RFC2

CORRIDOR
NORTH SEA – MEDITERRANEAN

Co-funded by
the European Union

Capacity KPIs and visualisations

Deliverable	**8 Management Summary**
Date	16.04.2024
Version	2-00

Full study on the RFC North Sea - Med website :
https://www.rfc-northsea-med.eu/

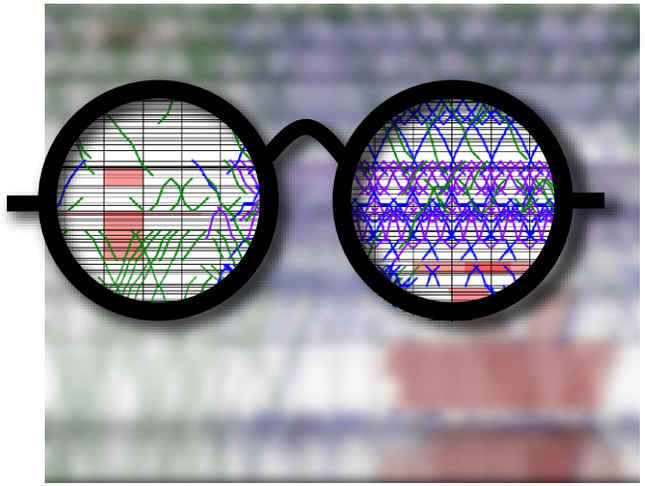
optimising railways

sma

Project governance

Name	Entity	Role
Le Floch Yann	RFC2	Project leader
Chassagne Rébécca	SMA	Project manager
Pelte Kathleen	ACF	Steering committee
Vanbeveren Thomas	Infrabel	Steering committee
Urbain Pierre	SNCF Réseau	Steering committee
Forster Pol	CFL	Steering committee
Stauffer Floraine	TVS	Steering committee

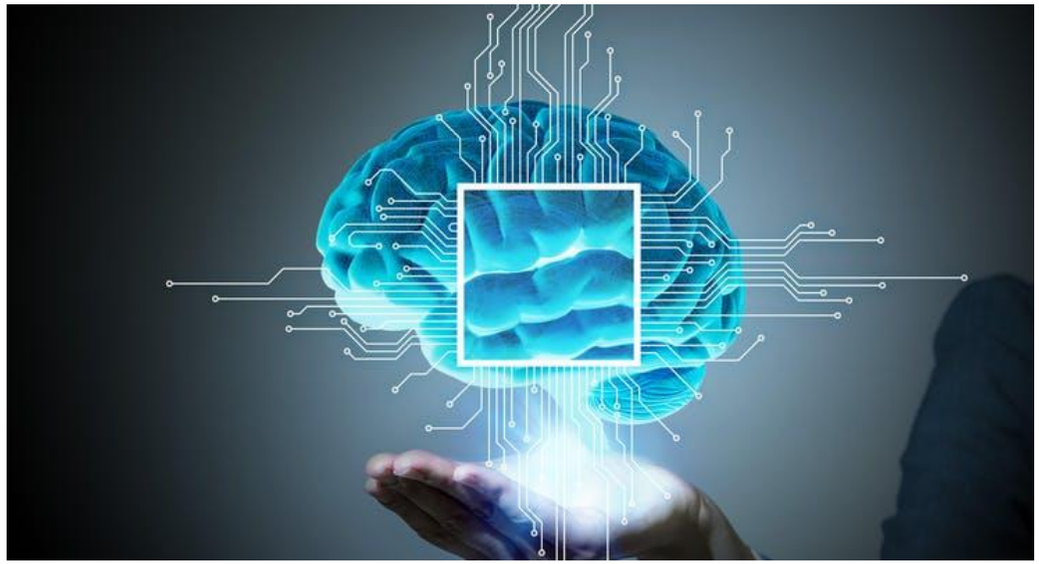
Our aim with this study



Enabling all stakeholders to have a common objective vision of the capacity situation on most of the North Sea – Med network

Most important, share the methodology developed for transferability to any other networks

“Capacity Intelligence”, a parallel with “Business Intelligence”



Business Intelligence = A process for analysing data and presenting information on Business to help executives, managers and other stakeholders to make informed Business decisions

Capacity Intelligence = A process for analyzing data and presenting information on Capacity to help executives, managers and other stakeholders to make informed Capacity decisions

The context

2021 Corridor NSM initiates a first step with a proof of concept on **one single route** of North Sea – Med (Antwerp – Basel) with a **non-consolidated database**

2022 RFC NSM proposes to go from a POC to a Minimum Viable Product (MVP), purpose of this study, and to join TTR.

2023 NSM starts the MVP under the umbrella of TTR and with the support of SMA

Deliverables

Database

1. A single multi-IMs capacity database (infrastructure characteristics / passenger paths / freight paths / TCRs)

Documents

2. A management summary (this document)
3. A memo on the database constitution
4. A document explaining each developed indicator and visualisations
5. A handbook for anyone who would like to reproduce the proposed indicators and visualisations
6. IT recommendations
7. A memo on the mirror groups
8. An overview of participating IMs processes (BE, FR, LU)
9. A portfolio of the visualisations, maps and charts applied to NSM routes

DATABASE CONSTITUTION

Overview

Legend

Not available	Not importable
Not exportable in this context	Importable after formatting
	Importable with manual treatment
	Automatically importable

in the software used here

		France		Belgium		Luxemburg	
		Line	Station	Line	Station	Line	Station
Past (real)	Trains	Not imported	Not imported	Not imported	Not imported	Not imported	Not imported
	TCRs						
Past, current & planned short-term	Infrastructure topo.						
	*Infrastructure perf.						
	Trains					Imported	
	TCRs			Imported	Not imported	Imported	Not imported
	Speed restrictions						
Planned mid-term	Infrastructure topo.						
	*Infrastructure perf.						
	Trains					Imported	
	TCRs			Imported	Not imported	Imported	Not imported
	Speed restrictions						
Planned long-term	Infrastructure topo.						
	*Infrastructure perf.						
	Trains					Imported	
	TCRs			Imported	Not imported	Imported	Not imported
	Speed restrictions						

* Signalling performance : headways, separation times

Relevant topics

Barriers to the construction of databases to process capacity KPIs at an international scale and at different milestones in the capacity processes

- **Characterisation of the data** and **underlying method** should be transmitted with all the exchanged data. Without these assumptions, data can't be processed to produce KPIs,
- Is the data **available** ? Planned or not, this refers to the **capacity processes** of the IMs,
- Is the data **exportable**, in which format ? This refers to the **capacity tools** of the IMs, and to the **standard formats**, currently implemented/in use,
- Is the data **automatically importable** ? **Level of modelling** used to plan trains, TCRs and infrastructure, which can be **micro. or macro.**, is a hurdle to the data exchange : at this time, a macroscopic model is not automatically a subset of a microscopic one.

