ERTMS Programme

Signalling System
Engineering Process Guideline
Engineering Guidelines

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1 INTRODUCTION

The purpose of the ERTMS Programme is to replace all existing signalling systems on the Norwegian Railway network with ERTMS. The replacement is foreseen to be a one-to-one replacement related to the program budget.
If additional signalling equipment is engineered with ERTMS, compared to today's amount (e.g. extra TVP sections, block posts, shunting signals, point machines, etc), this will affect the program budget and have to be handled according to the Programme Change Procedures.
Most of the Norwegian railway network consists of single track lines with two track stations, some parts of the network have double track lines and larger and more complex station layouts. Standardisation of signalling layout for ERTMS is therefore an important task related to optimising engineering (minimising time and cost) and ensure good predictable management of the ERTMS implementation project.

This document presents some of the engineering guidelines that shall be taken into account when engineering an ERTMS Level 2 line.

The engineering of a station/line shall be evaluated, based on the possible scenarios of signalling layouts defined in this document, in 4 different process steps to ensure support of the following core needs:

1) Provide necessary capacity (existing and future timetable if available)
2) Provide robustness to the timetable
3) Unified operational conditions (standardisation as far as reasonable)
4) Resource efficient in regard to Life Cycle Cost (don't build more than needed)

Based on different engineering proposals, the process steps above shall be performed in the order given, to provide the most appropriate solution for a specific railway line. It is important to see a line as a whole in this respect to ensure that all needs are reflected in the final design. Operational behavior might differ along the line, and the design shall support the needs at each part of the line. As an example, the Nordlandsbanen has local train traffic close to Trondheim and Bodø stations, but not on the whole 700 km of line. This may therefore support 2 different signalling layouts, one for the part of line with local train traffic and another on the part of line without.

1.1 Background

Bane NOR is renewing all signalling systems in Norway and migrating to ERTMS level 2. These engineering guidelines are developed to support Programme of ERTMS on the Norwegian railway network by the project ERTMS Programme.

Please see documentation in the ERTMS Programme project for technical requirements for the signalling system and other information on the rollout of ERTMS.

Please see ERP-00-A-00120 "Appendix N - Definitions and abbreviations" for terms and abbreviations.

1.2 Purpose and scope

This document describes the engineering guidelines and rules for engineering of an ERTMS/ETCS L2 line in Norway under the project ERTMS Programme.

Engineering guidelines are to be used for pre-engineering performed by ERTMS Programme as input to Signalling System Contractor's detailed engineering.

Engineering guidelines are to be used as input and high level rules for Signalling System Contractor's detailed engineering rules.

1.3 Technical drawings in AutoCAD

Guidelines for drawing of schematic plans for the ERTMS Programme can be obtained from Bane NOR: Document number 1000000414.

1.4 Guideline for interlocking parameters

Guidelines for engineering of interlocking paramters for the ERTMS Programme can be obtained from Bane NOR: Document number 1000007924.

1.5 Further work

The following topics are to be described further in later revisions of Engineering guidelines:

- High level balise engineering guidelines
- Speed profile and gradient information
- Table for signals and boards (skiltplantabell)

1.6 How to use document

The description of engineering guidelines and rules in this document are given with a set of requirements.

Shall requirements

Rationale: *To ensure a unified engineering of the signalling system rollout in compliance with technical and operational requirements.*

ENI-SS-ENG-1536 A shall requirement defines technical or operational solutions that must be followed when engineering a station or line section. Deviation from a shall requirement is only allowed after an application is approved by the technical management of the ERTMS Programme.

Should requirements

Rationale: *To ensure a unified engineering of the signalling system rollout in compliance operational requirements.*

ENI-SS-ENG-1537 A should requirement defines operational recommendations that should be followed when engineering a station or line section. Deviation from a should requirement shall be argued for and stated in the system definition for the station of line section.

Engineering Guidelines and “Teknisk regelverk”

Rationale: *To ensure a single point of rules.*

ENI-SS-ENG-1538 If a requirement is stated in both Engineering Guidelines and “Teknisk regelverk”, Engineering Guidelines shall be the set of requirements followed by ERTMS roll-out projects.

Deviation from Engineering Guidelines and “Teknisk regelverk”

Rationale: *To ensure single point of contact.*

ENI-SS-ENG-1539 If engineering of a station or line section requires a deviation from a requirement stated in both “Teknisk regelverk” and Engineering Guidelines, an application for deviation shall only be sent for the requirement in Engineering Guidelines. The technical management in the ERTMS Programme is responsible for discussing the deviation with the “Technology department” responsible for “Teknisk regelverk.

The applicant shall be responsible for stating in the application if the deviation is valid for both “Teknisk regelverk” and Engineering Guidelines.

Deviation from “Teknisk regelverk”

Rationale: *To ensure unifed engineering of the signalling system rollout and evaluate if a requirement in “Teknisk regelverk” that requires a deviation must be changed or included in Engineering Guidelines.*

ENI-SS-ENG-1540 The signalling system rollout project shall be responsible for deviations from requirements stated only in “Teknisk regelverk”. The following contact shall be included in the application for deviation:

eg.ertms@banenor.no

Application for deviation of Engineering guidelines

ENI-SS-ENG-1541 The following requirements shall apply for an application for deviation of Engineering guidelines:

ENI-SS-ENG-1542 a) The attached form, Application for deviation, shall be used.

ENI-SS-ENG-1543 b) One form shall be used for one deviation.

ENI-SS-ENG-1544 c) The application shall be written in English or Norwegian

ENI-SS-ENG-1545 d) All fields in the form shall be populated.

ENI-SS-ENG-1546 e) Case number shall be: 201905690

ENI-SS-ENG-1547 f) The application shall be sent as an attachment in email with the following recipient: eg.ertms@banenor.no

ENI-SS-ENG-1548 g) The subject field shall be: *Application for deviation of Engineering guidelines* - **<Station/line section> - <Object name> - <Requirement ID ENI-SS-ENG>**

1.7 English-Norwegian translations

English	Norwegian
Alternative route path	Viapunkt
Axle counter	Akselteller
Centrally operated	Sentralstilt
Crossover	Overkjøringssløyfe
Danger point	Farepunkt
Dead end track	Buttspor
Derailer	Sporsperre
Diamond crossing	Sporkryss
Double slip point	Dobbel kryss-sporveksel
Electrical multiple unit railcar	Motorvognsett (eks. Stadler FLIRT
Entry marker board	Innkjørstoppskilt
Exit marker board	Utkjørstoppskilt
Fouling point	Middel
Key lock	S.lås
Level crossing	Planovergang
Level crossing system (LX)	Veisikringsanlegg
Level transition	Nivåovergang (NTC ? ETCS)
Local Control Panel (LCP)	Lokalstiller
Locally operated	Lokalsilt
Marker board	Stoppskilt
Movable frog	Bevegelig kryss
Occupation of flank protection area	Belagt sidedekning
Overlap	Overlapp
Parking tracks	Hensettingsspor
Permanent Shunting Area (PSA)	Permanent skifteområde (godsterminaler)
PICOP (Person in charge of possession)	Hovedsikkerhetsvakt (HSV)
Point machine	Sporvekseldrivmaskin
Position lamp	Middelkontrollampe
Position Indication	Posisjonsindikering (Indikering på DMI erstatter Middelkontrollampe)
Release speed	Frislipphastighet
Safety distance	Sikkerhetsavstand
Safety zone	Sikkerhetssone
Simultaneous train movement	Samtidig togbevegelse
Single slip point	Enkel kryss-sporveksel
Shunting route	Skiftevei
Stock rail joint	Stokkskinneskjøt
Switch blade toe	Tungespiss
Temporary Shunting Area (TSA)	Midlertidig skifteområde/Lokalområde

1.8 Definitions

Direction relative to objects

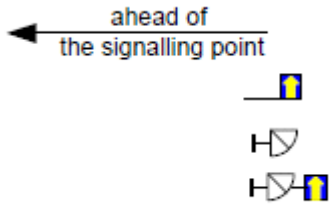
ENI-SS-ENG-1562 The following abbreviation shall be used to describe direction relative to an object.

Comments: *In the figures, signalling points is used as examples.*

Direction relative to objects

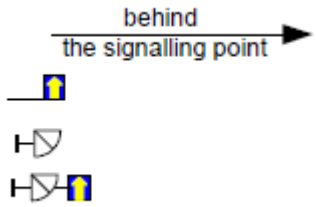
ENI-SS-ENG-1563

- Ahead of the “object”



ENI-SS-ENG-1565

- Behind the “object”



1.9 Change description

Changes from one revision to a following revision and the impact of the changes, is shown in the attached change description in Chapter 34 Change History.

2 MARKER BOARDS

Marker boards are designed according to the European standard NS-EN 16494-2015. They are located to give trains start and stop locations, which can have a huge impact on operational capacity.

Several important aspects of marker board locations can be:

- Operational stopping points for trains (platforms etc.)
- Needed safety distance to fouling point or conflicting routes/movement areas
- Distance between marker boards along the line (block posts) related to operational requirements/capacity
- Placement of catenary section breaks
- Operational needs for turning movements

2.1 General

Start point

ENI-SS-ENG-759 A marker board shall define the operational start point for a train.

Stop point

ENI-SS-ENG-760 A marker board shall define the operational stop point for a train.

Risk reduction

ENI-SS-ENG-761 A marker board shall not be placed in a location where stopping the train can result in a hazardous situation.

Dimensions

ENI-SS-ENG-22 Intentionally deleted

Marker board dimensions

ENI-SS-ENG-23 Intentionally deleted

MB with 70 cm x 70 cm dimensions

ENI-SS-ENG-751 Intentionally deleted

MB with 70 cm x 70 cm dimensions

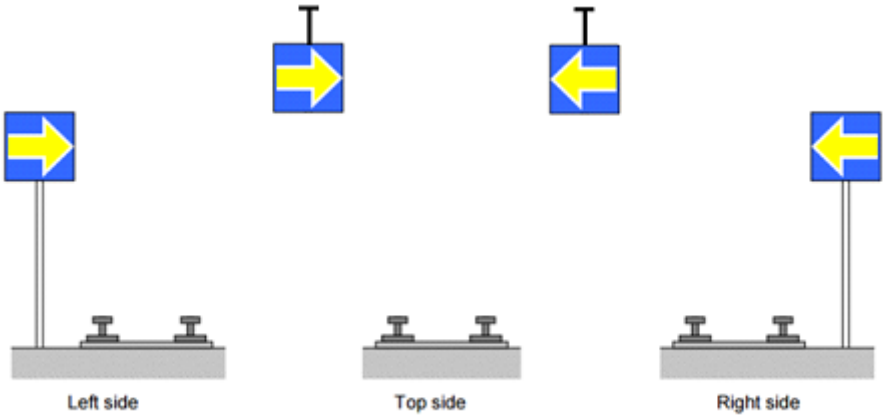
ENI-SS-ENG-24 Intentionally deleted

2.2 Placing

Marker board placements

ENI-SS-ENG-26

Marker boards shall refer to the track to which it belongs as indicated in the following figure.



Comments: *MB in dead end track shall have the arrow pointing down, see ENG-915*

Marker boards at single track lines

ENI-SS-ENG-27

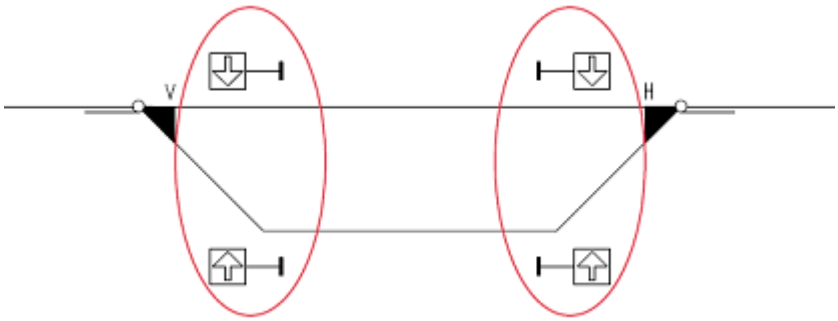
At single track lines, marker boards should be located to the right side of the track.

Marker boards on two track stations

ENI-SS-ENG-28

In typical two track stations, marker boards should be placed aligned at the outer side of each track as shown in the figure below.

Comments: *On stations where utilisation of track length is of importance the marker boards may not be placed aligned.*

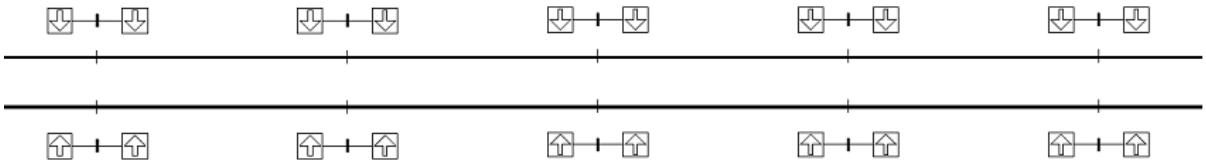


Marker boards at double track lines

ENI-SS-ENG-29

At double track lines, marker boards should be located

- to the right side of the right track in the direction of travel
- to the left side of the left track in the direction of travel



Marker boards at multiple track lines

ENI-SS-ENG-30

On lines with more than two tracks, marker boards should be located to the right side of each track in the direction of travel.

Combined Marker board and Shunting signal

ENI-SS-ENG-1465

Combined Marker board and Shunting signal shall always be placed on same location (left or right side of track, and same kilometre).

Comments: *If MB is placed above track, shunting signal can be placed on the same location, on the ground.*

Prioritized order of requirements for placement of Signalling point related to track

ENI-SS-ENG-1466

The following alternatives shall be considered in prioritized order when placing a Signalling point related to track.

Comments: *Signalling point is either a Marker board, a Shunting signal or a combined Marker board and Shunting signal.*

The operational requirements of that specific part of the station shall be considered, when defining the required gauge (A-85, shunting profile, etc.)

For required sight distance, see ENG-1441.

ENI-SS-ENG-1467

a) A Signalling point should be placed on either left or right side of track in direction of travel according to one of the applicable requirements, ENG-27, ENG-28, ENG-29 or ENG-30.

ENI-SS-ENG-1468

b) A Signalling point could be placed on opposite side of track due to space constraints or required sight distance.

ENI-SS-ENG-1469

c) Marker boards and Shunting signals could be placed above track due to space constraints.

Comments: *Signalling points in adjacent tracks shall be placed above track.*

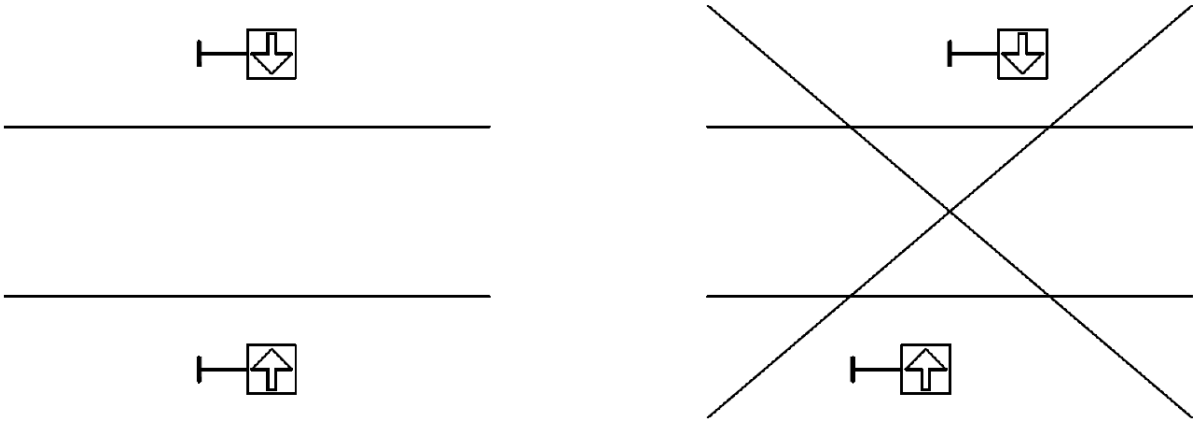
Signalling points in other parts of station or area can be placed on the ground.

Marker boards in adjacent tracks.

Rationale: *Due to unified operational conditions.*

ENI-SS-ENG-31

Corresponding marker boards in adjacent tracks should be aligned. Please see the figure below.



Markerboard placing to the related track

ENI-SS-ENG-1217

Marker Board shall be placed in such a way that they are unambiguously perceived to the related track. Marker Boards shall also be placed in such a way that the maximum track length can be utilized.

Sight distance to marker boards

ENI-SS-ENG-33

The sight distance should be 150 meters.

Minimum sight distance to marker boards as start and stop point for train

ENI-SS-ENG-1508

The sight distance shall be a minimum of 56 meters to marker boards that can be start and/or end point for train.

Comments: *5 seconds uninterrupted sight at 40 km/h. This marker board can be start and end point or only end point for train.*

Minimum sight distance to marker boards only as start point for train

ENI-SS-ENG-1858

The sight distance should be minimum 5 meters to marker boards that only can be used as start point for a train.

Comments: *This marker board cannot be end point for train route.*

Signal E61: Distance sign ERTMS

ENI-SS-ENG-1509

Signal E61: "Distance sign ERTMS" shall not be used if the distance to the previous marker board is less than 150 meters.

Prioritized order of requirements for fulfilment of required sight distance

ENI-SS-ENG-1441 If a sight distance of less than 150 meters is used, the following alternatives shall be considered in prioritized order:

Comments: *If alternative c) can be realized with limited cost, this shall be prioritized above b).*

ENI-SS-ENG-1442 a) Place marker board on left side in direction of travel.

ENI-SS-ENG-1443 b) Signal E61: "Distance sign ERTMS" shall be placed 150 meters from the marker board.

ENI-SS-ENG-1444 c) Move marker board to a different location where the required sight distance can be achieved.

Sight distance to other signs and boards

ENI-SS-ENG-1668 The sight distance should be 150 meters.

Minimum sight distance to other signs and boards

ENI-SS-ENG-1688 The sight distance shall be a minimum of 56 meters.

Comments: *5 seconds uninterrupted sight at 40 km/h. Ref to ENG-1860 for shunting signals only in start of shunting routes.*

Marker boards on platforms

Rationale: *This is recommended due to many elements that might be disturbing to the driver in the platform area.*

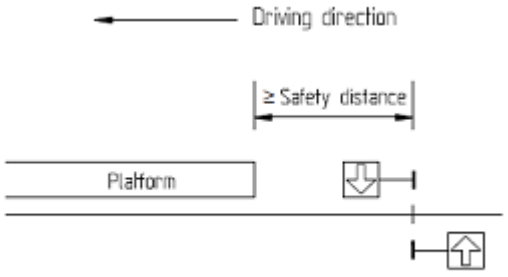
ENI-SS-ENG-34 Marker boards should not be placed on platforms.

Marker boards ahead of platforms on the line

Rationale: *To protect trains that regularly stops at the platform after a MB with 0 meter safety zone. This is not relevant if there is a safety zone after the MB.*

ENI-SS-ENG-1264 A marker board to be placed ahead of a platform in direction of travel, shall be placed at a defined safety distance as shown in the figure below.

Comments: *Typically on double track lines and stations, and block posts on single track lines.*



Marker board behind platforms

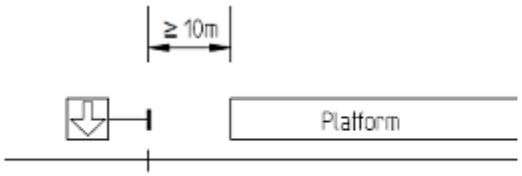
Rationale: *This will ensure that the driver is able to see the marker board ID from stopping at platform, if an MA cannot be provided by the RBC.*

ENI-SS-ENG-35 Marker boards shall be placed 10m or more from the platform in the direction of travel as shown in the figure below.

Comments: *This requirement is not valid for marker boards that are only as end of MA.*

If possible, the marker board should be between 10 - 50 meters from the platform in the direction of travel.

Train length boards could also be the reference when placing marker board at stopping location as substitute for platform edge. Placing marker board 10 meters from train length board, will fulfil requirement rationale.



Marker boards and distance to booster transformer

Rationale: *To avoid short circuiting of primary winding during normal train operation.*

ENI-SS-ENG-1751 Marker boards shall not conflict with booster transformer.

Comments: *Ref to TRV: 00398 and 00410.*

Catenary section break.

ENI-SS-ENG-322 Marker boards shall not be in conflict with catenary section break locations.

Comments: *Ref to TRV: 00929 and 00933.*

2.2.1 Placement in tunnels

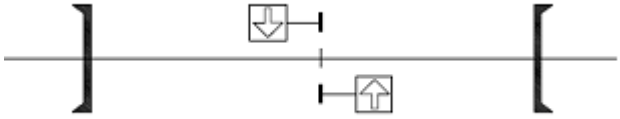
Marker boards in a tunnel

ENI-SS-ENG-1349 When placing marker boards in a tunnel, the following requirements apply:

ENI-SS-ENG-1350 1) Marker boards shall be placed at the same location for both driving directions.

ENI-SS-ENG-1351 2) Distance signs can be used if required visibility is not achieved (signal E61).

The figure below shows the placement of marker boards in a tunnel, and related work areas.

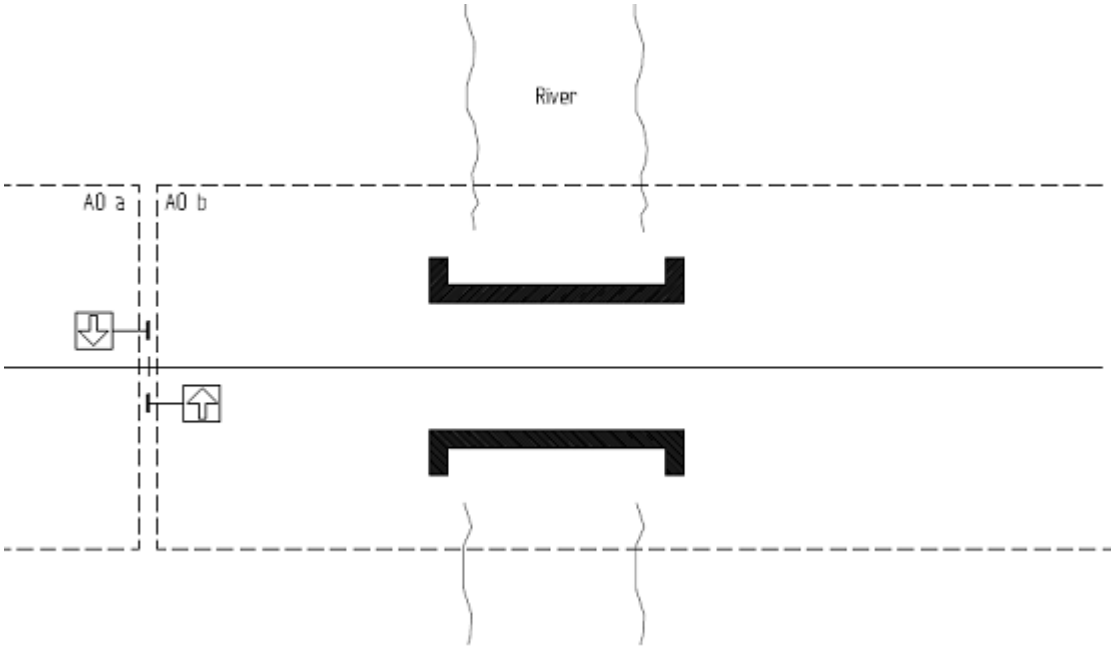


2.2.2 Placement on fixed bridges

Marker boards at the end of a bridge

ENI-SS-ENG-1355 Marker boards shall preferably be placed at the end of a bridge, and not on the bridge due to limited availability for maintenance of marker board and axle counters.

The figure below shows the preferred placement of marker boards at bridge, and related work areas.



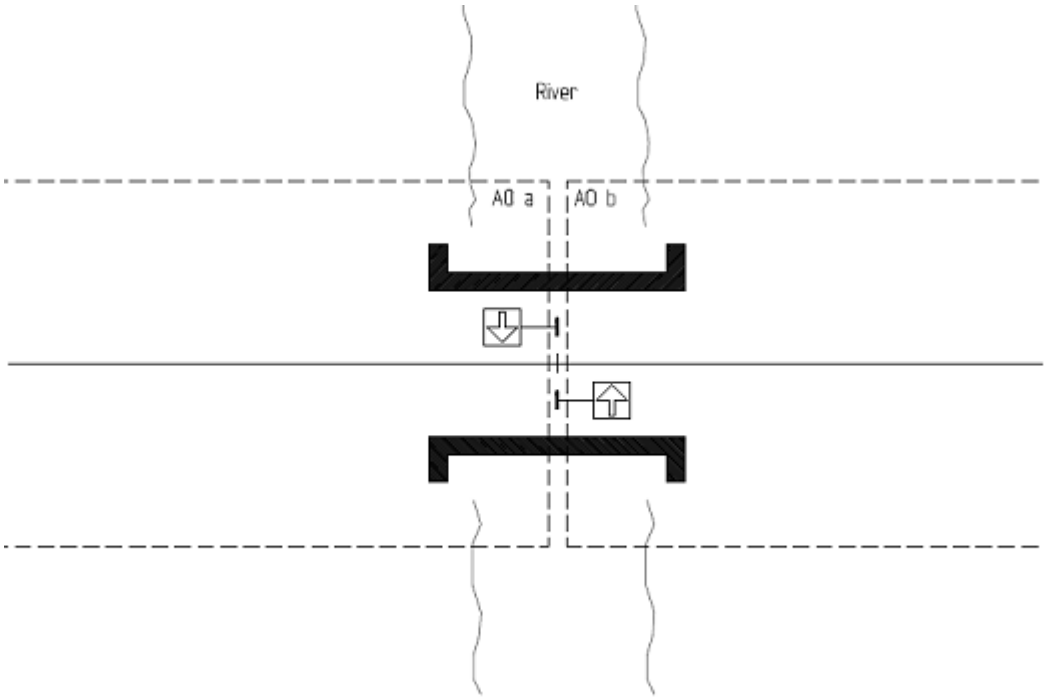
Marker board on bridge

ENI-SS-ENG-1358 If there is a need to place marker boards on a bridge, the following requirements apply:

ENI-SS-ENG-1359 1) Marker boards shall be placed at the same location for both driving directions.

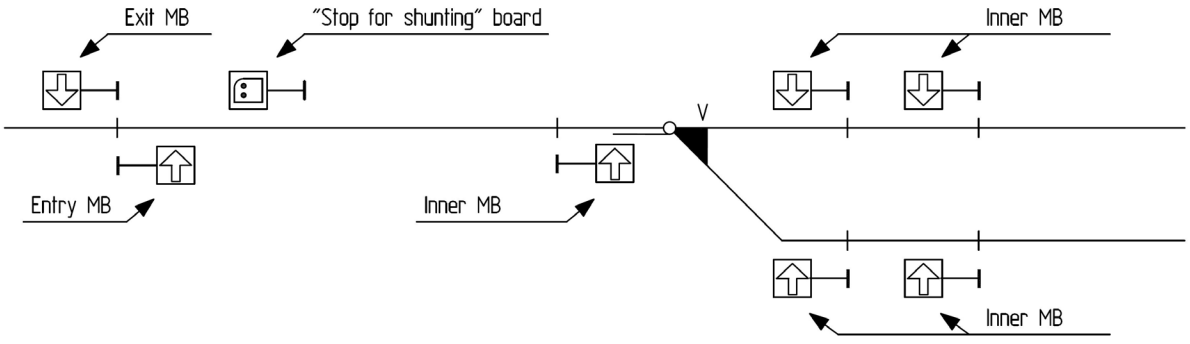
ENI-SS-ENG-1360 2) Distance signs can be used if required visibility is not achieved (signal E61).

The figure below shows the preferred placement of marker boards on a bridge, and related work areas.



2.3 Boards at stations

Please see figure below for an example of marker board placement for a two track station on a single track line and their name.



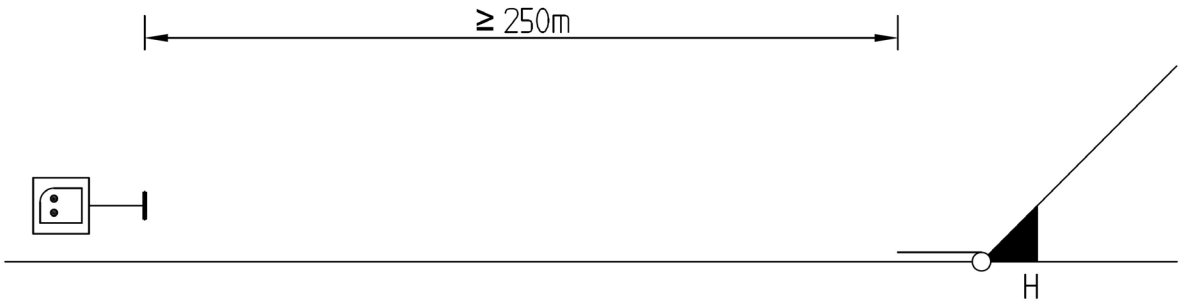
2.3.1 Signal 106: Stop for shunting board

Location of Signal 106: Stop for shunting board

ENI-SS-ENG-1534 When placing Signal 106: Stop for shunting board, the following shall be considered:

Comments: *Signal 106 is used to protect the catenary section break against the running of shunting units into the section break if the neighboring catenary section of the line is powerless and earthed. The entry marker board is used in the same way for protection against trains running towards the station when it is powerless and earthed.*

ENI-SS-ENG-444 a) Signal 106 shall on single track lines be placed in a distance of ≥ 250 meter from the outmost station point, or in accordance with the operational concept if this states the need for an increased shunting distance.
Rationale: *The distance of 250 meter ensures a length to perform shunting movements for a dimensioning EMU (double Stadler FLIRT train sets – 211 meters).*



ENI-SS-ENG-1384 Signal 106 "Stop for shunting board" shall be placed in accordance with the defined safety distance for shunting movements towards train movements in opposite direction towards the station border.
Rationale: *In order obtain required safety distance for allowing simultaneous shunting movements inside the station area (TSA) and train running towards the station entry marker board.*

ENI-SS-ENG-1470 Signal 106 “Stop for shunting board” shall be placed ahead of the catenary section break.
Rationale: *In order to prevent a shunting unit to enter the catenary brake section when the catenary section on the line is powerless and earthed.*

ENI-SS-ENG-1535

Signal 106 should, on double track lines or larger station areas, be placed in a distance of ≥ 250 meter from the outmost station points, or marker boards for turning movements ahead of the point's stock rail joint (see figure in ENG-327) to provide a shunting distance (see also ENG-1470).
Comments: *On double track lines and in larger station areas, catenary section breaks are typically not placed in an orderly way as on single track lines. Placing of marker boards in such areas will therefore be placed to support capacity and not necessarily according to catenary section breaks. For these areas, pre-testing in the TMS will be used to prevent train movements that might cause an hazardous situation.*

2.3.2 Entry marker board

Location of station entry marker board according to catenary section break

Rationale: *When maintenance work is performed on the catenary, the neighboring sections are earthed as well due to safety reasons. Therefore, if maintenance work is performed on a particular line section, it will be possible to set a train route towards the neighboring station due to the entry marker board being situated outside the catenary section break of that station.*

ENI-SS-ENG-286

On electrified lines, the station entry marker board shall be placed outside the nearest catenary section break, with the section break on the station side of the entry marker board.

