

**The sustainable freight railway: Designing the freight vehicle – track system for higher delivered tonnage with improved availability at reduced cost**

**SUSTRAIL**

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## 1. INTRODUCTION

SustRail Work Package 1 aims to provide a benchmark of the current freight ‘system’ to establish the existing ‘zero state’ for subsequent comparative and enhancement activities. The benchmarking is designed to provide information to support evaluation of the key system parameters which will ultimately influence and determine improvements towards freight sustainability and competitiveness.

Data collection has focussed on three selected European railway routes in Bulgaria, Spain and the UK. All three routes have a mixture of freight and passenger traffic, and provide a wide diversity upon which to assess the freight system throughout Europe encompassing a wide range of freight, asset conditions, climatic influences and social/economic/cultural differences.

Deliverable D1.2 (Task 1.2) provides an overview of the routes and their general characteristics, such as topography, route gradient and curvature, access charges, maintenance and renewal costs, asset condition, etc., depending on the availability of this information. This is summarised in Section §2 below; also, the impact of HS2, given the go-ahead by the UK government in January 2012, is discussed briefly. Deliverable D1.4 (Task 1.4), which focuses on infrastructure characteristics, provides complementary data.

*Note:* For the Framework 6 project InnoTrack, Deutsche Bahn presented details of a 327 km double-track mixed passenger/freight route. The report (Deliverable D1.2.2<sup>1</sup>) covers track structure and construction, track condition (failures and faults), and an analysis of costs. This detailed analysis provides, in essence, a fourth route for SustRail’s zero-state.

Work Package 5 will be performing RAMS analyses and evaluating LCC to support technological development in SustRail, and the task of collecting relevant data, or at least for determining the ownership and availability of the required data, has started in Work Package 1, with summaries provided in Deliverables D1.3, D1.4 and D1.5. Section §3 below gives an overview of the methodology for economic assessment of SustRail developments.

Deliverable D1.5 (Task 1.5) provides data on freight operations on the selected routes and models freight movements between stations and yards to study route capacity. See discussion in Section §4 below.

Deliverable D1.3 (Task 1.3) has collected data on the freight vehicles operating on the selected routes to identify the most common types of freight vehicle (see summary in Section §5 below). Work Packages 1 and 2 together provide a basis for the vehicle technologies developed in Work Package 3 and demonstrated in Work Package 6. It is important to target these developments so that an effective business case for adoption can be presented, whether for inclusion of SustRail technologies in manufacture of new wagons, or for retrofitting the existing fleet. In the former case, SustRail technologies need to target the next generation of freight wagons; Deliverable 2.2 (Task 2.2) looks at future logistics requirements and the characteristics of vehicles required to meet these demands. In the latter case, it is important that SustRail technologies are compatible with common wagon types currently in operation.

Finally, the test track at AFER’s Railway Testing Centre Faurei, which will be used for demonstrations in Work Package 6, has been visited. Deliverable D1.6 (Task 1.6) reports on this visit and the tests and measurements carried out.

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<sup>1</sup> Available from the InnoTrack website:

[http://www.innotrack.net/IMG/pdf/d122-f2p-track\\_sections\\_irregularities\\_analysis.pdf](http://www.innotrack.net/IMG/pdf/d122-f2p-track_sections_irregularities_analysis.pdf).

## 2. ROUTE SUMMARY

Deliverable D1.2 presents data for the following routes:

- the Mediterranean Corridor in Spain, which is a mixed traffic electrified line in the east of Spain;
- the Bulgarian route from the Serbian border to Turkey, an intermodal connection which is part of the European “Corridor 10” project; and
- two key intermodal freight routes in the UK, from the ports of Southampton and Felixstowe to the North West of England, part of Network Rail’s “Strategic Freight Network”.

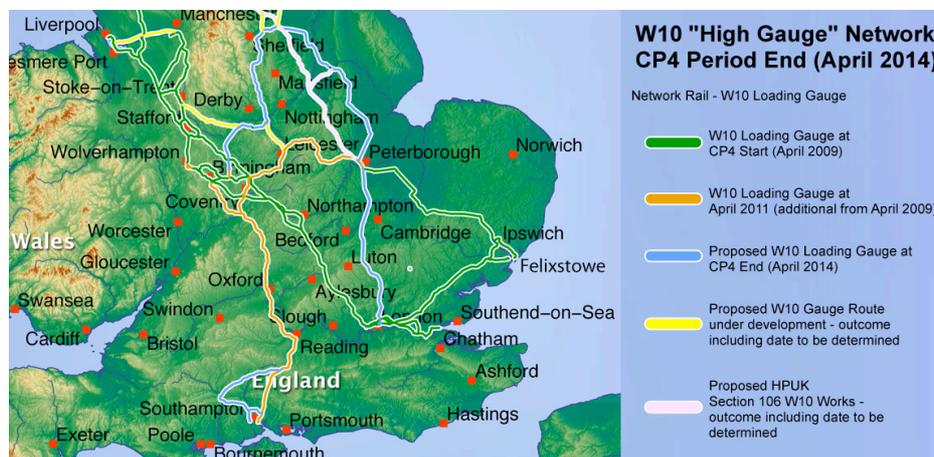
A short summary is given here. Deliverable D1.5 looks at freight operations along the selected routes in greater detail – see also Section §4 below.