→ **Detailed and tangible capacity processes have to be harmonised in parallel to the progress in data exchange formats (see D 3.4, 3.5), and transmitted with the data,**

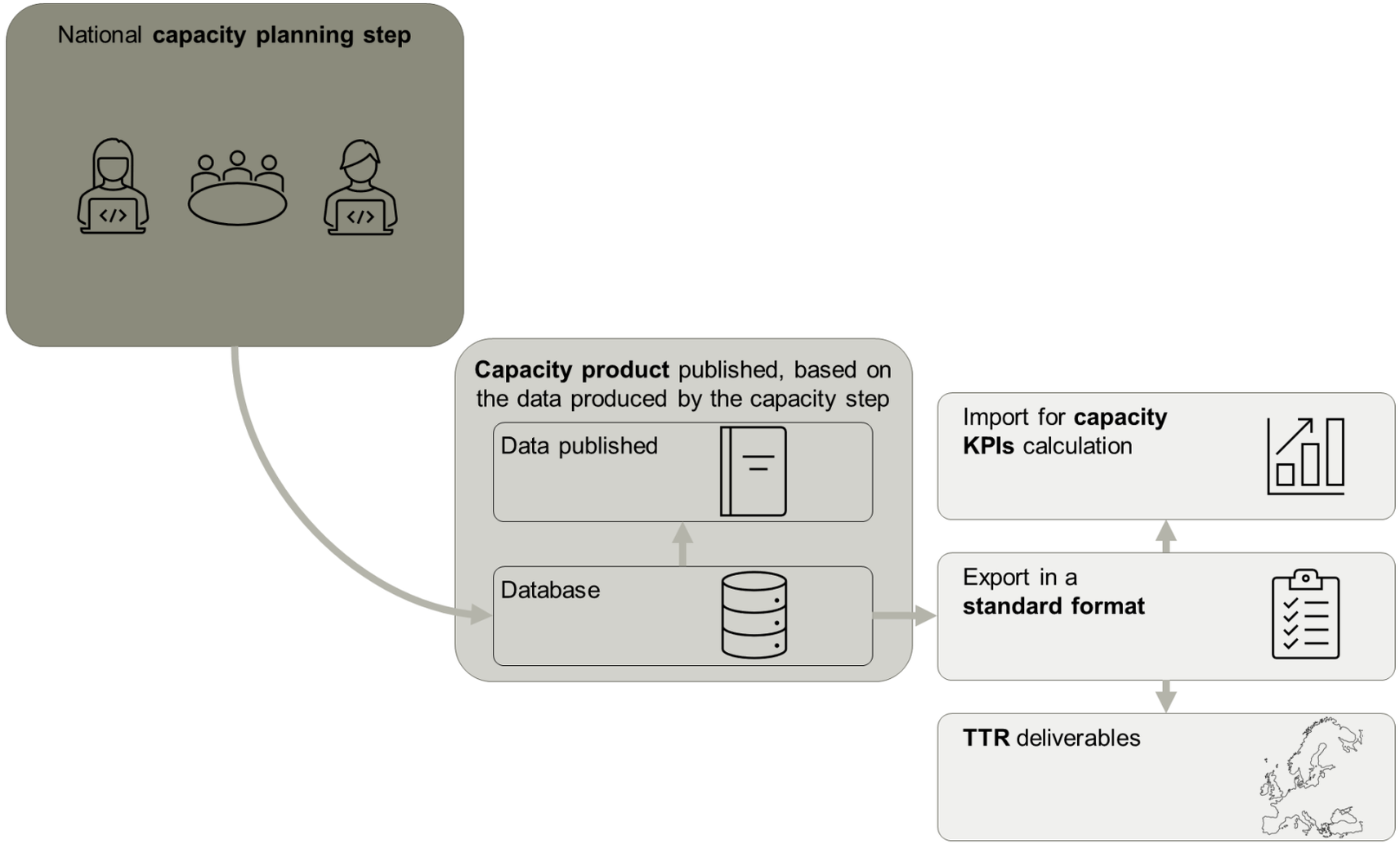
→ **As micro. and macro. levels are complementary in capacity processes, it's necessary to define standards in modelling, and continue the work on data (infrastructure topo. and perf., trains, TCRs) exchange standards to facilitate communication between them,**

→ **Intelligent API's (application programming interface) between macro and micro models could solve this challenge.**

From capacity planning to capacity KPIs

Common capacity language

National capacity planning steps lead to capacity products, including published data and underlying databases, which can be used to produce standard exports, TTR deliverables, and to calculate KPIs.



Capacity European framework

New regulation on the use of railway infrastructure capacity in the single European railway area

In July 2022, the Commission put forward a draft capacity regulation that will be subject to scrutiny by the Parliament and Council. Europe is getting more involved in the capacity planning and allocation process. After the regulation is adopted, it will be necessary for member states and IMs to comply.

The regulation aims to set:

- Obligations on infrastructure managers to work jointly to develop a European framework for capacity management, with specific provisions for the management of scarce capacity and in cases of restrictions relating to work on infrastructure and degraded infrastructure,
- General rules for mid-term capacity management in three stages aligned to the RNE's TTR process steps aiming at harmonising IMs capacity processes: Capacity Strategy, Capacity Model and Capacity Supply,
- Obligations concerning traffic management, disruption and crisis management and related cross-border coordination,
- A performance review framework, with monitoring tasks for the European Network of Infrastructure Managers (ENIM), and a new performance review body,
- The deployment of digital tools enabling better capacity and traffic management.

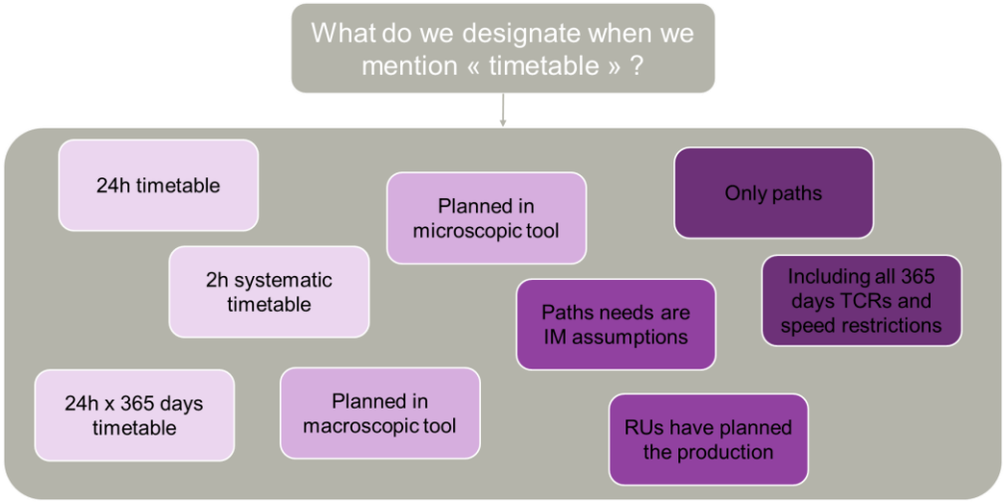
TTR analysis

Synthesis of the proposals

This study clearly demonstrated that the calculation of transnational capacity indicators requires **additional principles to TTR**, to ensure the **comparability of the data across countries**:

- To make the capacity framework converge and allow the building of international databases, **the capacity products** produced by the IMs should be defined more precisely. We propose to participate in the building of a **common capacity language.** *Ex : does the national capacity planning step corresponding to the capacity model include the stations track occupation plans ?*
- Deliverables of the different steps can't be compared to ensure a feedback on the process. We propose common deliverables. Ex : Capacity Strategy could be represented as a 2h systematic timetable, if IMs use it, this deliverable can then be updated at every step.
- A step between the 2h systematic timetable and the 24h timetable (Capacity Model) could be the declination in peak and off-peak hours, especially for freight trains.

