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ERTMS USERS GROUP - ENGINEERING GUIDELINE

HTD Engineering Guideline - Traceability Matrix against X2R Moving Block ENG Rules

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Version	Date	Comments	Author
0a	25/10/2021	First draft (presented at ESG94)	EUG
0b	24/11/2021	Update after ESG94 and ESG ad-hoc meeting 05/11/2021	EUG
0c	16/12/2021	Alignment with L3 Engineering guideline version 1d and update after ESG95	EUG
0d	23/12/2021	Alignment with L3 Engineering guideline version 2-	EUG
1-	23/12/2021	First finalised version and alignment with L3 Engineering guideline 2-	EUG
1a	28/10/2022	Update of traceability matrix according to Version 9 of X2R-5 engineering rules and L3 Engineering guideline version 2b	EUG
1b	01/12/2022	Update of traceability matrix according to Version 10 of X2R-5 engineering rules and L3 Engineering guideline version 2c	EUG
	12/12/2022	Adjustments of references after comments ESG104 meeting to HTD guideline version 2c	EUG
2-	19/12/2022	Finalised version 2 Alignment with HTD guideline version 3-	EUG

Engineering Rules X2R5

Modifications of X2R5 ENG rules since the publication of version 2 of the EUG guideline are marked in red

Engineering Rule	Description	Rationale	Guidance	Requirements	Update Oct 22 (version 10)	(L3 Engineering guideline) Content version 2-	(HTD Engineering guideline) Content version 3-
ENG-Generic-1	The L3 Trackside shall be configured to update a Movement Authority (MA) only in accordance with application-specific operational needs.	On a Level 3 Moving Block railway the End of Authority (EoA) can be at an arbitrary location on the track. Therefore, rules may be	A specific minimum distance for MA extension should be established, as well as a minimum time interval to send an update. Where this constraint is not required the distance and time could be set to zero.	REQ-MA-9		Covered by 4.4.1.5	4.4.1 deleted
ENG-Generic-2	Infrastructure Managers shall define EoA exclusion areas where the system shall not bring any part of a train to a stand due to it reaching an EoA.	On a Level 3 Moving Block railway the End of Authority can be at an arbitrary location on the track. Therefore, depending on the application, rules may be required to avoid trains stopping in areas where it is not considered safe or suitable.	Examples include avoiding MAs that end inside a tunnel, over a level crossing, junctions or any other areas where stopping a train is considered undesirable from a safety or operational perspective. Where it is unacceptable for a train to stop with a pantograph in a powerless section, the engineering of the EoA Exclusion areas should take account of potential positions of the pantograph. Projects may also consider configuration of Non-Stopping Areas for End of Authority Exclusion Areas. Note: Non-stopping areas transmitted by ETCS only provide information to the driver.	REQ-EoAExclusionArea-1		Covered by 4.4.1.2	4.4.1 deleted
~~ENG-Generic-3~~	~~Release Points shall be defined following divergences and convergences where the rear of a train, including any additional margin, will be sufficiently clear of another movement.~~	~~To improve capacity, it is desirable to release points as soon as a train has cleared them. The portion of route up to the Release Point will be released when the Confirmed Rear End of the train~~	~~The identification of Release Points is application specific. Release Points must be at or beyond a point of conflict, e.g. fouling point for points. Positioning of the Release Point can impact performance by influencing when routes are released.~~	~~REQ-PTS-2~~	**Removed**	Problem description is covered by 4.3.2.1. Solution is proposed in 4.3.5.1.	
