

English Version

**Railway applications - Urban guided transport management and
command/control systems - Part 3: System requirements
specification
(IEC 62290-3:2025)**

Applications ferroviaires - Systèmes de contrôle/commande
et de gestion des transports guidés urbains - Partie 3:
Spécification des exigences système
(IEC 62290-3:2025)

Bahnanwendungen - Betriebsleit- und
Zugsicherungssysteme für den städtischen
schienengebundenen Personennahverkehr - Teil 3:
Systembezogene Anforderungsspezifikation
(IEC 62290-3:2025)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 9/3168/FDIS, future edition 2 of IEC 62290-3, prepared by TC 9 "Electrical equipment and systems for railways" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62290-3:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2026-05-31 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2028-05-31 document have to be withdrawn

This document supersedes EN IEC 62290-3:2019 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62290-3:2025 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62290-1	2025	Railway applications - Urban guided transport management and command/control systems - Part 1: System principles and fundamental concepts	EN IEC 62290-1	2025
IEC 62290-2	2025	Railway applications - Urban guided transport management and command/control systems - Part 2: Functional requirements specification	EN IEC 62290-2	2025

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Railway applications – Urban guided transport management and
command/control systems –
Part 3: System requirements specification**

**Applications ferroviaires – Systèmes de contrôle/commande et de gestion des
transports guidés urbains –
Partie 3: Spécification des exigences système**

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U. AN TIÊU CHUẨN TC 2547

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RAILWAY APPLICATIONS – URBAN GUIDED TRANSPORT MANAGEMENT AND COMMAND/CONTROL SYSTEMS –

Part 3: System requirements specification

FOREWORD

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IEC 62290-3 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways. It is an International Standard.

This second edition cancels and replaces the first edition published in 2019. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the last maintenance of IEC 62290-1 is taken into account, in particular the changes made for describing the external environment of UGTMS;
- b) the last maintenance of IEC 62290-2 is taken into account, as IEC 62290-3 is using the requirements defined in the latter. Therefore, the document reflects the deleted functions and requirements in IEC 62290-2, and also the new functions and requirements.

The text of this International Standard is based on the following documents:

Draft	Report on voting
9/3168/FDIS	9/3199/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

For a better readability of the text, some elements of subclause 6.1.2 are in italic and bold characters to highlight the headlines of the functional tree of IEC 62290-2 (to avoid any confusion for the reader with the numbering of clauses and subclauses of IEC 62290-3), whose order and hierarchy is followed to do the allocation of requirements from this document IEC 62290-2. The mention of applicability depending on GOA of some functions having a condition to be mandatory is provided in bold characters.

Moreover, again for a question of a better readability of the text, the titles of the *functional tree of IEC 62290-2 standard* are prefixed with "FCN".

A list of all parts of IEC 62290 series, under the general title *Railway applications – Urban guided transport management and command/control systems*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

The IEC 62290 series specifies the functional, system and interface requirements for the command, control, and management systems intended to be used on urban, guided passenger transport lines and networks.

These systems are designated herein as urban guided transport management and command/control systems (UGTMS). UGTMS cover a wide range of operations needs from non-automated (GOA1) to unattended (GOA4) operation. A line may be equipped with UGTMS on its full length or only partly equipped.

The IEC 62290 series does not specifically address security issues. However, aspects of safety requirements may apply to ensuring security within the urban guided transit system.

The main objectives of this series are as follows:

- to provide a baseline system description and functional requirements specification for a transport authority to use in a request for proposal;
- to provide recommendations for those transport authorities wishing to acquire an interoperable or interchangeable system.

It is the responsibility of the transport authority concerned to decide on how to apply the IEC 62290 series and to take into account their particular needs.

The IEC 62290 series is also intended to support applications for upgrading existing signalling and command control systems. In this case, interchangeability and compatibility could be ensured only for the additional UGTMS equipment. Checking the possibility for upgrading existing equipment and the level of interoperability is the responsibility of the transport authority concerned.

Application of the series should take into account the differences between the various networks operated in different nations. Those differences include operational and regulatory requirements as well as different safety cultures.

The IEC 62290 series defines a catalogue of UGTMS requirements split into mandatory and optional functions. The functions used are based on the given grade of automation. Most of the functions characterized as mandatory are considered with no condition. Some specific functions have a condition to be mandatory (this condition being generally related to the use of an external equipment by UGTMS). By fulfilling the requirements, a supplier can create one or more generic applications including all mandatory functions and all or a subset of optional functions. A generic application will achieve interoperability within the defined specific application conditions. Customising a generic application will create a specific application taking into account of local conditions such as track layout and headway requirements. It is the choice of supplier and transport authority to add additional functions to a generic or specific application. These additional functions are not described in the IEC 62290 series.

According to IEC 62278, it is the responsibility of the transport authority to decide, taking into account their risk acceptance principles, to conduct specific hazard and risk analysis for each specific application. The safety levels for the functions of each specific application are determined by a specific risk analysis.

Terms like "safety-related command", "safety conditions", "safe station departure" are mentioned without having performed any hazard analysis.

The IEC 62290 series is intended to consist of four parts:

- IEC 62290-1, "System principles and fundamental concepts", provides an introduction to the IEC 62290 series and deals with the main concepts, the system definition, the principles and the basic functions of UGTMS.

The three other parts correspond to the three steps (see Figure 1) required in the process of specifying UGTMS and are used accordingly.

- IEC 62290-2, "Functional requirements specification", specifies the functional requirements associated to the basic functions provided by IEC 62290-1, within the system boundaries and interfaces as defined in IEC 62290-1:2024, Figure 3.

The FRS (functional requirements specification) identifies and defines the functions that are necessary to operate an urban guided transport system. Two types of functions are distinguished for a given grade of automation: mandatory functions (e.g. train detection) and optional functions (e.g. manage stabling). Requirements of functions have the same allocation, unless they are marked otherwise.

- IEC 62290-3, "System requirements specifications", deals with the architecture of the system and the allocation of the requirements and functions identified in IEC 62290-2 to UGTMS equipment.

The SRS (system requirement specification) specifies the architecture of a UGTMS system, with mandatory and optional UGTMS equipment.

- IEC 62290-4¹, "Interface specifications", deals with the definition of the interfaces, as well as the data exchanged by them (FIS and FFFIS), for the interoperable and interchangeable UGTMS equipment identified in IEC 62290-3.

For interfaces between UGTMS equipment, the logical interface or FIS (functional interface specification) and/or the physical and logical interface or FFFIS (form fit functional interface specification) will be considered.

NOTE The specific structure of IEC 62290-4 will be established to accommodate optional and mandatory UGTMS equipment, and to reflect local conditions. In principle, only one FIS or FFFIS will be defined for the same interface. However, when justified in some cases, several FISs or several FFFISs will be defined for the same interface.

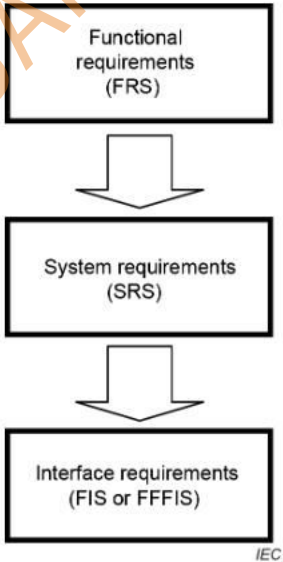


Figure 1 – The three-step process followed by the UGTMS standard

¹ Under consideration.

Requirements are those necessary to fulfil all operational needs for safe and orderly operation requested by transport authorities without regard to technical solutions.

The chosen level of detail in describing requirements enables customers as well as transport authorities to be assured that generic applications delivered by different suppliers will cover at least the same functionality as specified in this document.

Requirements which are established by the IEC 62290 series are indicated clearly with a requirement identification number related to the function to be covered.

Đ. AN TIÊU CHUẨN TC2547

RAILWAY APPLICATIONS – URBAN GUIDED TRANSPORT MANAGEMENT AND COMMAND/CONTROL SYSTEMS –

Part 3: System requirements specification

1 Scope

This part of IEC 62290 specifies the system architecture for urban guided transport management and command/control systems (UGTMS) as defined in IEC 62290-1 and IEC 62290-2, and the allocation of functions and requirements defined in IEC 62290-2 to the different UGTMS subsystems (designated as system constituents in IEC 62290-1 and IEC 62290-2), for use in urban guided passenger transport lines and networks.

This document is applicable for new lines or for upgrading existing signalling and command control systems.

This document is applicable to applications using

- continuous data transmission,
- continuous supervision of train movements by train protection profile, and
- localisation by onboard UGTMS equipment (reporting trains), and optionally by external wayside (and optionally onboard) device.

The functional allocations of the UGTMS subsystems are mandatory (forming a sort of core system) or optional, according to the mandatory/optional functions and requirements defined in IEC 62290-2.

This document is applicable as a basis to define FIS and FFFIS. For specific applications, some elements can be added to meet the requirements coming from additional functions or equipment.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62290-1:2024, *Railway applications – Urban guided transport management and command/control systems – Part 1: System principles and fundamental concepts*

IEC 62290-2:2024, *Railway applications – Urban guided transport management and command/control systems – Part 2: Functional requirements specification*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62290-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

run type

predefined speed profile which is managed at OCS level

EXAMPLE Energy saving profile, minimum run time.

3.2 Abbreviated terms

CSS	CCTV surveillance system
DCS	UGTMS data communication subsystem
EB	emergency braking
EIXL	external interlocking
FCN	function
HVCB	high voltage circuit breaker
INF	infrastructure
MS	maintenance system
OBS	UGTMS onboard subsystem
OCS	UGTMS operations control subsystem
OHMI	operations control HMI
OPS	operation planning system
PIS	passenger information system
REQ	requirement
SE	station equipment
SPTS	UGTMS spot transmission subsystem
THMI	train HMI
TPCS	traction power control system
TR	train (but not its HMI)
TSE	trackside signalling equipment
TSR	temporary speed restriction
VCS	voice communication system
WS	UGTMS wayside subsystem
ZOP	zone of protection

4 UGTMS system architecture and non-functional requirements

4.1 Overall system architecture

Clause 4 provides the general description of UGTMS architecture, the list of UGTMS subsystems, the identification of interfaces between UGTMS subsystems, and between UGTMS subsystems and the environment.

Non-functional requirements (like the ones related to performance) are described as well, in addition to the main choices made in this document and having an impact on architecture.

Figure 2 and Figure 3 describe the UGTMS system architecture in consistency with the environment described in IEC 62290-1, highlighting external interfaces with this environment and internal interfaces between UGTMS equipment.

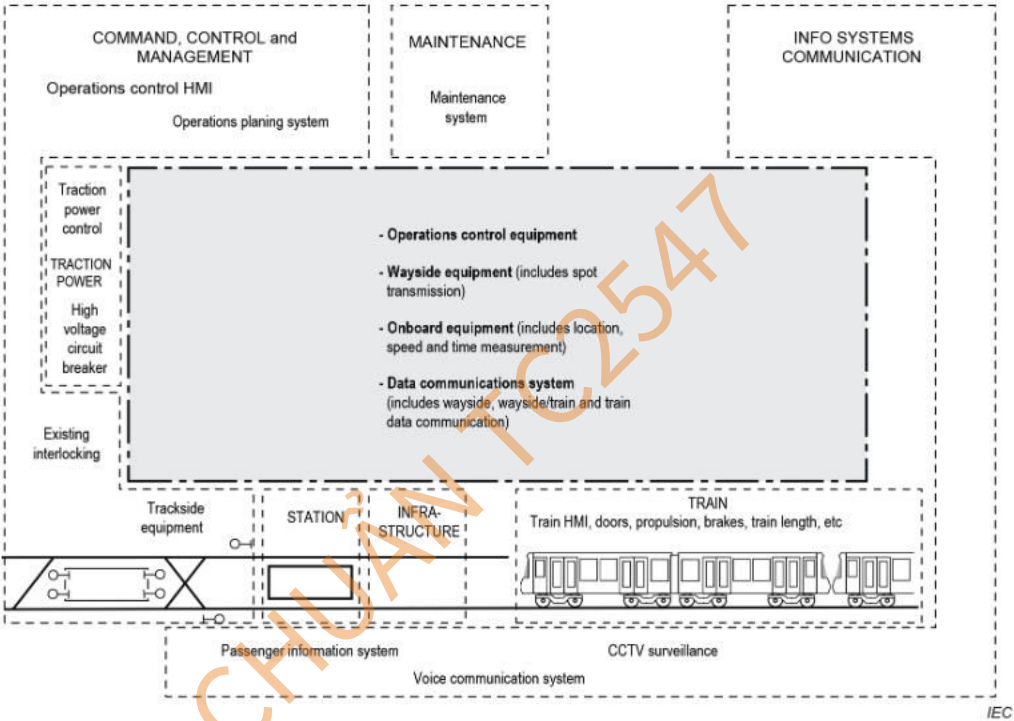


Figure 2 – UGTMS system environment (as defined in IEC 62290-1)

In the rest of the document, following an architecture decision (as shown in Figure 3), the spot transmission subsystem is considered as an independent UGTMS subsystem.

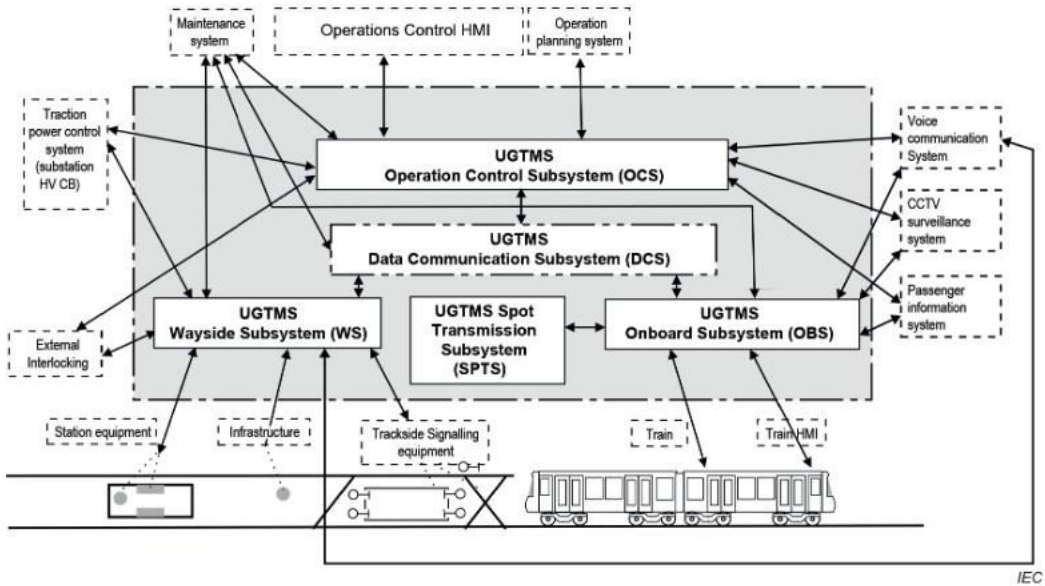


Figure 3 – UGTMS system architecture, external systems and external interfaces

It has to be noted that Figure 3 does not represent all the flows through the DCS subsystem, in order to keep it readable. The direct flows through the DCS existing possibly between external equipment and a UGTMS subsystem are described in 4.4, in 6.1 and 6.3.

It has to be noted as well that the allocation work done in Clause 6 has permitted the identification of potential communication links for external equipment through the DCS, but the document does not cover all of these communication links.

Hypotheses [H1], [H2] and [H3] in 4.2 have been applied for the determination of this system architecture.

4.2 Hypotheses for UGTMS architecture

Subclause 4.2 describes the major choices identified in this document and having an impact on architecture, and that result from the allocation done in 6.1 and in 6.2.

While Figure 3 is an architecture prepared to achieve the allocation of functions and requirements defined in IEC 62290-2, some allocating works are difficult on this system breakdown structure level of the figure. The following hypotheses complement the representation of architecture to complete the allocations (tag with "H" is added to each item in preparation to link related descriptions):

- [H1] It is assumed that the external OHMI is connected to the UGTMS subsystems via the OCS. As an option, according to the decided allocation for requirements from IEC 62290-2, the connection can be done directly through the DCS.
- [H2] It is assumed that the external train HMI is directly connected to the OBS. As an option, it could be through the DCS.
- [H3] The architecture and the related allocation considered in this document is the one of the current state of the art which involves both WS and OBS (different approaches induced by technology evolution could be considered in the future maintenance of this document, such as for instance an architecture which allocates a maximum of functions to OBS).
- [H4] The duty roster, if any, is considered to be included in the operation planning system.

4.3 General description of UGTMS subsystems

4.3.1 General

As shown on Figure 3, UGTMS system is split into five subsystems:

- the UGTMS wayside subsystem;
- the UGTMS onboard subsystem;
- the UGTMS spot transmission subsystem;
- the UGTMS data communication subsystem;
- the UGTMS operation control subsystem.

4.3.2 UGTMS wayside subsystem (WS)

The UGTMS wayside subsystem consists of UGTMS wayside equipment not related to the spot transmission subsystem.

The equipment included in the UGTMS wayside subsystem performs the following main functions:

- ensure safe route through interlocking related functions, or an interface with an external interlocking;
- ensure the safe separation of trains, for instance through the determination of movement authority to be sent to trains, or contribution to it, and based on train locations;
- ensure the management of inputs/outputs to interface with trackside signalling equipment (such as points, signals, etc.) or platform door control systems.

4.3.3 UGTMS onboard subsystem (OBS)

The UGTMS onboard subsystem consists of UGTMS onboard equipment not related to the spot transmission subsystem.

The equipment included in the UGTMS onboard subsystem performs the following main functions (depending on the GOA):

- determine the train location;
- ensure that the train proceeds safely in accordance with its movement authority and permitted speed;
- drive and control the train automatically;
- interface with the spot transmission subsystem.

4.3.4 UGTMS spot transmission subsystem (SPTS)

The UGTMS spot transmission subsystem interfaces with the OBS to provide data from the wayside which is unique to a guideway location.

An example of this system is a transponder interrogator on the train and transponders on the track. Static devices on the track that can be accurately read with an onboard camera can also be considered as SPTS.

The UGTMS spot transmission subsystem performs synchronisation of train location.

4.3.5 UGTMS data communication subsystem (DCS)

The UGTMS data communication subsystem provides data communication within UGTMS.

It can be used as well for exchanges between UGTMS subsystems and external systems.

It is made up of a wayside related part, the wayside data communication network, an onboard part, the onboard data communication network, and the radio data communication network making the connection between these two parts.

The onboard data communication network interconnects the UGTMS onboard equipment within a train. Another possible configuration might be for instance to connect a UGTMS onboard subsystem and a neighbouring subsystem, in the case of two trains coupled and equipped with UGTMS equipment.

The radio data communication network provides a radio link between UGTMS wayside equipment and UGTMS onboard subsystem.

4.3.6 UGTMS operation control subsystem (OCS)

The UGTMS operation control subsystem provides control and monitoring facilities to supervise the traffic and other subsystems.

The operations control human machine interface (OHMI) is out of UGTMS scope.

4.4 External equipment in the UGTMS environment

4.4.1 General

These external devices as shown on Figure 3 have been defined accordingly with IEC 62290-1:2024, Figure 3.

For external devices which are described in 4.4.2 to 4.4.14, depending on choices of options made by applying IEC 62290-2, the corresponding clauses in this document are applicable or not.

For instance, if an application of IEC 62290 does not consider the interface with the external voice communication system, then 4.4.10 is not applicable, and everything in relation with such an interface in the rest of this document is also not applicable.

