



ERJU SYSTEM PILLAR

# Operational Requirements Specification CCS System



# Operational Requirements Specification - CCS System

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Abstract	This document contains all Operational Requirements to be fulfilled by the CCS system. Stakeholder Requirements are derived from System Pillar high level targets.
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# 1 Preamble


## 1.1 Purpose





This document includes all the operational requirements defined for the CCS system. Operational requirements are precise requirements of stakeholders for the system of interest. They are derived from railway requirements and the operational analysis.





## 1.2 Intended audience

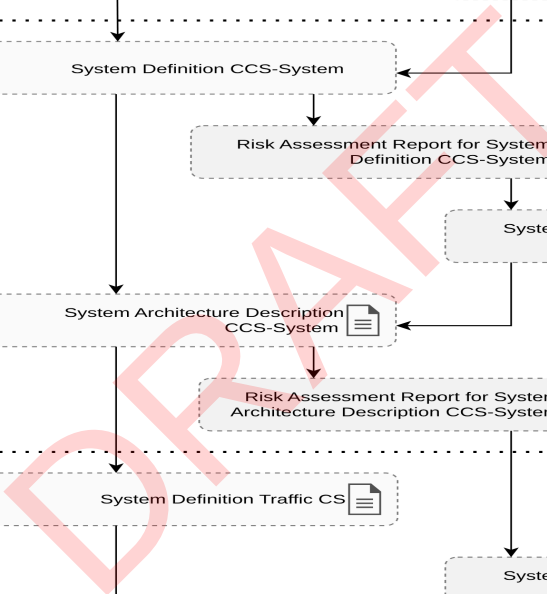
This document is intended for all stakeholders involved in the development, implementation, and operation of CCS systems (e.g. Business stakeholders, End users, Development and engineering teams, Assessors, etc).

## 1.3 Document context

As shown in  SPP-31450 - Dependencies between Configuration Items , the Operational Requirements Specification is based on the following inputs:

-  SPP-19162 - OD\_Operational Vision Breakdown Alignment CCS System\_V0.3]: This document derives the Operational Requirements and the Stakeholder Requirements from the  SPP-19402 - Operational Vision (Nov. 2022)]. The  SPP-19402 - Operational Vision (Nov. 2022)] itself is derived from the  SPP-8684 - System Pillar Common Business Objectives (May 2022)].

The  SPP-18355 - EET\_Systems Engineering Management Plan\_V4.0  explains in more detail the dependencies between the different documents.  SPP-31450 - Dependencies between Configuration Items below shows the Operational Requirement Specification CCS-System in the context of the overall document list (see also  SPP-19283 - Release Note ESPR1.0]).



ID	SPP-31450
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## 1.4 Glossary

### 1.4.1 Terms and definitions

Term	Definition
Co-operative Shortening of MA	Co-operative Shortening of MA is a special procedure between Traffic CS and Train CS to shorten a given Movement Authority.
Driver Machine Interface (DMI)	Train device to enable communication between the ETCS on-board and the driver.
End Of Authority	Location up to which a train or a shunting composition is authorised to proceed.
Grade of Automation	GoA - Grade of Automation
MOVEMENT AUTHORITY	Permission for a train to run to a specific location within the constraints of the infrastructure.
Passenger transfer	Passenger transfer is the process where a passenger enters, leaves or switches from one train to another.
Release speed	Maximum speed at which a train is allowed to reach the end of its MA.
Scheduled stop	Planned stop for commercial or operational reasons.
Shunting movement	Way of moving vehicles without train data and controlled by shunting orders.
Single European Railway Area	Defining the fundamental design principles and process for adopting a functional architecture for rail as a system, with a focus on CCS, CMS and TMS supporting the implementation of the SERA (Single European Railway Area)
Stopping point	A location identified in the schedule of a train where the train is planned to stop, usually to carry out a specific activity such as allowing passengers to join and leave the train.
Switched Off	Switched Off is one of the possible states of logical and physical Output Channels and logical and physical Input Channels with the interpretation, that in this state, no voltage is given resp. no current flows.
Trip	Irrevocable application of the emergency brakes by ETCS until the train/shunting composition is at a standstill.
Unsupervised movement	The unsupervised movement is not under the supervision of the CCS system. So, there is no Movement Authority like OS or FS. During this type of movement the Signaller and Driver have the responsibility for ensuring the safety and control of the train in the absence of the supervision by the CCS system.