ENG-Generic-3	The Infrastructure Managers shall define the maximum length of an Unknown Track Status Area that can be safely cleared by the L3 Trackside without sweeping or visual inspection.	This is to avoid needing to sweep short lengths of an Unknown Track Status Area left due to differences in the reported train length after shunting, splitting or	The length of the Unknown Track Status Area that can be cleared without sweeping needs to be established based on the vehicles using the railway and should be less than the length of the shortest vehicle operating on the railway.	REQ-TrackStatus-12	Formerly: ENG-Generic-4	Covered by 4.2.13.9	Covered by 4.2.13.9
ENG-Generic-4	Where the accurate determination of the rear of the train is required to avoid operational impact, the L3 Trackside engineering shall consider project specific mitigations to manage the location error within train position reports.	This is to avoid the impact on the operational performance of the line due to the assumed train position locking points or crossings.	This is project specific but could include, for example, the use of TTD around points or complex switching and crossings or having balise groups close enough to the End of Mission areas to minimise the confidence interval in train position reporting to the L3 Trackside. This may apply where trains regularly undertake End of Mission or stop at platforms or in loops with a requirement for other trains to pass or use other routes. In deciding whether to provide extra facilities, consideration should be given to the likelihood that a train is unable to report integrity confirmed.	REQ-TTD-3	Formerly: ENG-Generic-5	Use of TTD is covered by 4.2.5.7. The used of balise groups to reduce the confidence interval is explained in 4.2.6.2 & 4.2.6.3	Use of TTD is covered by 4.2.5.7. The used of balise groups to reduce the confidence interval is explained in 4.2.6.2 & 4.2.6.3
ENG-Generic-5	The IM shall establish the length of a "L3 Margin" to be used between trains.	There is a risk that trains may move before the ETCS supervision stops them. This can occur intentionally or accidentally. Use of the L3 Margin defined in this Rule enables reduction of the probability of a collision or derailment arising from an unsupervised or unauthorised movement of a train.	The L3 Margin is intended to protect against one forwards or backwards movement of a stationary train. It is not intended to protect against multiple forwards or backwards movements, or against unlimited unsupervised movement. The distance a train may move in SB before the brakes are applied is set by the value of D_NVROLL and the distance for trains to come to a stand depends on the braking characteristics of the train A distance of 2 x D_NVROLL for the value of L3 Margin is a reasonable estimate for most applications.	REQ-MA-3; REQ-MA-4; REQ-MA-6	Formerly: ENG-Generic-6	Covered by 4.2.5.3	Covered by 4.2.5.3
ENG-Generic-6	The Infrastructure Manager shall establish the application specific rules for establishing where Movement Authorities may end and the boundaries of track status areas when Fixed Virtual Block is deployed.	The configuration of the system when using FVB depends on the operational needs of the railway.	The design should take account of the required train movements including where End of Mission and Start of Mission will occur, where splitting and joining may occur and the required capacity of the railway.	REQ-FVB-1	Formerly: ENG-Generic-7	Very generic clause. No need to address it in the guideline.	Very generic clause. No need to address it in the guideline.
ENG-Generic-7	The Infrastructure Manager shall decide whether an Unknown Track Status Area created due to a faulty TTD may be treated as Clear following sweeping or other checks.	In the event of failure of a TTD, the area will be considered as Unknown Track Status even though the L3 Trackside may be able to monitor the passage of trains using Position Reports. Since TTD is often provided for degraded scenarios where the	The operational advantages of relying solely on Position Reports in the event of a TTD failure could be significant, however in establishing that the TTD status can be "ignored" the Infrastructure Manager should consider robust processes, such as sweeping, to confirm it is just a TTD failure and not an obstruction on the railway.	REQ-TTD-6	Formerly: ENG-Generic-8	Covered by 4.3.1.2	Covered by 4.3.1.2
ENG-Generic-8	The L3 Trackside shall be configured, where possible, to use Balise Linking Information.	Use of Balise Linking information improves the accuracy of train positioning, fundamental to the L3 Trackside locating every train in the L3 Area of Control.	It is expected that Balise Linking Information will be used in Level 3 areas. It is recommended to set a linking reaction for the first expected Balise Group in the linking chain when authorising trains to move which will brake the train if it is not found as expected.	REQ-MA-11	Formerly: ENG-Generic-9	Covered by 4.2.6.2	Covered by 4.2.6.2

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ENG-Generic-9	The Infrastructure Manager shall configure the L3 Trackside options for authorising a train without integrity confirmed to move within or enter a L3 area.	This is for operational reasons and to avoid leaving the area behind the train in an Unknown track status.	When trains undertake Start of Mission, it is not always possible to identify their Train Location uniquely. Engineering Rules need to define when a train with an unknown position or not reporting integrity confirmed can be authorised to move by the L3 Trackside. The Infrastructure Manager may decide that trains without integrity confirmed may not be authorised to move until extra controls are in place. The configuration options should include: Issue an MA irrespective of integrity status, Do not issue an MA unless integrity is confirmed, Only issue an MA when no integrity is confirmed with the Dispatcher's authorisation.	REQ-LossTI-9; REQ-FirstMA-2	Formerly: ENG-Generic-10	Covered by 4.2.3 & 4.2.4	Covered by 4.2.3
