HISPEEDMIX PROJECT

“High Speed Freight on the European High Speed Railway Network”

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Hispeedmix is a project initiated in 1997, under the aegis of the IV Framework Programme of Research and Development Technology of the European Union, in order to study the future potential of the European high speed Railway network with a view to providing a fast goods service.

The first objective was to identify the conditions under which the use of the high-speed network for mixed traffic is technically possible and profitable. The first step was to identify those segments of the high speed European network which were potentially profitable and on which the Hispeedmix service could be launched.

The project, which took approximately 33 months, costed 2,000,000 €, of which 50% was financed by the European Commission and the rest by the Project Group.

OBJECTIVES

Hispeedmix was proposed as a project to examine two different scenarios for offering freight services on the European High Speed Railway Network (EHSRN):

• to assess the market requirements for high speed freight traffic and the capability of the existing high speed lines to cope with such traffic;
• to study the utilisation of the high speed network for traditional freight traffic in mixed traffic conditions.

The objectives were to identify the strategic options for the mixed use of the EHSRN and to define the operational and technical parameters able to supply the identified potential demand.

The project was structured to achieve the following goals:

• To carry out detailed cost-benefit analysis with the development of financial models. This has provided us with the business case, which the investment necessary to offer new services will be based on.
• To define the economic and commercial reference parameters for offering European citizens a competitive freight and passenger service on the EHSRN.
• To examine the current freight transport market across Europe, and understand how the present market modal split arises. This has included the development of models to study how the rail
market share can be increased. It has involved a detailed examination of different commodity flows and detailed customer requirements.

- To examine how new freight services can be included with the existing EHSRN passenger timetable - that is, how freight can be pathed, or slotted, into the timetable. This will show us the journey times and number of trains which can be run on a network of key routes, for different combinations of operating parameters such as train speeds.
- To identify the figures expected for safety, availability and reliability of the system as a whole, in accordance with the indications developed during the economic and commercial study.
- To determine the reference parameters for the railway infrastructures and to determine the technical performances required for new high speed freight rolling stock, which lead to a reduction of Life-Cycle-Costs, without compromising quality and safety, in accordance with the objectives mentioned above.
- To define maintenance and operating models, which minimise costs, complying with the economic-commercial indications.

**PARTNERSHIP**

The partners in the Hispeedmix project were chosen in such a way to avoid overlaps and obtain synergy. The partnership structure was set up focusing on two groups of complementary members.

Two Research and Development organisations specialised in the transport area which are involved, at European and National level, with projects linked to Hispeedmix:

1) the Research Institute of the English Railways: ”AEA Technology Rail” and
2) the Italian Consultant Company of the transport sector: “SCIRO”.

Four of the most important rail freight operators and infrastructure managers in Europe: DB-Germany, FS-Italy, RENFE-Spain and SNCF-France.

In addition ERRI, the European Rail Research Institute, added its own expertise and established close links with all member railways, not directly participating in the project.

Four European Universities: Leeds (GB), Catalonia (ES), Madrid (ES) and Genoa (I), with the Centre for Transport Research, worked for the project development as well, as sub-contractors.
**TECHNICAL DESCRIPTION**

**The strategy adopted**

The market analysis clearly showed that the most promising sector, at least for the moment, is that of the integrators such as UPS, DHL and CERNAM. Also interesting were the results from the sectors of the market such as Post, Autotransportations and Airfreight. The integration of the different types of goods traffic between the largest European cities/airports will enable us to reach volumes sufficient to “fill” the Hispeedmix trains.

The punctuality is the critical/decisive factor for Hispeedmix success, much more so than cost and time.

In the typical goods delivery chain of the integrators – delivery within 24 hours – the railways can play a decisive role in the “direct night time connections” (9 hours) covering distances up to approximately 1500 – 1800 km, more than the hub/spoke connections where the journey time of approximately 3 hours would penalise the railway carrier when compared to other means of transport.

In such direct connections single branches of differing hub/spoke systems could be used by different integrators offering a delivery more efficient than their competitors (air and road).

The initial Hispeedmix offer is aimed at the Premium Traffic of those sectors of the market studied (integrators, post, autotransports and air cargo).

It is likely that, as a result of offering such a service, it will be possible to develop a daytime service for short distances (3 hours), which would further increase the productivity of the network in general.