### 1.4.2 Abbreviations

Abbreviation	Definition
COSMA	Co-operative Shortening of MA
EOA	End Of Authority
GoA	Grade of Automation
MA	MOVEMENT AUTHORITY
SERA	Single European Railway Area

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## 2 Operational Requirements derived from railway requirements

### CCS shall comply with the relevant CENELEC standards

CCS shall comply with the relevant CENELEC standards (e.g. EN 50126, EN50128, EN50129, EN50159, EN50176).

ID	SPP-6591
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**An harmonized process shall be defined to automatize and optimize the activation and deactivation of planned usage restriction and to define the role or tasks carried out by trackside personnel and non-trackbound vehicles during those restrictions.**

An harmonized process shall be defined to automatize and optimize the activation and deactivation of planned usage restriction and to define the role or tasks carried out by trackside personnel and non-trackbound vehicles during those restrictions.

ID	SPP-6679
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**An harmonized process shall be defined to automatize and optimize the activation and deactivation of unplanned usage restriction and to define the role or tasks carried out by trackside personnel and non-trackbound vehicles during those restrictions.**

An harmonized process shall be defined to automatize and optimize the activation and deactivation of unplanned usage restriction and to define the role or tasks carried out by trackside personnel and non-trackbound vehicles during those restrictions.

ID	SPP-6680
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**An harmonized process shall be defined to supervise all possible track users**

An harmonized process shall be defined to incorporate the non-track-bound track users (e.g. excavator, crane) or mobile objects (e.g. a locatable construction site boundary marking device) or a localized person (e.g. passenger counters at the platform) or trackside personnel into the safe supervision process - similar to what is used currently for train supervision. The process shall show how the different sources of sensors' information is integrated.

ID	SPP-6683
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**An harmonized process shall be defined to deal with remote train operation (RTO) including remote terminals (trackside or onsite).**

An harmonized process shall be defined to deal with remote train operation (RTO) including remote terminals (trackside or onsite).

ID	SPP-6686
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**Defined application configuration(s) to supervise operational production of all types of infrastructure needs and users and to automatically trigger event-related mitigations or corrective measures.**

Defined application configuration(s) shall guarantee :

- the ability to supervise operational production of all types of infrastructure needs and users (track-bound or non track-bound) against predefined or dynamic targets related to resources condition and availability;
- the ability to automatically trigger event-related mitigations or corrective measures

ID	SPP-6817
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**CCS shall rely on a standardized set of manual controls for normal operations, based on harmonised operational rules**

CCS shall rely on a standardized set of manual controls for normal operations, based on harmonized operational rules. This approach minimizes national variations in Generic Applications.

ID	SPP-6858
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**CCS shall rely on a standardized set of manual controls for degraded operations, based on harmonized operational rules**

CCS shall rely on a standardized set of manual controls for degraded operations, based on harmonized operational rules. This approach minimizes national variations in Generic Applications.

ID	SPP-6859
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**The operational processes involving trackside personnel and non-trackbound vehicles shall be optimized, in order to reduce their impact on railway operations.**

The operational processes involving trackside personnel and non-trackbound vehicles shall be optimized, in order to reduce their impact on railway operations.

ID	SPP-6881
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**Signaller shall have a visual representation of the complete, consistent and accurate status of the operational situation**

Signaller shall have a visual representation of the complete, consistent and accurate status of the operational situation in order to react to incidents that have the potential to limit the railway safety and track capacity.

ID	SPP-6932
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**Signaller shall have a visual representation of malfunctioning devices and their impact on the operational situation**

Signaller shall have a visual representation of malfunctioning devices and their impact on the operational situation in order to initiate appropriate measures in case of equipment failure.

ID	SPP-6935
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**An harmonized process shall be defined to automatically warn and advise trackside personnel, non-trackbound vehicles, and tagged objects**

An harmonized process shall be defined to automatically warn and advise trackside personnel, non-

trackbound vehicles, and tagged objects (during e.g. maintenance work, construction work, shunting work) near the track in a rapid, efficient, cheap, reliable and safe way.

ID	SPP-6952
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**An harmonized process shall be defined to access and entry of a construction site vehicle**

An harmonized process shall be defined to access and entry of a construction site vehicle (e.g. excavator, yellow fleet) into the construction site area.

ID	SPP-6953
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**An harmonized process shall be defined to locally operate trackside assets or local maintenance of trackside assets and define the role of Field Force during this operation.**

An harmonized process shall be defined to locally operate trackside assets or local maintenance of trackside assets and define the role of Field Force during this operation.

