

***FERRMED Study of Traffic and Modal Shift
Optimisation in the EU
FINAL REPORT PRESENTATION***

FERRMED CONFERENCE

***FERRMED, Fast, Flexible Integrated Rail-Road System of
Transport (+FIRRST)***

Brussels, November 29th 2023



**Promotion du Grand Axe Ferroviaire de marchandises
Scandinavie-Rhin-Rhône-Méditerranée Occidentale A.S.B.L**

WHY +FIRRST? (I)

Nowadays, railways are practically only used for **point-to-point** transport with complete trains. **Single wagon** procedures are used for **bulk products, mainly mining and chemicals, but not for manufactured or agrifood products**. For perishable products and those involving manufacturing processes, which require **just-in-time deliveries**, railway performance is not in line with shippers' requirements.



WHY +FIRRST? (II)

The only way to achieve the EC targets of road traffic transfer to rail is to incorporate a system that can move isolated truck semi-trailers, swap-bodies and containers (ILUs) from and to different destinations in a fast, flexible, integrated rail-road system of transport (+FIRRST). It is a novel way of organising intermodal rail-road transport in the form of "Mobility as a Service" (MaaS).

+FIRRST is an integrated combined transport system fully aligned with the road (as the most flexible mode), able to meet demand in real time.



+FIRRT BASIC REQUIREMENTS (I)

- Rail Network with: ERTMS (or equivalent) Control/Signalling system, P410/400 (or similar) loading gauge allowing 740 m long trains
- A set of specific intelligent freight trains with multipurpose wagons that can carry HGV semi-trailers, swap-bodies and containers (minimum length 740 m)
- A set of dual locomotives (electric+batteries/diesel) able to carry freight trains of 1,800 – 2,000 t gross weight at 100 – 120 km/h.



+FIRRS BASIC REQUIREMENTS (II)

- Three kinds of trains are envisaged:
 - **Point-to-point (Ptp)** for interconnections with enough traffic between origin/destination nodes to achieve full trains.
 - **Stop at predetermined intermediate terminals (Sai)** between the origin/destination nodes, covering the demand of all required intermediate nodes.
 - **Stop on request (Sor)**, for emergencies/urgent deliveries, additionally to the predetermined stops of Sai trains.



+FIRRST BASIC REQUIREMENTS (III)

- +FIRRST trains composition:
 - Common composition:
Only multipurpose wagons (able to carry semi-trailers, swap bodies and containers).
 - Complementary composition:
Mixed composition of multipurpose wagons and container wagons. Could be used in the cases where first Origin and final Destination of the journeys are terminals located in seaports.
 - **In all cases, the composition of +FIRRST trains is fixed** and they always have the same length of 740 m (700/720 m for wagons and 23/25 m for the locomotive).



+FIRrst BASIC REQUIREMENTS (IV)

- A set of flexible “pass-through” intermodal terminals suitable for fast loading/unloading of HGV semi-trailers, swap-bodies and/or containers throughout the EU Backbone Network and main feeders.
- An integrated rail-road freight flow control system (in the ERTMS framework) supported by a real time rolling planning concept (RTRP).
- Basic considerations for road haulage to facilitate combined transport.
 - Semi-trailer standardization.
 - Reinforced semi-trailers capable of vertical loading.



WHY DO WE REQUIRE Sai AND Sor TRAINS?

It is possible to have daily Ptp trains linking some of the EU strategic hubs, but with such trains, the daily demand among nodes can only be partially met.

The statistics concerning the determination of the +FIRRST interconnection routes with Ptp, Sai and Sor trains for the most important EU logistics hubs, clearly show that with Ptp trains we only can meet 20-40 % of the total demand.

We believe that to justify one Ptp daily train in both (O/D) directions, an exchange demand of 1,400 net tonnes (700 each direction) between nodes is required. Sai and Sor trains could cover such volumes with stops at intermediate nodes.



+FIRrst INTERMODAL TERMINALS (I)

General characteristics

+FIRrst terminals are “pass-through”, so no shunting locomotives are required. They will usually have **three basic elements:**

- Central Loading/Unloading (L/U) zone
- Two buffer zones (either side of the central loading/unloading zone)

The central loading/unloading zone usually has:

- Adequate space for HGV parking (in-out and safe), storage (for all kind of ILUs, including reefers), offices and appropriate loading/unloading devices (cranes, reachstackers, etc.)



+FIRrst INTERMODAL TERMINALS (II)

Three kinds of loading/unloading tracks:

- **Fast moving tracks (FMT)** for loading/unloading trains that stop only to load/unload a small number of ILUs (trailers / swap-bodies / containers).
- **Fast/moderate moving tracks (FMMT)** for loading/unloading trains that stop only to load/unload a moderate number of trailers / swap-bodies / containers (less than one third of the train capacity)
- **Moderate/slow moving tracks (MSMT)**, for trains that will be fully or partially loaded/unloaded in the terminal (more than one third of the train)

In all cases, track length available for L/U must be at least 740 m to allow this length of train.



+FIRRST INTERMODAL TERMINALS (III)

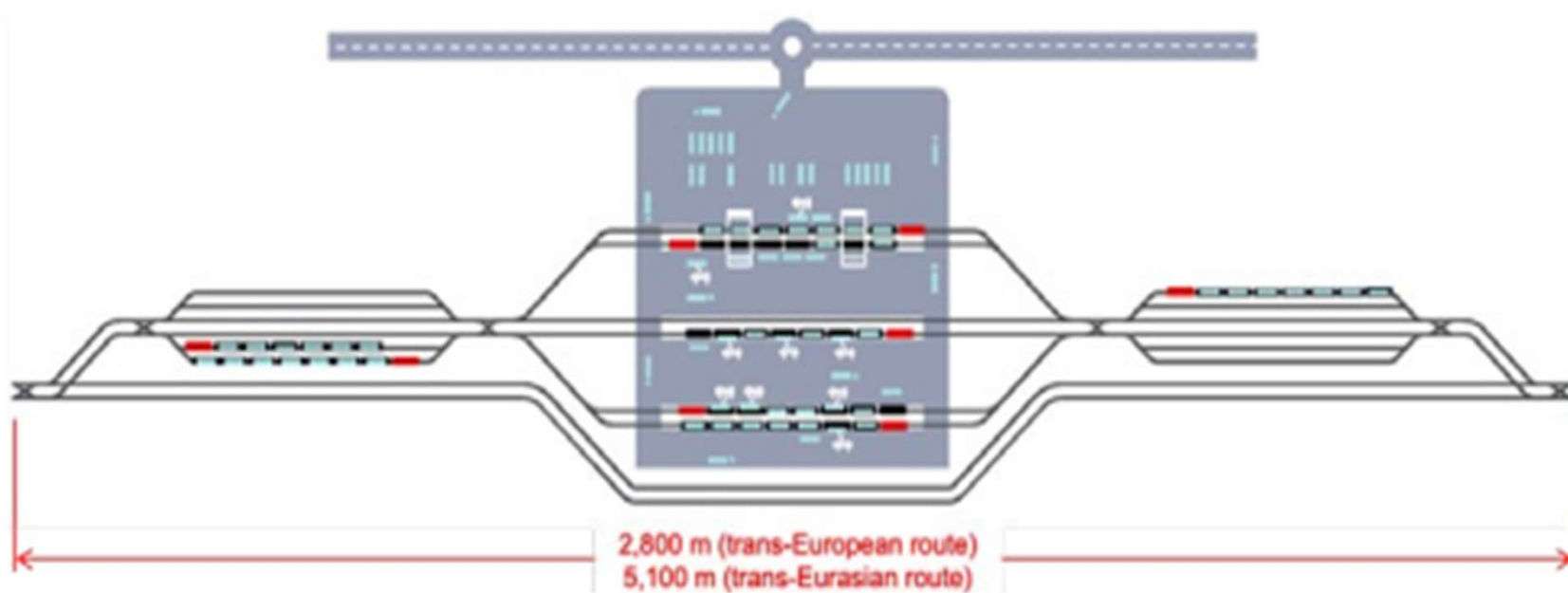
The purposes of the **buffer zones** are:

- Deceleration/acceleration of the freight trains entering and leaving the central loading/unloading zone.
- Queuing of freight trains when the loading/unloading tracks are occupied.

There are no zones for train composition as +FIRRST trains are fixed formations. The different types of suitable ILUs are loaded and unloaded according to predetermined routes and stops (considering real-time demand).

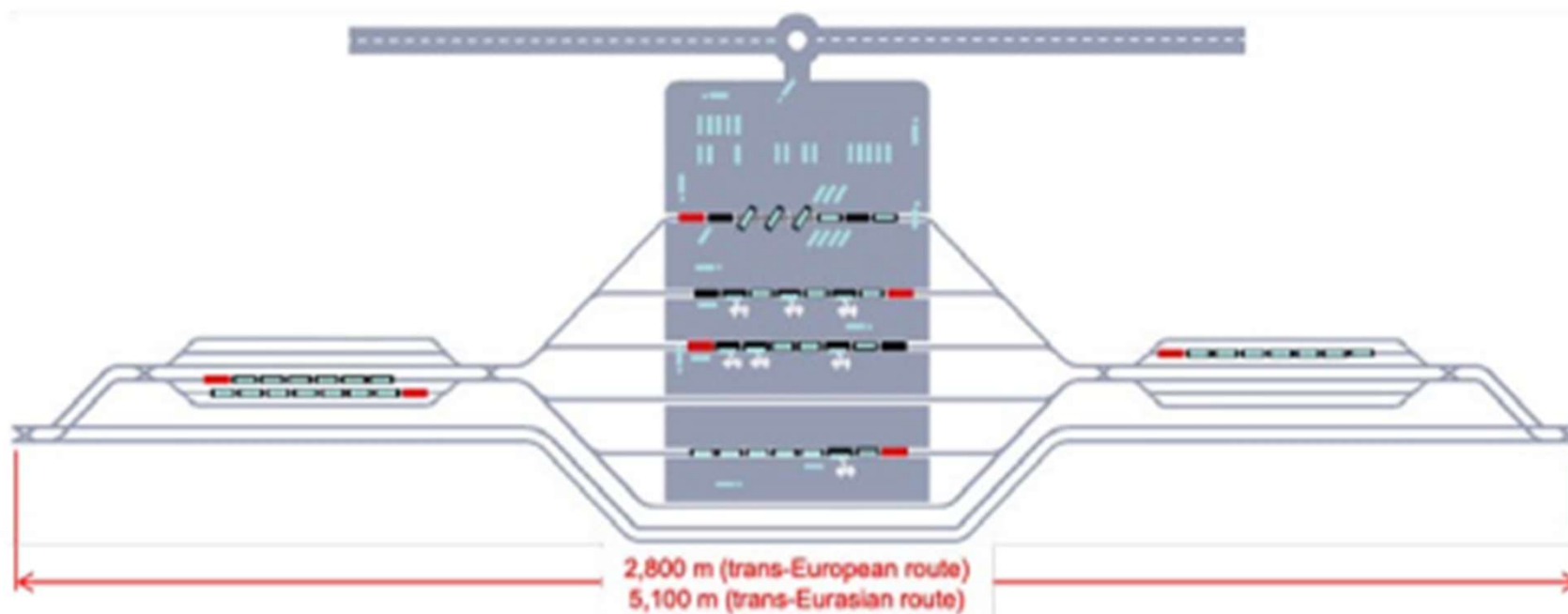
+FIRrst INTERMODAL TERMINALS CLASSIFICATION (I)

+FIRrst Strategic terminal (A)



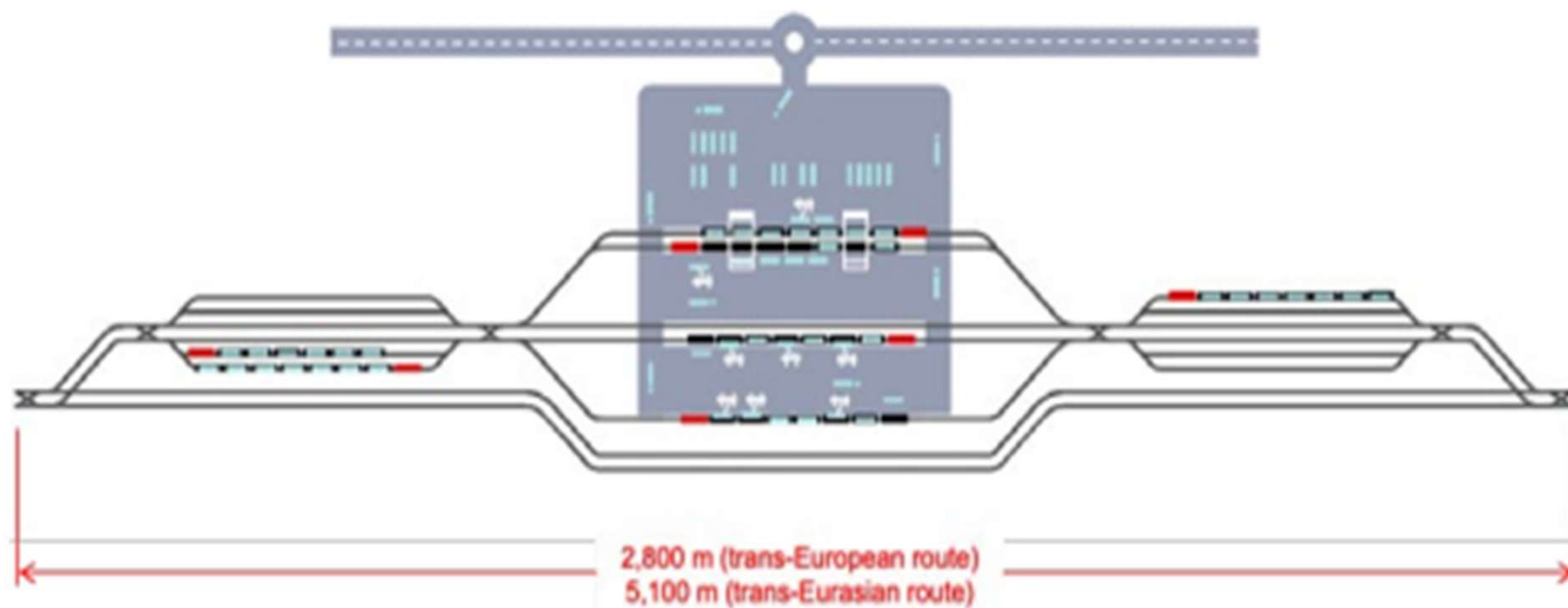
+FIRrst INTERMODAL TERMINALS CLASSIFICATION (II)

