



ERJU SYSTEM PILLAR


T3-OperationalEntitiesActorsRoles



Draft For TMS CMS Operational Entities, Actors & Roles

DISCLAIMER

This draft is to be intended as an Annex to the System Concept document and is issued as part of the planned deliverables of the first three months activity.

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Abstract	The document aims to sketch an complete view of all CMS/TMS actors and entities (system actors), with a proposal of their role, involved in those processes allocated to the functions allocated to CMS/TMS
Config Item	System Concept
Document ID	30 Deliverables/T3-OperationalEntitiesActorsRoles#714381  T3-OperationalEntitiesActorsRoles
Classification	Public
Status	Open (educated draft, discussion in domain nearly finished)
Version	2.04
Revision	714381
Last Change Date	24.09.2025
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1 History of Changes

Nr.	Changes	Leader/Authors
01.00	First draft for internal revision.	Marco Nanni
02.01	Integrated batch of contributions from	Marco Nanni, Patrick Konix, Herbert Knoedl, Peter Šišolák, Valter Pettinati
02.02	Added list of capabilities to CMS; refined list of capabilities for TMS; alignment with System Concept	Marco Nanni, Valter Pettinati
02.03	Fixed some errors, integrated some descriptions, added sect. 5.4.3	Marco Nanni Valter Pettinati, Simone Brezzi
02.04	Contains integrations according to the received comments from Mirror Group et.al.	Marco Nanni

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2 Reference

- [Ref. 1] - PROPOSAL of the REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL from 11/07/2023
- [Ref. 2] – TMS Variant v1.2
- [Ref. 3] – Operational Processes v.0.81
- [Ref. 4] - TMS-SYSCON-ES-014.00 System Concept R2
- [Ref. 5] – Task 2 Traffic CS - System Analysis v. 158368
- [Ref. 6] – D15.1 Requirements for the deployment of TMS linked with ATO/C-DAS
- [Ref. 7] – S2R- D5.1 WP5 GoA3/4 Specification v.0.2.2

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3 Abbreviations

API Application Programming Interface [SPT3TMS-12976]
CMS Capacity Management system [SPT3TMS-12984]
CNA Capacity Needs Announcements [SPT3TMS-13223]
CTC Centralized Traffic Control [SPT3TMS-12989]
ERTMS European Rail Traffic Management System [SPT3TMS-13222]
ETM European Traffic Management [SPT3TMS-13221]
IM Infrastructure Manager [SPT3TMS-13000]
KPI Key Performance Indicator [SPT3TMS-12953]
RIM Rail Infrastructure Manager [SPT3TMS-12957]
RU Railway Undertaking [SPT3TMS-13210]
SERA Single European Railway Area [SPT3TMS-13788]
TCC Traffic Control Centre [SPT3TMS-12958]
TCR Temporary Capacity Restriction [SPT3TMS-12963]
TCS Train Control & Supervision [SPT3TMS-12962]
TG Train Graph [SPT3TMS-12968]
TM Traffic Management [SPT3TMS-13224]
TMS Traffic Management System [SPT3TMS-12967]

4 Disclaimer

This document has some references to other documents belonging to other Domains, and links should be traced to these documents. As actually there are no permissions to trace links to documents belonging to other Domains, - different from CMS/TMS one, this specification shall be issued for approval without these links.

The permission to trace links to other Domains is going to be requested. After the completion of the approval process this specification shall be reopened and, once achieved the right level of permission, the links shall be traced. [SPT3TMS-13767]

5 Purpose and system context

5.1 Purpose

The document aims to sketch an exhaustive list of all CMS/TMS actors and entities (system actors) involved in those processes that the functions allocated to CMS/TMS are devoted to support. [SPT3TMS-11593]

Each actor and entity are characterized by their associated role; as a role is characterized by the capabilities which are intended to be given to the actor with that role, it also defines the capabilities that the system must implement to achieve the actors' goals. This document shall focus on the actors/entity viewpoint, giving a proposal of the features that every role should accomplish and considering the system as a black box, without specifying system capabilities. [SPT3TMS-11592]

5.2 Scope and exclusions

The document focuses on the description of the Actors and Entities which use the features provided by the CMS/TMS system. These features will implement and achieve the goals of planning, monitoring, producing and supervising the railway processes which nowadays are assigned a modern up-to-date railway system, and thus reaching the Key Performance Indicator (KPI) assigned to Railways Undertakings (RUs) and Railway Infrastructure Managers (RIMs) by European Governments. This is a key objective to effectively build and control a European-wide Business2Business traffic management network, which is the basis of the implementation of the Single European Railway Area (SERA) which is one of main goals of the System Pillars initiative. [SPT3TMS-11640]

The document shall highlight also other actors and proposed roles, not directly actively using CMS/TMS system, but which might take benefit from monitor in read-only mode several information necessary to have an overall both off-line and real-time view of the traffic planning and production processes. These actors are recalled here for sake of completeness and shall be shared for alignment with other tasks who deal with them; their identified role shall contribute to determine the complete set of capabilities that have to be apportioned to the CMS/TMS. [SPT3TMS-11639]

This document keeps a textual approach; actors and roles are described without modelling diagrams. Operational Entities and Capabilities diagrams shall be modelled later, according to this document, and Capella shall be used for this. [SPT3TMS-11642]

5.3 Assumptions

Nowadays every national railway organization in Europe put in place its own operational model to manage a control centre, with different number of layers, which comes from historical reasons and other constraints, and are consistent with the technological roadmap which has been defined and pursued along the last 30 and even more years. [SPT3TMS-11641]

All of these models aim to monitor and manage the traffic over the controlled area: then the actors designed to lead this activity are to a certain extent similar; however, every organization has defined its own processes and the operators' roles and tasks are anyway somehow different. [SPT3TMS-11636]

Then, to set up a first basis for a common understanding and sharing, the approach is to define a first set of actors and roles referring to the main similarities which can be derived from the experience and the contributions from the workgroup members, according to the processes defined in [Ref. 3]. These

processes are taken as a reference to develop a proposal for assigning tasks to roles suitable to make the execution of these processes possible. [SPT3TMS-11635]

We understand that nowadays several different processes and rules are in place in European IMs organizations, but a roadmap towards harmonization should be put in place if we believe in creating what is referred to as "SERA". Therefore, the document has to be intended as a first attempt to give a common view of users and roles involved in traffic regulation and supervision (giving an hint also for roles involved in monitoring activities for sake of completeness, as these activities are indeed in charge of Traffic Control and Supervision system). The proposal is in line with the high-level Operational Processes we have defines according to the 2022-2023 Remit Plan. [SPT3TMS-15937]

Later on, and after the domain approval, it is intended to share the document with a wider audience, where hopefully there are representative of a broader set of RUs in Europe, in addition to the representatives already present in CMS/TMS domain, to collect suggestions, refinements, changes which will bring a more general validity to the document and lay the basis for its acceptance and integration inside the harmonization process. [SPT3TMS-11638]

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6 Actors and roles

This chapter aims to identify who are the CMS/TMS users (human actors) and which roles they should be appointed to manage in an optimal way all railway processes. These users are grouped according to the main system they should use, even if there might be situations where the same user may have more roles related to functions implemented by different systems; this flexibility shall be supported by the technological solution which shall be available on every integrated workbench and are not in scope of this analysis. [SPT3TMS-11637]

With this assumption, actors and roles have been grouped into the following subsets: [SPT3TMS-11645]

