Handbook for European Traffic Management Network

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Content

1. Change history

VERSION	AUTHOR	DATE	CHANGES
0.0	Peter	03.08.2022	New document format
0.1	Task Force group	03.08.2022	Working version
0.2			
		23.09.2022	Version for VETMN P1 Project team
		10.10.2022	Physical meeting to discuss the project team comments
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		03.-04.11.202231	Document finetuning by PT
		07.11.2022	OG back
		08.11.2022	Report for MB
		16.11.2022	Final version for GA

2. Abbreviations

EC	European Commission
ETA	Estimated Time of Arrival
ETH	Estimated Time of Handover
ETx	Estimated Times of arrival/handover/runthrough, etc..
ETM	European Traffic Management
EU	European Union
GA	General Assembly
HL group	High – level group
ICM	International Contingency Management
IM	Infrastructure Manager
IMT	Incident Management Tool
IT	Information Technology
MB	Managing Board
NTCC	National Traffic Control Centre
nTMS	National Traffic Management System
R-CDM	Railway Collaborative Decision Making
RFC	Railway Freight Corridor
RNE	Rail Net Europe
RTCC	Regional Traffic Control Centre
RU	Railway Undertaking
TAF	Telematics Applications for Freight services
TAP	Telematics Applications for Passenger services
TCC	Traffic Control Centre
TCR	Temporary Capacity Restrictions
TF	Task Force
TIS	Train Information System
TM	Traffic Management
TM HLG	Traffic Management High Level Group
TMS	Traffic Management System
TSI	Technical Specifications for Interoperability
TT	Timetable
TTR	Timetable Redesign
UI	User Interface
VETMN	Virtual European Traffic Management Network
WG	Working Group

3. Handbook applicability and implementation

Following the RNE General Assembly decision from December 2022 members should implement the procedure and tasks based on the agreed implementation plan. The evaluation of implementation process is assessed on half-year bases according to the agreed KPIs set. The progress on implementation is a subject of regular discussion on TM HL group meetings and MB and GA are informed as well.

4. Updating procedure

RNE, with the support of the TM HL group, takes the responsibility of keeping this document up to date.

5. Recommendation for implementation

This handbook defines the functionalities necessary to establish and maintain the ETMN which requires full implementation of proposed process steps and TIS adaption.

This handbook further defines, that the data exchange defined is highly recommended. It is the prerequisite of the ETMN. According to the TIS Declaration, RNE provides a system (TIS + related modules) on which IMs should share and exchange their data. The degree of an additional integration into the national systems (e.g., TMS) remains within the individual members to decide themselves.

Recommendation of integrating the data defined in the ETMN handbook into the national TMS (nTMS) essentially scales up the value of the already existing national data in the nTMS. That is why it is highly recommended that ETA/ETH data and trains affected by the incident are imported into the nTMS.

6. Introduction

European goals

The European Commission aims at shifting traffic from road to rail which is a very important factor to pave the way to a greener future. More specifically, the Commission's plan for the rail sector foresees the implementation of measures to expand the rail market, meet the needs of railway undertakings for access to high-quality capacity and maximise the use of rail infrastructure. A clear message is directed at the rail transport sector which needs serious boosting through increased capacity, strengthened cross-border coordination and cooperation between rail infrastructure managers for better overall management of the rail network. In particular, the infrastructure managers are required to improve cross-border traffic management in normal and disrupted operations, so that fast and efficient border crossing is ensured in every operational situation.

Challenges in traffic management

An assessment of the status quo reveals that today's traffic management suffers on different levels and overall is still rather nationally orientated. Thus, a traffic management perspective from the origin to the final destination of the train is not ensured.

In particular, cross-border communication is not sufficiently standardized. Mostly bilateral agreements are in place but differ even within one country. This lack of European guidelines for information exchange, criteria for scenarios and tools becomes apparent, especially in cases of disrupted traffic.

Even for normal traffic situations, there is very limited processing of reliable cross-border train run information since the national IT systems are not systematically integrated nor has the use of TIS[1] been standardized and modernized as a source of information and tool of exchange. The potential of available information and intelligent applications to process this information for a more foresighted traffic management connecting IMs to act complementary has by far not been tapped. As can be traced, the absence of a minimum set of information leads to a fragmented low quality in traffic management and hence leading to frictions in the train run. The user of the Handbook should be aware of the identified gaps presented in Annex 1.

Consequently, the relevant information is not sufficiently passed on and IMs further down the transport chain cannot forecast and adapt. To date, there is a tendency that situations with unplanned capacity restrictions and TCRs are handled by processes applicable to regular traffic and mostly nationally. Only rarely there are means in place how to better coordinate in cases of irregular traffic or even prevent such neighbouring influences accumulate cross-border. Cross–border agreements are not effective and are not systematically targeting these cross-border obstacles from the perspective of a European train run.

Additionally, the lack of speaking a common language and weak working relationships also plays a significant negative role in hampering the exchange of relevant information and dealing with more complex situations when coordination beyond regular traffic is required. This lack sustains the prevailing national perspective and fails to serve an origin to destination perspective when cross – border traffic is concerned. A united traffic management requires a new more European oriented network approach.

[1] Train Information System by RNE

Vision of a future European Traffic Management

The spectrum of work to be done to realize the EUs strategy is clear and understood. The challenge is complex due to the railway sector being multifaceted. A way forward will have to manage the urgency to achieve the required changes and secure that these changes are sustainably penetrating all levels of traffic management and covering all rail transports down to the last mile. This naturally involves all stakeholders from terminals, to ports, infrastructure managers and rolling undertakings. A binding commitment not only from the top but down to the final operational levels is required to create this shift. Therefore, a European network approach with a focus on the cooperation and coordination between the Traffic Control Centres (TCCs) should best be able to mobilize all relevant operational competence levels towards a trans-European train run.

In seeking to implement the vision of a future European Traffic Management, all stakeholders should agree on the connecting denominators. This requires that the stakeholders outline their own scope of the rules and processes on which they can agree between them.

From the perspective of the RNE members, they define the rules and processes on which they can agree between them in order to enter the discussion with the other stakeholders. Therefore, currently this handbook presents the results of the discussion of the infrastructure managers only. In a second phase the discussion is extended to the connecting stakeholders (RUs, RFCs, Ports, etc.).

7. European Network Principles

The members of RNE agree to strengthen their cooperation in the traffic management in form of a European network. The network is based on the full commitment of each IM to implement guidelines which will allow a major improvement in the quality of international traffic management. On one hand, this is realized by improving the quality of information sharing along the whole train ride as well as increasing the availability of information and on the other hand by assuring the quick communication and coordinated actions between IMs. Overall, this improved cooperation will bring significant benefits to the international train run.

This European network acts in a decentralized manner based on commitment of all traffic cells to one goal, on guidelines for daily cooperation (Process of International Traffic Management), information exchange (providing relevant TM-related data to the neighbouring IM), and for communication (single communication module connecting all TCCs), to be prepared for the spectrum of traffic situations between regular traffic and ICM cases. A traffic cell represents the unit defined by an IM to dispatch the traffic within an area. They can reach from border areas to regional or national areas of responsibility and are controlled by a dedicated TCC. An IM consists of minimum one traffic cell but depending on the size of the IM, there is usually more than one. The core of a functioning European traffic management network is that traffic cells are connected by standardised ways of information sharing, the availability of common communication tools and commonly agreed procedures to handle minor deviations from plan as well as larger disruptions.

Train-related data is shared digitally and automated and is available for all IMs in the network. This concerns not only data like current position, timestamps, delay along the train run and train properties like maximum speed, weight and length but also train running forecast information (for this guideline: ETx, i.e., Estimated time of departure, handover, run-through, arrival) as the essential information.

Event-related data for deviations from the plan as well as obstructions and disruptions with an international impact should be shared digitally in a standardised format and if deemed necessary by making direct communication with the concerned parties (neighbouring IM(s) or IMs farther away depending on the current case). The aim is to move towards more digital information sharing over time, in accordance with TAF/TAP TSI and mutually agreed information exchange. In this regard, the further development of RNE TIS, as a main concept pillar, will improve the availability and accessibility of information. However, the RNE TIS shall not substitute or compete with nTMS, but rather serve as a complementary tool that enables IMs to access information beyond nTMS from the whole network.

Risk management is based both on sharing digital information, e.g., on TCRs and situations that might develop into risks and other means of communication. This allows early detection and communication of risks and includes the development of commonly agreed plans. Risk management should be performed by regular data exchange on progress and conference calls based on the available information on e.g., inclement weather conditions, strikes and TCRs.

The real benefit of the European network comes from actually operating as one unit without borders. The enabling elements described above allow TCCs to carry out *cooperated* traffic management in all situations, from handling delayed trains to dealing with obstructions and incidents in a way that brings benefits to international train runs.

The new network is focused on national traffic control centres in synergy with regional centres involved in cross border cooperation of neighbouring areas. To build a reliable European

Network IMs need to have strong contribution ties with other involved stakeholders e.g., RUs, terminals, ports. The goal of the proposed concept is to strengthen current practices and solutions on a more harmonised and developed level. A full sector approach will be developed within the R-CDM project. Based on the outputs, the ETMN Handbook will be adapted.

To summarise, the main principles of the European network are:

- All trains that cross at least one border are considered international trains and require coordination with neighbouring infrastructure managers.
- Developing European mindset by taking a wider approach from national to international perspective.
- Digital and automated information sharing as much as possible. As long as or where this is not applicable, manually typed data methods of sharing information are encouraged.
- Domestic systems are exchanging data based on TAF/TAP TSI and mutually agreed information exchange formats.
- RNE TIS serves as a complementary tool and offers additional information.
- IMs prepare and take into account forecasts of train runs and events.
- Cross-border monitoring is based on this information.
- The ETMN elements allow the IMs to complement their existing processes and rules.
- IMs agree to procedures and processes to perform internationally coordinated traffic management in a wide range of deviations from plan (from single delayed trains to major disruptions).
- Common risk management is based on information sharing and cooperation.
- Regular meetings for risk management and improving the overall cooperation are established.
- Supporting tools usage and European network status makes the cooperation more effective
- New communication and data sharing platform integrates dispatchers into common network.

8. Information – needs and modes of exchange

This first subchapter elaborates the information that is required as a backbone to the traffic management as such. Typically, the information is available within each infrastructure manager covering their own network. Within the network, the aim is to connect the information from each IM a way that results in a user-friendly large network.

The second subchapter focuses on the tools and functionalities through which the user can obtain the respective information or in some cases is required to provide information.

The solutions proposed in the subchapters are developed in a way that they complement the existing systems (e.g., national TMS) and bring benefit to the IMs with the provision of additional information.