**The potential offer**

Due to the lack of up-to-date traffic data, which have been substantially withheld by the operators in the sector, a gravitational model for predicting traffic, calibrated on some better-known connections, enabled us to form a traffic matrix for 22 European cities with a total of 231 possible connections.

The capacity of the railway lines played a key-role in the project. It was investigated for 372 different trains (2010-scenario) whether it is possible to get the required slots on the tracks without competing with a long distance passenger train. The result was that for all these trains a slot could be found. But, this was only possible by ignoring the night maintenance time in some countries when – today - the tracks are closed. More than 200 trains would be affected by this maintenance policy. Keeping this policy would take away the basis for this project.

Against this background possible capacity constraints for the pre- and end-haulage with trolleys for an on-airport-terminal (a terminal which is located directly at or in the airport) or lorries for an off-
airport-terminal seemed to be less important. Furthermore, for an on-airport-terminal it is unimportant whether the trolleys are used to feed a lorry or a train.

An important item was the dimension of a terminal. The capacity of a terminal depends on the timetable for departure from and arrival at the terminal. It is possible that the number of tracks in a terminal can be reduced by 18% by stretching the departure time of trains. Unfortunately, not all the necessary changes are feasible due to the timeframes for transportation.

In fact, if the number of tracks can be reduced the amount of the necessary rolling equipment can be reduced as well. Concerning the number of train sets a decrease of more than 22% seemed to be possible.

One of these train sets contains 8 wagons, if a TGV postal is taken as an example. It is not to be expected that one customer will hire a complete train because the offered capacity is too large. In this case a share of the train capacity is sensible and would be accepted by the interviewed customers.

In most cases the required departure and arrival times can be guaranteed only if, as mentioned above, the maintenance policy is assumed to be changed and other networks adjust their maintenance work as well. Nevertheless, it would sometimes be necessary to have the trains start outside the desired timeframe, but these would be exceptions.

On all relations with more than 1 train as many trains as possible will run as twins to save costs for the track and drivers. If, for example, 7 trains were to run from Rome to Milan, six of them would run as twins (= 3 pairs) while the 7th would have to run as a single one.

The necessary coupling and uncoupling process for running trains as twins is not a problem with the existing technology and will last only few seconds. Assuming the use of TGV-Postal equivalents the length of one twin is in the range of ordinary passenger-platforms (400 m). Therefore, coupling is not necessary while the trains run as a shuttle.

In conclusion, it is possible to operate a high speed freight system in parallel to the existing high speed passenger system. Some of the lines would be used very intensively, in the long-term view it will be necessary to upgrade lines or to build new lines. This has to be investigated in the future. Depending on the freight containers to be used, more or less modified, existing designs of trains could be used. The trains must be able to use multi-current supply in order to cross borders without changing the power cars.
For the same reasons the drivers have to be, at least, bilingual and they have to know the different operating/signalling systems, apart from this, they and the terminal staff do not have to get special skills.

The following table refers to direct connections, estimated for the years 2005 to 2010, between two typical European cities chosen from among the 22 identified in the study.

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Trains per day, per direction</td>
<td>121</td>
<td>192</td>
</tr>
<tr>
<td>200 km/h</td>
<td>88</td>
<td>142</td>
</tr>
<tr>
<td>%</td>
<td>73</td>
<td>74</td>
</tr>
<tr>
<td>300 km/h</td>
<td>33</td>
<td>50</td>
</tr>
<tr>
<td>%</td>
<td>27</td>
<td>26</td>
</tr>
</tbody>
</table>

The above data show that approximately 73 to 74% of the estimated demand could be satisfied with trains at 200 km/h. This is significant since such trains would cost far less to operate than very high speed trains. Furthermore, approximately 50% of the connections studied (117 out of 231) could be served by direct railway connections.

The impact on infrastructure maintenance

The Hispeedmix goods service will not affect the infrastructure more than any high speed passenger
service would do. In fact, the trains taken into consideration were specialised trains adapted from the high-speed passenger trains “loaded” with goods, which did not exceed 17 tons per axle. There will be no need for extra maintenance arrangements apart from those due to the increase in traffic, but the maintenance plans should be homogeneous throughout Europe and should, in addition, comply with “on condition” maintenance models assuring the running of the network 24 hours out of 24.

The high speed European Network for the 2005 is the scenario in which the “business” will be developed (see the illustration above).

Paris-Brussels-Cologne case study

The Case-Study carried out on the Paris-Brussels-Cologne connection, by electro-mechanical simulations, showed that the power supply equipment, which exists on the network today, would allow fast goods trains to travel up to 300 km/h to fulfil their service.