Common capacity language proposition



Why do we need a common capacity language ?

Proposal for a common capacity language: this list could be done **for each capacity product**

Category	Criterion	Definition of the products
Frame	Time perimeter	1 year, > 1 year, which year(s), etc.
Frame	Geographical perimeter	To be defined precisely
Frame	Geographical perimeter : interactions with other lines considered ?	yes, no
Frame	Before or after the path requests of April Y-1 (X-8.5) ?	aftere, before
Frame	Scale TCRs	2h, 2h peak + 2h off peak, 24h, 24hx365 days
Frame	Scale paths	2h, 2h peak + 2h off peak, 24h, 24hx365 days
Frame	Paths, TCRs, both	Pahs only, TCRs only, both, speed restrictions or not
Frame	Level of precision	macro, mico
Frame	Level of stability (linked to internal or external instability)	high, medium, low
Approach	Tool in which the object is built	Excel, microscopic tool, macroscopic tool, PowerPoint, etc.
Infrastructure topology and performance	Kind of infrastructure topology and signalling performance considered	Current, assumptions, result of a capacity step
TCRs (including speed restrictions)	Kind of TCRs considered	Current, assumptions, result of a capacity step, no TCRs
TCRs (including speed restrictions)	Scope of the TCRs considered	No, major, medium, high
TCRs (including speed restrictions)	Duplicates, overlaps	yes, no
Paths	Track occupation plans	yes, no
Paths	Contains empty runs from rolling stock planning	yes, no
Paths	Level of precision of the characteristics of the paths : locomotive, weight, length, composition	Linked to paths requests, IM assumptions, linked to current, not considered
Paths	Level of precision of the train path	Only a list of stops, complete list of nodes, nodes with track lines, nodes + lines & stations tracks
Paths	Conflicts between paths or duplicates or overlaps and their status (2 requests, alternative route, etc.)	yes, no
Paths and TCRs	Conflicts between paths and TCRs	yes, no
Interactions	Internal IM coordination on paths and TCRs	yes, no
Interactions	Production in RUs planned : drivers, rolling stock	yes, no
Interactions	Status : coordination with entities requesting the paths done ?	yes, no
Interactions	International coordination with other IMs done ?	yes, no
Interactions	Coordination with entities requesting the paths done for the connections ?	yes, no
Interactions	Coordination with entities requesting the paths done for the number of seats offered ?	yes, no

Decisive contributions of mirror groups

Capacity KPIs and visualisations have been discussed with IMs, RUs, and institutional bodies through mirror groups.

***IMs*, *RUs* and *Institutional Bodies* Mirror Groups expressed that the approach is very innovative and valuable.**

The 3 groups, particularly the *Institutional Bodies* Mirror Group, confirm that it is a significant contribution which should provide food for thought for the ongoing discussions on the new European framework on capacity.

Furthermore, decisive inputs from stakeholders have strongly influenced the study:

- Due to the richness and variety of indicators and visualisations, the IMs mirror group highlighted the need to structure the results. This has led to the 3 logical steps : (1. bottlenecks / 2.capacity consumption causes /3. toolbox).
- The IMs mirror group was an opportunity to share **a wish for a common capacity language,** hence the development of our **reading grid**.
- **Calendar stability KPIs have been promoted** by the IMs, although we haven't found the right indicator yet. There is a need to explore this issue further.
- The RUs mirror group emphasised that the capacity is mainly an IMs business, but that there is a **need for transparency** and that our “Capacity Intelligence” approach can help in this way.
- The approach by “routes” is promoted by RUs, especially if it can integrate all the possible itineraries. **Following this request from RUs, we have explored this "route approach" in more detail.**