+FIRrst Strategic terminal (B)



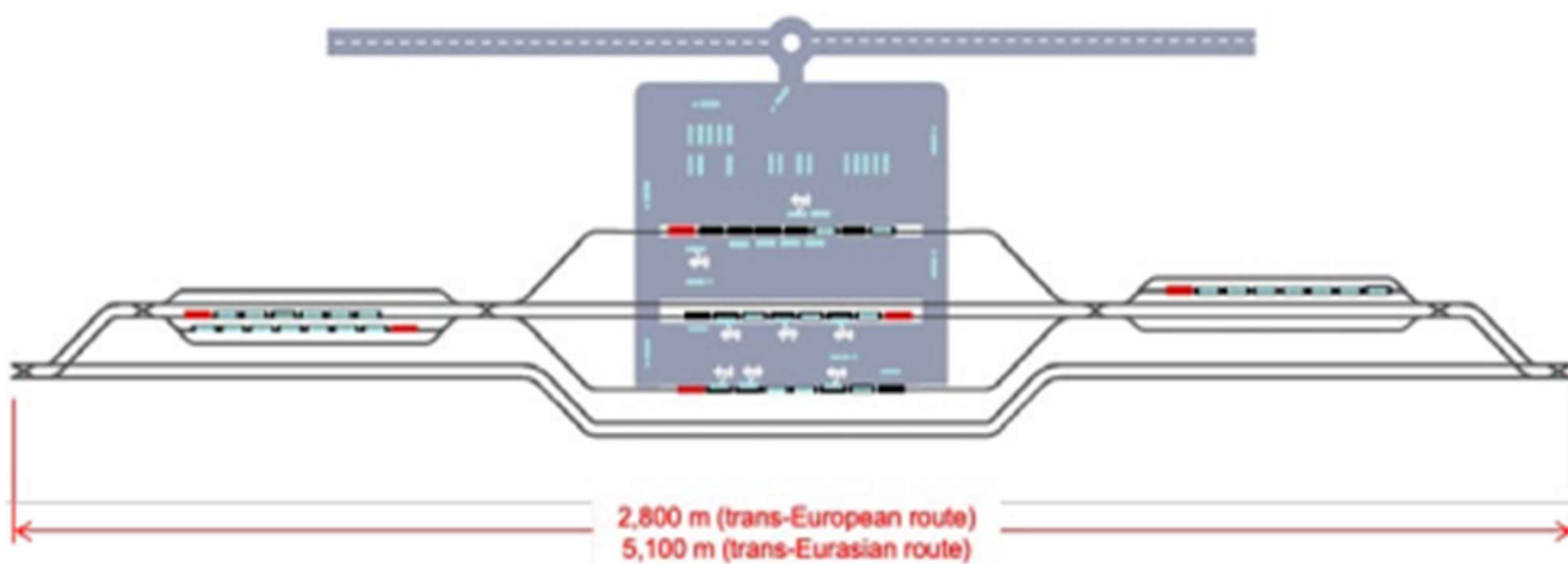
+FIRrst INTERMODAL TERMINALS CLASSIFICATION (III)

+FIRrst Strategic terminal (C)



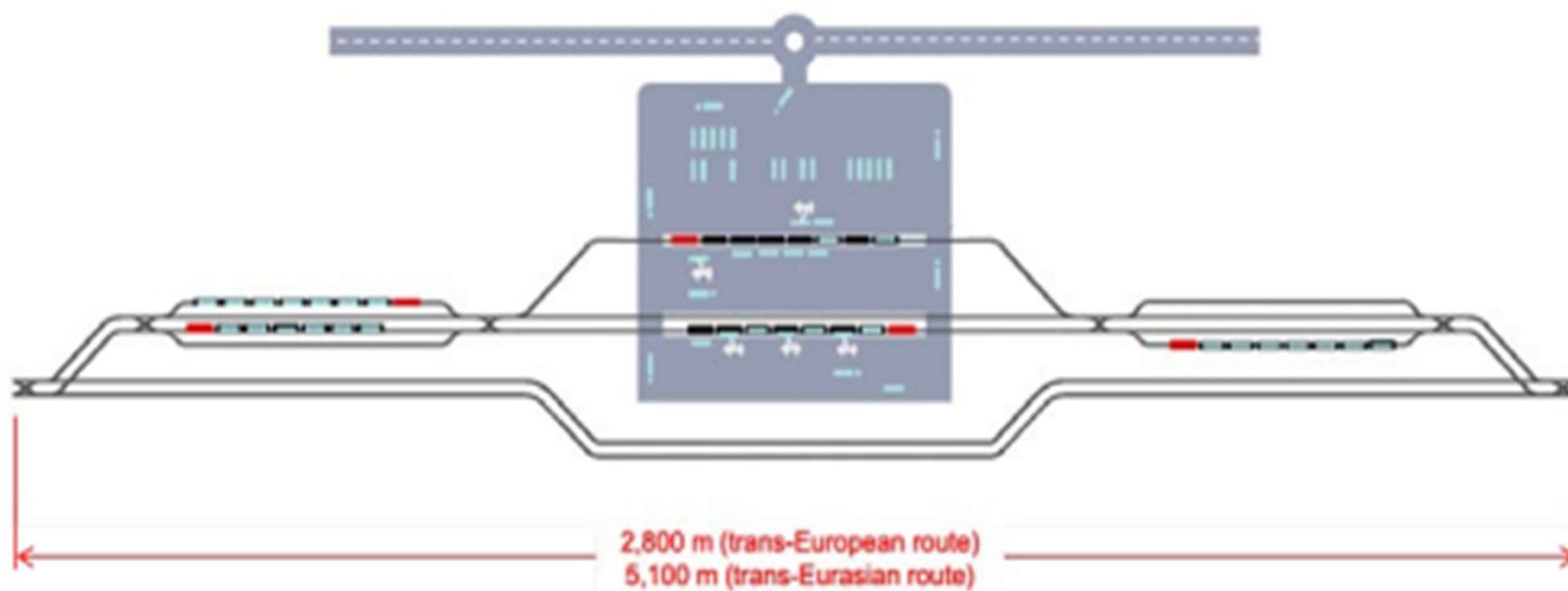
+FIRrst INTERMODAL TERMINALS CLASSIFICATION (IV)

