January 25th 2017

Measuring and upgrading the clearance gauge of railway lines

Measuring and upgrading the clearance gauge of railway lines,

Final dissemination meeting, December 2016

Index

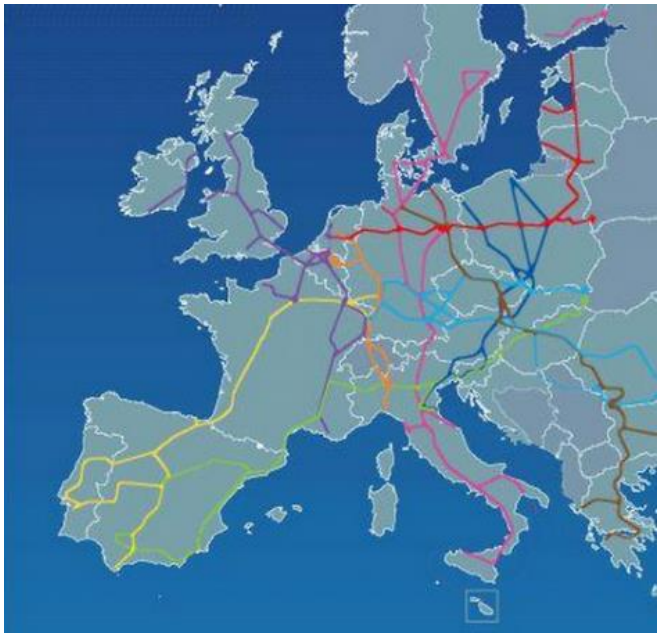
- Presentation of the results of the study
- Presentation of the regulation project
- Discussion about the implementation of the regulation
  - The role of the IMs
  - The role of the RUs

Context of the study

- Rise of rail freight transport in intermodal units in Europe (+41% between 2005 and 2013)

- Nine rail freight corridors:
  - Entry points to the network for Railway undertakings
  - Some axes already saturated (RFC1)

- Importance of Clearance gauge for the development of new traffics



Objectives of the study

- The main objectives are the following:
  - Create transparency on the access conditions of railway lines
  - Attract additional freight traffic for rail according to real markets
  - Open the rail freight market by removing unnecessary clearance gauge restrictions, and exploit economies of scale by giving wider network access to vehicles built to standard gauges
  - Strengthen demand-oriented infrastructure development
  - Identify the most profitable bottlenecks to act on
  - Identify how current practice and standards with regards to gauge could be simplified/ revised for increase efficiency in solving gauge questions
- The study works toward these objectives via the development of a best-practice guide with procedures for the revision of line codifications, with a view to upgrade line characteristics in a pilot program

Overall technical scope: 6 Work Packages (WP)

	Description
WP 1	Assessment of existing clearance gauge information systems
WP 2	Assessment of procedures to measure and enhance clearance gauge information
WP 3	Market study, resulting in selection of 2 to 6 gauge enlargement links
WP 4	Measurement campaign
WP 5	New gauge standard and Best practice guide
WP 6	Feasibility study and cost benefit analysis (CBA)

December 14th 2016

Measuring and upgrading the clearance gauge of railway lines

Feasibility Study

UIC FRET CAPTRAIN HUPAC SYSTRA

SNCF RÉSEAU COMSA RAIL TRANSPORT adif INFRABEL

Steps of the Feasibility Study

1) **Market Study**

2) **3D Measurement**

3) **Definition of the dynamic envelope**

4) **Investment estimate**

5) **Economic and financial appraisal**

Market Study – objectives

3 main objectives :