Necessary improvements

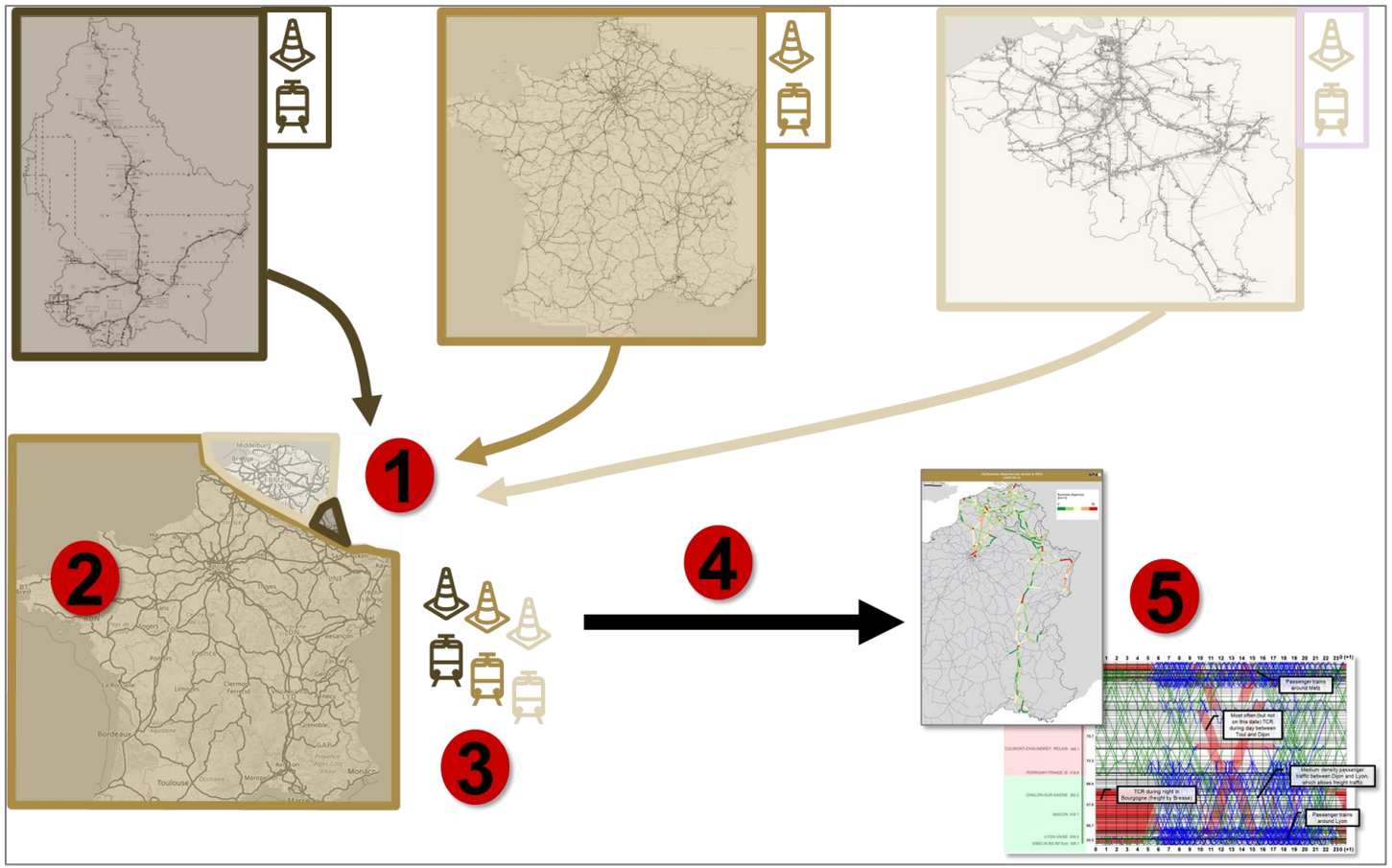
Data exchange

1	Characterise the data and the underlying method when transmitting data
2	Standardise infrastructure modelling and data exchange between macroscopy and microscopy
3	Build a standard format for TCRs and speed restrictions
4	Continue the work on existing standard formats (RailML)
5	Use default RailML attribute to exchange station tracks
6	Add a standard for yearly validities
7	Use standardised data exchange rules for boarders
8	Make sure that implementations of RailML and TAF/TAP-TSI are close enough across countries

Data content

1	Provide more data across years and capacity process steps regarding paths, TCRs and real data
2	Provide the infrastructure models corresponding to the timetables (for past and future)
3	Provide data about TCRs & paths needs (even if it’s without timetable)
4	Provide more details: paths, headways and separation times : raw times, margins, added times
5	Add markers to link paths and TCRs across capacity process steps
6	Add markers to link paths and TCRs across the year and measure calendar stability
7	Implement a tool to measure real TCRs use

Tooling challenges



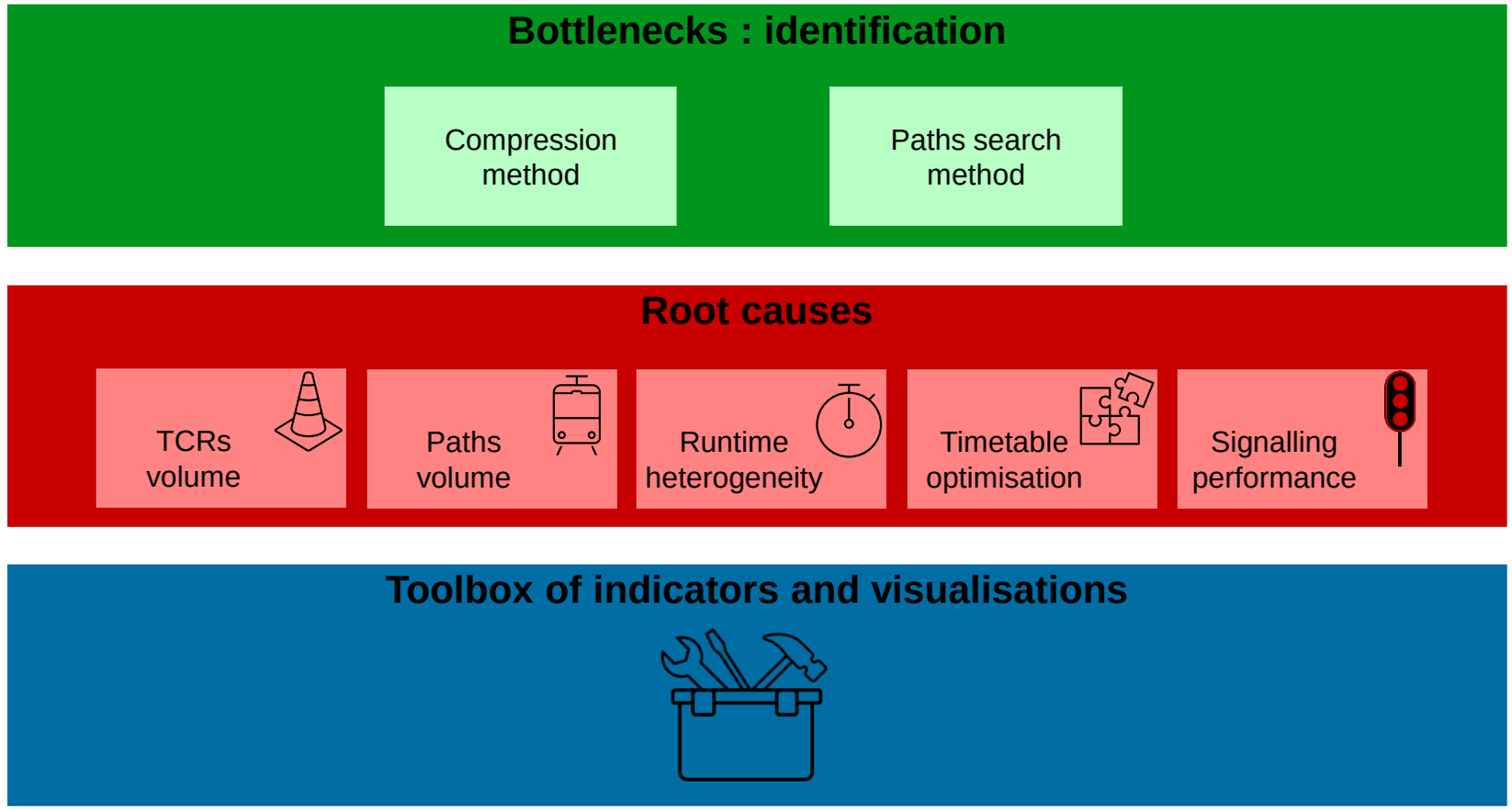
1. Merge data from **different countries**, with **different level of details** (infrastructure topology, signalling performance, trains, TCRs)
2. Create a database with different **states of the infrastructure**
3. Create a database with different **trains and TCRs scenarios,** different **years**
4. Produce **algorithms** to do timetable **compression, path search**, and data analyses
5. Display **maps and other graphical visualisations**, via the main planning tool and via interfaces with GIS

Overview

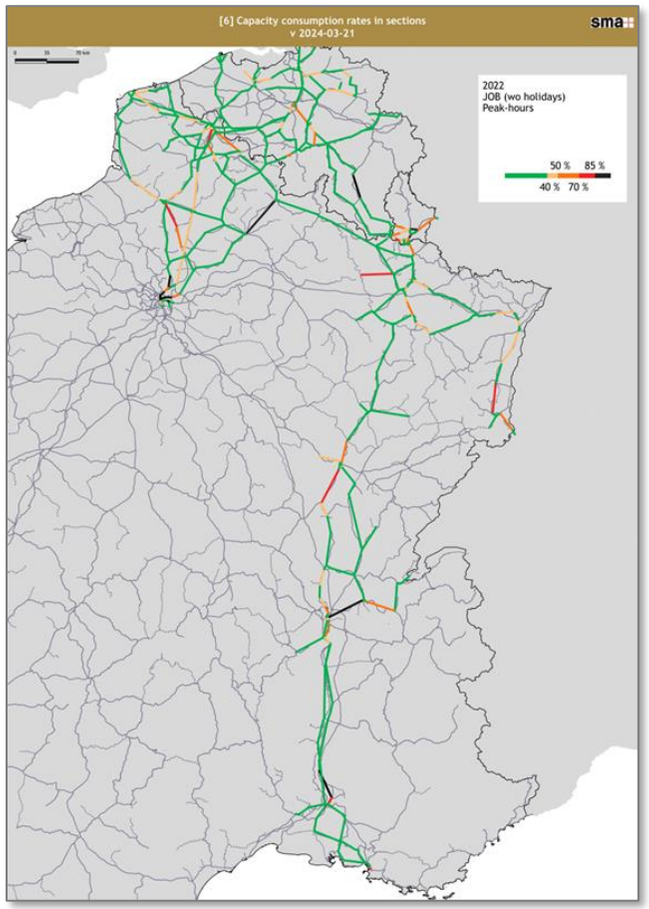
Past, planned, and projected capacity for paths & TCRs