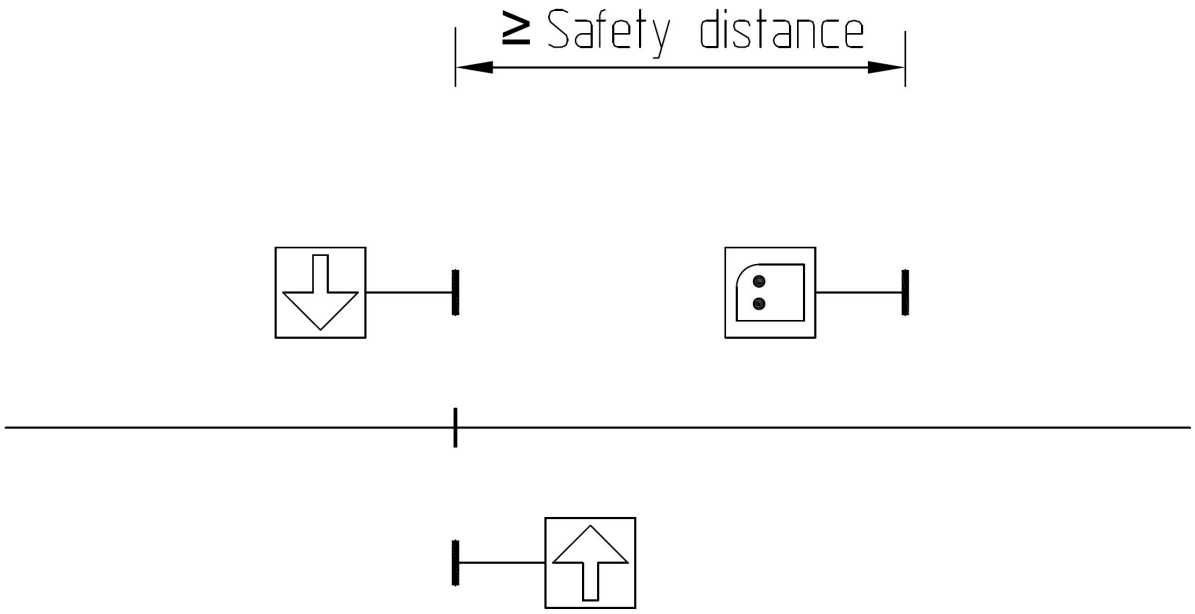
Comments: *This will cover the catenary section break. Additional "Signal 106: Stop for shunting" board will separate shunting movements on the station from the line.*

Exceptions are double track lines when catenary section breaks are not placed inside the existing station boarder as for single track lines. In these cases, the station marker boards shall be placed according to capacity a not necessarily according to catenary sections. The TMS will prevent locking of train routes into sections that are earthed. Please refer to illustration below.

Location of station entry marker board

ENI-SS-ENG-288

The station entry marker boards shall be placed at least according to defined safety distance outside from the "Signal 106: Stop for shunting" board.



Entry marker board close to level crossing

Rationale: *This placement avoids trains getting stranded on the level crossing if a movement authority cannot be provided at the entry marker board to the train in question.*

ENI-SS-ENG-1440

Entry marker board should be moved minimum 70 meters ahead of a level crossing system in driving direction, if the distance between the level crossing and the original marker board placement is less than 750 meters and the station is not designed for simultaneous entry routes.

Comments: *For stations built for simultaneous entry routes, trains will not normally stop at entry signal unless there is a platform on the line close to the level crossing that needs to be considered.*

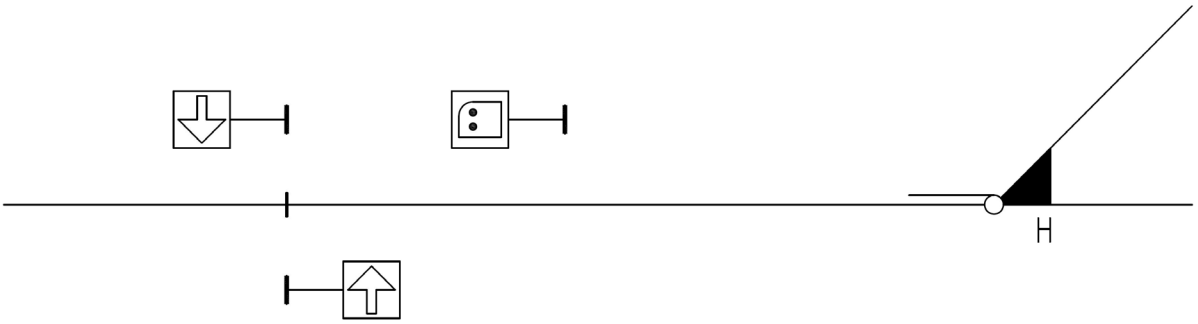
2.3.3 Exit marker board

Location of station exit marker board

Rationale: *To facilitate start point for route from the station.*

ENI-SS-ENG-283 The station exit marker boards shall be placed at the same location as station entry marker boards.

Comments: *This implies one common axle counter.*



2.3.4 Inner marker boards

Inner marker board ahead of first point

Rationale: *To allow shunting/turning operations or to facilitate needed capacity by allowing a train entering the station to approach the point at the same time as a train arrives in the platform track.*

ENI-SS-ENG-293 An inner marker board should be used ahead of the first point. Distance between it and the first marker board in the opposite direction shall be according to the defined safety distance of the signals in question.

Marker boards when simultaneous movements are not allowed

Rationale: *To define the end point of the route before the TVP section of the point*

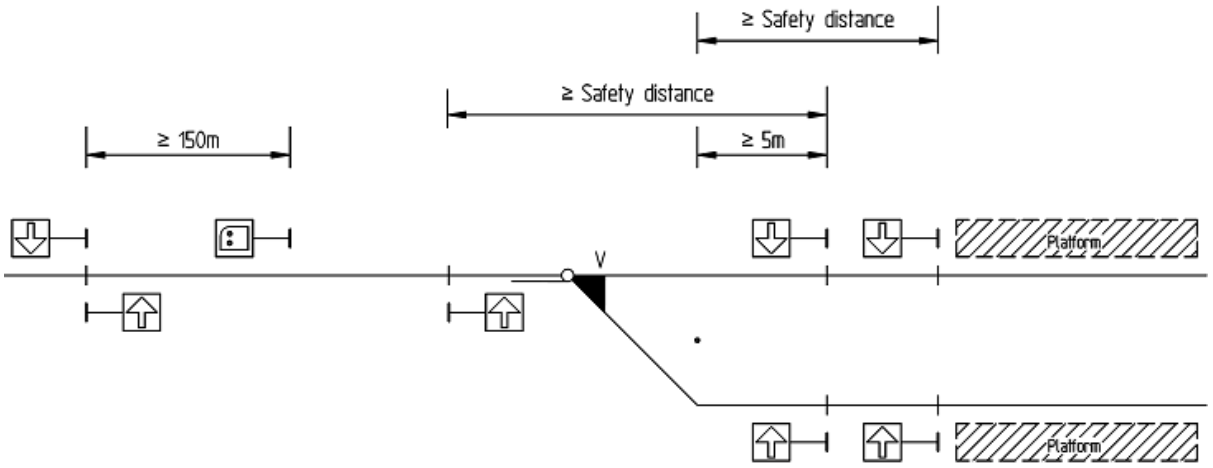
ENI-SS-ENG-295 An inner marker board shall be placed at least 5 meters ahead of the point's fouling point.

Comments: *According to nearest possible placement of axle counter from fouling point.*

Marker boards when simultaneous movements are allowed

Rationale: *To allow simultaneous entry routes, an additional inner marker board is placed ahead of the station's points.*

ENI-SS-ENG-296 An additional inner marker board on stations with simultaneous entry routes shall be placed with a distance of at least the defined safety distance ahead of the point's fouling point.



2.4 Dead-end tracks

MB in dead-end track

ENI-SS-ENG-915 If it is possible to set a route in to a dead-end track, a marker board shall be placed on the buffer stop with the arrow pointing down.

Comments: *No ID-board will be used on the marker board to show the driver that no train route can be locked from the marker board.*

Engineering of MB in dead-end track

ENI-SS-ENG-1510 The marker board in end of dead-end track shall be engineered and named as fictive end point.

Additional MBs in tracks

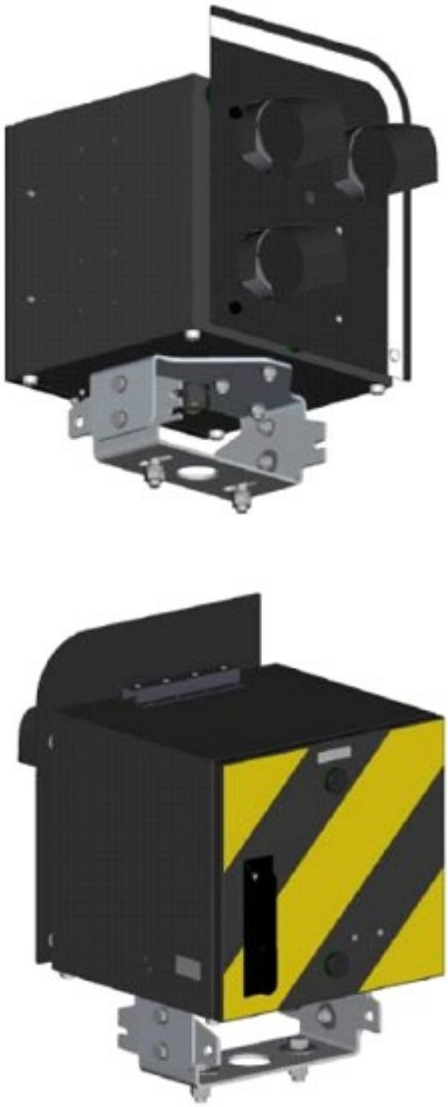
Rationale: *To store more than one train in a dead-end track or other tracks.*

ENI-SS-ENG-1269 If shortening of train route towards and out from the dead-end track or other tracks is needed, additional marker boards may be used.

Comments: *These additional marker boards shall have ID-boards. Se figure ENG-1392 for example.*

3 SHUNTING SIGNALS

The figure below shows a shunting signal. Design and dimensions are described in "Design requirements - signs and boards", doc.nr: 1000001649.



Placement

ENI-SS-ENG-44 A shunting signal should be located on the right side of the track.

Shunting signal with signal 102

ENI-SS-ENG-756 If it's not clear for the driver which track the shunting signal applies to, a signal 102 shall be placed on the shunting signal pointing towards the relevant track.

Sight distance

Rationale: *Ensures that the shunting signal is visible for the driver in the last 4 seconds before the driver passes the signal in the highest permitted speed in Shunting mode (40 km/h).*

ENI-SS-ENG-46

A shunting signal shall be placed so that it can be continuously observed by the driver at a distance of 50 meters until it is passed.

Minimum sight distance to shunting signal in start of shunting route.

ENI-SS-ENG-1860

The sight distance should be a minimum of 5 meters to shunting signals that only can be start point for shunting routes.

Comments: *Shunting signals with minimum sight distance cannot be end point for shunting routes or in PSA or TSA.*

Sight distance to shunting signal with respect to downhill gradients

ENI-SS-ENG-47

Shunting signals shall be placed so that it is visible in sufficient distance for a train in shunting mode driving in 40 km/h to be able to stop before the shunting route's stop signal with respect to downhill infrastructure gradients. Minimum sight distance related to gradient shall be according to the table below.

Grades decline g[‰]	Distance [m]
$g \leq 1$	177
$1 < g \leq 5$	184
$5 < g \leq 10$	192
$10 < g \leq 15$	201
$15 < g \leq 20$	212
$20 < g \leq 25$	226

4 TRACK VACANCY PROVING

Axle counters monitor track sections in order to verify if a train occupies it or not, and gives the status to the interlocking. Supplier specific constraints may apply to minimum length of track sections in relation to line speed.

Axle counter TSI CCS

ENI-SS-ENG-50 All requirements in TSI CCS regarding axle counter placement shall apply.

TVP minimum distance

Rationale: *In order to ensure that a vehicle or wagon can't bridge the TVP section.*

ENI-SS-ENG-51 No TVP section shall be shorter than 21 meters.

Section not detected maximum distance

Rationale: *In order to ensure not to get sections where train axles are not securely detected.*

ENI-SS-ENG-52 Sections in a supervised area not protected by a TVP section shall not exceed 3 meters.

Comments: *Sections not protected can be e.g. a zone between TVP sections.*

Section not detected at critical areas

ENI-SS-ENG-53 Sections in a supervised area not protected by a TVP section shall not comprise point's fouling point or other critical areas.

Comments: *Sections not protected can be e.g. a zone between TVP sections.*

Axle counters in points

Rationale: *To avoid influence in axle counting system from balise antennas under trains.*

ENI-SS-ENG-1861 An axle counter in a point shall not be placed in such a way that the ETCS antenna in a train passes over it.

4.1 Axle counter at signalling point

Axle counter at signalling point

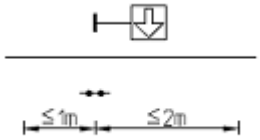
ENI-SS-ENG-1511 All signalling points shall have an axle counter.

Comments: *A signalling point can be a marker board, shunting signal or combined marker board and shunting signal.*

Placement of axle counter at signalling point

ENI-SS-ENG-55 An axle counter placed at a signalling point shall be at the same location as the signalling point.

Comments: *Deviation allowed is maximum 1 meter ahead of or 2 meters behind the signalling point. The deviation is to allow a leeway when installing the axle counter.*

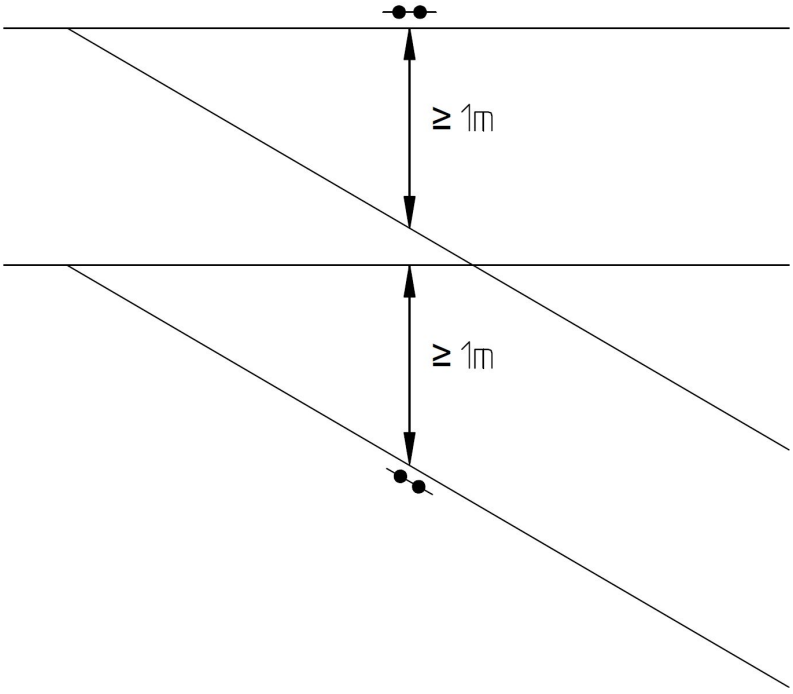


4.2 Points

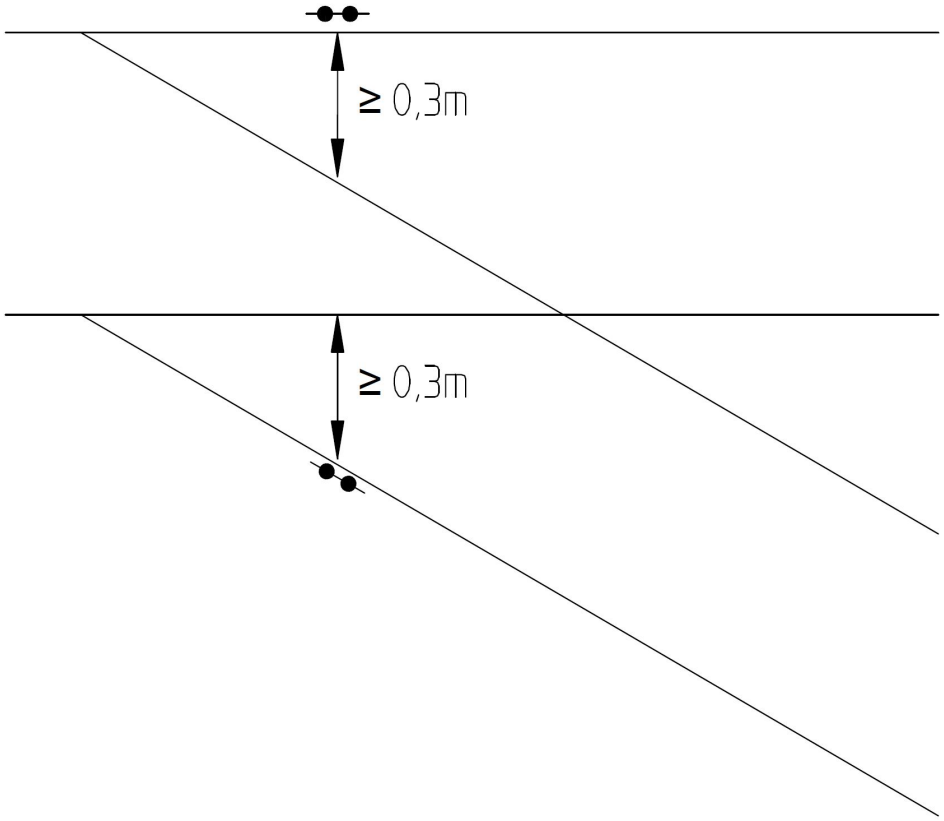
Axle counter in point area

ENI-SS-ENG-1513 The following minimum distances shall be fulfilled when placing axle counter in point area:

ENI-SS-ENG-1514 a) with no speed restriction



ENI-SS-ENG-1516 b) with speed ≤ 120 km/h



TVP section in points

Rationale: *To reduce the amount of axle counters*

ENI-SS-ENG-57 A point or a group of points that naturally belongs together should have its own TVP section.

Include TVP section of point in entry route

Rationale: *To reduce the amount of axle counters*

ENI-SS-ENG-1549 The point should be included in the TVP section of the entry route (typically track section A / B).

Distance from fouling point to axle counter

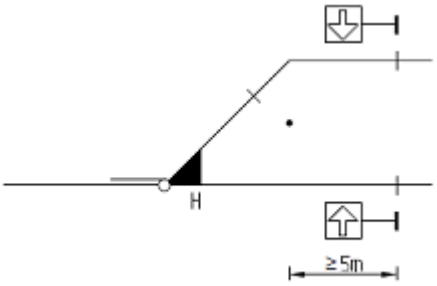
Rationale: *As described in TSI CCS Index 77 - A train detection system shall be able to detect:*

- *the first axle before the nose of the train reaches the danger point ahead*
- *the last axle until the tail of the train has passed the danger point*

ENI-SS-ENG-58

The TVP section in a point shall be engineered so that the distance from fouling point to flank protective signal is at least 5 meters.

Comments: *The TVP section in a point can be split into several sections.*

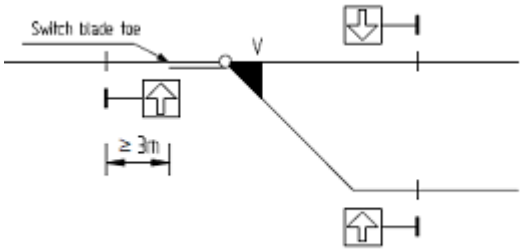


Distance from switch blade toe to the axle counter

Rationale: *This will ensure that if a train moving from the neighbouring TVP section (that has not yet occupied the point's TVP section) simultaneously as the point receives a "switch point to opposite position" command, the train will not reach the switch blade before the point's switch blade moves.*

ENI-SS-ENG-59

The distance from the switch blade toe for centrally operated points to an axle counter shall be at least 3 meters.



Preparatory reset of TVP in point

Rationale: *To make it possible to return to normal operation as easy and fast as possible.*

ENI-SS-ENG-1550

TVP section in a point or group of point shall be engineered so that preparatory reset is possible in both legs of all points.

Axle counter not passed when executing preparatory reset

ENI-SS-ENG-764

Axle counter not passed when executing preparatory reset in a point shall be placed within 10 meters from the point's fouling point.

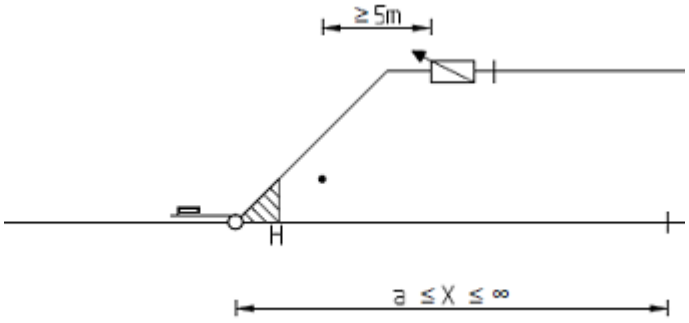
Comments: *If TVP section covers several points, the fouling point of the point in the route which is used when executing preparatory reset is the applicable fouling point.*

ENI-SS-ENG-849

Exception: At points controlled by a key lock, the axle counter in straight track can be placed more than 10 meters from the points fouling point. See figure below.

Comments: *Preparatory reset is operationally not allowed in diverging track in a point controlled by a key lock.*

Distance a is equal to the supplier's minimum distances for axle counters in point area, see ENG-1513.



TVP section in a group of centrally operated points

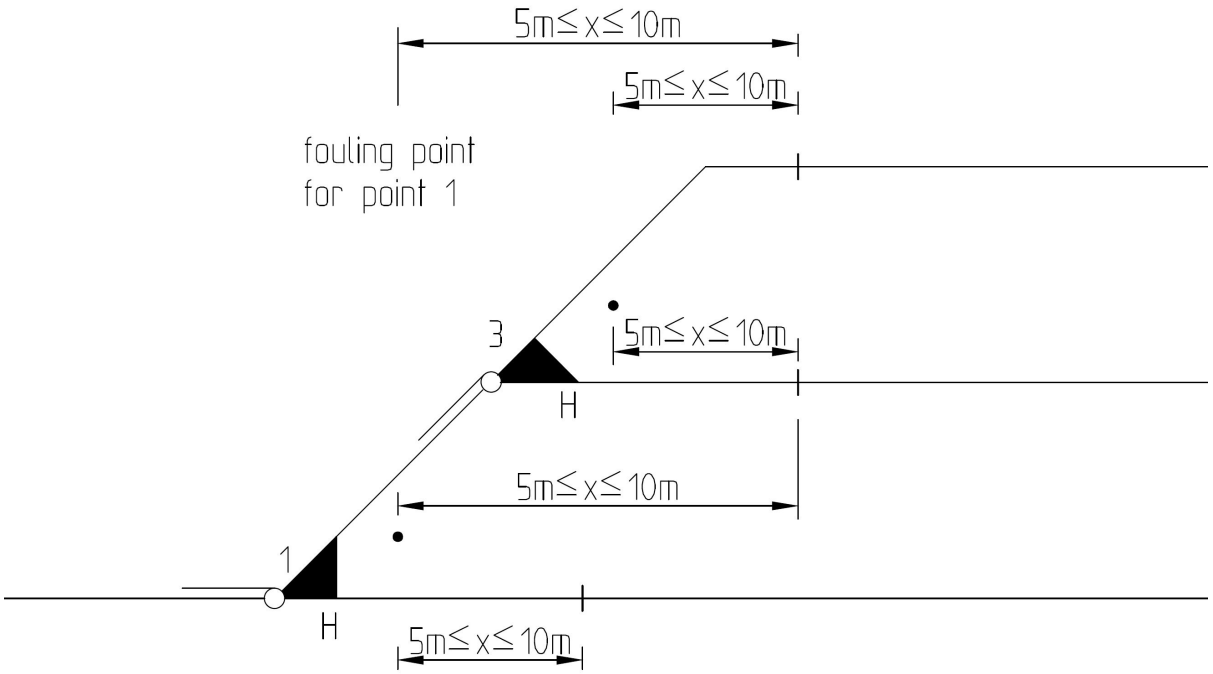
ENI-SS-ENG-1398

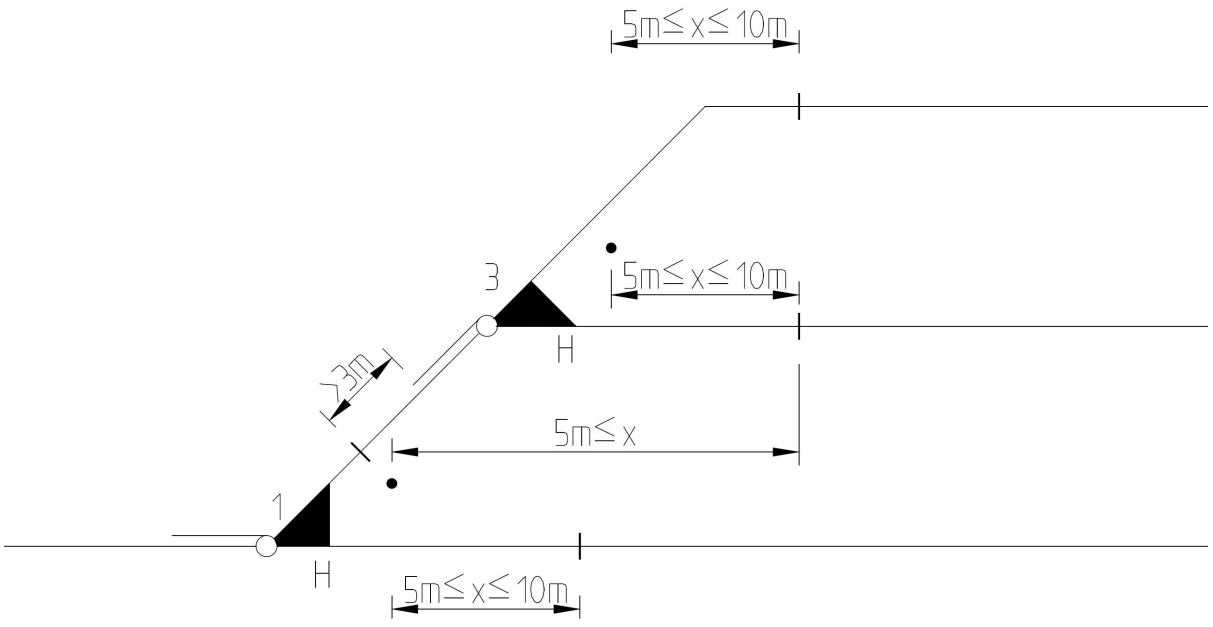
TVP sections in a group of centrally operated points shall be engineered as in the figures below:

Comments: *The following requirements are relevant in these cases:*

Distance from fouling point in centrally operated points to axle counter: ENG-58 and ENG-764

Distance from switch blade toe in a centrally operated point to the axle counter: ENG-59.





TVP section in a group of centrally or locally operated points and/or derailer

ENI-SS-ENG-1401

TVP section in a group of centrally or locally operated points and/or derailer should be engineered as in the figures below:

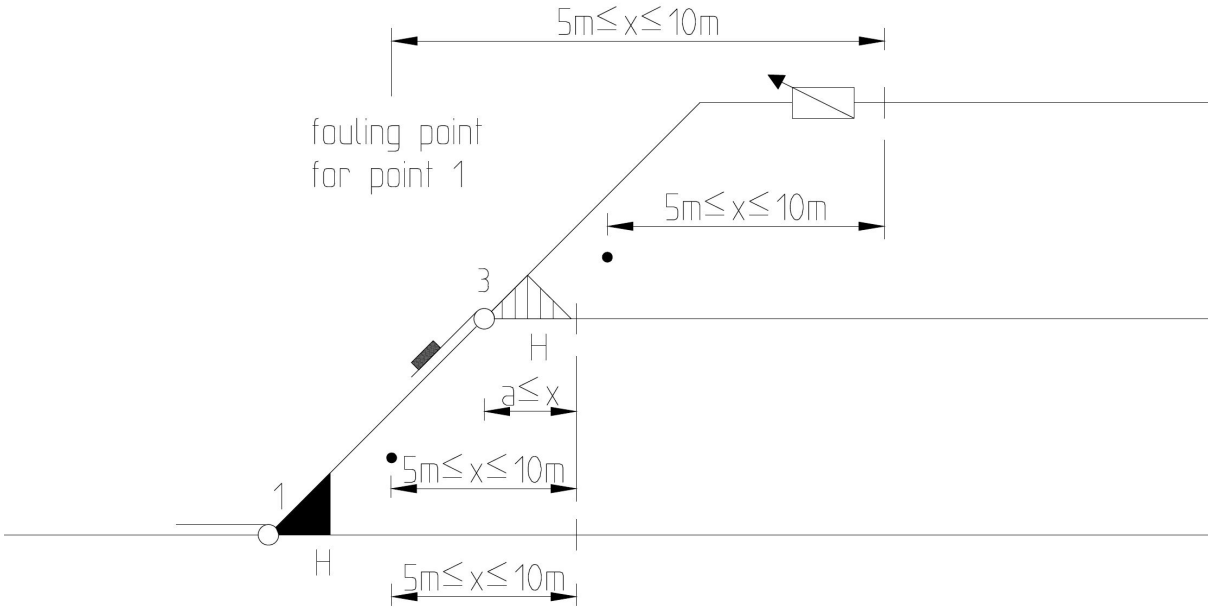
Comments: *The following requirements are relevant in these cases:*

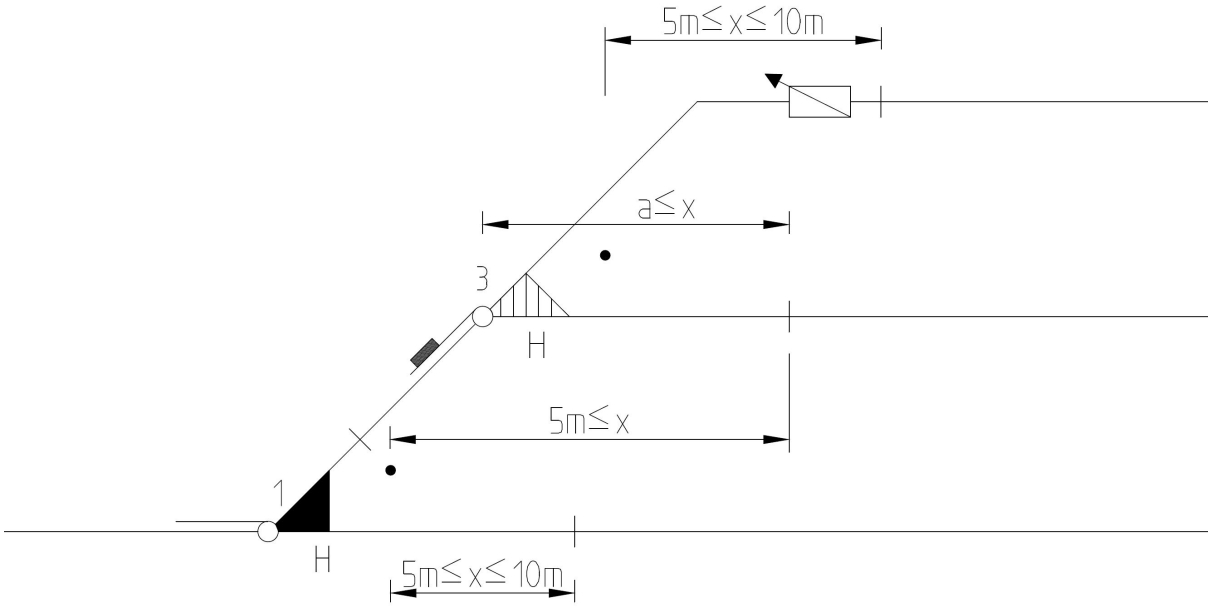
Distance from fouling point in centrally operated points to axle counter: ENG-58 and ENG-764.