+FIRrst intermediate terminal (A)



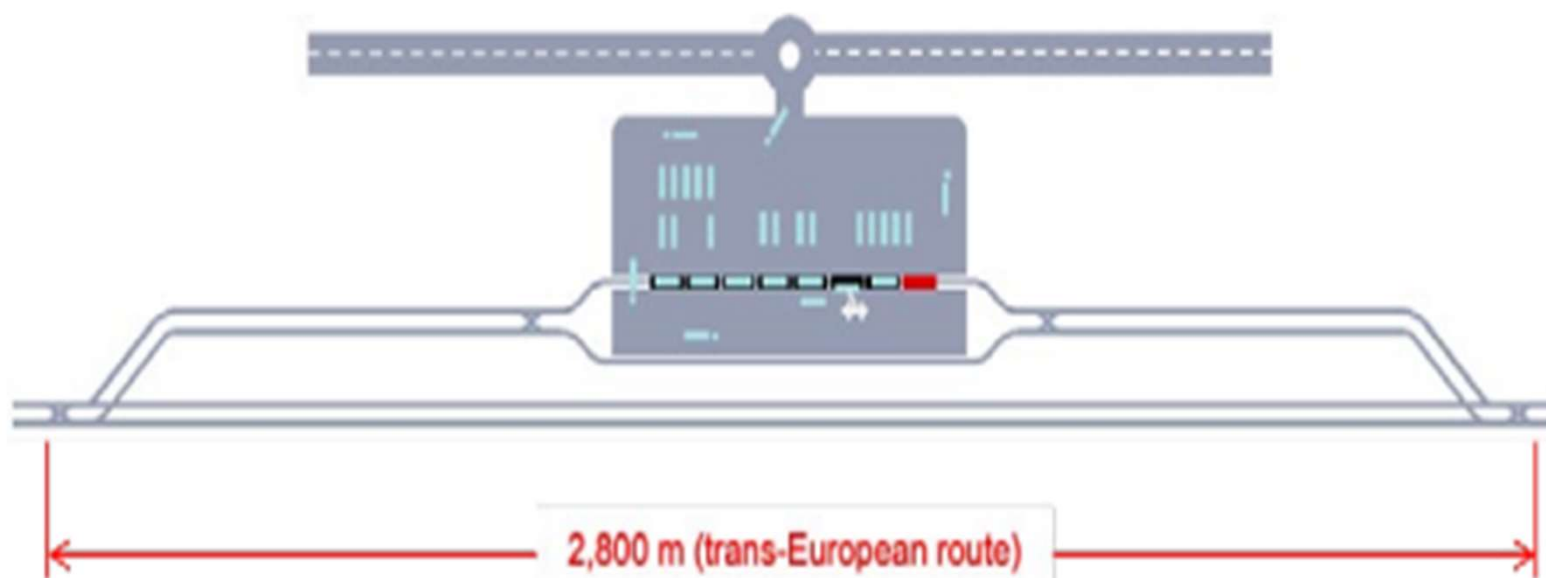
+FIRRST INTERMODAL TERMINALS CLASSIFICATION (V)

+FIRRST intermediate terminal (B)



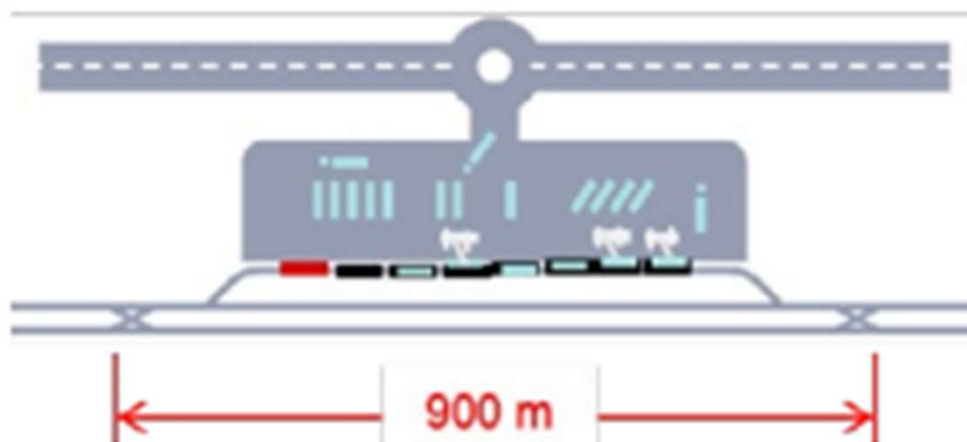
+FIRrst INTERMODAL TERMINALS CLASSIFICATION (VI)

+FIRrst intermediate small terminal



+FIRRSST INTERMODAL TERMINALS CLASSIFICATION (VII)

+FIRRSST intermediate mini terminal



CLASSIFICATION OF +FIRRT TERMINALS EUROPEAN UNION + SWITZERLAND

Type	L/U Buffers Layout	Num of terminals	Num of terminals	Location (Num of terminals)	
Strategic (A,B,C) (6 to 5 L/U tracks)	Full	60	89	Marshalling yard	19
	Semi-compact	22		Station yard / New site	70
	Compact	7			
Intermediate (A,B) (4 to 3 L/U tracks)	Full	66	149	Marshalling yard	22
	Semi-compact	68		Station yard / New site	127
	Compact	15			
Intermediate small (2 L/U tracks)	Full	73	165	Marshalling yard	37
	Semi-compact	60		Station yard / New site	128
	Compact	32			
Intermediate mini (1 L/U tracks)	Full	0	22	Marshalling yard	2
	Semi-compact	1		Station yard / New site	20
	Compact	21			

Type	Num	Share	Layout	Num	Share	Location	Num	Share
Strategic	89	21%	Full	199	46.8%	Marshalling yard	80	18.8%
Intermediate	149	35%	Semi-compact	151	35.5%	Station yard /New site	345	81.2%
Intermediate small	165	39%	Compact	75	17.7%	TOTAL	425	100%
Intermediate mini	22	5%						

+FIRrst TERMINALS: ADVANTAGES OVER CONVENTIONAL TERMINALS (I)

+FIRrst terminals versus conventional dead-end terminals

To put things in perspective, 86,5% of the existing intermodal terminals in the EU are dead-end terminals and the length of loading/unloading tracks is less than 500 m in 63% of the cases.