4.4.2 Infrastructure related equipment (INF)

The infrastructure related equipment covers:

- the track and related detectors (intrusion detection systems along the track, wayside obstacle detection, broken rail detection),
- devices used as staff protection purposes (e.g. plungers for switching off the power),
- the tunnel ventilation,
- fire and smoke detectors deployed in tunnels or along the track,
- washing machines,
- flood gates or blasting doors, and
- emergency exits.

4.4.3 Trackside signalling related equipment (TSE)

The concerned devices are those installed along the track, and that are in relation with signalling.

This covers:

- points, signals, track circuits and any other train detection devices like axle counters,
- equipment for displaying train hold information,
- equipment for displaying wayside obstacle information,
- equipment for displaying working zone information,
- equipment for displaying station departure authorization, and
- equipment for initiating the unattended turnback.

4.4.4 Station related equipment (SE)

The devices concerned are those installed in stations.

The devices that are covered by this category are:

- fire detection/protection systems deployed in stations,
- platform/track intrusion/fall detection systems,
- platform doors, and platform end doors,
- equipment for displaying platform screen door closing status,
- gap detection devices (falling or trapped objects/persons),
- gap filling devices,
- the overcrowding detection system,
- emergency handles, and
- stop request devices.

4.4.5 External interlocking related equipment (EIXL)

Such equipment is usually encountered when a choice has been made to retain an existing interlocking when upgrading the train control system to UGTMS.

External interlocking equipment may be of several different types, for example fully electronic, where both the control and safety functions are realised by a computer, all relay, where control and safety functions are realised by electromechanical relays and their associated wiring, or computer-controlled relay interlockings, which are hybrid systems, where the control functions are carried out by computer, but the safety functions are performed by relays.

4.4.6 Traction power control system related equipment (TPCS)

This equipment is intended to control the traction power system which supplies the trains with electrical power via the contact line or conductor rails.

The substations which feed the traction power system and their associated circuit-breakers are controlled from the traction power control system which may (but not necessarily) be located in the OCC.

4.4.7 Maintenance system related equipment (MS)

The maintenance system related equipment is in charge of the maintenance support for the operation of a UGTMS system, and of the diagnostic for failures or accidents.

The maintenance system covers the whole UGTMS system, and its subsystems, including the DCS.

The maintenance system is connected to the UGTMS DCS, to the UGTMS OCS or, in some cases, to the UGTMS WS.

The maintenance support and diagnostic is performed by using data and reported statuses or alarms from the different UGTMS subsystems.

4.4.8 Operations control HMI related equipment (OHMI)

The OHMI is the external equipment permitting the operations staff to manage the operations of UGTMS line through a set of displayed information and a set of commands.

Such equipment is located in the OCC, but can also be located locally in equipment rooms, or be portable with a wireless connection.

4.4.9 Operation planning system related equipment (OPS)

This is the external equipment which supports the staff to plan and manage timetables and provides to UGTMS the planned timetables for a given line, and the duty roster (see [H4] in 4.2).

4.4.10 Voice communication system related equipment (VCS)

This is a system whose equipment is located at the OCC, or on the platform, and at other locations within a station or possibly along the track, or onboard a train.

This system includes the emergency call devices for instance.

This system allows staff to talk with passengers and staff to communicate with other staff, wherever they are.

Such equipment has to provide an interface with the DCS in accordance with the DCS characteristics (e.g. communication protocols, or bandwidth, etc.).

4.4.11 CCTV surveillance system related equipment (CSS)

The concerned devices are those installed at the OCC, along the track and in the stations (both in platforms, technical rooms and other station's rooms), or onboard vehicles. This system allows the display, elaboration, transmission and recording of real-time videos for a real-time surveillance (monitoring and storing for additional processing) ensuring passengers' security and safety.

The use of it is basically for the OCC staff, but also possibly the train operator.

Such equipment has to provide an interface with the DCS in accordance with the DCS characteristics (e.g. communication protocols, or bandwidth, etc.).

4.4.12 Passenger information system related equipment (PIS)

The real-time passenger information can be displayed at platforms, in trains, concourses and ticket offices.

It may include the next station information, both predictions about arrival and departure times, as well as platform and train formation information. Onboard trains, it may also include predictions about arrival times and connections, as well as information about the nature and causes of disruptions.

4.4.13 Train related equipment (TR)

The devices that are covered by this category are the following (items listed in IEC 62290-1, Figure 3, "TRAIN" box):

- doors, propulsion, brakes, train length device (e.g. couplers);
- obstacle detection device, derailment detection device, fire/smoke detection device;
- gap detection device or gap closing device (gap fillers, moveable steps and similar devices);
- emergency stop/door release handles/alarm buttons;
- other equipment interfaces (e.g. lighting, HVAC, battery);
- train diagnostics (for maintenance);
- train status (for fitness for operation).

4.4.14 Train HMI related equipment (THMI)

The train HMI related equipment is to receive commands from train operator or staff, for instance about:

- changing driving modes,
- reset of emergency brake,
- train identification, train length,
- activation/resume of onboard equipment, and
- destination of train journey, etc.

The train HMI related equipment provides information to train operator or staff, for instance about:

- driving modes,
- door status,
- permitted maximum speed,
- failure information, test results, and
- station departure authorization, etc.

NOTE These commands and information items are extracted from statements of the REQ whose allocation includes a note with the expression "by REQ_6.5.2-1". The FCN 6.5.2 is "Manage the interface with the train HMI".

The external THMI covers all means intended for manual, visual, and audible interactions with operations staff onboard the train.

It could be made for instance via a combination of:

- screens,
- audible/visible indicators,
- dials,
- buttons,
- levers.

5 UGTMS rail network description

5.1 General

The UGTMS urban subsystems use a common description of the railway network.

In this model, the various objects of the network have fixed characteristics (track singularity such as permanent speed restriction, etc.). The static description is managed separately from the dynamic characteristics (e.g. aspect of wayside signals, etc.) or temporary characteristics (e.g. temporary speed restriction).

In 5.2 to 5.5, the UGTMS rail network description is mentioned as configuration data (the other configuration data referred to in this document are the ones in relation with the description of the train).

It is assumed that, under normal operation, each OBS shall have access to the entire configuration data corresponding at least to the whole line where it is expected to operate.

The configuration data related to the rail network description is structured according to the concepts of line sections and track segments described in 5.2 and 5.3.

5.2 Line section

The configuration data related to the rail network description is split into distinct sets.

Each set is named a line section, and gathers information such as description of track segments (see 5.3), description of transponders or equivalent, descriptions of gradients, locations of signals, etc.

The line section concept is used for modelling static data describing the track (and related elements).

The line section, as shown in Figure 4, is therefore the elementary set of consistent data allowing the description of the network:

- a line section can be as small as one interstation, and as large as a complete line;
- geographically, a line section corresponds to a set of track segments.

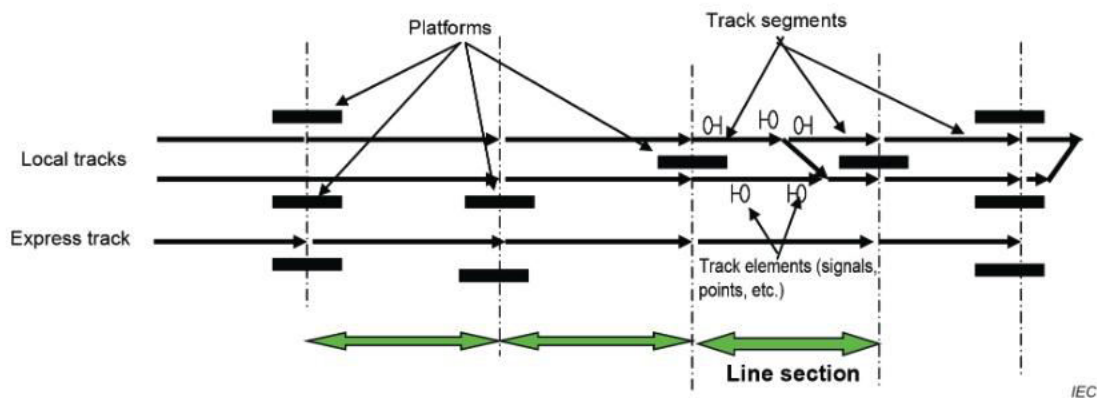


Figure 4 – UGTMS concept of line section

5.3 Track segment

The configuration data related to the rail network description is based on track segments connected to one another.

Track segment is the basic functional entity for managing locations.

A track segment, as shown in Figure 5, is a linear track part defined by

- an origin,
- a conventional orientation,
- a length, and
- an identity.

Any point of the train and any track singularity are perfectly located by using the track segment number and an offset (distance from the origin of the track segment).

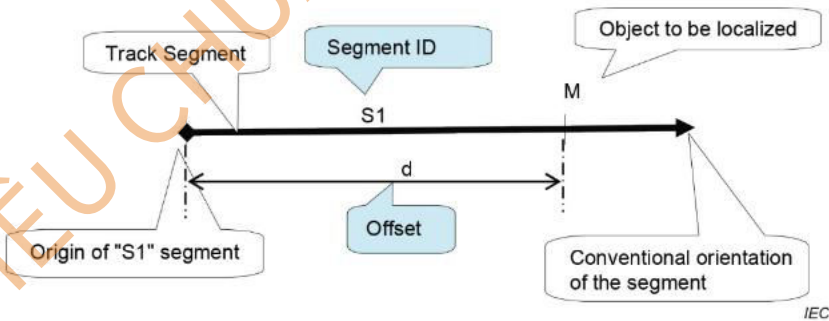


Figure 5 – UGTMS track segment definition

In Figure 5, location of "M" is defined by [S1 (Segment ID); d (Offset)].

"M" applies for any object, and such a way to describe a location applies as well for the determination of the position of a train, as described in corresponding requirements and allocations in the rest of the document.

Each track segment has an orientation.

Two adjacent track segments may have opposite orientations.

Configuration data related to the rail network description shall define relative orientation of neighbouring segments.

The direction of a train which is linked with the train movement is relative to the orientation of the segment where the train front is localised.

5.4 Connecting rules between track segments

The topology for configuration data related to the rail network description is represented by a graph of connected track segments.

The following rules shall be respected.

- Each track segment can be linked to at least one adjacent track segment (the maximum number of adjacent track segments linked to the extremity of one segment is defined site specifically).
- When a track segment extremity meets facing points, the connection relation is defined by the point indication (see track segments S2, S3 and S8 in Figure 6).
- When track segment extremity meets trailing points, the connection relation is considered as perfectly defined: the "destination" is always the same (see track segments S3, S4 and S9 in Figure 6).
- Where there is no point, the connection relation between two track segments is fixed (see track segments S1 to S2 in Figure 6).

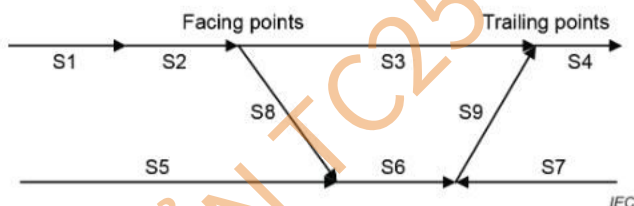


Figure 6 – UGTMS track segment chaining

5.5 Structure and content of the configuration data related to the rail network description

The structure of the configuration data related to the rail network description is based on line sections and their associated track segments.

For each track segment, the configuration data contains the list of objects belonging to the segment (for example, objects like points, signals or transponders, or properties like maximum speeds, gradients). These data are only static predefined information.

The configuration data related to the rail network description provides for example the following characteristics:

- topology: determines the connectivity of the track work, points and boundary;
- orientation: determines the origin and the extremity of track segments, allowing a unique location to be defined for all objects;
- distances: determines the distance of the track work between points;
- resolution: determines the smallest unit of measurement (quantum) by which an object can be located on the guideway;
- constraints: determines if the direction points can be passed, and if boundaries can be crossed;

- zones: determines the location of various regions on the guideway (e.g. the length of a train detection section, station, traction power section);
- object locations: determines the location of objects on the guideway (e.g. signals, transponders);
- properties: determines the features of the guideway (e.g. authorised travel directions, maximum speeds in each direction, gradients).

6 Requirement allocation and description

6.1 Functional and non-functional requirement allocation to UGTMS subsystems

6.1.1 General principles

Subclause 6.1.1 describes the allocation of functional and non-functional requirements to UGTMS subsystems.

It is structured according to the functional tree of IEC 62290-2 for functional requirements.

For each function or subfunction, its associated applicability depending on the GOA or other conditions is given.

For each requirement from IEC 62290-2:

- the requirement from IEC 62290-2 is given, with its associated applicability depending on the GOA, and on options,
- the column "Option" describes each possible option associated to the allocation of a requirement,
- the column "Processing" describes which subsystem has been allocated the processing of a requirement,
- the column "Internal inputs" describes inputs coming from other UGTMS subsystems into the considered processing subsystem,
- the column "Internal outputs" describes outputs sent to other UGTMS subsystems, from the considered processing subsystem,
- the column "External inputs" describes inputs coming from external equipment of the UGTMS environment into the considered processing subsystem, and
- the column "External outputs" describes outputs sent to external equipment of the UGTMS environment, from the considered processing subsystem.

Inputs are noted with letter I, outputs with letter O, associated numbered suffixes are references to the corresponding note. The letter X is used for the UGTMS subsystem(s) in charge of the processing.

An important rule for allocating the functional requirements of IEC 62290-2 is: when processing the allocation of a requirement from IEC 62290-2, the "I" and "O" with UGTMS subsystems and external equipment are given for data that are not already provided or used by another requirement. If it would be provided or used by another related requirement, then a reference to this requirement should be made in the "Note" for traceability.

The example of charts and figures in 6.1.2 is shown as Figure 7.

Figure 7 shows a typical case of 6.1.2 description to understand the note expression with options and the process diagram using letter "I", "X" and "O".

Figure 7 shows that requirement ("REQ_5.x.x.x-x") allocated can be implemented in two ways (option A and option B).

In option A, the requirement is processed by WS (WS X1) using input data from external input (TSE I1).

In option B, input data from external input (TSE I2) is processed by OCS (OCS X2): OCS sends output data to WS (WS O2), then the output data is received as input data from OCS (OCS I3) and processed by WS (WS X3).

[REQ_5.x.x.x-x]

{GOA1: y1; GOA2: y2; GOA3: y3; GOA4: y4}

Inserted here is the requirement to be performed by the subfunction, as stated in or derived from IEC 62290-2, and with the indications y1 to y4 mentioning if this requirement is seen as mandatory (M), optional (O) or not applicable (n/a) for GOA1 to 4.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1			TSE I1	
B	OCS X2 WS X3	OCS I3	WS O2	TSE I2	

This requirement can be implemented in two ways.

Option A:

NOTE 1 Inserted here any notes about X1 and TSE I1.

Option B:

NOTE 2 Inserted here any notes about X2, O2 and TSE I2.

NOTE 3 Inserted here any notes about X3 and I3.

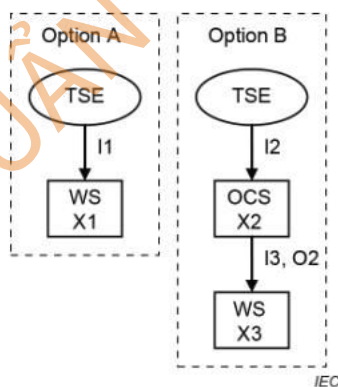


Figure 7 – Example for the description of 6.1.2

It has to be noted that every time, for each allocation done for requirements of IEC 62290-2, the part {GOA1: y1; GOA2: y2; GOA3: y3; GOA4: y4} applies at the requirement level. It says if the requirement as such applies for a given GOA.

When this requirement is described as mandatory for all GOAs, it means that we have a description {GOA1: M; GOA2: M; GOA3: M; GOA4: M}.

When this requirement is described as optional for all GOAs, it means that we have a description {GOA1: O; GOA2: O; GOA3: O GOA4: O}.

These situations for the two cases just above are simple ones, where the part {GOA1: y1; GOA2: y2; GOA3: y3; GOA4: y4} directly reflects the text of IEC 62290-2.

For the situation when the requirement belongs to a function which is not applicable for a GOA, then it has to be reflected in {GOA1: y1; GOA2: y2; GOA3: y3; GOA4: y4}. For instance, if a function is not applicable for GOA1, a mandatory requirement in IEC 62290-2 means we reflect it with {GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}.

The last situation to consider for {GOA1: y1; GOA2: y2; GOA3: y3; GOA4: y4} is when a requirement of IEC 62290-2 has parts describing different options for GOA.

For instance, in the case of [REQ_5.1.2.1.4-4], "UGTMS shall provide the information about the train location failure of reporting trains to the interface

- with the external operations control HMI, and
- with the external train HMI. (M for GOA1, M for GOA2, O for GOA3, O for GOA4).",

it is reflected by {GOA1: M; GOA2: M; GOA3: M; GOA4: M}, because this requirement is mandatory for all GOAs at least for its 1st bullet point.

6.1.2 Allocation of functional requirements from IEC 62290-2:2024

The functional tree in italic characters hereinafter, prefixed with "FCN" and starting from Clause 5 to end with 6.10 is the one from IEC 62290-2:2024, which structures the functional requirements in this document.

FCN 5 – Functions for train operation

FCN 5.1 – Ensure safe movement of trains

FCN 5.1.1 – Ensure safe route

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Mandatory: all GOAs if "Ensure safe route" functions are provided by UGTMS

FCN 5.1.1.1 – Set and protect route

FCN 5.1.1.1.1 – Set route

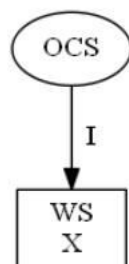
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.1.1.1-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall set a route by manual command provided via the interface with the external operations control HMI or automatically.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The processing is done by WS with inputs from OCS coming either <ul style="list-style-type: none">– from an operator command (the input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3), or– from an automatic route setting command provided either by REQ_6.2.2-4, 6 or 7.					

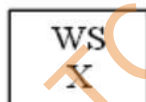


[REQ_5.1.1.1.1-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

For the route to be set, UGTMS shall determine the route elements required based on the route origin and destination, including elements required for flank protection, for overlap, and when required, elements related to the protection of the infrastructure (e.g. flood gates, blast doors, rolling shutters).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				
NOTE The route composition is provided by configuration data describing all routes with their elements and their required dynamic conditions.					

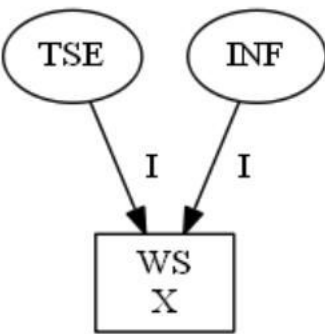


[REQ_5.1.1.1.1-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

For the route to be set, the availability of all determined route elements shall be checked.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I INF I	

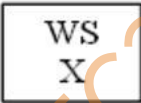


[REQ_5.1.1.1.1-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Availability shall be given if a route element is not blocked against route setting and not used by another route.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				



[REQ_5.1.1.1.1-5]

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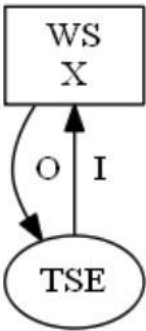
[REQ_5.1.1.1.1-6]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In order to set the route, UGTMS shall move all its movable route elements to the desired position if they are not already in that position, not occupied by a train and not blocked against moving.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I	TSE O

NOTE					
– TSE I for checking position of movable route element.					
– TSE O for moving the movable route element.					
– The occupancy resulting from reporting trains is provided by REQ_5.1.2.1.4-1.					
– The occupancy resulting from non-reporting trains is provided by REQ_5.1.2.2-1.					