- o Actors involved into long-term and short-term planning activities.
- o Actors who supervise and drive the correct real-time implementation of the capacity production plan.
- o Actors who directly execute the production plan and manually act on interlocking and ETCS systems replacing from this task the supervision system when necessary, who are not primarily using CMS/TMS system but whose role is relevant and tightly coupled with CMS/TMS
- o Other roles operating on ancillary systems which are nonetheless tightly connected with TMS and CMS and use their information to perform their functions. [SPT3TMS-11644]

The last two bullets indeed are not scope of CMS/TMS specification but are proposed to give an overall view of a Traffic Control Centre organization, which spans also over some field activities. [SPT3TMS-11643]

6.1 Strategic and Tactical Capacity Planning

This paragraph describes actors and related roles involved in the conception and preparation activities of the capacity plan which must be performed starting much in advance with respect to its coming into force and which are carried out until the due date with several levels of refinement. [SPT3TMS-11651]

The description of actors and related roles supports the definition of the CMS required functionalities. [SPT3TMS-11650]

The detailed description of these phases is out of scope of this document; to have a more specific description see [Ref. 4], while for having a view of associated processes see [Ref. 3]. [SPT3TMS-11653]

6.1.1 Capacity Developer

Capacity Developer

According to [Ref. 3], the Capacity Developer starts and performs the strategic analysis which shall lead to the submission and publishing of a “Capacity Strategy” document, whose goal is to offer and show the planned available capacity in the Single European Railway Area (SERA). [SPT3TMS-11665]

The Capacity Strategy document shall define the main principles to be used in the next refinement phases of the capacity planning and capacity allocation, which are supported by specific processes and provides a first estimation of the foreseen traffic. [SPT3TMS-11647]

The Capacity Developer shall be responsible for the analysis of the track slot market and, on top of it, shall propose changes and improvements to the network topology and prepare a consistent conceptual timetable which accomplishes the foreseen market needs for the future. [SPT3TMS-11646]

The Capacity Developer operates in a time horizon of [X-60, X-36] months, where “X” must be intended as the time when the final planned timetable comes into Commercial Operation. Therefore, the Capacity Developer doesn't need real-time information for his activity but needs to be equipped with capacity planning and simulation tools. [SPT3TMS-11649]

The Capacity Developer carries out the following main tasks: [SPT3TMS-11648]

- Liaises with RUs, RIMs and regulatory authorities (Ministries of Transport, Region, local government, transport associations, etc.) to learn about market and policy intentions towards the rail network. [SPT3TMS-11668]

- Manages inputs from the involved stakeholders which imply positive or negative changes in on-going capacity definition. [SPT3TMS-11667]
- Is responsible for drafting the topology according to known stakeholders' infrastructure development plans. [SPT3TMS-11670]
- Creates topology variants for any relevant scenario might occur in the future, according to known stakeholders' infrastructure development alternatives. [SPT3TMS-11669]
- Creates conceptual timetables for several scenarios of interest in the foreseeable future. [SPT3TMS-11662]
- Develops models for strategic (long-term) capacity planning. [SPT3TMS-11666]
- Works in collaboration with the Temporary Capacity Manager [SPT3TMS-11725]

6.1.2 Capacity Planner

Capacity Planner

According to [Ref. 3], the Capacity Planner moves from the strategic analysis described inside the "Capacity Strategy" document elaborated by the Capacity Developer and creates a Capacity Model consistent with it, breaking down the overall available capacity into time-space slots available for yearly timetables paths (so-called "positive" capacity) and sets of Temporary Capacity Restrictions ("negative" capacity, TCR). [SPT3TMS-11664]

On top of the "Capacity Strategy" document, the Capacity Planner will consider additional inputs which will add refinements, as Capacity Needs Announcements (CNA), rolling planning requests spanning over more than a year, framework agreements subsequent the submission of the Capacity Strategy plan. [SPT3TMS-11659]

This generated highly digitalized tactical plan will then include, among others: [SPT3TMS-11661]

- o seasonal economic happenings,
- o social changes of mobility,
- o government restrictions,
- o economic expectations etc. [SPT3TMS-11660]

and considers and forecasts the impact of past and new expected happenings as: [SPT3TMS-11656]

- o public events (holidays, big public events, etc.)
 - o economic events
 - o consequences of meteo events (support shipping when low water level in the rivers, etc.)
- [SPT3TMS-11655]

Then, this role refines and complements the first analysis of track slot market, providing a more realistic view of the expected traffic volumes which is to be shared with involved stakeholders as Infrastructure Managers, national and regional transport governments, facilities providers. [SPT3TMS-11658]

The Capacity Planner operates in a time horizon of [X-36, X-18] months, where "X" has the meaning shown at sect. 6.1.1. Delivering the detailed Capacity Model is a complex activity, prone to receive several requests for change by the involved clients. Therefore, a draft model should be submitted in advance, so as to collect comments and change requests, evaluate their feasibility and if possible, integrate them into a new version before the final publication. [Ref. 3] proposes a milestone for this intermediate draft but, regardless of when the milestone is planned, here it must be highlighted the principle. [SPT3TMS-11657]

The Capacity Planner carries out the following main tasks: [SPT3TMS-11663]

- Receives and analyses the strategic analysis contained in the "Capacity Strategy" document, highlighting differences and deviations from with the previous strategy, [SPT3TMS-11732]

- Liaises with RUs, RIMs, Service facilities providers and regulatory authorities (Ministries of Transport, Region, local government, etc.) to receive already known and available new requests, and to communicate the traffic volume as planned by the capacity model. [SPT3TMS-11734]
- Identifies the international traffic flows between the controlled area and the neighbouring lines. [SPT3TMS-11733]
- Masters and uses specific tools to build the capacity model, maximizing the number of slots available for timetable and TCR intervals. [SPT3TMS-11727]
- Liaises with Rus and RIMs of neighbouring national organizations to harmonize and fit traffic flows proposals and requests with the Capacity Model. [SPT3TMS-11726]
- Publishes an initial draft version of the Capacity Model, showing the capacity usage all over the controlled area and the capacity consumed by reserved TCR. [SPT3TMS-11730]
- Clearly highlights “Condensation” (congested) and “Compensation” zones, to permit interested stakeholders to make their own elaboration and propose changes. [SPT3TMS-11728]
- Collects all change requests and tries to integrate them into the Capacity Model, using supporting tools to keep optimization; rejects unfeasible requests. [SPT3TMS-11735]
- Communicates the expected traffic volumes to the involved stakeholders. [SPT3TMS-11731]
- Publish and maintain the Capacity Model [SPT3TMS-11729]

6.1.3 Short-Term Planner

Short-Term Planner

According to [Ref. 3], the Short-Term Planner operates on the pre-constructed paths previously published by the Capacity Planner, focusing on the production data for the annual schedule and handling yearly requests. The Short-Term Planner harmonizes and coordinates these latest, unplanned requests inside the capacity model whose feasibility was already validated. He manages also latest path requests, managing them at the same way yearly timetables are managed or on a first come-first served base according depending on when the request is received. [SPT3TMS-11741]

The Short-Term Planner temporal scope of work groups several time slots defined in the operational processes depicted in [Ref. 3]. He starts to build a yearly timetable according to defined processes and European allocation rules, which constitutes the framework for further refinements and the following steps. He considers then requests received after the defined deadline as defined by internationally defined planning processes, keeping a view which spans over national borders for cross-borders offers, as well as those requests received immediately before the coming into operational service of the timetable or even later, during the commercial operation time window (rolling plan request handling). He integrates on a first come-first served base the so-called ad-hoc requests which may occur at every time within the current timetable year. [SPT3TMS-11740]

Finally, the Short-Term Planner handles required changes to the timetable, in terms of cancellations or any capacity modification, having always in mind the goal to keep an optimized plan, according to the according to the changed conditions and constraints. [SPT3TMS-11743]