For terminals with one L/U track length of 251-500 m and average of 47 min of shunting movements are required.

In the most usual cases in which the terminals have more than one L/U track, some shunting movements could be made in parallel. In these cases the time requires for shunters movements that cannot be done in parallel is approximately 30 minutes.

+FIRRSST TERMINALS: ADVANTAGES OVER CONVENTIONAL TERMINALS (II)

+FIRRSST terminals versus conventional pass-through terminals

The main advantage is having buffers at each end of the central loading/unloading zone, which allows disruption to the main line to be minimised, as deceleration/acceleration of the freight train is done on siding tracks.

In addition, many existing, conventional pass-through terminals have parallel tracks to queue trains waiting for availability of the loading/unloading tracks. This means additional shunting movements, with the related time delay, and possibly even the requirement for shunting locomotives.

ABANDONED MARSHALLING YARD IN STERPENICH (BELGIUM)



+FIRRST TRAIN ROUTES

+FIRRST train routes will be mapped out following the corridors included in the Central and Extended EU Backbone Network, linking +FIRRST terminals and existing (conventional) pass-through terminals and dead-end terminals with 750 m long L/U tracks (preferably always pass-through terminals).

In this context, it is important that the matter of adapting existing terminals to pass-through and 750 m track length, as well as the gradual introduction of additional new +FIRRST terminals, is taken into account.

Train origins/destinations will be the intermodal terminals of the main EU logistics hubs, with possible stops in intermediate terminals, depending on real-time demand

DETERMINATION OF +FIRRSST TRAIN INTERCONNECTION ROUTES (Ptp-Sai-Sor) (I)

Analysis of the inflow/outflow of the 30 preselected main hubs

Determination of:

- Destinations with the possibility of Ptp trains from the preselected main hubs (places with daily exchanges that are enough to fill at least one full train per day and direction)
- Destinations that require Sai/Sor trains because of the lack of volume (demand) for daily Ptp trains
- Suitable +FIRRSST trains to interlink the 30 main hubs, the main additional sea ports (not belonging to the strategic hubs) and the key intermodal terminals located at the EU border or other key logistics areas

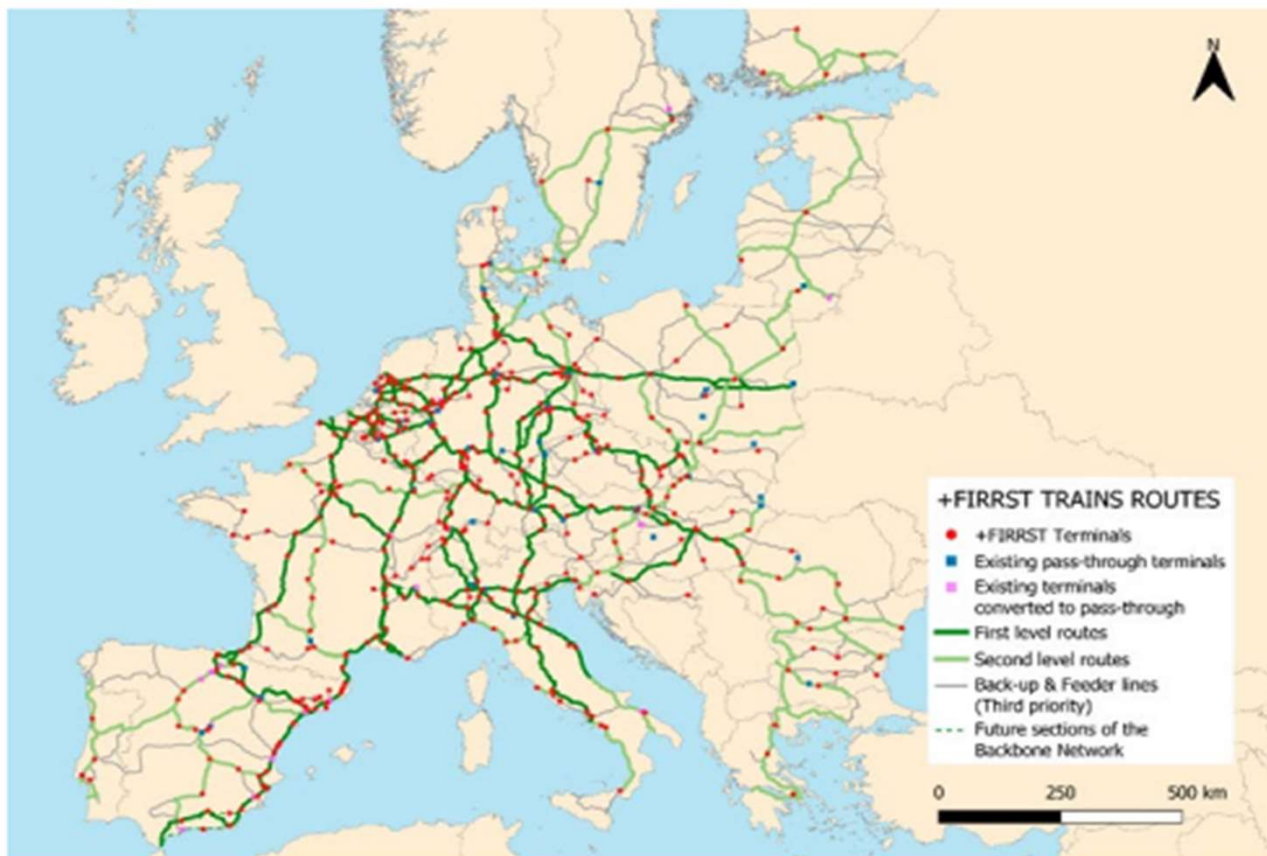
DETERMINATION OF +FIRRST TRAIN INTERCONNECTION ROUTES (Ptp-Sai-Sor) (II)

Analysis of the inflow/outflow of the intermediate hubs located on the +FIRRST trains routes

Determination of:

- The number of main +FIRRST train origin/destination hubs that are not fully completed
- Additional stops on the route to absorb the inflow-outflow traffic of the intermediate hubs (terminals) involved
- Number of Sai/Sor trains required on the route

FIRST DRAFT OF +FIRRS TRAIN ROUTES IN THE EU



+FIRRST TRAIN OPERATION PROCEDURE

Operational levels in the +FIRRST system to move freight between two main logistics hubs:

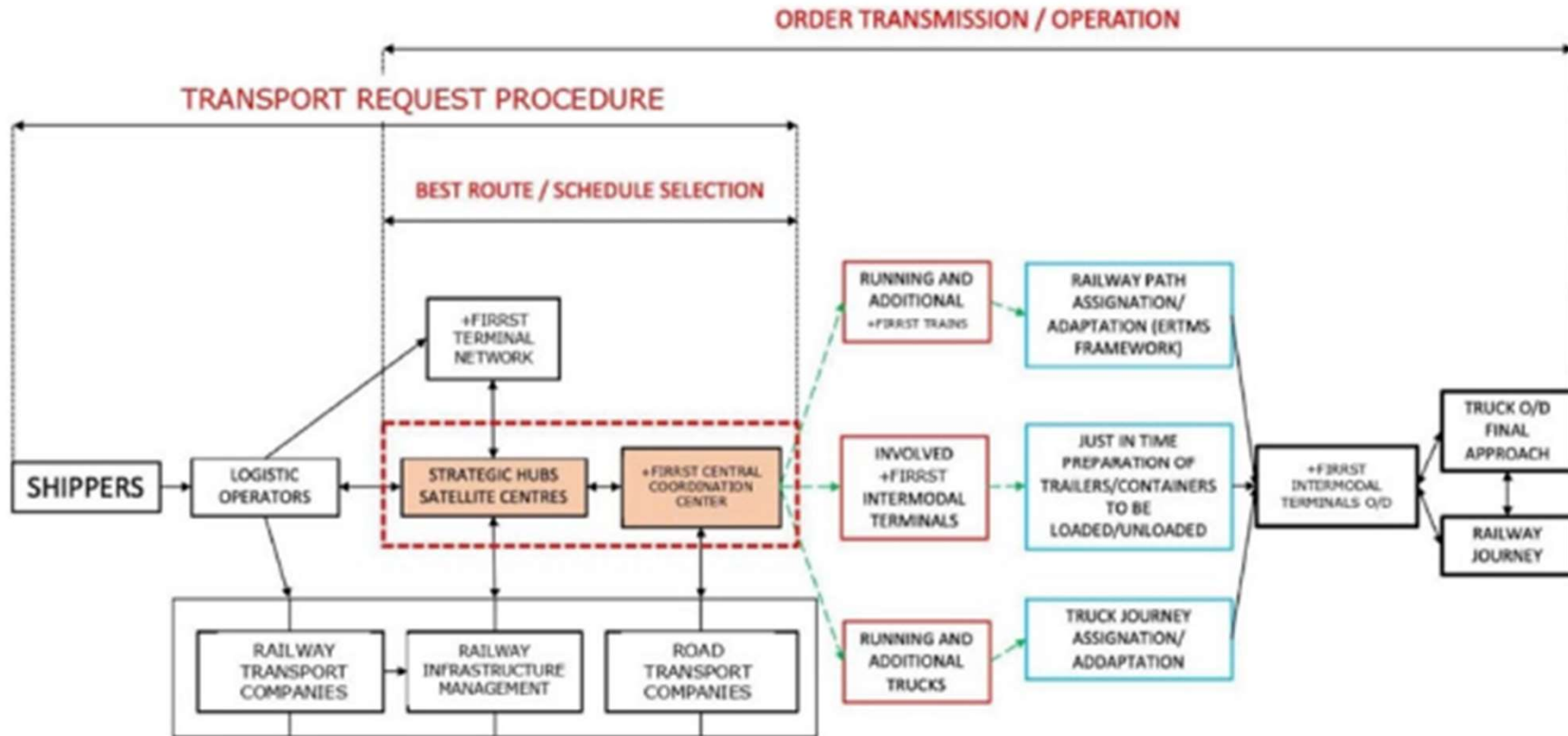
- **Level 1** – Updated versions of current Ptp container trains and rolling motorway procedures including Sai trains, with fixed stops
- **Level 2** – Wide availability of Ptp and flexible Sai train services but not Sor
- **Level 3** – Full deployment of +FIRRST system with dynamic path assignation (real time rolling planning) with two options:
 - Flexible stop times at the predetermined intermediate terminals (number of stops scheduled 3 hours before departure at the origin intermodal terminal)
 - Additional last minute stops at the predetermined terminals and/or at not previously scheduled terminals

SUMMARY OF +FIRRSST SYSTEM OPERATIONAL LEVELS

Item/Level	Level 1	Level 1.2	Level 2	Level 3
Type of train	Ptp	Ptp/Sai fixed	Ptp/Sai flexible	Ptp/Sai flexible/Sor
Type of wagon	Digitally interconnected with DAC	Multipurpose Digitally interconnected with DAC	Multipurpose Digitally interconnected with DAC	Multipurpose Digitally interconnected with DAC
Real-Time Rolling Planning implementation	Not required	Desirable	Required	Required
ERTMS implementation	Desirable	ERTMS Level 2 implemented	ERTMS Level 2 or 3 fully implemented	ERTMS Level 3 fully implemented
+FIRRSST GCMC (Global Coordination and Management Centre)	Not required	Recommended	Required	Required
PTLC (Private Transport and Logistics Control Companies)	No	Possible recommended for small road transport companies	Possible recommended for small road transport companies	Possible recommended for small road transport companies
Pool of tractors and drivers in the +FIRRSST terminals	Not required	Not required	Recommended for small companies	Recommended for small companies

Ptp: Point-to-Point train; **Sai fixed:** Stop at Intermediate fixed terminals; **Sai flexible:** flexible stops at intermediate terminals predefined just before the departure from the origin; **Sor:** full flexible Stops on Request

+FIRrst INTEGRATED FREIGHT CONTROL SYSTEM



BASIC CONSIDERATIONS FOR ROAD HAULAGE TO FACILITATE COMBINED TRANSPORT

Requirements for transferring semi-trailers from road to rail:

- Availability of tractors and semi-trailers in the origin and destination intermodal terminals
- Minimum ownership by road transport companies of tractors/semi-trailers to allow sufficient numbers at the different origin-destination terminals
- Craneable semi-trailers
- Standard shape of semi-trailers (13.6 m length) 13.95 m could also be accepted. In this regard, the best European Modular System (EMS) combination on the road is the "duo-trailers composition" with a total length of 31.75 m.
- Facilities in the terminals:
 - Adequate services for drivers
 - Sufficient parking space for tractors and semi-trailers
 - Safety conditions



ABC CURVE OF ROAD TRANSPORT IN THE EU

Trucks range	Number of companies	Total trucks	Total trailer
1	328.592	328.220	235.454
2 a 5	154.462	525.859	362.044
6 a 9	62.437	436.947	293.680
10 a 19	37.594	507.982	346.530
20 a 49	21.188	537.750	363.384
50 a 499	7.027	1.243.311	839.615
500 a 999	595	415.374	290.003
> 1000	181	201.700	139.328
	612.076	4.197.143	2.870.038

We can see that haulier companies with 20 and more HGVs (4.7% of companies own 57% of HGVs and trailers).