ENG-Generic-10	The Infrastructure Manager shall configure the L3 Trackside to only issue Movement Authority updates relevant for operation of the railway.	Changes to the Movement Authority issued to a train cause recalculation of the speed supervision on board, and the results are displayed in the planning area. Frequent changes to the Movement Authority can therefore lead to distraction of the Driver. In accordance with 7.4.1.1 of ERA_ERTMS_015560, v3.60 [15560], if the train is in Target Speed Monitoring for the EoA then a sound is played each time the Most Restrictive Displayed Target is updated. The configuration should allow the Infrastructure Manager to prevent changes in the extent/content of Movement Authorities until a period of time has elapsed or the change in the	A threshold, based on time or distance, could be established such that only MA updates that exceed these limits are issued. The Infrastructure Manager should select the time and distance criteria for sending updates of MA. The distance should be selected to reflect the type of railway and would be shorter for a frequent service. Exceptions to the time and distance selected may be required to allow for short MA extensions to be sent to allow a train to complete a mission. In implementing such limits on the MA update, it will be important to bear in mind the potential impact this may have on ATO operation (if fitted). Limiting the MA update may result in degrading the service due to suboptimal speed curves being followed. Careful analysis therefore needs to take place to ensure the impact is minimised. An alternative, that would require a change to the current ETCS baseline [BL3 R2], would be to decouple the update of the MA from the alerts that the Driver receives.	REQ-MA-9.	Formerly: ENG-Generic-11	Covered by 4.4.3.2	Covered by 4.4.3.2
ENG-Generic-11	The Infrastructure Manager shall determine whether or not additional mitigation measures are required to protect against hazards arising from unintentional movements of railway vehicles.	Unintentional movements of railway vehicles could result in hazards.	A Hazard Analysis will be required to determine the hazards associated with unintentional movements of railway vehicles. The Hazard Analysis will depend on the specific topology of the railway, and whether there is protection (e.g. trap points) or detection (e.g. Trackside Train Detection) provided in locations where vehicles are regularly parked or stationary. The Hazard Analysis will depend on the nature of the rolling stock permitted to run on a railway. If the rolling stock can be assured to become stationary in the event of loss of integrity, then additional mitigation may not be required. If the rolling stock includes vehicles which are not assured to become stationary, then the analysis may determine that it is necessary to protect the area in rear of the train which has lost train integrity. A potential additional mitigation measure is to implement a propagation algorithm for Unknown Track Status areas. If propagation of Unknown Track Status is required, it is project specific to define the propagation algorithm, including location, timing and extent. Such an algorithm may require configurable parameters. If propagation of Unknown Track Status is required, it may also be necessary to consider propagation across handover boundaries between adjacent L3 Trackside systems.	None	**This was the former ENG-LossTI-2**		Covered by 5.2.1

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ENG-Generic-12	The L3 Trackside shall be engineered so that, if an area of track within a Reserved Status Area becomes Occupied before the L3 Trackside has authorised a train for this Reserved Status Area, it will: a) restrict the Authorisation to the start of the Unknown area or b) not send the authorisation to the train or c) request a decision from the Traffic Management System	This functionality enables the L3 Trackside to react as required if an area of track within a Reserved Status Areas becomes occupied.	Each Infrastructure Manager must decide, in conjunction with the Railway Undertakings, which option should be chosen.	REQ-MA-8	**New**		Covered by 6.1.7
ENG-TrackInit-1	Infrastructure Managers shall select which information is to be stored by the L3 Trackside and establish for how long it can be used safely when the L3 Trackside is re-initialised.	Stored information may no longer be valid and may require confirmation. The rules for which information must be stored and for how long it will be used need to be the subject of site-specific assessment.	In circumstances in which the system cannot be sure that all the stored information is still relevant, then either it should be confirmed by the Dispatcher, or all the information discarded, and the status of the railway treated as track status Unknown. Information which may be relevant to store can be found in the linked requirements. In assessing how long information may be considered valid, it should be considered whether the information can be used to prevent a potentially obstructed section being declared Clear (due to human error) or whether it will be used to enable the system to establish a section is not obstructed. In the former the information may be considered valid for longer whereas in the latter a short time period is recommended based on the amount and extent of train movements which may have occurred.	REQ-TrackInit-2; REQ-TrainLoc-11		Covered by 4.2.13.8	Covered by 4.2.13.8
ENG-TrackInit-2	The Infrastructure Manager shall configure whether or not the L3 Trackside shall require confirmation by the Responsible Person that the trackside initialisation procedure is complete when using Stored Information.	If Stored Information is used at Trackside Initialisation, confirmation by the Responsible Person is optional.	None	~~None~~ REQ-TrackInit-3	Requirement REQ-TrackInit-3 added	Covered by 4.2.13.8	Covered by 4.2.13.8
ENG-SoM-1	The Infrastructure Manager shall configure whether or not the L3 Trackside shall alert the TMS/~~Dispatcher~~ of a train which has terminated its communication session without Validated Train Data being received by the L3 Trackside.	This is used in case the Dispatcher has to take an additional action to ensure the track. i.e. extend the Unknown area to protect the train, remove it in case the train is reporting at a different location, etc.	The Dispatcher, following non-harmonised rules, may need to contact the Driver to ensure e.g. where this train is, whether it was a Driver's mistake, etc.	REQ-SoM-14		Covered by 4.2.3 & 4.2.4	Covered by 4.2.3
ENG-SoM-2	The Infrastructure Manager shall configure whether or not the L3 Trackside shall alert the TMS/~~Dispatcher~~ if a train has not report Validated Train Data within a configurable time.	In the event of a some failure in the communication which prevents the reception of the Validated Train Data, the Dispatcher can take the needed action so that the	The Dispatcher, following non-harmonised rules, may need to contact the Driver to ensure e.g. where this train is, whether it was a Driver's mistake, etc.	REQ-TrackStatus-11; REQ-TrackStatus-5; REQ-SoM-14		~~Covered by 4.2.12.1.7 & 4.2.12.1.8~~ ENG-SoM-2 is a generic rule (not specific for L3). See flowchart Start of Mission, SS-026 5.4.4, S11 comes after A33 or A34.	ENG-SoM-2 is a generic rule (not specific for L3). See flowchart Start of Mission, SS-026 5.4.4, S11 comes after A33 or A34.