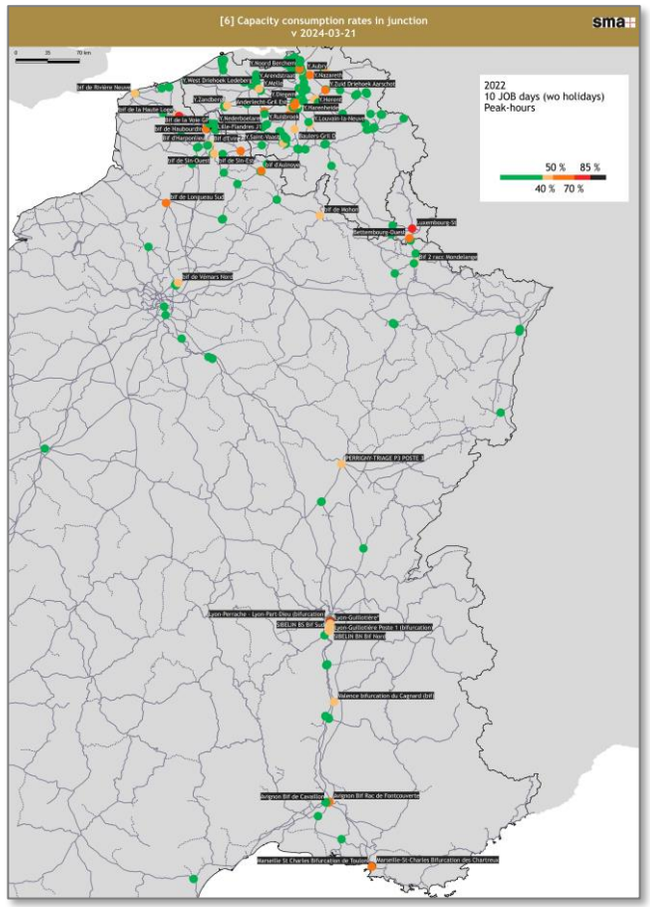
All the analyses are based on **assumptions**.

The KPIs and visualisation can be used on past, current, and planned capacity, as well as on a **multiannual vision**. They can also help the analysis of the **impacts of some measures** on capacity (ex: quantity of additional capacity allowed by an infrastructure evolution).



Bottlenecks list (I)

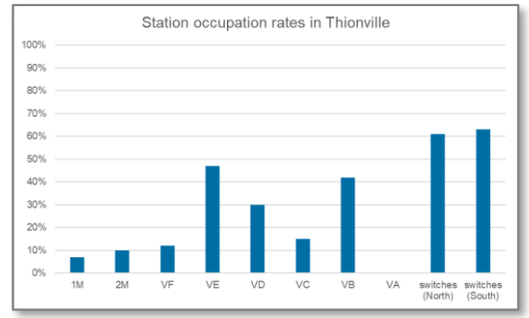


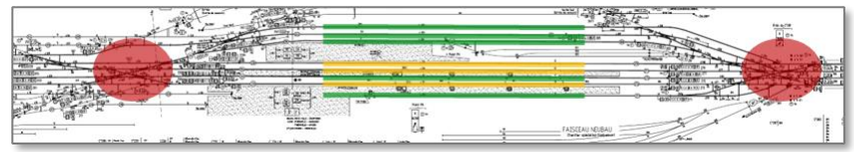


Compression of timetables

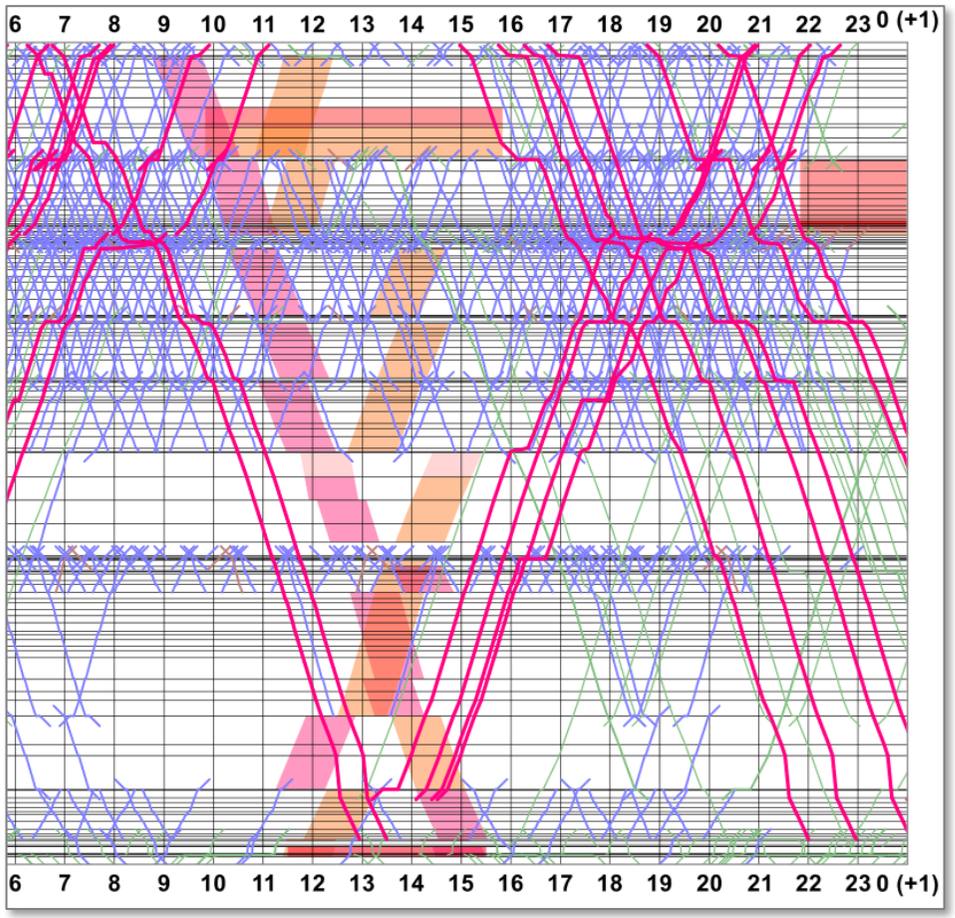
365 days, each day-period
Sections, junctions, stations
Automated and precise sections cutting