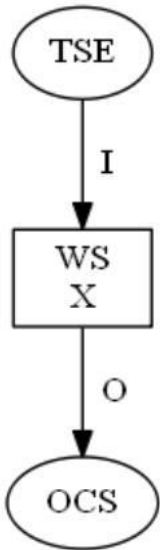


[REQ_5.1.1.1.1-7]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

If a movable route element does not reach the desired position in a predefined time, a failure message shall be provided to the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O	TSE I	
NOTE					
<div><div></div><div>- TSE I for checking position of movable route elements.</div><div>- WS for predefined time, provided by configuration data determined for each type of element.</div><div>- OCS O then the output to OHMI is provided by REQ_6.5.1-2.</div></div>					

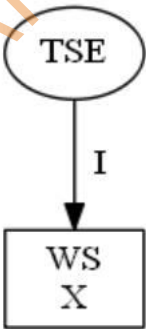


[REQ_5.1.1.1.1-8]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

When all the route elements of the route are confirmed in the required position, the route is set, and UGTMS shall lock it.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I	
NOTE TSE I for checking position of movable route elements.					

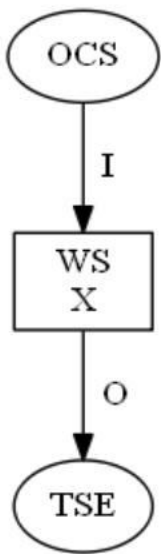


[REQ_5.1.1.1.1-9]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall command movable route elements (e.g. a point) from one position to the other by command provided via the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			TSE O
NOTE					
– TSE O for commanding movable route elements.					
– OCS I from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					

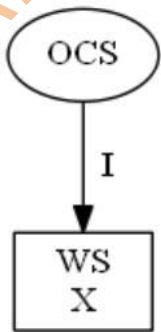


[REQ_5.1.1.1.1-10]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall block a movable route element against switching, or unblock, by command provided via the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					



FCN 5.1.1.1.2 – Supervise route

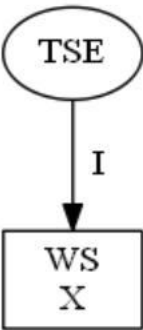
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.1.1.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall supervise that determined route elements are confirmed in the required position and locked.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I	
NOTE TSE I for checking position of route elements.					

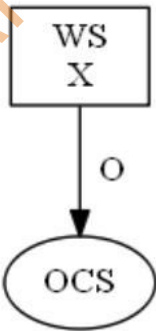


[REQ_5.1.1.1.2-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

The supervision status of a route shall be provided to the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					



[REQ_5.1.1.1.2-3]

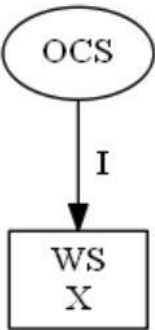
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[REQ_5.1.1.1.2-4]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

The entrance to a route shall be prohibited by a safety-related command provided via the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					



FCN 5.1.1.1.3 – Lock route by train

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.1.1.3-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

A route approach area longer than the operational braking distance shall be determined in front of a route origin.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				
NOTE To be determined in configuration data for each route origin.					



[REQ_5.1.1.1.3-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The route shall be locked by approach if a train is in the approach area and a movement authority beyond the route origin has been given to the train.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				
NOTE <ul style="list-style-type: none">For checking occupancy of approach area, see the corresponding REQ_5.1.2.1.4-1 for reporting trains.For checking occupancy of approach area, see the corresponding REQ_5.1.2.2-1 for non-reporting trains.For movement authority, see the corresponding REQ_5.1.4.2-5 for reporting trains.For movement authority, see the corresponding REQ_5.1.4.3-1 for non-reporting trains checking entry signal.					

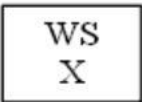


[REQ_5.1.1.1.3-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

When the train has entered the route, the route shall be maintained as locked until conditions for releasing it are fulfilled (as described in 5.1.1.2).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				
NOTE					
– Refer to REQ_5.1.2.1.4-1 for determining the location from reporting trains.					
– Refer to REQ_5.1.2.2-1 for determining the location from non-reporting trains.					



FCN 5.1.1.2 – Release route

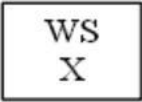
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.1.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

For automatic route release, UGTMS shall release a route element by element, by group of elements or as a whole by a train traversing the elements in the sequence corresponding to the authorized direction.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				
NOTE					
– Refer to REQ_5.1.2.1.4-1 for determining the location from reporting trains.					
– Refer to REQ_5.1.2.2-1 for determining the location from non-reporting trains.					

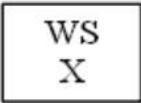


[REQ_5.1.1.2-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Route elements in the flank protection area shall be released together with the corresponding route elements.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				
NOTE Corresponding flank protection elements are provided by configuration data.					

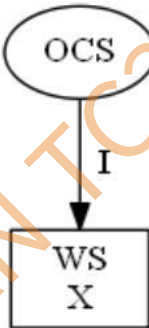


[REQ_5.1.1.2-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall allow route release by operational command provided via the interface with the external operations control HMI if the route is not locked.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					



[REQ_5.1.1.2-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall allow route release by operational command provided via the interface with the external operations control HMI for a route that is locked, if no train is occupying the route and if it can be ensured that a train in the route approach area, if any, will not enter the route.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X1 OBS X2	WS I2 OBS I1 OCS I1	WS O2 OBS O1		TR O2

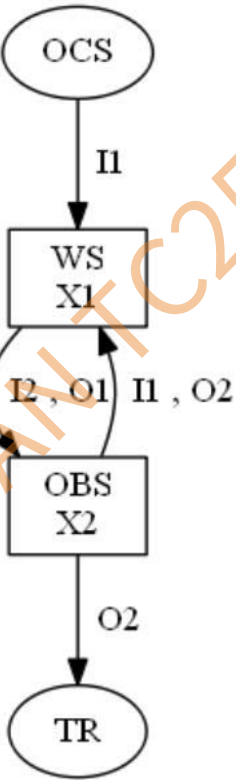
The processing is done by WS and OBS.

NOTE 1 WS receives the command I1 from OCS (this is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.). The presence of an approaching train is covered in REQ_5.1.2.1.4-1 and REQ_5.1.2.2-1 (respectively for reporting and non-reporting trains). In the case of non-reporting trains, the WS will not allow the release, as no guarantee for ensuring that this train will not enter the route can be obtained.

For reporting trains, the output O1 is sent to OBS to obtain a confirmation I1 from OBS indicating whether it can ensure the train will stop before the entrance of the route.

NOTE 2 When receiving I2 from the WS to check if it can stop before the entrance of the route, OBS determines this capability and then reports back to WS O2.

If OBS determines it can stop before the entrance of the route, it sends O2 to the train (but not its HMI) a request for braking.



[REQ_5.1.1.2-5]

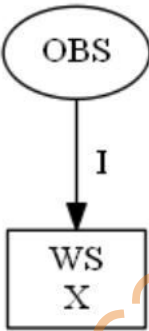
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[REQ_5.1.1.2-6]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall cancel an overlap when the train has stopped at the route destination. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OBS I			
<div>NOTE</div> <div><div><div>-</div><div>The information about the location of reporting trains is covered in REQ_5.1.2.1.4-1 and the stopping information is provided by OBS thanks to REQ_5.1.5.1-3.</div></div><div><div>-</div><div>The information about the stopping of non-reporting trains is managed through a WS internal processing (e.g. a timer), and about the location in REQ_5.1.2.2-1.</div></div></div>					



FCN 5.1.2 – Ensure safe separation of trains

FCN 5.1.2.1 – Locate UGTMS reporting trains

FCN 5.1.2.1.1 – Initialise UGTMS reporting trains location

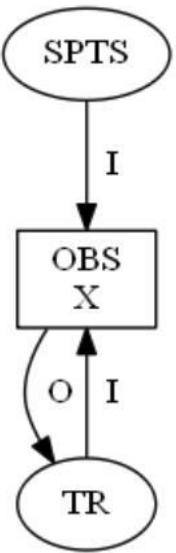
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.2.1.1-1]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall initialise the train location for reporting trains stationary in stabling locations after the awakening process. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	SPTS I		TR I	TR O
<div>NOTE</div> <div>OBS manages the awakening process through exchanges with the train (but not its HMI).</div> <div>OBS manages the initialization on its own, or optionally by using SPTS which provides the location through dedicated wayside devices, installed in stabling locations.</div>					

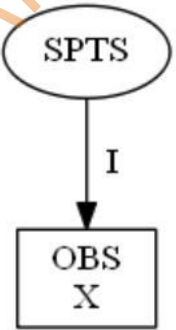


[REQ_5.1.2.1.1-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall initialise the train location for reporting trains entering UGTMS territory.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	SPTS I			
NOTE SPTS provides the location through dedicated wayside devices on UGTMS territory.					

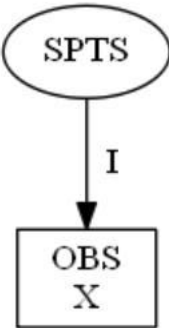


[REQ_5.1.2.1.1-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

For reporting trains, UGTMS shall initialise the train location on recovery from UGTMS equipment failures leading to loss of train location.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	SPTS I			
NOTE SPTS provides the location through dedicated wayside devices for location recovery.					

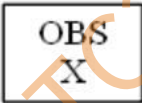


[REQ_5.1.2.1.1-4]

{GOA1: O; GOA2: O; GOA3: O; GOA4: M}

UGTMS shall determine the train length of reporting trains. (O for GOA1, O for GOA2, O for GOA3, M for GOA4)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The train length is provided by configuration data.					

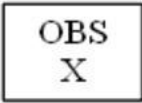


[REQ_5.1.2.1.1-5]

{GOA1: O; GOA2: O; GOA3: O; GOA4: n/a}

UGTMS shall allow manual input of train length data of reporting trains. (O for GOA1, O for GOA2, O for GOA3, not applicable for GOA4)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The input from THMI is provided either by REQ_6.5.2-1 or REQ_6.5.2-2.					

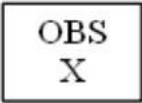


[REQ_5.1.2.1.1-6]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall allow initialisation of the train location for reporting trains through a movement of train under manual or automatic driving mode.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE See REQ_5.5.2-4 and REQ_5.5.2-5 for the manual driving mode management. See REQ_5.5.2-2 for the automatic driving mode management.					



FCN 5.1.2.1.2 – Determine train orientation

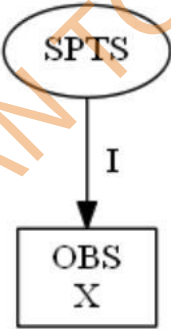
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.2.1.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the physical orientation of the reporting train relative to the defined orientation of the track.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	SPTS I			



FCN 5.1.2.1.3 – Determine actual train travel direction

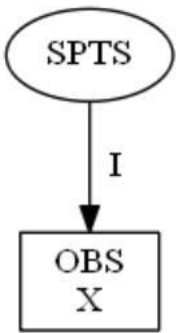
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.2.1.3-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the actual travel direction of the reporting train on the track.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	SPTS I			

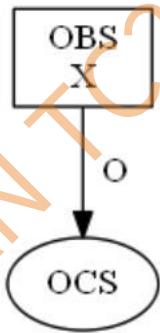


[REQ_5.1.2.1.3-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Actual train travel direction of reporting trains shall be provided to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					



FCN 5.1.2.1.4 – Determine train location

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

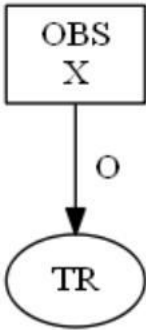
[REQ_5.1.2.1.4-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the location of the front and rear of all reporting trains.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	SPTS I	WS O OCS O		
<p>NOTE</p> <ul style="list-style-type: none">– After having initialized the train location (REQ_5.1.2.1.1-1 or REQ_5.1.2.1.1-2 or REQ_5.1.2.1.1-3 or REQ_5.1.2.1.1-4 or REQ_5.1.2.1.1-6) the travel distance is measured using input information from UGTMS onboard sensors (e.g. odometers, radar sensors, accelerometers, etc.).– To keep the travel distance within acceptable accuracy, it can be corrected when a wayside SPTS device is detected.– The train location is transmitted to WS, and possibly to OCS.					

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE An example of train location failure is the failure of UGTMS sensors (e.g. odometer).					



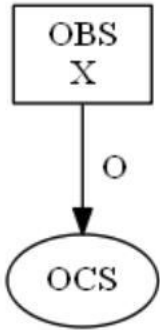
[REQ_5.1.2.1.4-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide the information about the train location failure of reporting trains to the interface

- with the external operations control HMI, and
- with the external train HMI. (M for GOA1, M for GOA2, O for GOA3, O for GOA4).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2. The output to THMI is provided by REQ_6.5.2-1.					



[REQ_5.1.2.1.4-5]

Deleted.

[REQ_5.1.2.1.4-6]

{GOA1: M; GOA2: M; GOA3: O; GOA4: O}

Following loss of train localisation, in order to permit re-initialisation of train localisation, UGTMS shall release the emergency brake after receiving a safety-related command via the interface

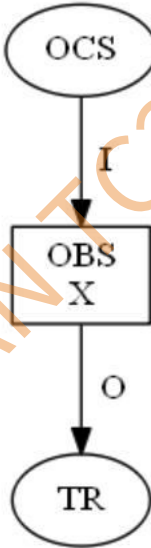
- with the external train HMI, (M for GOA1, M for GOA2, O for GOA3, O for GOA4), and
- with the external operations control HMI. (O)

NOTE 1 The application of such requirement is not mandatory for GOA3 and GOA4: this allows for the automatic release of the emergency brake, following a check done by UGTMS of conditions for making the release.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			TR O

NOTE The processing is done by OBS with inputs coming from

- OCS via an operator command (the input from/output to OHMI is provided by REQ_6.5.1-3), or
- THMI provided by REQ_6.5.2-2.



[REQ_5.1.2.1.4-7]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide train location status to the interface with the external train HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				

NOTE The output to THMI is provided by REQ_6.5.2-1.

OBS
X

[REQ_5.1.2.1.4-8]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Following the loss of train location status of a reporting train, UGTMS shall determine the area where the concerned train is and optionally set the corresponding zone(s) of protection.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				
NOTE See the REQ_5.1.4.4-1 for the setting of ZOP.					

WS
X

[REQ_5.1.2.1.4-9]

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FCN 5.1.2.2 – Locate non-reporting trains

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

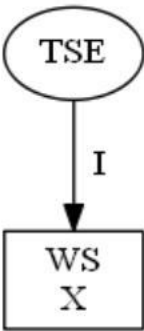
Mandatory: all GOAs if external train detection devices are used by UGTMS

[REQ_5.1.2.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the location of non-reporting trains based on inputs received from external train detection devices.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I	
NOTE The location of the reporting trains is provided to WS by REQ_5.1.2.1.4-1, this information being required in order to distinguish the occupation of non-reporting trains from reporting ones.					

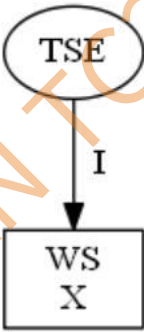


[REQ_5.1.2.2-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

A track section shall be determined to be logically non-occupied only if an adjacent track section has been detected occupied before the considered track section has reported unoccupied. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I	
NOTE TSE I for adjacent track sections to be taken into account.					



FCN 5.1.3 – Determine permitted speed

FCN 5.1.3.1 – Determine static speed profile

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.3.1-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the maximum permitted speed for all guideway locations.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X1 OBS X2				
NOTE The maximum permitted speed for all guideway locations is actually pre-calculated (done offline), and then considered as a configuration data. These data are then used possibly by WS and/or OBS.					



[REQ_5.1.3.1-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall allow the determination of different speed profiles for different types of trains and for different driving modes. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X1 OBS X2				
NOTE The different speed profiles for different types of trains and for different driving modes are actually pre-calculated (done offline), and then considered as a configuration data. These data are then used possibly by WS and/or OBS.					



FCN 5.1.3.2 – Determine temporary infrastructure speed restrictions

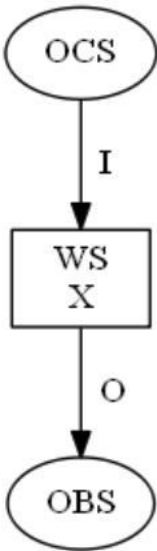
{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.1.3.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall set a zone of temporary speed restriction by operational command provided via the interface with the external operations control HMI, including a selected speed limit and the concerned area of the track.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I	OBS O		
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					



[REQ_5.1.3.2-2]

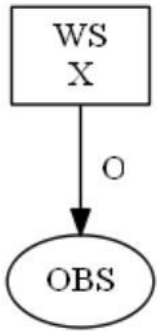
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[REQ_5.1.3.2-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case several speed restrictions can be set at the same location, UGTMS shall enforce the lowest speed restriction.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OBS O		



[REQ_5.1.3.2-4]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

Setting a new temporary speed restriction shall not remove existing speed restrictions set at the same location. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				

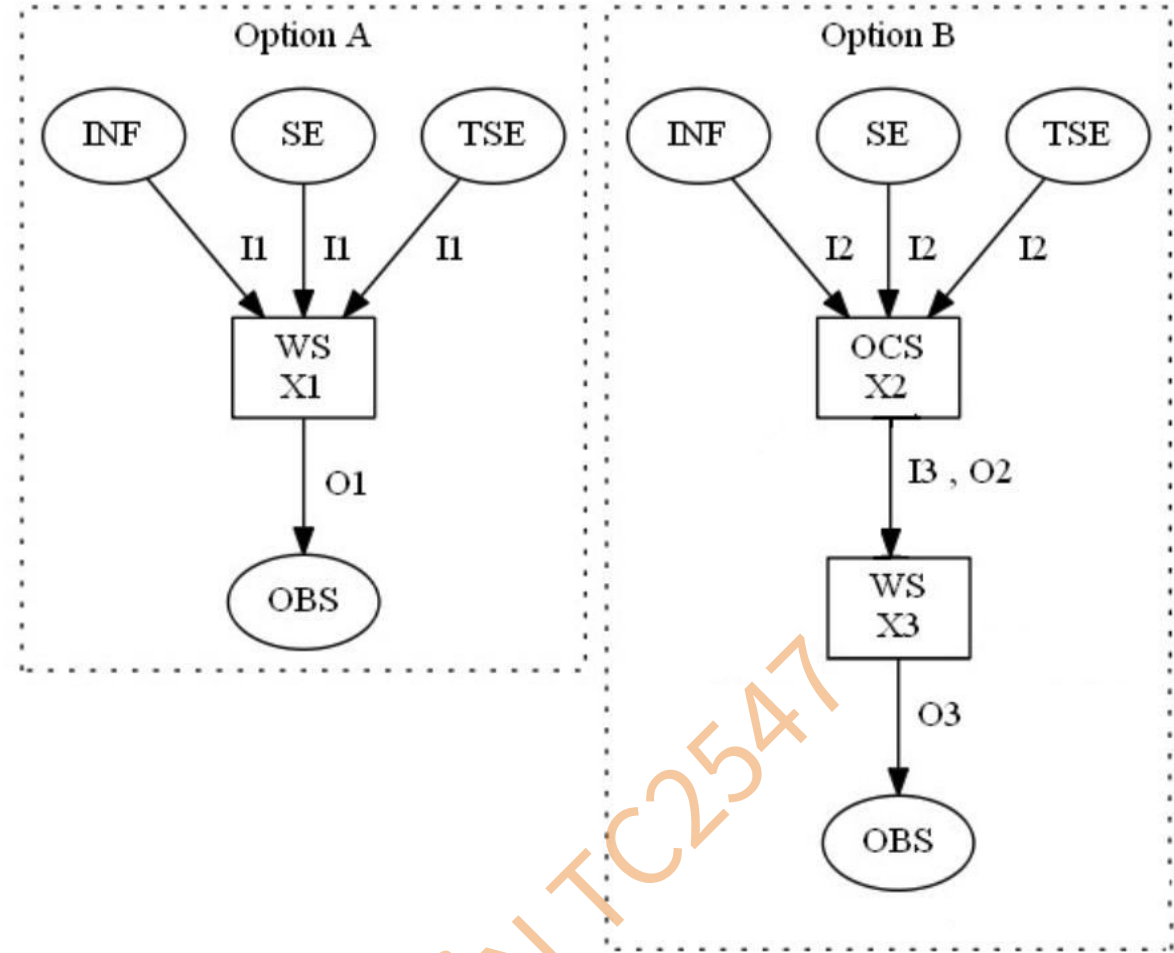


[REQ_5.1.3.2-5]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall automatically create speed restrictions based on statuses provided by external devices (e.g. bad weather detectors). (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1		OBS O1	TSE I1 SE I1 INF I1	
B	WS X3 OCS X2	OCS I3	WS O2 OBS O3	TSE I2 SE I2 INF I2	
<p>This requirement can be implemented in two ways (the options defined for the allocation of this requirement are not design options decided for UGTMS, but resulting from the design of the external environment and how it is connected to UGTMS):</p> <p>Option A:</p> <p>NOTE 1 The sensors provide directly the inputs to WS.</p> <p>Option B:</p> <p>NOTE 2 The sensors provide the information to OCS, which defines the speed restriction to be created by WS. OCS sends this information to WS.</p> <p>NOTE 3 WS creates speed restrictions.</p>					