ENG-LevelTrans-1	The Infrastructure Manager shall engineer a means for the L3 Trackside to monitor trains entering the L3 Only area.	This is to prevent a train from entering the L3 Only area unnoticed by the L3 Trackside and support establishing track status.	This can be done by engineering, such as a small section of TTD at the border or other means that are application specific. The provision of TTD either side of the border allows the L3 Trackside to monitor the progress of trains and confirm that a "ghost" train has not followed an authorised movement. The provision of balises, which are known to the L3 Trackside, can be used to help establish the correct position of all trains transitioning.	REQ-LevelTrans-1		Covered by 4.2.3 & 6.1.7	Covered by 4.2.3 & 6.1.7

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ENG-HO-1	The furthest balise group(s) in the Accepting area required to be known to the Handing Over RBC shall be placed at a distance from the border not less than the maximum train length allowed to run on the line, plus a margin.	In compliance with the L2-based ERTMS/ETCS system, a balise group with such an engineered position allows the Handing Over RBC to disconnect any reporting train passing the border. Furthermore, the foreseen margin could be computed so that the Handing Over RBC is able to detect a train reporting integrity confirmed having passed the border with its CRE, which allows it to regard the Handing Over area as Clear. Should the CRE still be localised	The margin could be calculated taking in account at least the following: a.the maximum speed of the line; b. the number of position report repetitions defined in Appendix A3.1 of SS26 [SS026]; c.the frequency of position reports; d.the frequency of TIMS confirmations. e. Where there are divergences beyond the Handing Over border, the extent of the balises known to the Handing Over RBC should consider all potential routes.	REQ-HO-2		Disconnection with the HOV RBC happens when the min safe rear end/CRE of the train passes the RBC-RBC border, so no need of additional balise groups in the ACC RBC that orders the disconnection. There is no need for an engineering rule as suggested by S2R.	Disconnection with the HOV RBC happens when the min safe rear end/CRE of the train passes the RBC-RBC border, so no need of additional balise groups in the ACC RBC that orders the disconnection. There is no need for an engineering rule as suggested by S2R.
ENG-OS-1	The L3 Trackside shall be engineered so that, if an area of track within a Reserved Status Area becomes Unknown before the L3 Trackside has authorised a train for this Reserved Status Area, it will ~~either~~: a) include an OS mode profile for the Unknown Track Status Area or b) restrict the Authorisation to the start of the Unknown area or c)not send the authorisation to the train or d) request a decision from the Traffic Management System	This functionality enables the L3 Trackside to automatically authorise trains to sweep Unknown Areas, thus improving availability of the railway and minimising the workload of the Dispatcher. However, for some railways this functionality may not be desirable as authorisation by a Dispatcher may be preferred.	Each Infrastructure Manager must decide, in conjunction with the Railway Undertakings, which option should be chosen. This may be affected by whether TTD is provided. In some countries, drivers are expected to accept an On-sight movement authority and drive cautiously checking for vehicles or other significant obstructions without having been previously advised. Other countries require the Driver to be aware of reason for the On- sight movement authority due to knowledge of the timetable, verbal communications, text messages or other means.	REQ-MA-~~12~~7	Changed	Covered by 4.2.13.9.1	Covered by 4.2.13.9.1
ENG-EoM-1	The Infrastructure Manager shall consider the provision of TTD in areas where trains are regularly left without a communication session.	The location of trains not in communication will be regarded as Unknown Areas. Even if trains are provided with Cold Movement Detection, this is only useful once the train reconnects and it may have safety benefits to detect the movement of trains which should not be moved.	TTD should be considered for both where trains are regularly left not in communication and for the running lines in the vicinity in order to detect runaways particularly if the gradient is favourable.	None		Covered by 4.2.12.2 & 5.1.1.3	Covered by 4.2.12.2 & 5.1.1.3