Distance from points controlled by key lock to the axle counter in the track without derailer or diverging point: ENG-1513

Distance from fouling point in the same track as the axle counter: ENG-849

Distance from switch blade toe in point controlled by key lock: ENG-59





4.3 Derailers

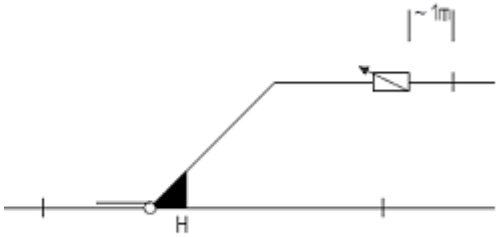
Distance from axle counter to derailer

Rationale: *To avoid that shunting movements up to the derailer are detected as occupied section over the point.*

ENI-SS-ENG-61 The axle counter shall be placed approximately 1 meter ahead of the derailer, but as close to the derailer as possible.

Comments: *Exact distance depending on supplier specific constraints.*

If the derailer is placed closer than 5 meters from the point's fouling point, the axle counter is placed in such a distance to the fouling point that the derailer can be moved to its correct location later.



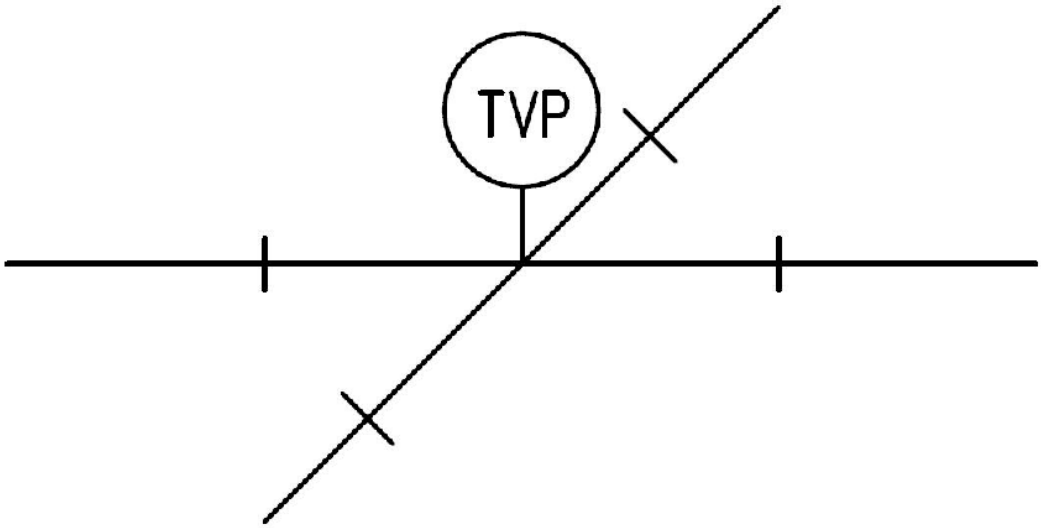
4.4 Diamond crossing and slip point

Diamond crossing and slip point

ENI-SS-ENG-63

A TVP section in a Diamond crossing or slip point (single or double) shall have an extent as shown in the figure below.

Comments: *If points and/or derailers are located close to the crossing or the slip point, these can be included in the section. This can be the case to avoid that the track section become shorter than 21m.*

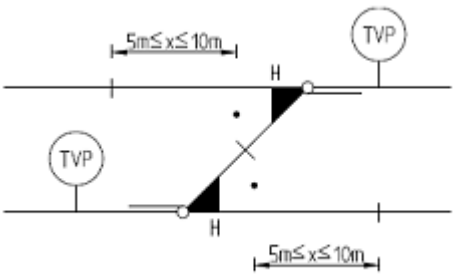


4.5 Crossover

Single crossover

ENI-SS-ENG-65

A TVP section in a single crossover shall be engineered as in the figure below.

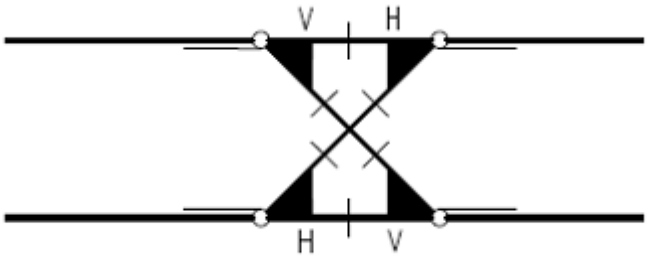


Double crossover

ENI-SS-ENG-66

A TVP section in a double crossover with diamond crossing shall be engineered as in the figure below.

Comments: *The minimum distance of 21 meters must be observed in the cross.*



4.6 Level crossing systems

Deactivation of level crossing systems

Rationale: *Minimum 5 meters in order to ensure that the front of the train has not reached the road before the road barriers are activated (minimum distance between nose of train and the first axle of the train).*

ENI-SS-ENG-68

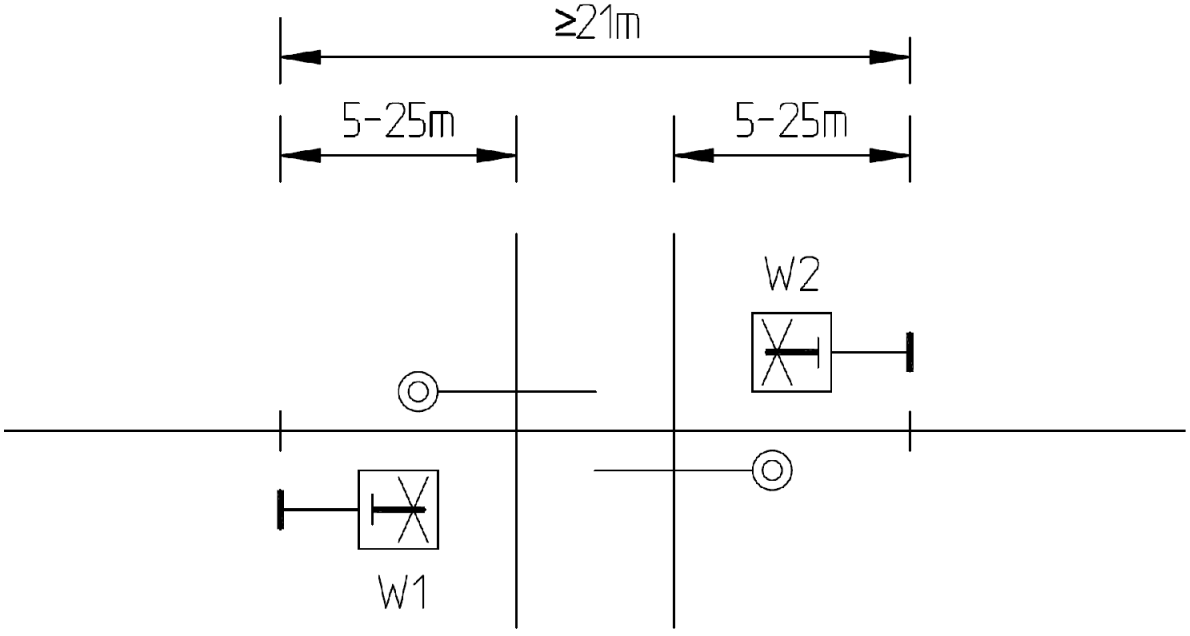
The axle counters for deactivation of a level crossing system shall be placed between 5 and 25 meters from the edge of the road.

Comments: *Please note that the figure is merely indicating the placement of axle counters. Also keep in mind the minimum distance of a TVP section (21 meters).*

Recommended distance

ENI-SS-ENG-1728

The axle counters for deactivation of a level crossing system should be placed 10 meters from the edge of the road.



Activation of warning lamp

ENI-SS-ENG-777 Intentionally deleted

4.7 Dead end tracks

Dead end track

Rationale: *To ensure that both the train can fit the section, and additional balises ahead of marker board.*

ENI-SS-ENG-152 The length of a dead end track's TVP section shall be engineered as train length + at least 20 meters.

Comments: *Operational concept will state the lengths of trains using the track section.*

5 BALISES

Balise TSI CCS

ENI-SS-ENG-72 All requirements in TSI CCS regarding balise placements apply.

Relation to axle counter

ENI-SS-ENG-73 Balises constituting a balise group shall all be located to the same side of any axle counter detection unit.

Relocation balises

Rationale: *To ensure sufficient odometric accuracy*

ENI-SS-ENG-552 Balises shall be placed to ensure sufficient odometric accuracy at locations where trains will have target point for speed changes.

Distance from balise to other equipment

ENI-SS-ENG-577 Balise placement shall take supplier specific constraints for distance to other equipment into consideration, for example distance from axle counter detection unit or guard rails.

Comments: *Different suppliers have different requirement for placement of equipment that has to be taken into consideration.*

From L0 and PSA's

Rationale: *To ensure that a vehicle entering the ERTMS area has a valid position.*

ENI-SS-ENG-1991 At the boundary to ERTMS areas (from e.g., depots) positioning balises shall be concidered installed, according to the specific layout and use of the area.

Harmonized in front of Marker Boards

Rationale: *To ensure that track length usage is not limited.*

ENI-SS-ENG-1992 Balises ahead of Marker Boards shall be mounted in a harmonized way and as close to the Marker Board as feasible.

Close to Marker Boards

Rationale: *Balises has to be read by the train and the position information sent to the RBC before the signal is set to stop by train passing the signal, occupying the TVP section in question.*

ENI-SS-ENG-1993 If balises needs to be mounted very close to a Marker Board due to a combination of limited track length and the dimensioning train length, “delayed signal to stop” can be engineered. With “delayed signal to stop”, the signal is set to stop by occupying the second TVP section in front of the signal instead of the first.

Note: for placement of level transition balises, please see the chapter regarding level transition.

6 POINT MACHINES

Exact placement of point machines and detection devices in a point is decided by the supplier's design of point machines and detection devices.

6.1 Replacement of existing point machines

Some of the existing point machines can be replaced 1:1, as indicated in the following subchapter. Regulations for the other point machines are given in the subsequent subchapters.

Replacement of point machines 1:1

ENI-SS-ENG-80

The following table shows where a replacement of point machines can be done one to one based on four scenarios.

Scenario	Description	Interpretation related to TRV (Signal/550 Prosjektering – Kap. 8 Sporveksel- og sporsperreutrustning)	Exceptions from interpretation
1	Distance between existing and new holes in the switch blade are according to requirements in TRV. No measures needed. Point machines can be installed with exiting blades Location of Point machines changed due to drilling of new holes.	Requirements in the following chapters will not apply. **Replacement of point machines can be done one to one.**	1. Points that is **1:12 or bigger shall be equipped according to the following chapters.** 2. Speed over point **greater than 130 km/h, equipped according to the following chapters.**
2	Distance between existing and new holes in switch blade are according to requirements in TRV. One or both tongues will be replaced with equal blades (no change in "functional performance"). Location of point machines changed due to drilling of new holes.	Requirement in the following chapters will not apply. **Replacement of point machines can be done one to one.**	**1.** Points that is **1:12 or bigger shall be equipped according to the following chapters.** 2. Speed over point **greater than 130 km/h, equipped according to the following chapters.**
3	Replacement of the complete point.	Equipping of the point shall be done according to the following chapters.	
4	Adding point machine to a manually controlled point. Existing or new blade. «Functional performance» will not be changed.	Requirement in the following chapters will not apply. Same number of position detection units can be used, meaning that **one detection device (position key lock), is replaced by one point machine.**	**1.** Points that is **1:12 or bigger shall be equipped according to the following chapters.** 2. Speed over point greater than **130 km/h, equipped according to the following chapters.**

6.2 Equipping of points

Point equipment

ENI-SS-ENG-76

A point controlled by the Signalling System shall be equipped with point machines and/or detection devices as given in this chapter.

Comments: *This means that centrally operated points in non-supervised areas or points only used in shunting activities could be equipped different than described in this chapter. This has to be decided specifically in each case.*

Permitted speed > 130 km/h

ENI-SS-ENG-77

A point with permitted speed > 130 km/h shall be equipped with point machine(s) and/or detection device(s).

Permitted speed in diverging track > 40 km/h

ENI-SS-ENG-78

A point with permitted speed in diverging track > 40 km/h shall be equipped with point machine(s) and/or detection device(s).

6.2.1 Point with grade 1:9

Equipping of point with grade 1:9

ENI-SS-ENG-82

Equipping of point with grade 1:9 shall be done according to the following table and figures. Please note that the last figure is including movable frog.

Comments: *Regarding the table:*

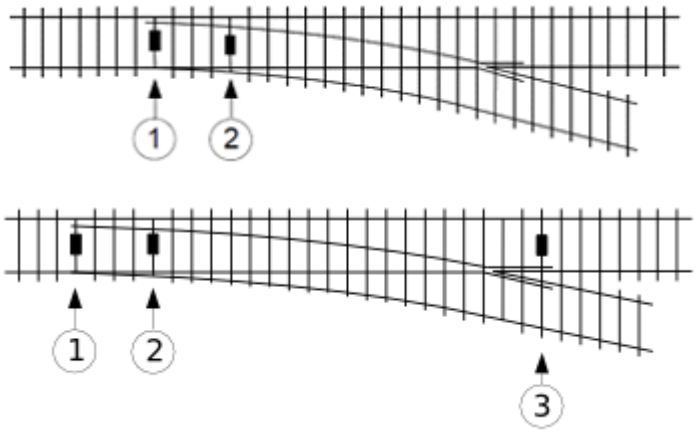
PM = Point machine

DD = Detection device

**) Holding force on open switch blade shall be limited to avoid deformation of the switch blade.*

Type		Switch blade		Vee junction
		1	2	3
1:9 R190 S54	Equipping	PM	DD	PM
	Holding force – closed switch blade [kN]	≥ 40	(≥ 6)	≥ 40
	Holding force – open switch blade [kN]	≥ 10*	(≥6*)	
	Moving force [kN]	≤ 6.5	(≥ 6.5)	≤ 6.5
1:9 R300 S54 / UIC60	Equipping	PM	PM	PM
	Holding force – closed switch blade [kN]	≥ 40	≥ 6	≥ 40
	Holding force – open switch blade [kN]	≥ 10*	≥ 6*	
	Moving force [kN]	≤ 6.5	≤ 6.5	≤6.5

Type		Switch blade		Vee junction
		1	2	3
Grade = 1:9 R < 300 Speed = 40	Equipping	PM	DD	PM
	Holding force – closed switch blade [kN]	= 40	-	= 40
	Holding force – open switch blade [kN]	= 10*	-	
	Moving force [kN]	= 6,5	-	= 6,5



6.2.2 Point with grade between 1:12 and 1:18.4

Equipping of point with grade between 1:12 and 1:18.4

ENI-SS-ENG-84

Equipping of point with grade between 1:12 and 1:18.4 shall be done according to the following table and figures. Please note that the last figure is including movable frog.

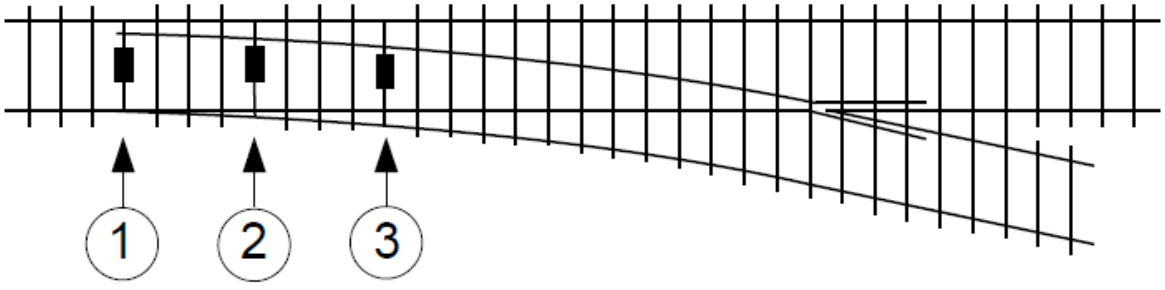
Comments: *Regarding the table:*

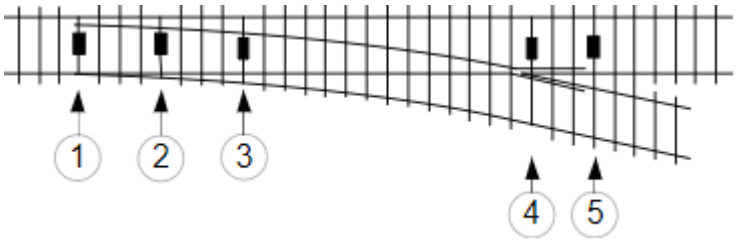
PM = Point machine

DD = Detection device

**) Holding force on open switch blade shall be limited to avoid deformation of the switch blade.*

Type		Switch blade			Vee junction	
		1	2	3	4	5
1:12 R500 S54 / UIC60	Equipping	PM	DD	PM	PM	PM
	Holding force – closed switch blade [kN]	≥ 40	(≥ 6)	≥ 6	≥ 40	(≥ 6)
	Holding force – open switch blade [kN]	≥ 10*	(≥ 6*)	≥ 6*		
	Moving force [kN]	≤ 6.5	(≤ 6.5)	≤ 6.5	≤ 6.5	≤ 6.5
1:14 R760	Equipping	PM	PM	PM	PM	PM
	Holding force – closed switch blade [kN]	≥ 40	≥ 6	≥ 6	≥ 40	≥ 6
	Holding force – open switch blade [kN]	≥ 10*	≥ 6*	≥ 6*		
	Moving force [kN]	≤ 4	≤ 4	≤ 4	≤ 6.5	≤ 6.5
1:14/15 R760 UIC60	Equipping	PM	PM	PM	PM	PM
	Holding force – closed switch blade [kN]	≥ 40	≥ 6	≥ 6	≥ 40	≥ 6
	Holding force – open switch blade [kN]	≥ 10*	≥ 6*	≥ 6*		
	Moving force [kN]	≤ 6.5	≤ 6.5	≤ 6.5	≤ 6.5	≤ 6.5
1:18.4 R1200 UIC60	Equipping	PM	PM	PM	PM	PM
	Holding force – closed switch blade [kN]	≥ 40	≥ 6	≥ 6	≥ 40	≥ 6
	Holding force – open switch blade [kN]	≥ 10*	≥ 6*	≥ 6*		
	Moving force [kN]	≤ 4	≤ 4	≤ 4	≤ 6.5	≤ 6.5





6.2.3 Point with grade 1:26.1

Equipping of point with grade 1:26.1

ENI-SS-ENG-86

Equipping of point with grade 1:26.1 shall be done according to the following table and figure. Please note that the figure is including movable frog.

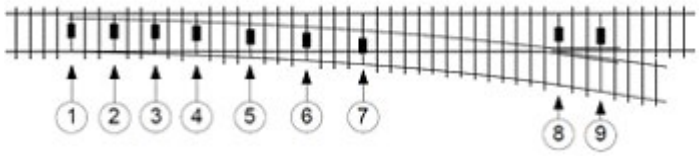
Comments: *Regarding the table:*

PM = Point machine

DD = Detection device

**) Holding force on open switch blade shall be limited to avoid deformation of the switch blade.*

Type		Switch blade				
		1	2	3	4	5
1:26.1 R2500 UIC60	Equipping	PM	DD	PM	DD	PM
	Holding force – closed switch blade [kN]	≥ 40	(≥ 6)	≥ 6	(≥ 6)	≥ 6
	Holding force – open switch blade [kN]	≥ 10*	(≥ 6*)	≥ 6*	(≥ 6*)	≥ 6*
	Moving force [kN]	≤ 6.5	(≤ 6.5)	≤ 6.5	(≤ 6.5)	≤ 6.5
		Switch blade		Vee junction		
		6	7	8	9	
	Equipping	DD	PM	PM	PM	
	Holding force – closed switch blade [kN]	(≥ 6)	≥ 6	≥ 40	≥ 6	
	Holding force – open switch blade [kN]	(≥ 6*)	≥ 6*			
	Moving force [kN]	(≤ 6.5)	≤ 6.5	≤ 6.5	≤ 6.5	



6.2.4 Single and double slip diamond crossing

Equipping of single and double slip

ENI-SS-ENG-782

Single and double slip diamond crossing shall be equipped with a point machine at the switch blade toe.

7 DERAILERS

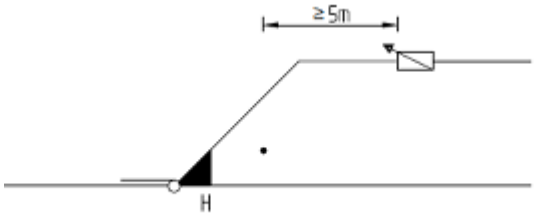
Distance from derailer to fouling point

ENI-SS-ENG-90

The distance from the derailer to the point's fouling point shall be at least 5 meters.

Comments: *Existing locally operated derailers are typically placed 3 meters inside the fouling point. In such case it shall be considered to keep the existing placement of the derailer.*

If derailer is closer than 5 meters from the fouling point, the axle counter for the track section covering the derailer is still placed according to ENG-58.



Derailment direction

Rationale: *To minimize damage in case of derailment.*

ENI-SS-ENG-94

A derailer shall be placed so that derailment will happen in the direction where it is no other track or to the track with the least traffic.

ENI-SS-ENG-92

For a train's derailment to the left, the derailer shall be placed on the left rail.

ENI-SS-ENG-93

For a train's derailment to the right, the derailer shall be placed on the right rail.

8 DIRECTION SIGNALS FOR POINTS AND DERAILERS

Point and derailer direction signals

ENI-SS-ENG-1213 Locally operated points and derailers shall be equipped with the following direction signals:

ENI-SS-ENG-1220 · Points - Signal 51 ("Sporvekselsignal for enkel sporveksel")

ENI-SS-ENG-1221 · Single- / double slip points – Signal 52 ("Sporvekselsignal for kryssporveksel")

ENI-SS-ENG-1222 · Derailers – Signal 53 ("Sporsperresignal")

Point and derailer secured by using shunting- and/or train routes

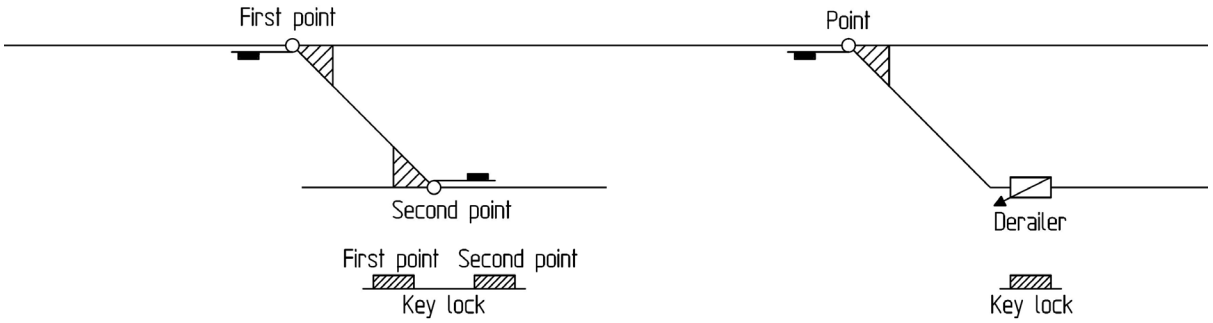
ENI-SS-ENG-1214 Point and derailer that are secured using shunting- and/or train routes, shall not be equipped with direction signals.

Exception: Derailer used in high density traffic areas where trains regularly and at high frequency turn its running direction (e.g. Gardermoen) shall be equipped with direction signal (due the consequences a derailment will have in such an area).

9 KEY LOCK

A key lock for point and derailer functions as follows:
Key number 1 which is placed in the key lock is used to unlock the Derailer. The Derailer can then be moved to “off” position which enable removal of key number 2 (located at the Derailer). This key is now used to lock the Derailer in “off” position, then removed from the derailer and used to unlock the Point, which now can be thrown to the opposite position.

A key lock for two points, or one point and one point for derailing functions as follows:
The key lock contains the number of keys consistent to the number of points controlled by the key lock. The points can be operated independent of each other. All keys are released simultaneously from the key lock and all keys must be in the key lock to get control on the key lock.



Number of keys in key lock

ENI-SS-ENG-1520 Intentionally deleted

Points or a point and derailer with dependencies to each other

ENI-SS-ENG-1236 When two points or a point and derailer are mechanically locked with dependencies to each other, both shall be controlled by the same Key lock.

Comments: *A key lock can have 1 or more keys.*

Number of keys in key lock

ENI-SS-ENG-1984 A key lock shall contain the number of keys consistent to the number of points controlled by the key lock.

Key lock close to derailer

Rationale: *To ensure effective operation of the derailer and the point. The derailer have to be controlled in "off" position at first to get the key for the point.*

ENI-SS-ENG-907 Key locks controlling a derailer and a point shall be placed close to the derailer.

Unique keys on station

ENI-SS-ENG-908 All different keys to different key locks in one and the same station shall be unique.

Comments: *As of now, there are 48 different types of keys used in Norway.*

Unique keys in adjacent stations

ENI-SS-ENG-909 It shall not be used the same type of key on two adjacent stations.

Two unique keys in derailer and corresponding point

ENI-SS-ENG-910 It shall not be used the same type of key in the derailer as in the corresponding point.

10 LOCAL CONTROL PANEL FOR POINTS AND DERAILERS

A local control panel for points is used when a station or part of a station is released for shunting.

Location of local control panel

Rationale: *In order to see the position of the switch blade toe.*

ENI-SS-ENG-96 A local control panel shall be placed 1-2 meters ahead of the point's switch blade toe.

10.1 Criteria for local control panel for points

Stations without local control panel for points

Rationale: *To facilitate changing track with movement authority or dispatcher throwing the point in a TSA*

ENI-SS-ENG-1524 The need for local control panels for points shall be clarified for every station with the Traffic department.

Local control panel

ENI-SS-ENG-1211 Points shall be equipped with local control panels as definded in the document 2000004206.

Comments: *If stations are not defined to have local control panels, points will be locally operated by use of handheld terminal in TSA, PSA and WA.*

10.2 Criteria for local control panel for derailers

Local control panel for derailers

ENI-SS-ENG-1864 Derailers shall not have local operation panels.

Comments: *Derailers will be locally operated by use of handheld terminal in WA. Derailers are in position of the track in TSA and PSA.*

11 CRANK CABINETS

Crank cabinets are installed to hold cranks for manually throwing of points.

Generic work routines will have to make sure cranks are located in the cabinets. Cranks will not be controlled by the interlocking.

Cranks removed from cabinet will not be indicated in the TMS.

Crank cabinet

Rationale: *In dense traffic areas the use of hand cranks is not possible. It usually only maintenance personnel that is allowed to use hand cranks on points. Danger for derailment in points with many point machines.*

ENI-SS-ENG-927 Crank cabinets should as default not be engineered.

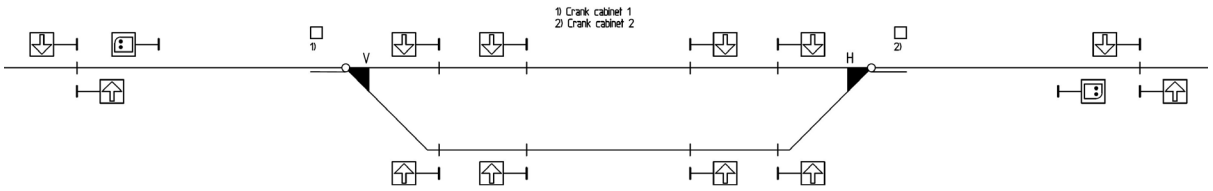
Comments: *Crank cabinets may be used in cases where this is considered a "last resort" in a failure situation to operate a point, i.e.: at mountain passes, but they will not be connected to the signalling system.*

Crank cabinets at mountain passes

ENI-SS-ENG-928 Crank cabinets may be used in cases where this is considered a "last resort" in a failure situation to operate a point, i. e.: at mountain passes.

Placement of crank cabinets

ENI-SS-ENG-929 If used, crank cabinets shall be placed at the station's outmost points in each end.



12 LEVEL CROSSINGS

A level crossing is the actual crossing between a road and the track. The level crossing system (LX) is the system that controls the safety of the level crossing and all parts connected to the level crossing system as well as being the part that is connected to the interlocking.

A LX will be activated by a command from the signalling system, based on an approaching railway vehicle, or command from TMS or LCP.

Activation of a LX initiates closing of barriers and activation of warning devices.

The activation distance for a LX is dimensioned to ensure that an approaching railway vehicle can continue at line speed without brake intervention. This includes the time the LX needs to reach the state "protected", including time delay for lowering the barriers.
Activation distance will be handled by generic functions and is not a topic for detailed engineering.

A LX will be deactivated based on the passing of a railway vehicle, a command from LCP or a command from TMS.

Deactivation of a LX initiates opening of barriers and deactivation of warning devices.

Deactivation section is defined as the TVP section that holds the deactivation equipment. This is defined by two axle counters, one placed on each side of the LX, between 5 and 25 meters from the edge of the road.