### 2.1 UK Route – and a note on HS2

Figure 2.1 shows the main freight routes in the south of England. The UK routes studied in SustRail run:

1. from the port of Felixstowe in south-east England, north-west to Peterborough, west to Nuneaton near Birmingham, then north-west up the WCML to Warrington; and
2. from the port of Southampton on the south coast, north to Nuneaton, where it joins the WCML north-west to Warrington, as in the first route.

Since the WCML is a major high-speed passenger route, numerous problems arise from the need to operate both types of traffic<sup>2</sup>. The freight traffic on these routes, forecast for 2020, is shown in Figure 2.2 – this predicts up to 200 freight trains operating on the West Coast Mainline (WCML) between Nuneaton and Warrington.



**Figure 2.1 Topographic map of the UK showing planned Network Rail route status by April 2014.**

[Original topographic map by Equestenebrarum, licensed under Creative Commons Attribution 3.0 Unported; see [http://commons.wikimedia.org/wiki/File:Topographic Map of the UK - English.png](http://commons.wikimedia.org/wiki/File:Topographic_Map_of_the_UK_-_English.png).]

The economic case for the new high speed route paralleling the WCML (High Speed 2 – HS2) is largely based on the benefits of freeing up capacity on the WCML<sup>3</sup>: ‘*performance improvements on the WCML as a result of running a more homogenised train service on the*

<sup>2</sup> See, e.g., ‘High Speed 2 Strategic Alternatives Study: Rail Interventions Report,’ Atkins, March 2010.

<sup>3</sup> Quoting 9.2.3 from: ‘Economic Case for HS2: Updated appraisal of transport user benefits and wider economic benefits A report to Government by HS2 Ltd,’ DfT, January, 2012.

line (with the fastest trains transferred onto HS2, the trains running along the line have more similar service characteristics which typically aids performance) and the possible use of released capacity to enhance provision for transporting freight.’

The UK Government has just given the go ahead for development of the HS2 network connecting London with Manchester and Leeds. The initial phase of the project will be between London and Birmingham, to be running by 2026, and a second phase will extend the route in two branches up to Manchester and Leeds by about 2033. Figure 2.3 shows the planned routes, and the predicted impact on long-distance passenger trips on the WCML.

Map 5: Daily Freight Trains by Route 2020 (average weekday)