ENG-Rev-1 (Optional)	Infrastructure Managers shall define the Boundary for Reversing for each area in which a train may reverse to escape a dangerous situation.	This is to know where the rear end of a train may stop after reversing and thereby avoid collision with other train movements. Projects could decide to have multiple fixed boundary locations depending on the types of trains operating on the line.	This requirement is optional as the location for a Boundary for Reversing could also be calculated dynamically per train, e.g. depending on the actual train length. Figure 60 illustrates the location of the Boundary for Reversing, being the end of the area to be protected from other train movements. The Reversing Area is where a train may start to reverse and the Reversing Distance is how far it may reverse from the reference location. The Reversing Margin should consider the lengths of trains permitted to reverse and an estimated distance for the trains to brake to stop if overpassing the permitted reversing distance.	REQ-REV-1		Covered by 4.2.12.8	Covered by 4.2.12.8

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ENG-SH-1	The Infrastructure Manager shall define Permanent and T~~t~~emporary S~~s~~hunting A~~a~~reas in the L3 Trackside where operationally required.	Temporary S~~s~~hunting A~~a~~reas are predefined areas in which shunting is allowed. Temporary Shunting Areas can be activated and deactivated as required. Shunting Areas are used ~~This is~~ to protect shunting activities from other authorised train movements and to protect authorised train movements from shunting activities.	One possibility could be to pre-configure in the L3 Trackside a set of areas where movements in SH mode could take place and allow the TMS~~Dispatcher~~ to activate and link them where needed, thus resulting in larger shunting areas. Infrastructure Managers could restrict the extent of shunting areas to areas where corresponding protection means such as, for example, derailing points, balises with "Danger for Shunting Information" or TTD are available. A similar method may be used to manage shunting in Level 2, however the reliance on train position reports means that shunting has to be more tightly controlled.	REQ-SH-1	Changed	Covered by 4.2.12.3	Covered by 4.2.12.3
ENG-LossComms-1	The Infrastructure Manager shall establish the value of a mute timer within the L3 Trackside to detect a loss of regular train position reports.	The L3 Trackside needs to establish when a train is not providing sufficient train position reports (possibly due to communications failure) in order to take safe reactions. Since communications can be lost and re-established during normal operation, a suitable delay is required before the L3 Trackside reacts.	The timer is restarted whenever a message is received from a train. The timer expires when the configured value is reached without receipt of a further message. If the timer expires, the L3 Trackside will treat this train as having lost communications. The value of the mute timer will be longer than the variable T_NVCONTACT and less than the communication session expiry, as defined in [SS026]. Use of the mute timer in this range permits a faster reaction to a loss of communications between a train and the L3 Trackside, when compared with waiting for communication session expiry. It should be possible to disable the mute timer if detection of communication session expiry is sufficient. For the mute timer to be applicable, T_NVCONTACT should not be set to infinity and should be significantly less than the communication expiry session time in [SS026], and M_NVCONTACT should not be set to 'no reaction'. If the mute timer is not used, then it is recommended to have a reaction defined for specific M_NVCONTACT, since then the L3 Trackside will be certain that the train has come to a stop by session expiry.	REQ-LossComms-1; REQ-LossComms-2		Covered by 6.1.2	M_NVCONTACT is addressed in 4.2.1.4 and 6.1.3.10 Mute timer is addressed in 6.1.2
ENG-LossComms-2	The Infrastructure Manager shall ensure that the reaction to expiry of the session timer (T_NVCONTACT), defined in parameter M_NVCONTACT, is not set to "No Reaction"	In a railway operating using L3, it is important the trains come to a stop if communications are lost.	None	REQ-LossComms-1; REQ-LossComms-2.	New		M_NVCONTACT is addressed in 4.2.1.4 and 6.1.3.10
ENG-LossTI-1	The Infrastructure Manager shall establish the value of the 'Integrity wait' timer used by the L3 Trackside, according to project specific requirements.	The timer enables the L3 Trackside to react when a position report other than 'No integrity information available' has not been received within a set time.	The timer will have a special value that means the function is disabled. Configuring this timer to a high value would be similar to disabling the function, whilst a too short value might create unnecessary Unknown areas.	REQ-LossTI-4; REQ-LossTI-5; REQ-LossTI-6		Covered by 6.1.4	Covered by 6.1.4