→ **Identify where the network has a high utilisation rate**





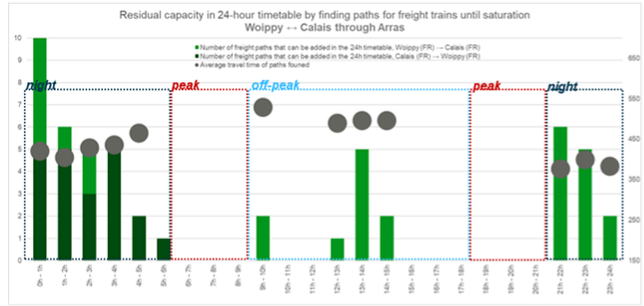
Bottlenecks list (II)

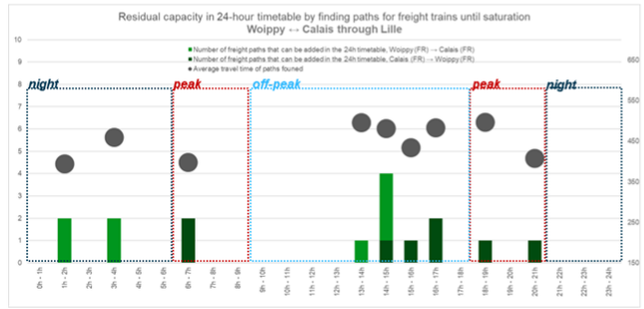


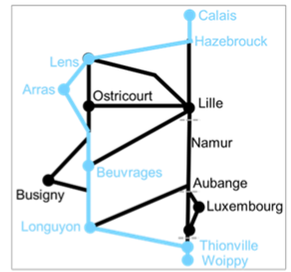
Path search

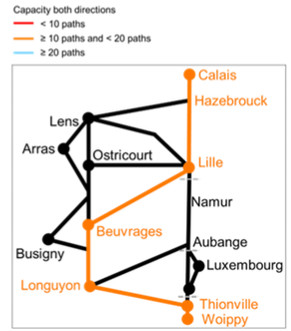
Automatic path search for chosen routes

→ **Identify the real remaining available paths for an Origin – Destination**

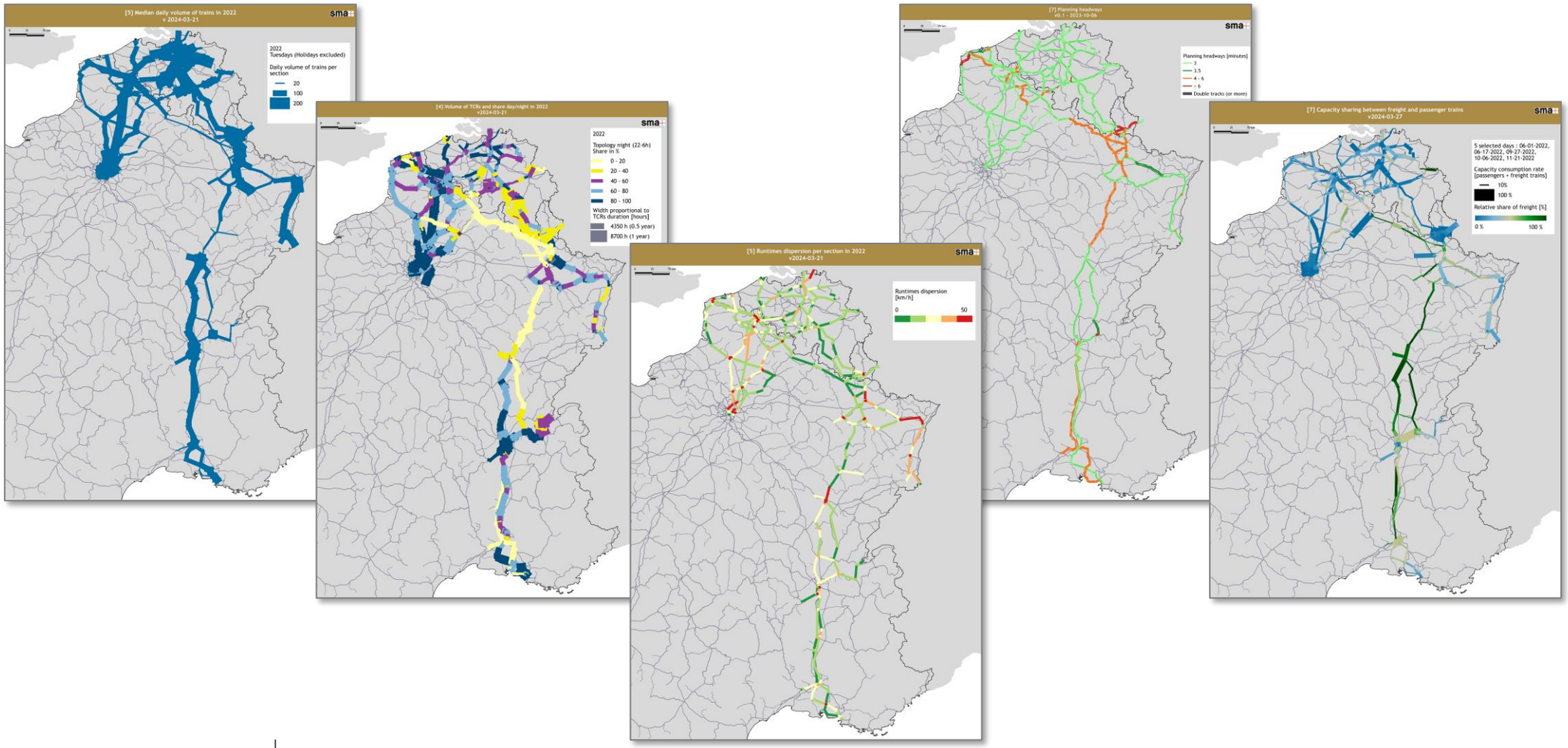




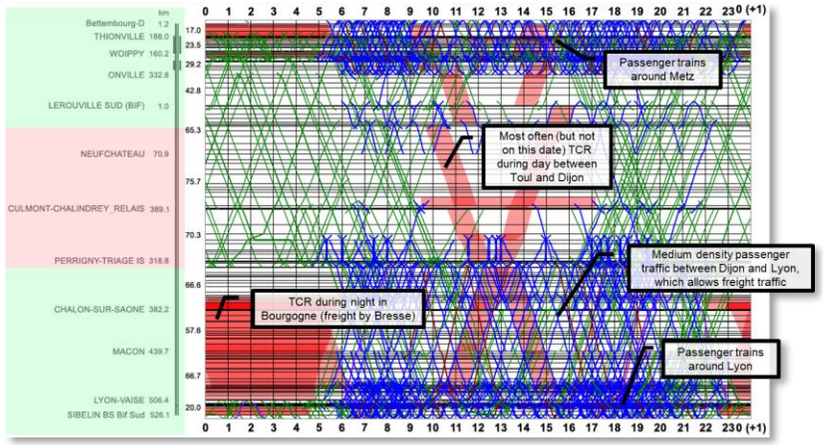


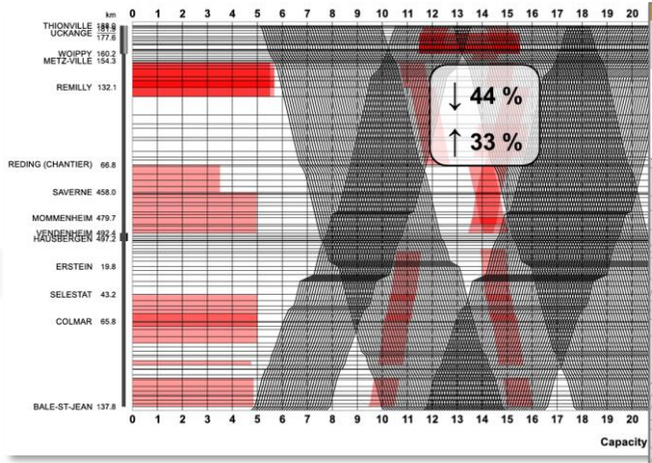


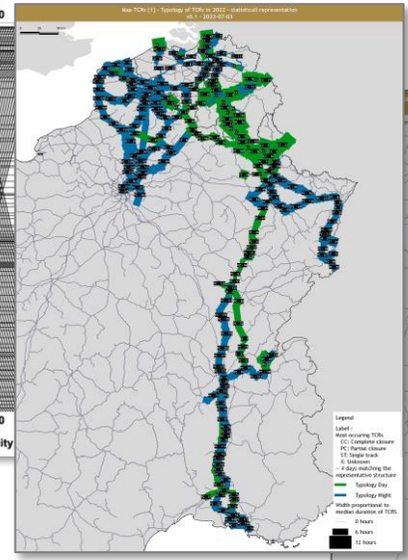
Capacity consumption causes (I)