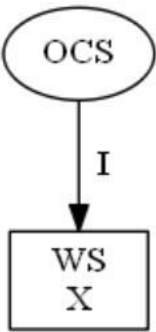


[REQ_5.1.3.2-6]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

A temporary speed restriction set manually shall be released by safety-related command provided via the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					

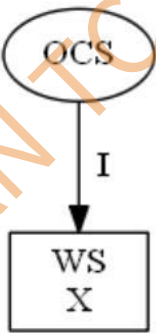


[REQ_5.1.3.2-7]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

A temporary speed restriction set automatically shall be released by safety-related command provided via the interface with the external operations control HMI if the external condition is no longer detected. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					

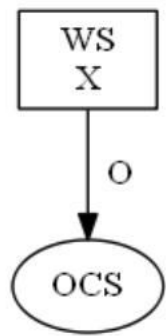


[REQ_5.1.3.2-8]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

When a temporary speed restriction is established, the status of the speed restriction including as a minimum the selected speed and covered zone shall be provided to the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE <ul style="list-style-type: none">The reason for setting the TSR can also be provided to the interface with the operations control HMI.The output to OHMI is provided by REQ_6.5.1-2.					



FCN 5.1.3.3 – Determine maximum speed by train type

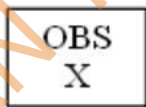
{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.1.3.3-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the maximum permitted speed for each type of train.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The processing of this requirement is done in OBS, and the type of train is an internal UGTMS data (e.g. coming from the onboard configuration data).					



FCN 5.1.3.4 – Determine temporary train speed restrictions

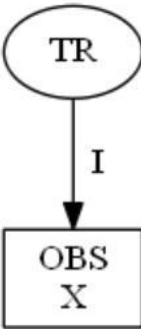
{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.1.3.4-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine speed restrictions based on train conditions detected and provided by the train (e.g. failures).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X			TR I	

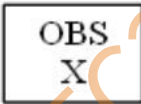


[REQ_5.1.3.4-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine speed restrictions based on the driving mode.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The driving mode is managed by REQ_5.5.2-2, REQ_5.5.2-4 and REQ_5.5.2-5.					



FCN 5.1.4 – Authorize train movement

FCN 5.1.4.1 – Determine movement authority limit

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.4.1-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine for each train the limit of its movement authority based on the most restrictive of the following:

- limit of safe route;
- limit based on safe train separation;
- limit based on the guideway (e.g. end of track);
- limit based on zones of protection;
- limit based on work zones.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1		OBS O1		
B	WS X2	WS I3	OBS O2		
	OBS X3				

The input from EIXL is provided by REQ_5.1.6-1.

This requirement can be implemented in two ways:

Option A:

NOTE 1 WS is in charge of processing.

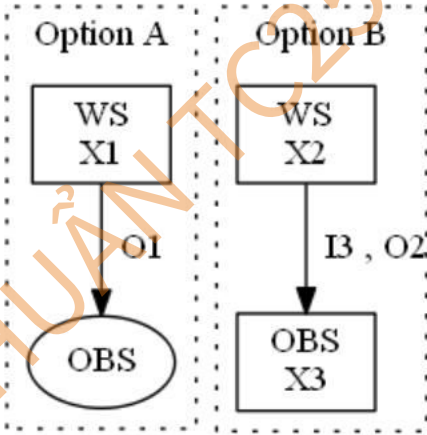
WS provides the movement authority O1 to OBS, calculated on the basis of its internal data (related to safe route, etc.) or of data received from the external interlocking.

Option B: the processing is done by WS and OBS.

NOTE 2 WS provides to OBS the movement authority limit O2 (whose calculation is based on safe train separation), and independently provides field element information (managed internally or received from the external interlocking).

NOTE 3 The OBS combines the information to create its movement authority.

OBS restricts accordingly its movement authority limit, depending on the context such as the driving mode of the train, the status of the train.



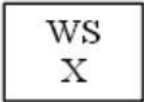
[REQ_5.1.4.1-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In the event of a loss of safe route once a movement authority has been issued, UGTMS shall pull back the movement authority limit to the new limit of safe route.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				

NOTE The input from EIXL is provided by REQ_5.1.6-1.



[REQ_5.1.4.1-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

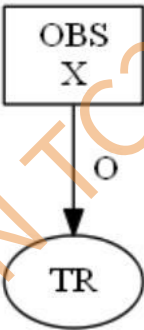
In case a movement authority accepted by the train exceeds its validity period (e.g. due to data communication failure), UGTMS shall either:

- pull back the movement authority limit to the first potential danger point ahead of the train, or
- stop the train immediately.

NOTE 2 The characterization of what is a potential danger point is defined by the transport authority.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O

NOTE The relevant danger point is provided by configuration data.



FCN 5.1.4.2 – Determine train protection profile

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

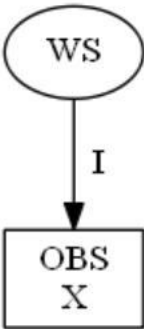
[REQ_5.1.4.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the train protection profile for each UGTMS-operated train, taking into account the speed profiles, train and infrastructure parameters (e.g. gradients of track, track section lengths, locations of points), and the movement authority limit.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	WS I			

NOTE OBS receives the temporary infrastructure speed restriction from WS (see REQ_5.1.3.2-1).



[REQ_5.1.4.2-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall allow a train protection profile with reduced or no safety margins in specific areas and at a speed sufficiently slow to reduce the consequences of a collision (shunting in depot, stabling areas, automatic coupling of train units, etc.). (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE All information needed is already available at OBS level, as described in REQ_5.1.4.2-1.					

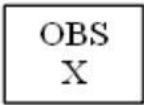


[REQ_5.1.4.2-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall calculate the speed limit that results from the most restrictive of all safety-related constraints applied to the UGTMS trains.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE All information needed is already available at OBS level, as described in REQ_5.1.4.2-1.					

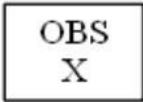


[REQ_5.1.4.2-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall enforce speed limits for the whole length of the train.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				

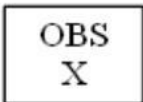


[REQ_5.1.4.2-5]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall authorize train movement for UGTMS-operated trains in accordance with the train protection profile when established.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				



FCN 5.1.4.3 – Authorize train movement by wayside signals

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

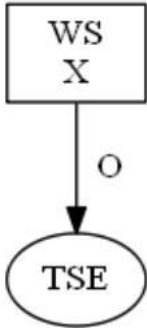
Mandatory: all GOAs if wayside signals are used by UGTMS

[REQ_5.1.4.3-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall control wayside signals in consistency with movement authorities and supervised routes.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				TSE O

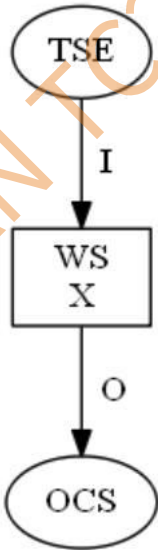


[REQ_5.1.4.3-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall transmit the status information (e.g. "signal at danger", "failure status") received from each specific signal to the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O	TSE I	
NOTE The output to OHMI is provided by REQ_6.5.1-2.					

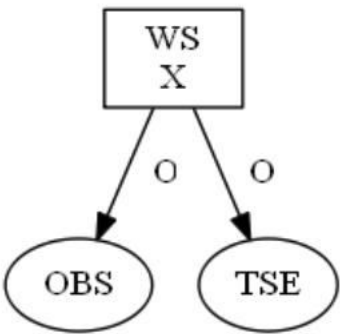


[REQ_5.1.4.3-3]

{GOA1: M; GOA2: M; GOA3: O; GOA4: O}

UGTMS shall ensure that the information given to control the wayside signal and the information provided to the interface with the external train HMI are consistent (M for GOA1, M for GOA2, O for GOA3, O for GOA4).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OBS O		TSE O
NOTE The output to THMI is provided by REQ_6.5.2-1.					



FCN 5.1.4.4 – Determine a zone of protection

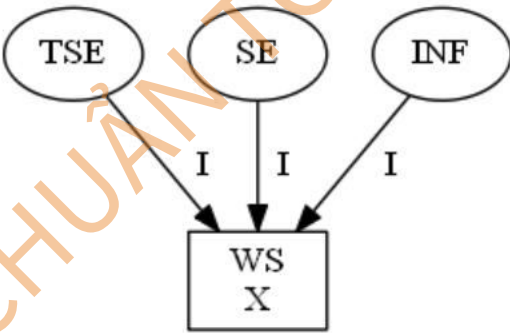
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.4.4-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall automatically set a zone of protection based on input provided by external devices (e.g. emergency stop request from platform), if such external devices are used by UGTMS.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I SE I INF I	

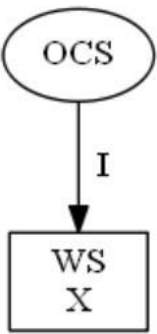


[REQ_5.1.4.4-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall apply a zone of protection created by operational command from the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					

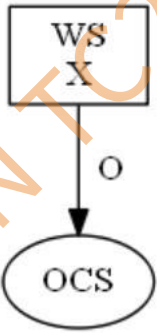


[REQ_5.1.4.4-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide the zone of protection status, including the covered area and the reason, to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					



[REQ_5.1.4.4-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall stop by emergency braking all trains present in the zone of protection, except, optionally, for the hazardous situations defined by the transport authority which require trains to leave the zone of protection.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1 OBS X2	WS I2	OBS O1		TR O2
B	WS X3 OBS X4	WS I4	OBS O3		TR O4

Train location is provided by REQ_5.1.2.1.4-1.

This requirement can be implemented in two ways:

Option A: WS updates movement authority of affected trains

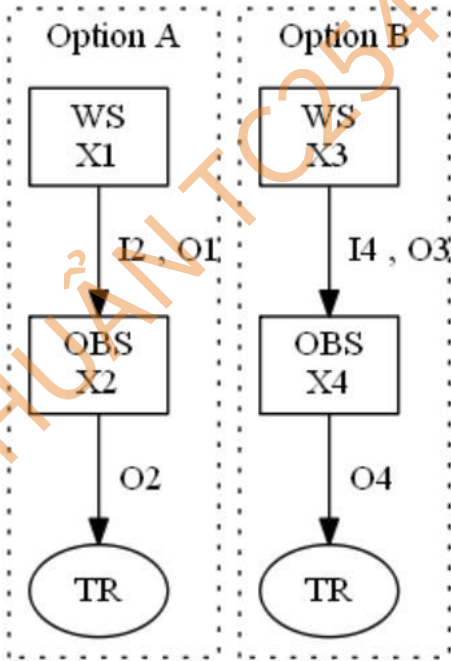
NOTE 1 Processing in WS to update the movement authority for trains in the concerned area taking into consideration any hazardous situation, and WS sends updated movement authority O1 to OBS. Train movement authority is covered by REQ_5.1.4.1-1.

NOTE 2 OBS performs an EB if required by WS.

Option B: WS sends the ZOP status to all OBS

NOTE 3 WS sends the ZOP status and characteristics to OBS.

NOTE 4 OBS reacts accordingly depending on its location and any hazardous situation.



[REQ_5.1.4.4-5]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

- UGTMS shall prevent trains from entering the zone of protection.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1		OBS O1		
B	WS X2 OBS X3	WS I3	OBS O2		TR O3

This requirement can be implemented in two ways:

Option A: the processing is done by WS

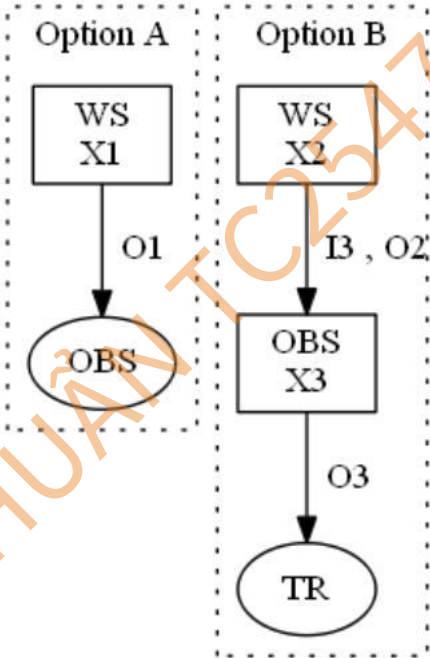
NOTE 1 WS determines which trains are concerned (train location is provided by REQ_5.1.2.1.4-1).

The way to prevent trains from entering the ZOP is to send to the train a movement authority limit, modified accordingly (i.e. at the boundary of the ZOP).

Option B: the processing is done by WS and OBS

NOTE 2 WS sends the ZOP status and characteristics to OBS.

NOTE 3 OBS reacts accordingly depending on its location.



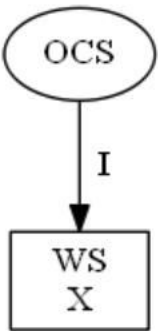
[REQ_5.1.4.4-6]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

A zone of protection set manually shall be released by safety-related command provided via the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			

NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.

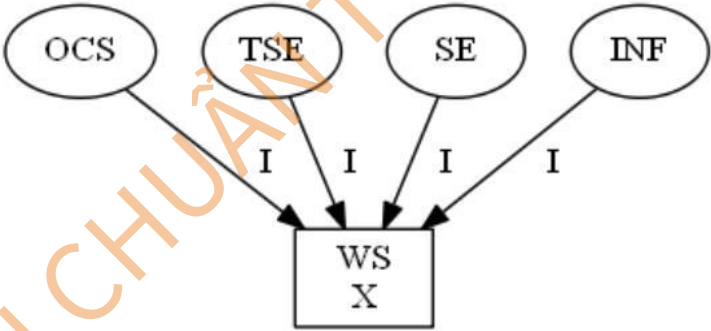


[REQ_5.1.4.4-7]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

A zone of protection set automatically shall be released by safety-related command provided via the interface with the external operations control HMI if the external condition is no longer detected.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I		TSE I SE I INF I	
NOTE					
– The input from/output to OHMI is provided by REQ_6.5.1-3.					
– TSE I, SE I, INF I for checking external conditions					

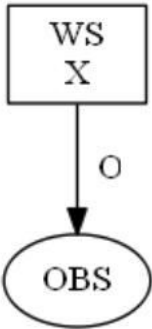


[REQ_5.1.4.4-8]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide the zone of protection status, including the covered area and the reason, via the interface with the external train HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OBS O		
NOTE The output to THMI is provided by REQ_6.5.2-1.					



FCN 5.1.4.5 – Deleted

FCN 5.1.4.6 – Authorize the entry of non-operative UGTMS trains into UGTMS territory

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.1.4.6-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall authorize the entry through appropriate wayside signals when the conditions (e.g. track section occupancy) defined by the transport authority for entry into UGTMS territory have been fulfilled.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1			TSE I1	TSE O1
B	WS X2				

The allocation of this requirement can be done through two options (the options defined for the allocation of this requirement are not design options decided for UGTMS, but resulting from the design of the external environment and how it is connected to UGTMS):

Option A: the appropriate wayside signals are managed by UGTMS

NOTE 1

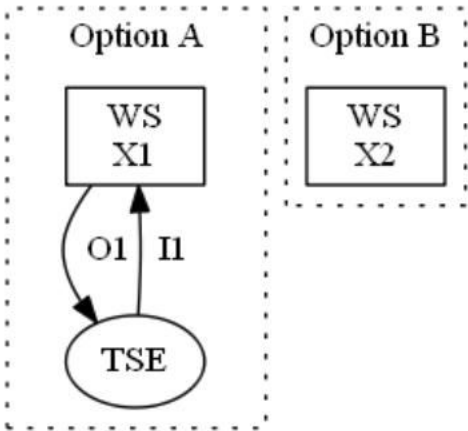
- Input from external train detection devices.
- Output to wayside signals.

Option B: the appropriate wayside signals are managed by the external interlocking

NOTE 2

- Input from external interlocking.
- Output to external interlocking.

The input/output from/to EIXL is provided by REQ_5.1.6-1 and REQ_5.1.6-3.

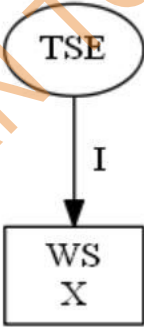


[REQ_5.1.4.6-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall detect a non-operative UGTMS train entering a transfer track of the UGTMS territory.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I	



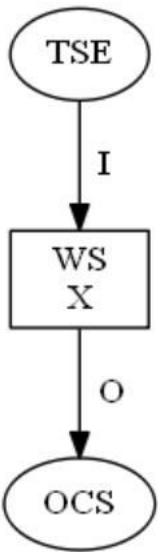
[REQ_5.1.4.6-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall report the entrance of a non-operative UGTMS train into a transfer track and into UGTMS territory to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O	TSE I	

NOTE The output to OHMI is provided by REQ_6.5.1-2.



FCN 5.1.5 – Supervise train movement

FCN 5.1.5.1 – Determine actual train speed

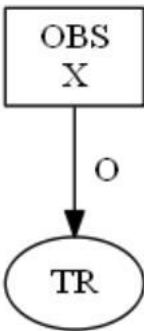
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.5.1-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall detect and determine the actual train speed.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X			TR I	
NOTE Depending on train characteristics, information from the train can be required for speed determination.					



FCN 5.1.5.2 – Supervise safe train speed

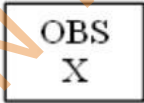
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.5.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall supervise the permitted speed of trains operated by UGTMS to ensure that the trains remain within the train protection profile.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The determination of train speed profile is covered in REQ_5.1.4.2-1 or REQ_5.1.4.2-2.					

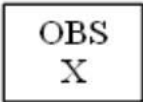


[REQ_5.1.5.2-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

In manual driving mode, UGTMS shall provide warning information, triggered by a predefined warning profile that is more restrictive than the train protection profile, to the interface with external train HMI in order to enable the train operator to react and avoid brake intervention triggered by the system. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The output to THMI is provided by REQ_6.5.2-1.					