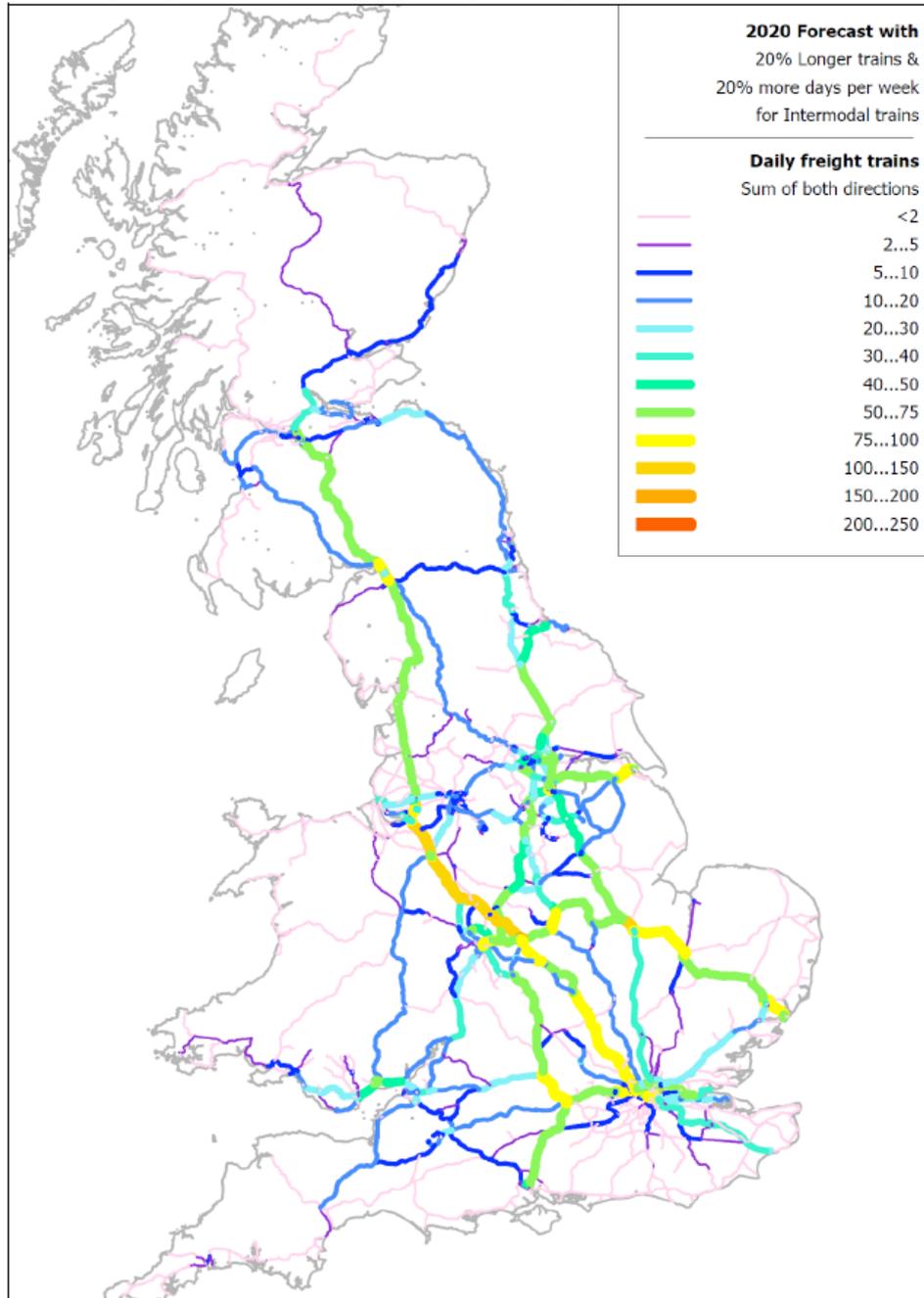


Figure 2.2 Forecast for 2020: Number of freight trains per day.  
‘Rail freight demand forecasts to 2030,’ MDS Transmodal Limited, 2011.

The High Speed 2 network

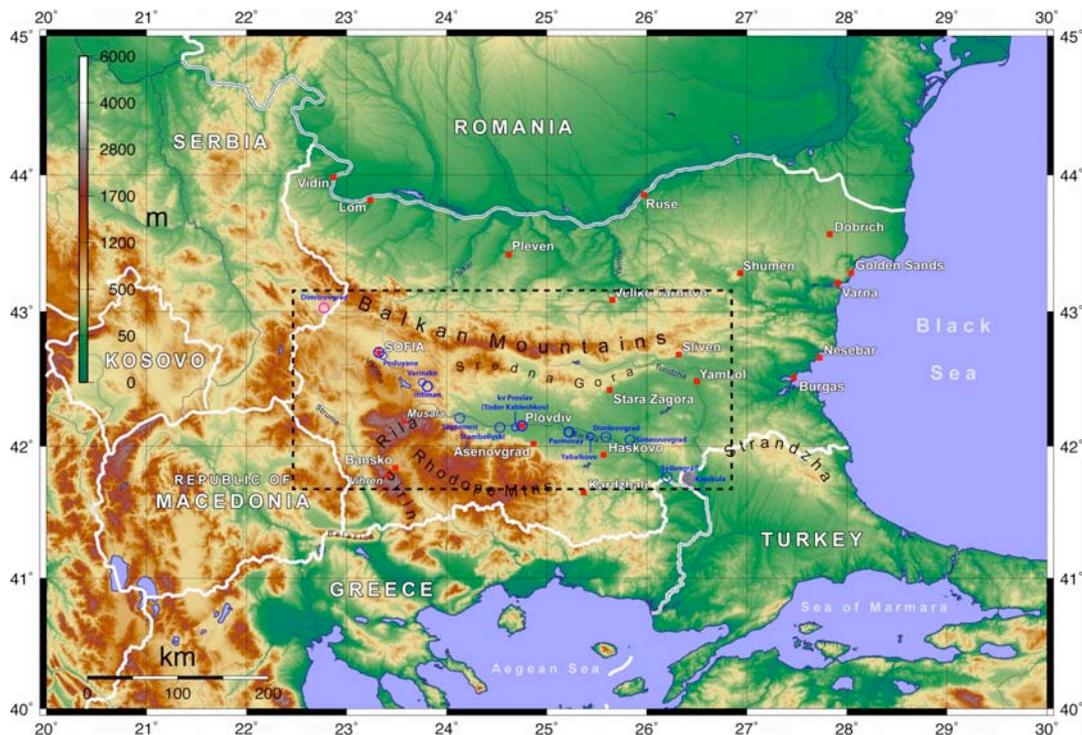


**Figure 2.3** Left: Routes and connectivity for HS2. Right: Change in long distance daily trips after the introduction of HS2 (London – West Midlands), in 2037  
 ‘High Speed Rail: Investing in Britain’s Future: The Government’s decisions,’ DfT, January, 2012.  
 ‘Economic Case for HS2: Updated appraisal of transport user benefits and wider economic benefits A report to Government by HS2 Ltd,’ DfT, January, 2012.

## 2.2 Bulgarian Route

The Bulgarian route runs between the Serbian border (Kalotina in Bulgaria, by Dimitrovgrad in Serbia; note: there is another Dimitrovgrad on the route in Bulgaria just north of Haskovo) and the Turkish border (Svilengrad in Bulgaria, by Kapikule in Turkey). The freight on this line is a combination of local and international traffic. It has an operational pattern of both liner and multi-stopping services and intermediate services are carried out along the line.

As part of the European TEN-T project, intermodal terminals are planned for construction at Sofia and Plodviv, initially followed by terminals at Svilengrad and Dragoman. Plodviv is the second city in Bulgaria after Sofia and the centre of rapidly increasing commercial and agricultural trade and activity.



**Figure 2.4 Topography of Balkan region showing key locations on Bulgarian route.**  
 [Original topographic map by Equestenebrarum, licensed under Creative Commons Attribution 3.0 Unported; see [http://commons.wikimedia.org/wiki/File:Topographic\\_Map\\_of\\_Bulgaria\\_English.png](http://commons.wikimedia.org/wiki/File:Topographic_Map_of_Bulgaria_English.png).]