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~~ENG-LossTI-2~~	~~The Infrastructure Manager shall determine whether or not additional mitigation measures are required to protect against hazards arising from unintentional movements of railway vehicles.~~	~~Unintentional movements of railway vehicles could result in hazards.~~	~~A Hazard Analysis will be required to determine the hazards associated with unintentional movements of railway vehicles.~~ ~~The Hazard Analysis will depend on the specific topology of the railway, and whether there is protection (e.g. trap points) or detection (e.g. Trackside Train Detection) provided in locations where vehicles are regularly parked or stationary.~~ ~~The Hazard Analysis will depend on the nature of the rolling stock permitted to run on a railway. If the rolling stock can be assured to become stationary in the event of loss of integrity, then additional mitigation may not be required. If the rolling stock includes vehicles which are not assured to become stationary, then the analysis may determine that it is necessary to protect the area in rear of the train which has lost train integrity.~~ ~~A potential additional mitigation measure is to implement a propagation algorithm for Unknown Track Status areas.~~ ~~If propagation of Unknown Track Status is required, it is project specific to define the propagation algorithm, including location, timing and extent. Such an algorithm may require configurable parameters.~~ ~~If propagation of Unknown Track Status is required, it may also be necessary to consider propagation across handover boundaries between adjacent L3 Trackside systems.~~	~~None~~	This is now ENG-Generic-12	Covered by 5.2.1	
ENG-LossTI-2	The Infrastructure Manager shall configure the L3 Trackside to accept confirmation of integrity by the Driver if this is required by the project.	Confirmation of integrity by the Driver introduces risk into the L3 System, in terms of both the risk of the Driver preforming the procedure and the risk of it being confirmed incorrectly. The L3 Trackside is specified to either	None	REQ-TrainLoc-6, REQ_TrackStatus-4.	Formerly ENG-LossTI-3	Covered by 3.1.1.5 & 3.4.1.3	Covered by 3.1.1.6 & 3.4.2.1.2
ENG-LossTI-3	The Infrastructure Manager shall configure whether the L3 Trackside authorises a Movement Authority either for a train reporting 'loss of integrity' or a train reporting 'No integrity information available' for longer than the Integrity wait Timer.	Movement of a train without integrity within the L3 area could have significant impact on the operational availability. In some situations, however it may be required, for example to move a train without integrity into a siding.	If the L3 Trackside is configured not to authorise an MA for a train unable to confirm integrity, this could cause operational difficulties since this may prohibit a failed train from being moved to a siding – obstructing traffic and disrupting operations. Therefore, projects may decide to apply this rule only for certain areas to limit the operational impact.	REQ-LossTI-7	Formerly ENG-LossTI-4	Covered by 4.3.4 & 5.2.1.2	Covered by 4.3.4 & 5.2.1.2
ENG-LossTI-4	The reaction the L3 Trackside takes when a train reports loss of integrity, or when there is an assumed loss of integrity due to the integrity wait timer expiring, shall be engineered according to project specific requirements.	Depending on project specific requirements, the L3 Trackside can be configured to take a safe reaction including update the MA, allow the train to reach the end of the MA without extending it, stop the train, protecting other movements, etc.	In considering whether to send an emergency stop message the movement of the train should be considered and whether passengers or staff may be exposed to risk due to an emergency stop or collision of the divided parts of the train. In particular sending an emergency stop message should be avoided if the train is in RV to escape a, potentially, greater hazard. The Infrastructure manager may configure the L3 Trackside to utilise additional information (e.g. reported train speed) to determine if the Loss of Integrity is intentional or not. Intentional Loss of Integrity will occur for example when a train is split as part of an operational procedure. An unintentional loss of integrity could be for example the train coupling breaking, or a failure of the TIMS equipment. The reaction of the L3 Trackside may be configured differently depending on the outcome of this – e.g. only take a reaction if the Loss of Integrity is considered unintentional. It is important to note though that a reported loss of Integrity may be part of an intentional splitting operation, and so any reaction taken by the L3 Trackside needs to balance safety with operational performance.	REQ-LossTI-~~7~~3	- Change - Formerly ENG-LossTI-4	Covered by 4.2.12.4.3 & 4.2.13.7	Covered by 4.2.12.4.3 & 4.2.13.7

Engineering Rules X2R5 Modifications of X2R5 ENG rules since the publication of version 2 of the EUG guideline are marked in red						(L3 Engineering guideline)	(HTD Engineering guideline)
Engineering Rule	**Description**	**Rationale**	**Guidance**	**Requirements**	**Update Oct 22 (version 10)**	**Content version 2-**	**Content version 3-**