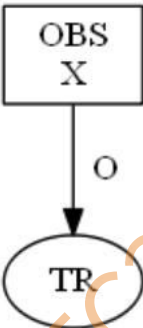


[REQ_5.1.5.2-3]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

In manual driving mode, UGTMS shall trigger service braking in accordance with the warning profile in order to respect the train protection profile and to avoid emergency brake intervention.
(O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O

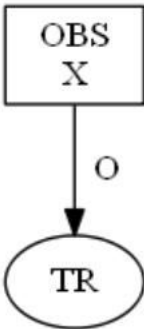


[REQ_5.1.5.2-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If the determined actual train speed is higher than the speed permitted by the train protection profile, UGTMS shall trigger an emergency brake.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O

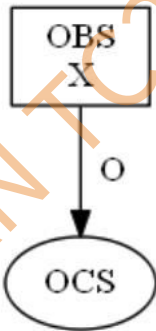


[REQ_5.1.5.2-5]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide information about the triggering of emergency brake to the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					



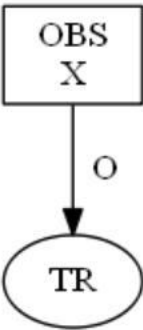
[REQ_5.1.5.2-6]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide one of the two following possibilities for automatic emergency brake release, provided that there are no other conditions for triggering the emergency brake (O):

- during deceleration when the actual determined train speed returns below the train protection profile; or
- when the actual train speed is determined as zero.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O

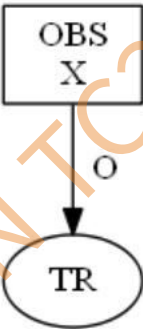


[REQ_5.1.5.2-7]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall automatically release emergency brake only if overspeed is not detected a predefined number of times within a predefined time period. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O

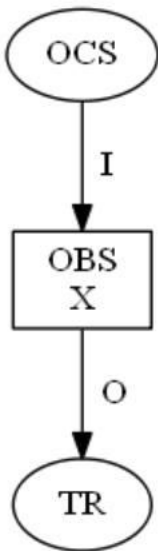


[REQ_5.1.5.2-8]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

The emergency brake shall be released by safety-related command provided via the interface with the external operations control HMI if the actual train speed is determined as zero and there is no more condition for triggering the emergency brake. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			TR O
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					

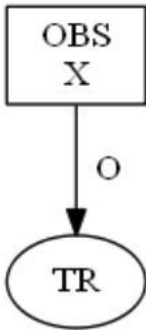


[REQ_5.1.5.2-9]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

The emergency brake shall be released by command provided via the interface with the external train HMI if the actual train speed is determined as zero and there is no more condition for triggering the emergency brake. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE The input from/output to THMI is provided either by REQ_6.5.2-1 or REQ_6.5.2-2.					

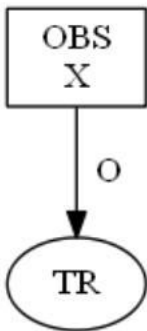


[REQ_5.1.5.2-10]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall automatically release the service brake during deceleration if actual determined train speed returns below the warning profile. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O

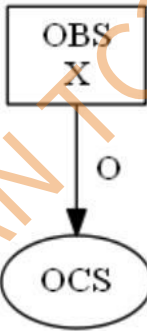


[REQ_5.1.5.2-11]

{GOA1: O; GOA2: O; GOA3: M; GOA4: M}

UGTMS shall provide information about the release of emergency brake to the interface with the external operations control HMI. (O for GOA1, O for GOA2, M for GOA3, M for GOA4)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					



FCN 5.1.5.3 – Inhibit train stops

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Mandatory: all GOAs if train stops are used by UGTMS

[REQ_5.1.5.3-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall command the inhibition and reactivation of the train stop functionality according to the specified safety conditions (trains with operating UGTMS).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1				TSE O1
B	OBS X2				TR O2

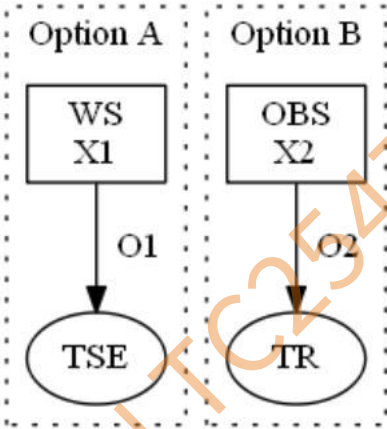
This requirement can be implemented in two ways, depending on the type of train stops (the options defined for the allocation of this requirement are not design options decided for UGTMS, but result from the design of the external environment and how it is connected to UGTMS):

Option A: the active part of the train stop device is installed on wayside

NOTE 1 The processing for inhibition and re-activation is done by WS.

Option B: the active part of the train stop device is installed onboard

NOTE 2 The processing for inhibition and re-activation is done by OBS. It applies only to the onboard component of the train stop.



FCN 5.1.5.4 – Deleted

FCN 5.1.5.5 – Supervise train rollaway

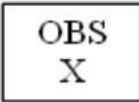
{GOA1: O; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.1.5.5-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall detect an unauthorized movement of the train in case of travel of the train against the authorized direction of travel beyond a predefined distance.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				

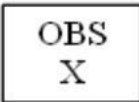


[REQ_5.1.5.5-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

For a train at standstill, UGTMS shall detect unauthorized motion beyond a predefined distance. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				

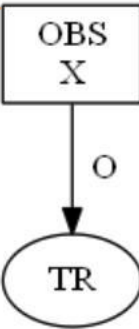


[REQ_5.1.5.5-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

When rollaway is detected, UGTMS shall apply the emergency brake.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O



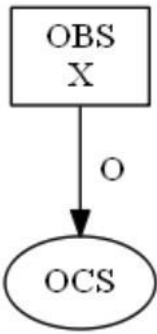
[REQ_5.1.5.5-4]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide the necessary information about the detected rollaway to the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X		OCS O		

NOTE The output to OHMI is provided by REQ_6.5.1-2.

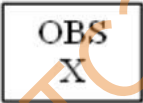


[REQ_5.1.5.5-5]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide the necessary information about the detected rollaway to the interface with the external train HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The output to THMI is provided by REQ_6.5.2-1.					



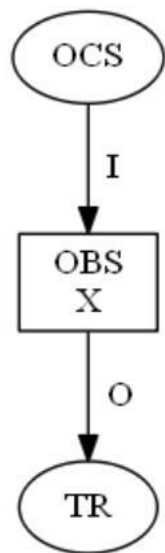
[REQ_5.1.5.5-6]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Unless prohibited by the train protection profile, UGTMS shall release the emergency brake provided by a safety-related command

- via the interface with the external train HMI, (M for GOA1, M for GOA2, O for GOA3, O for GOA4), and
- via the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			TR O
NOTE <ul style="list-style-type: none">The input from/output to THMI is provided by REQ_6.5.2-2.The input from/output to OHMI is provided by REQ_6.5.1-3.					



FCN 5.1.5.6 – React to unauthorized movements of non-operative UGTMS trains

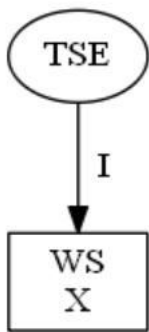
{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.1.5.6-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall detect unauthorized movement of non-operative UGTMS trains based on inputs from an external device.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			TSE I	

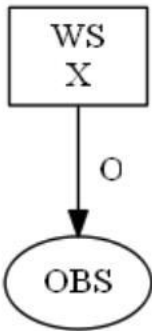


[REQ_5.1.5.6-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall restrict the movement authority of UGTMS trains that are in conflict with an unauthorized movement of a non-operative UGTMS train when such an unauthorized movement is detected.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OBS O		
NOTE WS provides the restricted movement authority O to the concerned OBS.					

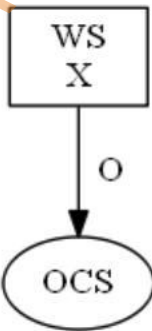


[REQ_5.1.5.6-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide an alarm about the restriction of the movement authority of a train in conflict with the detected unauthorized movement of a non-operative UGTMS train to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					



FCN 5.1.6 – Provide interface with external interlocking

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

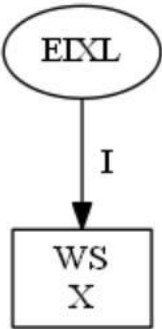
Mandatory: all GOAs if "Ensure safe route" functions are not provided by UGTMS

[REQ_5.1.6-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall receive all necessary information (e.g. status of movable and non-movable route elements, train detection systems, signals) provided by the external interlocking as status information in order to ensure safe movement of trains.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			EIXL I	



[REQ_5.1.6-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide the information (e.g. status of movable and non-movable route elements, train detection systems, signals) received from the external interlocking to the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1		OCS O1	EIXL I1	
B	OCS X2			EIXL I2	

This requirement can be implemented through two ways (the options defined for the allocation of this requirement are not design options decided for UGTMS, but result from the design of the external environment and how it is connected to UGTMS):

Option A: case when the EIXL is connected only to WS

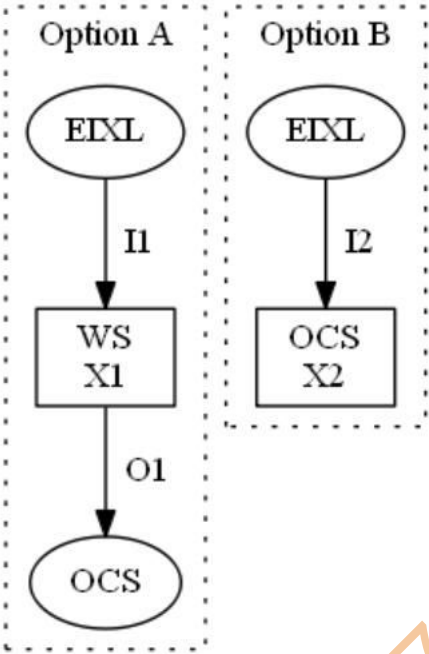
NOTE 1 The processing is done by WS.

The output to OHMI is provided by REQ_6.5.1-2.

Option B: case when the EIXL is connected to WS and to OCS

NOTE 2 The processing is done by OCS.

The output to OHMI is provided by REQ_6.5.1-2.



[REQ_5.1.6-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide all necessary commands (e.g. set route automatically, set signal to danger) to the external interlocking in order to control the interlocking if required.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1 X3 OCS X2	OCS I3	WS O2		EIXL O1 O3
B	WS X4 OCS X5				EIXL O4 O5

This requirement can be implemented through two ways (the options defined for the allocation of this requirement are not design options decided for UGTMS, but result from the design of the external environment and how it is connected to UGTMS):

Option A: case when the EIXL is connected only to WS

NOTE 1 WS processes its allocated commands, and sends the corresponding outputs to external interlocking; for instance "setting a signal to danger".

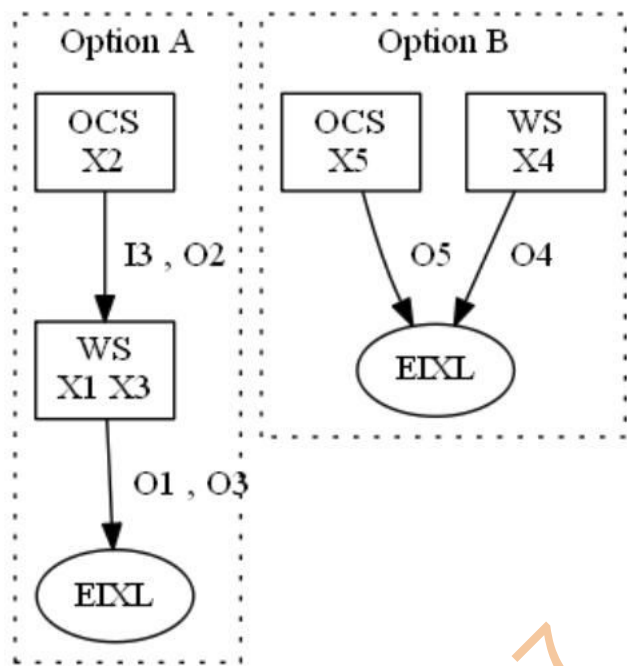
NOTE 2 OCS processes its allocated commands, and sends the corresponding outputs to WS; for instance "setting a route automatically".

NOTE 3 WS receives commands from OCS, and forwards it to the external interlocking.

Option B: case with the EIXL is connected to WS and to OCS

NOTE 4 WS processes its allocated commands, and sends the corresponding outputs to external interlocking; for instance "setting a signal to danger".

NOTE 5 OCS processes its allocated commands, and sends the corresponding outputs to external interlocking; for instance "setting a route automatically".

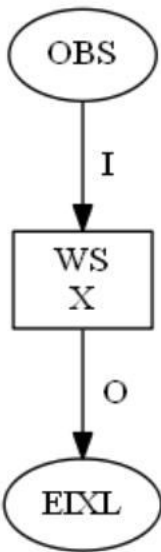


[REQ_5.1.6-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

For UGTMS trains, UGTMS shall send override commands to the external interlocking, based on trains' location, speed and movement authority.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OBS I			EIXL O
NOTE Train location is provided by REQ_5.1.2.1.4-1. Input from OBS to WS to get the train speed.					



[REQ_5.1.6-5]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide all necessary commands (e.g. set route, move point, set signal to danger) received from the interface with the external operations control HMI to the external interlocking in order to control the interlocking by operations staff. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X2 OCS X1	OCS I2	WS O1		EIXL O2
B	OCS X3				EIXL O3

This requirement can be implemented through two ways (the options defined for the allocation of this requirement are not design options decided for UGTMS, but result from the design of the external environment and how it is connected to UGTMS):

Option A: case when the EIXL is connected only to WS.

The processing is done by OCS and WS.

NOTE 1 OCS sends commands to WS for EIXL in order to control the interlocking by operations staff.

The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.

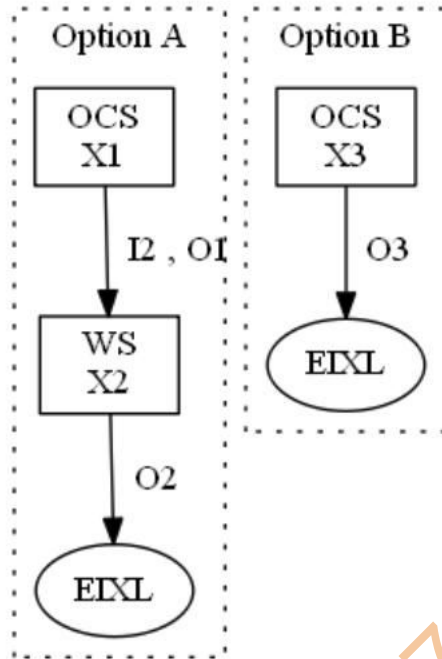
NOTE 2 WS sends the commands received from OCS to EIXL.

Option B: case when the EIXL is connected to WS and to OCS.

The processing is done by OCS.

NOTE 3 OCS sends commands to EIXL in order to control the interlocking by operations staff.

The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.



FCN 5.2 – Drive train

FCN 5.2.1 – Determine operating speed profile

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.2.1-1]

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the operating speed profile in accordance with the following four categories:

- infrastructure data;
- train parameters and statuses;
- train protection profile;
- operational non-safety critical parameters related to stopping points such as stopping points in stations or sidings, authorizations to enter in station, departure conditions.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1	WS I1 OCS I1		TR I1	
B	OBS X3 OCS X2	OCS I3	OBS O2	TR I3	

This requirement can be implemented in two ways:

Option A: the processing is done by OBS.

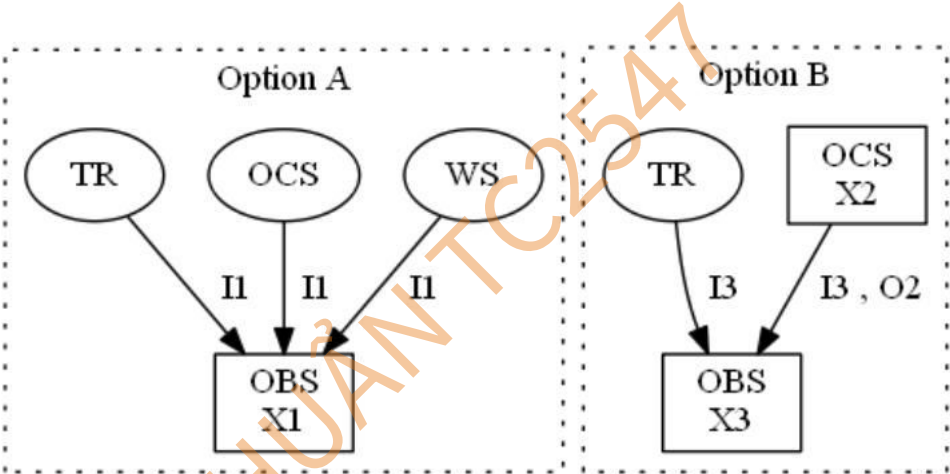
NOTE 1 Inputs are coming from either

- WS or configuration data for infrastructure data (two possible options),
- OCS for missions (provided by REQ_6.2.1-2), and other operational non-safety critical data (from REQ_5.2.3.2-1, or REQ_5.2.3.2-2 or REQ_5.2.3.2-6), or
- the train (but not its HMI) for TR status.

Option B: the processing is done by OCS and by OBS.

NOTE 2 OCS provides a preliminary determination of operational speed profile (run types), and sends it to OBS.

NOTE 3 OBS completes/modifies it (TR status is provided by train (but not its HMI)).



[REQ_5.2.1-2]

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall determine the next operating speed profile which enables the train to stop at the following stopping point (e.g. station stopping point, end of mission or other stopping point) as required by the mission of the train.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1	OCS I1			
B	OBS X3 OCS X2	OCS I3	OBS O2		

This requirement can be implemented in two ways (the choice of option has to be the same as the one made for REQ_5.2.1-1):

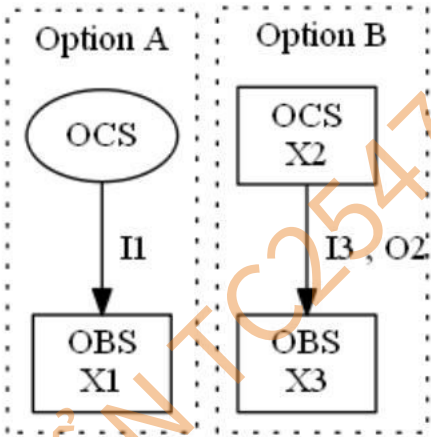
Option A: The processing is done by OBS.

NOTE 1 Inputs are coming from REQ_5.2.1-1.

Option B: The processing is done by OCS and by OBS.

NOTE 2 OCS provides a preliminary determination of operational speed profile (run types), and sends it to OBS.

NOTE 3 OBS completes/modifies it (inputs are coming from REQ_5.2.1-1).

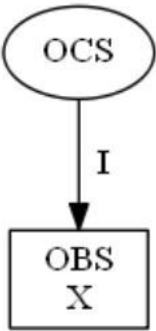


[REQ_5.2.1-3]

{GOA1: n/a; GOA2: O; GOA3: M; GOA4: M}

UGTMS shall determine the operating speed profile to enable the train to stop at the next stopping point (e.g. station stopping point, end of mission or other stopping point) by command provided via the interface with the external operations control HMI (e.g. stop at next station). (O for GOA2, M for GOA3, M for GOA4)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			
NOTE Performed by REQ_6.2.1-11 through a modification of the train mission.					