### 2.3 Spanish Route

The Castellbisbal-Silla Corridor is located on the east coast of Spain. Castellbisbal is in the north, near Barcelona, and Silla is just south of Valencia.



**Figure 2.5 Map of Spanish railways.**  
 [Maps available from [http://www.bueker.net/trainspotting/maps\\_iberian-peninsula.php](http://www.bueker.net/trainspotting/maps_iberian-peninsula.php) and [http://www.bueker.net/trainspotting/maps\\_barcelona-area.php](http://www.bueker.net/trainspotting/maps_barcelona-area.php); free for non-commercial use – see webpage for details.]

### 3. ECONOMIC ANALYSIS

#### 3.1 Methodology for benchmarking SustRail developments

Economic analysis to determine the benefits of improved performance of selected SustRail innovations developed in Work Packages 3 and 4 against the benchmark case, as well as the business case for such innovations, will be conducted in Work Package 5 which commences in Month 13 (particularly in Tasks 5.2 and 5.3). This analysis will follow on from the Life Cycle Costing (LCC) and a Reliability, Availability, Maintenance and Safety (RAMS) analysis of each option where the parameters for this analysis will be informed by the Duty Requirements established in Work Package 2 (Task 5.1) and the outcomes of the benchmarking exercises relating to track and rolling stock delivered in Work Package 1.

Consideration of track access charges forms an important aspect of this work, because it is likely that the options developed in Work Packages 3 and 4 will impact on a variety of the many different organisations that comprise the railway as a whole, including infrastructure managers, and freight and passenger train operators. Track access charges are a key economic variable at the interface between train operators and infrastructure managers, and if such charges can be adjusted to appropriately reflect the damage caused to the infrastructure by a particular vehicle and the network capacity that it consumes, then they can provide a strong incentive for operators to use rolling stock which minimises whole system cost. Hence our research will consider refinements to the differentiation of access charges to best reflect the cost impact of different vehicles (Task 5.3).

Furthermore, because railway infrastructure and vehicles tend to have very long asset lives, it is necessary to consider (a) how the novel technologies and processes developed in Work Packages 3 and 4 can be phased into the existing railway system in a sustainable way from engineering and operations perspectives, and (b) to what extent the new technologies can be retrofitted onto existing vehicles, and how this might affect the overall benefit stream. This analysis will need to consider a range of technical and financing issues (Task 5.4).

Initial business case assessments will be used in an iterative manner to guide the focus of work in Work Packages 3 and 4 in order to refine the choice of innovations as these work packages progress. In Task 5.5, cost saving estimates will be compared with the benefit estimates, allowing the overall economic and business case for each innovation to be considered alongside any issues that arise from the implementation work packages.

More specifically, in Task 5.2 we will first undertake initial quantitative and qualitative assessment of the likely freight and passenger benefits from the various options being developed in Work Packages 3 and 4, to inform which options should go forward to be developed in greater depth. On top of the cost saving benefits identified in the LCC and RAMS analysis, we will need to quantify other benefits for the railway system resulting from the technology options developed in Work Packages 3 and 4, such as freight user benefits resulting from, for example, higher speed freight services, or infrastructure path capacity benefits if freight trains are able to run closer to line speed. Likewise, environmental impacts relative to the current situation resulting from new technologies, for example, changes in noise and CO<sub>2</sub> emissions, will also need to be estimated and evaluated, bearing in mind that if running freight trains at higher speed increases energy use, then some key environmental impacts may well be negative.

Once preferred options have been identified, case studies based on the selected SustRail route corridors will be conducted in order to quantify the likely freight user benefits and to determine the potential capacity benefits from improved freight services. Some demand

estimation using modelling exercises will be required, and further modelling will be required to conduct the valuation of any train paths that may be freed up for either further freight or for passenger services.

In Task 5.3 we will enhance our understanding of the relative damage (and associated cost) of different vehicle types, with the objective of refining the differentiation of access charges to best reflect the cost impact of different vehicles. This work will determine how changes to such charges for freight trains might be used to achieve an equitable distribution of whole system savings, and will draw on previous experiences of Sustrail partners, which cover both an econometric (or statistical) approach through the analysis of actual infrastructure cost data (an approach which has been relatively successful in determining what proportion of cost is variable with usage by train services) and an alternative ‘engineering’ approach through the use of models to predict the damage done by specific vehicles and then to predict the remedial work required. In so doing, we need to understand also how the market responds to access charging regimes and whether there are any barriers that prevent the benefits from being realised.

Data availability, and hence the requirement to identify and obtain additional data where necessary, has been investigated. The outcomes of this investigation have been included in Deliverables D1.3, D1.4 and D1.5. Some additional data on access charges and maintenance and renewal costs are presented in Deliverable D1.2.

### 3.2 Freight vehicle noise and access charges

The European Parliament is currently considering a proposed recast of the First Railway Package [COM(2010) 475]. Following the first reading of the revised text, in November 2011, the proposed legislation will allow differential track access charging according to noise level, and suggests compensation for retrofitting vehicles with low-noise technology. (The Commission recently introduced legislation [Directive 2011/76/EU] allowing charging for emissions of road vehicles.) The European Noise Directive (END) [Directive 2002/49/EC] has required Member States to develop Noise Action Plans to reduce noise levels, and the course of action preferred by many is widespread introduction and retrofitting of freight wagons with composite brake blocks – an estimated 370,000 freight wagons would be eligible for retrofitting.