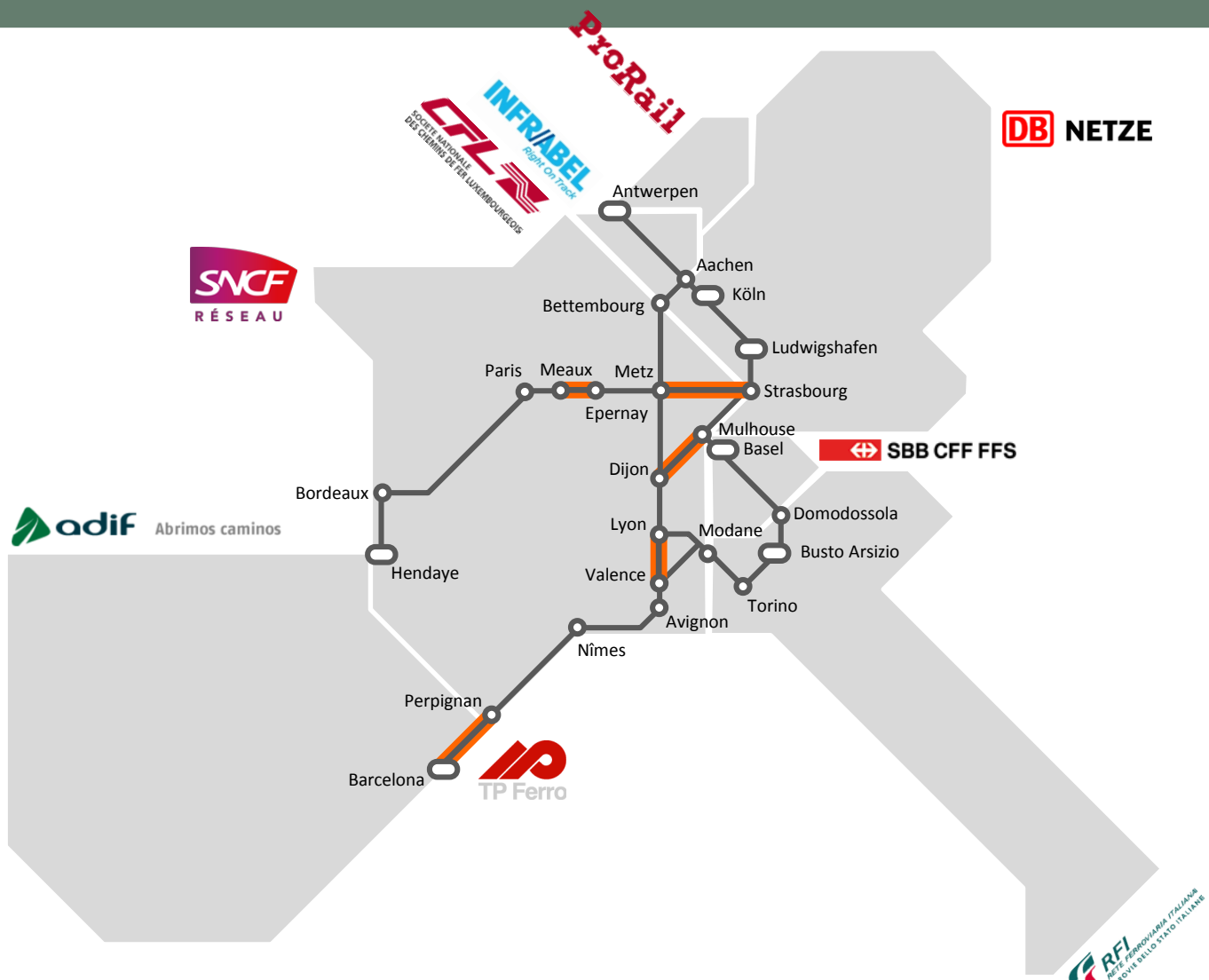
- Identification of gauge enlargement links
  - Input for the measurement campaign
- Identification of desired profile
  - Input for target gauge definition
- Traffic forecast
  - Input for the economic appraisal

Market Study

What is a bottleneck ?

- A short section where works are needed
- The upgrade of which would open a long road
- …on the European Rail Freight Corridors

Market Study – gauge enlargement links



Market Study – identification of desired profile

- One specific profile is desired by the stakeholders and expected to be mostly encountered
  - **P400**

- Two profiles have been selected to be studied during the following steps of the study
  - **P400**
  - … and also **P394**

Market Study – trafic forecast

Traffic forecast made using a questionnaire, in order to know about stakeholders' intention in case of gauge enhancement operations.

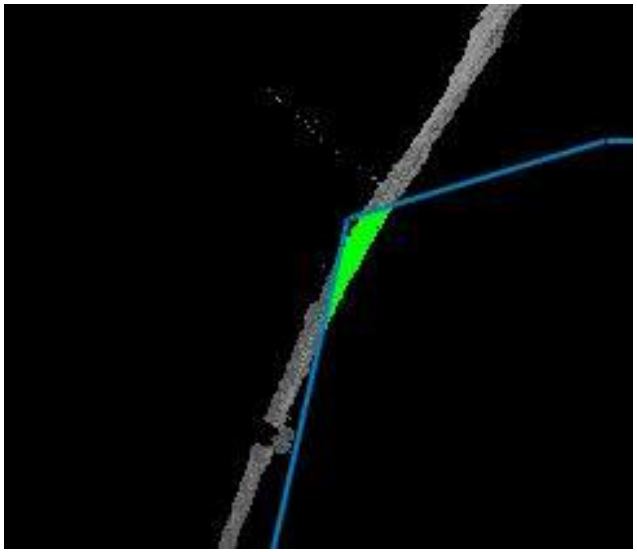
Main topics of the questionnaire:

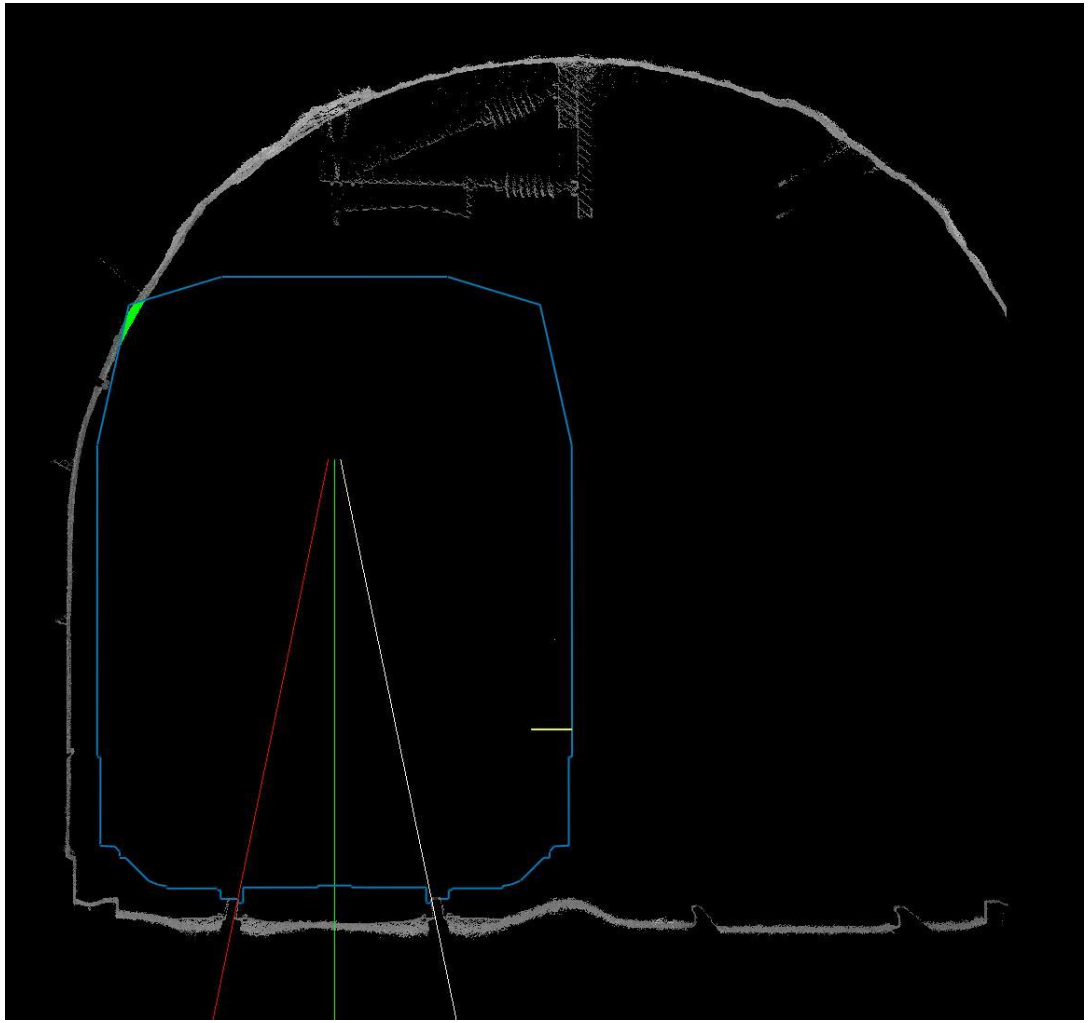
- **Current activity**
  - Traffic volumes
  - Origins and destination
- **Potential development**
  - Traffic growth
  - Origins and destinations (same and new ones)
- **Difference from a counterfactual situation**
  - Is it modal shift?
  - Is route deviation?

Measurement campaign

The selection and validation of these gauge enlargement sections have triggered the beginning of the measurement campaign.