European network status comprising status of all infrastructure managers

In order to unfold the leap forward by the interaction between the network members, it must be secured that three categories of information are made available:

- train running status and status forecast for all trains from origin to destination
- infrastructure network status and its forecast
- risks

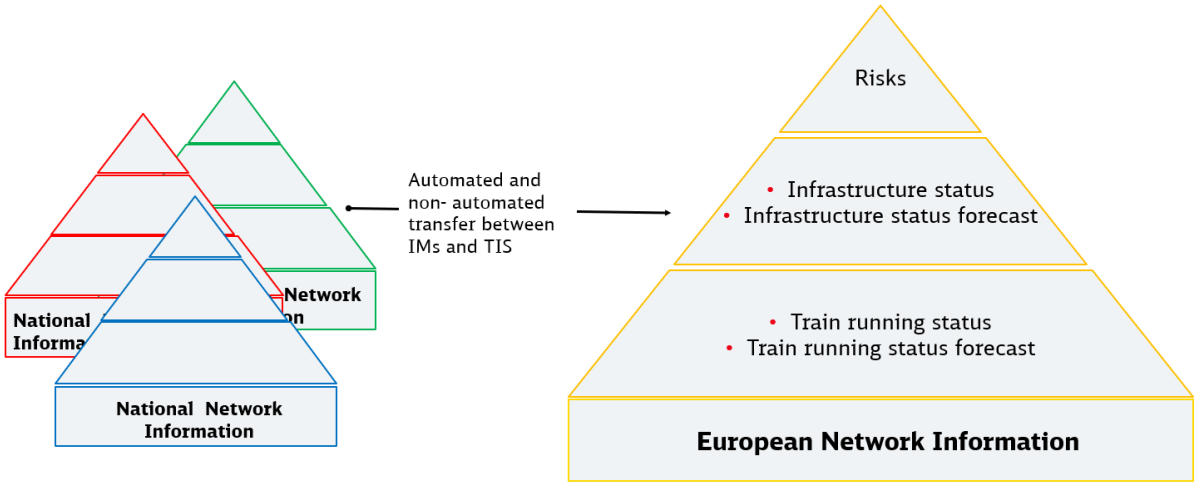


Figure 1: The integration of the national data is a tool for the European operating base

A permanent and regular information flow is the backbone of the network approach and is supplemented by the European network status. This means that the IM can not only observe trains on its own traffic cell, but also on neighbouring traffic cells and cells that are even further away (over-the-cell-vision).

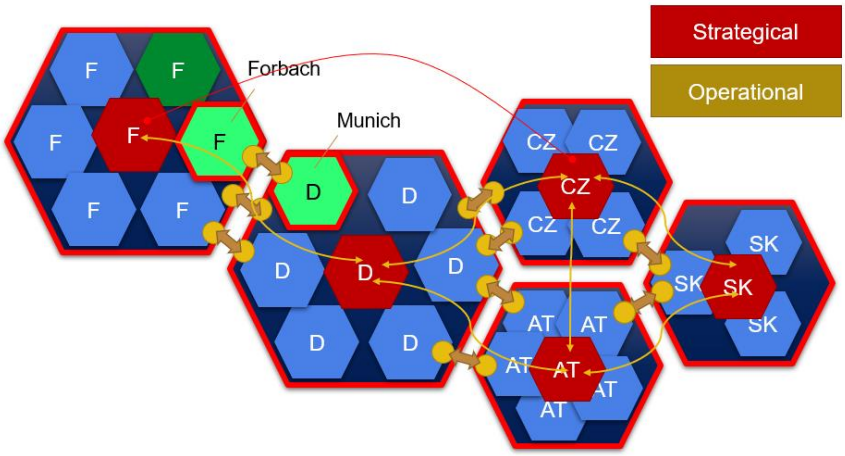


Figure 2: Traffic cells - over the cell cooperation option

Principles of information exchange

As the network is based on a constant flow of information IMs are responsible on one hand to be able to receive information and on the other hand to send information into the network. The types of information exchange reach from only manual to fully automated but were possible, it should be automated.

Data exchange

Concerning the transmission of data, the European regulations for TAF/TAP TSI set the basis for data exchange in the network. Once TAF/TAP TSI is fully realized, this commonly agreed and standardized data format makes it easier for participants of rail traffic to share data. The ETMN is not conflicting the TAF TAP TSI regulation.

To ensure more effective cooperation of the IMs as it is stated in the TIS declaration, IMs forward train data to TIS. Where the central data repository is created the TIS can further forward these data to interested IMs and to relevant subjects based on the general agreement and rules. For the more effective ETM Network, the further TIS development and adaption is planned to cover other train related information and events to be exchange in the ETMN platform (e.g., incidents, obstructions, forecast information from external companies).

Verbal communication

There is still a need to exchange information verbally since it is not always possible to automate the exchange of information. Thus, for an improved international traffic management, it is crucial that dispatchers can communicate with each other. For that reason, ETMN is based on the following principles:

- English is the main language for verbal and written communication between NTCCs.
- Within NTCCs, at least one English speaking staff member shall be available 24/7h (according to the decision of RNE GA 12/2017); for this purpose, a dedicated group/contact should be established in the communication platform.
- Communication can be carried out in other languages if agreed by involved IMs.
- Communication language of RTCCs is up to agreements between neighbouring IMs.

Categories of information: training running status and forecast; infrastructure status and forecast, risks

For ETMN, three information categories can be defined. The categories are described below:

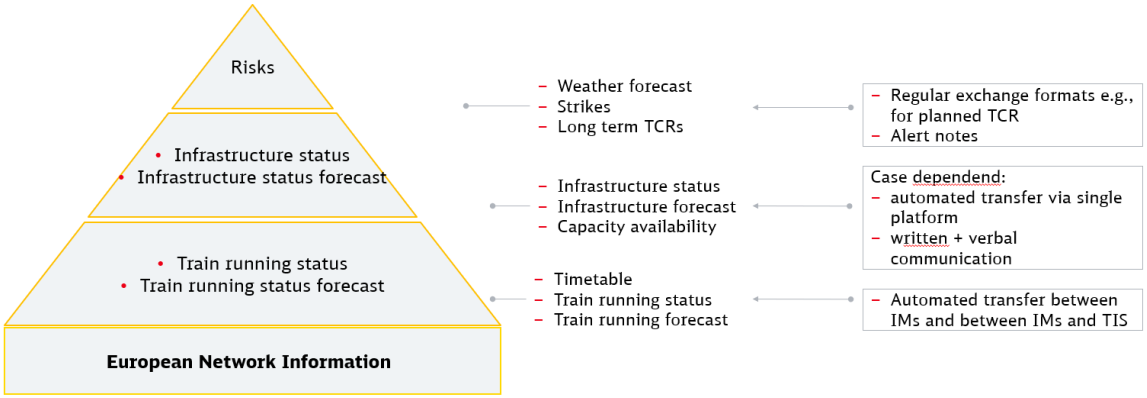


Figure 3: European Network information

Train data to be made available in the network

Timetable information

The train runs are organised based on the customers' requirements and available capacity of the lines. The agreed timing and capacity utilization is presented in the train timetable, usually in a spacetime diagram form. The timetables contain the essential information for effective train run management for the dispatchers in their shift. In the network approach the dispatchers should have access to the full international timetable for the concerned trains they are involved in managing on their network. Keeping the train running according to the agreed timetable creates precondition for effective traffic management. Exchange on any change of the timetable should be done within the network.

Train running information

Train running information provides essential information about the current occupation of the allocated train path giving an indication for the train's current location and deviation from the agreed timetable. Having this information, dispatchers can assess the traffic situation (e.g. traffic density, deviation from TT) in their responsible traffic cell and intervene if necessary.

Train composition

Train properties are always essential to better manage the trains, especially in case of rerouting and other deviations from the allocated path. It is important for IMs to know when train properties deviate from what was indicated in the path request or during the train ride. During operation, the exact knowledge of the train properties, especially train length and weight, allows are more efficient overall traffic management as it prevents unnecessary capacity wastage (e.g., in case of overtaking or parking of trains).

Train forecast information

Train forecast information is key to an efficient traffic management in the network. It allows a foresighted dispatching of trains as it is constantly clear when trains will enter and leave the traffic cells. The forecasting contributes to better capacity utilization especially in cases when

trains are deviating from their timetables. That is why, a key element in the ETMN-concept and various procedures developed in it, is the dissemination of Etx between Ims. Especially, in order to create the network effect, ETH is the core information that connects traffic cells indicating when the train approaches the border and giving the neighbouring cell the opportunity to coordinate. RNEs' Network ETA solution (if implemented) can contribute to the forecasting also within the own IM's network.

The list below shows the detailed information that is required for international coordination and cooperation:

- Timetable
- Train running information
  - Current location
  - Current delta from timetable
  - Delta at previous locations
- Train properties
  - Length
  - Weight
  - Maximum speed
  - Traction
  - Train composition
- Train running forecast
  - ETH (estimated time of handover) available for each border crossing once the train departed from its origin. ETH is the crucial minimum timestamp for the functioning of the network.
  - Etx for any location during the train run, especially for larger networks where the train runs through several RTCCs. The ETx (departure, run-through, arrival) can substitute internal ETH between RTCCs inside one Ims network
  - For the final destination (may be covered by the RNE "Network ETA" solution)

Infrastructure data

A key element for effective international traffic management is the availability of the current status of the infrastructures surrounding one traffic cell. In other words, in some situations it is beneficial from an IMs perspective to know what is the status of the infrastructure of the neighbouring IM(s). Especially, information about ongoing disruptions affecting international traffic is important for other traffic cells so that IMs can prepare for effects on their own network. Where necessary, this information can also initiate further contact and coordination between infrastructure managers.

The list below shows the detailed information that is required for international coordination and cooperation:

- Infrastructure status
  - Disruptions
    - Location/section/area
    - Impact on capacity
    - Expected duration
    - Type (e.g., accident, technical malfunction, weather, urgent TCR)
  - Unplanned TCRs
    - Location/section/area
    - Impact on capacity

        - Estimated end
- Infrastructure forecast status
- Capacity availability

Risk data

Risk management is based on information about expected conditions in the upcoming days or weeks. In this context, infrastructure restrictions and unplannable events are particularly worth mentioning. An example is that in case of a planned TCR, train runs should be adapted accordingly. However, the traffic flow during a planned TCR is more vulnerable to disturbances and unexpected events than regular traffic with full capacity. Furthermore, TCRs – contrary to how they are timetabled – may be delayed. This can have negative effects on international trains runs. Risk management also considers other circumstances like inclement weather condition or planned strikes that can heavily affect traffic flows. Sharing information about these risks is important for Ims to coordinate common actions or prepare common plans for a possible reaction to these risks.