The Short-Term Planner operates in a time horizon of [X-11, X+12] months, where “X” has the meaning shown at sect. 6.1.1. He is responsible for the complete mapping of the daily target for the whole Commercial Operation period. [SPT3TMS-11742]

The Short-Term Planner carries out the following main tasks: [SPT3TMS-11737]

- Integrates additional information to the capacity plan for production preparation in the annual timetable. [SPT3TMS-11736]
- Updates the annual timetable integrating late paths requests and planned construction/maintenance works. [SPT3TMS-11739]
- Evaluates impacts consequential to updates and consults and proposes solutions to the impacted stakeholders. [SPT3TMS-11738]

- According to the first come-first served principle, serves rolling-plan requests which spans all along the timetable validity period. [SPT3TMS-11744]
- Handles Infrastructure Managers answers received according to the process, in due time. [SPT3TMS-11748]
- Handles ad-hoc very short-term requests according to the first come-first served principle, taking benefit of residual capacity, predefined paths envisaged by the Capacity Model, preconstructed ad-hoc capacity paths. [SPT3TMS-11747]
- Ensures the high-quality level of the end-to-end offer and that it is internationally harmonized for cross-border trains. [SPT3TMS-11746]
- Handles paths cancellation requests received from applicants, either complete or partial. [SPT3TMS-11745]
- Handle changes of cross-border path valid for the actual/upcoming timetable period. [SPT3TMS-11752]

6.1.4 TCR Manager

TCR Manager

According to [Ref. 3], the Temporary Capacity Restrictions manager (TCR manager) ensures efficient use of the rail infrastructure by designing targeted and optimized compromises between the maximum possible infrastructure capacity for infrastructure capacity holders and infrastructure capacity for development / maintenance on a fixed infrastructure. This must be achieved all over the network, for every across all timetable slots. [SPT3TMS-11751]

The outcome of the TCR planning process is integrated into the capacity plan, and TCR shall optimize together the whole movements plan. [SPT3TMS-11750]

The TCR manager complements the capacity model elaborated by the Capacity Planner introducing the “negative” capacity resulting from taking into consideration the needs of the infrastructure managers to keep always in an optimal state their owned assets, keeping a clear overview on the steps to be followed during the lifecycles of TCR. [SPT3TMS-11749]

The TCR manager operates in a time horizon which spans along all planning phases in capacity planning, and his scope varies from the long-term “negative” capacity planning, harmonized and integrated with the strategic and tactical planning operated by the Capacity developers and planners, to the handling of late TCR. Therefore, he must submit a draft model in advance as well as the capacity planner does, contributing to evaluate the impact of the TCR on the overall time-space slots allocation and to receive and process the requests for change by the impacted clients. [SPT3TMS-11754]

The Temporary Capacity Restrictions manager carries out the following main tasks: [SPT3TMS-11753]

- Plans and coordinates capacity restrictions, either blocked tracks or speed restrictions. [SPT3TMS-11755]
- Facilitates the TCR Coordination process with the commonly agreed principles and methods to be used. [SPT3TMS-11759]
- Applies a predefined and agreed method to evaluate the planned and real TCR consumption. [SPT3TMS-11758]
- Liaises with Applicants and relevant stakeholders. [SPT3TMS-11757]
- Prepares of Capacity Model TCR variants. [SPT3TMS-11756]
- Integrates into the Capacity Model the TCR variants. [SPT3TMS-11762]
- Publishes TCR according to deadlines defined by Annex VII of the Directive 2012/34/EU [SPT3TMS-11761]

6.2 Capacity Production

This paragraph describes actors and related relevant roles involved in the real-time or nearly real-time supervision of the proper execution of the Operational Plan, which shall occur in a time interval which spans from few hours before to the moment when the plan comes into force. The supervision aims to ensure that the level of performances and quality defined by the infrastructure managers organization are secured. [SPT3TMS-11760]

6.2.1 Generalities

Capacity production is based on the agreed train timetable including request from the yearly or later path requests. The outputs from the capacity planning are inputs to the capacity production processes. For the operational capacity production, only that trains are included where all necessary information has been provided from the RUs side based on the RIMs Network statement. Besides the train path allocation information, a complete TAP/TAF TSI Train Composition information is necessary to manage the train run effectively and, in many cases, accept it on the railway network to manage its run. [SPT3TMS-11769]

The goal of the operational capacity production management is to ensure: [SPT3TMS-11768]

- Fulfilment of the train timetable and train paths according to the capacity model planned earlier, integrated with possibly late, ad-hoc or short-term requests, i.e. fulfilment of the overall Trains Transport Plan
- Implementation of the agreed change plan
- Management of all events affecting the running of trains
- Handling of exceptional, unforeseen events, incidents, emergencies
- Handling of traffic disruptions and their consequent deviations from operational plan
- Exchange information with neighbouring systems [SPT3TMS-11764]

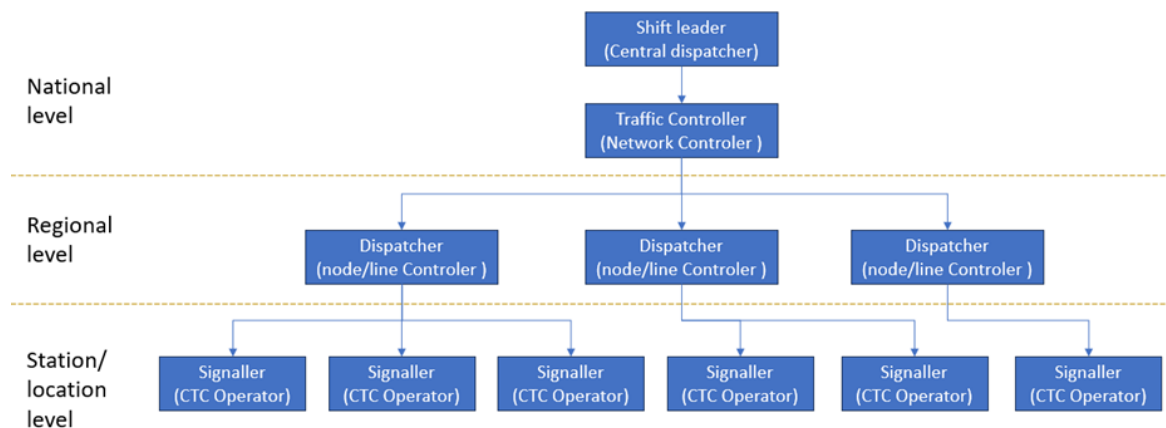
These goals are achieved by different specialized actors, using not only TMS-based features, but also by TCS subsystem. For sake of completeness, the next section 6.3 will give an overview of other actors and roles not mainly related to TMS but cooperating to fulfil the proper execution of the Operational Plan. [SPT3TMS-11763]

Capacity production processes are built on: [SPT3TMS-11766]

- Full characterization of timetable and network by a complete data model
- Continuous updating and forecasting of train times and routes
- Conflict identification and solution
- A suitable and friendly set of graphical representations which display current network and train running data [SPT3TMS-11765]

In the last years and often now the dispatching structures are set up based on a traditional approach covering three levels of traffic management: [SPT3TMS-11770]

- National level
- Regional level
- Station/location level [SPT3TMS-11767]



[SPT3TMS-11777]

Figure 1: Traditional organisational structure for Capacity Production management

The organization combines the tasks of operations management in traffic control centre for network-wide coordination of transport and in operations centres for regional operational and scheduling implementation. [SPT3TMS-11776]

The traffic control centre is the central information hub on the network for management, authorities, etc... All bodies involved in operations management are obliged to provide information to the traffic control centre. The operations control centre performs organisational and planning tasks for the respective operations control centre area as well as direct operational tasks for the respective control areas. [SPT3TMS-11779]