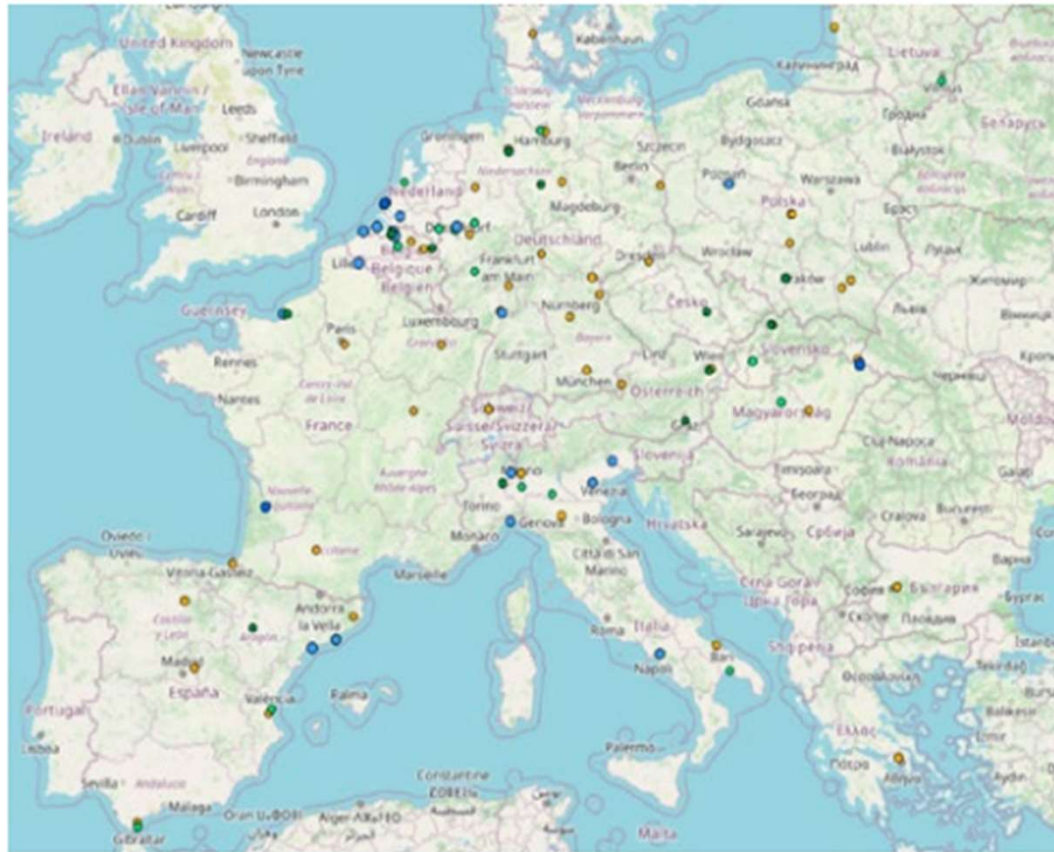
DETERMINATION OF THE BEST ROUTES FOR TESTING +FIRRST TRAINS

Realistic deployment of the +FIRRST system

- ❖ Routes with:
 - ERTMS signaling/control system (or similar) deployed
 - Adequate loading gauge P410-P400 (or similar)
 - Allowing running trains of 740 m

- ❖ Three phase envisaged:
 - Making the use of existing terminals that can already handle the +FIRRST trains
 - Developing new +FIRRST terminals by refurbishing abandoned or semi abandoned marshalling yards
 - Building the needed +FIRRST terminals to achieve the EC (2011) White Paper on Transport Policy targets

MAP OF TERMINALS TO BE USED DURING THE FIRST PHASE OF DEPLOYMENT OF +FIRRS



MAP OF TERMINALS TO BE USED DURING THE SECOND PHASE OF DEPLOYMENT OF +FIRRSST

In the second phase we overlay the new +FIRRSST terminals in old marshalling yards (shown in red):

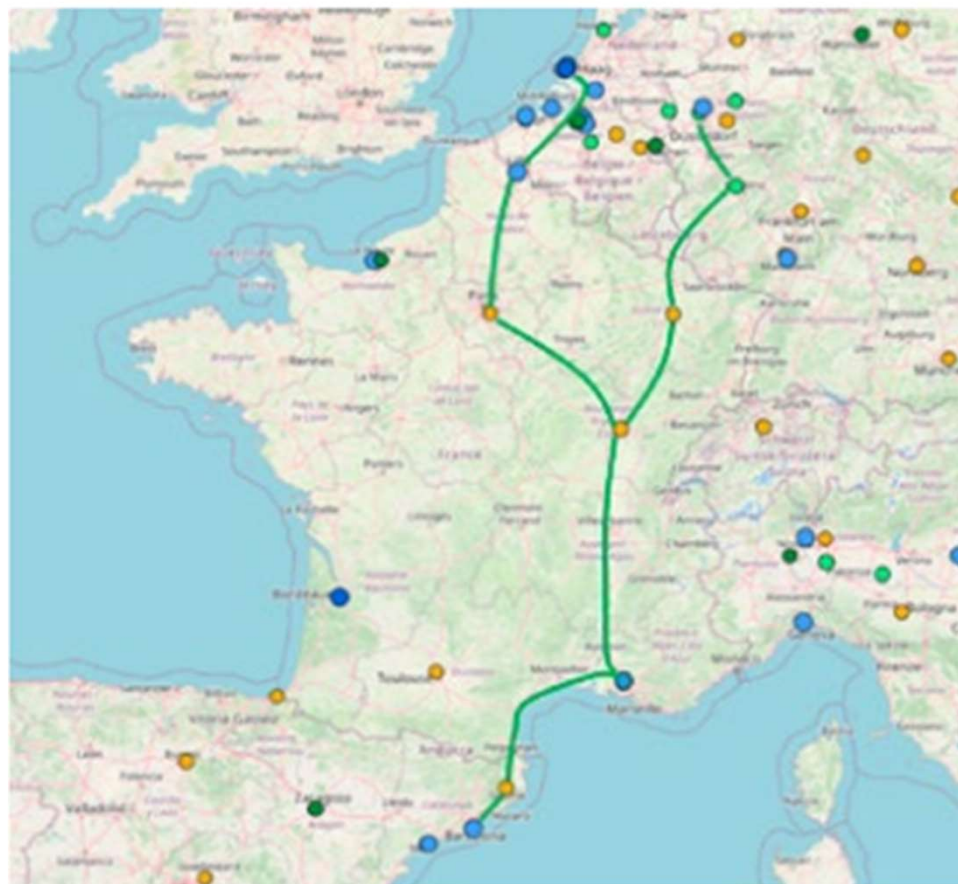


MAP OF TERMINALS TO BE USED DURING THE THIRD PHASE OF DEPLOYMENT OF +FIRRST

Finally, for the third phase, we consider all the new proposed +FIRRST terminals (small red dots):