Circumstances that may have an impact on international traffic (risks in the upcoming days and weeks)

    - Type (weather, strikes, other)
    - Expected impact
    - Expected duration
- Long term TCRs
    - Effects related to the planned TCRs (in the upcoming days and weeks)
        - Timeframe of TCR
        - Location/section/area of the TCR
        - Estimated impact on capacity

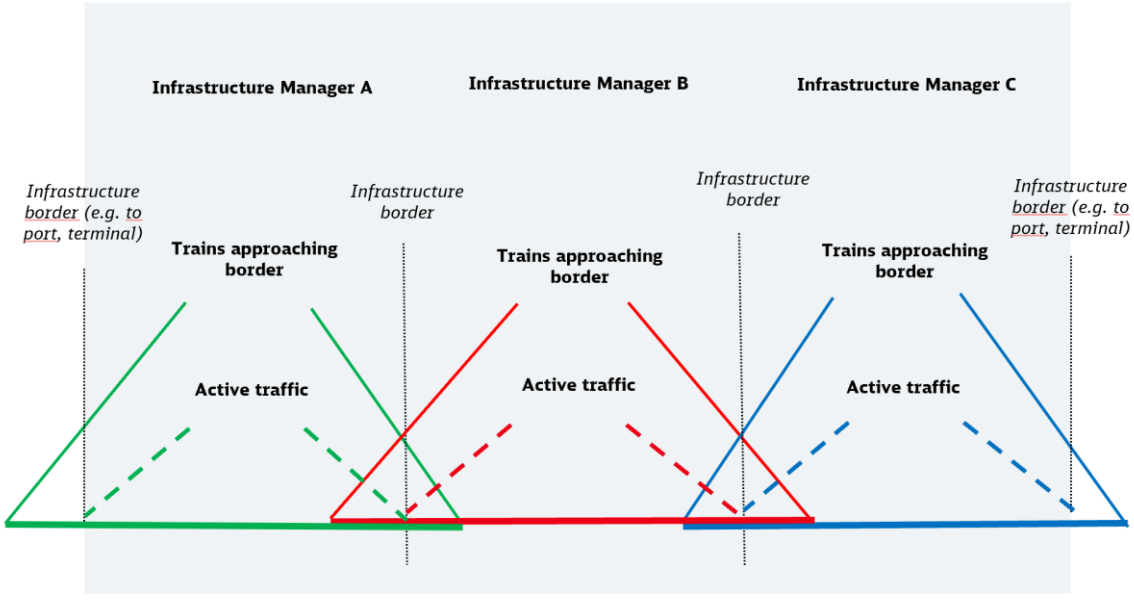


Figure 4: Information from across the border allows foresighted traffic management

9. ETMN Cooperation platform

The essential base to the ETM Network is sharing information and barrier-free communication about any situation if needed. Therefore, the goal is to ensure effective communication at all times allowing coordinated responses to various traffic situations and a more foresighted traffic management. In chapter 8 it became obvious that the information need within ETMN is almost the same in comparison to what is already available within the single IM today. For that reason, ETMN focuses on sharing this information and making it available throughout the entire train run for all involved Ims. This subchapter will explain how the required information is to be made available and sourced into suggested IT-systems and IT-tools as part of the steps within the international traffic management process.

9.1. Importance of Train Information System

In order to create the network effect of information exchange, RNE-members agreed that RNE TIS is the main pillar for an effective ETM-Network. For this reason, RNE-members developed and approved the TIS-Declaration in 2021 where they commitment to

- recognize TIS as a key enabler of an improved cross-border rail traffic management in line with market needs and EU expectations.
- strengthening the role of TIS as the only European tool for international rail traffic monitoring and as the main data exchange platform
- strengthening the role of TIS as the key tool for international contingency management

Referring to the TIS-Declaration, the focus of ETMN is on TIS as an important application to enable the establishment of the network. In this context, IMs should make all in this handbook described information available in TIS to fulfil the objectives of ETMN.

However, this does not mean preventing bilateral exchange of information based on TAF/TAP TSI. By centralizing the data for further resharing and setting up a data warehouse, which can be accessed by stakeholders involved in the train-run, it increases the overall efficiency of the network, such as facilitating coordinated actions.

To reach the goal of a more foresighted and better-informed traffic management, TIS should be developed further. To be more precise, the following requirements shall be met and are described in chapters below:

- Real-time monitoring
  - IMs should provide agreed train running data to TIS from their national systems
  - extending the use of IMT for smaller incidents and disruptions
- Future
  - network ETA is created
  - extending use of IMT for potentially upcoming obstructions
  - information about line capacity
  - overall network status

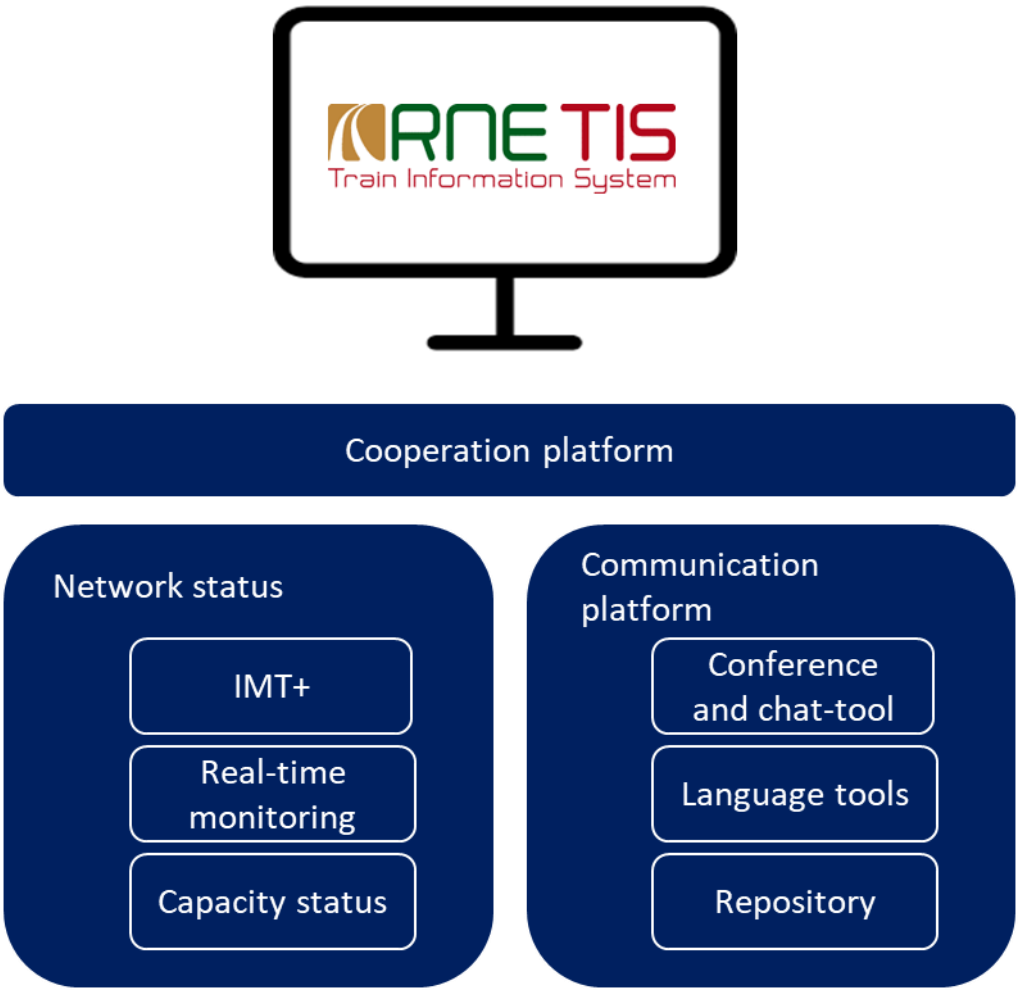


Figure 5: Overview TIS-Modules

The further development of TIS can be categorized in modules which will be described in the following section.

9.2. TIS-Module: Communication

To unfold the ETMN, a core prerequisite is to offer a Europe – wide centralized information and communication architecture enabling effective verbal and written communication. For effective cooperation of the ETMN an integrated communication module should be established. The module is a centralized tool interconnecting all NTCCs in the first phase of implementation and later other stakeholders involved in the train-run. Efficiency is facilitated as it shall be possible to communicate directly once information is being exchanged through more automated channels. In other words, this means taking as much information as possible from what is already sent out by the IMs national systems and aggregating it in a user-friendly way in a centralized platform. It also specifically requires an interface connecting other TIS modules (e.g., Incident Management Tool). It allows that an IM recipient who considers to be concerned can respond directly to a specific alert message and enter a discussion on the impact etc. This includes for instance alerts on ICM cases and other obstructions. The main advantage of an integrated communication architecture is that the personnel of an infrastructure manager may refer to one interface only.

A new platform adapting TIS possibly using commercially available applications should fulfil at least the following criteria:

- Predefined contact list of responsible personnel for each IM/RFC
- Predefined contact groups e.g., related to the TIS modules as described below
- Private and conference calls/chats
- Chat function with built-in translation
- Log and record all communication
- Possible file exchange
- Possible processing of predefined formats either from other TIS modules or sourced in by email
- Call priority selection
- File repository

On a bilateral relation other means of communication can be used as long as all parties involved agreed (e.g., phone/email/other).

Further elaboration is going to be part of the EMTN project 2.

9.3. TIS-Module: Real – time monitoring (TIS)

The network should enable better cooperation and communication between the NTCCs. For these purposes the RNE TIS application can serve as an interconnecting interface. RNE TIS is based on the TAF/TAP TSI regulation and currently is recognized as a unique tool presenting train related information shortly before they start, run and ends its journeys across borders. This information is stored for further reporting purposes.

The core function of the TIS enables real-time monitoring of the complete international train run from origin to destination even when the train run has only been separately recognized on national sections. Linking of related train runs creates a precondition for a network approach where TCCs can follow the train run from its origin to its destination and exchange necessary information in advance before the train enters new national networks. The TIS principles are predefined to establish the first level of national TM system interconnection via active TAF/TAP TSI message exchange. The dispatchers are recommended to use the TIS web user interface or use the data from TIS presented in their adapted national TM systems or to exchange it bilaterally.

For effective network performance, predictions covering the whole European network are essential.

Network ETA has the goal to ensure at least one prediction for the most important locations labelled with accuracy indicators. As a precondition for effective network cooperation, the ETH information shall be available in any case. The forecast information from IMs shall be sent to TIS where an accuracy calculation and further forwarding take place. This approach ensures a permanent train running prediction from different sources accompanied by accuracy indicators. The possibility to monitor the received train forecast information provides a basis for better decision-making. The accuracy indicator exchanged together with forwarded forecasts which will be the task of RNE TIS, allows IM to evaluate the precision of the received data.

9.4. TIS-Module: IMT+

TIS IMT

TIS is already a platform developed to cope with international contingencies and incidents which significantly helps NTCCs to reduce the impact of such events.

The Incident Management Tool (IMT) enables to identify and manage trains affected by incidents and inform all involved parties in an automated manner. It is a functionality in the TIS system.