Comparison with the dynamic envelope





Feasibility study – Measurement analysis

Overlapping sections identification

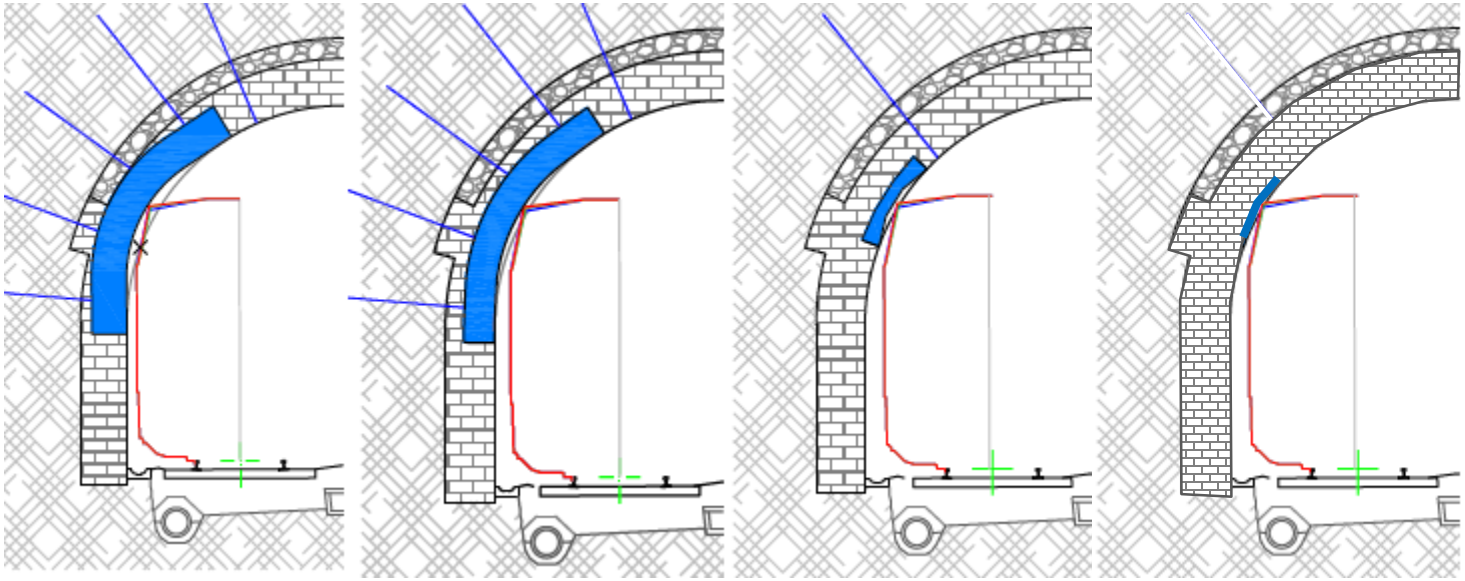
- 47 tunnels analysed = 22 km
- 29 tunnels with overlapping sections = 15 km of tunnels
  - 64% impacted for the P394 profile
  - 72% impacted for the P400 profile

Lines	Number of tunnels	Tunnel Length (km)	% of tunnel impacted	
			P394	P400
Paris/Metz (Meaux-Epergnay)	**3**	2.22	63%	77%
Metz/Strasbourg (Tunnels des Vosges)	**6**	4.65	58%	64%
Dijon/Mulhouse	**16**	6.55	71%	78%
Paris/Marseille (Vallée du Rhône)	**4**	1.41	52%	63%

Feasibility study - Technical solutions

1. Works on the tunnel vault

- 4 types of work depending on the overlapping depth
- 2 options :
  - → Option 1: night work (6h daily) = partial service interruption
  - → Option 2: total service interruption



Type A: Deep lining repair
> 20 cm

Type B: Lining repair
10 to 20 cm

Type C: Shotcrete arch segment
5 to 10 cm

Type D: Coating operation
0 to 5 cm

Feasibility study - Technical solutions

2. Works of roadbed lowering

Work specificities:

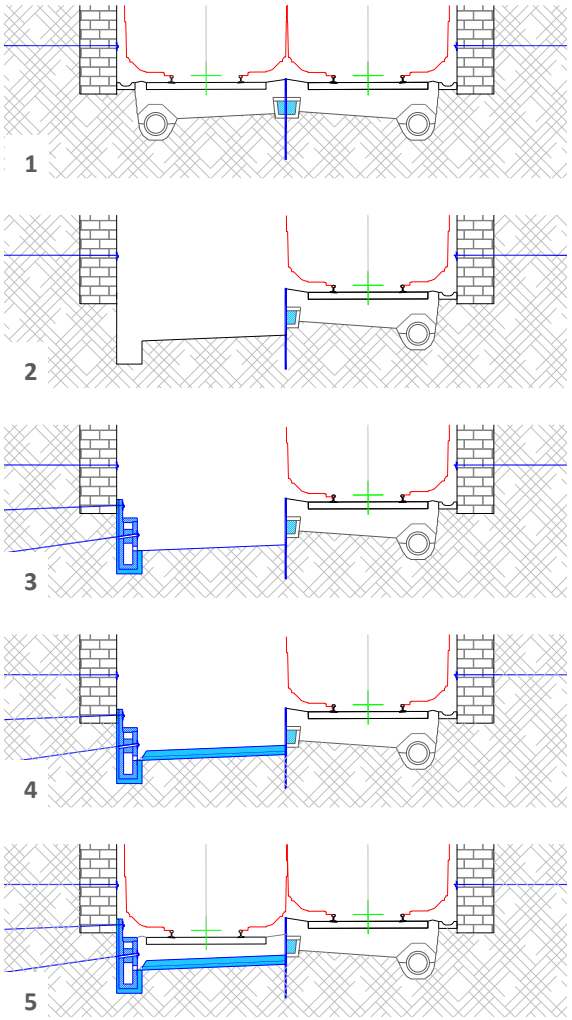
- Implies sewage and drainage systems modification
- Potential underpinning additional works