This layered model is continuously evolving, taking benefit of the more and more powerful tools that the current technology makes available nowadays. This leads to design wider and wider controlled areas, reducing the number of control centres and increasing the geographical scope for each of them. [SPT3TMS-11778]

This strategy is being implemented in stages. A migration plan must be prepared, focused on the context to be approached, to enable a stepwise and smooth process so that operating centres are either operated remotely from a centralized control centre or some low-level centres. [SPT3TMS-11772]

This trend is in line with the Customer Business Objectives which are the cornerstones of System Pillars program, and time has come to draw an organizational model where the management of a single station is definitively absorbed into a wider area of responsibility centralized by a single TMS Control Centre. In addition to that, this opens also other scenarios which stress even more the level of centralization, minimizing the regional one and fostering the evolution towards a full national centralization model. This is being described into [Ref. 2]. [SPT3TMS-11771]

The complexity of a Traffic Management System consists mainly in the coordination of activities aiming at fulfilling the Capacity Production Plan, which integrates the requirements submitted by the RUs. These activities always have priority over other activities. Traffic management staff have specific responsibility for traffic management results. [SPT3TMS-11774]

Actors involved in the operational capacity production management are responsible for the safety, smoothness and timeliness of train transport within the controlled district and designated area of responsibility. Their tasks are the following: [SPT3TMS-11773]

- monitor and coordinate the development of the traffic situation in their controlled area.
- be informed about the traffic situation in neighbouring controlled area.
- set up actions for prevent and remove adverse effects on the safety and smoothness of train traffic.
- control the fulfilment of the prescribed actions. [SPT3TMS-11780]

The following subsections propose a list of actors involved into the management of the Capacity production, along with their apportioned tasks. [SPT3TMS-11775]

6.2.2 Dispatcher (node/line controller)

Dispatcher

The Dispatcher is responsible to achieve the optimal system performances inside his controlled area. The dispatcher manages, organizes and coordinates train traffic, monitors and evaluates the development of the traffic situation in the assigned node/line area, including proposal of necessary measures. The Dispatcher is responsible for the fulfilment of the planned train timetable and has the ultimate responsibility for trains rescheduling inside his assigned area. [SPT3TMS-11285]

In cooperation with the Signallers (using the Traffic Control and Supervision system), he takes measures to ensure the fulfilment of the train timetable, the completeness and consistency of the input information provided by RIMs. He also assesses the allocated path of the train drawn up based on RIMs additional late path requests and, when applicable, train runs of cross-border trains crossing his area from/to a neighbouring one, evaluating the impact on the plan. [SPT3TMS-11804]

The Dispatcher scope is the real-time; he operates in a short time horizon between the current time and the next few hours (which can be configured but at most span to the next 12 hours), when the effects of occurring events are evaluated and clearly shown by TMS features, and suitable decisions to manage them can be taken. This time interval is a sliding window and flows in time, applying to all dispatchers who follow one another over time. [SPT3TMS-11803]

The Dispatcher carries out the following main tasks: [SPT3TMS-11806]

- Supervises traffic process; ensures on-time running of trains according to capacity plan and that connections between services are respected. [SPT3TMS-11284]
- Evaluates the performances of the infrastructure and rolling stock and operates to recover in case of degradation. [SPT3TMS-11286]
- On the basis of knowledge and analysis of the situation, reschedules movements in case of divergence from Operational Plan, to maximize overall system performance. [SPT3TMS-11805]
- Checks the execution of the issued measures and draw conclusions from their non-fulfilment. [SPT3TMS-11800]
- Carries out a preliminary analysis of the train run disruptions. [SPT3TMS-11799]
- Assesses the train runs of cross-border trains as well as trains passing through his assigned area to the neighbouring one. [SPT3TMS-11802]
- Triggers the transmission of the plan changes to the destination node/line. [SPT3TMS-11801]
- Manages the handover of trains among individual nodes of the dedicated RIM and between his network and neighbouring areas. [SPT3TMS-15945]
- Gets information about the situation in neighbouring areas, which might impact over the supervised traffic process. [SPT3TMS-11807]
- Informs neighbouring areas in a timely manner about the deterioration of the situation in his controlled area. [SPT3TMS-11812]
- Motivates his decisions when the RIMs service level goals are affected. [SPT3TMS-11811]
- Liaises with Operations & Maintenance Coordinator about changes occurring on infrastructure status. [SPT3TMS-11810]
- To effectively fulfil the Operational Plan, takes into account resources that are temporarily unavailable and when they will become available again. [SPT3TMS-11809]
- Liaises with appropriate external stakeholders to manage incidents. [SPT3TMS-11816]
- Shares his Capacity Plan evaluation with his manager following the national specification of the RIM. [SPT3TMS-11815]
- Alarms emergency services by interfacing the Incident Management System [SPT3TMS-11813]
- Has access to several functions via the TMS user interface: [SPT3TMS-11817]

- o Dispatcher overviews, showing where trains are, Temporary Capacity Restrictions status, Speed Restrictions status, etc., in a format suitable to effectively perform his assigned tasks. [SPT3TMS-11821]
- o Time Distance Graph (scrollable and adjustable in the extent of time defined for his role) [SPT3TMS-11820]
- o Conflict detection and resolution views. [SPT3TMS-11819]
- o Views supporting decisions, where actions for conflict resolution including train connection management are proposed. [SPT3TMS-11818]

6.2.3 Network Controller

Network Controller

The Network Controller is responsible for ensuring the quality of traffic management for the entire Traffic Control Centre and coordinates the railway operation on the railway network in connection with the work of neighbouring RIMs and railway companies. [SPT3TMS-11808]

The Network Controller organizes the activities of the dispatchers, focusing on optimal solutions to the traffic context and supervising the Production Plan for passenger and freight transport. [SPT3TMS-11824]

The Network Controller operates in a short time horizon as the Dispatcher and has his same scope, which flows in time. [SPT3TMS-11823]

The Network Controller carries out the following main tasks: [SPT3TMS-11832]

- Manages the handover of trains among individual nodes of the dedicated RIM and between his network and neighbouring areas. [SPT3TMS-11831]
- Makes fundamental decisions in the event of major disruptions to the network (when predefined actions or mitigations cannot be implemented). [SPT3TMS-11830]
- Approves the standardised customer information in the event of supra-regional incidents and creates information posters in the event of longer lasting supra-regional restrictions. [SPT3TMS-11827]
- Is responsible for notifying the top management, authorities and other defined internal and external bodies in accordance with emergency, incident and deviation management. [SPT3TMS-11826]
- Takes the responsibility of fundamental decisions regarding handling of restrictions on traffic handling, in case of large delays or disruptions, when the impact spans over an area covered by two or more dispatchers. [SPT3TMS-11829]
- For large delays or disruptions, coordinates network traffic in cooperation with the transport controller of RUs, and acts as a point of contact with the crisis team (when active). [SPT3TMS-11828]
- Keeps under control the activities on the border stations and decisive marshalling yards. [SPT3TMS-11833]
- Validates the path allocation of a train prepared based on the additional request of the RU for the routes of international trains, as well as trains passing through several nodes. [SPT3TMS-11837]
- Proposes to the Short-Term planner cancellations and services reductions in case of incidents or other divergencies which reduce the available capacity of the production plan. [SPT3TMS-11836]
- Supports dispatchers in case of emergencies. [SPT3TMS-11835]
- Acts as point of contact for foreign infrastructure managers in the event of cross-border infrastructure restrictions or deviations and ensures the distribution of relevant information to the operations control centres. [SPT3TMS-11834]
- Prepares and distributes the necessary ongoing reports for the top management. [SPT3TMS-11841]
- Is responsible for quality assurance and improvement measures to be taken on the network with the other Dispatchers. [SPT3TMS-11840]
- Distributes the relevant information to the control centre members. [SPT3TMS-11838]

6.2.4 Shift Leader

Shift Leader

The Shift Leader is responsible for the proper and effective operation of the Traffic Control Centre at national level, for the activities related to the optimal organization of the personnel shifts.