As of 01/2022, the IMT tool is mandatory to be used by all IMs to inform about and manage all incidents defined by the ICM handbook namely:

- Incidents/ obstruction affects traffic cells on other IMs networks
- Expected that it will last at least 3 days
- At least 50% of international freight trains are affected

Further updated IMT+

The IMT+ is a further development of the IMT. It is recommended to be used for ongoing incidents and future expected obstructions. This means it could be used in a wider range of situations. In addition to this infrastructure managers may use other means of sharing information on such obstructions.

The IMT+ is highly recommended to be used in the ETM Network to inform about and manage all incidents with the following criteria:

- Incidents affects traffic cells on other IM's networks
- Expected that it will last at least 6 hours, or as agreed by neighbouring Ims
- At least 10 international trains are affected, or as agreed by neighbouring Ims
- As soon as you have to apply restrictions on received trains
- trains are rejected at the border
- several trains are parked at the border

The IMT+ is recommended to be used in the ETM Network to inform about and manage expected obstructions with the following criteria:

- obstruction expected to affect traffic cells on other IM's networks
- potential duration of expected obstructions
- international trains may be affected
- application of restrictions is expected

This tool should gradually substitute all other internationally exchanged documents on incident-related information, bringing benefits of structured digital data exchange.

The NTCCs can benefit from automatic data exchange. For this purpose, in the future mutually agreed new sector messages should be used. These messages would cover information about ongoing incidents and future expected obstructions. All members should provide this information in TIS and it can also be shared bilaterally. Afterwards, TIS can identify affected trains based on the received information, this exchange will automatize the current manual IMT usage.

Incident management handling is done in TIS IMT, where notification or publication of the incident will be performed automatically (being developed), or manually based on user preference. The relevant affected trains should be managed using the TIS IMT application clearly defining their status on the network and presenting requested actions from RUs or neighbouring Ims.

In case of potential obstruction, the same procedure is recommended to be applied.

The tool shall allow a digital exchange of train data, their status and requested handling.

9.5. TIS-Module: European Network Status

All the above listed modules/information (automated train running information, train running forecast and incident management information) comprised will provide an overview of the status of the European railway network to anyone it may concern at any given time to a chosen degree in a compact format. As it bases on the input of many sources, the module will evolve in the longer run.

The addressees could be higher stakeholders as well as for NTCCs to coordinate. The latter may be especially interested in the possibility to zoom in a wider section beyond their own network to observe for instance not only the ETH but particular incoming trains and possible reasons for and duration for delay in neighbouring countries.

European Network Status will enable better high-level decision making and planning of the next dispatcher shift. The information should be presented on a European map in a user-friendly way. The exact design will have to be developed, but the following is examples of what must or may be included:

- Ongoing incidents reported in IMT
- Risks/future disruptions reported in IMT (e.g., unplanned TCRs, bad weather, risk of strikes)
- TCRs with a substantial impact on international train traffic
- Sections with severe train delays based on train running information

Complementary to a status representing the current situation, a solution, which can offer a general prediction for the whole national network or regions should be beneficial for the network.

The development of such a solution where the NTCCs report on the expected effects on the international train runs via the national network should allow more effective international traffic management.

The “Network Status” will present the European network status and give the general picture how the international trains will be affected by the national network for the next twelve hours.

Any forecasts on events which can affect train runs should be included in the report e.g., severe weather conditions, strikes or any situation which can cause deviation on the train run. The comprised presentation of each national network status jointly describes the European network situation. Such an information is just a base for dispatchers shift planning and creates a base for better cooperation to manage international train runs. This can have a positive effect on the national network, as well.

The solution can have two modules.

- Manual – NTCC reports
  - Regularly filed on half day bases, or in case of an update to an agreed form preferably in TIS user interface UI. The NTCCs present the general expected situation for the next twelve hours. The national data, put together, creates an overall picture of the European network status. This information can be presented and available in the form of a map or text.

- Automated – Oracle analyses (based on artificial intelligence)
  - This approach can have two steps when the reporting analytical tool automatically works with the recent data and presents the situation with train runs for areas or national network. In the future, an enhanced approach could use Artificial Intelligence technologies to predict the network status for preferred time period.

9.6. TIS-Module: Capacity status

The idea of a capacity overview could be also beneficial for the efficiency of the network in the future. The proper capacity offer and its effective utilization are the main preconditions for the success of the railway business and customer satisfaction. A constantly available accurate overview of the capacity that is available for traffic management combined with the current status of traffic and infrastructure allows dispatchers to optimize traffic. This constitutes the core responsibility of traffic management.

The dispatchers should be aware of the current and expected available capacity of the border lines under their responsibility and about the situation on the neighbouring cell up to a reasonable point. This would allow them to be more integrated with traffic management on the neighbouring cell and cooperate on the optimal train run. This approach can bring benefits for cooperating neighbours in better capacity utilization with need of direct communication and negotiations for each case. This is especially the case during incident management and the subsequent re-routing of trains.

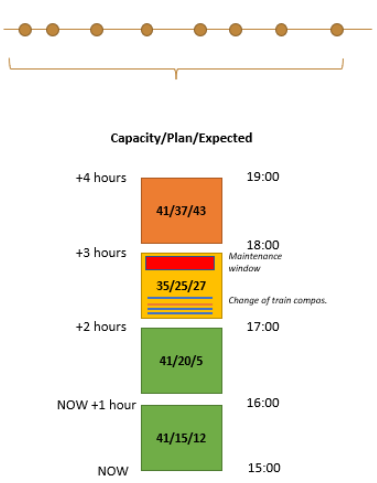
Description

- Agregaded presentation of hourly capacity utilisation for the next time period (6/12/24 hours)

Benefits

- Overview of the situation on own and neighbouring section
- Information enables better assess the overall situation on the network
- Insight to work of possible communication party

Figure 6: Representation of the capacity situation in the next four hours of the borderlines



Aim

- Provide dispetchers with overview of avalable capacity for the agreed time periods

Presented data

- Avalaible capacity for the line
- Planned capacity accordinfg to the timetable
- Occupied capacity according to the train run forecasts (Network ETA)

Source of the information

- National overview of the lines capacity
- Train run forecasting ETH & Network ETA

Figure 7: Details of the capacity situation in the next four hours of the borderlines

The output of the related TTR project should contribute to the tool presenting capacity overviews for dispatchers in ETM network with all necessary information to assess the situation and better manage the traffic, reflecting the wider perspective of the lines capacity. The current state of the art brings this benefit nationally for advance traffic management systems, however a proper presentation of currently known capacity data could be a gap filling solution.

9.7. Summary of information modes and exchange

For this the guideline is that,

- Information exchange as described above is a prerequisite for the ETM network
- TIS and IMT+ is used to exchange train running data, forecast information and information about ongoing disruptions
- It is recommended to use TIS also for future preconditions (risks).
- For the exchange of non-standardized data, a common tool should be used, namely the new to be developed communication platform. The platform should have functions to support both text based and verbal communication between individuals and groups and should also support coherent communication for single events.
- The information exchange described here is mainly aimed at IMs national and regional TCCs but may concern other parts depending on the internal organisation.
- Besides the TAF/TAP TSI message exchange regulations, IMs may access information in the TIS from the above-mentioned modules directly via the TIS web-UI, or via interface interconnecting TIS and national traffic control systems (nTMS). The decision is on each IM.

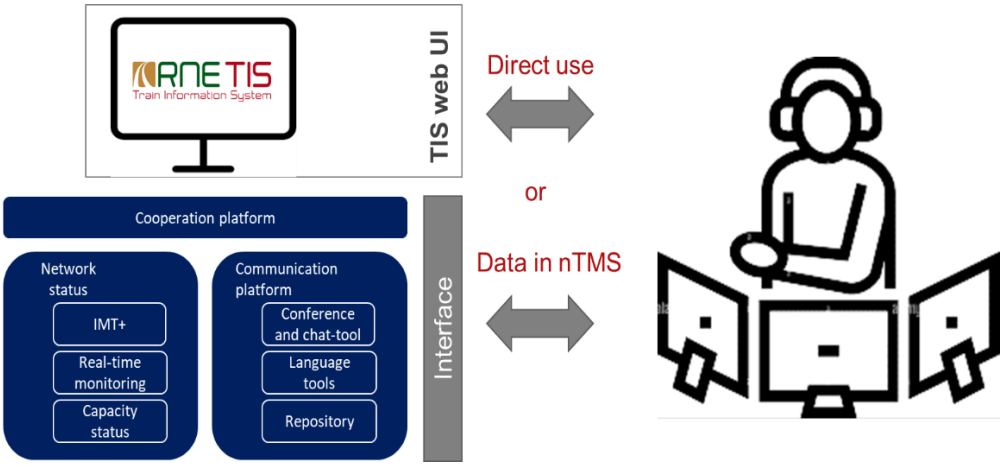


Figure 8: Summary of information modes and exchange

10. The functioning and processes in the European Traffic Management Network

The starting point for the standard mode of operations within the network bases on the common process steps for traffic management applicable to a TCC: provide information – monitor – manage risks – coordinate actions – improve cooperations. It is noted that the process of traffic management is going on simultaneously at all TCCs and thus can be understand as one process at the network. It exists in all Ims, but it is not consequently and bindingly standardized.

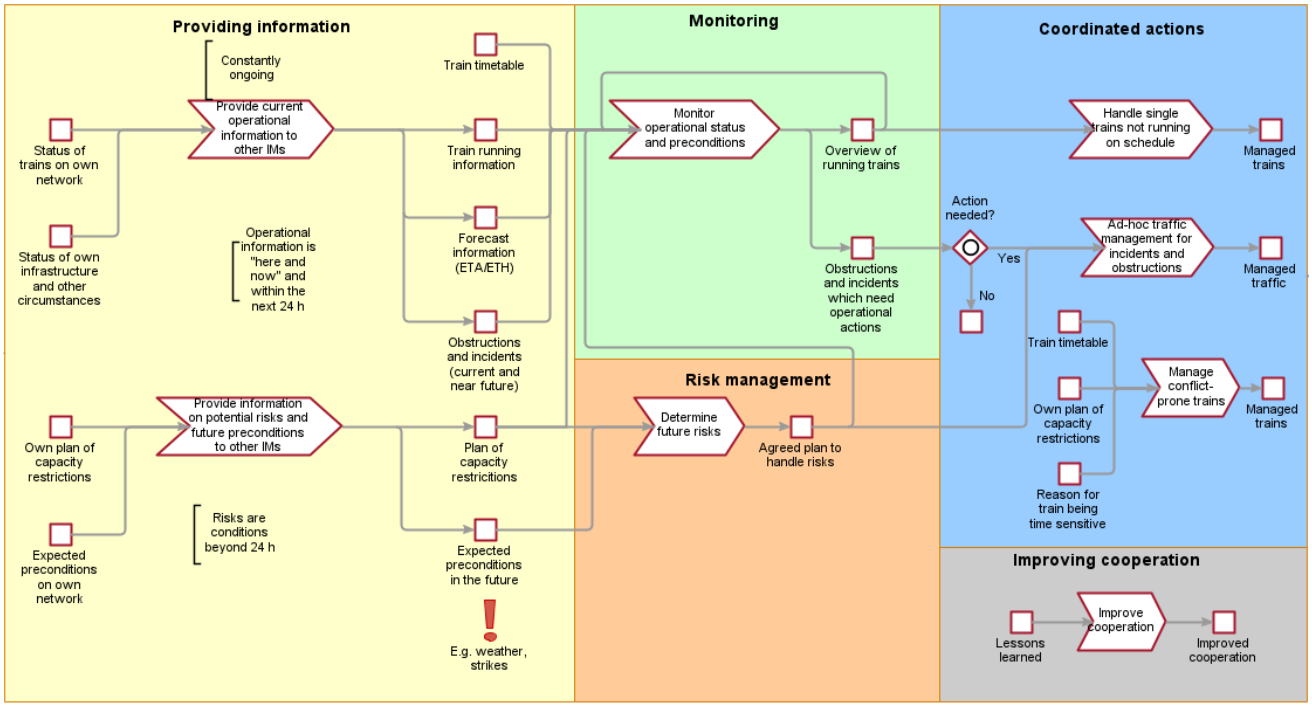


Figure 9: ETMN Process Map

The following description of the respective steps seeks to describe what elements are recommended to be *added* to the existing national processes to develop the current patchwork of standards towards an amalgam with sound level of common standards unfolding their impact on towards the whole network.