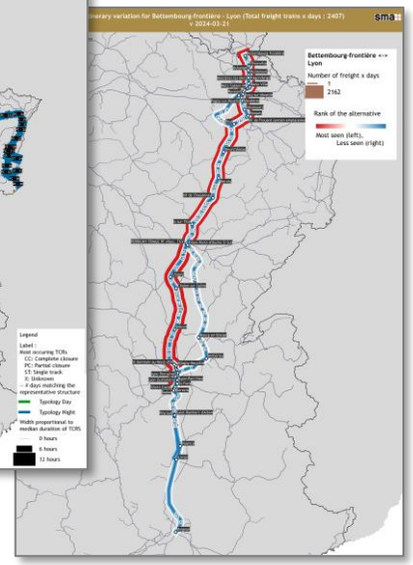


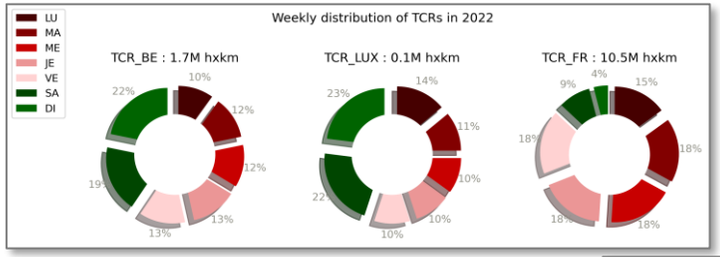
Toolbox (I)

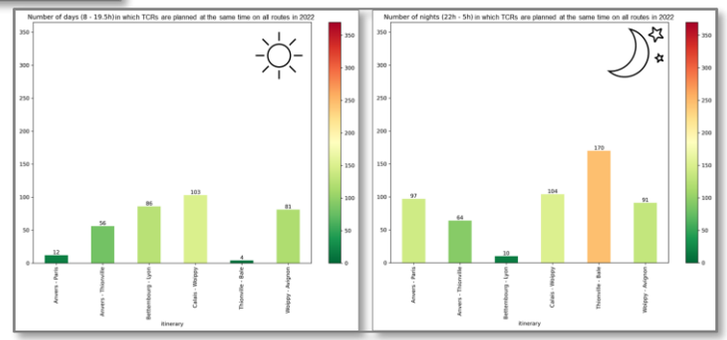

Passenger trains around Metz
Most often (but not on this date) TCR during day between Toul and Dijon
Medium density passenger traffic between Dijon and Lyon, which allows freight traffic
TCR during night in Bourgogne (freight by Bresse)
Passenger trains around Lyon

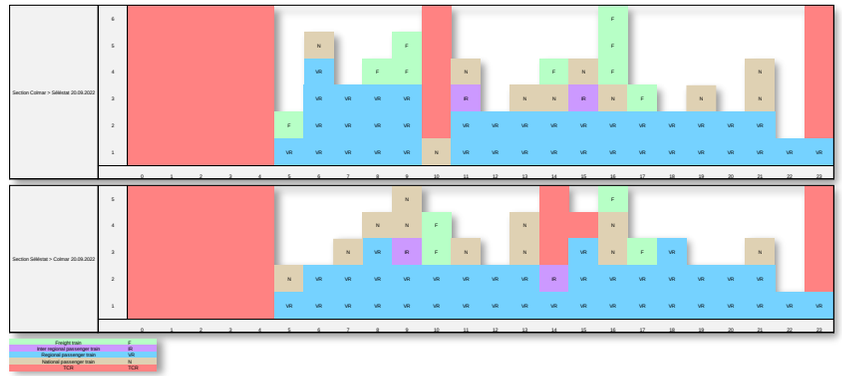

↓ 44 %
↑ 33 %
Capacity






Weekly distribution of TCRs in 2022
LU
MA
ME
JE
VE
SA
DI
TCR_BE : 1.7M hxkm
TCR_LUX : 0.1M hxkm
TCR_FR : 10.5M hxkm



