roma - Bologna</td>
<td>Km.354</td>
<td>2’28” ⇒ 1’55”</td>
</tr>
<tr>
<td>Roma - Firenze</td>
<td>Km.262</td>
<td>1’36” ⇒ 1’31”</td>
</tr>
<tr>
<td>Roma - Napoli</td>
<td>Km.214</td>
<td>1’45” ⇒ 1’09”</td>
</tr>
</tbody>
</table>
HS Line Milano-Bologna: technical features

- Length = 185 km
- Power supply = 25 kV a.c. 50Hz
- Signalling system = ERTMS/ETCS with no lineside signals
- Maximum speed = 300 km/h
- Number of connections with the traditional line = 9
- Peripheral Posts = 19
- Railway circulation is managed from a Traffic Control Room located in Bologna

Journey time: 60'
HS Line Bologna-Firenze: technical features

- Length = 78.5 km
  - 73.8 km tunnel
- Power supply = 25 kV a.c. 50Hz
- Signalling system = ERTMS/ETCS with no lineside signals
- Maximum speed = 300 km/h
- Peripheral Posts = 8
- Railway circulation is managed from a Traffic Control Room located in Bologna

Journey time: 37'
Bologna junction: the new HS Connection

- Length = 17.8 km
  - 13 km tunnel
- Signalling system = ERTMS/ETCS L2
- Maximum speed = 260 km/h
- Railway circulation is managed from a Traffic Control Room located in Bologna

Starting date:
- 22 June 2012 (no stop trains)
High Speed Commercial offer

MILANO – BOLOGNA HS
110 (28) 10

BOLOGNA – FIRENZE HS
162 (34) 14

Punctuality Data [0-15’]

<table>
<thead>
<tr>
<th>Route: Milano - Roma</th>
<th>Target 2012</th>
<th>Result 2012</th>
<th>Apr 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>94,7%</td>
<td>95,2%</td>
<td>95,6%</td>
</tr>
</tbody>
</table>

ETR 500

AGV

ETR 600
Bologna HS and ground level station

**GROUND LEVEL STATION**
Winning project of an international competition in the 2007
Architect: Arata Isozaki
Cost: ~ 340 million euro
Area: 42,000 mq

**UNDERGROUND STATION**
Open: June 2013
Bologna Control Room
The new Frecciarossa 1000

NASCE IN ITALIA
IL PIÙ BEL TRENO
AL MONDO

INNOVATION TECHNOLOGY
COMFORT E QUALITY
DESIGN A SUSTENIBILITY
INTEROPERABILITY
Thank you for your attention