ID	SPP-6954
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**An harmonized process shall be defined to perform manually train composition and define the role of Field Force and Driver during this operation.**

An harmonized process shall be defined to perform manually train composition and define the role of Field Force and Driver during this operation.

ID	SPP-6955
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**Real time management of routine operational production procedures**

Predefined procedures shall be defined for ensuring real-time optimization of railway operation.

ID	SPP-7067
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**Automated routine operational production procedures for train movements or shunting movements**

Operational production procedures shall support the automated and/or the unattended execution of the processes related to routine train movements or shunting movements; i.e. the processes executed during 'normal' operation and the processes that are routinely used for the management or recovery of degraded situations.

ID	SPP-7071
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**Automated routine operational production procedures for field force work**

Operational production procedures shall support the automated execution of the processes related to field force work (e.g. granting possessions for construction sites, track access for maintenance teams, warning processes, or the change of a point position that a maintenance team needs).

Note:

This includes, for example following operational processes: automatic warning of trackside personnel, management of slow speed sections and possessions, access and entry of a construction site vehicle

(e.g. excavator, yellow fleet) into the construction site area, lubrication of points, composition of freight trains.

ID	SPP-7072
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**An harmonized process shall be defined to report, store and distribute diagnosis information to/from a centralised system.**

An harmonized process shall be defined to report, store and distribute diagnosis information to/from a centralised system.

ID	SPP-9681
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**Standardisation and automation of operational processes to reduce training and increase safety of personnel**

CCS shall support the standardisation and automation of operational processes involving trackside and on-board personnel and non-trackbound vehicles, in order to reduce training effort and increase safety.

ID	SPP-9935
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**Application configurations shall support backward compatibility**

With exception of the first configuration, CCS application configurations shall AFARP support interoperability among mixed-generation of subsystems, on behalf of the backward compatibility.

ID	SPP-7664
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**Procedures and their implementation rules variations shall be harmonized**

The railway operation production procedures and their implementation rules variations - e.g. existing engineering rules that support the Railway System's progressive functional evolution paths - shall be harmonized.

ID	SPP-7699
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**An harmonised process shall be defined to systems configuration during rail operation**

An harmonised process shall be defined to systems configuration during rail operation

ID	SPP-8624
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**An harmonized process shall be defined to run diagnose test of a component during running time**

An harmonized process shall be defined to run diagnose test of a component during running time.

ID	SPP-8625
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**An harmonized process shall be defined to mitigation measures to react in case of an incident**

An harmonized process shall be defined to mitigation measures to react in case of an incident (e.g. track section sweeping, deploying/requesting unplanned maintenance routines, etc.)

ID	SPP-8650
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**An harmonized process shall be defined to show the driver optimal energy-efficient driving and an optimised driving speed profile recommendations**

An harmonized process shall be defined to show the driver optimal energy-efficient driving and an optimised driving speed profile recommendations.

ID	SPP-8840
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#### **An harmonized process shall be defined to automatically or semi-automatic trigger pre-defined mitigation measures**

An harmonized process shall be defined to automatically or semi-automatic trigger pre-defined mitigation measures based on recognition of abnormal events in the railway production using real-time "sensor fusion" information.

ID	SPP-9037
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#### **Manned intervention in automated operation**

Where automated operation is provided, standardized operational procedures shall be readily to an operator while ensuring safety, production capacity and automation at the highest possible level.

ID	SPP-7083
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#### **Automated regulation of infrastructure resources deployment**

Operational production procedures shall allow for automated regulation of rail traffic and of deployment of CCS resources.

All the operational production needs, such as the use of available technical/physical or human resources shall be regulated with automation.

ID	SPP-7107
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#### **Harmonized and scalable railway operation production**

The railway operation production shall be harmonized regardless of the framework conditions such as the number of trains and infrastructure elements to be managed, the size of the area, the amount of data to be processed or even new functionalities.

ID	SPP-7123
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#### **Harmonised SERA operational rules**

Railway operation shall be based on harmonised operational concept and harmonised operational rules in order to support a Single European Railway Area (SERA)

ID	SPP-7129
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#### **Operational production shall support Migration**

The operational production routines and procedures shall support affordable migration and manage the movement of mixed fleets accepting also partially supervised trains.

Note: in this context 'migration' is not strictly associated to the migration from current class A and B systems (legacy) to the target system, but the evolutionary paths within the capabilities/configurations of the target system

ID	SPP-7198
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#### **For non safety critical systems, an harmonized process shall be defined to configure new rules to automatically or semi-automatic trigger pre-defined mitigation measures**

For non safety critical systems, an harmonized process shall be defined to configure new rules to automatically or semi-automatic trigger pre-defined mitigation measures based on recognition of abnormal events in the railway production using real-time "sensor fusion" information.