Process of International Traffic Management

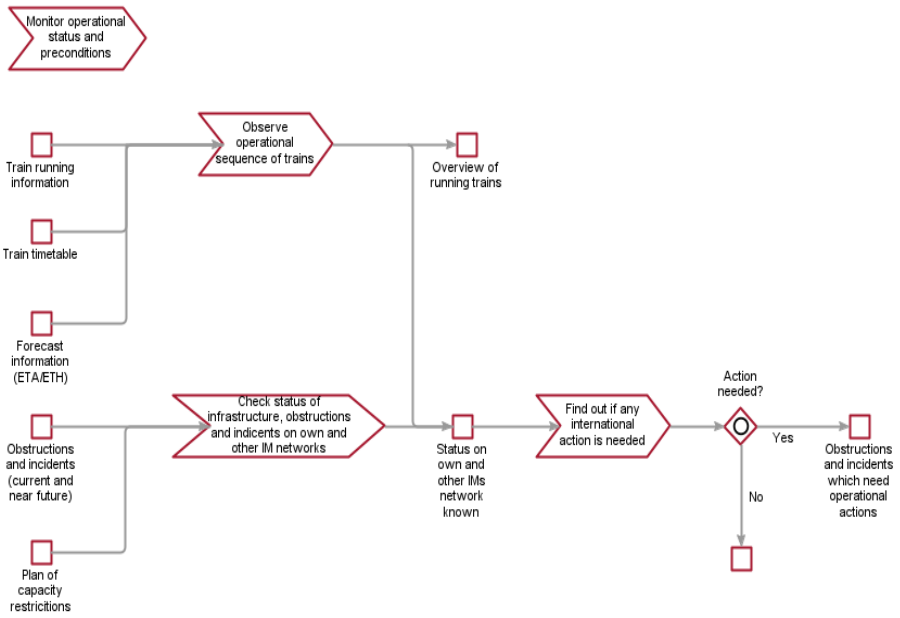
Target Group	Traffic control functions in charge of cross – border activities (depending on infrastructure manage this involves units at regional and/or national level)
Area of deployment	Traffic management of trains crossing at least one border
Applicability	This process is applicable,

	- To all officers in charge of train runs crossing at least one international border. - It applies to all situations ranging from regular to irregular traffic to cases requiring international contingency management.
Basic principle	(1) The rules apply in addition to the national rules of each IM, set to ensure the flow of information and coordinated actions. Each IM is in charge of incorporating these requirements in its own processes. (2) This guideline applies to the IM as a whole and does not differentiate between regional and national dispatching level since Ims are structured differently. (3) The procedures are continuously executed, or event based; partly automated, partly based on personal exchange.
Aim of the Guideline	(1) Ensure that all infrastructure managers pass on all relevant information to ensure the flow of information along the train route from source to destination. (2) Ensure efficient cross-border traffic management, in particular, to optimize train handling and increase overall punctuality. (3) Enable IMs to increase their dispatching capabilities to better anticipate traffic flow arriving and departing their networks in a standardized manner. (4) Define responsibilities for exercising joint actions (5) Establish responsibilities for conducting joint actions, providing information and coordinating, in response to specific conditions of international significance within IMs' own network. (6) Ensure that the status of the network is known at all times and risks are recognized to be able to take according actions. (7) Assure a uniform handling of trains at all European border crossings.
Subprocesses	The basic sequence of the international traffic management process is universal for railway traffic management. It consists of subprocesses or process steps that are recurrently repeated.
	Providing current operational information to other Ims
Aim of the sub-process	Increase transparency about the current train runs and status of the single networks inside the whole virtual network to be able to take coordinated actions.
Automated and non-automated transfer of data	Each IM is in charge of providing operational information in an automated and standardized way according to TAF/TAP TSI and valid RNE TM – related guidelines. Operational information is made available to all IMs either via RNE's IT application TIS or via standardised interfaces between IMs. This information shall be made compliant to function in R-CDM in the future.
Source of information	The information that is exchanged is based on input from IMs domestic systems and facilitates the connected stakeholders to obtain the required train-related information and to gain an initial understanding of situations that deviate from the plan. Each IM should use its information on:

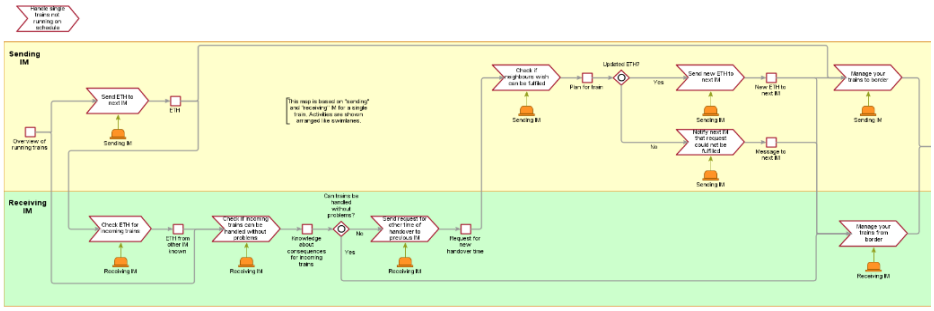
	○ Train related information on own network ○ Status of infrastructure including remaining capacity and other circumstances on own network It should be ensured that the information is as real-time/timely and reliable as possible.
Providing information	- Each IM should automatically transfer TAF TAP TSI compliant (or TIS accepted) format train timetable information and train running information for all agreed trains to TIS and where applicable to agreed IT application of neighbouring IMs. - IMs provide train forecast information to the neighbours and to TIS (at least ETH for all borders). Other train running forecast information are recommended to be exchanged. - Additionally, to automated data transfer, it is considered most beneficial to implement a process of regular exchange between dispatchers digitally or verbally to exercise regular personal contact. The content of the exchange is described in the Improved cooperation process. - Each IM is recommended to implement a procedure to secure that all internationally relevant information about the network status in terms of duration, location and impact of obstructions, incidents and ongoing TCRs. It is made available via an additional functionality of TIS [named IMT+]. This information can be sent in XML “TAF/TAP similar” format or entered manually in TIS. - Incidents / obstructions that meet the following criteria should be provided to IMT+ which triggers an automatic notification to concerned IMs ○ Incidents/obstructions affecting traffic cells on other IM’s networks ○ Expected that it will last at least 6 hours ○ At least 10 international trains are affected ○ As soon as you have to apply restrictions on received trains IMs may agree that this information should be shared also for incidents and obstructions with lower thresholds.
	<u>Providing information on expected conditions: Risks and future preconditions to other IMs</u>
Aim of the sub-process	Ensure internationally foresighted traffic management by being aware of risks and future conditions and regularly updating each other on these topics and potentially upcoming developments that might influence cross-border traffic.
Source of information	Each IM should take into account - their plan of TCRs on their network (to the degree the TM wishes) - the TCR tool indicating internationally coordinated TCRs and information on TCRs provided internally

	- an estimate of upcoming risks that may affect cross border traffic e.g., due to weather conditions or strikes
Information about expected future preconditions	Each IM is highly recommended to provide information on upcoming conditions that may restrict capacity for international trains or affect international train runs (e.g., inclement weather conditions, expected strikes) to their neighbouring IMs and virtual network.
Information about TCRs	Each IM should actively share details about the TCRs affecting international trains via *IMT+* based on the following requirements: - Information about TCRs that may evolve as a risk if trains are likely to deviate from their timetable, expected to cause train delays exceeding certain time (commonly agreed with a neighbouring IM, delay time for each shared track line may vary depending on a congestion of a particular line). This applies both to early planned TCRs (e.g., reduction to single track, close of important track of stations), where the timetable has been adapted and later TCRs. - TCRs that have not been processed into a new timetable. - All changes of TCRs affecting capacity including duration. Additionally, information about TCR status can be a frequent topic in regular meetings between TCC/IMs at least once a week. The actual procedure should be agreed upon in bilateral agreements.
Information about events *potentially* affecting train operations	TCCs are recommended to actively inform their neighbours and European network about other events or circumstances *potentially* affecting train operations in the upcoming days or weeks (e.g., weather effects, strikes). An indication of such an event is that one expects: - - to apply restrictions on the handover of inbound and outbound trains - - effects on the international train run on its own and networks outside the national one - - if that event occurs – the consequences o Affect network outside the national one and traffic cells on a directly neighbouring IM's network o affect traffic cells further than the directly neighbouring network o lasts at least 6 hours o more than 10 cross-border trains are affected - The actual effects of an event are handled by sharing information in the process step above (providing current operational information to other IMs) This information can be sent in XML format or entered manually in TIS.
	<u>Monitoring of international train runs</u>
Aim of the sub-process	- Create awareness of conditions on other IMs networks that will affect "my" network