[REQ_5.2.1-4]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall choose the most adapted operating speed profile (e.g. tight, coasting) in accordance with the regulation strategy. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1	OCS I1			
B	OBS X3 OCS X2	OCS I3	OBS O2		

This requirement can be implemented in two ways (the choice of option has to be the same as the one made for REQ_5.2.1-1):

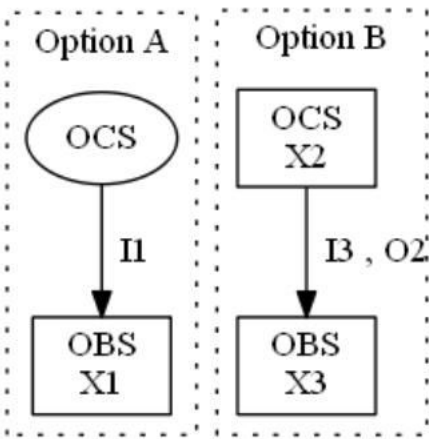
Option A: The processing is done by OBS.

NOTE 1 Inputs are coming from REQ_5.2.1-1, with the additional input about the regulation strategy from OCS provided by REQ_6.2.3-3.

Option B: The processing is done by OCS and by OBS.

NOTE 2 OCS provides a preliminary determination of operational speed profile (run types), and sends it to OBS.

NOTE 3 OBS completes/modifies it (inputs are coming from REQ_5.2.1-1).

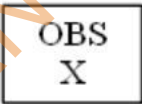


[REQ_5.2.1-5]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide the operating speed profile to the interface with the external train HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The output to THMI is provided by REQ_6.5.2-1. The operating speed profile is provided by REQ_5.2.1-1, -2, -3 and -4.					

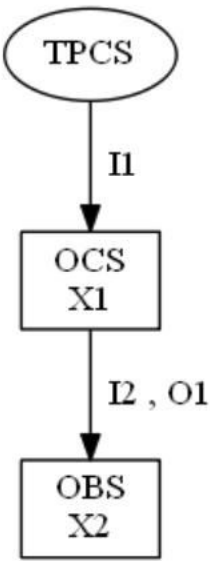


[REQ_5.2.1-6]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall apply load-shedding running of trains in order to limit the power consumption in electrical sections where there is a lack of available power. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X2 OCS X1	OCS I2	OBS O1	TPCS I1	
The lack of available power is provided to the OCS by the traction control power system (TPCS). Processing is done by OCS and OBS. NOTE 1 OCS monitors the presence of power in electrical sections. OCS sends information to OBS of each affected train. These trains then apply a specific operating speed profile (load-shedding running profile) to cope with the lack of available power in the concerned area. NOTE 2 Another way to tackle the question of lack of available power in an electrical section is to limit the number of train departures at the same time in the affected traction power section. This is covered already by REQ_6.2.6-1.					



FCN 5.2.2 – Control train movement in accordance with train operating speed profile

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

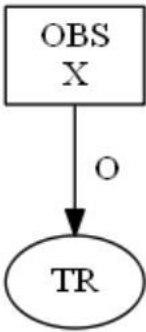
[REQ_5.2.2-1]

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall command acceleration/deceleration to the train complying with the operating speed profile and the required travel direction.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O

NOTE Traction and braking commands to train (but not its HMI).

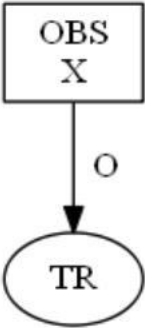


[REQ_5.2.2-2]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall deliver traction/regenerative braking commands in such a way that unnecessary drawing/delivering of electrical current is avoided whilst the train is traversing a gap between two sections of the conductor rail or catenary. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE UGTMS train location is known by OBS thanks to REQ_5.1.2.1.4-1. Information about "traction power gaps" is provided by configuration data.					

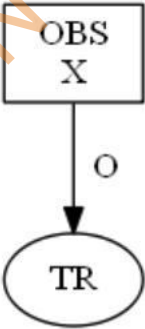


[REQ_5.2.2-3]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall inhibit traction/regenerative braking commands to the train while the train is running in a non-powered section. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O



[REQ_5.2.2-4]

Deleted.

FCN 5.2.3 – Stop train in station

FCN 5.2.3.1 – Stop train at next station

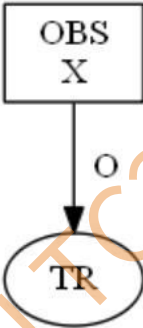
{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

[REQ_5.2.3.1-1]

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall allow the train to stop in the station if the stop is part of the mission and no other command to skip the station has been sent to the train.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE Train missions are managed thanks to REQ_6.2.1-2, and the skip function is covered in REQ_5.2.3.3-1.					

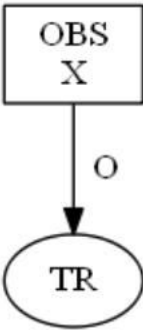


[REQ_5.2.3.1-2]

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

Further to a command modifying the status of a station from "station not to be served" to "station to be served", UGTMS shall command the train to stop in the station if the stop can be achieved through normal service braking.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE Serving the station is defined by the mission, known by OBS thanks to REQ_6.2.1-2.					

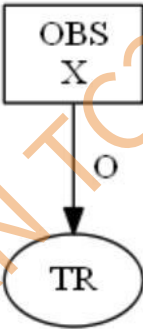


[REQ_5.2.3.1-3]

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall stop the train in the station according to the stopping point determined in the train operating profile.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O



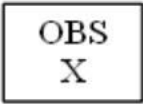
[REQ_5.2.3.1-4]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

When a train that is not serving a station stops in the station, UGTMS shall keep the train doors, and the platform doors if existing, closed. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				

NOTE The information about the status of stations serving is given by the mission, provided by REQ_6.2.1-2.

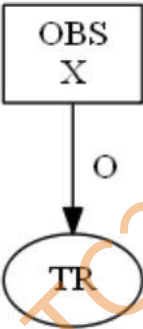


[REQ_5.2.3.1-5]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

If the train overruns the platform stop by a distance higher than an acceptable limit (missed station), the train shall proceed to the next station. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE The stopping tolerance is determined by configuration data.					

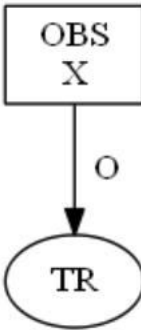


[REQ_5.2.3.1-6]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

If the train fails to reach the stopping point at the platform, the train shall jog forward automatically until it is correctly aligned. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O

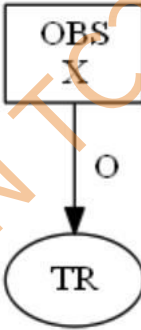


[REQ_5.2.3.1-7]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

If a train overruns the platform stop by a distance lower than an acceptable limit, UGTMS shall command the train to jog backward the train until it is correctly aligned. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE The rollback tolerance is determined by configuration data.					

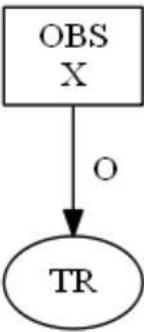


[REQ_5.2.3.1-8]

{GOA1: n/a; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall command the train to proceed to the next station (unless terminal station) after a limited number of jogs have been attempted without reaching the stopping point. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE The number of jog attempts is determined by configuration data.					



FCN 5.2.3.2 – Hold train at station

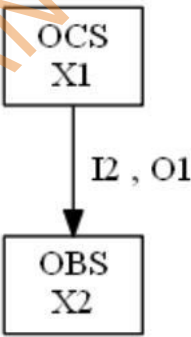
{GOA1: O; GOA2: O; GOA3: M; GOA4: M}

[REQ_5.2.3.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If a hold request for a specific platform track provided via the interface with the external operations control HMI is received, UGTMS shall hold any affected train.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OCS X1 OBS X2	OCS I2	OBS O1		
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					



[REQ_5.2.3.2-2]

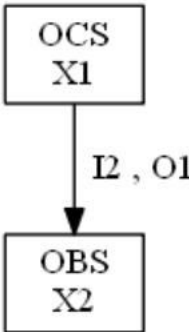
{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If a hold request for a specific platform track is triggered by UGTMS (e.g. train regulation, power supply failure ahead), UGTMS shall hold any affected train.

NOTE The release of such hold request is not covered by a requirement as, depending on use cases, the release can be either automatic or manual (possibly in case of fire).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OCS X1 OBS X2	OCS I2	OBS O1		

NOTE The input for the train hold request generated by another UGTMS function can come both from WS and OCS. We consider that any trigger coming from a function in WS is provided first to the OCS, and then to OBS.



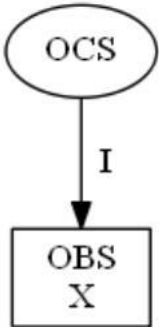
[REQ_5.2.3.2-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Once stopped at platform, the train shall not be able to depart until the train hold request set previously by the external operations control HMI is released by command provided via the interface with the external operations control HMI, if no other hold condition exists.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			

NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.

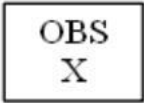


[REQ_5.2.3.2-4]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide train hold information to the interface with the external train HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The hold status is known by OBS (REQ_5.2.3.2-1 and -2). The output to THMI is provided by REQ_6.5.2-1.					



[REQ_5.2.3.2-5]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide information about the status of the train hold in station to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OCS X				
NOTE The output to OHMI is provided by REQ_6.5.1-2					

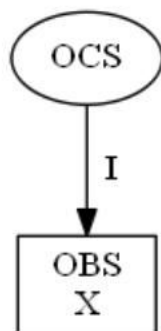


[REQ_5.2.3.2-6]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall hold a specific train at the next station to be served if a hold request for this train via the interface with the external operations control HMI is received. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					

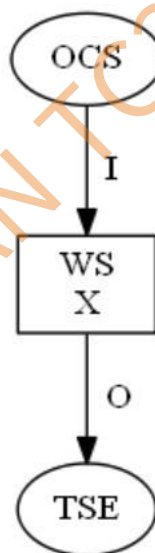


[REQ_5.2.3.2-7]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide train hold information to the interface with the external wayside device (e.g. indicator). (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			TSE O
NOTE The hold status is received from OCS and sent to the wayside external device.					



FCN 5.2.3.3 – Skip station stop

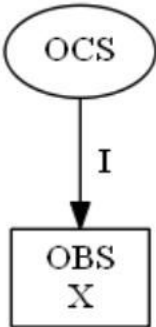
{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.2.3.3-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall force a train to skip a station, if the stop is not part of the mission, or a command to skip the station has been addressed to the train.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					

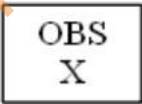


[REQ_5.2.3.3-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall limit the speed of the train skipping the station whilst running along the platform.
(O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The value of the maximum permitted speed when skipping a station (to be taken into account in the operating speed profile) is provided by configuration data.					

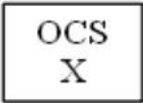


[REQ_5.2.3.3-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide skip station status to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OCS X				
NOTE The output to OHMI is provided by REQ_6.5.1-2.					



FCN 5.3 – Supervise guideway

FCN 5.3.1 – Prevent collision with obstacles

FCN 5.3.1.1 – Supervise wayside obstacle detection device

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

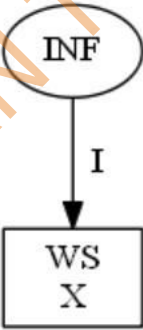
Mandatory: all GOAs if wayside obstacle detection devices are used by UGTMS

[REQ_5.3.1.1-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If an obstacle intrusion is reported from the external device, UGTMS shall establish the corresponding zone of protection.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			INF I	
NOTE Management of ZOP is provided by REQ_5.1.4.4-1.					

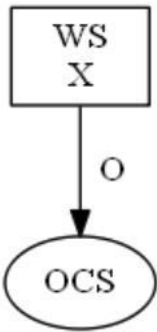


[REQ_5.3.1.1-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide the necessary information (e.g. obstacle intrusion status and the wayside location of the obstacle) to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					

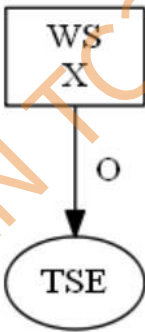


[REQ_5.3.1.1-3]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall provide information about the detected intrusion to the interface with the external wayside device (e.g. indicator). (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				TSE O
NOTE The output to THMI is provided by REQ_6.5.2-1.					

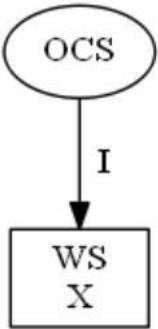


[REQ_5.3.1.1-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The reaction of the system in case of a detected obstacle intrusion shall be maintained until it is released by operations staff using a safety-related command provided via the interface with the external operations control HMI. This can only be done if the external condition having caused the triggering of the detection is no longer active.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					



FCN 5.3.1.2 – Supervise onboard obstacle detection device

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

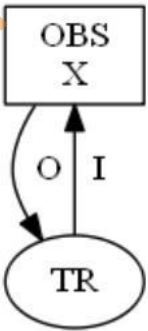
Mandatory: all GOAs if an onboard obstacle detection device is used by UGTMS

[REQ_5.3.1.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If an obstacle detection is reported from the external onboard detection device, UGTMS shall immediately trigger an emergency brake application if it is not directly triggered by the train.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X			TR I	TR O
NOTE Input from onboard obstacle detection device, EB as output (if not triggered directly by TR).					

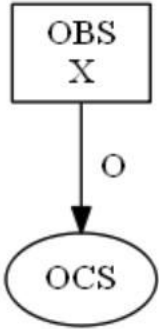


[REQ_5.3.1.2-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide onboard obstacle detection device operational status and information about the detected obstacle including the specific train identification, as emergency message to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					

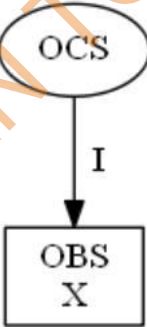


[REQ_5.3.1.2-3]

{GOA1: O; GOA2: O; GOA3: O; GOA4: M}

The reaction of the system in case of a detected obstacle shall be maintained until it is released by safety-related command provided via the interface with the external operations control HMI (O for GOA1, O for GOA2, O for GOA3, M for GOA4). This can only be done if the external condition having caused the triggering of the detection is no longer active.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3. The condition to check (obstacle detection) is the one of REQ_5.3.1.2-1.					



[REQ_5.3.1.2-4]

{GOA1: M; GOA2: M; GOA3: O; GOA4: O}

UGTMS shall provide information about the detected obstacle to the interface with the external train HMI. (M for GOA1, M for GOA2, O for GOA3, O for GOA4)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The output to THMI is provided by REQ_6.5.2-1.					

OBS
X

[REQ_5.3.1.2-5]

{GOA1: M; GOA2: M; GOA3: O; GOA4: O}

The reaction of the system in case of a detected obstacle shall be maintained until it is released by safety-related command provided via the interface with the external train HMI. This can only be done if the external condition having caused the triggering of the detection is no longer active. (M for GOA1, M for GOA2, O for GOA3, O for GOA4)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The input from/output to THMI is provided by REQ_6.5.2-2.					

OBS
X

FCN 5.3.2 – Prevent collisions with persons on tracks

FCN 5.3.2.1 – Warn passengers to stay away from the platform edge

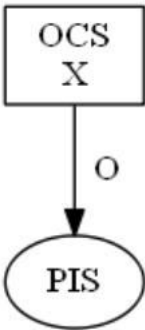
{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.3.2.1-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

When a train is approaching a platform, UGTMS shall provide information to external public address system to warn passengers on the platform.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OCS X				PIS O
This requirement is processed by OCS (to inform PIS).					
NOTE The determination of train approaching is provided by REQ_6.3.1-1, and the output to PIS is provided by REQ_6.7-1.					



FCN 5.3.2.2 – React to emergency stop request from platforms

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

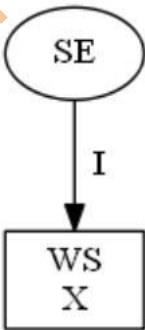
Mandatory: all GOAs if platform emergency stop request devices are used by UGTMS

[REQ_5.3.2.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of an emergency stop request from a station platform, a zone of protection covering the platform tracks shall be established.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			SE I	
NOTE Management of ZOP is provided by REQ_5.1.4.4-1.					



[REQ_5.3.2.2-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

In case of an emergency stop request from a station platform, UGTMS shall provide information to the external voice communication system to initiate communication between the requesting person and staff in OCC or staff in station. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	WS X1				VCS O1
B	OCS X2	WS I2			VCS O2

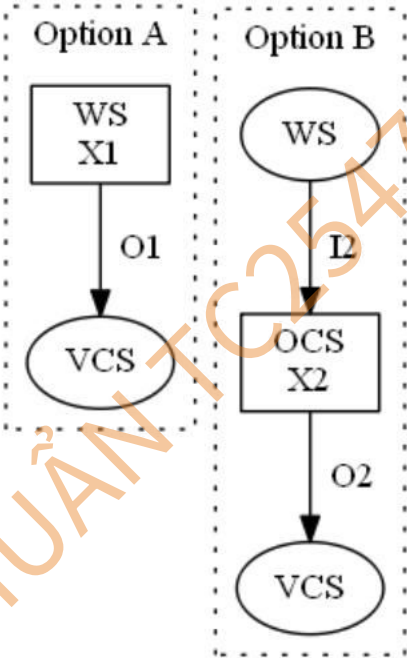
This requirement can be implemented in two ways (the options defined for the allocation of this requirement are not design options decided for UGTMS, but result from the design of the external environment and how it is connected to UGTMS):

Option A: external voice communication system is connected to WS: processing is done in WS

NOTE 1 WS is informed of the emergency stop request (REQ_5.3.2.2-1) and sends the information to the external voice communication system.

Option B: external voice communication system is connected to OCS: processing is done in OCS

NOTE 2 OCS receives the emergency stop request from WS (REQ_5.3.2.2-1) and sends the information to the external voice communication system.



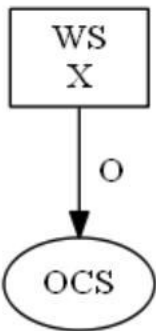
[REQ_5.3.2.2-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of an emergency stop request from a station platform, UGTMS shall provide the necessary information (e.g. status and location) to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		

NOTE The output to OHMI is provided by REQ_6.5.1-2.

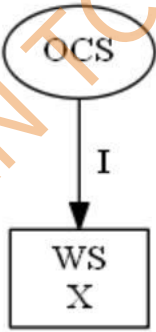


[REQ_5.3.2.2-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

An emergency stop request and the reaction of the system shall be maintained until it is released by safety-related command provided via the interface with the external operations control HMI. This can only be done if the external condition having caused the triggering of the request is no longer active.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					

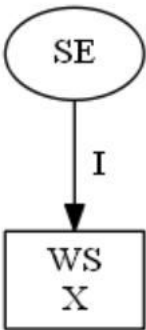


[REQ_5.3.2.2-5]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

In case of an emergency stop request from a station platform, UGTMS shall command the cut-off of the traction power of the concerned area. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			SE I	
NOTE Management of ZOP is provided by REQ_5.1.4.4-1.					

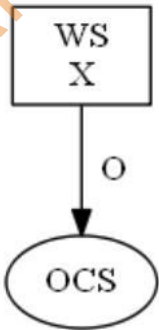


[REQ_5.3.2.3-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of platform door unintentionally open, UGTMS shall provide the necessary information (e.g. status and location) to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE Door unintentionally open is known by WS thanks to REQ_5.3.2.3-1. The output to OHMI is provided by REQ_6.5.1-2.					