[SPT3TMS-11847]

He's the ultimate responsible for the proper implementation of the Operational Production Plan and keeps contacts with state administration authorities (Ministry of Transport, Police, Crisis Management Authorities, Environmental Authorities of the country, Nuclear Surveillance Office, relevant Regional Office of Public Health, relevant district offices, etc.). The Shift Leader represents the highest operational function in the Traffic Control Centre and is authorised to give orders to all other operational staff. [SPT3TMS-11846]

He cooperates with infrastructure managers in neighbouring and over neighbouring (ETM Network concept) areas. [SPT3TMS-11849]

It seems to be possible joining this role with the previous Network Controller role, but it is kept disjointed now for sake of clarity. [SPT3TMS-11848]

The Shift Leader carries out the following main tasks: [SPT3TMS-11843]

- Implements the shift plan previously elaborated by the Crew Manager. [SPT3TMS-11842]
- In critical situations where the personnel in service according to the plan results to be understaffed, recalls into service the standby staff. [SPT3TMS-11845]
- Liaises with the Network Controller, aligning on decisions taken for the optimal execution of the Operational Production Plan. [SPT3TMS-11844]
- Liaises with the Crew Manager, sharing decisions taken about staff allocation when necessary. [SPT3TMS-11850]
- Reallocates the responsibility of the elementary zones inside the controlled area among the dispatchers according to the specific unforeseen context. [SPT3TMS-11854]
- Acts as a front-end between dispatchers and other roles and involved in the control centre, for activities not directly related to traffic management, providing support for the solution of issues and conflicts. [SPT3TMS-11853]
- Acts as a front-end with RUs dispatchers [SPT3TMS-11852]
- Liaises with his counterparts abroad about events affecting the running of cross-borders trains. [SPT3TMS-11851]
- After aligning with the Network Controller, in justified cases, he orders or grants permission to stop trains. He notifies the relevant railway company of the train stoppage with information on the train number and stop station. [SPT3TMS-11857]
- It keeps an overview of all stopped trains on the tracks in the network and leads the evaluation of the working shift. [SPT3TMS-11856]
- He is responsible for the ongoing quality assurance and improvement. [SPT3TMS-11855]

6.3 Operational Plan Execution

The future workplaces and supporting tools (e.g. tablets) will be designed to host and integrate several applications/interfaces of different railway systems, which a single operator (if he is granted with suitable privileges) can use contemporarily in time frames where the workload permits this (non-peak periods, during public holidays, low-traffic railway lines, etc.), thus optimizing workload. The same applications/interfaces may also be used to have a more general view of the traffic situation, for monitoring only purposes. [SPT3TMS-11859]

For these reasons, it is considered useful to recall here some of the most relevant actors who are primarily using other systems to give an overall view of the activities which can be performed. [SPT3TMS-11858]

Therefore, this paragraph shortly describes actors and related relevant roles involved in the real-time execution of the Operational Plan. These actors don't actively operate on TMS to perform their assigned task, as TMS doesn't provide the necessary controlling functionalities, but take benefit of TMS monitoring functions to have an overall view of the traffic inside the controlled area. TMS monitoring features, in addition to the capabilities provided by the Traffic Control and Supervision system (TCS), support these users in performing those manual activities which are necessary in case of degraded modes or in all those cases where the system execution of the production plan is impaired by unforeseen external factors. [SPT3TMS-11861]

The description of actors and related roles gives an implicit indication of which monitoring features might be provided by TMS and supports the definition of the TCS required functionalities. The latter is out of scope of this document, which can be used by TCS team as supporting paper for their specifications. [SPT3TMS-11862]

The exchange of data among applications of different systems hosted on the same integrated workplace has to be approached. Question to be raised to and discussed with Task 2 SD4. [SPT3TMS-11860]

6.3.1 Signal Operator / Signaller (TCS Operator)

Signal Operator / Signaller

The Signal Operator / Signaller (afterwards referred to as Signal Operator for conciseness) implements the production plan and on the assigned controlled area, ensures the smooth management of traffic process and, in the event of its slowing down by prohibitive dispositions, he notifies the operation dispatcher in advance, stating the reason and the likely duration prohibition, also proposing countermeasures. [SPT3TMS-11865]

The Signal Operator is a skilled person who handles and supervises any part of the Signalling System belonging to his controlled area. Unlike Dispatchers, the Signal Operator has responsibility of performing all safety critical actions related to train movements or infrastructure operations. [SPT3TMS-11880]

The Signal Operator ensures train runs and shifts in its area according to the dispatcher's plans. He operates TCS equipment, central and manually adjusted switches, signals for running trains and for shunting, and track brakes. He determines the availability of the train path in its controlled area, monitors the running of trains and shunting, and keeps traffic records. He inspects and maintains the switches in his area. Supervises the level-crossing devices where present and operates them manually when required, checks its operation, and guards the level-crossing in the event of a malfunction. [SPT3TMS-11879]

The Signal Operator carries out the following main tasks: [SPT3TMS-11882]

- Ensures that safe movement authorities are timely requested according to the production plan, which then can be executed at the correct time. [SPT3TMS-11881]
- Is responsible for all safety critical actions performed from the Traffic Control Centre by sending controls to the elements of the Signalling System by using safe interfaces. [SPT3TMS-11876]
- Performs operations on interlockings and RBC of his assigned area, and specifically performs requests to Interlocking at the correct time when Automatic Route Setting is disabled or not working. [SPT3TMS-11875]
- Operates point switches in degraded mode or when manual actions must be performed remotely in an area where a restriction is active and: [SPT3TMS-11878]
 - o manages train traffic and ensures the overall organization of the operation in the restricted area. [SPT3TMS-11877]
 - o operates the command control system in the assigned section (sets train and shunt paths and reports the status and availability of train routes in cooperation with authorized employees). [SPT3TMS-11884]
 - o keeps the prescribed transport documentation. [SPT3TMS-11892]
- Can reset axle counters (this responsibility can be shared with the Operations and Maintenance operator). [SPT3TMS-11890]

- In exceptional and unforeseen cases, can set up restrictions at the current time over part of his controlled area liaising with personnel along the tracks. [SPT3TMS-11888]
- Operates on speed restrictions status, setting, changing speed or resetting them. [SPT3TMS-11886]
- Operates on point switches, blocking and unblocking of points (this responsibility can be shared with the Operations and Maintenance operator). [SPT3TMS-11898]
- Contacts train drivers running on his controlled area in case of disturbances and disruptions. [SPT3TMS-15944]
- Liaises with personnel active along the tracks, granting them a safe access to the railway area. [SPT3TMS-11896]
- Makes voice calls with train on-board personnel (for example, by using the telephonic system by his workplace). [SPT3TMS-11895]
- Provides trains with written orders (directly or at the order of Dispatcher). [SPT3TMS-11894]
- Cooperates with Incident Management system operators in case of emergencies in passenger transport (train delays, passenger transfers, immobile passengers, etc.), controlling and handling the impact of the event. [SPT3TMS-11901]
- Cooperates in determining the reason for diversion in train timetable (monitors compliance with timely train departures, cause exceeding the dwell times of trains) and informs the Dispatcher. [SPT3TMS-11900]
- Monitors the operational situation on the relevant IT system and, in the event of a malfunction of the IT system, notifies the event and follows the instructions of his manager. [SPT3TMS-11902]
- Performs other actions ordered by the Dispatcher or the shift manager. [SPT3TMS-11906]