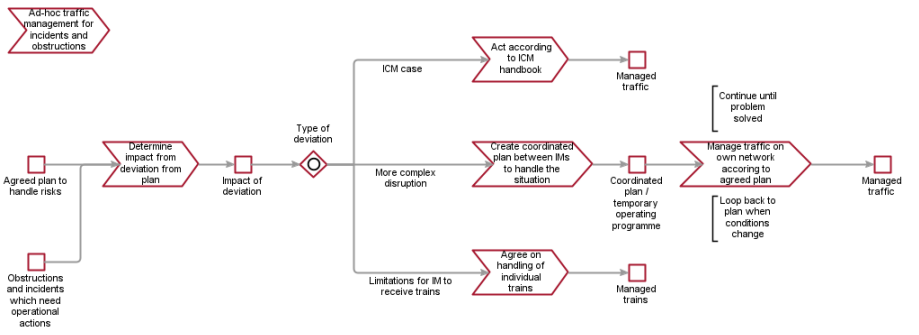
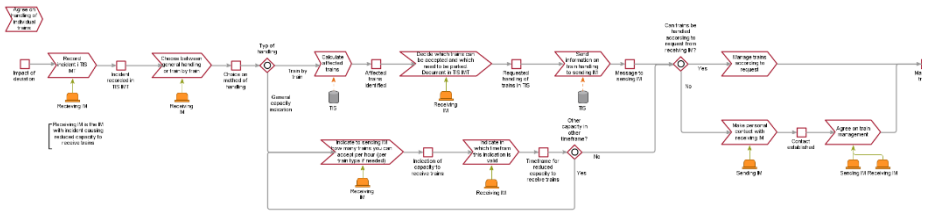
	- Understand situations that require coordinated actions with other Ims and thus trigger the sub-process “Ad-hoc traffic management for incidents and obstructions” - Get an overview of running trains coming from other IM networks and potentially trigger the sub-process “Handle single trains not running on schedule”
Input to the process	The input to the process comes from the previous process steps where IMs provide both current operational information to other IMs. The information consists of these main parts: - Train timetables - Train running information - Forecast information (ETA/ETH) - Current and upcoming obstructions and incidents (within 24 h) - Planned TCRs - Capacity status on other Ims networks
Process steps	Dispatchers in each IM are recommended to perform the following actions regarding trains from other IMs and their networks. Focus should be on neighbouring IMs but, depending on the network, traffic and geography, a further outlook may be needed. 1. Observe operational sequence of trains. This process step enables dispatchers to see both single delayed trains and larger irregularities in the incoming traffic. This may lead to adaptations in the IMs own plan to manage trains coming from other IMs as well as create a first alert about larger problems. 2. Check current status of the infrastructure regarding current unplanned obstructions and incidents as well as planned TCRs. This enables both a better understanding of the current traffic situation and the effect it will have on the own network and serve as an input to determine if any further actions are needed. 3. Find out if any international actions are needed. Each IM affected by disruption with international impact must consider if any internationally coordinated action is needed. If so, it will trigger the process of an “Ad-hoc traffic management for incidents and obstructions”.

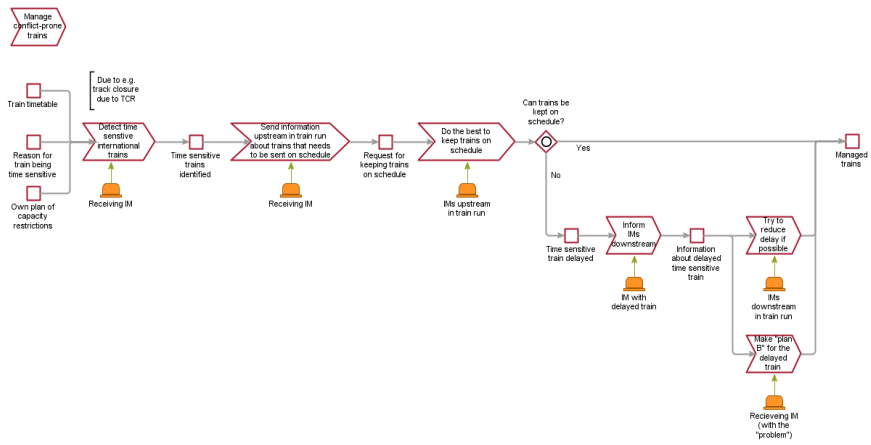
Process map	
	<u>Risk management</u>
Aim of the sub-process	Determine whether risks from inside “my” network affect surrounding IMs or risks from outside influence “my” traffic and which coordination steps are needed.
Input to the process	Input to the risk management process is: ○ Scheduled capacity restrictions on own network and on neighbouring IMs network that will affect international trains ○ Expected conditions on own and on neighbouring IMs network that will affect international trains (e.g., inclement weather conditions, expected strikes).
IT-support for communication	Potential circumstances that may develop into risks or actual risks are preferably shared via personal contact (e.g., phone call, chat, chat with translation function). Further IT-support may be agreed between IMs. Future developments of international supporting tools may support this communication in a more coordinated way.
Process description	1. Each IM should analyse the received information and estimate the impact. 2. Each IM is recommended to assess whether the expected conditions need coordination with other IMs. 3. If international coordination is needed either of these options shall be used to plan the coordinated actions a. At a regular or already scheduled meeting if there is enough time b. Plan a meeting if needed 4. If a common plan is made, make this available for concerned dispatchers.

Communication	Coordination of risks is mainly done at already planned or ad-hoc conference calls as described in the process. TCRs and other risks should be documented and sent to TIS according to the requirements in the process step "*Providing information on expected conditions: Risks and future preconditions to other IMs*" as described above.
	Coordinated Actions between infrastructure managers
	Coordinated actions are all actions that actually *are* traffic management. Depending on the traffic situation, IMs may implement the actions within their own organisation as long as they lead to a common concerted procedure with affected IMs. Implementation could be coordinated along an RFC. Situations can be differentiated concerning - regular and irregular traffic and - single trains versus all/most trains affected on the route - and combinations of the above. There are different types of actions that can be triggered depending on the circumstances. This will also depend on the case and if e.g., other incidents influence the situation. The following actions are not exclusive; they are options to ensure better border-oriented traffic management.
Coordinated Action 1	**Handle single trains not running on schedule**
Aim of the sub-process	Improved handover of single trains at borders by early coordination.
Glossary	Sending IM: The IM that sends an international train towards a border outside its traffic cell. Receiving IM: The IM that takes over a train from another IM. Third IM: the IM after the receiving IM ("over the cell")
Prerequisites	Active dissemination of ETH (Estimated Time of Handover) from sending IM
Applicability	The process is activated if the sending IM sends an altered ETH. Receiving IM decides if the process will continue due to the receiving IM not being able to accept the new ETH.
Input to the process	Overview of running trains, specifically ETH.
Process description (see also process map below)	1. Receiving IM: Checks ETH for incoming trains at the border. 2. Receiving IM: If ETH for a single train is not suitable, i.e., the train cannot be handled smoothly without any significant problems, continue to step 3. If ETH is accepted, no further action is needed, and the process is terminated.

	3. Receiving IM: Determine the suitable time of handover (specific time or preferably interval). Request this time/interval for handover from sending IM by *the common communication platform*. 4. Sending IM: Check if the request from receiving IM can be fulfilled. a. If yes, go to step 5. b. If no, go to step 6. 5. Send new ETH to receiving IM. Then go to step 7. 6. Notify receiving IM that the request cannot be fulfilled. This may depend on e.g., lack of parking options or other capacity related or train running reasons. 7. Sending IM: Make the best effort to keep indicated ETH (original or new). Update ETH if needed. Receiving IM: Plan for taking over the train at ETH (original or new). 8. The process is terminated after this. It may be restarted if sending IM updates ETH without a request from receiving IM.
Common communication platform	IMs exchange on the actual trains and agree if a new ETH can be agreed on or has to be denied. After a transition period this should be done in a harmonized way via the *common communication platform*.
Process map	
Coordinated Action 2	**Ad hoc traffic management for incidents and obstructions**
Aim of the sub-process	Improved international coordination of incidents with consequences below ICM-case and ICM cases.
Applicability	The process is recommended if one IM is affected by an incident or obstruction - call for action.
Input to the process	From process “Monitor operational status and preconditions”: Obstructions and incidents which need operational action. This means that someone has discovered a condition that needs to be handled internationally between IMs and that also concerned IMs shouldbe informed about the situation, forwarding this information to concerned IMs. From process “Determine future risks”: Agreed plan to handle risks. If IMs have agreed on actions for risk management prior to the operational day, this also needs to be considered at the operational stage.
Process description (see also process map below)	1. Determine impact from deviation from plan. Each IM investigates the foreseen impacts from the deviation.

	2. Continued actions depend on the type of deviation: a. ICM case i. Incidents/ obstruction affects traffic cells on other IM's networks ii. Expected that it will last at least 3 days iii. At least 50% of international freight trains are affected b. Disruption that should be managed together between IMs, but not ICM case. i. If one IM requests coordination (because of a direct incident or cascading impact) ii. Incidents/ obstruction affects traffic cells on other IM's networks iii. Expected that it will last at least 6 hours iv. At least 10 international trains are affected c. One IM has limitations in receiving trains due to temporary limited capacity on its network.
Coordination in case of ICM case (Case 2a)	Act according to the ICM handbook. This is not further described here. Please see the handbook*: RNE European Rail Infrastructure Managers Handbook for International Contingency Management*
Coordination in case of disruption but not ICM case (Case 2b)	In case of any type of disruption but not ICM case: 1. *Any concerned* IM should initiate coordination. In most cases, this will be done by inviting other affected IMs to a conference call or the common communication platform in the English language or using available language tools. 2. Coordinate actions: a. Instigating IM provides information in a structured way in IMT+ on e.g., the general implication of disturbance, impacted capacity/ reduced number of trains (link to agenda template). b. Leading IM provides proposals for overall handling of the incident (e.g., priorities of trains, parking of trains, re-routing). c. The affected IMs evaluate the impact on neighbouring IMs and coordinate themselves further if needed. 3. Coordination between IMs requires coordination by individual IMs on a national level with RUs. After that, it may require repetitive meetings or other means of coordination with affected IMs. 4. Each IM manages trains on their own network according to the agreed and coordinated plan. 5. The process is repeated when one IM sees the need for it, e.g., when conditions change. When the disruption is solved, each IM goes back to normal operations.
Automated coordination in case of limitations in receiving trains (Case 2c)	In the case of the specific disruption (but not ICM case) such as that an IM experiences limitations in receiving trains 1. IM with temporarily reduced capacity, "receiving IM", records the incident in IMT+. 2. The receiving IM chooses if they would like to specify the ability to receive trains "train by train" or indicate the capacity in "trains per hour".