One goal of Sustrail is to increase freight vehicle speed from 120 km/h to 140 km/h, which will increase noise emissions slightly – by at least 1 dB(A) – unless other technological or design measures (in addition to the introduction of composite brake blocks, which should be considered an independent measure) are taken to reduce noise levels. To be truly sustainable and competitive, the technologies developed in Sustrail should produce a wagon that is both faster and quieter.

Finally, if Sustrail technologies are suitable for retrofitting, then this process could ‘piggyback’ on the composite brake block retrofitting programme, with wagon owners offered a choice of ‘*Composite brake blocks for a quieter, cheaper wagon!*’ or ...

*‘Sustrail upgrade for an even quieter, even cheaper wagon – and it’s faster too!’*

Noise issues are the subject of Task 2.4.5 and will be discussed in Deliverable D2.4.

## 4. CAPACITY MODELLING

This section follows on from the capacity modelling in Deliverable D1.5.

### 4.1 Route summary: Logistics and local freight market

The objective of this study is to provide benchmarking of the current freight ‘system’, to establish the existing ‘zero state’ for subsequent comparative and enhancement activities. The benchmarking is designed to provide information to support evaluation of the key system parameters which will ultimately influence and determine improvements towards freight sustainability and competitiveness.

#### 4.1.1 Spanish Route – Mediterranean Corridor

The Castellbisbal-Silla Corridor is located on the east coast of Spain (see Figure 4.1). The route is an electrified line, with a typical line speed of 100 km/h (75 km/h for freight). The majority of the route is double track, apart from a 57 km section between Villarreal and Tarragona, which is single track. A combination of freight and passenger traffic uses the line, which has a signalling system of cab radio and colour light signals. Train control is managed by automatic blocks. All of the freight on this line runs from rail yard to rail yard without intermediate service activity on the line. The total number of freight trains per day is indicated in Table 4.1. Bulk commodities such as iron and steel are transported along the line, as well as many cars, car parts and intermodal traffic.

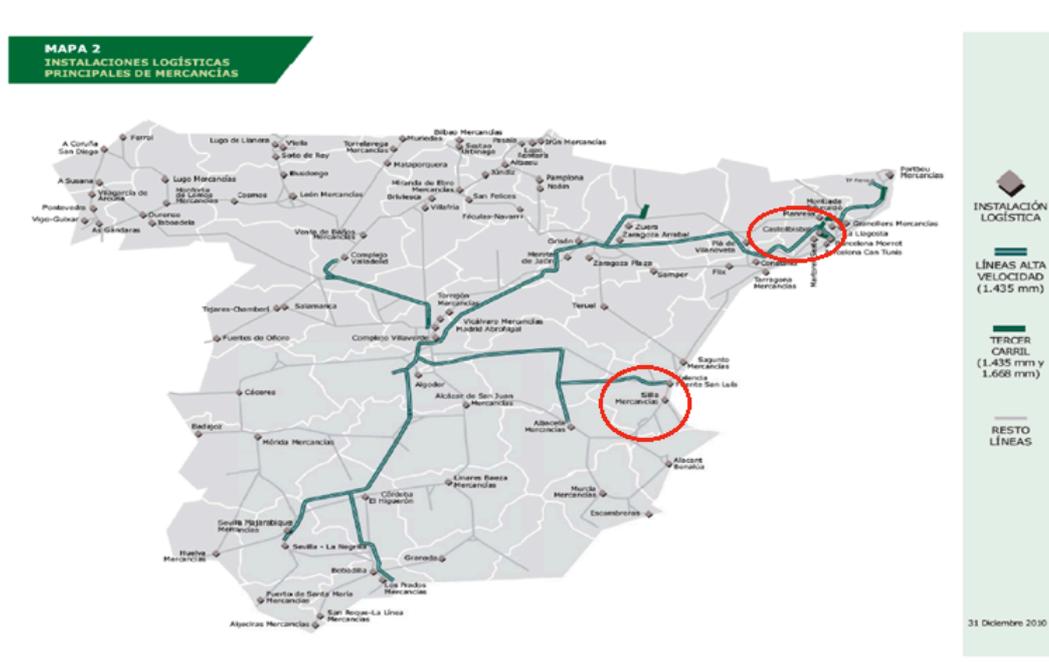


Figure 4.1 Map of the Spanish railways, indicating the route end-points Castellbisbal and Silla.

Table 4.1 Total freight Tarragona-Valencia (total trains per day).

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
15	18	17	14	17	3	2

Currently Spanish rail freight holds only 5% of the land freight market. The main traffic on the Castellbisbal-Silla Corridor is cars and bulk freight, with some intermodal. If improvements can be made both locally (e.g., double-tracking the whole route) and to its

integration with the European network, then a significant increase in utilisation might be expected from the current 16 trains/day (which is just on week days).

A typical line speed of 75 km/h demonstrates that the condition of the infrastructure is reasonable and that the typical line speed could increase with the right infrastructure and rolling stock conditions. In comparison to passenger traffic on the same line, which has an average speed of 100 km/h, and freight traffic in Central and Western Europe in some locations which has a maximum speed of 120 km/h, 75 km/h is relatively low. The average train length is shorter than other routes under study in Europe, which indicates there is potential to increase the number of wagons per train.