[REQ_5.3.2.3-3]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

If platform doors are detected open when no train is berthed in the station, UGTMS shall command the cut off of traction power of the concerned area to the traction power supply system. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OCS X1	WS I1			TPCS O1
B	WS X2				TPCS O2

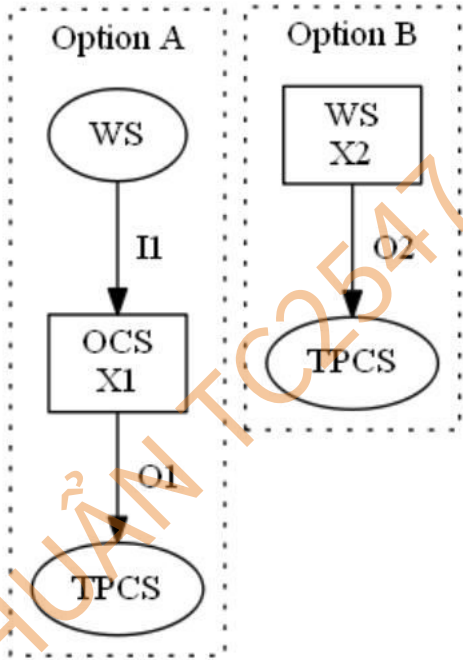
This requirement can be implemented in two ways, depending on how TPCS is connected to UGTMS (the choice of option has to be the same as the one made for REQ_5.3.2.2-5):

Option A: when TPCS is interfaced to OCS

NOTE 1 The cut-off is commanded by OCS, connected to TPCS, from data received from WS (door unintentionally open from REQ_5.3.2.3-1).

Option B: when TPCS is interfaced to WS

NOTE 2 The cut-off is commanded by WS (door unintentionally open from REQ_5.3.2.3-1), connected to TPCS.



FCN 5.3.2.4 – Supervise platform tracks

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Mandatory: all GOAs if platform track detection devices are used by UGTMS

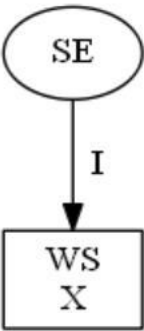
[REQ_5.3.2.4-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case the status of an external platform track detection device indicates an intrusion, a corresponding zone of protection shall be established.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			SE I	

NOTE Management of ZOP is provided by REQ_5.1.4.4-1.

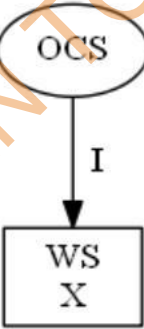


[REQ_5.3.2.4-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The status of a detected intrusion shall be maintained until it is released by safety-related command provided via the interface with the external operations control HMI. This can only be done if the external condition having caused the triggering of the detection is no longer active.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					
The condition to check (intrusion detection) is the one of REQ_5.3.2.4-1.					



[REQ_5.3.2.4-3]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

In case the status of an external platform track detection device indicates an intrusion, UGTMS shall request the cut-off of traction power of the concerned area. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OCS X1	WS I1			TPCS O1
B	WS X2				TPCS O2

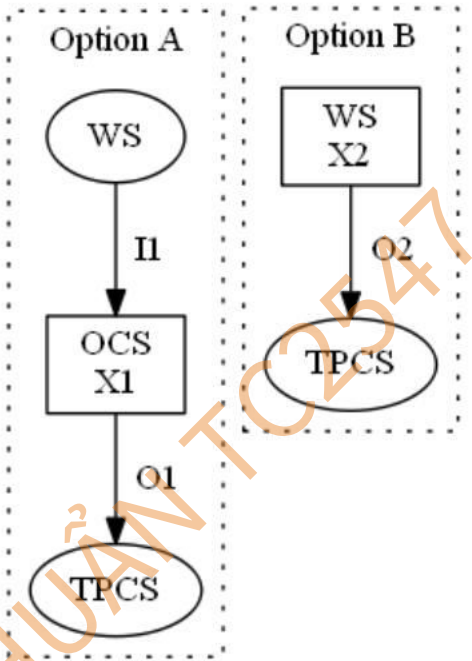
This requirement can be implemented in two ways, depending on how TPCS is connected to UGTMS (the choice of option has to be the same as the one made for REQ_5.3.2.2-5):

Option A: when TPCS is interfaced to OCS

NOTE 1 The cut-off is commanded by OCS, connected to TPCS, from data received from WS (REQ_5.3.2.4-1).

Option B: when TPCS is interfaced to WS

NOTE 2 The cut-off is commanded by WS (request from REQ_5.3.2.4-1), connected to TPCS.



[REQ_5.3.2.4-4]

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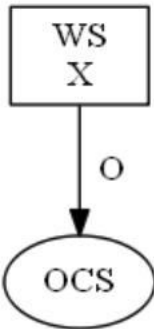
[REQ_5.3.2.4-5]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of platform track intrusion, UGTMS shall provide the intrusion information (e.g. status and location) to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		

NOTE The output to OHMI is provided by REQ_6.5.1-2.



[REQ_5.3.2.4-6]

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FCN 5.3.2.5 – Supervise border between platform tracks and other tracks

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

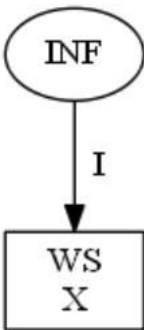
Mandatory: all GOAs if detection devices for borders of platform tracks are used by UGTMS

[REQ_5.3.2.5-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of an intrusion message from the external equipment, a predetermined zone of protection covering the whole area towards the next station(s) shall be established.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			INF I	
NOTE Management of ZOP is provided by REQ_5.1.4.4-1.					

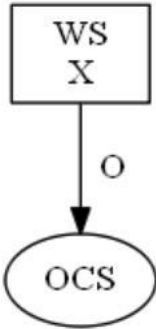


[REQ_5.3.2.5-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of detected intrusion, UGTMS shall provide the intrusion information (e.g. status and location) to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					



[REQ_5.3.2.5-3]

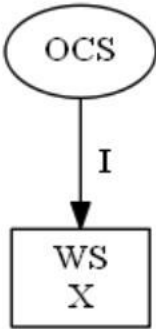
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[REQ_5.3.2.5-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The status of a detected intrusion shall be maintained until it is released by safety-related command provided via the interface with the external operations control HMI. This can only be done if the external condition having caused the triggering of the detection is no longer active.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					
The condition to check (intrusion detection) is the one of REQ_5.3.2.5-1.					



[REQ_5.3.2.5-5]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

In case of intrusion onto the track between stations, UGTMS shall request the cut-off of traction power of the concerned area. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OCS X1	WS I1			TPCS O1
B	WS X2				TPCS O2

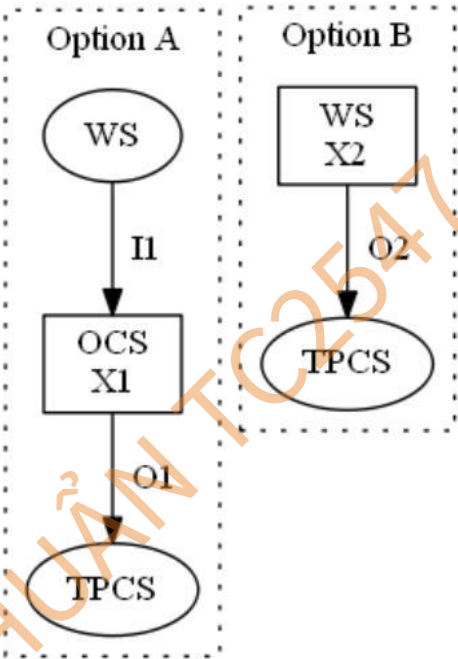
This requirement can be implemented in two ways, depending on how TPCS is connected to UGTMS (the choice of option has to be the same as the one made for REQ_5.3.2.2-5):

Option A: when TPCS is interfaced to OCS

NOTE 1 The cut-off is commanded by OCS, connected to TPCS, from data received from WS (intrusion known thanks to REQ_5.3.2.5-1).

Option B: when TPCS is interfaced to WS

NOTE 2 The cut-off is commanded by WS (intrusion known thanks to REQ_5.3.2.5-1), connected to TPCS.



FCN 5.3.2.6 – Supervise platform end doors

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

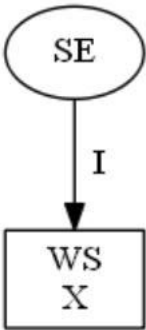
Mandatory: all GOAs if platform end doors are used by UGTMS

[REQ_5.3.2.6-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of a door open message reported from the external equipment and access is not permitted, an unauthorized door opening status shall be triggered, and a predefined zone of protection covering the whole area towards the next station(s) shall be established.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			SE I	
NOTE Management of ZOP is provided by REQ_5.1.4.4-1.					

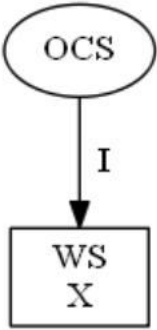


[REQ_5.3.2.6-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The unauthorized door opening status shall be maintained until it is released by safety-related command provided via the interface with the external operations control HMI. This can only be done if the external condition having caused the triggering of the detection is no longer active.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3. The condition to check is the one of REQ_5.3.2.6-1.					

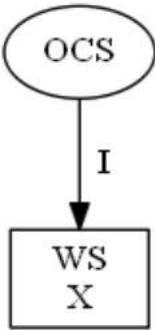


[REQ_5.3.2.6-3]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

In order to avoid an unauthorized door opening status and performing a zone of protection, access of authorized person shall be permitted by safety-related command provided via the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					



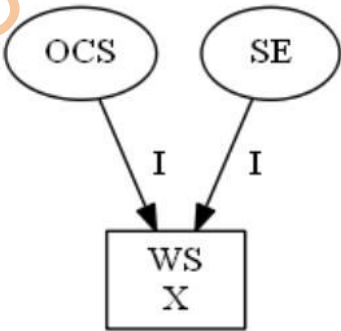
[REQ_5.3.2.6-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The access permission shall be withdrawn

- when the door is closed,
- after a predefined time (O), or
- by command provided via the interface with the external operations control HMI. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I		SE I	
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					

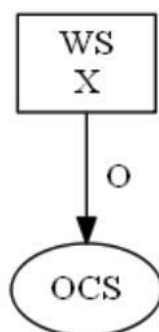


[REQ_5.3.2.6-5]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of detection of unauthorized door opening, UGTMS shall provide the platform end door open information (e.g. status and location) to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE Intrusion is known by WS thanks to REQ_5.3.2.6-1. The output to OHMI is provided by REQ_6.5.1-2.					



FCN 5.3.2.7 – Supervise emergency exits from guideway

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

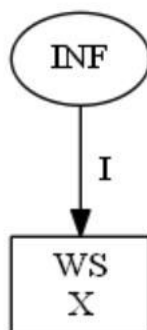
Mandatory: all GOAs if emergency exits from guideway are interfaced with UGTMS

[REQ_5.3.2.7-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of a detection of the opening of an emergency exit reported from the external equipment, an opening of emergency exit status shall be triggered, and a predefined zone of protection shall be established.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X			INF I	
NOTE Management of ZOP is provided by REQ_5.1.4.4-1.					

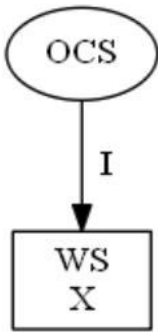


[REQ_5.3.2.7-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The opening of emergency exit status shall be maintained until it is released by safety-related command provided via the interface with the external operations control HMI. This can only be done if the external condition having caused the triggering of the detection is no longer active.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					
The condition to check is the one of REQ_5.3.2.7-1.					

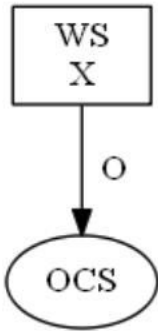


[REQ_5.3.2.7-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In case of detection of the opening of an emergency exit, UGTMS shall provide information about the emergency exit (e.g. status and location) to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE Intrusion is known by WS thanks to REQ_5.3.2.7-1. The output to OHMI is provided by REQ_6.5.1-2.					



FCN 5.3.3 – Protect staff on track by work zone

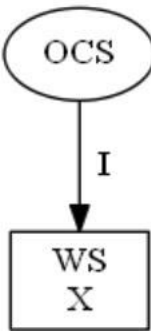
{GOA1: O; GOA2: O; GOA3: M; GOA4: M}

[REQ_5.3.3-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The required work zone shall be established by specific command provided via the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3.					

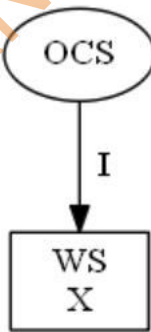


[REQ_5.3.3-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

The required work zone shall be released by specific safety-related command provided via the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3.					

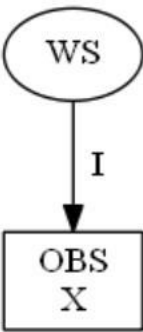


[REQ_5.3.3-3]

{GOA1: n/a; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall prevent trains in automatic driving mode from entering an established work zone.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	WS I			

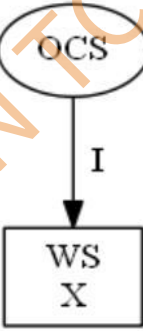


[REQ_5.3.3-4]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

The command which establishes the work zone shall include the choice of a selected speed restriction. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3. The command from OCS includes the choice of speed restriction.					

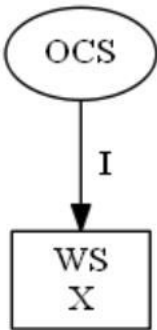


[REQ_5.3.3-5]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall prevent trains in manual driving mode from entering an established work zone until entry is authorized by safety-related command provided via the interface with the external operations control HMI, one train after the other. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X	OCS I			
NOTE The input from/output to OHMI is provided by REQ_6.5.1-3. The restriction to enter the work zone, and then the entry into it when it is granted by the command, is done via the movement authority sent to OBS, as covered in REQ_5.1.4.1-1.					

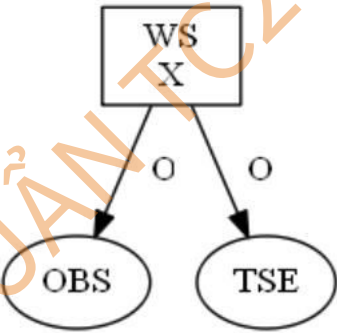


[REQ_5.3.3-6]

{GOA1: M; GOA2: M; GOA3: O; GOA4: O}

UGTMS shall provide work zone information to the interface with the external train HMI or to the interface with the external wayside device (e.g. indicator), as long as the work zone is established. (M for GOA1, M for GOA2, O for GOA3, O for GOA4)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OBS O		TSE O
NOTE The output to THMI is provided by REQ_6.5.2-1.					

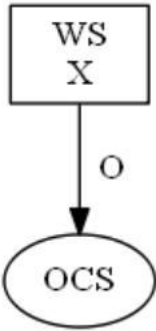


[REQ_5.3.3-7]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall provide the necessary information about the established work zones to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X		OCS O		
NOTE The output to OHMI is provided by REQ_6.5.1-2.					

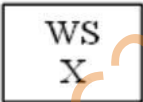


[REQ_5.3.3-8]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

Releasing an existing work zone shall not remove temporary speed restrictions in force at the same location.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	WS X				



FCN 5.4 – Supervise passenger transfer

FCN 5.4.1 – Control train and platform doors

FCN 5.4.1.1 – Authorize door opening

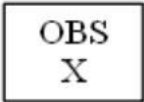
{GOA1: O; GOA2: O; GOA3: O; GOA4: M}

[REQ_5.4.1.1-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall ensure that only the train doors on the correct side according to train orientation are selected for opening.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				



[REQ_5.4.1.1-2]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

In the presence of platforms on both sides, it shall be possible to select the opening of the doors on both sides. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				



[REQ_5.4.1.1-3]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall authorize opening of train doors (and corresponding platform doors if handled by UGTMS) on the selected side of the train when the zero-speed status is detected and the train is located within the tolerance of the stopping point as specified by the transport authority.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1				SE O1 TR O1
B	WS X3 OBS X2	OBS I3	WS O2		SE O3 TR O2

This requirement can be implemented in two ways.

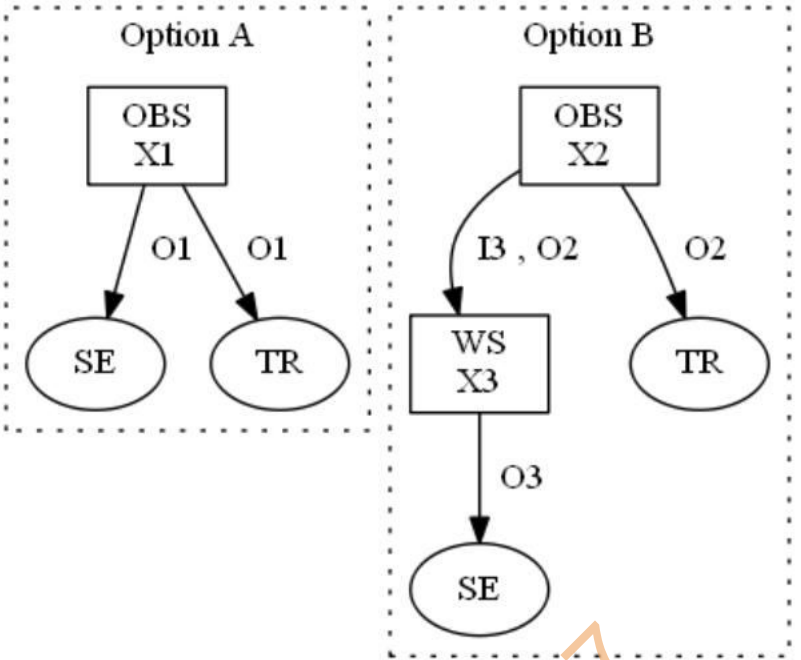
Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.

NOTE 1 The opening authorization is sent to the platform doors directly via the DCS, and to the train (but not its HMI).

Option B: Platform doors are interfaced to WS: processing is done by OBS and WS (data forwarding).

NOTE 2 The opening authorization is sent by OBS to WS, and to the train (but not its HMI).

NOTE 3 WS is in charge of forwarding to platform doors the received opening authorization.

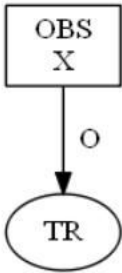


[REQ_5.4.1.1-4]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall prevent movement of the train when door opening is authorized. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				TR O
NOTE O is traction and braking commands to train.					



[REQ_5.4.1.1-5]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

When a door is detected as open while door opening is not authorized (e.g. manual action), UGTMS shall provide the necessary information (e.g. status and location)

- to the interface with the external train HMI (M for GOA1, M for GOA2, O for GOA3, O for GOA4), and
- to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1		OCS O1	SE I1 TR I1	
B	WS X3 OBS X2	WS I2	OBS O3 OCS O2 O3	SE I3 TR I2	

This requirement can be implemented in two ways (the choice of option has to be the same as the one made for REQ_5.4.1.1-3):

Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.

NOTE 1 The train door status and platform doors status are sent by OBS to OCS.

The output to OHMI is provided by REQ_6.5.1-2, and the output to THMI is provided by REQ_6.5.2-1.