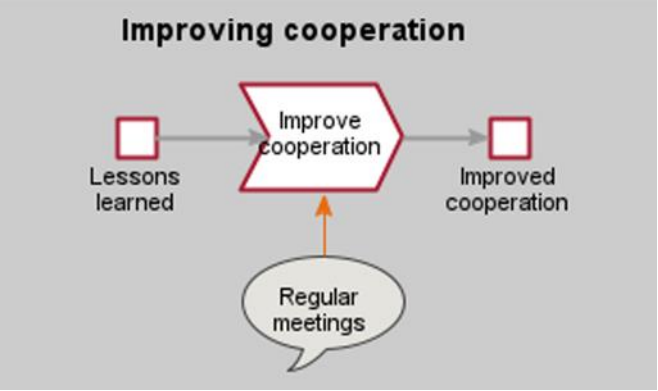
	Train by train 3. TIS IMT presents affected trains. The receiving IM decides which of these trains need to be parked on the sending IM's network and records this in TIS IMT. This information is distributed through TIS to the sending IM. Then go to step vii. *Trains per hour* 4. The receiving IM should indicate the number of trains they can receive per hour. The indication can be divided into train types, e.g., X freight trains and Y commuter trains. 5. The receiving IM should indicate the timeframe in which the limitation in step iv is valid. 6. The receiving IM should indicate a different capacity to receive trains in different timeframes. If so, steps iv and v are repeated.
Handling after coordination: Common process continued	*1.* If the sending IM can fulfil the requested train handling according to one of the procedures mentioned above, no further action than managing trains according to the request is needed. *2.* If the sending IM cannot fulfil the request from the receiving IM, they should make personal contact with the receiving IM and agree on the best mutual train management.
Process map for "ad hoc traffic management for incidents and obstructions"	
Process map for the sub-process "Agree on handling of individual trains"	
Coordinated Action 3	**Manage conflict-prone trains**
Aim of the sub-process	Keep international trains running fluently approaching a TCR/bottleneck.
Applicability	The process is recommended if one IM sees the need for it. This is the case if either train with TT close to the time of a track closure/TCR or trains with real running time close to the time of track closure/TCR. Then a foresighted coordination shall be initiated. (See Annex 2)
Input to the process	IM's own plan of TCRs, Train Timetable, Running Information and ETH.

Applicable TIS-Modules	Real-time Monitoring, Communication
Process description (see also process map below)	In case of planned TCR/track closure, the receiving IM checks internally in advance if it has trains that need to enter its network strictly on time to pass the location of TCR before the TCR/track closure starts. The receiving IM sends information to IMs upstream in the train run with reference to the international train number/TrainID and date(s). The reason for sending the information “upstream” in the train run is that trains may require special attention to be kept on schedule or managed in a way on several IMs networks passing the TCR before it starts. IMs upstream shall do their best to keep these conflict-prone trains on schedule. If conflict-prone trains have become delayed, these measures should be taken: Information should be sent to IMs downstream along the train run. IMs between the current location of the train and the receiving IM should make an effort to let the trains catch up, if possible. The receiving IM prepares for other measures regarding affected trains, e.g., parking or re-routing.
Process map for the process “Manage conflict-prone trains”	

	Improving cooperation
Aim of the sub-process	Improve cooperation between TCCs to ensure an uninterrupted flow of information in regular as well as disrupted traffic situations.
Prerequisites	• Active participation of all involved subjects • Mutual understanding of language and content of the communication • Cooperating parties should be involved in permanent information exchange triggered by relevant events • Regular socialization – team-building activities • Availability of permanent and irregular data, information and knowledge exchange • All data and information must be coherent, complete, and relevant

	• Established a technical platform for communication and cooperation
	• Two main process flows of information exchange are applied to improve cooperation
	  ○ Data exchange
	  ○ Verbal exchange
	• Data and communication channels are created between the subjects for
	  ○ Data exchange – TIS using XML message exchange (TAF/TAP TSI and agreed formats)
	  ○ Verbal or written exchange – new common conference platform (e.g., MS Teams)

Process description (see also process map below	Better cooperation is achieved primarily through the improved possibilities of a direct exchange within the network.
	
	TCCs exchange information verbally on the processes they are responsible for
	a. On a regular basis - more often than once a week preferably with neighbouring NTCCs to exchange on topics like current traffic situation and possible risks.
	b. Irregularly with over-neighbouring NTCCs to
	  i. Get more detailed information about the partner network status
	  ii. Ask to park/cancel/send trains differently from the timetable
	  iii. Coordinate contingencies
	
	c. Heads of NTCCs are recommended meet twice a year in group meetings organised by RNE:
	  i. To inform each other about the structure, working procedures, strategies and goals
	  ii. To coordinate mutually on the European level
	  iii. To discuss the expected European network status
	  iv. To evaluate the agreed performance figures of the European network
	  v. To define and test new procedures for improving European network efficiency
	  vi. Harmonise TCC procedures on a European level
	  vii. Create and maintain necessary guidelines
	  viii. Prepare TCCs´ teambuilding

Process map for the sub-process “Improving cooperation”	

Communication	To establish and maintain cooperation, infrastructure managers are encouraged to ensure not only digital communication e.g., via the communication platform, but arrange meetings in person to reduce barriers of communication.

11. Integrating ETMN in the context of the full logistic chain

Although focus of the ETMN-concept is the cooperation between IMs, it is worth considering effects on other stakeholders of the logistic chain as well. It is obvious that decisions taken on side of the IMs can heavily influence the traffic flow and thus affect other entities.

Cooperation with other stakeholders along the logistic chain

In the context of the full logistic chain, the IMs main task is to execute the traffic management on their responsible networks. Interfaces with other stakeholders (e.g., terminals, ports and shunting yards) exist up and downstream when entering the IMs network. Along the whole logistic chain, the main goal of the rail sector is to keep the train running in coherency with its timetable and to minimize any deviation from it. The optimal situation is when trains run according to their timetable and there is no need for coordination between the partners.

However, due to the high number of interfaces along the logistic chain and taking into account the long distances of international train runs, they are prone to run into delays. Consequently, mitigation measures are required many times to avoid or at least ease bottleneck situations. As experience in other sectors shows, individual players can best handle their part in the logistic chain if they early enough receive information like departure time, arrival time and forecasts. This enables them in advance to initiate additional actions and increase overall efficiency.

A prerequisite to overall better performance is data sharing and communication with all involved parties. This can be also the guiding framework for the railway sector. However, the outline of such a set-up and the definition of the relationships and related roles goes beyond the ETMN concept. But the EMTN approach can itself become part of such a perspective.

In such a larger framework, a data exchange platform would ideally exchange all relevant information that is needed to allow all involved subjects to act in a coordinated manner. This approach creates a high demand for functional IT networks for data exchange with the agreed level of access to each piece of information. Additionally, a centralized communication system should be established to allow quick communication between the involved subjects if needed. However, to reduce the language barrier as much as possible information exchange should be automated.

Cooperation with overarching stakeholders

The important role of the RFCs persists and remains on the supporting level as it was presented in the Declaration of Intent on ETMN. In the first stage, there is no intention to directly involve them in traffic management. However, the RFC's role remains to monitor the performance of international freight trains and to interact with involved stakeholders. This RFC role contributes to the performance of ETMN. In case of international disruptions, the role of RFCs is already clearly described and remains the subject of the ICM Handbook. The RFCs further role will be defined from the results of the R-CDM project.

With the above outline of the ETMN approach, the RNE members define their traffic management standards as input into a larger framework. But the merging into the larger framework has to be specified in another project involving all stakeholders. As there is already a concept paper of a potential set-up named Railway – Collaboration Decision Making, a project named thereafter would be the next step. The role of all stakeholders, responsibilities and processes can be discussed there.

12. Proposal for Key Performance Indicators

For successful implementation of the ETMN concept monitoring of development and implementation is necessary. The recommended KPIs are setup in a way to track both phases of the ETMN concept. The time frame for implementation of the modules and processes are defined in the Gantt-chart and the full implementation by members is recommended according to the milestones.

Section in handbook	Specific subject	Target goal	Short term requirement (2023)	Medium term requirement (2024-2025)	Long term requirement (2026-2030)	Other aspect / comment	KPI'S
5.1 Information needs	Provide train running data to TIS	Relevant trains sent to interested IMs and TIS	Recommended International Passenger, International Freight, National Freight	Recommended National Passenger and Maintenance Trains			Share of IMs providing agreed train running data to TIS [%]
	Provide train running forecast (ETH)	Provide ETH for all borders for all trains		Recommended in TIS ETH for all RFC-borders delivered	Recommended in TIS ETH for all borders delivered	Manually means e.g. a phone call, chat	Share of provided trains with an ETH per IM in TIS [%]
	Already requirement	Relevant IMs informed about disruptions and unplanned TCRs	Commonly agreed, can be delivered "manually"	Recommended in TIS IMT+		Several delivery methods	-
	Provide capacity status	Indication for full and available paths/capacity on border lines is available in TIS		Based on TTR-development	Recommended Detailed overview available	Tool and function needs to be delivered	Development status of the Capacity tool [%] Usage of the Capacity tool by IMs [No. & %]

	Provide information about risks	Relevant IMs informed about risks		Voluntary in TIS IMT+	Recommended in TIS IMT+	Needs a tool to make information available	-
5.2.1 Communication language	English speaking dispatcher at NTCCs	Ensure capability to communicate on NTCC-level	Mandatory	Mandatory	Mandatory	Already a requirement from ICM handbook	Already monitored
5.2.2 Module communication	Unified platform for communication	Ability to exchange in a structured manner		Available and voluntary to be used	Recommended for everyday use	Used means when described in the process	Development status of the Communication platform [%] Usage of Communication platform by stakeholders [No. & %]
5.2.3 Module capacity status	Capacity overview on border lines	Enable foresighted TM based on capacity data		Available (Pilot testing)	Recommended		Development status of the Capacity overview [%] Usage of the Capacity overview [No. & %]
5.2.4 Module real-time monitoring (TIS)	Network ETA (enhanced ETx)	Network ETA available in TIS	Available				Development status of the Network ETA [%]
5.2.6 Module IMT+	Use for incidents and disruptions	Ensure awareness about ongoing disruptions	Voluntary	Recommended		Used means when	Development status of the IMT+ [%]

						described in the process	Usage of IMT+ by IMs [No. & %]
	Use for expected disruptions and risks	Ensure awareness about expected disruptions and risks		Voluntary	Recommended	Used means when described in the process	
5.2.7 European Network status	Provide general overview of the European network	Ensuring European wide awareness			Available		Development status of the European network status [%] Usage of European network status module [No.]
6. Functioning and processes	Integration of ETMN-processes inside IMs	Securing the unified standards for cross-border TM	Start implementation on own processes	Upgrade to ETMN-Standards when Tools are available			-