Process description:

- 1 : Preliminary works: sidewalls anchoring
- 2 : Railway line dismantling and underpinning excavation
- 3 : Lateral gutters anchoring
- 4 : sewage system implementation
- 5 : Railway line installation

Interesting option in the following cases:

- Short tunnels (< 500 m)
- Gauges overlapping for more than the half of tunnel length
- Specific situation for which vault works are very expensive
- No concrete apron to modify
- No reinforced concrete sidewalls to modify
- Partial service interruption by direction



Economic appraisal - Scenarios definition

	Bottleneck works	Best Price		Min Customer loss		Markets captured	Annual vol.
		Vault works with total traffic interruption by track		Vault works with partial traffic interruption by track[i]			
		P394	**P400**	**P394**	**P400**		
A	B1: Vosges Tunnels	43 M€	51 M€	70 M€	85 M€	M1: Belgium – Swiss/Italy	28 KTEU
B	B1 : Vosges Tunnels B4: Meaux-Epernay	57 M€	75 M€	93 M€	125 M€	M1: Belgium – Swiss/Italy M3: South West France – Germany	46 KTEU
C	B2 : Rhône Valley B3: Perpignan Barcelona	10 M€[ii]	18 M€[ii]	16 M€[ii]	30 M€[ii]	M2: Spain – Belgium/Italy	54 KTEU
D	B2 : Rhône Valley B3: Perpignan Barcelona B5: Dijon-Mulhouse	155 M€[ii]	195 M€[ii]	265 M€[ii]	335 M€[ii]	M4: Spain – South Germany	116 KTEU
E	B2 : Rhône Valley B5: Dijon-Mulhouse	155 M€	195 M€	265 M€	335 M€	M5: South France – South Germany	62 KTEU

[i]:except roadbed lowering for the following tunnels: Arzviller, Lutzerlbourg, Niederrheilthal, Haut Barr (Vosges) and Rang (Dijon-Mulhouse)
[ii]:Perpignan Barcelona investments not included

Economic appraisal – Concerned Stakeholders

- **Freight Clients**
  - Transport services prices
  - Goods immobilization costs
- **Road hauliers, Rail operators, Shipping companies**
  - Costs and revenues
- **Infrastructure Managers**
  - Operational expenses, maintenance and renewal
  - Track access charges
- **Stevedores**
  - Handling revenues
- **Public Authorities**
  - Taxation (fuel, corporate income…)
- **Externalities (third parties)**
  - Congestion
  - Road safety
  - Air pollution
  - Noise
  - Climate change
  - Up and down-stream process

Economic appraisal - Net present value per scenario

B1 Vosges Tunnels	B1 & B4 Vosges Tunnels and Meaux-Epernay	B2 & B3 Rhône Valley and Perpignan Barcelona	B2 & B3 & B5 Rhône Valley, Perpignan Barcelona and Dijon-Mulhouse	B2 & B5 Rhône Valley and Dijon-Mulhouse
M1 Belgium – Swiss/Italy	M1+M3 Belgium – Swiss/Italy and South West France - Germany	M2+M4 Spain – Belgium/Italy/South Germany (via Metz)	M2+M4 Spain – Belgium/Italy/South Germany (via Mulhouse)	M5 South France – South Germany

Scenario C and D do not take into account Perpignan-Barcelona investments

Economic appraisal - Economic rate of return

	P400 "Best Price"	P394 "Best Price"	P400 "Minimal customer loss"	P394 "Minimal customer loss"
A	7%	9%	2%	4%
B	23%	31%	12%	18%
C	>30%	>30%	>30%	>30%
D	17%	22%	8%	12%
E	-8%	-6%	-12%	-11%

Scenario C and D do not take into account Perpignan-Barcelona investments

Financial appraisal - assumptions

Appraisal assumptions

- Appraisal period : 30 years
- Discount rate : 5%
- Focuses on
  - The investor (IM)
  - The operators
  - The national financiers