Types of LXs

ENI-SS-ENG-106 These different types of LXs is specified for the ERTMS signalling system:

Comments: *Please see requirements specifications, Attachment E1.5 to the Signalling System contract, ERP-30-S-00059 for details on functionality.*

ENI-SS-ENG-1258 a) Full barrier system
Comments: *Corresponds to "Helbomanlegg (Ba)"*

ENI-SS-ENG-1259 b) Half barrier system
Comments: *Corresponds to "Halvbomanlegg (1/2 Ba)"*

ENI-SS-ENG-1260 c) Road signal system
Comments: *Corresponds to "Veisignalanlegg (La)"*

ENI-SS-ENG-1261 d) Simplified road signal system
Comments: *Corresponds to "Enkelt veisignalanlegg"*

ENI-SS-ENG-1262 e) Warning lamp
Comments: *Corresponds to "Varsellampe"*

LX types to be used in the ERTMS signalling system

ENI-SS-ENG-1555 Only LX type a) and c) shall be used in the ERTMS signalling system.
Comments: *Other types can be used if guidelines from the "infrastructure department" has been received and a deviation from Engineering guidelines is accepted.*

LX conversion table

ENI-SS-ENG-1570

The following table shall be used when converting existing LX types to the types specified in ENG-1555:

Comments: *The guidelines for LX in Bane NOR technical rules shall be considered when choosing LX type - https://trv.banenor.no/wiki/Overbygning/Vedlikehold/Planoverganger/Vedlegg/Veiledning_sikringsmetoder_og_tiltak*

This guideline can cause an up- or downgrade to respectively a) or c), if the conditions (i.e. road users, train traffic, rebuild of road) for has changed.

**type b) can be used if deviation from ENG-1555 is accepted.*

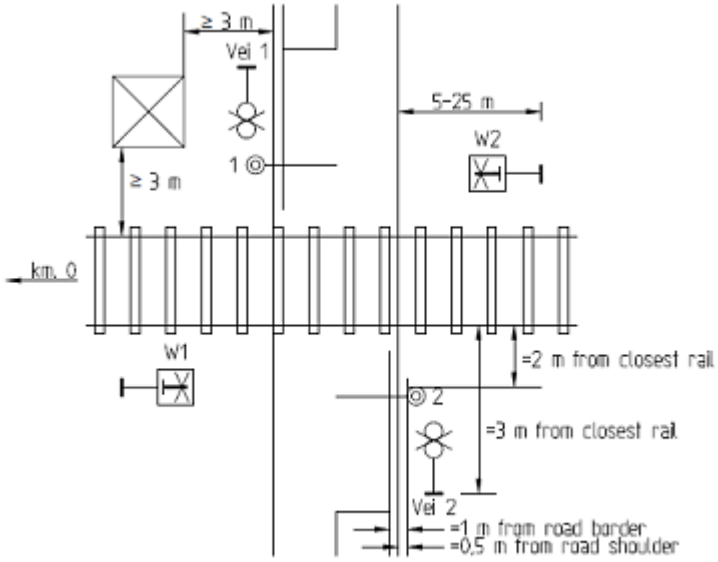
Legacy LX type	a)	b)	c)	d)	e)
LX type used in ERTMS	a)	a)*	c)	c)	c)

12.1 Level crossing system

Level crossing equipment

ENI-SS-ENG-111

Level crossing equipment for LX types a) - d) shall in general be placed according to the figure below and as described in this chapter.



Obstacle detector

ENI-SS-ENG-113

Obstacle detector may be used to detect road users that are trapped on an activated level crossing.

Comments: *Criteria for use of obstacle detector are not yet defined.*

12.1.1 Signal E36: Level crossing board

Signal E36: "Level crossing board" right side

ENI-SS-ENG-768 Signal E36: "Level crossing board" shall be placed on the right side of the track aligned with the level crossing's TVP section.

Comments: *If the requirements to sight distance can't be fulfilled, the board can be placed on the left side of the track.*

Signal E36: "Level crossing board" at each track

ENI-SS-ENG-769 If a level crossing applies to two or more tracks, Signal E36: "Level crossing board" shall be located at each track that has track number.

Comments: *Platform tracks and tracks for parking of vehicles in station are numbered. Crossovers between tracks are not numbered. If only one train or shunting vehicle can be located on the same side of the level crossing at the same time, one level crossing board may be sufficient.*

Signal E36: "Level crossing board"

Rationale: *To inform driver that there is a level crossing.*

ENI-SS-ENG-390 Signal E36: "Level crossing board" shall be placed at the same location as the axle counter for deactivation of the level crossing.

Signal E36: "Level crossing board" sight distance

ENI-SS-ENG-770 Sight distance shall be according to ENG-1668 and ENG-1688

12.1.2 Road signal

Road signal is used for regulating the road traffic using red and white light signals. Road signals show correct signal aspect towards the road and report correct status information to the interlocking.

Road signal right side

ENI-SS-ENG-116 The road signal shall be placed on the right side of the road.

Exception: *For level crossing used for platform entry the best placement of the signal for pedestrians (passengers) shall be considered. Location here is allowed on the right side, left side or on both sides of the platform entry.*

Road signal placement distance

ENI-SS-ENG-117 The road signal shall be placed as close to the road as possible, but never closer than 0.5 meters from the road shoulder or 1 meter from the road's edge line.

Road signal left side

ENI-SS-ENG-118 A road signal shall, in addition to the one on the right, be placed on the left side of the road if the width of the road is more than 6 meters, or because of sight issues.

Comments: *The road width is measured 90 degrees on the driving direction, next to the right-side road signal.*

Multiple roads

ENI-SS-ENG-119 If multiple roads diverge from the level crossing, all the roads shall be signalled with a road signal.

Road signal distance from rail

ENI-SS-ENG-120 A road signal shall be placed as close to the track as possible, but never closer than 3 meters from the closest rail.

Mounting of "St. Andrew's cross"

ENI-SS-ENG-121 Traffic sign 138 Railway track (St. Andrew's cross) shall be mounted on the road signal's pole.

12.1.3 Acoustic signals

The acoustic signal is intended to warn persons in the vicinity of the level crossing of a passing train. It gives notice in form of sound when signal is received.

Acoustic signal right side

ENI-SS-ENG-125 An acoustic signal shall be placed at the right side of the road normal to the road signal, normally on the same pole as signals Vei1/Vei2.

Exception: *For level crossings as platform entry, placement of the acoustic signal for pedestrians may be adapted to optimize the quality/strength of the sound. Location of the sound device may be on either side of the platform entry, or at either side of the track where the level crossing is placed.*

Acoustic signal left side

ENI-SS-ENG-126 An acoustic signal may in addition to the one on the right be placed on the left side of the road if needed, normally on the same pole as signals Vei3/Vei4.

Multiple roads

ENI-SS-ENG-127 If multiple roads diverge from the level crossing, all the roads may be required to be signalled with an acoustic signal to ensure all approaching pedestrians can hear the signal.

12.1.4 Barrier

Barrier drive right side

ENI-SS-ENG-129 The barrier drive shall be placed on the right side of the road.

Barrier drive left side

ENI-SS-ENG-130 If more than two barriers are used, the third and fourth barrier drive shall be placed on the left side of the road.

Barrier drive distance from road

ENI-SS-ENG-131 The barrier drive(s) shall be placed as close to the road as possible, but never closer than 0.5 meters from the road shoulder or 1 meter from the road's edge line.

Half barrier 90 degrees to the road

ENI-SS-ENG-132 Intentionally deleted

Full barrier parallel to the track

ENI-SS-ENG-133 A full barrier shall be adjusted parallel to the track.

Barrier drive distance from rail

ENI-SS-ENG-134 The barrier drive(s) shall be placed as close to the track as possible, but never closer than 2 meters from closest rail.

12.1.5 Level crossing systems in Level 0 and PSA areas

One level crossing system may cross several parallel tracks. Some of the tracks might be assigned as TSA or PSA, while other tracks are used for running trains or shunting movements.
A level crossing system can be used in both interlocked and non-interlocked areas.

Optical signals for train in Level 0 areas

ENI-SS-ENG-1867 A Level Crossing system in Level 0 areas shall have optical signals towards trains.

Optical signals for train in PSA areas

ENI-SS-ENG-1868 A Level Crossing system in dedicated PSA areas shall have optical signals towards trains

Comments: *This requirement is not relevant for level crossing systems covering several parallel tracks where some are dedicated to PSA while others are used for train- and/or shunting routes*

TVP section in Level 0 areas

ENI-SS-ENG-1869 A Level Crossing system in a Level 0 areas shall have TVP sections for activation and deactivation of the level crossing.

TVP section in PSA

ENI-SS-ENG-1870 Level crossing systems in interloced PSA areas shall have TVP sections for deactivating of the level crossing.

Comments: *This requirement is not relevant for non-interlocked PSA areas.*

12.1.6 LX technical house

Technical house distance from road and rail

ENI-SS-ENG-136 The technical house shall be placed as close to the level crossing as possible, but never closer than 3 meters from the road shoulder and closest rail.

Blocking road user's line of sight

ENI-SS-ENG-137 The technical house shall be placed so that it as far as possible does not block the line of sight from the road to the track.

Local control panel

ENI-SS-ENG-138 The local control panel (LCP) shall be placed so that the user can observe the road traffic while operating the level crossing system.

12.2 Warning lamp

Warning lamp visibility

ENI-SS-ENG-774 Intentionally deleted

Warning lamp placement

ENI-SS-ENG-775 Intentionally deleted

Warning lamp distance from road

ENI-SS-ENG-776 Intentionally deleted

12.3 Maintenance level crossing

Maintenance level crossing for platform entry

ENI-SS-ENG-1913 Level crossings only used for maintenance purposes of platform areas shall not have level crossing systems.

Comments: *Such level crossings are not used by passengers, and may therefore be safeguarded by operational procedures/routines.*

13 AVALANCHE DETECTION

An avalanche detection system consists of an avalanche fence which captures falling rocks from the mountain side. When rocks hit the fence, detectors on the fence will inform the signalling system, which then take certain measures to protect the train from entering the area.

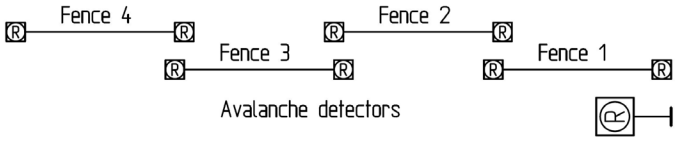
Avalanche detection

ENI-SS-ENG-141 An avalanche detection area shall be engineered as follows:

ENI-SS-ENG-142 1) A yellow and white pole (Signal 64C) shall be placed to mark the beginning and end of an avalanche area.
Comments: *Already existing on the Norwegian railway network today, see chapter regarding signs/boards/signals.*

ENI-SS-ENG-144 2) An avalanche warning signal (Signal E38: "Avalanche area") should be placed 250 meters ahead of signal 64C.
Comments: *The distance of 250 meters can be increased because of e.g. space constraints or poor visibility.*

The figure below shows the placement of avalanche warning signal and signal 64C:



14 TUNNEL GATES

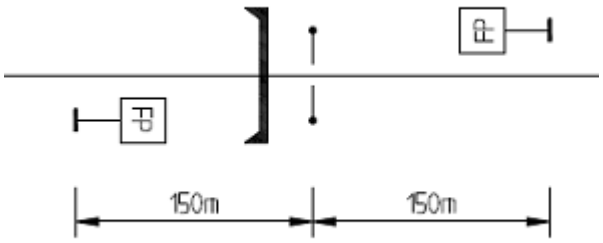
A tunnel gate system consists of tunnel gates that closes a tunnel to avoid draft in the tunnel. E.g. draft in tunnels might lead to ice spikes from the tunnel roof which might short circuit the catenary wire causing the wire to burn off. The signalling system initiate opening and closing of the tunnel gates. A Movement Authority through the gates requires them to be in open position.

As long as the tunnel gate do not report the status "open", the RBC shall give a Movement Authority ending at the tunnel gate location.

When the tunnel gate reports the status "open", the RBC shall provide a Movement Authority through the tunnel if a main or on-sight route (FS- or OS-route) is secured.

ENI-SS-ENG-1370 Signal E39: "Tunnel Gate" (frostport) shall be placed 150 meters ahead of the tunnel gates (only required for trains running in SR-mode, because SH-mode will require the gate open).

The figure below shows the placement of Signal E39: "Tunnel Gate" (frostport):



15 MOVABLE BRIDGE

There are merely two movable bridges in Norway as of today, and they are both located at Trondheim station. The movable bridge system is a locally operated autonomous system equipped with its own signals, operating panel, bridge machine control circuit and indication circuit.

Marker boards at moveable bridge

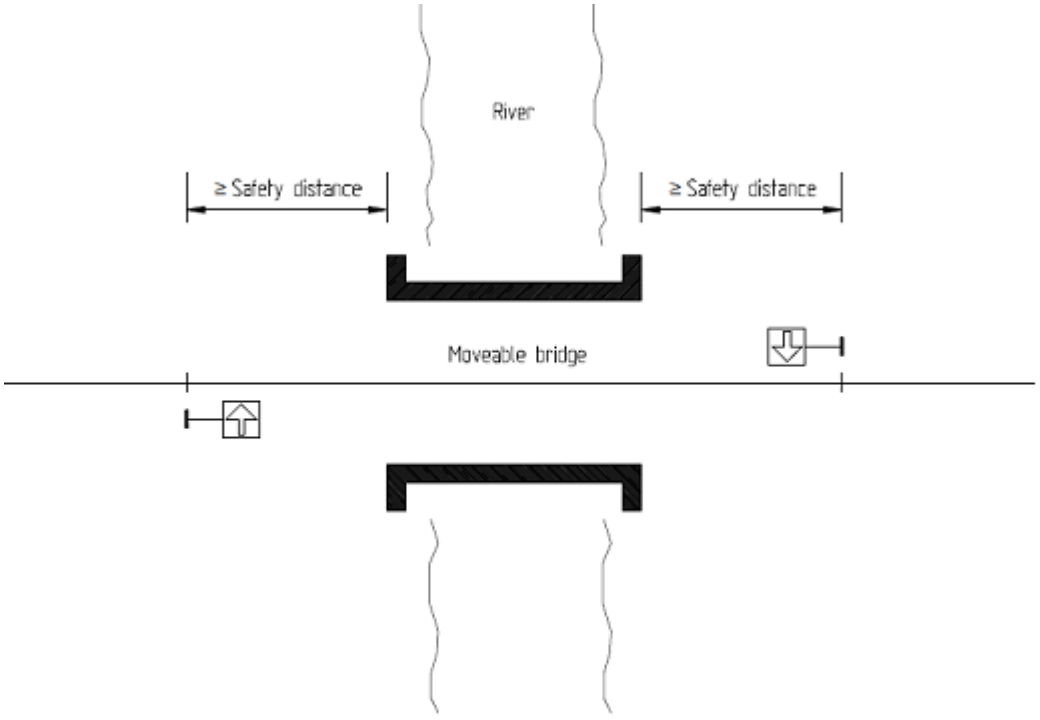
Rationale: *To avoid hindrance of ship traffic if a movement authority cannot be provided at the block marker board to the train in question.*

ENI-SS-ENG-1364 For placing marker boards at moveable bridges, the following requirements apply:

ENI-SS-ENG-1365 1) Marker boards shall be placed at each end of a moveable bridge and in the correct distance to the bridge according to the defined safety distance for each marker board.

ENI-SS-ENG-1366 2) Distance signs should be used if required visibility is not achieved (signal E61).

The figure below shows the preferred placement of marker boards at moveable bridge, and related work areas (the moveable bridge shall have a separate work area).



16 INFLUENCE ON OTHER DISCIPLINES

The following ENG-requirements refers to requirements in TRV for other disciplines than the signalling system:

- Marker Board, distance to booster transformer. ENG-1751
- Marker Board, distance to catenary section break. ENG-322
- Work area, dependency to catenary section break. ENG-1908

17 TRAIN ROUTES

A route is an appointed section of track for a specific railway vehicle's movement on a station or on the line. It is used to safeguard train operations.

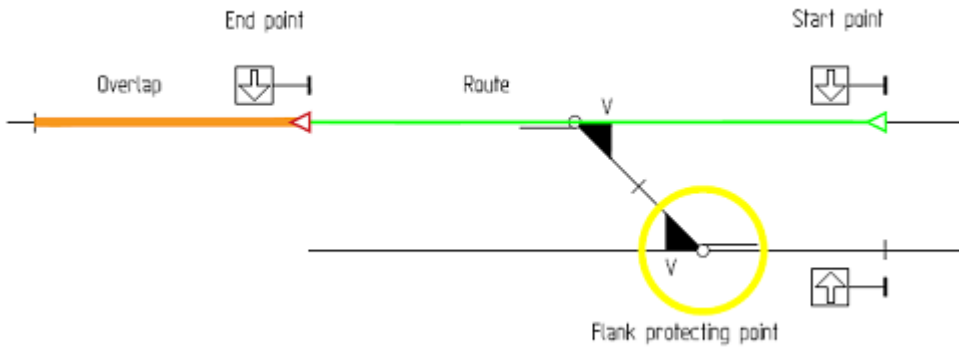
The Signalling System uses the following types of train routes:

- Main route: All objects in the route are proven in correct position and locked, and Track Vacancy Proving (TVP) sections are free of occupation. A main route is needed to give a railway vehicle a Full Supervision Movement Authority.
- On Sight (OS) route: All objects in the route are proven in correct position and locked. TVP sections may be occupied. On sight routes imply a speed restriction. The driver of the railway vehicle is responsible for avoiding collisions with obstacles in or near the track. A railway vehicle can get an On Sight Movement Authority through an On Sight route.
- Staff Responsible (SR) route: Some of the objects in the route may not be proven in correct position and TVP sections may be occupied. The driver is responsible for checking that all objects are in the right position and for avoiding collisions with hindrances on the track. Objects in a staff responsible route will be locked for route setting if possible.

A train route starts and ends at a marker board.

In the figure below, a generic route concept is shown. A route consists of the following elements:

- a start point
- the route between the start point and the end point
- an end point
- an overlap, where its length is related to the release speed at the end point of the route
- flank protection



Start point of a route: The start point of a route is always at a marker board. The train receives a Movement Authority (MA) which is valid from the train's position close to the first marker board of the route.

The route: A route starts at a marker board and ends at another marker board. A route may comprise one or more track elements such as TVP sections, points, level crossings and/or flank protections. The interlocking sets the route by locking and/or controlling the track elements in the correct position,

according to principles for each route type. The radio block centre (RBC) can issue MA to the train when a route is proven.

End point of a route: The end point of a route is always at a marker board. If the route in question is the last route section secured for the train, ERTMS will supervise this point as End of Authority.

Overlap: An overlap is a function the suppliers can use to control a defined distance after the end point of a route. The length of the overlap defined for the end point of the route is depending on release speed and gradients. An overlap may comprise one or more track elements such as TVP sections, points, level crossing systems and/or flank protection elements.

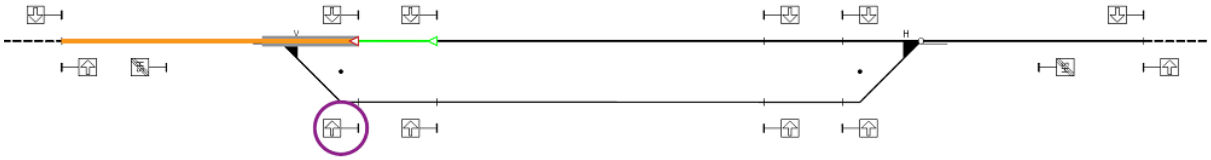
Flank protection
An element providing flank protection to a route or an overlap can be a marker board but is typically a point and/or derailer controlled in diverging position for the route or overlap in question.

The generic route concept can be applied for any track layout on the network. The generic route concept consists of a generic functionality that applies to any route based on the interlocking rules. The only elements that allow modifications are:

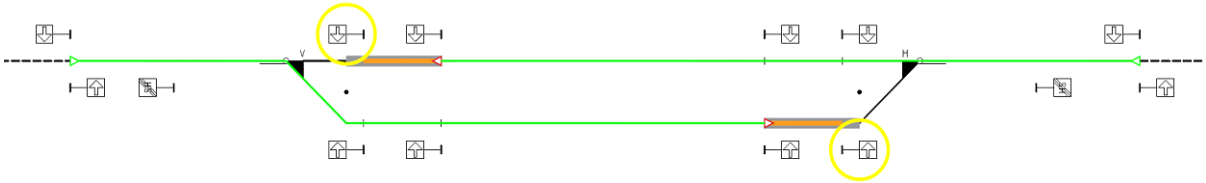
- the length of the route
- the length of the overlap
- the release speed

These factors will influence the operational properties and the capacity of a line. This can be shown in the figures below, where the generic route concept is used in a two-track station with different overlap lengths as well as different route lengths.

The figure below shows a train route using the outmost inner marker board as end point. The route's overlap extends through the point located beyond the end of the route. i.e. no route in opposite direction of the set route can be set, neither to the track in question nor to the neighboring track.



The figure below shows a train route using the inner marker board as end point, which shortens the overlap and opens the possibility for simultaneous train movements to the opposite track (the overlap of the first route is no longer conflicting to the second route).



Train route starting point

ENI-SS-ENG-168 A marker board shall be placed to define a start point for any type of train route.

Train route end point

ENI-SS-ENG-169 A marker board shall be placed to define an end point for any type of train route.

17.1 Flank protection

Flank protection elements are used to secure the flank of train- and shunting routes.

Elements used for flank protection.

ENI-SS-ENG-1296 The following elements shall be used for flank protection:

ENI-SS-ENG-1297 1) Marker board

ENI-SS-ENG-1298 2) Point (directly or via key-lock)

ENI-SS-ENG-1299 3) Derailer (directly or via key-lock)

ENI-SS-ENG-1300 4) Shunting signal

Alternative flank protection

ENI-SS-ENG-1423 If the nearest flank protecting object (e.g. a point) cannot give flank protection, an alternative flank protection shall be established (e.g. a Marker board).

Fictive flank protection

ENI-SS-ENG-1571 If a single object requires flank protection and this by engineering cannot be provided by another flank protective element, fictive flank protection shall be used.

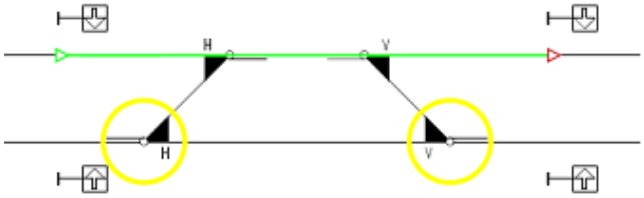
Comments: *In this case the object requiring flank protection could e.g. be a derailer.*

17.1.1 Marker board for flank protection

The figure below shows a train route with Marker board as flank protection.

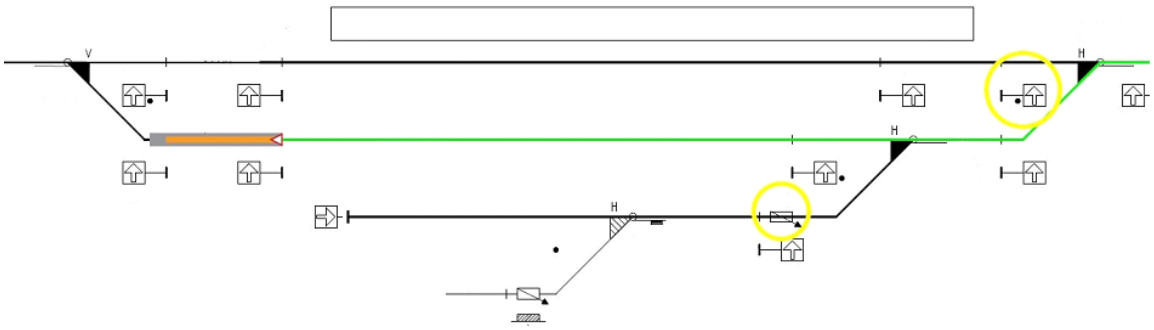
17.1.2 Point for flank protection

The figure below shows a train route with two flank protective elements, both points.



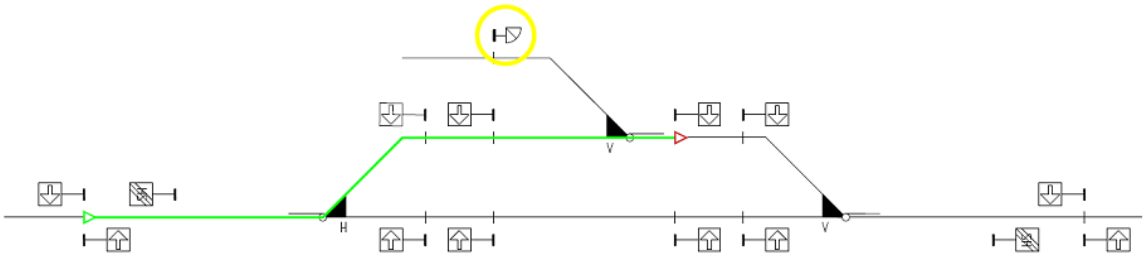
17.1.3 Derailer for flank protection

The figure below shows a train route with two flank protective elements, one Marker board and one derailer.



17.1.4 Shunting signal as flank protection

The figure below shows a train route with shunting signal as flank protection.



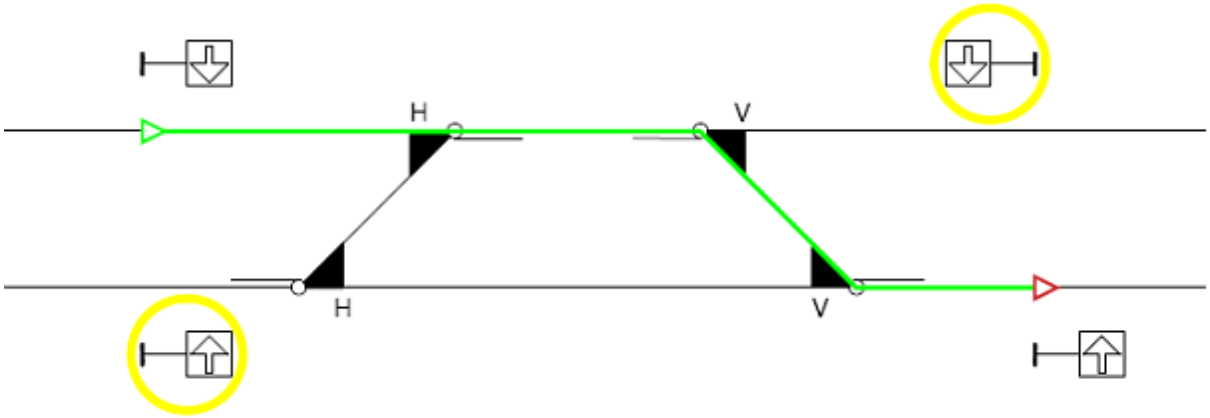
Shunting signal placed on a Marker board

Rationale: *To enhance availability if the shunting signal providing flank protection is faulty.*

ENI-SS-ENG-1313 If a shunting signal is placed on a Marker board, the marker board shall be the element providing flank protection.

17.1.5 Double protective point

The figure below shows a train route with three flank protective elements, two Marker boards and one point. The point is defined as double protective, having to protect both its legs to provide flank protection.

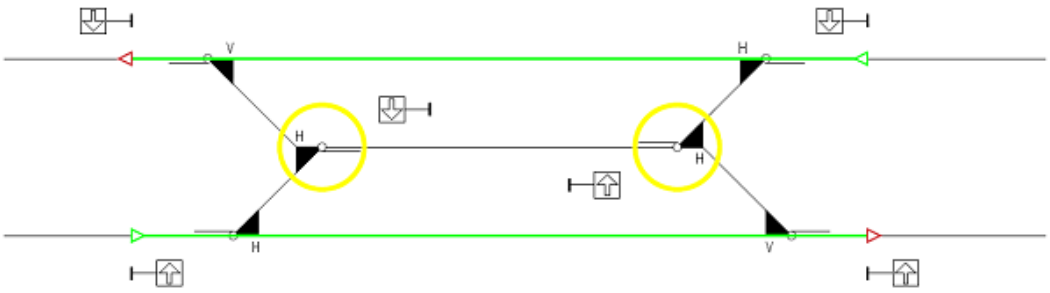


Double protective point

ENI-SS-ENG-1317 If a point is double protective the protection of one of the legs shall be forwarded to the previous element giving necessary flank protection.

17.1.6 Prioritized protection

The figure below shows two double protective points, forwarding the protection of one leg their respective previous element, in this case a marker board. Flank protection provided by the points itself are prioritized so that the worst scenario, in this case front-front collision, are prevented. This is called prioritized protection.

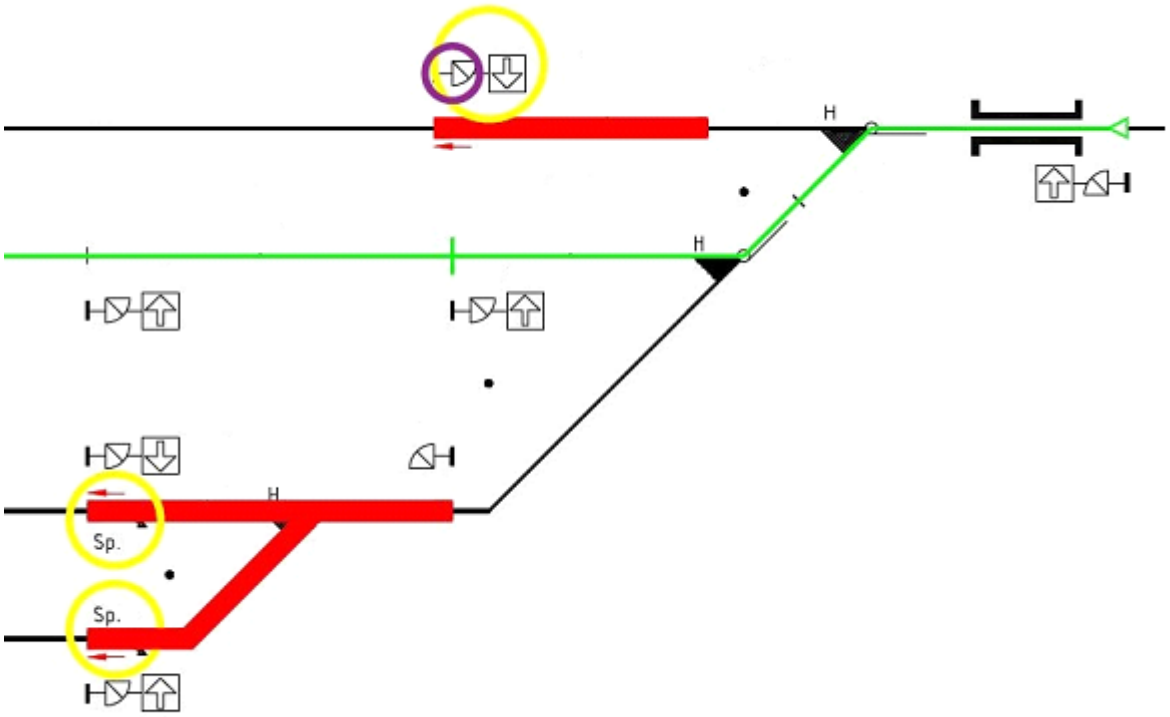


Prioritized protection

ENI-SS-ENG-1321 Prioritized protection shall be used on lines with speeds above 130 km/h and in cases where the consequence of an accident is significant.