ENG-MovSR-1	The Infrastructure Manager shall determine the maximum distance for SR Authorisation the L3 Trackside is able to authorise.	SR Authorisation is required in order to move trains without a Known Location. All train movements in SR must be protected. Some Infrastructure Managers may determine that limiting the distance for SR Authorisation reduces risk of operational errors.	The operational advantage of moving trains in SR is that it is possible to move trains in degraded situations. Long distances for SR Authorisation may increase the risk of operational errors. This is similar in L2; however, the risk is greater in L3 systems where there may not be TTD to detect a train that has overpassed its intended stopping location.	REQ-Reserved-1; REQ-Reserved-2; REQ-MovSR-1; REQ-MovSR-3		Covered by 4.2.12.1.2	Covered by 4.2.12.1.2
ENG-FVB-1	For systems with FVB, the L3 Trackside shall be engineered such that an FVB boundary is at each Release point.	Release Points are used to release infrastructure such that it can be used for another route. It is therefore logical for these locations to align with the	It is project specific whether the points area which is also an EoA Exclusion area is covered by a single FVB.	REQ-PTS-2		Covered by 5.1.2.2	Covered by 5.1.2.2
ENG-FVB-2	For systems with FVB, the L3 Trackside shall be engineered such that an FVB boundary is at a boundary of the L3 Area.	The L3 Trackside only supervises the Track Status within its boundaries.	None	None		Covered by 5.1.2.2	Covered by 5.1.2.2
ENG-FVB-3	For systems with FVB and without TTD, the L3 Trackside shall be engineered such that a Radio Hole is covered and aligned with a single FVB.	The L3 Trackside only needs to supervise a Radio Hole as one FVB section, as only one train will	With this engineering rule, the boundaries of the FVB will be aligned with the Radio Hole boundaries.	None	Change	Covered by 4.2.13.5.2 & 4.2.13.5.3	Covered by 4.2.13.5.2 & 4.2.13.5.3
ENG-FVB-4	For a system using Fixed Virtual Blocks, these shall be engineered to align the Trackside Train Detection system boundaries with the Fixed Virtual Block boundaries.	To enable a mixture of trains operating in Level 3 and legacy trains to operate on a line, the L3 Trackside needs to be able to combine the reports received from trains reporting integrity confirmed with information received from the Trackside Train Detection and to enable consistent movement authorisations to be issued. This minimises the risk of trains that are unknown to the Level 3	It is still possible to further subdivide a TTD section into several Virtual Blocks for use with trains operating in Level 3.	None		Covered by 1.2.1.5 & 1.2.1.7. The alignment of fixed virtual blocks and the TTD borders are not explicitly mentioned, because the guideline already refers to the HL3 concept for the fixed virtual block.	The HTD guideline is based on the HTD concept, which covers by default the system using TTD information and virtual subsections.
ENG-TTD-1	For a system with Trackside Train Detection, the L3 Trackside shall be engineered, where possible, such that a TTD boundary is at each Release point at a set of points.	For a system with Trackside Train Detection, the L3 Trackside shall be engineered, where possible, such that a TTD boundary is at each Release point at a set of points.	As with engineering for a L2 scheme, consideration needs to be taken with the location of TTD boundaries relative to the fouling point to account for vehicle overhang. Note that projects may have additional constraints in the trackside engineering that may prevent aligning the TTD boundaries with the Release Point location. For example, there may be existing TTD located on the track which cannot be re-engineered so that the Release points are exactly aligned.	REQ-PTS-2		Covered by 3.1.1.5	Covered by 5.1.2.2
ENG-PTS-1	The Infrastructure Manager shall engineer Release Points for points in the L3 Area, to define when points will be released after the passage of a train.	Points will remain locked until a train has cleared the Points.	The Release Points must be at or beyond the Fouling Points for the divergences, and at or beyond the Point Toe for convergences, as shown in Figure X below. In order to determine the value of value of "X" as shown in Figure X, consideration should be given to the risk of rollback of a train which is stationary, with its rear at a Release Point or the Point Toe. The area bounded by the Release Point will be similar to that which would be bounded by TTD in a traditional signalling system. For a system with Fixed Virtual Blocks, the Release Points will define Fixed Virtual Block boundaries.	Requirements; REQ-PTS-1, REQ-PTS-2		Covered by 4.4.4	4.4.4.3 is intentionally deleted. Concept of overhang is addressed in 4.2.5.8 and recommendation of TTD borders is given in 5.1.2

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Engineering Rule	**Description**	**Rationale**	**Guidance**	**Requirements**	**Update Oct 22 (version 10)**	**Content version 2-**	**Content version 3-**
			For a system with TTD, if there is a TTD over the Points, this will provide the locking and release.				