ID	SPP-9038
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**An harmonized process shall be defined to automatically or semi-automatic detect abnormal events in the railway production using real-time "sensor fusion" information.**

An harmonized process shall be defined to automatically or semi-automatic detect abnormal events in the railway production using real-time "sensor fusion" information.

ID	SPP-9041
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**An harmonized process shall be defined to display dynamically pre-defined assistive information**

An harmonized process shall be defined to display dynamically pre-defined assistive information (e.g. proposing workflows, alternatives) to the operator when an abnormal event in the railway production (in a specific situation or location) is detected to facilitate the execution of the operator's activities.

ID	SPP-9042
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**An harmonized process shall be defined to support automated , efficient and fully supervised joining manoeuvres**

An harmonized process shall be defined to support automated , efficient and fully supervised joining manoeuvres.

ID	SPP-9043
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**Categorisation of system components and functional variations according to application configuration(s).**

Changes of functionality to subsystem components, and changes to system component's capabilities or

interfaces, to support the Railway System's progressive functional evolution paths shall be categorised according to its applicable configuration(s)

ID	SPP-11716
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**Automated portions of processes "hidden" to the interfacing actor(s)**

Functional procedure variants within a capability which have no impact to an interaction actor/system shall be AFARP implemented through functional automation.

ID	SPP-12094
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**An harmonized process shall be defined to support automated splitting manoeuvres**

An harmonized process shall be defined to support automated splitting manoeuvres.

ID	SPP-9045
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**Support for efficient rollout processes**

The CCS shall support a predefined and efficient rollout process for specific configurations.

ID	SPP-9301
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**PRAMSS targets agreed by all the stakeholders**

The definition of the PRAMSS targets shall consider a balance between the needs of all System Pillar stakeholders, the output of a risk analysis and the costs needed to meet such targets.

ID	SPP-9470
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**An harmonized process shall be defined to incorporate additional standard subsystems sensory information sources**

An harmonized process shall be defined to incorporate additional standard subsystems sensory information sources into the supervision procedures on run time ("plug-and-play").

ID	SPP-6989
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**The operational processes shall be simplified in order to optimize as much as possible the commercial and operational production processes within the Railway System boundary.**

The operational processes shall be simplified in order to optimize as much as possible the commercial and operational production processes within the Railway System boundary.

ID	SPP-7051
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**A process shall feature the ability of executing rolling stock routine manoeuvres for commercial operational production.**

Based on defined application configuration(s), a process shall feature the ability of executing rolling stock routine manoeuvres for commercial operational production (including shunting/marshalling yard operations) under the complete safety supervision of CCS.

*Note: complete safety supervision is meant as a minimum as the supervision of all the variables which are today supervised in the mode "FS", and it is independent of GoA levels. This does not preclude that with advancement of technology, "complete supervision" could include the supervision which is total*

*undertaken by a Driver. Variables are configured to support risk mitigation related to the procedure, which is also interlinked with trackside CCS safety supervision. E.g.: Override by driver-actor is only allowed onboard if the trackside has allowed it based on the required imposition of mitigation measures; or shunting within AoC is supervised with regards its path (including and of authorised path) and speed; etc.*

ID	SPP-7052
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**An harmonized process shall defined to execution safety-related mitigation measures for Track Workers protection**

An harmonized process shall defined to execution safety-related mitigation measures for Track Workers protection - e.g. warnings initialisation, emergency train-braking application commands, etc.

ID	SPP-7055
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**An harmonized process shall be defined to acquire data configuration related with railway infrastructure**

An harmonized process shall be defined to acquire data configuration related with infrastructure

ID	SPP-14116
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### 3 Operational Requirements derived from operational analysis

**A procedure is required to move a train which stopped short of the expected stopping location, if it cannot be moved in a supervised mode.**

A specific procedure shall be defined for allowing the train driver/ATO to reach the target position in case the train has been stopped short of the expected stopping location and the MA available on-board does not allow the train to be moved until the correct stopping location.

ID	SPP-23764
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**The Signaller and the Driver shall rely on a specific procedure even for managing situations when the next operational next is not known**

ID	SPP-18575
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#### Automatic triggering

It shall be possible to automatically trigger the co-operative shortening of MA based on real-time updates to the train's timetable.