13. Deployment plan

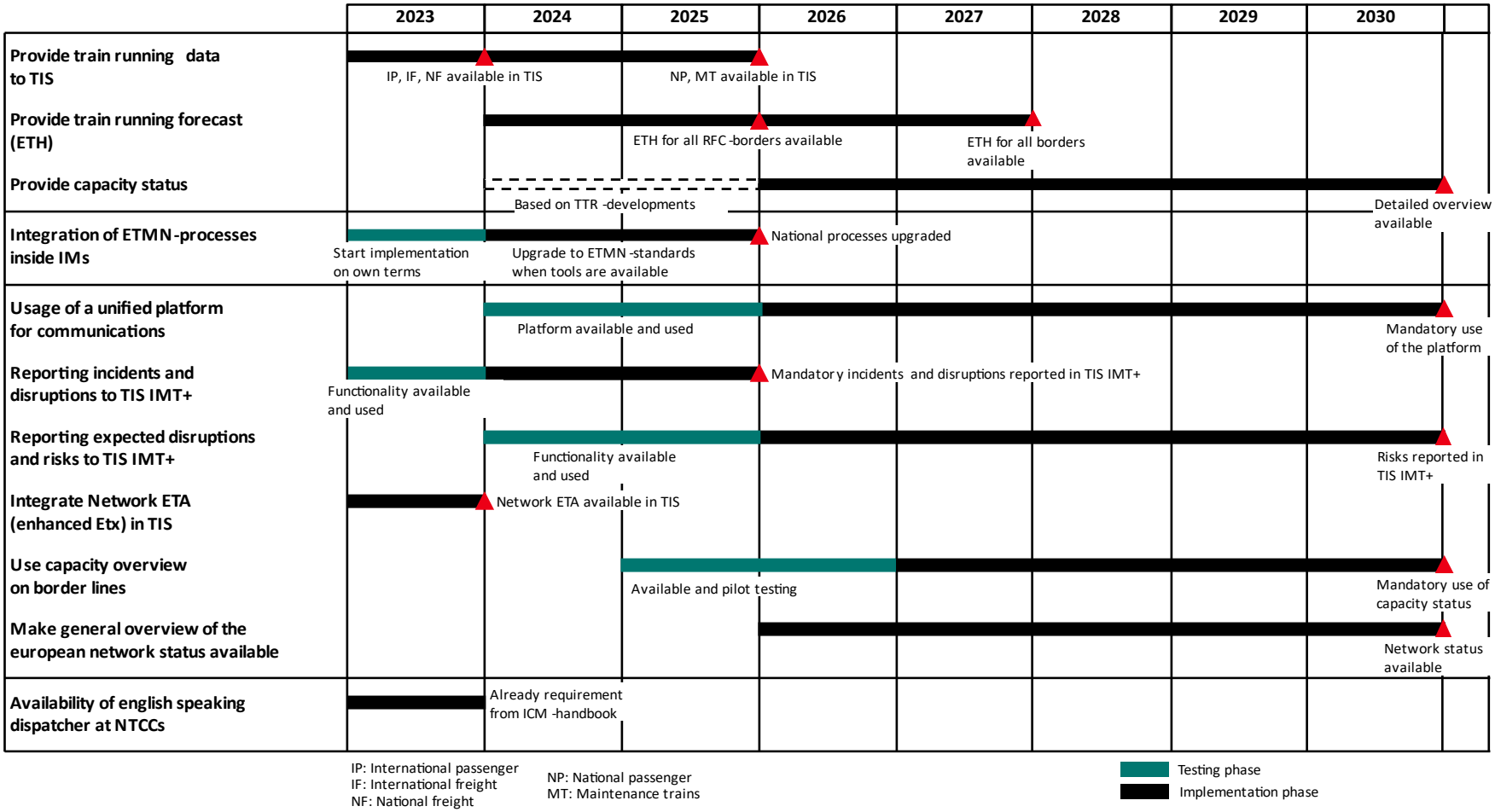


Figure 10: Deployment plan

14. Annexes

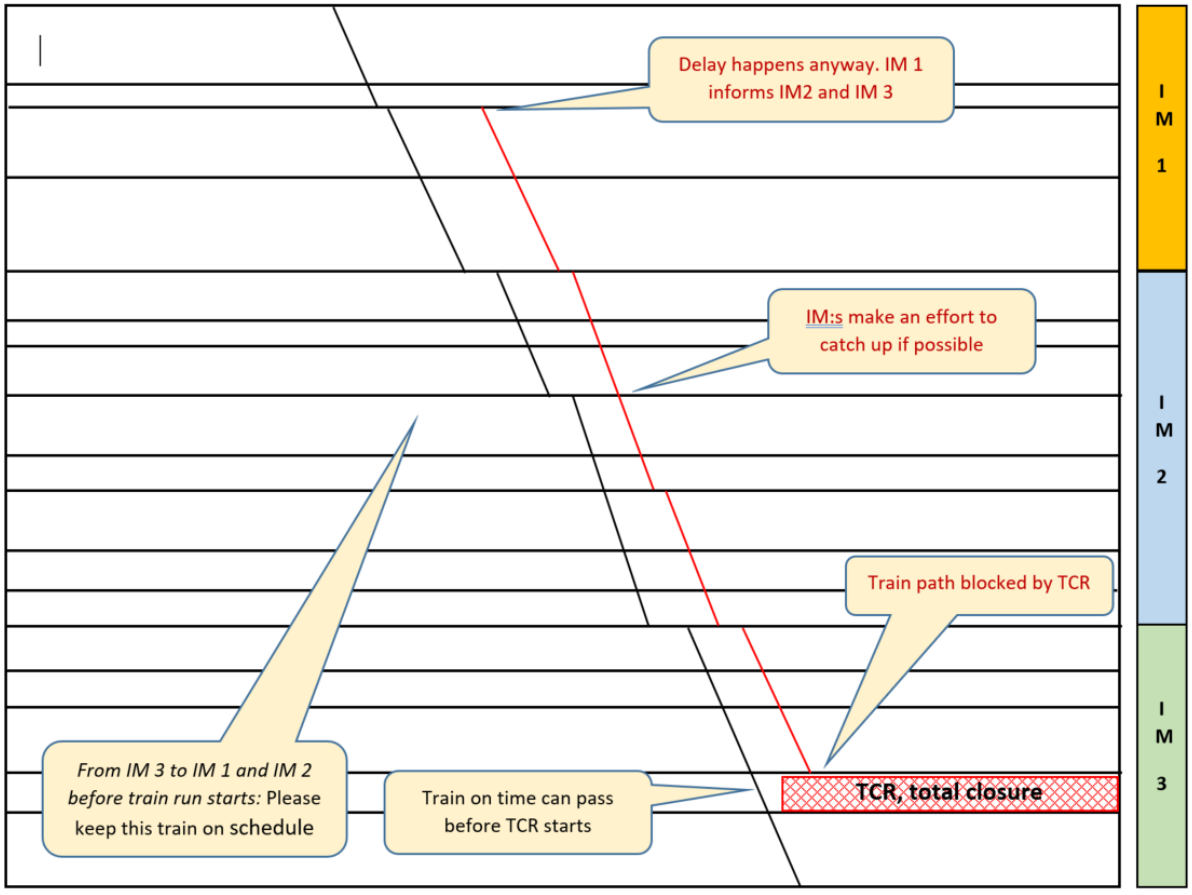
14.1. Annex 1. Gap analysis and explanation

European mindset	IMs are (in most cases) national organisations and it's easy to focus on national problems. These are of course important, but it is also very important to meet the challenges we face in Europe together for the benefit of the whole continent regarding socio-economic development made in a sustainable and environmentally friendly way. This will require a European mindset where we see international issues as being equally important as national ones.
Binding nature	RNE guidelines not fully implemented
Insufficient information about the forecast	IMs should be prepared to manage trains approaching their network from other IMs. Forecasts, especially Estimated Time of Handover (ETH), are important, but also forecasts for other points of the network (ETA, Estimated Time of Arrival). The situation across Europe today is that ETH is missing between many IMs, although dissemination is working on some border crossings. Solutions are also different. A working European network depends on reliable forecasts disseminated digitally using standardised interfaces. ETH is the most relevant timestamp for the ETMN; however, the importance of fluent forecasting is necessary for as many locations on the train run as possible. The forecasted values should meet the agreed threshold to serve in the operation and bring its benefits.
Lack of information about incidents	The process for larger disruptions, longer than three days and with a substantial impact on international traffic, has been defined in the Handbook for International Contingency Management. In parallel, an agreement of IMs to report them in the TIS Incident Management tool is valid and significantly supports the ETMN concept. Most disruptions and obstructions that occur on the rail network are smaller, but they can still affect international trains substantially. We have a large gap today, both when it comes to informing other IMs about incidents affecting international trains and no agreed process for cooperating on how to handle affected trains. The exchange on all incidents affecting international train runs should increase the overall European network performance.

Missing information about train properties	Reliable traffic management is based on knowledge about train properties. You need to know e.g., how fast the trains can run, their weight, axle load and length. Information about train properties is partly available on the European network, but for efficient train handling that doesn't lead to unnecessary delays, this information needs to be available at all times for all trains. Moreover, the information is needed well before trains reach another IM's network so routing, parking etc. can be planned correctly. The exchange of Train composition message can fill this gap. Involvement and consent of RUs on this information exchange is a step to start with.
Traffic management is not coordinated	At best, information is shared between IMs for trains running across borders, but even this is not always the case, as mentioned above. The vision of the European Traffic Management Network goes beyond this. There is a need to really *coordinate* dispatching as if it was between two regions or signalling districts within one IM. Only then will we reach the highest benefits for customers where railway transports are punctual and reliable and therefore attractive for passengers and freight operators.
Missing contact information and contact procedures	The European network will only work if both digital information sharing and cooperation on a human level are working well. Today, there are often uncertainties about whom to contact, when, about what and how. Cooperation methods, procedures and channels should be made clear and harmonised to a certain level across Europe. Keeping personal contacts alive in regular situations will also help when things heat up and there are disruptions to handle.
Missing working cooperation between IMs with continuous improvements	Many IMs do not have regular meetings with their neighbours on a regular basis to share experiences and improve their collaboration. Working methods, means of contact etc. need to be evaluated recurrently. A working European network should to be kept alive with regular meetings, ideally involving NTCCs.
Multimodal integration of the rail freight services	The logistic chain in its railway section starts and ends with terminals. Nowadays the cooperation and data exchange between IMs and RUs works based on the TAP/TAP TSIs. The missing elements are still the terminals as an inherent element of the railway logistic chain. The involvement of the terminals in data exchange and more intensive cooperation with the TCCs will support the overall increase in railway performance and customer satisfaction rate and contributing to the European modal shift to railways.
Support of long-distance international trains	The increased individual road transport cases are the regular bottlenecks and environmental burden. The newly reopened segment of long-distance international trains needs a European network approach to which the ETMN concept could contribute. Preferences on these trains run from TCCs keeping them punctual on the whole journey should be the goal of the ETMN concept supporting the overall sector performance.
Coordination between the operation and stakeholders	The important role of the RFCs has been already proven. Their good knowledge of the customers and the corridor transport features can help to increase the railway transport performance. Their role as an interface between TCCs and RUs and their customers can be a field for their contribution to the overall concept of the ETMN.

with RFCs support	
Capacity management and TCCs	Capacity management should be corelated with Traffic Control centres. Currently, there are no regulations or standards for capacity management on a global European scale. Some IMs have capacity managers, some just downshift this work to their dispatchers. Overloading dispatchers with additional tasks poorly reflect on their main duties as well as new duties are not fulfilled well.

14.2. Annex 2. Train in conflict with TCR



additional annexes to be considered