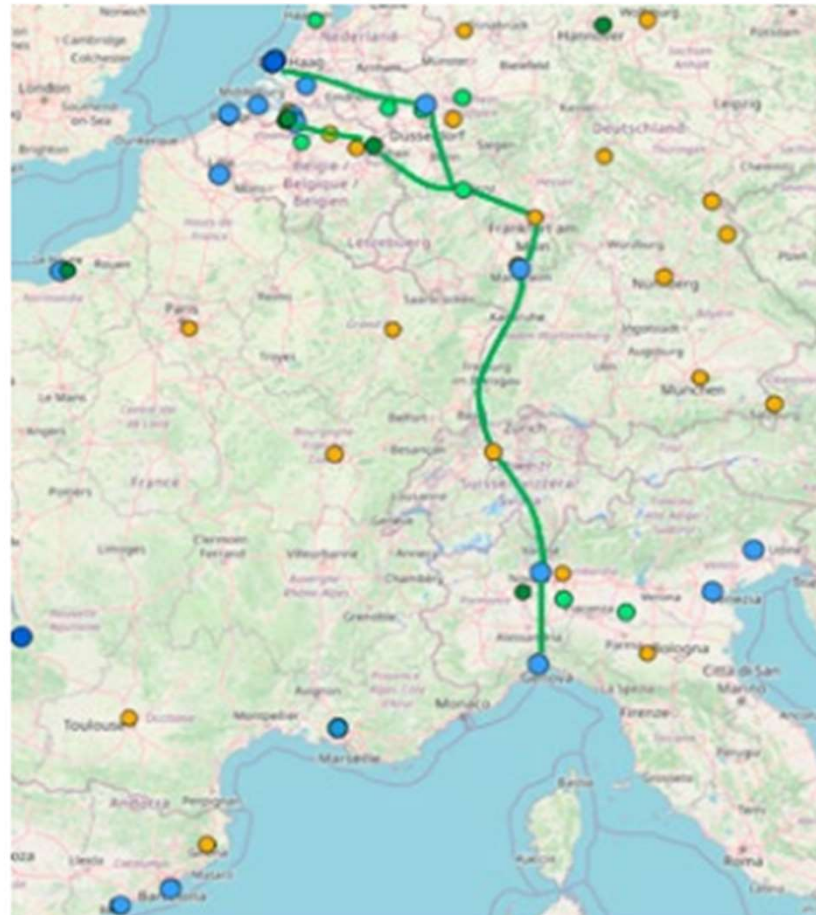
+FIRrst TEST ROUTE ROTTERDAM/DUISBURG – PARIS – BARCELONA FOR THE FIRST PHASE



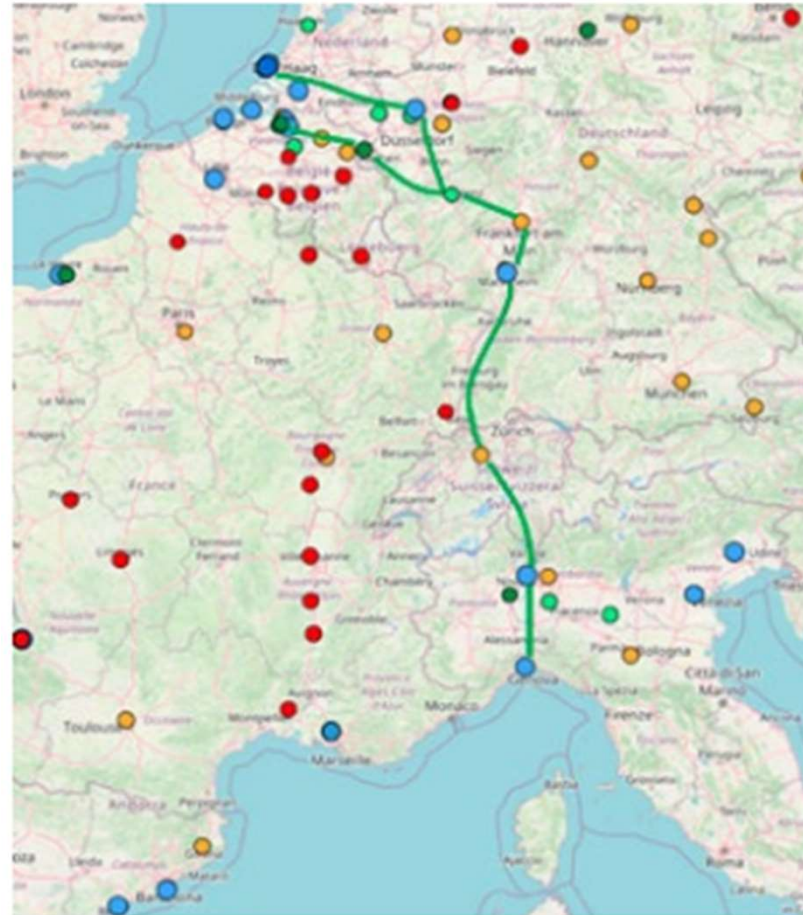
+FIRrst TEST ROUTE ROTTERDAM/DUISBURG – PARIS – BARCELONA FOR THE SECOND PHASE



+FIRrst TEST ROUTE ROTTERDAM/ANTWERP – FRANKFURT – GENOA FOR THE FIRST PHASE



+FIRrst TEST ROUTE ROTTERDAM/ANTWERP – FRANKFURT – GENOA FOR THE SECOND PHASE



POTENTIAL OF +FIRRST FLOWS CAPTURED AND INVESTMENT NEEDED

Route	Rotterdam- Paris-Barcelona	Rotterdam- Frankfurt-Genoa
% of potential +FIRRST flows captured in phase 1	55 %	48 %
% of potential +FIRRST flows captured in phase 2	67 %	52 %
<i>Investment needed in terminals of phase 2</i>	€234 m	€86 m
% of potential +FIRRST flows captured in phase 3	100 %	100 %
<i>Investment needed in terminals of phase 3</i>	€709 m	€947 m

OTHER ROUTES TO BE CONSIDERED FOR THE GRADUAL DEPLOYMENT OF +FIRRSY SYSTEM

- Rotterdam/Antwerp-Ruhr area – Hannover – Berlin – Warsaw – Terespol/Malaszewicze.
- Frankfurt am Main – Mannheim - Stuttgart - Munich - Vienna - Budapest – Fenyeseitke.
- Paris/Barcelona – Lyon – Milan – Venice - Vienna/Ljubljana - Budapest. (In this route there are a lot of infrastructure improvements required, as it is the case of new lines Lyon-Turin, Koper-Divaca, etc.).

FERRMED Study of Traffic and Modal Shift Optimization in the EU