ID	SPP-6674
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**The activation of planned TSRs is fully managed automatically by the Trackside CCS**

Planned TSRs are stored in the Trackside CCS. The selection of parameters (conditions for the activation, extension, time validity, ecc.) of the stored TSRs is a matter of the planned activity.

ID	SPP-15031
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**The activation of planned TSRs requests a signaller confirmation only for specific cases**

The activation of planned TSRs requests a signaller confirmation. Ex: in case the speed limit is lower than the speed allowed for not supervised train movements. The confirmation can be given after the signaller has taken the responsibility of managing the not supervised train movement.

ID	SPP-15032
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#### Update log

The **System** shall log the temporary speed restriction deactivation, when the temporary speed restriction is deactivated and no longer indicated on the signalling control display,

ID	SPP-6133
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**The Train Driver shall be able to switch off the Train**

The Train Driver shall be able to switch off the Train

ID	SPP-25172
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#### Stop at correct location

The train shall be able to move in case of stopping point overshooting or stopping short.

Manual forward and backward movement shall be allowed for the train driver in case of stopping short or overshooting the stopping point.

ID	SPP-9607
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#### Approaching stop location - GoA1

If the train operates in GoA1, the approach shall be managed manually by train driver. The train driver

shall stop the train at the correct position on the platform, to accurately approach a stopping point, e.g., to be able to use station platform length or protection equipment for opening the doors on the correct side.

ID	SPP-9600
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#### Stopping point close to an EoA

When the scheduled stopping point is near the EoA, the train shall approach the EoA as closely as possible.

The use of release speed shall be considered if the stopping point is close to an EoA. The train doors are finally opened.

ID	SPP-9595
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#### Scheduled stopping point

The scheduled stopping point shall be before or at the EoA indicated on the DMI but must not exceed it. The stopping point shall consider the location of points that should not be unnecessarily occupied by the rear end of the train.

ID	SPP-9593
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#### On-board indication of stop location to train driver

The train driver shall have a clear indication of the most suitable location for its service on the track, according to the length of the train, preferably by means of on-board indications.

ID	SPP-9612
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#### Audible information regarding approach to stopping point

If GoA2 is not implemented, an audio solution shall be used to inform the train driver when approaching the stopping point, rather than on-board indications displayed on the DMI.

ID	SPP-9610
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#### Approaching stop location - GoA2

If the train operates in GoA2, the approach can be managed automatically by Onboard CCS or manually by the train driver. Onboard CCS shall drive the train and stop the train at the correct position on the platform.

ID	SPP-28689
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#### Ensure safe passenger transfer

Ensuring safe passenger transfer until the doors are confirmed correctly closed, according to infrastructure manager and railway undertaking specific rules.

ID	SPP-9439
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#### Facilitate coordination of actors for timely departure and optimal capacity use

The actors and entities involved in the passenger transfer process shall exchange information relevant to the departure time as much as possible, depending on the technical means available.

ID	SPP-9432
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#### **Reduce the risk of tripping a train**

The Trackside CCS shall support the Signaller in selecting a suitable stopping location to which an MA for a train is shortened, to help ensure that trains are not tripped unnecessarily.

ID	SPP-27377
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#### **Reduce commands**

To avoid mistakes, the options (commands) available to revoke a given authorisation should be as few as possible.

ID	SPP-27380
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#### **Creating a safe train path depending on the actual situation of infrastructure and train's location and based on the plan managed by Traffic Management.**






During the regular supervised movement of a train a safe path shall be created for it and allocated as an updated Movement Authority. This path shall depend on the actual situation of infrastructure and train's location and shall be based on the Automatic Operational Plan managed by the Plan Execution System.

ID	SPP-23860
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## 4 Appendix

### 4.1 References

Id	Description	Reference
[  SPP-18362 - EET_Requirements Management Plan Version_1.0]	For System Pillar the plan describes a strategy for traceability between requirements levels, architecture elements and application conditions. Further the type of requirements and their related workflows are defined.	Link
[  SPP-19162 - OD_Operational Vision Breakdown Alignment CCS System_V0.3]	Operational Vision Breakdown Alignment	Link
[  SPP-19402 - Operational Vision (Nov. 2022)]	This document sketches a compressed operational picture of the CCS and TMS/CM future.	Link
[  SPP-19283 - Release Note ESPR1.0]	This Release Note describes the scope of the ESPR1.0.	Link
[  SPP-8684 - System Pillar Common Business Objectives (May 2022)]	Common Business Objectives (CBO) – targets and improvements - to guide the development of the outputs of the System Pillar within Europe's Rail Joint Undertaking.	Link

## 4.2 Open points

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No open points

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