ENG-PTS-2	The Infrastructure Manager shall engineer Release Points for Crossings in the L3 Area, to define when Crossings will be released after the passage of a train.	Crossings will remain locked for using in one sense only, until a train has cleared the Crossing.	The Release Points must be at or beyond the Fouling Points for the divergences, as shown in Figure Y below. In order to determine the value of value of "X" as shown in Figure X, consideration should be given to the risk of rollback of a train which is stationary, with its rear at a Release Point. The area bounded by the Release Point will be similar to that which would be bounded by TTD in a traditional signalling system. For a system with Fixed Virtual Blocks, the Release Points will define Fixed Virtual Block boundaries. For a system with TTD, if there is a TTD over the Crossing, this will provide the locking and release.	Requirements; REQ-PTS-1, REQ-PTS-2		Covered by 4.4.4	4.4.4.3 is intentionally deleted. Concept of overhang is addressed in 4.2.5.8 and recommendation of TTD borders is given in 5.1.2
ENG-PTS-3	The Infrastructure Manager shall engineer Sweeping Points for Points in the L3 Area, to define the extent of the Point which will be swept by a sweeping train.	A sweeping train which passes successfully confirms that part of the alternate leg of the points is clear.	The Sweeping Points must be at or beyond the Fouling Points for the divergences, and at or beyond the Point Toe for convergences. The Sweeping Points must also be at or within the area defined by Release Points. This is shown in Figure Z below. This distances between the Fouling Points and the Sweeping Points, and between the Sweeping Points and the Release Points may depend on the Operational Rules for driving with an On Sight Mode Profile.	Requirements; REQ-PTS-4		Covered by 4.2.13.9 Covered by 4.2.13.9.3	Covered by 4.2.13.9 Covered by 4.2.13.9.3
ENG-PTS-4	The Infrastructure Manager shall engineer Sweeping Points for Crossings in the L3 Area, to define the extent of the Crossing which will be swept by a sweeping train.	A sweeping train which passes successfully confirms that part of the alternate leg of the Crossing is clear.	The Sweeping Points must be at or beyond the Fouling Points. The Sweeping Points must also be at or within the area defined by Release Points. This is shown in Figure Z below. This distances between the Fouling Points and the Sweeping Points, and between the Sweeping Points and the Release Points may depend on the Operational Rules for driving with an On Sight Mode Profile.	Requirements; REQ-PTS-4		Covered by 4.4.4.3	Covered by 4.2.13.9.3
ENG-PTS-5	For Points within the L3 Area, in the case that the Sweeping Points are within the ~~Release Points~~ Locking Area, the Infrastructure Manager shall determine whether or not Points are able to be moved after the passage of a sweeping train.	For Points within the L3 Area, in the case that the Sweeping Points are within the Release Points, the Infrastructure Manager shall determine whether or not Points	When the Sweeping Points are within the Release Points, a small area of Unknown Track Status Area may remain within the area defined by the Release Points. This would result in the points being locked, and therefore requiring an override to be moved.	Requirements; REQ-PTS-5	Change	Covered by 4.2.13.9 & 4.4.4	Covered by 4.2.13.9 & 4.4.4
~~ENG-RadioHole-1~~	~~The Infrastructure Manager shall engineer the conditions for considering a train to be inside a Radio Hole.~~	~~This is required for the L3 Trackside to manage Radio Holes.~~	~~The conditions for considering that a train is inside a Radio Hole apply both for entering and leaving a Radio Hole.~~	~~REQ-RadioHole-4; REQ-RadioHole-8.~~	ENG-rule removed	Covered by 4.2.13.5.1	
ENG-RadioHole-~~12~~	The Infrastructure Manager shall engineer pre-defined Temporary Radio Holes which may be activated in the event of failure of communication system elements.	If part of the communications system fails, the Dispatcher needs to be able to instruct the L3 Trackside to not take a reaction if	The allocation of these Temporary Radio Holes depends on the communications architecture and likely interruptions to service due to failure. Enabled Radio Holes are treated as EoA exclusion areas.	REQ-RadioHole-1.	Number ENG-rule changed	Covered by 4.2.13.6	Covered by 4.2.13.6
ENG-RadioHole-~~23~~	The Infrastructure Manager shall engineer for each Radio Hole the time allowed for a train to pass through the Radio Hole before the system reacts by alerting the Dispatcher.	If a train takes an excessive time to pass through a Radio Hole the Dispatcher may need to take other measures to confirm that there has not been an accident, or other reasons for the delay.	The time could be established automatically or by user or Dispatcher input. To avoid unnecessary alerts, the lowest speed profile through the area is used reduced by 20% to allow for acceleration, braking and drivability is recommended. When determining the length for a radio hole timer, it must be considered how the L3 trackside determines when a train has entered the radio hole and has left the radio hole. This will be project specific.	None	Number ENG-rule changed	Covered by 4.2.13.5.4	Covered by 4.2.13.5.4