6.3.2 Operation and Maintenance Coordinator

Operation and Maintenance Coordinator

The Operation and Maintenance Coordinator supervises the status of the signalling system, receives information about equipment faults, works as proactively as possible making prevention and anticipating faults, plans and monitors the intervention for repairing, prepares and publishes reports. As coordinator, he has the responsibility to assess defects, define issues priorities and organize maintainers activities. [SPT3TMS-11905]

The Operation and Maintenance Coordinator carries out the following main tasks: [SPT3TMS-11904]

- Monitors and controls the Signalling System by means of the appropriate monitoring system. [SPT3TMS-11903]
- Assesses if failures are safety relevant and applies suitable safety related processes for corrective and preventive maintenance. [SPT3TMS-11910]
- Estimates the technical impact and duration of the disruption. [SPT3TMS-12156]
- Acts as front-end between dispatchers and shift leaders, and all other maintenance actors. [SPT3TMS-11909]
- Initiates unscheduled and short-term scheduled maintenance. [SPT3TMS-11908]
- Liaises with the maintenance organisation. [SPT3TMS-11907]
- Reports on Signalling System's failure. [SPT3TMS-11911]
- When deemed necessary, due to unplanned events, requires Temporary Capacity Restriction (TCR) liaising with Signal Operators and Dispatchers. [SPT3TMS-11885]
- Updates Failure Management Plans for the Signalling System in due time. [SPT3TMS-11883]

6.3.3 Vehicle Dispatcher

Vehicle Dispatcher

The Vehicle Dispatcher oversees the targeted creation of trainsets in freight transport. [SPT3TMS-11893]

The Vehicle Dispatcher carries out the following main tasks: [SPT3TMS-11891]

- Concentrates the creation of trains in a smaller number of modernly equipped and efficient marshalling yards for the purpose of reducing both number of wagons to be reordered and number of workers and shunting devices involved. [SPT3TMS-11889]
- Speeds up the circulation of wagons and delivery of goods. [SPT3TMS-11887]
- Oversees the wagons loads at the loading station and ensures that the local service brings the wagon to the train station, where the wagon is transferred to an inter marshalling yard train till the final decisive train-forming station from which the wagon is taken to the departure track. [SPT3TMS-11899]
- Handles cleaning of the empty wagons, fuelling of Diesel locos and other activities which are necessary for their next service. [SPT3TMS-11897]

6.3.4 Switch Operator

Switch Operator

The Switch Operator is in charge of operating manually and locally adjusted switches for running trains and during shunting. He supports the Signal Operator in monitoring trains running from field. He performs inspection and operational maintenance of switches, after that safe field conditions have been set up jointly with the Signal Operator. He can operate level-crossing devices, guards the level-crossing in the event of a malfunction. His tasks are given based on the technological work procedure at the station. [SPT3TMS-11917]

The Switch Operator carries out the following main tasks: [SPT3TMS-11916]

- keeps and guards the keys to switches, derailments and track barriers, operates manually adjusted switches. [SPT3TMS-11919]
- Performs inspection and operational maintenance of switches. [SPT3TMS-11918]
- Carries out regular inspections of switches and signals, [SPT3TMS-11913]
- Monitors trains movements, when he participates in the preparation of the train route, or if he is ordered by the Signal Operator to check the end of the train. [SPT3TMS-11912]
- In the event of malfunctions of the signalling system, perform the change and securing of switches in the train path, as well as checking the availability of train path in the railway station [SPT3TMS-11915]
- performs other actions ordered by the Dispatcher or the signaller. [SPT3TMS-11914]

6.3.5 Shunting Manager

Shunting Manager

The Shunting Manager supervises the operation of the shunting locomotive and the assigned team in the designated area. He is responsible for effective, safe and timely shunting according to the station's technological procedures. [SPT3TMS-11920]

The Shunting Manager carries out the following main tasks: [SPT3TMS-11924]

- Plans shunting sequences according to the shunting plan. [SPT3TMS-11923]
- Liaises with Signal Operator for requesting shunting routes and/or shunting areas. [SPT3TMS-11922]
- Handles the communication with the Driver. [SPT3TMS-11921]
- Declares the train "completed" when all shunting activities are over. [SPT3TMS-11928]

6.3.6 Shunter

Shunter

The Shunter executes the activities according to the plan and the instructions provided by the Shunting manager, usually provided inside specific operating documents or received on adequate electronic media. [SPT3TMS-11927]

The Shunter carries out the following main tasks: [SPT3TMS-11926]

- Carries out safe shunting movements, sometimes with a shunting team. [SPT3TMS-11925]
- Unhooks and hooks wagons, stopping them with drag shoes. [SPT3TMS-11929]
- Operates hand brakes of wagons. [SPT3TMS-11930]
- Secures wagons against unintentional movement. [SPT3TMS-11931]

6.3.7 Hump yard manager

Hump Yard Manager

The Hump Yard Manager is responsible for the safe, efficient, economical and timely decommissioning and composition of trains at the hump. [SPT3TMS-11935]

The Hump Yard Manager carries out the following main tasks: [SPT3TMS-11934]

- Organizes the effective distribution of shunters during the shift according to the analysis of the load on the sorting tracks so that their use is balanced. [SPT3TMS-11933]
- Operates the track brakes when necessary. [SPT3TMS-11932]
- Manages the activities of all assigned employees of the yard. [SPT3TMS-11936]

6.4 Other roles

This paragraph shortly describes actors and related relevant roles involved in the context of the railway system, not directly using TMS or TCS but impacting or impacted by the execution of the production plan. These actors handle different applications whose goals need inputs from TMS to be performed. [SPT3TMS-11943]

Therefore, these actors are reported here for sake of completeness and to give a more complete view of the Railway process, and their roles and responsibilities are not dealt with. [SPT3TMS-11942]

6.4.1 Power Supply Dispatcher

Power Supply Dispatcher

The Power Supply Dispatcher has the responsibility of the supervision and management of the overhead line system, keeping it fully operating and planning maintenance activities liaising with TMS managers, avoiding unwanted power supply shortages. [SPT3TMS-11945]

The management of the overhead line is out of the scope of TMS but TMS interfaces the catenary management system, as planning of capacity restrictions is also impacted by the availability of the catenary; therefore it is worth to recall this role which is a key one in the organization of a centralized Traffic Control Centre. [SPT3TMS-11944]

The Power Supply Dispatcher carries out the following main tasks: [SPT3TMS-11940]

- Monitors and controls the Overhead Line system. [SPT3TMS-11939]

- Switches on and off the traction power, in case of maintenance works and for any other necessary activity. [SPT3TMS-11941]
- Liaises with Dispatchers to: [SPT3TMS-11946]
 - o establish when powering on and off the overhead line. [SPT3TMS-11950]
 - o Inform each other and coordinate their activities in the case of events (planned and unplanned) affecting train traffic and railway operations. [SPT3TMS-11949]
- Liaises with Signal Operators and Operations & Maintenance Coordinators when powering on and off the overhead line. [SPT3TMS-11948]
- Requires capacity restrictions to Capacity Planners in advance for short-term planned maintenance activities. [SPT3TMS-11947]
- Requires emergency capacity restrictions TSR from the Signal Operator when unforeseen catenary issues arise. [SPT3TMS-11953]
- He's responsible to promptly identify faults, isolate the impacted parts, plan and start repairing activities, communicating the estimation of the duration of the disruption to the Dispatchers and Shift Leaders and creating conditions for optimal operation. [SPT3TMS-11952]
- Cooperates with catenary managers who control neighbouring overhead systems exchanging information about sudden changes in the operational situation at the control points, [SPT3TMS-11951]