17.1.7 Occupation of flank protection area

The figure below shows a non-hazardous occupation in the flank protection area. In this case only one inner MB is used, but together with the extra TVP section between this MB and the points fouling point. Trains running in opposite direction of travel can then occupy this TVP section, and the MB will still provide flank protection to other routes.



Occupation of flank protection area

ENI-SS-ENG-1463 Occupation of flank protection area as shown in figure above, should be configured to be allowed if all of the following are fulfilled:

ENI-SS-ENG-1735 · It is ≥ 5 meters from the fouling point to the occupied TVP section

ENI-SS-ENG-1736 · There is no steep gradients towards the flank protection area which might cause a train to roll backwards when releasing the brakes

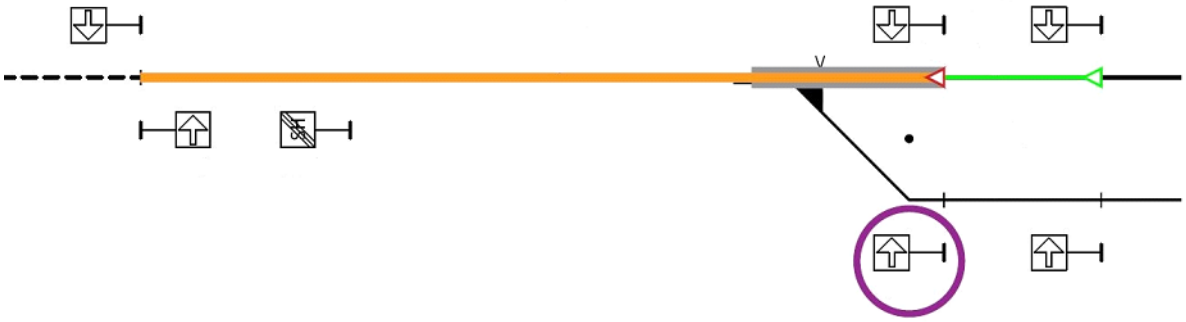
ENI-SS-ENG-1737 · There is an operational advantage, related to the schematic layout or traffic pattern

17.2 Overlap

Length of overlap shall be configured as described in ENG-816.

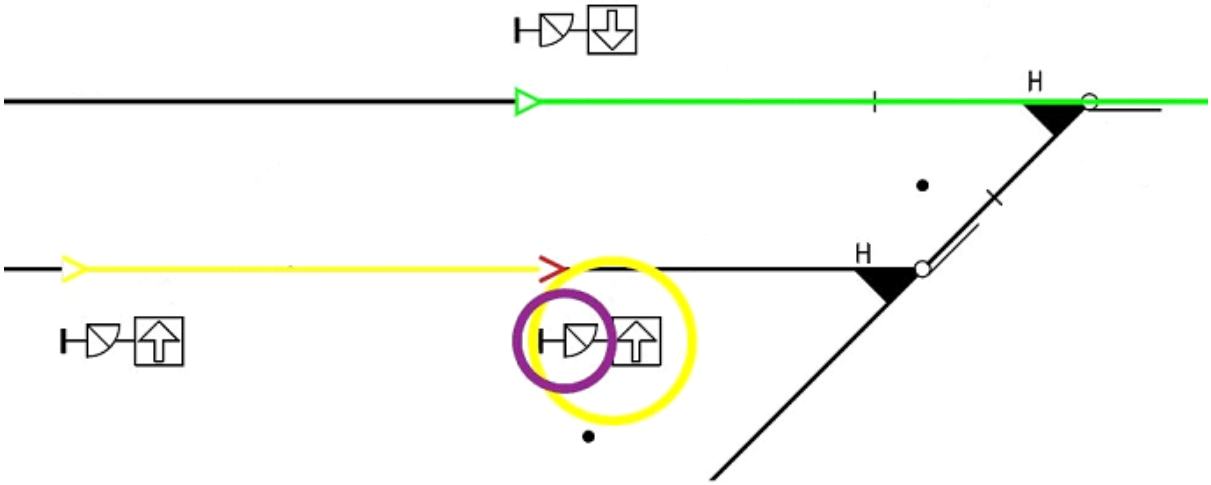
Overlaps for train routes can as a basic design rule use the same piece of track simultaneously. The simultaneous use of track may have to be prevented if the required safety distance between train route end points is not fulfilled (see ENG-816)

The figure below shows the specific configuration. The purple ring indicates that the outemost inner marker board cannot be used as an end point at the same time as it is providing flank protection to the train route ending at the outmost marker board.



The figure below shows a train route set to a block signal with an overlap of 0 meters. To obtain the required safety distance between two train routes in opposite direction, route setting in the opposite direction is inhibited, which is indicated by the purple ring.

The figure below shows a shunting route set towards the flank of a train route. In case the required safety distance between the end point of a shunting route and the flank of a train routes is not possible to fulfill, shunting routes does not use overlaps. The purple ring indicates that the combined marker board and shunting signal cannot be used as end point of the shunting route and simultaneously provide flank protection. This inhibits the simultaneous train- shunting routes, fulfilling the required safety distance.



Simultaneous end object of train /shunting route

ENI-SS-ENG-1579

If the required safety distance is not fulfilled by placement of the applicable signalling points, simultaneous use of end point of train/shunting routes shall be inhibited by configuration for each applicable combination of train movements.

Comments: *The engineering of signalling point placement should always try to fulfil the required safety distance and by this the possibility of simultaneous train movements. If by operational needs, it is required to place signalling points resulting in a shorter safety distance than required. Simultaneous use of end point of train/shunting routes shall be inhibited by configuration.*

The function requires specific configuration and testing and should therefor be limited.

17.3 Release of train routes

Train routes can release automatically initiated by train movements or cancelled manually by the train dispatcher by a command from the TMS.

Train routes are engineered with the use of different track elements, connected in a similar way as the track layout. A route's track elements are released sequentially as a train passes through the route, occupying and un-occupying TVP sections. The sequential route release requires a correct TVP passage sequence.

A route signalling end point can be released as follows:

- Correct sequential release, by passage of the routes end point
- Platform track release, by release of the last active element of the route (i.e point, crossing)
- Route rest release, by movement in opposite direction

Platform track is defined as a track where a train typically ends its route and may change its driving direction.

Overlap to a train route will release when the train is at standstill in the last track section of the route.

Release of train routes ending at platform or dead-end tracks

Rationale: *To facilitate parking and joining of trains and changing of driving direction in platform tracks or dead-end tracks*

ENI-SS-ENG-1582 Routes ending at platform or dead-end tracks shall be configured so that the routes signalling end point is released when the train has fully entered the track.

Comments: *The train route is released when defined TVP section behind last marker bord for opposite direction is free after train. The end signals for this train routes are numbered with three digits or is in a dead-end track.*

Route rest release

ENI-SS-ENG-1729 Intentionally deleted

Release of train routes in station entry- or exit- areas

Rationale: *To facilitate not stopping trains or trains changing driving direction in tracks not defined as platform tracks.*

ENI-SS-ENG-1886 Tracks not defined as platform tracks, but where train not normally stops or may change driving direction shall be configured so that the routes signalling end point is released when the entire train has past the marker board or the train changes direction and drives on a route in the opposite direction.

Comments: *The end signals for this train routes are numbered in 900X series. The train rout will release automatically if train turn direction ahead of last markerboard or shunting signal in opposite direction in the train route.*

Release of train routes ending at station borders or block posts

ENI-SS-ENG-1887 Routes ending at station entry-, exit- or block post marker boards shall be configured so that the routes signalling end point is released when the entire train has past the marker board

Comments: *These marker boards don't use overlaps. The route end point will release either by passing it with the correct sequence, or by rest release if driving direction is turned.*

Release of points, derailers and level crossing systems within a route

Rationale: *Train route elements such as points, derailers or level crossing systems are released when passed with a correct sequence.*

ENI-SS-ENG-1888 A train route's signalling end point shall not release before all points, derailers and level crossings systems in the route are released by train passage

Comments: *A train route may release before all points, derailers and level crossings systems in the route is completely passed by the train if the train returns on a train- or shunting route in opposite direction.*

17.4 Alternative route path

Alternative route path

Rationale: *To obtain the highest possible flexibility and capacity of the existing track layout.*

ENI-SS-ENG-1634 Alternative routes shall be engineered where a track layout provides the possibility for more than one path between a route start- and end point.

Comments: *The alternative route is engineered as a second, separate route from signalling start- to end point. It is not possible to set a separate speed for an alternative route path.*

17.5 Position Indication Message

A text message is sent to the Onboard unit which indicates to the driver (on the DMI) that the rear end of the train has passed the fouling point or other defined points. For the activation of the Position Indication Message, a route must be locked across the defined TVP section border.

Position Indication Message

ENI-SS-ENG-1891 Position Indication Message should primarily be used for tracks where cargo trains stop to loaded/unload cargo or where shunting is performed.

Comments: *It shall be clarified with the traffic department where this function shall be used. Passenger trains are normally using "train length sign" for position to platforms.*

Position Indication Message

ENI-SS-ENG-1892 Position Indication Message shall be given when defined TVP section in the train route becomes not occupied.

Comments: *The TVP sections can be with or without points.*

18 SHUNTING ROUTES

A shunting route is used to safeguard shunting operations in larger station areas. Shunting routes have similar requirements as main routes, but normally the driving distance between the signalling points is shorter. All objects in a shunting route are controlled by the Signalling System.

Shunting route start point

ENI-SS-ENG-172 A shunting signal shall be placed to define a start point for a shunting route.

Shunting route end point

ENI-SS-ENG-173 A shunting signal shall be placed to define an end point for a shunting route.

Comments: *Exceptions are shunting routes that end in a dead end track, in an unsecured area, or in a Signal 106: "Stop for shunting" board.*

Signal 106: "Stop for shunting" as end of a shunting route

ENI-SS-ENG-916 A shunting route ending at a border between a station and the line shall end at Signal 106: "Stop for shunting" board.

18.1 Criteria for shunting signals

In a main route, all signalling and route data are displayed on the Driver Machine Interface (DMI) display in the trainborne cab. In Shunting (SH) mode, however, merely the fixed supervised speed is displayed, and no information regarding the start and end point of a shunting route. Therefore, shunting signals will be required at some stations in order to fulfil the capacity requirements of the railway network.

A guidance matrix is given in the DOORS module "Signalling System Shunting Signals" related to which stations that should be equipped with shunting signals

Shunting Signals at stations

ENI-SS-ENG-1525 The need for shunting signals shall be evaluated for every station based on the guidance given by the Traffic department and the criterias below.

Comments: *The need for shunting signals may change over time.*

Criteria for shunting signals in Level 2 areas

ENI-SS-ENG-681 Shunting routes/signals should be used in ERTMS Level 2 areas when:

ENI-SS-ENG-682 a) it is considered necessary in order to fulfil the capacity requirements that are stated in the document "Operational Concept" for a specific line, or

ENI-SS-ENG-683 b) FS-/OS-mode are not sufficient in terms of capacity requirements, including time and personnel, in order to move/shunt electric multiple unit railcars (e.g. Stadler FLIRT) between station tracks, or

ENI-SS-ENG-684

c) the use of TSA for shunting movements is not sufficient in order to fulfil capacity requirements, and operational needs for maintenance trains. It includes the following criteria:

- frequent and repetitive shunting movements for sorting items of rolling stock into complete trains, or the reverse
- reversing movements (including additional personnel for lookout)
- driving of centrally operated maintenance vehicles

ENI-SS-ENG-685

On stations, when there are required shunting movements at one part of the station, and commercial train traffic in another part of the station at the same time.

Comments: *If the criteria for shunting routes/signals is only fulfilled for some areas of a larger station, only these areas need to be equipped with shunting routes/signals.*

Criteria for not using shunting signals in Level 2 areas

ENI-SS-ENG-686

Shunting routes/signals shall normally not be used in ERTMS Level 2 areas when:

ENI-SS-ENG-687

Stations where every day/scheduled shunting operations are only including electrical multiple unit railcars (e.g. Stadler FLIRT)

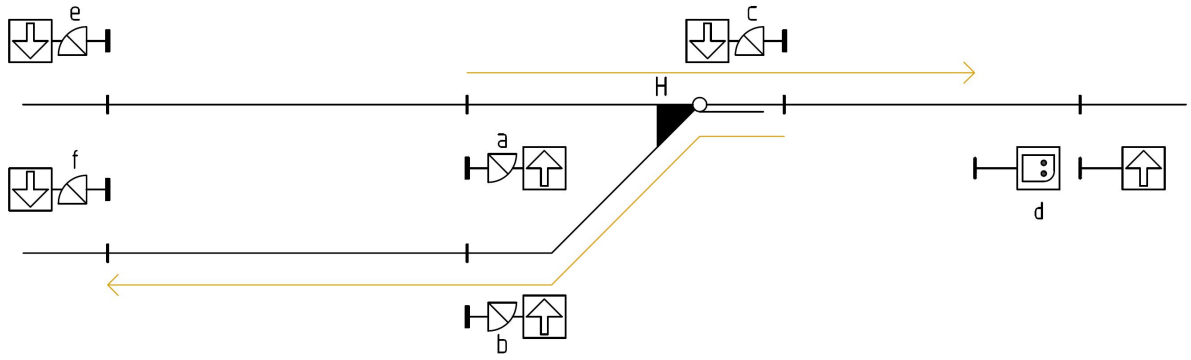
Comments: *Shunting movements include parking, reversing and joining/splitting of train sets.*

18.2 Placement of shunting signals

If shunting signals are required at the station, the following rules for placement will apply.

18.2.1 Shunting from one track to another

Shunting signals are placed so that it is possible to move a vehicle from one track to another.



Distance from fouling point to the shunting signal

ENI-SS-ENG-716

Shunting signals "a" and "b" shall be placed at least 5 meters from the fouling point.

Distance from switch blade toe to the shunting signal

ENI-SS-ENG-717

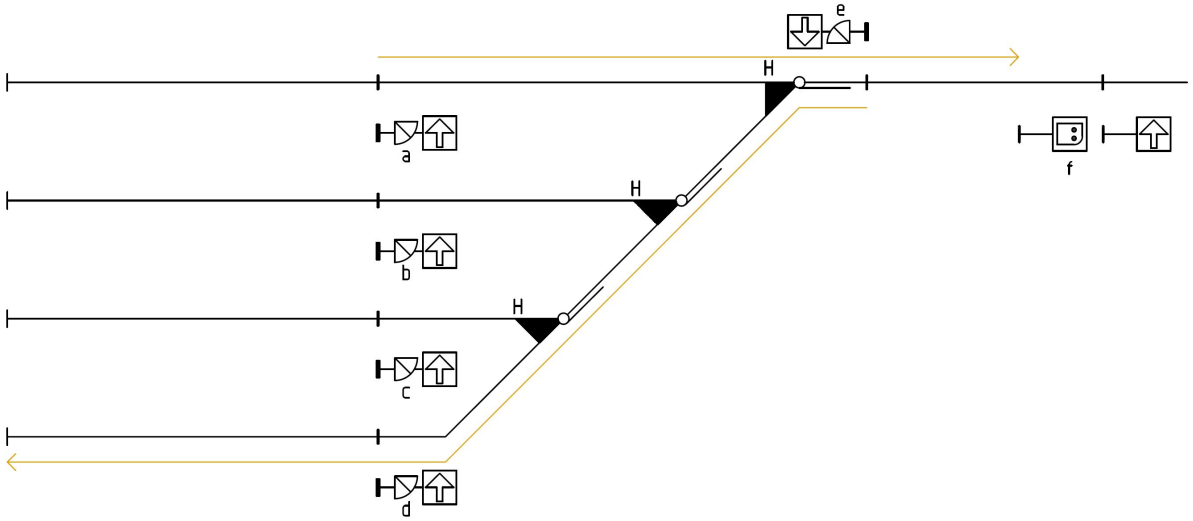
Shunting signal "c" shall be placed at least 3 meters from the switch blade toe.

Replacing shunting signal with Signal 106: "Stop for shunting" board

ENI-SS-ENG-718 Shunting signal "d" shall be a Signal 106: "Stop for shunting" board.

18.2.2 Shunting to/from larger track layout

Shunting signals are placed so that it is possible to move a vehicle in/out to/from a larger track layout.



Replacing shunting signal with Signal 106: "Stop for shunting" board

ENI-SS-ENG-722 Shunting signal "f" shall be a Signal 106: "Stop for shunting" board.

Distance from switch blade toe to the shunting signal

ENI-SS-ENG-721 Shunting signal "e" shall be placed at least 3 meters from the switch blade toe.

Distance from fouling point to the shunting signal

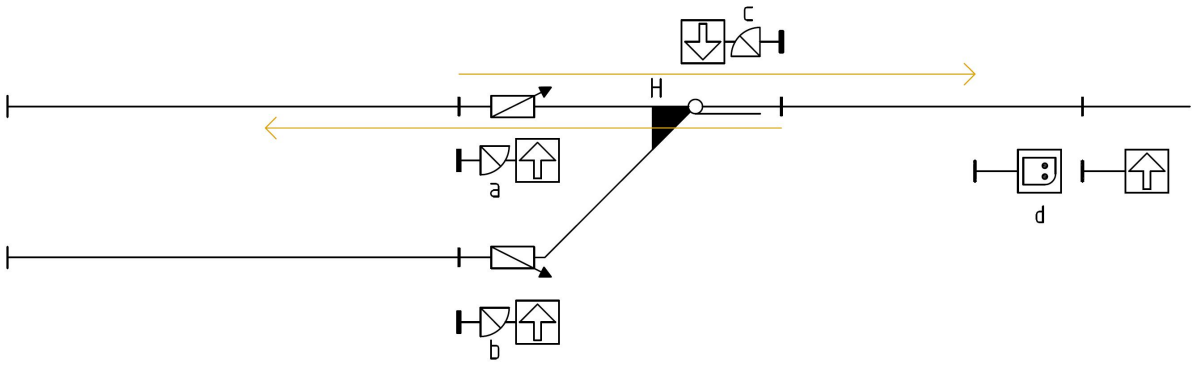
ENI-SS-ENG-720 Shunting signals "a"-"d" shall be placed at least 5 meters from the fouling point.

TVP section

ENI-SS-ENG-729 There should be only one TVP section between the shunting signals "a"/"b"/"c"/"d" and "e". This is independent of how many tracks the shunting signal "e" is distributed to.

18.2.3 Shunting to/from parking areas with derailer

Shunting signals are placed so that it is possible to move a vehicle in/out to/from a parking area.



Distance from derailer to the shunting signal

Rationale: *This prevents vehicles inside the parking area from unintentional driving on the derailers, yet as close as possible ahead of the derailers. This is to avoid losing length on the parking area.*

ENI-SS-ENG-724 Shunting signals "a" and "b" shall be placed ahead of the derailers.

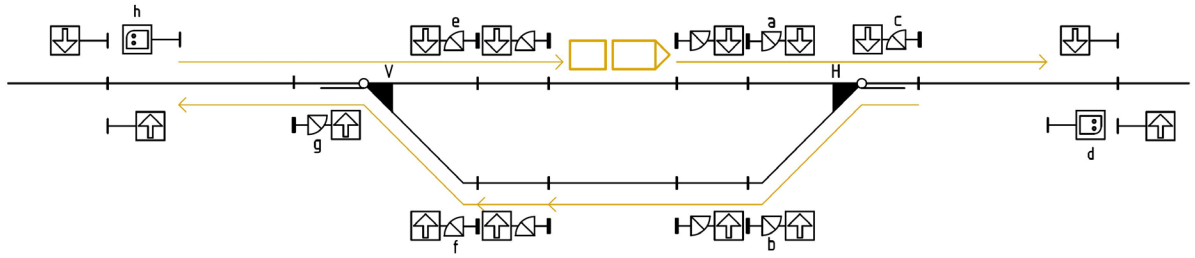
Comments: *It is most likely the axle counter that sets the distance limit due to metal mass in the derailers.*

Replacing shunting signal with Signal 106: "Stop for shunting" board

ENI-SS-ENG-917 Shunting signal "d" shall be a Signal 106: "Stop for shunting" board.

18.2.4 Shunting from front to back on a train

Shunting signals are placed so that it is possible to move a vehicle from the train's front end to its back end.



Placement of shunting signals

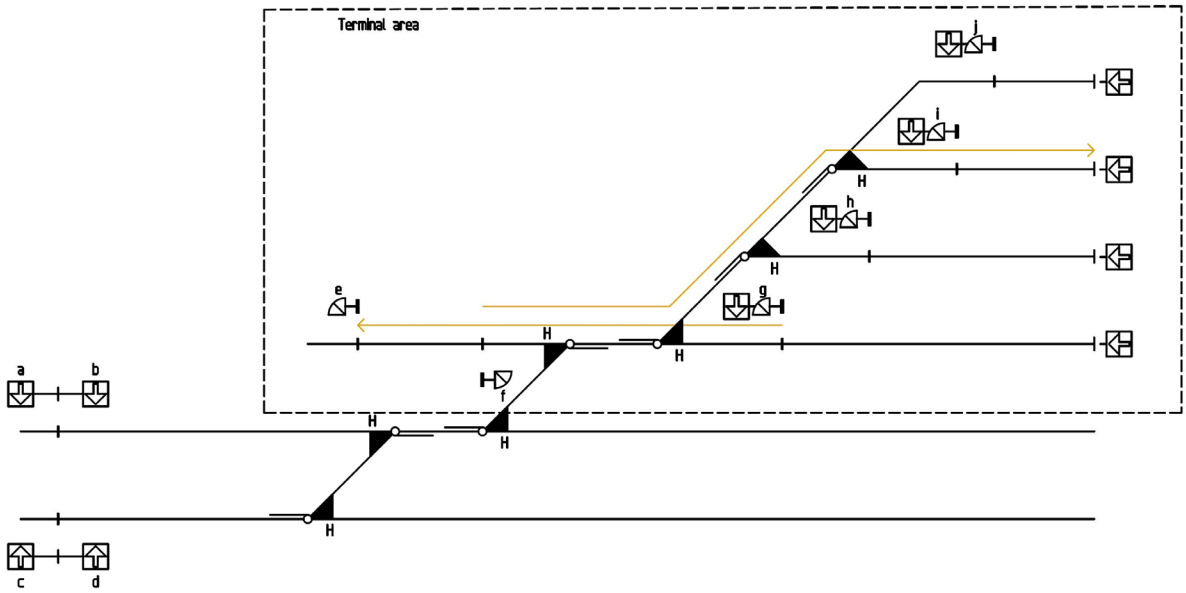
ENI-SS-ENG-734 Shunting signals shall be placed correspondingly at both ends of the station/areas that are signalled to enable driving as shown in the figure

Replacing shunting signal with Signal 106: "Stop for shunting" board

ENI-SS-ENG-918 Shunting signal "d" and "h" shall be a Signal 106: "Stop for shunting" board.

18.2.5 Shunting movements on terminal areas and parking/maintenance areas

Shunting signals are placed so that it is possible to move a vehicle from one track to another.



Distance from fouling point to the shunting signal

ENI-SS-ENG-739 Shunting signals "g"-"j" shall be placed at least 5 meters from the fouling point.

Distance from switch blade toe to the shunting signal

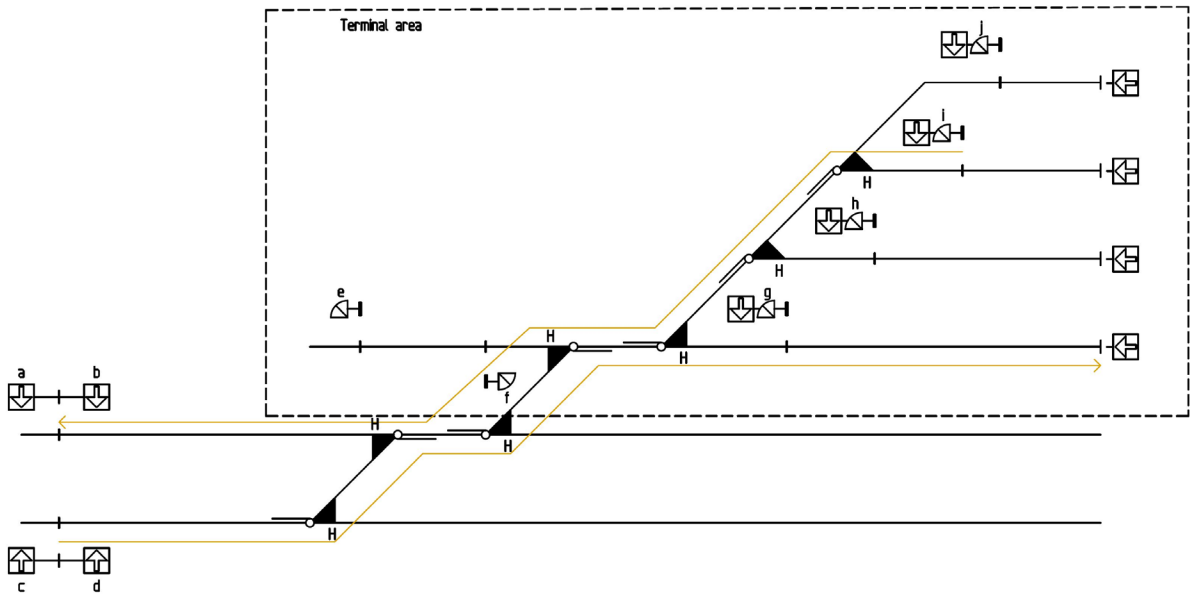
ENI-SS-ENG-740 Shunting signal "f" shall be placed at least 3 meters from the switch blade toe.

Shunting signal on dead end tracks

ENI-SS-ENG-741 Shunting signal "e" should be omitted if the track is a dead end track.

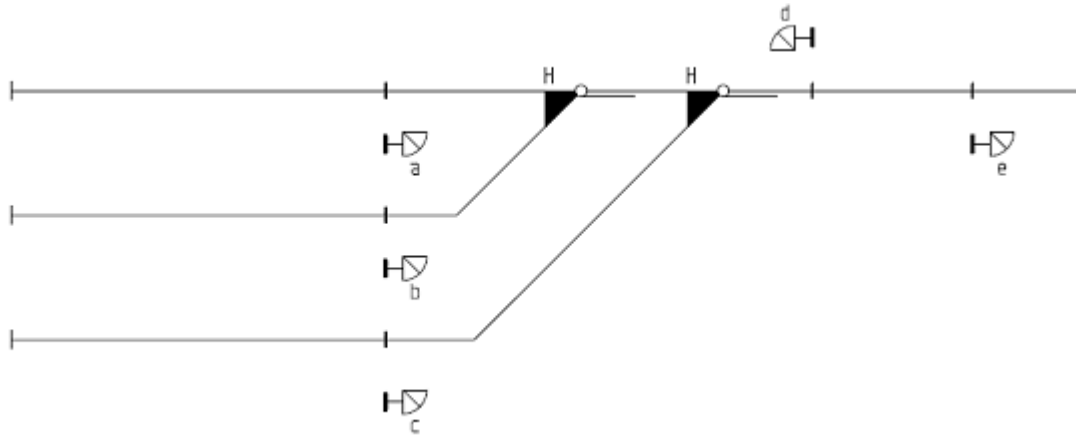
18.2.6 Driving to/from terminal areas and parking/maintenance areas

Marker Boards are placed so that it is possible to drive to/from the terminal area.



18.2.7 Limitation of shunting signals

Since shunting signals have a relatively high cost, it is necessary to assess whether one and the same shunting signal can be used for multiple shunting movements. The figure below shows a shunting signal "d" that can be used to give driving permission to all three tracks.



Limitation of shunting signals

ENI-SS-ENG-879

In cases as in the figure above, the time spent/distance of the shunting movement shall determine the need for an additional shunting signal "d" between the points.

18.3 Release of shunting routes

Shunting routes are engineered with the use of different track elements, connected in a similar way as the track layout. A route's track elements are released sequentially as a train passes through the route, occupying and un-occupying TVP sections. The sequential route release requires a correct TVP passage sequence.

A shunting movement may comprise different train lengths and different track lengths, so a medium time delay is used. For areas mainly used for shunting a shorter time delay is used to ensure efficient shunting of wagons (especially freight). Shunting movements, using shunting routes in ERTMS areas, will be limited since most movements will be done in FS-/OS-mode.

Time for cancellation of shunting route

ENI-SS-ENG-1272

Route cancellation time shall be 0 seconds for shunting routes, in areas mainly used for shunting movements (PSA type 1). For other areas, the route cancellation time shall be 30 seconds.

Comments: *Route cancellation timer protects a vehicle approaching the start signal of a route if it is unintentionally set to stop and overrun. Route cancelation timer is activated by the train dispatcher.*

Time for release of shunting route

ENI-SS-ENG-1895

Route release time shall be 0 seconds for shunting routes:

- in areas mainly used for shunting movements (PSA type 1).
- ending in "other tracks"
- to non-interlocked areas

For other areas, the route release time shall be 30 seconds

Comments: *"Other tracks" is defined as tracks other than platform or dead-end tracks. Release timer protects train movements beyond the end signal of the route if it is at stop and unintentionally overrun. Rout release timer is activated automatically by the train when it has past defined positions in the shunting route.*

Release of shunting route ending in platform or dead-end tracks

ENI-SS-ENG-1896

Shunting routes ending in platform- or dead end-tracks shall be configured so that the shunting route and the shunting route end point is released when the train has fully entered the track.

Comments: *Platform tracks is tracks with signals out of both ends of the track and without points. The shunting route is released when defined TVP section behind last marker bord or shunting signal for opposite direction is free after train. Requirements for route release time is described in ENG-1895.*

Release of shunting route ending in "other tracks"

ENI-SS-ENG-1897

Shunting routes ending in “other tracks” shall be configured so that the shunting routes and shunting route end point is released when the entire train has past the shunting signal in end of the route, or the train changes direction and drives on a route in the opposite direction.

Comments: *"Other tracks" is defined as tracks other than platform or dead-end tracks. Requirements for route release time is described in ENG-1895.*

Release of shunting routes to non-interlocked areas

ENI-SS-ENG-1898

Shunting routes ending in non-interlocked areas shall be configured so that the shunting routes end point is released when the entire train has past the border to the non-interlocking area

Comments: *Requirements for route release time is described in ENG-1895.*

19 PERMANENT SHUNTING AREA

Permanent shunting areas (PSA) are used to describe track areas mainly used for shunting, and/or parking of vehicles.