#### 4.1.2 Bulgarian Route

The Dimitrovgrad (Serbia) – Kapikule (Turkey) line runs through Bulgaria from west to east (see Figure 4.2). The traffic mix on this line is freight and passenger; freight traffic has a typical line speed of 75 km/h, except for the section between Parvomaj and Jabalkovo where freight can travel at up to 120 km/h; the speed for passenger traffic on this line ranges from 65-130 km/h. The line is electrified west of Plovdiv (see Deliverable D1.2 for details) and has a combination of single and double track. The signalling on this route is controlled by colour light and cab radio, while train control is managed by automatic blocks. The freight on this line is a combination of local and international traffic. It has an operational pattern of both liner and multi-stopping services, and intermediate services are carried out along the line. There are two marshalling yards on this line, one each at Poduyane and Plovdiv; Sadovo is an intermediate station where only freight operations are carried out.

As part of the European TEN-T project, intermodal terminals are planned for construction at Sofia and Plovdiv, followed by terminals at Svilengrad and Dragoman. Plovdiv is the second city in Bulgaria after Sofia and the centre of rapidly increasing commercial and agricultural trade and activity.

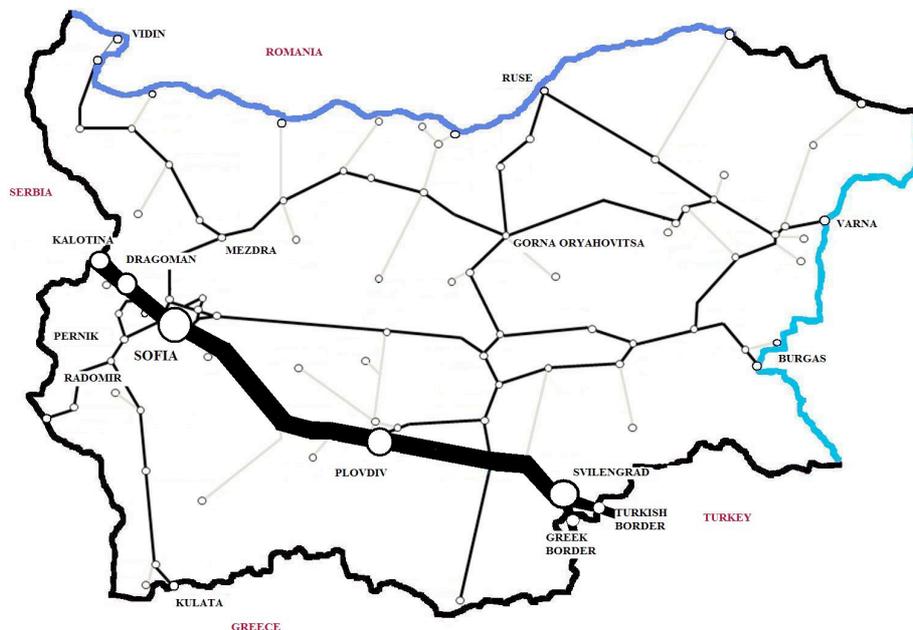


Figure 4.2 Map of the Bulgarian Route.

Rail freight in Bulgaria has approximately a 10 per cent share of total goods carried by surface transport. The main markets for rail freight in Bulgaria are:

- Agricultural products and animals
- Foodstuffs and fodders
- Solid mineral fuels
- Petroleum and petroleum products
- Ores and metal scrap
- Ferrous and non-ferrous metallurgy produce
- Elaborated and non-elaborated non-metallic raw materials
- Fertilisers
- Chemical substances and products

Although there has been a decline in rail freight to carry only 10% of land transport freight there are plans to invest in the main freight corridors. The selected line connects key locations within Bulgaria and internationally, and the EU has identified it as an important route as it has the ability to transport a wide variety of freight. The current average speeds are relatively low but with improvements to the line and the rolling stock the increases in capacity and potential are very significant. The freight services on this line could benefit very significantly from the innovations proposed in SustRail.

The parameters for the route demonstrate a maximum line utilisation (i.e., the maximum number of trains using the line at any one time) of 30 and a minimum line utilisation of 10. Information regarding infrastructure for the route suggests a large variation in track condition, with some sections in good track condition but much still in poor condition. Evidence of poor infrastructure condition is supported by an average speed of 75 km/h this average does not indicate the maximum speed of 120 km/h and the minimum speed of 50 km/h. Average train length of 500 m, the same as the Mediterranean Corridor, indicates there is potential for the average number of wagons per train to increase; however, further research is needed to clarify any restrictions regarding train length along this route.

#### **4.1.3 UK Routes: Southampton & Felixstowe- North West England**

It is estimated that over 25% of freight containers originating from the Far East and shipped into ports like Southampton and Felixstowe are now transported onwards by rail. General characteristics that apply to both the Felixstowe and Southampton routes include the following:

- on the WCML (and other lines shared with passenger services), freight runs at up to 120 km/h, but on other sections freight runs at well below its potential speed (often around 50 km/h) due to going into loops or slow lines and because of being stopped for passenger services;
- at peak times there are very few freight trains, but in off-peak periods, both routes have 2 paths/hour each way; and
- generally, intermodal trains run directly from the port to their inland freight terminal and the Freight Operating Companies (FOCs) will usually try to use a single driver for the journey if working hours allow.