6.4.2 RU Dispatcher

RU Dispatcher

The basic task of the operational management of the RU dispatcher is to ensure the smooth and fluent transport of trains and mobile vehicles, while respecting the requirements of customers, concerning safety, timeliness, uniformity and economy of operation. [SPT3TMS-12537]

Operational work is a summary of the operational activities of a specified unit (according to organizational structure) for: [SPT3TMS-12536]

- train transport. [SPT3TMS-12539]
- managing the operation of freight wagons: a summary of activities that ensure the efficient and economical routing of freight wagons to ensure the requirements arising from commercial and transport activities. [SPT3TMS-12538]
- management of locomotives: a summary of activities that ensure efficient and efficient operation management of rolling stock and locomotive personnel. [SPT3TMS-12533]

The operational work in the designated district is always managed and ensured by one person. [SPT3TMS-12532]

RU employees involved in operational management are responsible for the safety, smoothness and effectiveness of operations in the district controlled by them and specified scope. [SPT3TMS-12535]

The RU Dispatcher carries out the following main tasks: [SPT3TMS-12534]

- Monitors the development of the operational situation. [SPT3TMS-12540]
- Finds out about situations in neighbouring districts. [SPT3TMS-12544]
- Orders measures leading to the elimination of deviations and adverse effects for operational work. [SPT3TMS-12543]
- Controls the fulfilment of the prescribed measures. [SPT3TMS-12542]
- Pays increased attention to the operation of certified logistics trains. [SPT3TMS-12541]
- Ensures the efficient use of allocated train paths. [SPT3TMS-12548]
- Ensures the optimal use of locomotives and its crews. [SPT3TMS-12547]

- Ensures the efficient use of the fleet of freight wagons. [SPT3TMS-12546]
- Completes the train traffic schedule. [SPT3TMS-12545]
- Handles transport in the event of accidents and emergencies. [SPT3TMS-12550]
- Manages special transports (transportation of radioactive material, transport of dangerous goods, military transport, etc.). [SPT3TMS-12549]
- Orders and secures the emergency trains in cooperation with the relevant locomotive depot. [SPT3TMS-12551]
- Provides diverted traffic routes in the event of track closures and accidents, liaising with Dispatcher. [SPT3TMS-12555]
- Coordinates and cooperates with dispatchers of other organisations (IMs, RUs, terminals), [SPT3TMS-12554]
- Notifies to designated management employees in case of declared: [SPT3TMS-12553]
 - o emergency, [SPT3TMS-12552]
 - o exceptional situation, [SPT3TMS-12558]
 - o state of war, [SPT3TMS-12557]
 - o declaration of war. [SPT3TMS-12556]

6.4.3 Information Operator

Information Operator

The Information Operator is responsible for customer information within the assigned control areas. [SPT3TMS-11960]

Using suitable tools provided by the Customer Information Centre, it ensures that customers are informed in real-time about traffic operations inside the controlled area, centralizing and handling all visual and audible information of interest for final users. [SPT3TMS-11959]

The Information Operator carries out the following main tasks: [SPT3TMS-11962]

- Prepares/revises data for customer information systems in a correct, up-to-date and complete form. [SPT3TMS-11961]
- Monitors visual and audible peripherals automatic at stations for passenger information. [SPT3TMS-11956]
- Using all available communication channels, informs customers in the event of deviations. [SPT3TMS-11955]
- Manually updates visual and audible passenger information in stations overriding those provided by underlying systems in case of divergences. [SPT3TMS-11958]
- Provides audible passenger information into trains in case of divergences, according to RUs directives. [SPT3TMS-11957]
- Carries out the complete documentation of customer information measures. [SPT3TMS-11964]
- Keeps the overview of information regarding actual train running and delays: [SPT3TMS-11971]
 - o Train connections [SPT3TMS-11969]
 - o Timetable/Online Production Plan [SPT3TMS-11967]
 - o etc [SPT3TMS-11965]
- Liaises with Dispatchers and RUs operators. [SPT3TMS-11978]
- Provides information to Local Information Staff. [SPT3TMS-11976]

6.4.4 Post-execution analysis Operator

Post-execution analysis Operator

The Post Execution Analysis Operators shall take care of the result of the execution of the operational plan and evaluates it according to specific KPIs. Such analysis aims to optimize railway systems in a feedback loop. [SPT3TMS-11974]

According to [Ref 3], aspects generally referred to as “Post Execution Analysis” are considered not in scope of CMS / TMS system and so do operators to them assigned, but they shall be intended as participating in the information flow from the TMS / CMS system perspective. [SPT3TMS-11973]

The Post-execution analysis Operator carries out the following main tasks: [SPT3TMS-11981]

- Infrastructure Utilization analysis [SPT3TMS-11980]
- Capacity Utilization analysis [SPT3TMS-11982]
- Train Performance analysis [SPT3TMS-11986]

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7 Neighbouring Entities

The TMS interfaces a number of neighbouring systems, exchanging with them a set of information which are necessary for all of them to perform their apportioned functionalities, so as to build an overall railway system performing in an optimal way. [SPT3TMS-11985]

Afterwards, these entities are recalled, along with a short description of their goals. [SPT3TMS-11984]

7.1 Traffic Control and Supervision

Traffic Control and Supervision entity

The Traffic Control and Supervision system, as stated also in [Ref. 5], elaborates and executes the Capacity Plan as provided by the Traffic Management System, supervising the train movement in any operation mode safely, from a location to another according to the operational plan. [SPT3TMS-11983]

In the opposite direction, TCS provides TMS with real-time information about trains position and infrastructure status, along with the relevant trains characteristics, necessary to identify how the train moves along the assigned path and then evaluate its precise forecasted trip. [SPT3TMS-11990]

TCS shall perform any safety related command which is needed to be issued to the interlocking or ETCS subsystems and is provided with an adequate set of HMI interfaces to accomplish its functions. [SPT3TMS-11989]

Therefore, TCS performs all fully supervised train movements, supporting all the activities which start from the train composition at the marshalling yard, including train formation by joining and splitting when necessary, to the final end of the trip according to the operational plan; TCS supports the change of train direction when the train, reached its end, reverts with a different service ID. TCS provides also means to manual operate on trackside field objects, and manages speed restrictions and possessions, as well as constructions works. [SPT3TMS-11988]

TCS communicates with its neighbouring peers to accept incoming trains and handover outgoing ones. [SPT3TMS-11987]

7.2 Customer Information Centre

Customer Information Centre entity

The Customer Information Centre handles customer information related to traffic process, within the control area assigned operations management centre. The Customer Information Centre receives from TMS the current Production Plan, updated in real-time, with scheduled data, trains forecasted path, current infrastructures status, elaborates and publishes this information on its peripherals, ensuring that customers are promptly informed about traffic status, divergencies and measures taken to mitigate disruptions and recover to the planned service. [SPT3TMS-11991]

The area controlled by the Customer Information Centre may partially or fully overlap with the area controlled by the TMS control centre, but can be even wider, depending on the technical equipment or specific regulations. [SPT3TMS-11963]

7.3 Incident Management System

Incident Management entity

The main goal of the Incident Management System is to operate as a central source of critical network operations monitoring in a railway system (and not only), required to support traffic management requests and decisions coming from TMS and other actors inside the Traffic Control Centre, which need capabilities and means not provided by the railway systems. [SPT3TMS-11972]