Funding assumptions

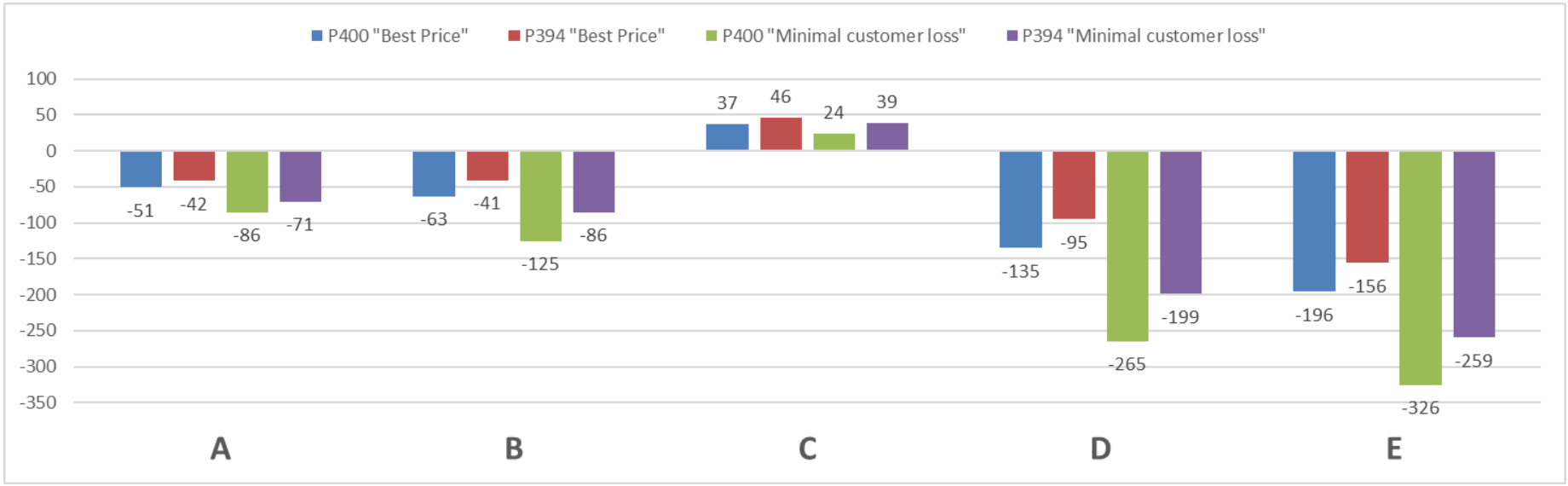
- Cohesion fund financed projects
- EU Grant
  - Funding Gap Ratio
  - Co-funding ratio of 85%
- Rest of the funding:
  - 30% for National Public Grant
  - 40% of equity
  - 20% on loan (30 years, 2%)

Financial appraisal – Funding detail

	P400 "Best Price"			P394 "Best Price"			P400 "Minimal customer loss"			P394 "Minimal customer loss"		
	FGR	EU Grant		FGR	EU Grant		FGR	EU Grant		FGR	EU Grant	
A	75%	64%	33 M€	73%	62%	27 M€	78%	66%	56 M€	77%	65%	46 M€
B	51%	43%	32 M€	41%	35%	20 M€	64%	54%	68 M€	57%	48%	45 M€
C	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
D	50%	43%	8 M€	41%	35%	4 M€	62%	53%	16 M€	57%	48%	8 M€
E	80%	68%	133 M€	79%	67%	104 M€	81%	69%	231 M€	80%	68%	180 M€

Scenario C and D do not take into account Perpignan-Barcelona investments

Financial appraisal - Return on investment



Scenario C and D do not take into account Perpignan-Barcelona investments

14th December 2016

Measuring and upgrading the clearance gauge of railway lines

Presentation of the Best Practice Guide

Introduction – General Principles

- Make easier and faster the access to the network for RUs
  - Understandable and available information
  - Harmonization of the gauge information

- Allow interested RUs to compute the line codification
  - Reliable and available measurement data
  - Need for a common methodology of line codification
  - Better cooperation between IMs and RUs in the procedure for the line codification

- Enlargement of the bottlenecks
  - Market study to select the enlargement works
  - Identification of the bottlenecks
  - Strategy to resolve the bottlenecks

Introduction – Methodology of the Best Practice Guide

- Results of the study
- Seminar with all stakeholders (sept. 2015)
- Questionnaires sent to IMs and RUs
- Bilateral discussions
- Proposals from the advisory board (02/2016)
- Compromises and roadmap expressed during a collaborative workshop (10/2016)