The so-called “Cross Country” route runs west from Felixstowe. This route section is approximately 257 km in length. The route from Southampton heads north towards Birmingham via Reading, and this route is approximately 212 km in length. The two routes meet just east of Birmingham at a town called Nuneaton, and then run north for a further 136



The greatest increase in rail freight traffic in the foreseeable future will be intermodal container traffic via the UK's sea ports. There are plans to increase the capacity of several major UK ports and to carry a greater proportion of onward traffic on the railway network. The UK government has outlined the strategically important UK rail freight lines, and Network Rail is implementing change as part of their Freight Route Utilisation Strategy. This includes various loading gauge improvements on key routes, and removing key bottlenecks from the network. However, there are other restrictions to the expansion of freight, and primary amongst these is the need to accommodate ever-increasing numbers of passenger services.

## 4.2 Issues to be addressed

### 4.2.1 The Mediterranean Corridor

The Mediterranean Corridor has the potential to increase capacity, as current freight volumes are significantly low. Rail freight in Spain holds only 5% of the land freight market, which indicates there is a large potential for market share increase.

This may be achieved through the development of rail freight into new markets alongside car parts and bulk commodities. A higher market share could also be captured through improved links with intermodal transport, a move to encourage modal shift from road to rail freight, and integration with the wider European Network. To accommodate increased freight volumes, it should be possible to increase train length and the number of wagons per train.

Capacity modelling has indicated that due to a low volume of freight along this route, bottlenecks do not currently exist. The sections of the route with the highest capacity and most susceptible to bottlenecks in the future are Tarragona-Sagunto and Valencia-Silla. Improvements to the corridor to prevent bottlenecks in the future include double tracking of the route throughout.

Alongside increasing market share, it is expected that increasing the average freight speed from 75 km/h to 100 km/h along the route will increase capacity and provide further benefits, i.e., improved interaction between freight and passenger traffic. Passenger traffic on this route currently has an average speed of 100 km/h.

### 4.2.2 Bulgarian route

Rail freight holds a 10% share of total goods carried by surface transport in Bulgaria. An increase in the market share of freight volumes may be addressed through the addition of a number of intermodal terminals along the route, which will enable movement into additional markets.

Infrastructure along the Bulgarian Corridor indicates large variations in track condition; many sections of the track are in poor condition, with short sections in good condition. Route utilisation is satisfactory, but the average speed throughout is lower than expected for freight routes elsewhere in the EU. This suggests that poor technical conditions may be a factor along the route since the condition of infrastructure would have a negative impact on speed. Technical conditions may be addressed through the investments in infrastructure and rolling stock. Local improvements, including double tracking throughout the route, could lead to a decrease in travel time and an increase in route capacity.

Capacity modelling indicates bottlenecks at marshalling yards at Poduyane and Plovdiv due to significantly longer processing times in classification yards than at other stations, this may be addressed through further research into yard operations. Bottlenecks are also visible at Svilengrad station (the last station before the border with Turkey); freight processing times at

this station are significantly longer than at other stations along the route. The bottlenecks may be addressed through a study of border crossing procedures as currently these are time consuming, which may lead to a significant cost for the railway freight operator and questions over the level of sustainability of the entire route.

The average train length along this route is 500 m, suggesting there is capacity to increase the number of wagons per train if demand is available.

Together with an increase in market share which is expected to increase freight volumes, it is expected that increasing the average speed of freight along this route from 75 km/h to 120 km/h (potentially 140 km/h) will lead to an increase in capacity. There is potential to increase speed up to 120 km/h on this route, as some sections which have already invested in infrastructure can run freight at 120 km/h. Of course, running freight at a higher speed may lead to additional bottlenecks, particularly at stations and in yards, which would need to be upgraded to meet the increased line capacity. For the scheme to be successful, significant investment in infrastructure along the route would be needed.

### 4.2.3 UK routes

Rail freight holds an 11% share of surface transport in the UK, which indicates there is potential for an increase in freight market share. This may be achieved through improvements to the loading gauge as this would allow a higher number of containers per wagon. Loading gauge enhancements provide a number of benefits, including an increase in capacity to allow the ever-increasing demand to be met. Gauge enhancements allow the provision of fast reliable journeys which allow rail freight to compete more effectively with other modes.

**Table 4.2 Forecast freight train paths per day.**

		Scenario 1				Scenario 2			
		2019		2030		2019		2030	
		Bulk	Non-Bulk	Bulk	Non-Bulk	Bulk	Non-Bulk	Bulk	Non-Bulk
Southampton	St Denys	5	28	7	44	5	36	7	57
Basingstoke	Reading	2	20	2	30	2	27	2	40
Reading	Didcot East	6	21	6	47	6	27	6	61
Didcot East	Oxford	4	20	5	34	4	26	5	44
Oxford	Aynho	2	20	2	31	2	26	2	40

Assumptions: 640 length trains; 6 days a week; path utilisations as per Freight RUS; Scenario 2 contains a 30 % uplift in non-bulk trains.

Source: Presentation prepared by Tim Cook for Rail Future Freight Services Development Committee 12.11.11

As Southampton-WCML is approaching capacity when both freight and passenger services are considered, the option to run longer trains along this route is being considered. This will include train-lengthening options of 665 m and 775 m with extended loops at Southampton Maritime / Redbridge, Southampton Western Docks, Eastleigh, Oxford, Fenny Compton, Hatton, Dorridge and Washwood Heath. Forecasts suggest that container freight trains will increase by 2030 (see Table 4.2).