There are several types of areas that are mainly used for shunting movements that can be defined as a PSA, e.g.:

- Alnabru
- Lodalen
- Lillestrøm parking area for train sets

A permanent shunting area may be supervised by a signalling system or not.

19.1 PSA type

19.1.1 PSA type 1: for parking of railway vehicles

These kind of areas are mainly used for parking of train sets.

ENI-SS-ENG-864 PSAs mainly used for parking of railway vehicles shall be equipped with train routes and marker boards.

19.1.2 PSA type 2: for shunting movements

PSA for shunting movements

ENI-SS-ENG-866 PSAs mainly used for shunting areas shall be equipped with shunting routes and shunting signals.

Comments: *Requirements regarding shunting routes and shunting signals are given in this document. These kinds of areas are mainly used for shunting operations for freight or passenger trains (locomotives and wagons).*

19.1.3 PSA type 3: where several types of operations are combined

Some PSAs are used for different operations, combining solutions for PSA type 1 and 2, defined as PSA type 3.

PSA where several types of operations are combined

ENI-SS-ENG-868 PSAs where several types of operations are combined shall be equipped to satisfy requirements regarding shunting routes and shunting signals but can also be equipped with train routes and marker boards.

Comments: *Requirements regarding shunting routes, shunting signals, train routes and marker boards are given in this document. These kinds of areas combine the functionality of PSA type 1 and 2.*

19.2 Criteria for shunting signals

Criteria for shunting signals in PSA

ENI-SS-ENG-871 Shunting routes/signals shall be engineered in a PSA by the same criteria listed earlier in this document for ERTMS L2 areas.

19.3 Shunting signals in PSA

Placement of shunting signals

ENI-SS-ENG-880 Placement of shunting signals in PSAs shall be engineered by the same requirements stated earlier in this document.

Maintenance areas

ENI-SS-ENG-1672 Workshops for maintenance of railway vehicles shall not have shunting signals or Marker Boards installed (non-interlocked PSA).

The signalling system boundary shall be placed at the outside of the workshop gates (track entry location).

Comments: *Such areas may be equipped with proprietary signals. The signalling system border is placed at the outside of the workshop gates (track entry location). Border is engineered according to chapter 19.4.*

19.4 PSA border

19.4.1 PSA in a non-interlocked area

The train shall have SH mode in PSA.

For the transition from interlocked area to PSA, the driver must acknowledge the transition to SH-mode. The following two possibilities for transition to PSA shall be established:

- If there is a shunting route towards the border of the PSA, the marker board in end of the last train route before the shunting route has a release speed of 0 km / h. The driver must acknowledge transition to SH mode in "Acknowledge Distance" in order not to be stopped at the end point of the train route. It cannot be shunting signals inside the "Acknowledge Distance" since shunting signals are switched off (dark) in a train route.
- If there is a train route towards the border of the PSA, the train automatically switches to SH mode when it enters PSA. Driver must acknowledge transition to SH-mode within 5 seconds to avoid that the train is being stopped.

For the transition from a PSA to an interlocked area, the train must be in a “trusted area” which is an area without points and where the RBC knows the train’s position. Balises inside the area can provide the position to the train if needed. When a train route is set from the marker board at the border to the interlocked area, a train in «Trusted Area» can get OS-MA to the border to the interlocked area. The train will switch automatically to FS-MA when it passes the border. The distance from the border to where the train can get OS-MA must be defined.

At the border

ENI-SS-ENG-2002 Signalling objects at the border shall be engineered as follows:

ENI-SS-ENG-885 A Signal 107 "Non-interlocked area" shall be placed on the border ahead of the PSA.

ENI-SS-ENG-883 Signal 107: "Non-interlocked area" shall be engineered as a signalling point (without MB).

ENI-SS-ENG-882 "Mode profile" shall be changed automatically from FS to SH-mode at Signal 107 "Non-interlocked area"
Comments: *Change of mode profile is triggered by balise*

ENI-SS-ENG-2003 A balise shall be installed 22 - 44m ahead of the border for automatically change to SH-mode.
Comments: *The supplier is responsible for placement of balises. Balises installed for this purpose shall only affect trains going into PSA and must therefore be placed between last point and the border to the PSA.*
The distance from the balise to the border must be sufficient to allow technical transition of the system.

ENI-SS-ENG-2004 If the distance from last fouling point in interlocked area to Signal 107 is greater or equal to 44m, release speed at Signal 107 shall be maximum 40 km/h.
Comments: *A lower release speed may be used. i.e. if maximum allowed speed is lower than 40 km/h.*

ENI-SS-ENG-2005 If the distance from last fouling point in interlocked area to Signal 107 is shorter than 44m, release speed in Signal 107 shall be 20 km/h.

Last train and shunting route ahead of the border

ENI-SS-ENG-2006 Last train and shunting routes ahead of the border to a PSA shall be engineered as follows:

ENI-SS-ENG-2007 It shall be possible to set both train route and shunting route to the border.

Second last train and shunting route ahead of the border

ENI-SS-ENG-2008 The second last train and shunting routes ahead of the border to a PSA shall be engineered as follows:

ENI-SS-ENG-2009 Release speed in last marker board before the PSA shall be 0 km/h.
Rationale: This requirement is according to international regulations.

ENI-SS-ENG-2010 The second last train route shall contain an acknowledgement distance for changing for FS-MA to SH-mode.

ENI-SS-ENG-884 Acknowledgement distance for transition to SH shall be minimum 400 meters.
Rationale: To make sure the train speed is not significantly reduced below 40 km/h at the boundary to the area since release speed in marker bord in end of Acknowledgement distance is 0 km/h.

ENI-SS-ENG-1471 There shall be no shunting signals in Acknowledgement distance.
Rationale: The acknowledge distance shall only cover one shunting route to inhibit transition to SH-mode ahead of a shunting signal showing dark aspect.

In a PSA

ENI-SS-ENG-2011 Signalling objects in a PSA shall be engineered as follows:

ENI-SS-ENG-1901 It shall be a TVP section inside the border of a PSA, if required, for indication of the position of a departing train.
Comments: *There is normally no need for TVP sections in a non-interlocked PSA.*

ENI-SS-ENG-2012 It shall be a TVP section at the border of a PSA, if required, as overlap after Signal 107.
Comments: *There is normally no need for TVP sections in a non-interlocked PSA, but for certain train operations this might be required.*

ENI-SS-ENG-2013 If there is a TVP section at the border of a TSA, as overlap after Signal 107, Signal 108 shall be placed at the end of the overlap TVP section, facing the PSA.

ENI-SS-ENG-1900 A "trusted area" in the PSA shall include required balises to provide positioning of trains leaving the PSA.
Comments: *The supplier is responsible for placement of balises.*

Border between an L2 area and a non-interlocked PSA

ENI-SS-ENG-881 Intentionally deleted. Ref ENG-2002, ENG-2006, ENG-2008 and ENG-2011

ENI-SS-ENG-1472 Intentionally deleted

Figure below shows border between an L2 area without shunting signals and a non-interlocked PSA

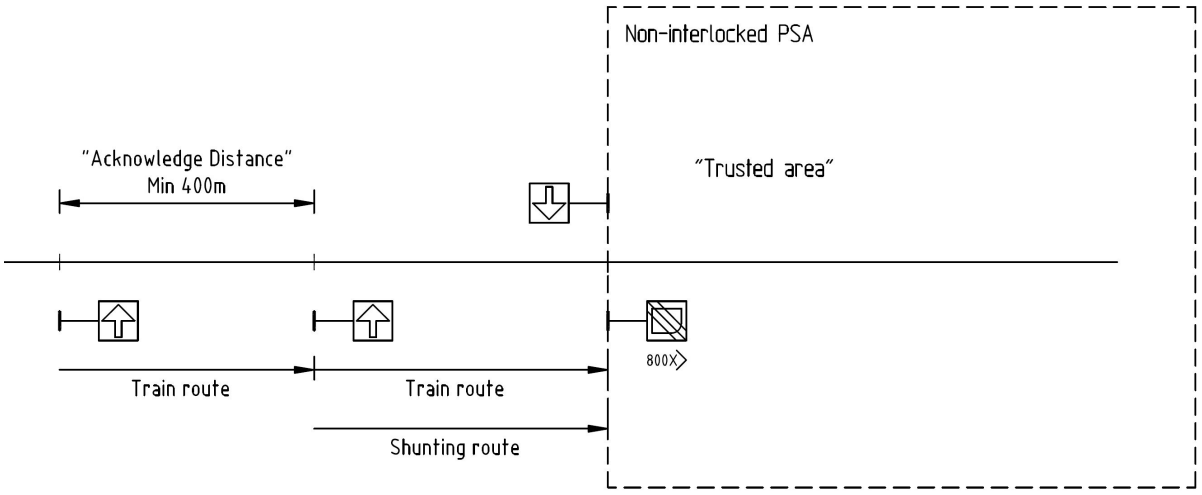


Figure below shows border between an L2 area with shunting signals and a non-interlocked PSA

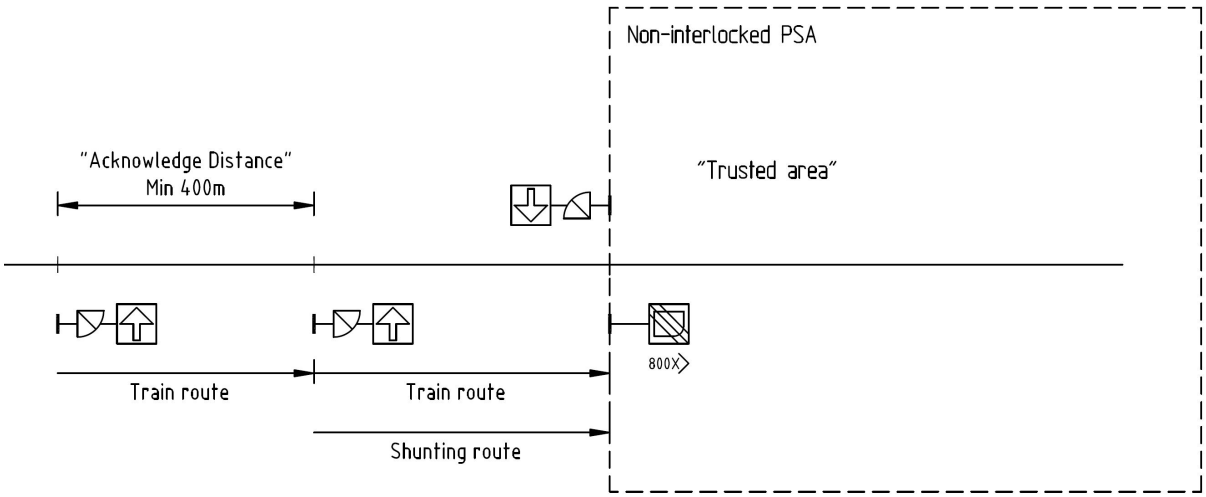
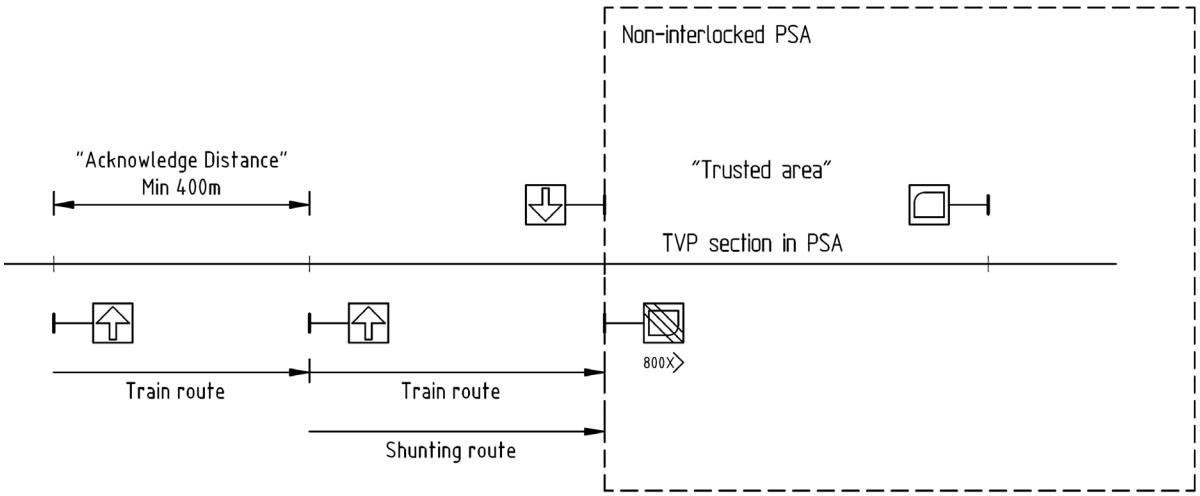


Figure below shows border between an L2 area with TVP section in non-interlocked PSA



Special case: Non-symmetrical border

ENI-SS-ENG-1473 Intentionally deleted

ENI-SS-ENG-1474 Intentionally deleted

ENI-SS-ENG-1475 Intentionally deleted. Ref ENG-882

ENI-SS-ENG-1477 Intentionally deleted. Ref ENG-885

ENI-SS-ENG-1476 Intentionally deleted. Ref ENG-2004 and ENG-2005

ENI-SS-ENG-1478 Intentionally deleted. Ref ENG-884

ENI-SS-ENG-1479 Intentionally deleted

ENI-SS-ENG-1480 Intentionally deleted. Ref ENG-1471

ENI-SS-ENG-1481 Intentionally deleted

Special case: Extended signalling

ENI-SS-ENG-1483 Intentionally deleted

ENI-SS-ENG-1484 Intentionally deleted

Intentionally deleted

19.4.2 PSA in an interlocked area with shunting routes/signals

Border between an L2 area and an interlocked PSA

ENI-SS-ENG-889 Border between an L2 and an interlocked PSA (with shunting routes) shall be engineered as required in ENG-2002, ENG-2006, ENG-2008 and according to following requirements (see figure below):

ENI-SS-ENG-890 Intentionally deleted. Ref ENG-882

ENI-SS-ENG-891 Intentionally deleted. Ref ENG-2004 and ENG-2005

ENI-SS-ENG-893 A shunting signal shall be placed at "MB m".

ENI-SS-ENG-1731 A signal 106: "Stop for shunting" or a shunting signal shall be placed at MB n.

ENI-SS-ENG-1486 Intentionally deleted. Ref ENG-1900

ENI-SS-ENG-1487 Intentionally deleted. Ref ENG-1471

ENI-SS-ENG-1488 Intentionally deleted

Figure below shows border between an L2 area without shunting signals and an interlocked PSA

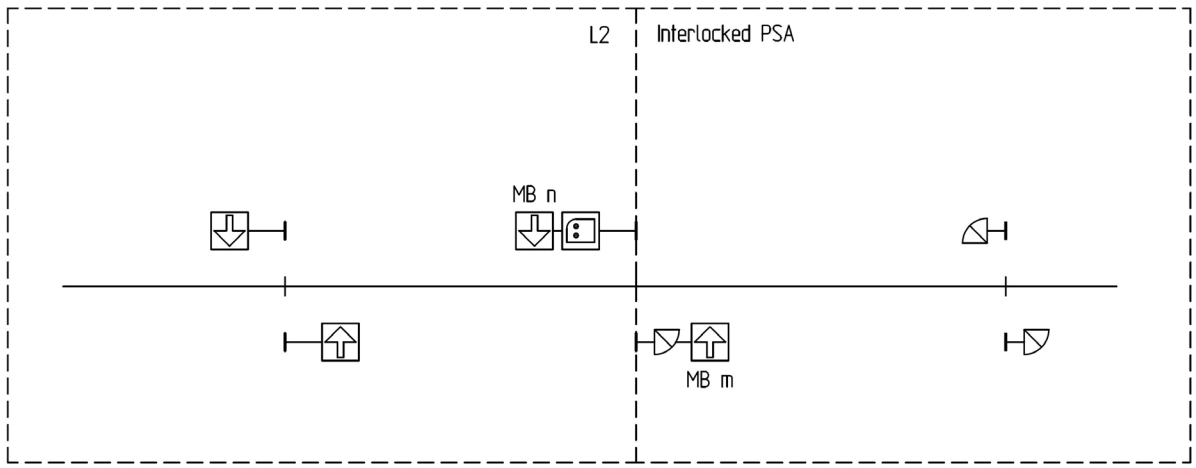
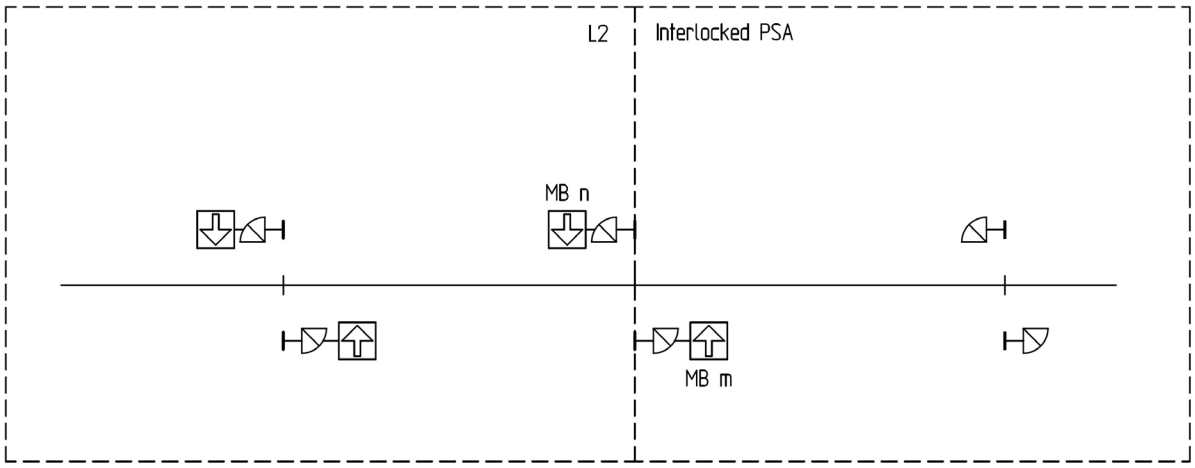


Figure below shows border between an L2 area with shunting signals and an interlocked PSA



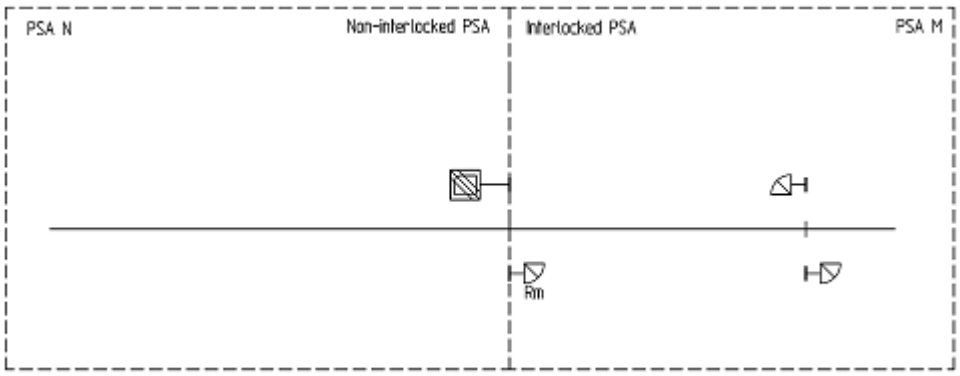
Border between a non-interlocked PSA and an interlocked PSA

ENI-SS-ENG-1489 Border between a non-interlocked PSA and an interlocked PSA (with shunting routes) shall be engineered as follows (see figure below):

ENI-SS-ENG-1490 a) Shunting signal Rm shall be placed at the border towards Interlocked PSA.

ENI-SS-ENG-1732 b) Signal 107: "Non-interlocked area" shall be placed on the border towards Non-interlocked PSA.

ENI-SS-ENG-1491 Intentionally deleted



20 TEMPORARY SHUNTING AREA

A Temporary Shunting Area (TSA) ("Lokalområde" in Norwegian (Lok.)) is a predefined limited area where railway vehicles can individually shunt without setting any route.

The activation of a TSA implies the release of all key locks and setting of points for local operation inside the area, excluding derailers centrally operated from the Signalling System which will be switched to “off” (passable) position.

Border protection of TSA is managed by fixed balises including “danger for SH" telegrams and/or by route elements (for example points in a specified position). Not all TSAs will have border protection.

Several TSAs are neighboring if they have the same border and they are connected with one track in minimum.

Activated TSAs cannot overlap each other.

If several TSAs are engineered in the same area, only one of them can be activated at the time

The border between two TSAs can be in the middle of a track in a station area. This track will then be a part of both TSAs. It is then possible to activate both TSAs at the same time.

TSA border

ENI-SS-ENG-180 A TSA border shall be defined by a marker board, a Signal 106: "Stop for shunting" board, a shunting signal or a deviating point.

Comments: *Signal 106 is used to limit shunting movements. At a station, the signal is placed minimum 150 m within the station border Entry Marker Board (valid for shunting towards the station border). In shunting areas, Signal 106 can be used to limit shunting movements in direction of other trafficked tracks/areas. Signal 106 is neither used on the line in ERTMS areas (Class A), nor at the border between an ERTMS area and an area equipped with conventional optical signalling (Class B).*

Balises with "Danger for SH"

ENI-SS-ENG-1216 Fixed balises with “Danger for SH” telegrams shall be used on the border between TSA in station and TSA on the line.

Comments: *This includes a balise at the station entry MB and a balise at the Signal 106: "Stop for shunting".*

20.1 Single track line

TSA on two track station - single track line

Rationale: *To allow shunting on a two track station, the whole station has to be released as a Temporary Shunting Area (TSA).*

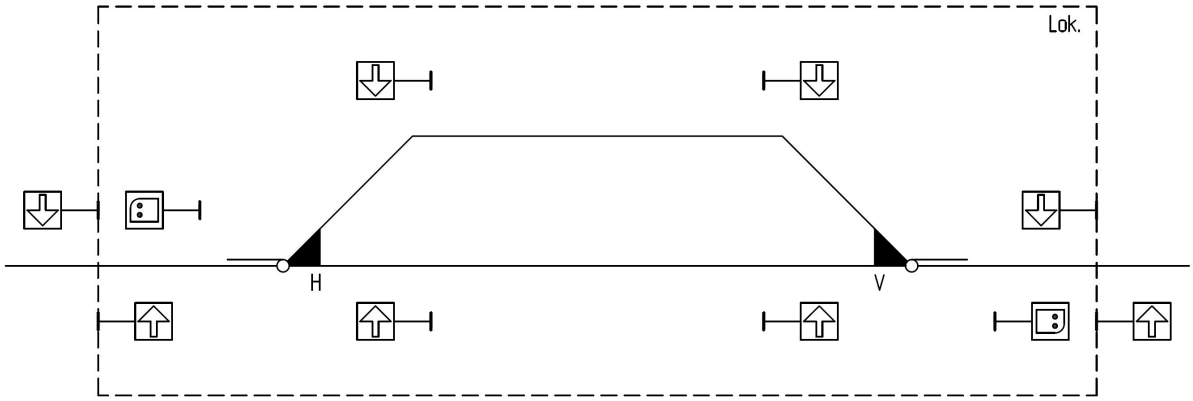
ENI-SS-ENG-183 Two track stations shall have one TSA. The TSA shall have its border by the station's entry and exit marker boards.

Comments: *Fixed balises will be installed here with telegram "Danger for Shunting".*

TSA border balise

ENI-SS-ENG-912

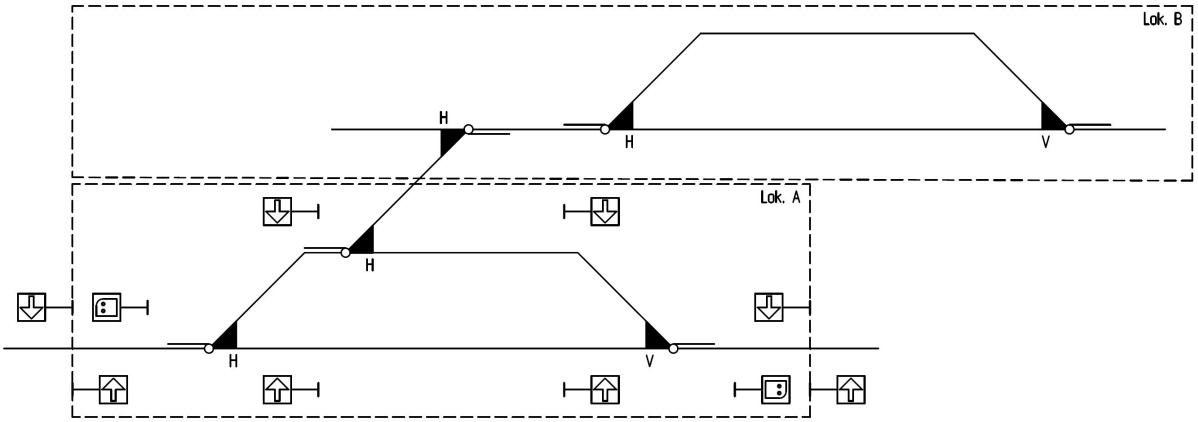
Fixed balises with telegram "Danger for shunting" shall protect the border of the TSA and Signal 106: "Stop for shunting" board.



TSA on siding

ENI-SS-ENG-184

Sidings on stations where several objects can be operated should have a separate, parallel TSA.



Combined TSAs - station

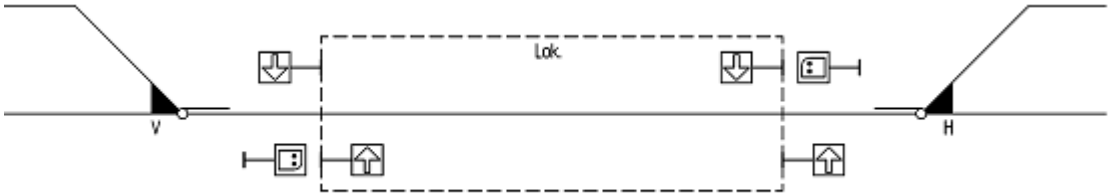
ENI-SS-ENG-185

When the TSA for both the station and siding is "released for local shunting" the points between shall also be released.

Comments: *Referring to the figure above, "TSA A" and "TSA B" can be combined into a single TSA.*

TSA on the line - single track line

ENI-SS-ENG-186 The line between two stations shall have a separate TSA. The border of the TSA shall be the stations' entry marker boards.



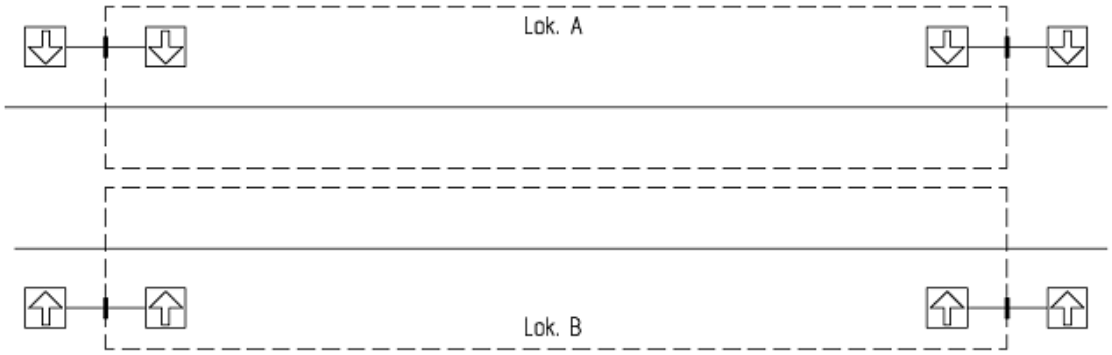
Combined TSAs - line and station

ENI-SS-ENG-187 If a station TSA and a neighboring line TSA shall be used together, they shall be merged into a single TSA.

20.2 Double track line

TSA on the line - double track line

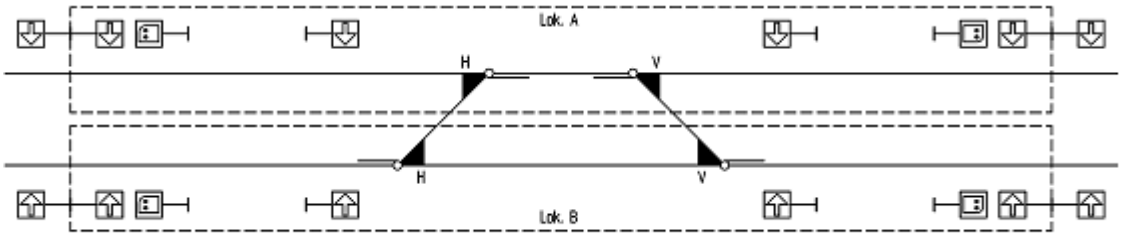
ENI-SS-ENG-189 The line between two stations shall have two separate TSAs, one for each track. The border of the TSAs shall be the stations' entry marker boards.



TSA on double crossover - double track line

ENI-SS-ENG-190

A double crossover/two track station shall have two separate TSAs, one for each track, which can be merged. The limit of the TSAs shall be the nearest block post/station's exit marker boards.

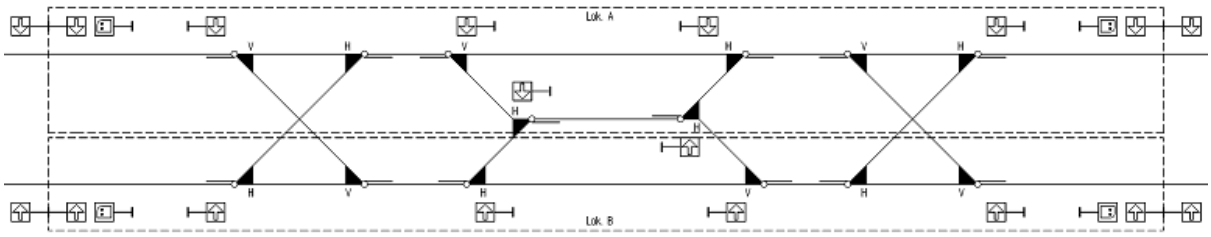


TSA on 3 track station - double track line

ENI-SS-ENG-191

A 3 track station shall have two separate TSAs, which can be merged. When engineering a station layout the third track shall be included in either TSA A or TSA B based on operational needs. The border of the TSAs shall be the station's exit marker boards.