Introduction - Outline

1. Acquisition of the gauge data
2. Information management
3. Line codification
4. Gauge enlargement works

1. Acquisition of the gauge data

Measurement – state of play

- IMs are responsible for the measurement
  - Some have advanced measurement system
  - Some subcontract the gauge measurement
  - The measurement frequency is very diverse
  - IMs finance the measurement

Measurement – Recommendations

- *Accuracy*: Use of a laser-based inspecting device
  - mounted on railway vehicles for regular measurements
  - trolley-type device for accurate and specific measurements

- *Frequency*: Increase the measurement frequency:
  - Obstacle records to be regularly updated
  - Systematic measurement after infrastructure works impacting the gauge

Measurement – Stakeholders

- Allow RUs or other stakeholders (e.g. transport authorities) to finance and to perform measurements:
  - Enhancement of the measurement database with measures from other stakeholders
  - Measurement of a line for a specific market

- The IM remains the unique manager of the measurement data:
  - Quality of the data guaranteed by a quality certificate, attesting the measurement process and the data format.
  - Standardization of the data exchange format

Measurement – Data management

- The European Commission suggests to make the measurement data available on demand for the RUs.
- Vigilance points:
  - Validity and reliability of the data need to be guaranteed.
  - Could lead to misunderstanding if the codification methodologies remain different between IMs and RUs.

2.

Information management

Information sharing – Recommendations

Share more information than today

- Infrastructure:
  - Bottlenecks list
  - Topology of tunnels
  - Distance between track axes
- Engineering works:
  - Short-term prevision and Long-term vision to anticipate new markets
  - Diversion routes to adapt the routes efficiently
- Publish negative and/or positive answers for exceptional transport.

Information sharing – Recommendations

Information distribution

- Support several information vectors:
  - Profile catalogue
  - Digital platform/web service
  - GIS tool at a national/corridor/European scale
- Do not separate the raw data and the methodology to process them, but set up a standard methodology
- Have the information management supervised by neutral actors (eg. regulatory bodies)

Network statements – Recommendations

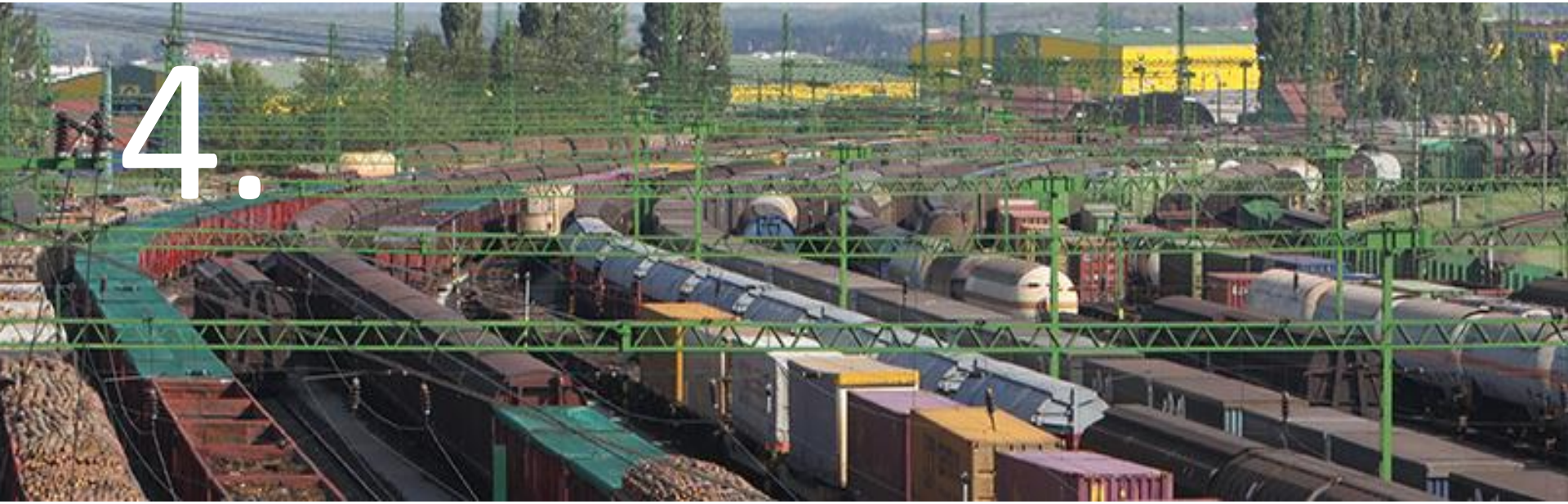
- Provide additional requirements regarding the content of the NS:
  - Clearance gauge information in two languages, including English, and regularly updated (once a year)
  - Present data for combined transport
  - Indicate infrastructure gauge and loading gauge
  - Display the relevant information as maps, graphical information and GIS, and give URLs to these maps and online services.
  - Give the contact of the IM department in charge of the network access

Harmonization of the NS content

IM is responsible

European harmonization – Recommendations

- Harmonization of the codification methodology
  - ⇒Codification system understandable by each stakeholder
  - ⇒Need of a working group made up of experts to build a common codification methodology
- Harmonization of the information format (eg. RailML)
  - ⇒Better exchangeability
- Harmonization of the interface giving access to the information
  - ⇒Better user-friendliness and access to the information



4.