The Incident Management System monitors well-known incidents as provided by TMS and diagnostic systems, collects information about occurred disruptions, impacted trains, overall impact analysis (provided by TMS), data external to the railway traffic process, as extreme weather conditions or relevant events in the cities useful to give more insights for classifying and anticipating services disruptions; these data are processed to generate statistical analytics (KPIs and dashboards) as well as APIs for publishing raw and processed data to other systems. At the same time, making use of different techniques, even AI based, the Incident Management System proposes, sets up and coordinates those actions which are

necessary to intervene on the railway system assets to restore the nominal situation and which cannot be taken by railway systems as beyond their capabilities (e.g., as prompt intervention of firemen to put out a fire). [SPT3TMS-11970]

This system then focuses on the operational management of traffic in the event of a crisis situation, where this term has to be considered in its wider interpretation and among others the following events are considered: [SPT3TMS-11968]

- martial law,
- state of emergency (mass civil unrest – terrorism, vandalism, etc.),
- state of emergency (natural disasters – earthquakes, floods, snow disasters, etc., accidents – industrial, operational, transport, in which there was a leak of dangerous substances, injury or death of persons),
- evacuation based on the requirements of the state administration in the field of traffic security,
- mass transport of passengers (during important sports, cultural and other social events),
- restrictions on railway operations during the liquidation of the consequences of accidents, incidents, operational malfunctions, and other extraordinary events (technological failures – power outages, information system failures, notification of explosives, discoveries of unknown substances, theft of material and damage to RIMs property, etc.),
- strike emergency and strike. [SPT3TMS-11966]

For these situations, it is necessary to organize the management activity primarily according to the valid provisions of the relevant regulations and instructions of the competent authorities, to restore the normal state. Designated employees of the dispatching staff must be familiar with the methodology for declaring the degree of threat to railway operations during operation in the winter season, with the location and method of ordering recovery and emergency resources, and further with all diversion routes and the conditions of their use. [SPT3TMS-11979]

In the case of ensuring the evacuation of the territory of the relevant territorial unit through RIM, the evacuation plans of the relevant territorial unit must be known and available. In the event of accidents and extraordinary events in transport, all employees involved in the management of train traffic (even those who do not belong to the RIM dispatch apparatus) are obliged to cooperate in the implementation of measures, according to the instructions of the relevant crisis teams. [SPT3TMS-11977]

8 CMS Capabilities

The main functionalities needed for the Capacity Management System (long and short term planning, late and ad-hoc requests management) are the following: [SPT3TMS-11975]

Import the railway topological model from the Asset Management Data system. [SPT3TMS-11999]

Handle the coexistence of more versions of the topological model. [SPT3TMS-11998]

Build a Capacity Plan for the controlled area. [SPT3TMS-12001]

Build a Capacity Model for the controlled area [SPT3TMS-12000]

Build the yearly capacity plan for the controlled area [SPT3TMS-12004]

Build variants of the Capacity Plan to apply in case of needs ("emergency timetables") [SPT3TMS-12015]

Calculate the optimal path for every train of the Capacity Plan [SPT3TMS-12013]

Maximize the exploitation of the railway infrastructure of the controlled area, in terms of availability of the time-space slots of the network resources [SPT3TMS-12011]

Handle availability/unavailability of the infrastructure resources [SPT3TMS-12009]

Build a strategic and tactical plan for the possessions and speed restrictions ("negative capacity") [SPT3TMS-12023]

Support the simulation processes to perform the studies aiming to determine how train paths and infrastructure planning fit inside a feasible timetable [SPT3TMS-12021]

Handle late paths and ad-hoc requests and integrate them into the yearly timetable [SPT3TMS-12019]

Detect and solve Planning conflicts [SPT3TMS-12018]

Handle requests for timetable and TCR modifications (adding new paths, modifying or deleting an existing path) [SPT3TMS-12026]

Implement a Human Machine Interface with a full set of Graphical and Tabular views, suitable for performing all planning activities and displaying/processing stored data. [SPT3TMS-12025]

Interface the Traffic Management system to deliver and update the Capacity Plan [SPT3TMS-12028]

Interface other planning and timetable publishing systems to deliver and update the Capacity Plan [SPT3TMS-12036]

Interface ROC owned systems to handle path requests, import vehicle and other types of functional data and export and update the Capacity Plan [SPT3TMS-12035]

Interface an external secure Identity and Access Management system for managing digital identities (human users and assets) and roles for authorisation and single-sign on [SPT3TMS-12034]

Interface an external secure Public Key Infrastructure system for receiving certificates and their status and thus ensure secure communication [SPT3TMS-12033]

Interface an external Secure Time Synchronisation system, to guarantee a secure time synchronisation necessary to validate certificates. [SPT3TMS-12043]

Interface an external Domain Name System, for name resolution to map domain names to IP addresses. [SPT3TMS-12041]

Interface an external Network Access Control system, for identifying, authenticating, and authorizing network access [SPT3TMS-12039]

9 TMS Capabilities

The main functionalities needed for traffic management (dispatching) are the following:

[SPT3TMS-11992]

Achieve field data and train position updates [SPT3TMS-12038]

Organize and display a wide set of train and infrastructure information necessary to support TMS actors in managing the execution of the production plan [SPT3TMS-12045]

Represent trains position and status of infrastructure on a time-space diagram (Train Graph, TG) [SPT3TMS-12005]

Provide a wide set of views where all data necessary to monitor and control the execution of apportioned capabilities are grouped into homogeneous sets [SPT3TMS-12002]

Perform all necessary variations to the Production Plan, according to the current traffic situation, in terms of replanning: [SPT3TMS-12016]

1. Cancellation of a train, or part of it
2. Execution of an additional train
3. Change of train path
4. Change of connections
5. Change of resource allocation (rolling stock)

[SPT3TMS-12042]

Performing all necessary variations to the Production Plan, according to the current traffic situation, in terms of decision: [SPT3TMS-12020]

1. Change of route
2. Change of track
3. Change of platform
4. Change of arrival time
5. Change of departure time
6. Change of driving strategy

[SPT3TMS-12044]

Evaluate a precise traffic forecasting for every train, including sectional run time calculation to update the operational plan based on current positions of trains, availability of assets and mutual influence of trains. [SPT3TMS-12040]

Dynamically update the availability status of infrastructure resources [SPT3TMS-12008]

Set / Reset / Update the status of Infrastructure Restrictions [SPT3TMS-12007]

Detect conflicts for future traffic situations [SPT3TMS-12006]

Solve detected conflicts according to a specific objective function [SPT3TMS-12003]

Manage the impact of incidents and deviations with respect the Capacity Production Plan [SPT3TMS-12017]

Interface an external secure Identity and Access Management system for managing digital identities (human users and assets) and roles for authorisation and single-sign on [SPT3TMS-12014]

Interface an external secure Public Key Infrastructure system for receiving certificates and their status and thus ensure secure communication [SPT3TMS-12012]

Interface an external secure Time Synchronisation system, to guarantee a secure time synchronisation necessary to validate certificates. [SPT3TMS-12010]

Interface an external Domain Name System, for name resolution to map domain names to IP addresses. [SPT3TMS-12024]

Interface an external Security Logging system, for collecting log messages [SPT3TMS-12022]

Interface an external Network Access Control system, for identifying, authenticating, and authorizing network access [SPT3TMS-12027]

Interface the Traffic Control and Supervision system [SPT3TMS-12031]

Interface the Incident Management system [SPT3TMS-12030]

Interface the Capacity Management system [SPT3TMS-12037]

Interface neighbouring Traffic Management Systems [SPT3TMS-12029]

Manages a telephonic connection with the train driver [SPT3TMS-13741]

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