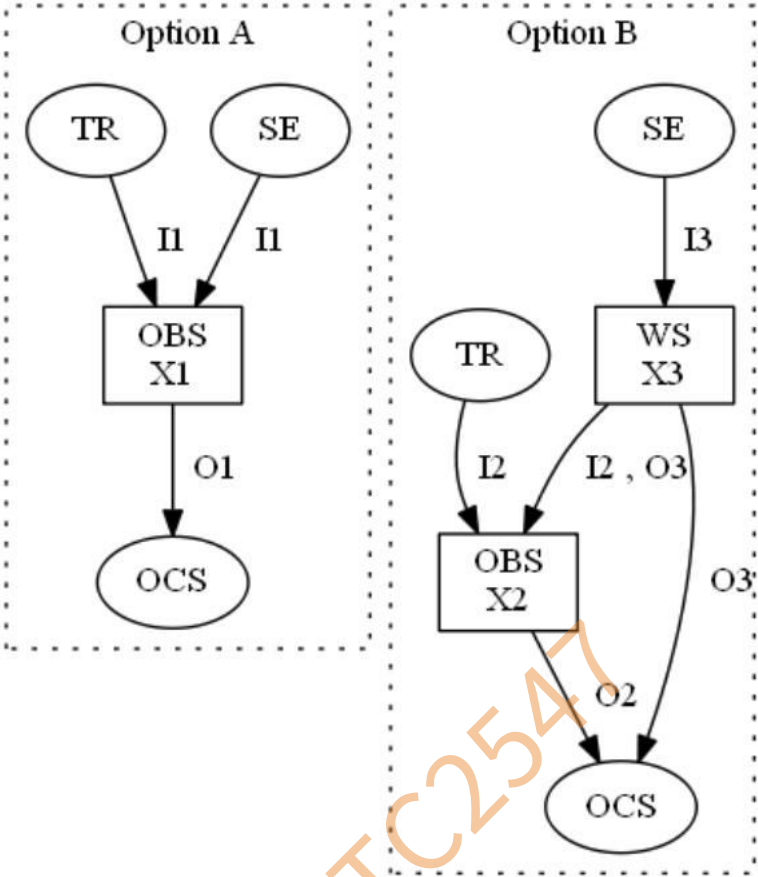
Option B: Platform doors are interfaced to WS: processing is done by OBS and WS (data forwarding).

NOTE 2 The train door status is sent from OBS to OCS.

The output to OHMI is provided by REQ_6.5.1-2, and the output to THMI is provided by REQ_6.5.2-1 (platform doors status received from WS, I2, and train door status received from TR, I2).

NOTE 3 The platform doors status is sent by WS to OCS; the output to OHMI is provided by REQ_6.5.1-2.

And the platform doors status is sent by WS to OBS; the output to THMI is provided by REQ_6.5.2-1.



[REQ_5.4.1.1-6]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If platform doors are handled by UGTMS, if the length of the platform is greater than the length of the train, only the platform doors facing the opening of the train doors shall be authorized by UGTMS.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1				
B	WS X2				

This requirement can be implemented in two ways (the choice of option has to be the same as the one made for REQ_5.4.1.1-3).

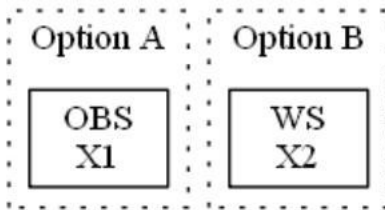
In both options, doors opening authorization is provided by REQ_5.4.1.1-3.

Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.

NOTE 1 Platform doors restriction is done by OBS.

Option B: Platform doors are interfaced to WS: processing is done by WS

NOTE 2 Platform doors restriction is done by WS.



[REQ_5.4.1.1-7]

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FCN 5.4.1.2 – Command door opening

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.4.1.2-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall command opening of doors if they are authorized for opening.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1				SE O1 TR O1
B	WS X3 OBS X2	OBS I3	WS O2		SE O3 TR O2

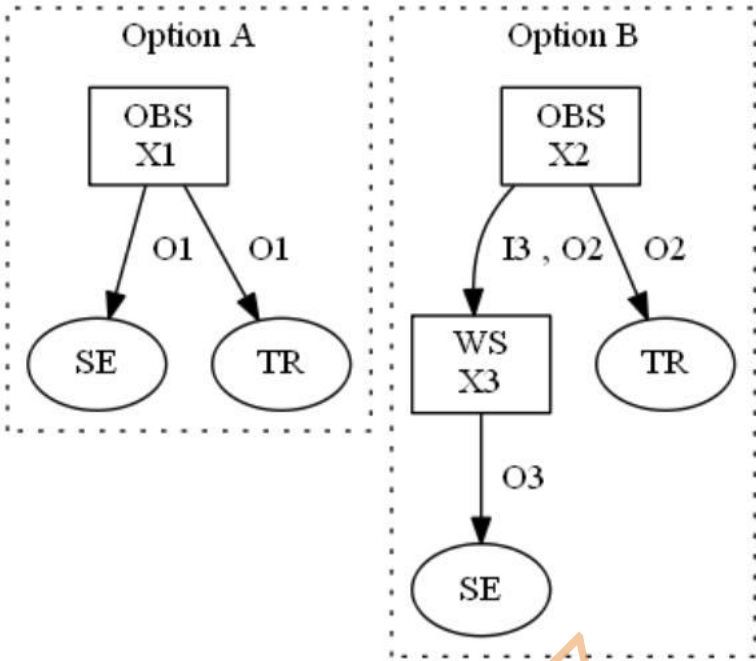
This requirement can be implemented in two ways (as it is generally connected to architecture, the choice of option for REQ_5.4.1.2-1 is recommended to be the same as the one made for REQ_5.4.1.1-3):

Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.

NOTE 1 Opening authorization is provided by REQ_5.4.1.1-3. The opening command are sent to the platform doors directly via the DCS, and to the train (but not its HMI).

NOTE 2 Opening authorization is provided by REQ_5.4.1.1-3. The opening command are sent from OBS to WS, and to the train (but not its HMI).

NOTE 3 WS is in charge of forwarding to platform doors the received opening command.



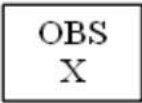
[REQ_5.4.1.2-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

In the presence of platforms on both sides, it shall be possible to command the opening of the doors

- on one side, or
- on both sides. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The opening command is provided by REQ_5.4.1.2-1.					



[REQ_5.4.1.2-3]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

If both sides of a train are commanded for door opening, it shall be possible to manage the opening with a time shift between both sides. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The opening command is provided by REQ_5.4.1.2-1.					

OBS
X

[REQ_5.4.1.2-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If platform doors are handled by UGTMS, opening of platform and train doors shall be synchronised within a given time tolerance (if required by operations, the time difference between the opening of platform and train doors could include an intentional lag).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The opening command is provided by REQ_5.4.1.2-1					

OBS
X

[REQ_5.4.1.2-5]

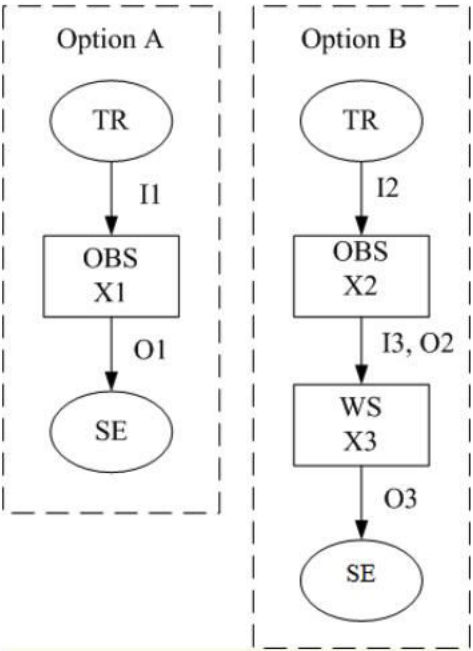
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[REQ_5.4.1.2-6]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

If platform doors are handled by UGTMS, if a train door is out of service, UGTMS shall indicate to the platform door system which platform door shall not be opened. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1			TR I1	SE O1
B	OBS X2 WS X3	OBS I3	WS O2	TR I2	SE O3
<p>This requirement can be implemented in two ways (the choice of option has to be the same as the one made for REQ_5.4.1.1-3):</p> <p>Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.</p> <p>Option B: Platform doors are interfaced to WS: processing is done by OBS and WS (data forwarding).</p>					



[REQ_5.4.1.2-7]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

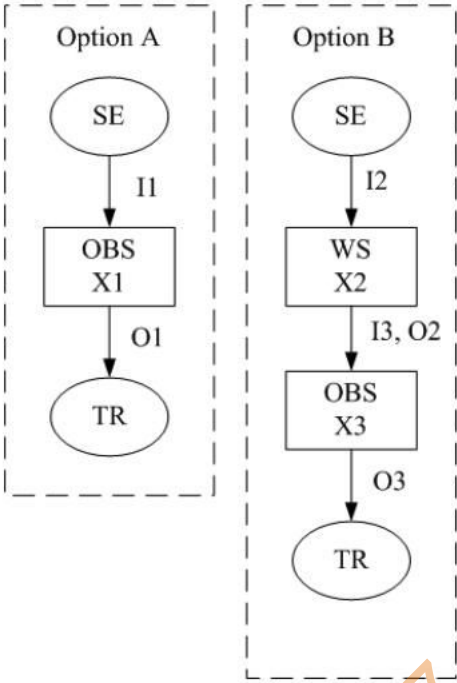
If platform doors are handled by UGTMS, if a platform door is out of service, UGTMS shall indicate to the train which train door shall not be opened. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1			SE I1	TR O1
B	WS X2 OBS X3	WS I3	OBS O2	SE I2	TR O3

This requirement can be implemented in two ways (the choice of option has to be the same as the one made for REQ_5.4.1.1-3):

Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.

Option B: Platform doors are interfaced to WS: processing is done by OBS and WS (data forwarding).



FCN 5.4.1.3 – Request door closing

{GOA1: O; GOA2: O; GOA3: O; GOA4: M}

[REQ_5.4.1.3-1]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

UGTMS shall request door closing when the departure time has been reached and starting conditions are fulfilled (except train doors closed status and the ability to completely leave the station).

NOTE When the door closing is triggered, the ability to completely leave the station is not always met.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1				SE O1 TR O1
B	WS X3 OBS X2	OBS I3	WS O2		SE O3 TR O2

This requirement can be implemented in two ways (as it is generally connected to architecture, the choice of option for REQ_5.4.1.3-1 is recommended to be the same as the one made for REQ_5.4.1.1-3):

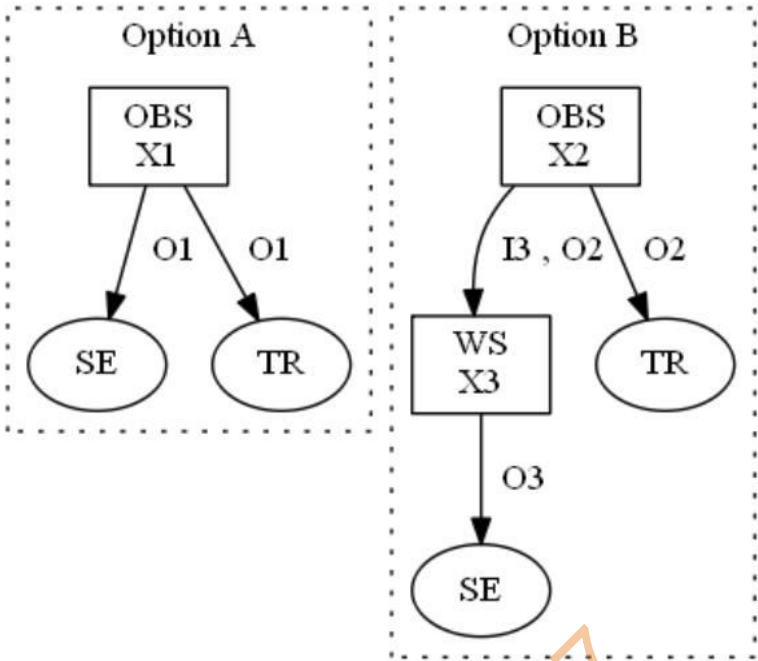
Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.

NOTE 1 The fulfillment of starting conditions is provided by REQ_5.4.3.1-1 and REQ_5.4.3.2-1. The door closing requests are sent to the platform doors directly via the DCS, and to the train (but not its HMI).

Option B: Platform doors are interfaced to WS: processing is done by OBS and WS (data forwarding).

NOTE 2 The fulfillment of starting conditions is provided by REQ_5.4.3.1-1 and REQ_5.4.3.2-1. The door closing requests are sent by OBS to WS, and to the train (but not its HMI).

NOTE 3 WS is in charge of forwarding to platform doors the received door closing request.



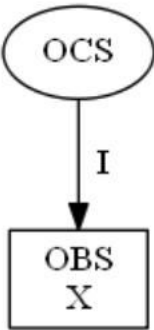
[REQ_5.4.1.3-2]

{GOA1: n/a; GOA2: n/a; GOA3: O; GOA4: O}

UGTMS shall request doors to close by command provided via the interface with the external operations control HMI. (not applicable for GOA1, not applicable for GOA2, O for GOA3, O for GOA4)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X	OCS I			

NOTE The input from OHMI is provided either by REQ_6.5.1-2 or REQ_6.5.1-3. The management of the door closing request is provided by REQ_5.4.1.3-1.



[REQ_5.4.1.3-3]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

UGTMS shall trigger visible and audible warnings informing passengers of impending door closure. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1				SE O1 TR O1
B	WS X3 OBS X2	OBS I3	WS O2		SE O3 TR O2

The visible and audible warning of passengers of the impending doors closure is supported by an external warning device, part of the station equipment (depending on architecture, interfaced by WS), and by the train (but not its HMI) (interfaced by OBS).

This requirement can be implemented in two ways (as it is generally connected to architecture, the choice of option for REQ_5.4.1.3-3 is recommended to be the same as the one made for REQ_5.4.1.1-3):

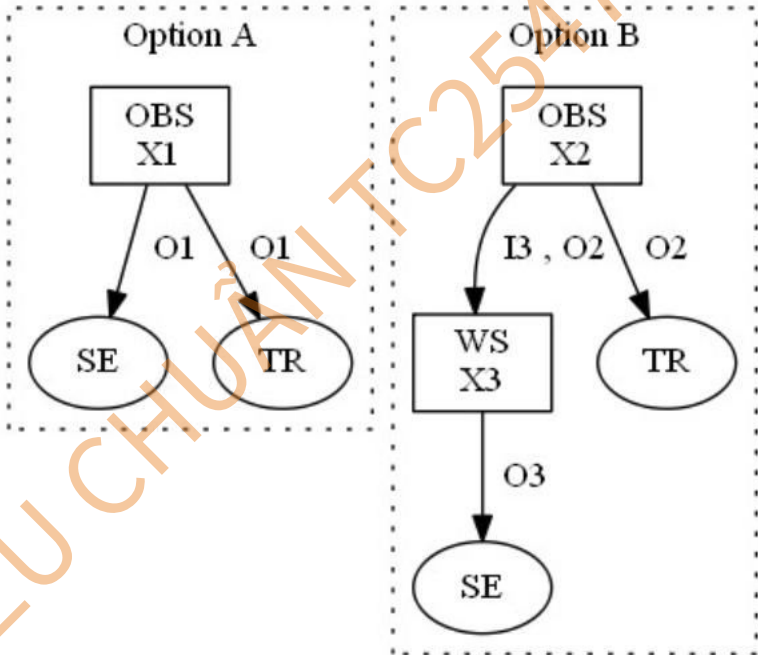
Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.

NOTE 1 The impending door closure is sent by OBS (REQ_5.4.1.3-1) to the train (but not its HMI) and to the external warning device of the station equipment.

Option B: Platform doors are interfaced to WS: processing is done by OBS and WS (data forwarding).

NOTE 2 The impending door closure is sent by OBS (REQ_5.4.1.3-1) to the train (but not its HMI) and to WS.

NOTE 3 WS is sending the received impending door closure to the external warning device of the station equipment.

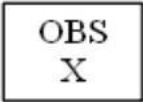


[REQ_5.4.1.3-4]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If platform doors are handled by UGTMS, closing of platform and train doors shall be synchronised within a given time tolerance (if required by operations, the time difference between the closing of platform and train doors could include an intentional lag).

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
	OBS X				
NOTE The management of the door closing request is provided by REQ_5.4.1.3-1.					



[REQ_5.4.1.3-5]

Deleted.

FCN 5.4.1.4 – Supervise door closing

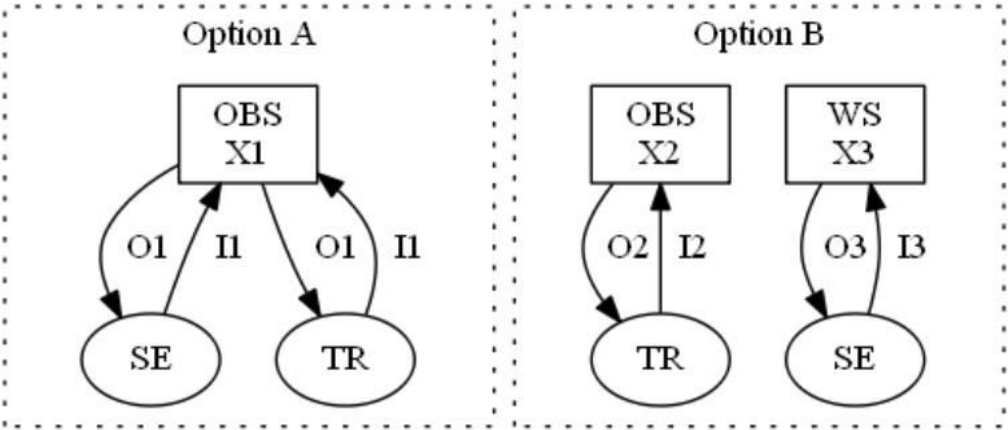
{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

[REQ_5.4.1.4-1]

{GOA1: O; GOA2: O; GOA3: O; GOA4: O}

If doors are not detected as closed and locked within a predefined time, UGTMS shall repeat door closing command a predefined number of times. (O)

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1			SE I1 TR I1	SE O1 TR O1
B	WS X3 OBS X2			SE I3 TR I2	SE O3 TR O2
<p>This requirement can be implemented in two ways (the choice of option has to be the same as the one made for REQ_5.4.1.1-3):</p> <p>Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.</p> <p>NOTE 1 Based on doors status received from the platform doors directly through DCS and from the train (but not its HMI), OBS sends commands to the platform doors directly through DCS and to the train (but not its HMI).</p> <p>Option B: Platform doors are interfaced to WS: processing is done by WS (platform doors) and by OBS (train doors)</p> <p>NOTE 2 Based on doors status received from the train (but not its HMI), OBS is sending commands to the train (but not its HMI).</p> <p>NOTE 3 Based on doors status received from the platform doors, WS is sending commands to the platform doors.</p>					



[REQ_5.4.1.4-2]

{GOA1: M; GOA2: M; GOA3: M; GOA4: M}

If the closed and locked status of doors is not obtained within a predefined time, UGTMS shall raise an alarm to the interface with the external operations control HMI.

Option	Processing	Internal inputs	Internal outputs	External inputs	External outputs
A	OBS X1		OCS O1	SE I1 TR I1	
B	WS X3 OBS X2		OCS O2 O3	SE I3 TR I2	

This requirement can be implemented in two ways (the choice of option has to be the same as the one made for REQ_5.4.1.1-3).

The output to OHMI is provided by REQ_6.5.1-2.

Option A: Platform doors are interfaced to OBS through DCS: processing is done only in OBS.

NOTE 1 The train (but not its HMI) and platform doors door alarm is sent by OBS to OCS.

Option B: Platform doors are interfaced to WS: processing is done by WS for platform doors door alarm and by OBS for train door alarm.

NOTE 2 The train door alarm is sent by OBS to OCS.

NOTE 3 The platform doors door alarm is sent by WS to OCS.