The drawing-up of the potential “Hispeedmix offer” railway timetable based on the data included in the case-study showed that the trains could be used on the existing high speed network with sufficient high quality and profitability.

RESULTS AND CONCLUSIONS

The first analysis on the Return of Investment of a new Hispeedmix service was carried out by FS, in tight co-operation with the Partners. The methodological basis of an overall Hispeedmix Business Plan was prepared, while an algorithm to analyse the service profitability was created and run. Results were quite encouraging, confirming the substantial feasibility of such an investment. A cash flow analysis was carried out, according to the methodology adopted. The annual estimated financial flows (based on sales, circulation and terminal costs) were compared; they arose from Hispeedmix service during the considered period, which corresponded to the investment
economic life (30 years). The year of actualisation, which the changing value of money was referred to, was fixed to 1997. Three different hypothesis of actualisation rate, which were necessary to verify the profitability of the high speed train service for freight, were identified: 0%, 8% and 20%. The three different Net Present Values arising from the application of the actualisation rates were the following.

- Actualisation rate 0%: 7,576,914,340
- Actualisation rate 8%: 767,108,210
- Actualisation rate 20%: -586,776,267

The methodology adopted to evaluate the profitability of the whole network was to study the economical efficiency of each terminal on the network, considering all the connections starting from this point. Then, once the results were obtained for each terminal, the profitability ratios were calculated for the entire European network.

In order to estimate costs and revenues arising from the Hispeedmix service, different hypothesis concerning the terminal and the exploitation of the train set fleet were defined.

With regard to the number of train sets, a study was carried out in order to optimise their utilisation on each line and to determine a timetable. Its conclusions concerning the fleet needed were the base of the profitability study for the train sets investment. The train sets needed for each O/D pair was identified and the cost for one train set is about 12,200,000.

The number of trains run between each origin and destination was used to determine the variable exploitation costs; another criteria concerning these costs was the number of kilometres between each origin-destination.

The terminal costs were linked to the number of train sets used on each line and to the general timetable of departures and arrivals in the terminal for every origin-destination pair. Actually, the number of train sets and the timetable determined the number of platforms that would be needed. So, the study concerning the timetable was also taken as an input to the profitability study in order to give the number of tracks and platforms needed in each terminal.

Finally, the amortisation of terminals and train sets was done over 30 years and the overhead costs were fixed at 15% of the whole costs. It was also considered that the land on which the terminals are built would be rented.

Concerning the revenues, the selling price used was 0.17 per ton/km, which corresponds to what could be accepted by the market. It is above road prices, but also far under air prices: this means that the profitability of the service, which yet is very good, could even be improved.
In analysing profitability the following elements have been taken into consideration for each “terminal” of the network: loading and unloading platforms, the entire trains necessary to fulfil the service, the time slots, the cost of personnel and maintenance.

The Internal Profitability Rate, which makes the NPV equal to zero, corresponds to 11.75%. It is possible to say that this ratio is good: effectively, a project is supposed to be reliable as long as its internal profitability ratio is above 8%, which is the case for Hispeedmix.

In particular the profitability calculated for the section of the network studied is equal to approximately 11.75%, taking a time span of 30 years for the amortisation of the acquisition of the terminals and the trains.

EXPLOITATION AND FUTURE WORK

The results are encouraging for the European railway Companies which grasp the opportunity of starting a new business. It must be strongly emphasised that the success of the new service offered will be affected by organisational factors much more than by technical factors.

The Hispeedmix context is a potential new business area for railway companies, but it is necessary to verify the risk level for all interested partners, consisting of integrators, transport partners and airport companies as well. Therefore, the aim of a new Hispeedmix project is to carry out a complete analysis of the European high speed service for freight.

The challenge in this new area of business will call for the necessity of co-operation at an international level, which could be possibly done by forming a “Hispeedmix Company”. This Company should be organised for quality service and should have a flexible approach to the market.

In this way the Railways could have the possibility of playing a fundamental role in this fast growing new sector of the market. The service could be extended to other sectors, step by step, requiring a fleet of fast goods trains, which could be used indifferently during the day and the night on the high speed European Railway network.

In order to realise the beginning of the Hispeedmix service a more detailed feasibility study will have to be undertaken on specific corridors followed by a business plan and integrated with a handbook specifying technical and managerial aspects of the service. Promising results would allow a pilot service to be launched.