Line codification

Exceptional transport – Current good practice

1. Preliminary study performed by the RU.
2. Request from the RU to the department for exceptional consignments of the IM.
3. The department for exceptional consignments reviews the preliminary study and conducts additional studies.
4. The department of exceptional consignments releases the transport authorization to the RU.
5. The RU asks for a running plan to the traffic department.

Exceptional transport – Recommendations

- Better cooperation between IMs and RUs:
  - Inform about supplementary analysis
  - Discussion about the loading and the calculation of the gauge
  - Propose alternative route in case of negative answer
  - Answer in a precise time lapse.
- The EC suggests that RUs could compute the line codification on their own
  - Requires a common codification methodology
  - IMs should be able to check the codification proposed by RUs.

5.

Gauge enlargement works

Enlargement strategies – state of play

- Big diversity of enlargement strategies among IMs:
  - long-term strategy according to corridors priorities (SNCF)
  - market studies for combined transport (Trafikverket)
  - enlarge bottlenecks with a located-based point of view (ADIF)
  - enlargements decided by public stakeholders (Switzerland, Romania)

Enlargement works – Recommendations

Actions

- Identify the bottlenecks in each corridor (corridors and IMs)
- Propose a strategy for resolving these bottlenecks (corridors, IMs, RUs,)
- Target a P400 codification

Enlargement works – Recommendations

Stakeholders

- Involve more the RUs in the enlargement decision processes
  - Perform market studies before the enlargement decision
  - Have a systematic representation of the RAGs in RFCs management boards
- Define the enlargement strategy at the corridor scale:
  - Have the market studies coordinated by corridors
  - Make the enlargement decisions taking into account the whole corridor network.

Funding enlargement works – Recommendations

- Partial funding by potentially interested RUs:
  - Supported by compensations (discounts in future path rates)
  - In the frame of a public-private partnership
- Guarantee a return on investment for IMs:
  - Commitment of the RUs to a certain traffic level
  - Commitment of the RUs to a rail toll
- Take advantage from regular maintenance or investment operations on track to carry out the enlargement works.

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Measuring and upgrading the clearance gauge of railway lines

Discussion group : new role of RUs

Proposals for the role of RUs

- The **compatibility is under the responsibility of the RU**, using an agreed method, for exceptional transport.
- If information is not available or up to date, **RU are allowed to perform measurements** or to have them performed by third parties.
- The measurements results should be made available to the relevant IM.

Difficulties and opportunities for RUs

- **RUs need relevant information regarding the gauge:** IM provides the relevant information (gauge, speed, cant, track position) needed to compute the compatibility vehicle/infrastructure.

- **The information should be easy to find:** using a web service linked to the Network Statement. For classic transport, the information is displayed on profile catalogues and GIS.

- **Conditions of the compatibility computation: The methodology for the compatibility is agreed by the IM and the RU.** The IM checks the conditions of the compatibility computation, and possibily the results if there is some disagreement on the conditions.

Enhancement for the whole system

- The measurements database is more frequently measured and more reliable, using measurements from the RUs.
- The IM can update the codification using the codification computed by the RU, if relevant.
- The IM shares the new codifications with the other RUs.
- Regulatory bodies supervises only the overall process.

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Measuring and upgrading the clearance gauge of railway lines

Discussion group : new role of IMs

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Difficulties and opportunities for IMs

Today:
Common « language » (GA, GB, P400…) : configurations are well known

Tomorrow,if case by case: difficulty for the IM to guaranty things about specific and numerous configurations. IM would have to maintain the infrastructure for every type of existing rolling-stock.

The question of the responsability, in case of accident, for instance, is crucial once the IM no longer holds full control of the process.

Proposals for the role of IMs

Today:

IM is responsible of every step of the process.

Proposals for the role of IMs

Proposal:

The IM is the one that holds responsability of the knowledge of the infrastructure

- **Does the measurement (frequently)**
- **Gives information to the clients (quickly) :**
  - Current and recent state of the infrastructure
  - With security marigins

IM is responsible for the delay to provide information:

- Very short if information already available
- Longer if measurements are necessary

→Information is published on the web site

→RU uses the data from the IM and check the latest update before processing

Thank you for your kind attention