To increase capacity at Southampton Western Docks, an extension to one of the sidings has been proposed.

Forecasts suggest that container freight trains will also increase between Felixstowe and Nuneaton; plans have been developed to increase capacity up to 56 trains per day in each

direction by 2030. Work will include double tracking and signalling remodelling along the route.

In January 2012, High Speed 2 between London and Birmingham initially, followed by a second development between Birmingham and Manchester and Birmingham and Leeds, has been approved by the UK government with an expected opening date of 2026. High Speed 1 increased freight capacity through the Channel Tunnel by 40%; it is possible that High Speed 2 will have a similar impact on freight capacity on the WCML.

Forecasts suggest that HS2 will have a positive impact on freight on the WCML as it will have the ability to accommodate 85 and 80 freight trains per day on the Wembley-Rugby and Rugby-Stafford sections of the line. The freight paths are not expected to have significantly longer journey times or a reduction in capacity compared to current levels.

Several proposals have been put forward to increase capacity on the WCML another suggestion which is expected to increase capacity is to increase the average speed for freight from 80 km/h to 120 km/h. Predictions suggest that this will benefit the WCML as it will lead to an improved interaction between freight and passenger traffic.

### 4.3 References

- [1] 'HS2 frees up space for faster, more frequent trains,' 19 January, 2012, <http://www.networkrail.co.uk/hs2-wcml.aspx>.
- [2] Presentation prepared by Tim Cook for Rail Future Freight Services Development Committee 12.11.11.
- [3] 'Value and Importance of Rail Freight,' Network Rail, July, 2010.
- [4] 'Freight Route Utilisation Strategy,' Network Rail, March, 2007.

## 5. VEHICLES

*This is a summary of the main findings of Deliverable D1.3.*

### 5.1 Locomotives

**Motive power:** Both Diesel and Electric powered locomotives are being successfully used for freight transport on the selected routes and wider, in partner countries. Diesel locomotives are still the most common (e.g., the Class 66 in UK), but the Electric locomotives are preferred on freight routes that have a consistently high traffic volume, or in areas with advanced rail networks.

**Power transmission (for Diesel locomotives):** The Diesel-Electric transmission is the most common and widely used (considering its reliability and economic advantages as well).

**Axle arrangement:** Two common solutions were identified: Co'Co' and Bo'Bo'. Few models are using a B'B' arrangement.

**Power:** the following ranges were identified:

- ✓ Diesel powered freight locomotives: 2000-2750 kW (lower power models for lighter trains: 1500-1700 kW)
- ✓ Electric powered freight locomotives: 4600-6700 kW (lighter models: 3000-4000 kW)

**Braking system:** Usually tread brakes / shoe brakes (only a few new solutions using disc brakes on axles were identified).

**Lifetime:** 35-46 years (economic lifetime: 25-40 years).

**Shunting freight locomotives:** Diesel powered (400-1000 kW).

### 5.2 Wagons

**Classes in operation:** Two categories of wagons most common in operation on the selected routes and wider, in partner countries, were observed:

- ✓ **Flat wagons:**
  - Class R – ordinary flat wagon with bogies;
  - Class S – special flat wagon with bogies; and
  - Class L – special flat wagon with separate axles.

The flat wagons are intensively used – mainly in the UK and Spain, but an increasing demand was also reported in Bulgaria and Romania. This trend is mainly due to their utilisation for intermodal freight, and, also, to the alternative freight possibilities (wood, steel, auto, etc.) offered by the special models.

- ✓ **Open high-sided wagons:**
  - Class E – ordinary high-sided wagon;
  - Class F – special high-sided wagon.

The open high-sided wagons have the major share of freight in Bulgaria and Romania due to particularities in economic sectors of New Member States, but with a decreasing trend of their utilisation. These classes also have a high utilisation in the UK (probably the 3<sup>rd</sup> share as tonne-km) and Spain (but not on the selected route for SustRail). Although the demand for these classes is still high and will always keep an important share on the market due to specific types of freight (bulk and aggregates), the supply offered by the existing fleets seems to be more than sufficient considering the actual trends. In the UK, and elsewhere, there has been a growing market for the Class F hopper types, although there have been new orders for Class E wagons in Poland for the Freightliner coal traffic.

Apart from these two main categories, other types of wagons of different classes were reported to operate on selected routes/countries, such as:

- Class G – ordinary covered wagons (highly used in Bulgaria);
- Class Z – tank wagons (for oils, bitumen, etc.);
- Class U – special wagons (for cereals, powders, etc.);
- Class I – refrigerated vans;
- Class K – ordinary flat wagon with separate axles (for bulk);
- Class H – special covered wagons;
- Class T – goods wagons with opening roof.

**Age of the wagons in operation:** A vast range (4-37 years) was recorded, depending on the types of wagons, builder, etc. The highest diversity of older wagons (over 30 years) was observed to operate on the selected route in Spain.

**Bogie type:** The Y25 bogie is the most common and widely used for recorded freight wagons (different versions, depending on type of wagon, builder and country). However, other types were also reported: Y33, TF25, Y21 (the most common in Spain), etc.

**Braking system:** Almost all reported wagons are equipped with tread brakes / shoe brakes.