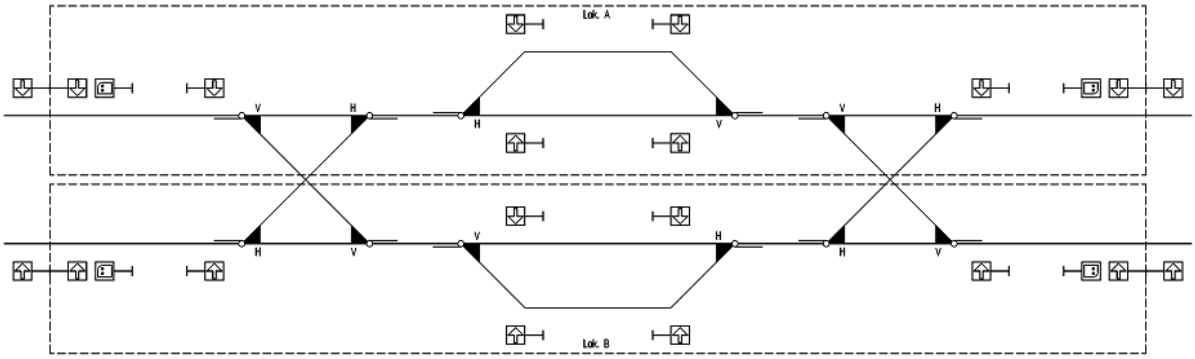
Comments: *TSAs can not overlap.*



TSA on 4 track station - double track line

ENI-SS-ENG-192

A 4 track station shall have two TSAs, which can be merged, with two tracks in each TSA. The border of the TSAs shall be the station's exit marker boards.



TSA on larger station areas - double track line

ENI-SS-ENG-193

On larger station areas the TSAs shall be divided in the longitudinal direction. The TSAs shall cover the entire station's extent bounded by the station's exit marker boards.

21 FREIGHT TERMINAL AREAS

Freight Terminal are small and larger areas where trains can enter and do operations like load and unload cargo wagons.

21.1 Entering terminal areas

Entry to terminal areas

ENI-SS-ENG-1905 In order to be able to set a train- or shunting-route into a Terminal area, the train dispatcher shall first accept the route after reviewing a checklist provided by the TMS plausibility check

Entry to small freight terminal

ENI-SS-ENG-1275 Intentionally deleted

21.2 Larger freight terminal areas

21.2.1 Separate arrival track and freight loading area

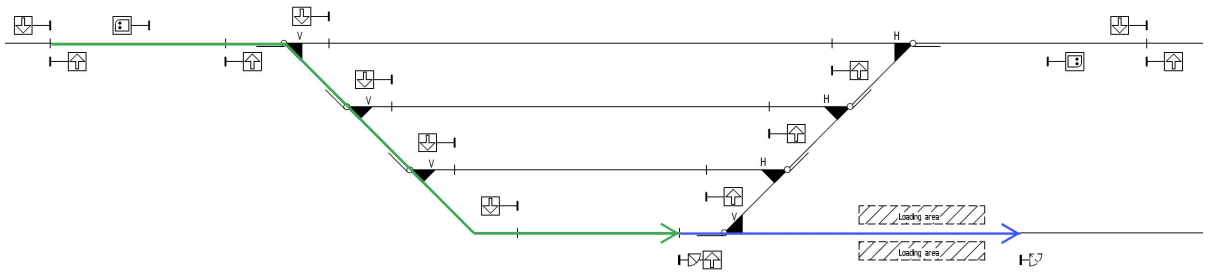
Entry to larger freight terminal

ENI-SS-ENG-1281 In case where freight trains enter a track, and where its wagons are moved into the freight loading area by a shunting movement, a FS-route shall be possible to set into the arrival track.

Comments: *In this case the rest of the movement is a shunting movement regulated by shunting signals.*

ENI-SS-ENG-1282 Train movements within in the freight terminal shall be monitored by shunting routes.

Figure below shows an FS-route set into an arrival track and a shunting route set further on into the freight loading area.



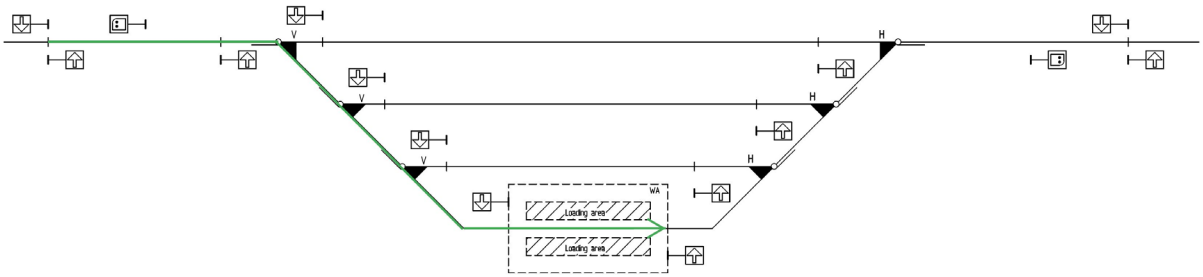
21.2.2 Combined arrival track and freight loading area

Entry to larger freight terminal

ENI-SS-ENG-1286 In case where freight trains enter a track that is a combined arrival track and freight loading area, a FS-route shall be possible to set into the arrival track if confirmed available.

ENI-SS-ENG-1287 Intentionally deleted

Figure below shows an FS-route set into a combined arrival track and freight loading area.



22 WORK AREA

A Work Area (WA)("Arbeidsområde" in norwegian (AO)) is a predefined area used to protect maintenance personnel working in the track.

Before maintenance personnel can work at the track, the dispatcher has to block a WA in order to ensure that the WA is safe for the maintenance personnel. A blocked WA ensures blocking of route setting. When the WA is blocked, the maintenance personnel can activate the WA. An activated WA cannot be unblocked by the dispatcher before the WA has been deactivated by the maintenance personnel.

Objects (such as points, derailers, level crossings and tunnel gates) within a WA will be released for manual operation by use of Local Control Panel (LCP) or Hand Held Terminal (HHT) in case a WA is activated.

If an object inside a WA gives boarder protection to another WA. Both Work Ares need to be activated for release of the object for manual operation.

A WA can be extended with one or more neighboring WAs.

If a station contains a level crossing or a siding, these can be integrated in the respective WAs.

A railway vehicle can operate in SH mode in the WA only if the WA is so configured.

Safety

ENI-SS-ENG-765 Work areas shall be engineered in such a way that work can be executed safely.

Equivalent WAs

Rationale: *To ensure PICOPs perception of the extent of the areas.*

ENI-SS-ENG-691 As far as possible, the division/extension of work areas at all stations should be equivalent.

WA borders

ENI-SS-ENG-208 All WA borders should as far as possible be defined at a Marker Board or Shunting signal. If this is not possible due to local constraints, the WA boarder can be marked by a Work Area border sign.

WA borders

ENI-SS-ENG-1906 If a WA border is between two parallel tracks, both points in a crossover between the tracks shall be locked in protecting position

Comments: *The WA will have flank protection in the point that is not a part of the activated WA. Both points will be released for local operation if a WA also is activated in the neighboring track.*

WA overlap

Rationale: *It can be difficult for the PICOP to relate to the extent of the current WA if the areas overlap each other.*

ENI-SS-ENG-199 WAs should not overlap each other.

Comments: *Merged WAs, ex. WA for a complete two track station, will cover all the separate WAs for each track and side, and is not defined as an overlapping WA.*

Division of WAs

ENI-SS-ENG-692 Work areas shall be divided in parallel along the direction of the stations/lines longitudinal direction.

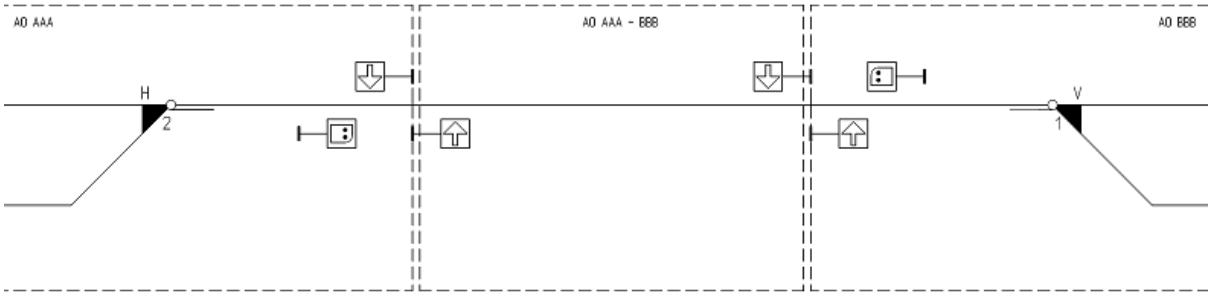
Ensure simultaneous activated work areas and train movements

ENI-SS-ENG-693 One should strive for solutions that ensure simultaneous activated work areas and train movements.

22.1 Work areas on single track lines

Work areas on the line

ENI-SS-ENG-654 Work areas for the line between two stations are shown in the figure below.



Work areas on the line with block posts

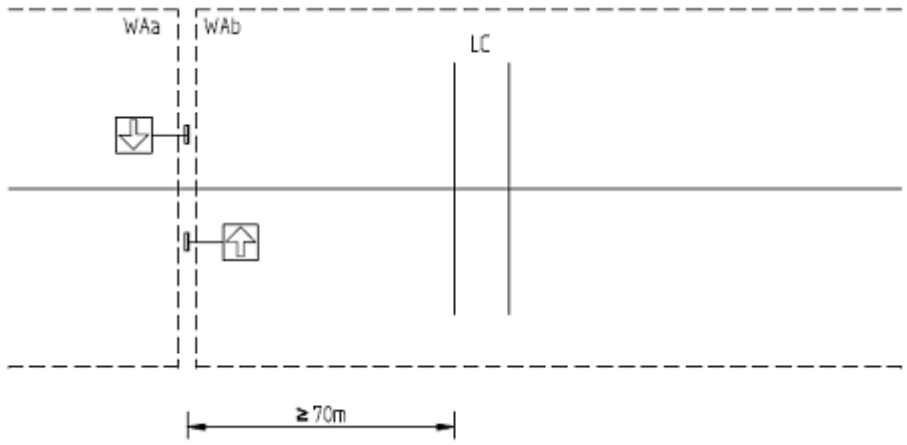
Rationale: *This will ensure that work can start right after the last train has left the block section.*

ENI-SS-ENG-656 If the line contains block posts there should be a work area for each block section.

Comments: *The need is assessed for each line, based on line speed and number of block posts between the stations.*

Work areas with block posts close to level crossing system

ENI-SS-ENG-1406 If work area is configured for each block section and the block post is close to a level crossing system, the work areas shall be divided as shown in the figures below.



22.1.1 Work areas at stations

Work areas on stations

ENI-SS-ENG-690 Stations on single track lines shall have a WA containing the whole station

Work areas on station tracks

ENI-SS-ENG-698 Each track shall have a separate WA.

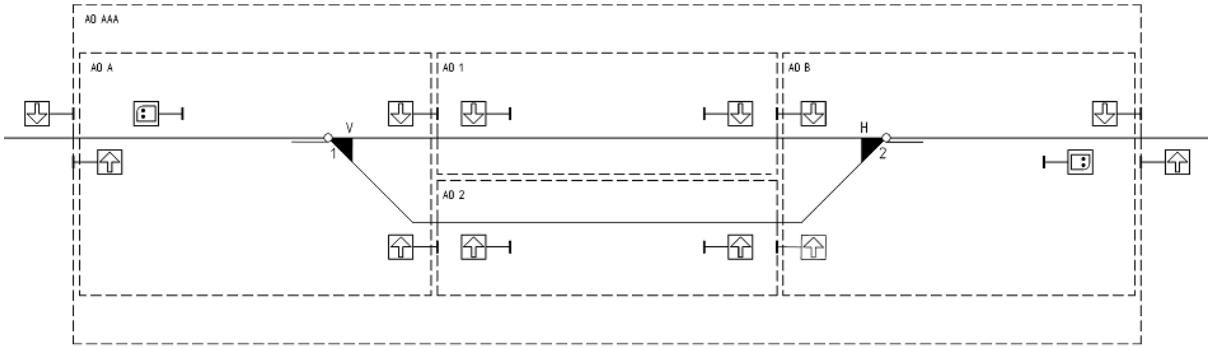
Work area on A- and B-side of station

ENI-SS-ENG-699 The A-side and the B-side of the station should have WAs.

WAs at two track station with simultaneous entry routes

Rationale: *The sectioning in this figure allows work in one of the station points while a train is entering the station from the opposite side. This due to the overlap achieved between the inner marker boards.*

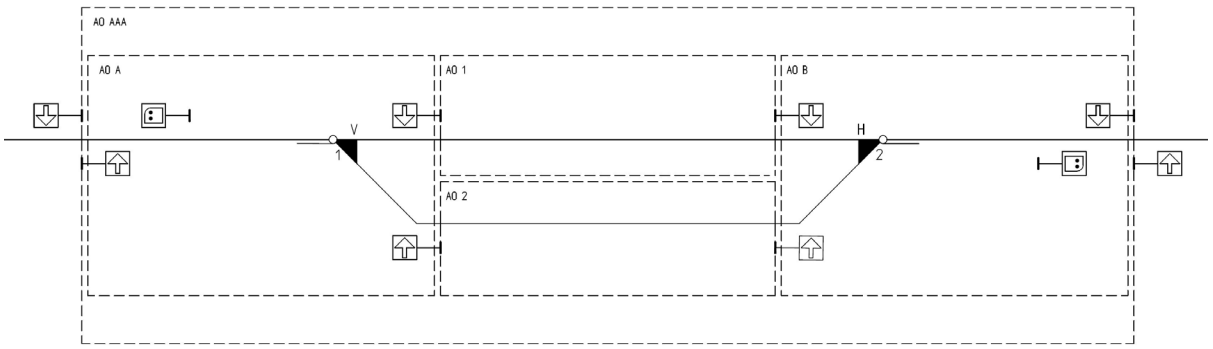
ENI-SS-ENG-664 The figure below shows work areas for a two track station with simultaneous train movements.



WAs at two track station without simultaneous entry routes

Rationale: *The sectioning in this figure does not allow work in one of the station points while a train is entering the station from the opposite side.*

ENI-SS-ENG-665 The figure below shows work areas for a two track station without simultaneous train movements.



AO AAA

ENI-SS-ENG-201 Intentionally deleted

22.2 Work areas for double track line

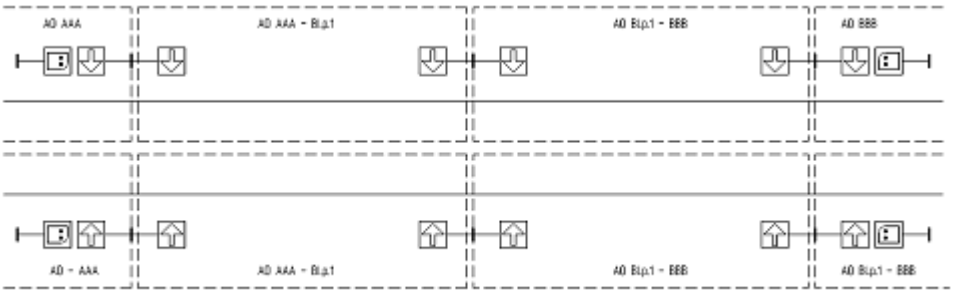
22.2.1 Work areas on the line

Work areas for double track line

Rationale: *This will ensure that work can start right after the last train has left the block section.*

ENI-SS-ENG-670 Work areas for double track lines shall be engineered one for each block section.

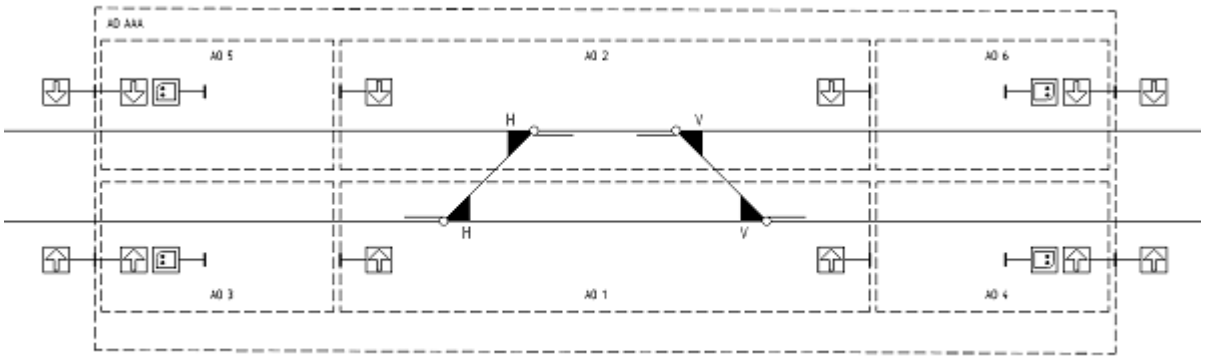
Comments: *The need is assessed for each line, based on line speed and number of block posts between the stations*



22.2.2 Work areas for double crossover

Work areas for double crossover

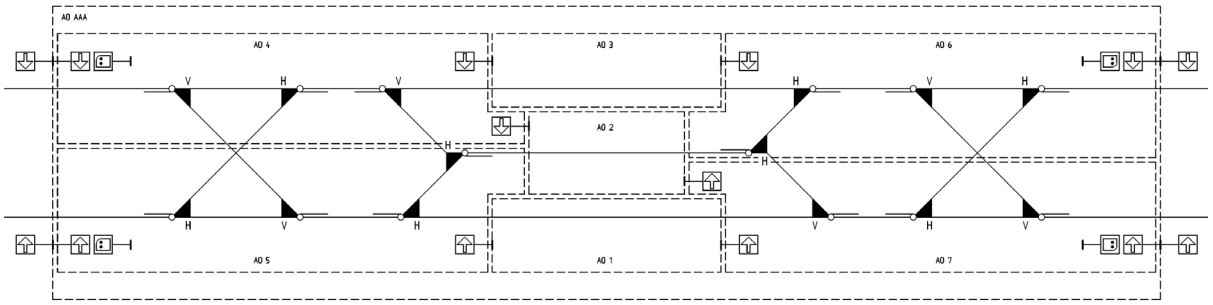
ENI-SS-ENG-668 Work areas for a double crossover shall be engineered as shown in the figure below.



22.2.3 Work areas for three track station

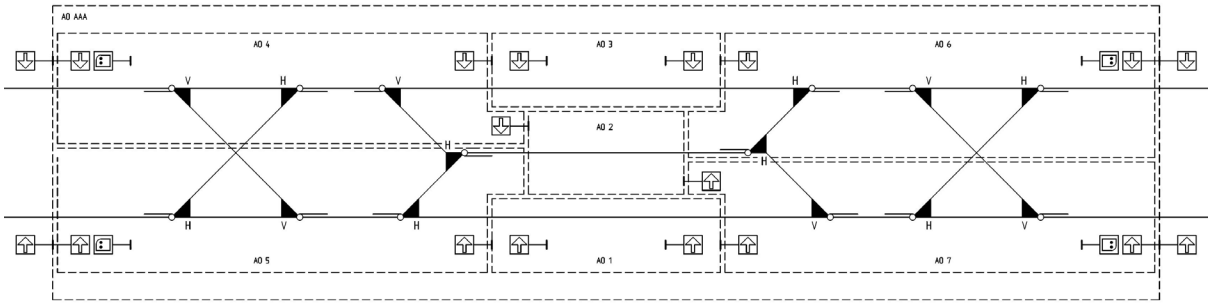
Work areas for three-track stations

ENI-SS-ENG-673 Work areas for a three-track station without simultaneous train movements shall be engineered as shown in the figure below.



Work areas for three-track stations with simultaneous train movements

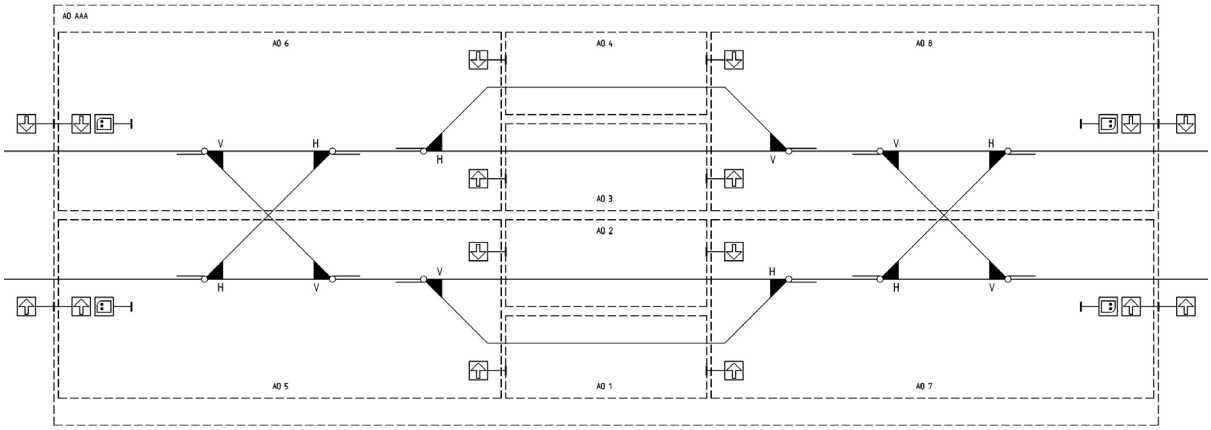
ENI-SS-ENG-672 Work areas for a three-track station with simultaneous train movements shall be engineered as shown in the figure below.



22.2.4 Work areas for four-track station

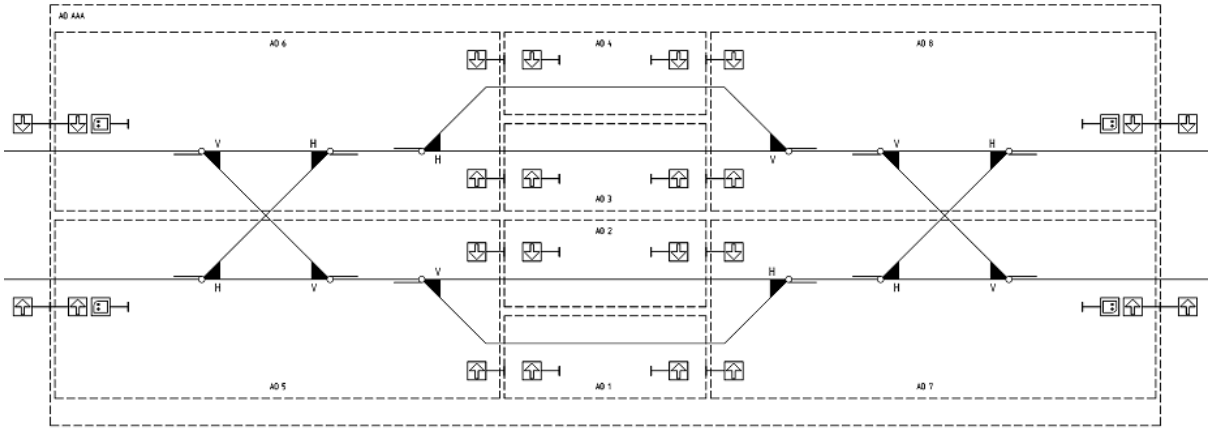
Work areas for four-track stations

ENI-SS-ENG-674 Work areas for a four-track station without simultaneous train movements shall be engineered as shown in the figure below.



Work areas for four-track stations with simultaneous train movements

ENI-SS-ENG-675 Work areas for a four-track station with simultaneous train movements shall be engineered as shown in the figure below.



22.2.5 Examples of other specific applications

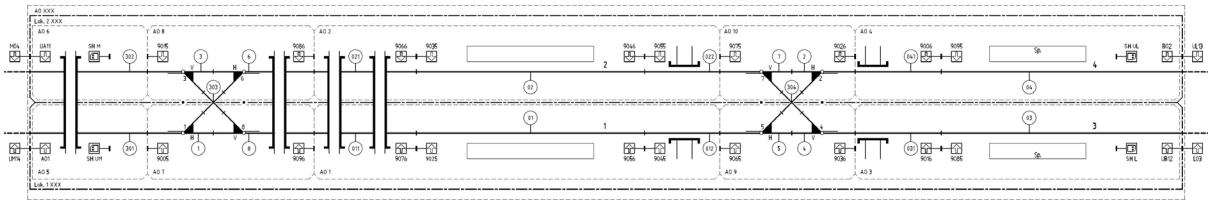
Work areas for a typical double track station

ENI-SS-ENG-1745

The figure below shows engineering of work areas for a typical double track station

Comments: *The work area 5 and 8 is made separate from 9 and 6 to allow simultaneous use of crossover.*

Work area between signals 9075 - 9086 and 9065 - 9096 is not made separate to lack of safety distance.



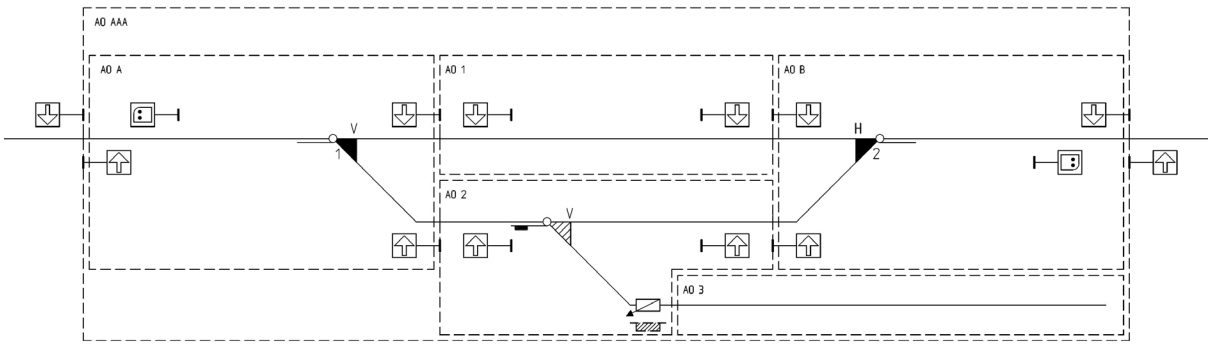
22.3 Work area in non-supervised area

WA in non-supervised area

ENI-SS-ENG-932

Non-supervised areas in stations (eg. Tracks secured by a derailer) shall be given its own Work Area with boarder at the derailer or diverging point.

Comments: *This Area is only realized in TMS as an informational function to be used by the Train dispatcher when maintenance work is carried out in such an area. The key lock has dependency to AO 2 and cannot have dependancy to AO 3 due to that is in a non-interlocked area.*

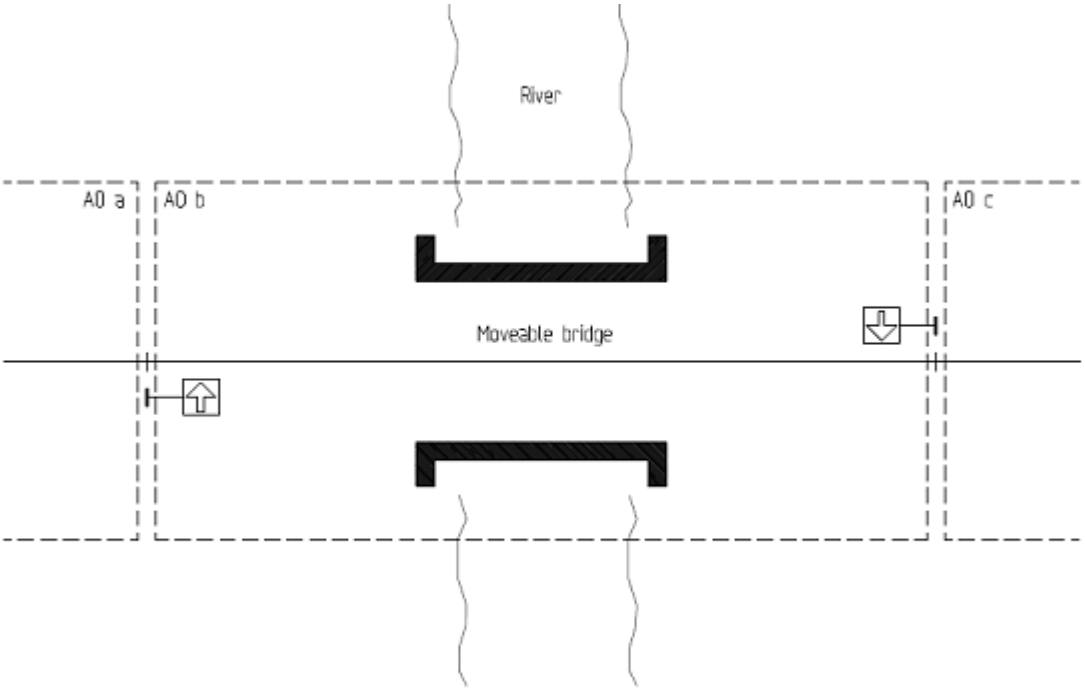


22.4 Work area moveable bridge

Work area moveable bridge

ENI-SS-ENG-1410

Work areas on moveable bridge shall be engineered as shown in the figure below.

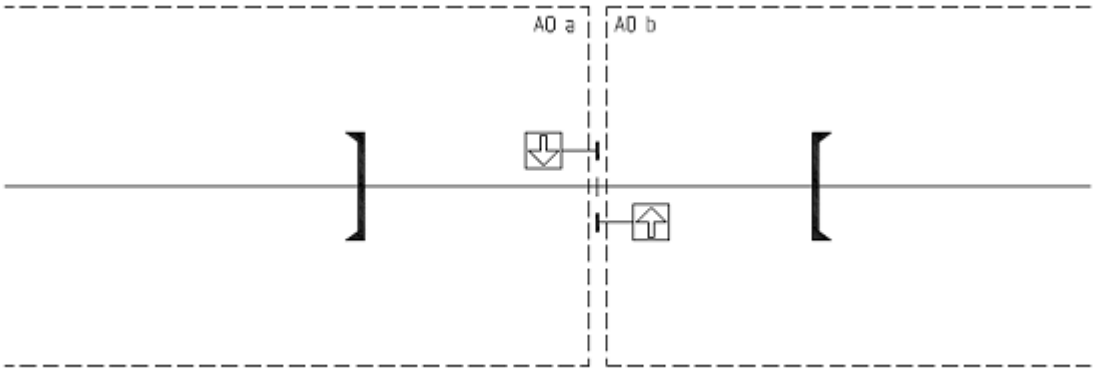


22.5 Work area tunnel

Work area tunnel

ENI-SS-ENG-1413

If work area is configured for each block section and the block post is in a tunnel, the work areas shall be divided as shown in the figure below.



22.6 Work area catenary section break

Work area catenary section break

ENI-SS-ENG-1908 Work areas shall not be in conflict with catenary section break locations.

Comments: *Ref to TRV: 00927*

23 EMERGENCY STOP

23.1 Unconditional emergency stop area (UESA)

If an Unconditional Emergency Stop Area is activated, railway vehicles which are approaching or inside the emergency stop area will be technically stopped.

The Unconditional emergency stop areas is a predefined (engineered) area, activated by the train dispatcher.

Derailment indicators are the only function to use the Unconditional Emergency Stop Area function.