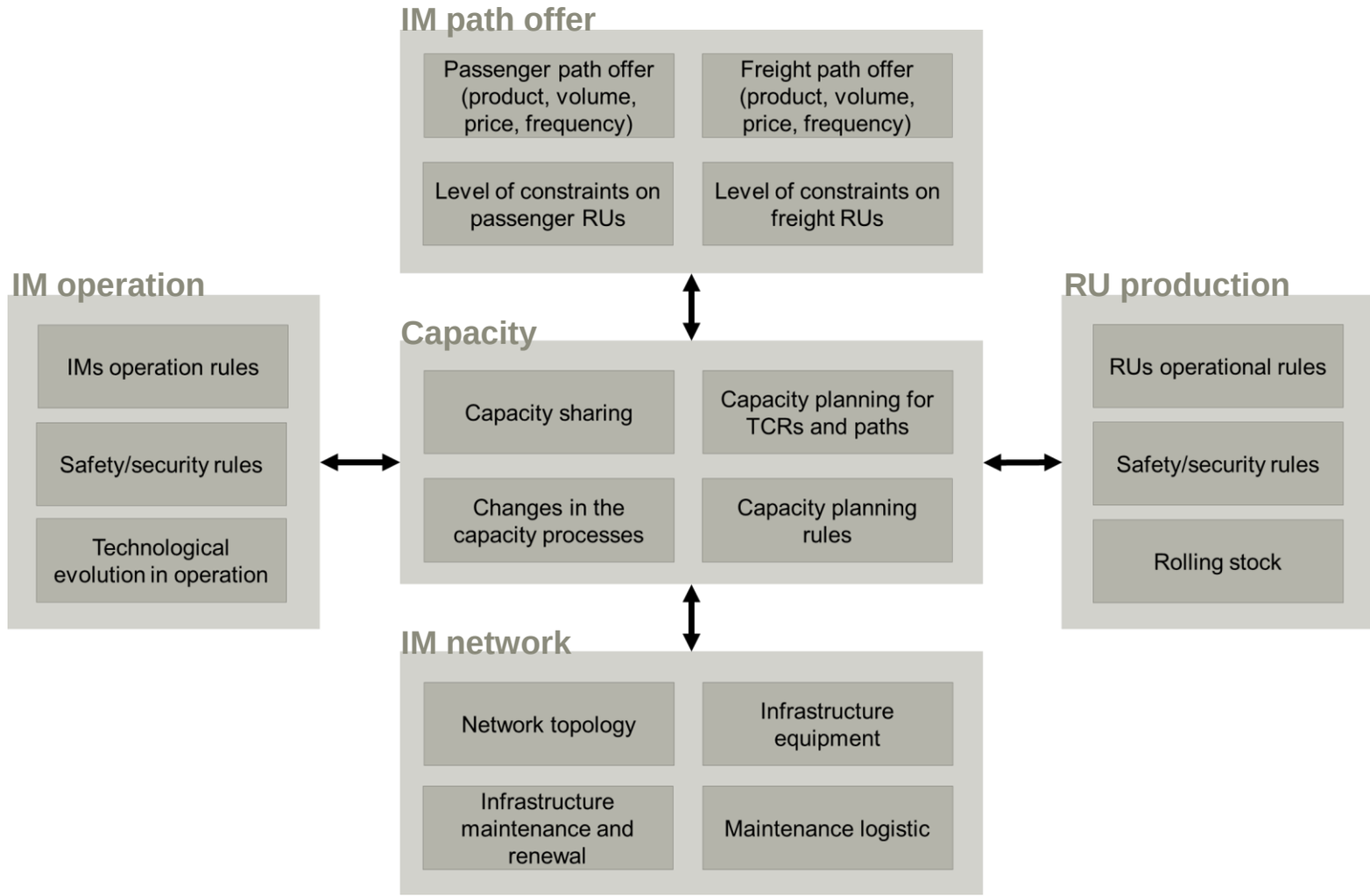


Which decisions do the capacity KPIs enlighten ?

IMs can activate different kinds of levers to **work on capacity**, depending on:

- **What is needed** : increase capacity, increase path performance, work on delays, etc.,
- The **political and economical** conditions/choices.

"How do the capacity KPIs help decision-making ?" was not in the scope of this study, and refers to the capacity planning methods.

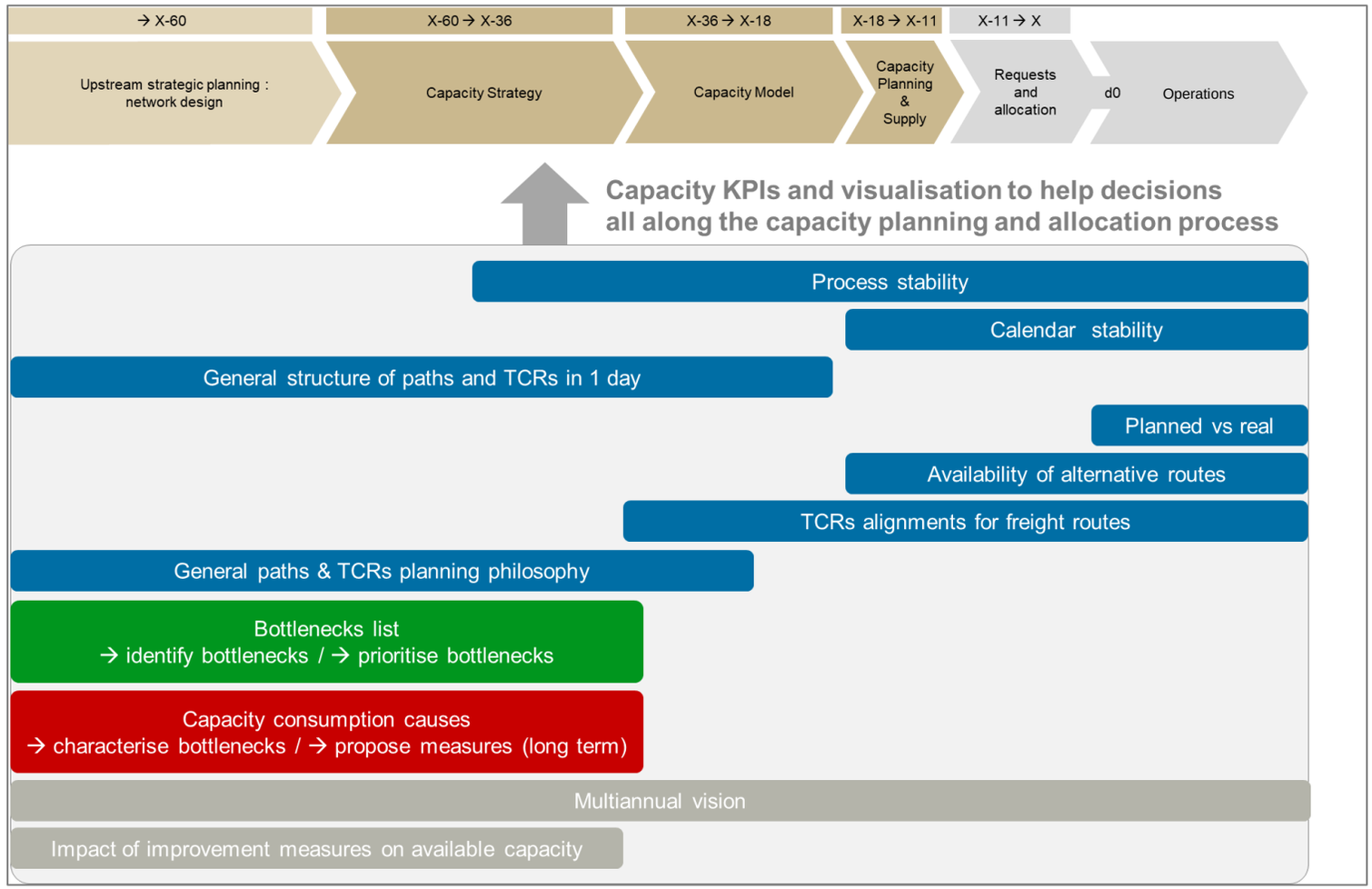


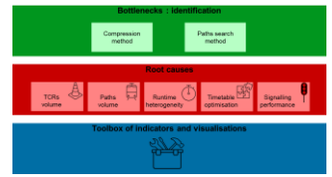
How to insert capacity KPIs in the processes ?

Use of the proposed capacity KPIs and visualisations within the TTR mid-term planning process (tactical) and upstream (strategic)

These KPIs and visualisations are useful at all steps of the capacity planning and allocation process provided by the new European regulation. They bring objectivity and transparency among the stakeholders and illuminates the challenges associated with harmonization and international cooperation.

The same KPIs can also be used to quantify potential capacity increase due to foreseen improvements on timetabling, infrastructure, etc.





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