UESA on the line

ENI-SS-ENG-1458 Each line section shall have a separate UESA

UESA at stations

ENI-SS-ENG-1459 Each station shall have a separate UESA.

UESA at junction station diverging to ≥ 3 lines

ENI-SS-ENG-836 Junction stations diverging to ≥ 3 lines shall be engineered as one UESA. The UESA may include one of the diverging lines with the least amount of traffic.

Comments: *The line with the least traffic may be merged into the UESA for the junction station. This will be realized in TMS.*

UESA at junction station with > 8 train movements an hour

ENI-SS-ENG-837 Junction stations with > 8 train movements an hour shall be engineered as one separated UESA.

Comments: *This will be realized in TMS.*

UESA on the line

ENI-SS-ENG-838 The line(s) between two junction stations shall be engineered as one separated UESA if the driving time do not exceed 30 minutes.

Comments: *If the driving time exceeds 30 minutes the line must be divided into two or more UESAs. This will be realized in TMS.*

UESA on single track line

ENI-SS-ENG-839 On single track lines shall at least three stations and the line between them be engineered as a separated UESA if the driving time do not exceed 60 minutes.

Comments: *This will be realized in TMS.*

Dispatcher's area of responsibility

ENI-SS-ENG-840 The UESA shall not cross one Dispatcher's area of responsibility.

Comments: *This will be realized in TMS.*

23.2 Conditional emergency stop area (CESA)

If a Conditional Emergency Stop Area is activated only the vehicles that are able to stop before entering the Conditional Emergency Stop Area are technically stopped.

The Conditional emergency stop areas are predefined areas (e.g. tunnels and bridges over a specified length) activated by sensors (e.g. fire alarms).

Activation of CESA

ENI-SS-ENG-1531 CESA shall be activated by sensor.

Engineering of CESA

ENI-SS-ENG-1532 The following requirements shall only be considered if Bane NOR has decided to implement sensor that can stop a train:

Comments: *The requirements below are only examples of what a CESA can be used for together with appropriate sensors.*

ENI-SS-ENG-841 1) **"Særskilte brannobjekter"**:CESA shall be considered engineered for all "særskilte brannobjekter".
Comments:
https://orv.banenor.no/sjn/doku.php?id=tunneler:tunneler_start

ENI-SS-ENG-842 2) **CESA for tunnels**: CESA shall be engineered for tunnels with length ≥ 1000 meters.

ENI-SS-ENG-843 3) **CESA for bridges**: CESA shall be engineered for bridges with length ≥ 90 meters

ENI-SS-ENG-844 4) **CESA for other areas**: CESA shall be considered engineered for other areas where evacuation of a train may be difficult e.g. ledge or intersection.

23.3 Non stopping areas

Non stopping areas are areas where the driver gets information in the DMI that it's not desirable to stop the train in this location. The function has no technical influence on the train.

Non stopping area

ENI-SS-ENG-846 Non stopping areas shall not be engineered.

Comments: *A decision has been made that Non stopping areas shall not be used.*

23.4 Derailment indicator

A derailment indicator shall activate an Unconditional Emergency Stop Area.

Derailment indicator

ENI-SS-ENG-1586 Derailment indicator shall be engineered for tunnels or section of tunnels longer than 1000 meters.

Comments: *Derailment indicator shall only be used in tunnels longer than 1000 meters that also fulfills requirement ENG-1588 and ENG-1589.*

Derailment indicator activation of UESA

ENI-SS-ENG-1587 A derailment indicator shall activate Unconditional Emergency Stop Area (UESA).

Number of derailment indicators connected to one UESA

ENI-SS-ENG-1909 One UESA can be connected to maximum 5 different derailment indicators

Derailment indicator double track tunnels

ENI-SS-ENG-1588 A derailment indicator shall be installed in both tracks ahead of applicable double track tunnels and sections of tunnels.

Comments: *Derailment indicator shall only be used for tunnels or section of tunnels longer than 1000 meter. See requirement ENG-1586.*

Derailment indicator single track tunnels with station

ENI-SS-ENG-1589 A derailment indicator shall be installed ahead of the danger point of a point in applicable single-track tunnels with stations.

Comments: *Derailment indicator shall only be used for tunnels or section of tunnels longer than 1000 meter. See requirement ENG-1586.*

Derailment indicator placement

ENI-SS-ENG-1590 A derailment indicator shall be placed so that the derailed part of a freight train can stop before entering the tunnel or the station:

ENI-SS-ENG-1591 a) For double track lines the derailment indicators shall be placed 1500 m ahead of the tunnel portal.

ENI-SS-ENG-1592 b) For single track with station the derailment indicator shall be placed 1500 m ahead of the danger point of the first point.

ENI-SS-ENG-1593 c) If the area 1500 m ahead of the tunnel portal or the danger point contains a complex layout increasing the possibility for derailment, placing the derailment indicator closer to the danger point shall be considered.

Derailment indicator UESA

Rationale: *To make sure that the longest trains (750 meters) are stopped in case of derailment and that train does not conflict with trains in parallel tracks.*

ENI-SS-ENG-1594 An UESA activated my a derailment indicator shall be engineered as follows:

ENI-SS-ENG-1595 a) UESA shall not be shorter than 1000 meters.

ENI-SS-ENG-1596 b) UESA shall cover the distance from the derailment indicator to the tunnel portal at double track lines.

ENI-SS-ENG-1597 c) UESA shall cover the distance from the derailment indicator to the danger point of the first point at single track lines with station.

ENI-SS-ENG-1910 d) UESA shall cover the same distance in parallel tracks as the track where a derailment indicator has been activated

24 LEVEL TRANSITION

24.1 Level transition border

Symmetric border

ENI-SS-ENG-648 The border between ERTMS and existing signalling system should be symmetric, in order to avoid two different operational set of rules on the same part of a line.

Comments: *This solution is equivalent to the level transition borders today on the national ERTMS pilot line (Østfoldbanens Østre Linje).*

Marker board placement

ENI-SS-ENG-649 A marker board shall be placed at the station entry of existing signalling system in direction towards Level 2 area for level transition.

Level transition board

ENI-SS-ENG-1251 Level transition boards shall be placed where train performs transition to the applicable mode.

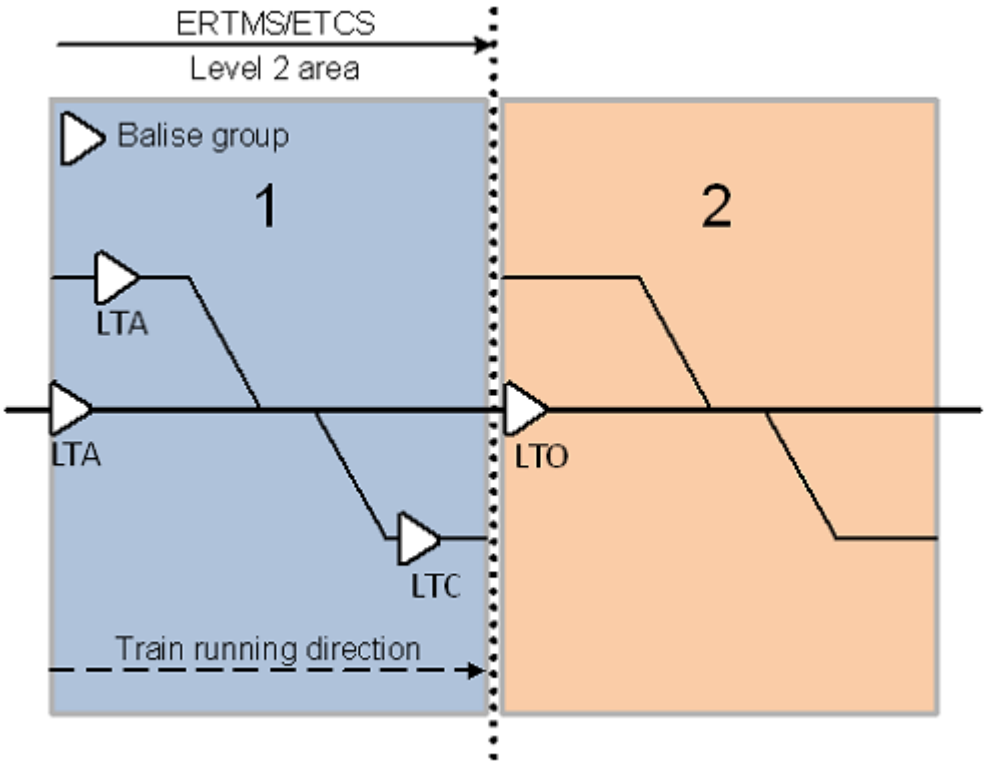
24.2 Level 2 to level NTC

The transition to level NTC (National Train Control) is divided into the following functional steps:

1) Level transition announcement and MA
2) Level NTC transition

The following drawing shows the general and relevant track design and balise groups needed to perform the different functional steps of the transition from level 2 to level NTC.

Level transition to level NTC



The Level Transition Announcement balise group (LTA) announces the transition to level NTC.

The Level Transition Cancellation balise group (LTC) cancels the transition in case the train is routed away from the ETCS border after the level transition announcement has been received.

The Level Transition Order balise group (LTO) is located at the ETCS border and orders the immediate transition to level NTC.

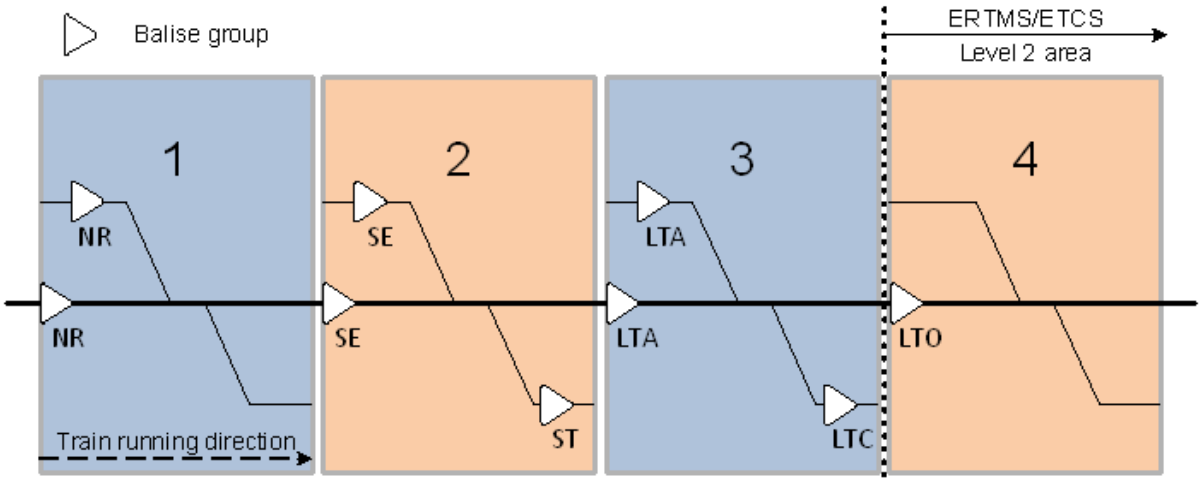
24.3 Level NTC to level 2

The transition is divided into the following function steps:

1) Radio Network registration
2) Radio Block Centre (RBC) connection establishment
3) Level 2 announcement and MA
4) Level 2 transition

Each of these steps has to be completed before the next is performed.

The following drawing shows the general and relevant track design and balise groups needed to perform the different functional steps of the transition from level NTC to level 2



Balise group Network Registration (NR) orders the train to register with the appropriate radio network. This means that the network must be available at this location. Norway has full GSM-R coverage across the railway network so the onboard equipment is already connected to the radio network when operating in level NTC.

Balise group Session Establishment (SE) orders the train to establish communication session with the RBC. The RBC contact information is stored onboard the train.

Balise group Session Termination (ST) orders the train to disconnect with the RBC in case the train is routed away from the ETCS border. Alternatively, ST can be left out if SE has a switchable balise with information depending on route locking.

Balise group Level Transition Announcement (LTA) announces the transition to level 2 and is also an important location reference for the RBC to be able to give MA to the train. There must be one such balise group and if possible, the LTA is placed where there are no more tracks diverging from the border.

Balise group Level Transition Cancellation (LTC) is needed for cancelling a level transition order in case there are diverging tracks between LTA and the ETCS border.

Balise group Level Transition Order (LTO) is located at the ETCS border and orders the immediate transition to ETCS level 2.

24.4 Border between interlockings

Location of interlocking border.

Rationale: *This solution provides new functionality on the line between stations and will impose least changes to existing infrastructure.*

ENI-SS-ENG-224 The interlocking border shall be placed at the entry signal of the station with the legacy interlocking.

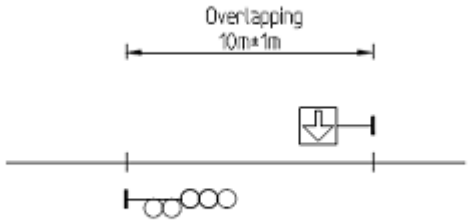
Comments: *Interfaces between legacy and the new interlocking should be avoided or kept as simple as possible.*

Boundary between TVP systems

Rationale: *Either one of the two TVP system or both have to detect occupation while a train is passing to ensure correct sequence for the route release function.*

ENI-SS-ENG-1599 The boundary between two different adjacent TVP systems shall have an overlap of 10 meters ± 1 meter.

Comments: *This applies either if one TVP system are axle counters and the other are track circuits, or if both are axle counters.*



24.5 Border between supervision systems

Location of level transition from level 2 to level NTC.

Rationale: *Having an optical signal at the border gives the driver a clear message on the state of the system he is entering.*

ENI-SS-ENG-226 The location of the level transition from level 2 to level NTC shall be placed at the entrance signal to the station with legacy system.

Location of level transition from level NTC to level 2.

Rationale: *This solution provides a symmetric border for the level transition.*

ENI-SS-ENG-227 The location of the level transition from level NTC to level 2 shall be placed at the entrance signal to the station with legacy system.

Comments: *This may lead to the need for a speed reduction in the transition phase due to the space that is needed to perform all operations in the level transition.*

Stations where level transitions are executed

ENI-SS-ENG-228 The stations where the level transitions are executed shall be stations with simple layouts and simple train operations e.g. no planned (in the timetable) turning of trains.

Comments: *The operational concept may be used to decide a station where level transitions are executed.*

24.6 Location of level transition balises

24.6.1 Level transition from level NTC to level 2

Minimum distance between balise groups SE and LTA.

Rationale: *This will ensure that the communication session is established when the message from the LTA is received onboard and that the level transition can be made when travelling at line speed.*

ENI-SS-ENG-231 The minimum distance between balise groups SE and LTA should be calculated using the time 55 seconds and the applicable line speed.

Comments: *A processing time up to 1.5 seconds is needed in the ERTMS/ETCS onboard equipment to initiate a communication session establishment. Up to 40 seconds is needed to establish the connection between the RBC and the ERTMS/ETCS onboard equipment. Up to 13.5 seconds is needed to establish the communication session between the RBC and the ERTMS/ETCS onboard equipment, it also includes the time needed to send the validated train data and the parameters for MA-request and position reporting.*

Minimum distance between balise groups LTA and LTO

Rationale: *This will ensure that the Movement Authority is received before passing the ETCS border.*

ENI-SS-ENG-232 The minimum distance between balise groups LTA and LTO should be calculated using the time 10 seconds and the applicable line speed.

Comments: *The 10 seconds consists of the time needed by the ERTMS/ETCS onboard equipment to process the information received from the LTA balise group before sending a position report, this takes up to 1.5s. It takes up to 7 seconds to transmit a position report to the RBC, for the RBC to generate a Movement Authority and to transmit the MA from the RBC to the ERTMS/ETCS onboard equipment. Then, the ERTMS/ETCS onboard equipment processes the MA which takes up to 1.5 seconds.*

Minimum distance between balise group LTO and first marker board.

Rationale: *This will ensure that the level transition is presented in the driver DMI before passing the first marker board.*

ENI-SS-ENG-233 The minimum distance between the LTO balise and the first marker board should be calculated using the time 1.5 seconds and the applicable line speed.

Comments: *This is the time needed by the ERTMS/ETCS onboard equipment to process the information received from the LTO before presenting it to the driver DMI.*

ATC balise at border

Rationale: *To stop trains without active ETCS onboard.*

ENI-SS-ENG-555 ATC balises ordering trains to stop shall be placed at the level transition border.

24.6.2 Level transition from level 2 to level NTC

Minimum distance between balise groups LTA and LTO

ENI-SS-ENG-235 The minimum distance between the balise groups LTA and LTO should be calculated using the time 11.5 seconds and the applicable line speed.

Comments: *The maximum time for the ERTMS/ETCS onboard to indicate a status change to the driver after receiving information from a balise group is 1.5 seconds. The maximum time allowed for the STM to report being in hot standby is 10 seconds.*

Minimum distance between the balise group LTO and EoA

Rationale: *To ensure that the train will be tripped if passing the last EoA in advance of the transition location.*

ENI-SS-ENG-236 The minimum distance between the balise group LTO and last EoA should be calculated using the time 6.5 seconds and the applicable line speed.

Comments: *1.5 seconds is the maximum time for the ERTMS/ETCS onboard to process the information received from the LTO balise group before presenting it to the driver DMI. In this time the ERTMS/ETCS onboard also orders the NTC to state Data Available (DA).*

The NTC is expected to report state Data Available (DA) within 5 seconds.

24.7 Level transition example

Engineering of level transition from NTC to L2

ENI-SS-ENG-1674 The following figure shows an example of engineering of level transition from NTC to L2.

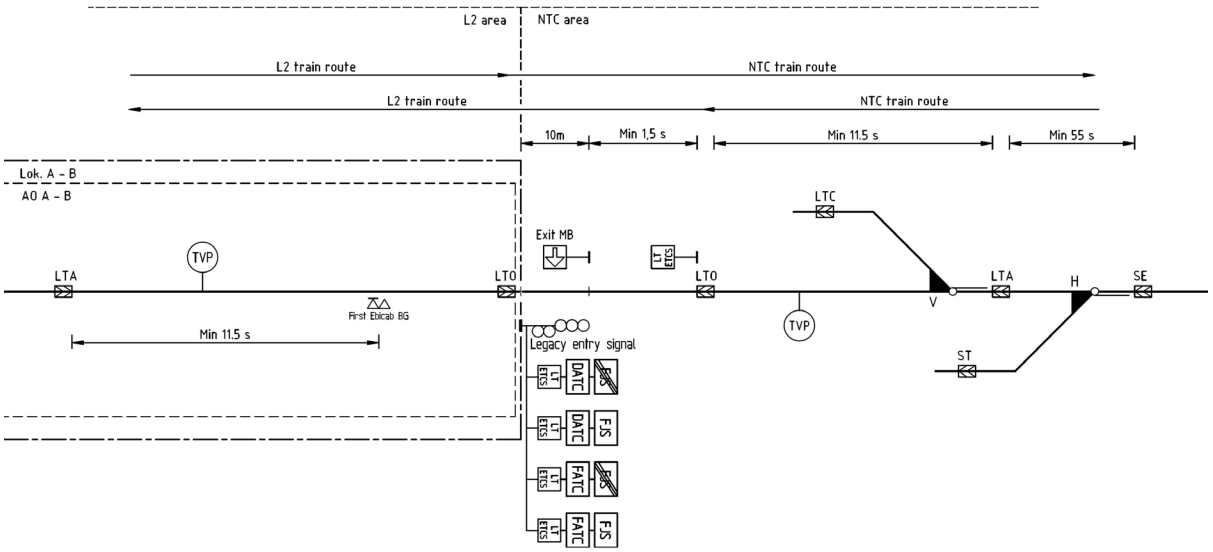
Comments: *Distance from LTO to first MB will have to be optimized to ensure that an onboard unit has transitioned to L2 before train has passed first MB (Exit MB).*

Engineering of level transition from L2 to NTC

ENI-SS-ENG-1676 The following figure shows an example of engineering of level transition from L2 to NTC, respectively for FATC and DATC.

Comments: *The LTO balise group is placed as close ETCS LT board as possible.*

Legacy balises are shown under the line. The figure only shows the first legacy balise group which needs to be considered when placing the LTA. The figure will be updated when the final solution regarding the legacy balises is made available.



24.8 Level 2 to and from level 0

Level 0 areas are lines with other operational traffic regulations than the rest of Bane NOR's railway network.

Comment: Examples are Krødebanen and Gamle Vossebanen where older operational traffic regulations are used.

Border between an L2 area and an L0 area

ENI-SS-ENG-1493 Border between an L2 area and an L0 area shall be engineered as follows (see figure below):

ENI-SS-ENG-1494 a) A generic function at the start of the L0 area shall automatically trigger a "mode profile" from FS to UN mode at "MB m"

ENI-SS-ENG-1530 b) "MB m" shall be engineered with a release speed of according to the applicable speed in the Uniftted area.

Comments: A lower release speed can be used, i.e. if maximum allowed speed in point is lower than the applicable speed.

ENI-SS-ENG-1495

c) Acknowledge distance for transition to UN shall be at least 155 m, but adapted to the release speed.

Rationale: To make sure the train speed is not significantly reduced below 40 km/h at the boundary to the area.

Comment: Another acknowledge distance can be considered, if the speed in the UN area is higher than 40 km/h.

ENI-SS-ENG-1496

d) The distance from the previous MB/shunting signal to MB m shall not be shorter than the required acknowledge distance.

Rationale: To ensure that the driver has sufficient time to acknowledge the UN-transition request.
Comments: The acknowledge distance covers the last route towards the transition area.

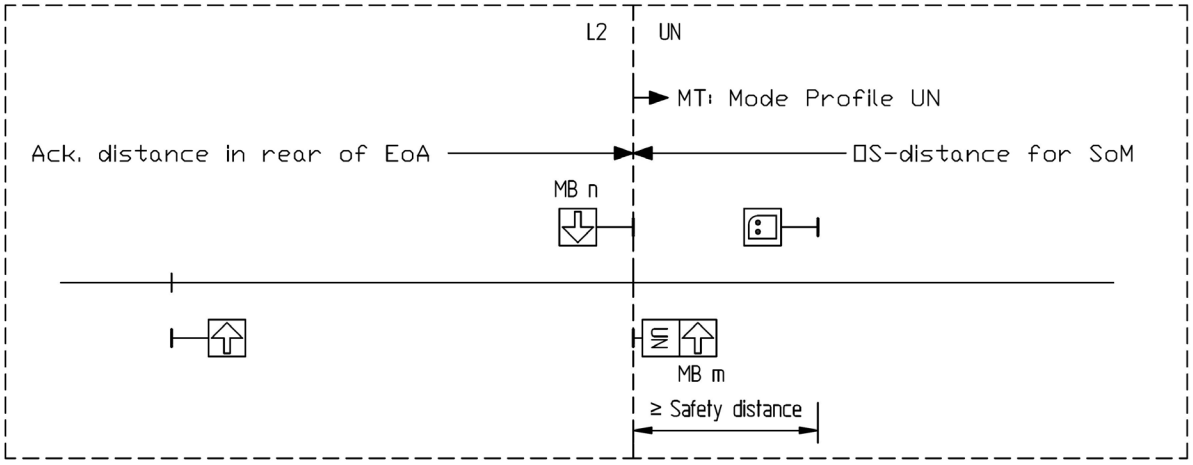
ENI-SS-ENG-1497

e) The OS-distance for SoM when driving from an Unfitted area (UN) to a L2 area, shall be set equal to the safety distance + 50 meters.

Comments: The OS-distance enable the train to obtain OS-MA ahead of signal 106, which give the driver permission to pass signal 106.

ENI-SS-ENG-1498

f) A Signal 106: "Stop for shunting" board shall be placed at “safety distance” from the boarder towards L2.



25 TEMPORARY SPEED RESTRICTION

Predefined Temporary speed restrictions

ENI-SS-ENG-1449 Intentionally deleted

26 SINGLE TRACK LINE

Block sectioning

ENI-SS-ENG-823

Block Marker Boards shall be placed in accordance with capacity needs, but maintenance challenges related to a location shall be evaluated.

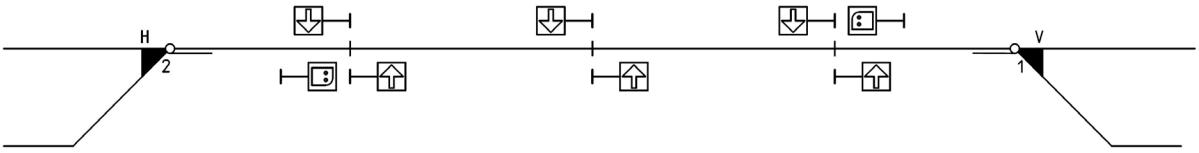
Comments: *As defined in operational concept.*

See ERP-30-S-00114 for specific recommendations.

Block posts at single track line

ENI-SS-ENG-824

Block posts on single track lines shall be engineered aligned as in the figure below.



ENI-SS-ENG-1435

A second block post shall be considered if Block Marker Boards needs to be placed at different locations due to local conditions.

Comments: *Local conditions can be different driving time from each neighboring block post/station due to difference in gradient.*

Distance from block post to level crossing

Rationale: *This will ensure that there is no conflict between a train stopping at the block post and the level crossing.*

ENI-SS-ENG-1533

Block marker boards should be placed more than 750 meters from a level crossing.

Minimum distance from level crossing systems

Rationale: *Due to an ERTMS function that might cause a brake intervention in the train when the level crossing system is activated and that this distance corresponds to the release speed of the block post marker boards.*

ENI-SS-ENG-1335

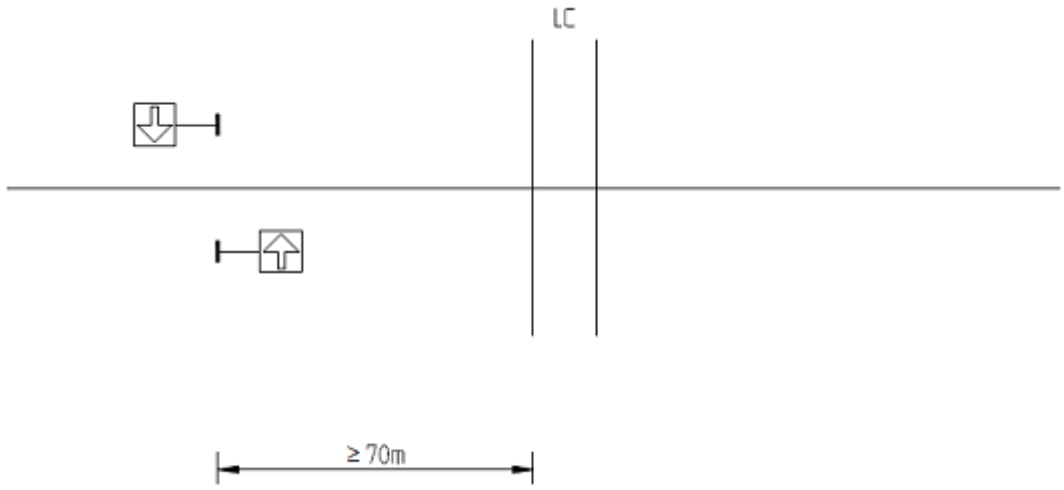
Block marker boards shall be placed at a minimum of 70 meter from a level crossing with level crossing system.

Placement according to driving direction

ENI-SS-ENG-1332 Block marker boards shall be placed at the same location for both driving directions on one side of the level crossing

Comments: *Marker boards shall be placed on each side of the track as shown in the figure.*

The figure below shows the placement of block marker boards close to a level crossing.



27 SIDINGS ON THE LINE

Centrally operated siding: A siding which is normally entered and/or left by a train in FS-MA. Points and derailers are centrally operated.

Locally operated siding: A siding which is normally entered and/or left by a train in SH-mode. Points and derailers are locally operated.

27.1 Selection of solution

Centrally operated siding.

Rationale: *The operational concept will decide if the siding shall be equipped as a centrally operated or locally operated siding.*

ENI-SS-ENG-241 A commercial siding used for freight or parking of trains shall be equipped as a centrally operated siding.

Locally operated siding.

Rationale: *The operational concept will decide if the siding shall be equipped as a centralised operated or locally operated siding.*

ENI-SS-ENG-242 A non-commercial siding that has less than 5 train movements in/out per day should be equipped as a locally operated siding.

27.2 ERTMS Operational modes

Centrally operated siding

Rationale: *To ensure engineering of train route and TSA/shunting route.*

ENI-SS-ENG-244 It shall be possible to enter and leave a centrally operated siding in either FS-mode or SH-mode.

Comments: *If unknown position and/or points not in control, it should also be possible to leave in OS-mode or SR-mode.*

Locally operated siding

Rationale: *To ensure engineering of TSA or Shunting route.*

ENI-SS-ENG-245 It shall be possible to enter and leave a locally operated siding in SH-mode.

27.3 Points and derailers

Centrally operated siding

Rationale: *To ensure engineering of train routes and TSA.*

ENI-SS-ENG-247 At a centrally operated siding, it shall be possible to operate points and derailers either centrally or locally.

Locally operated siding

Rationale: *To ensure engineering of TSA.*

ENI-SS-ENG-248 At a locally operated siding, it shall be possible to operate points and derailers locally.

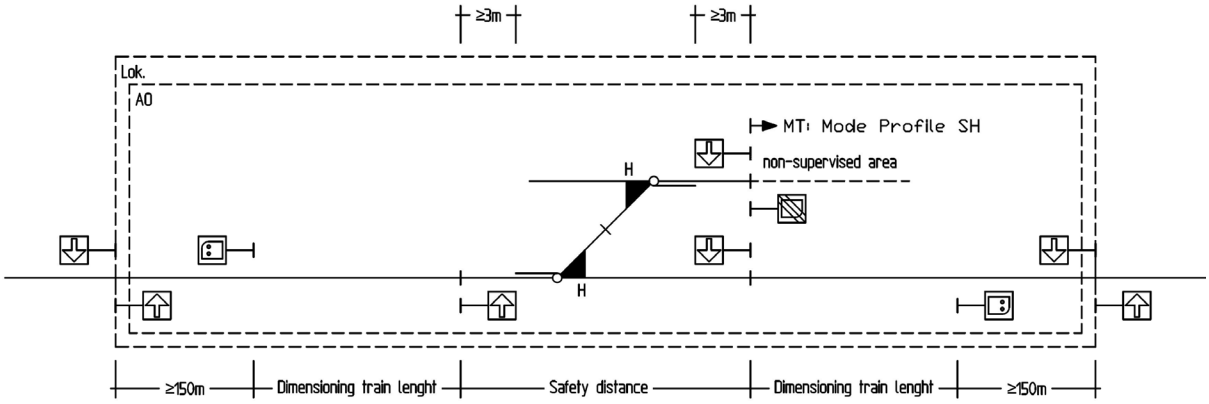
Sidings secured with point machines

ENI-SS-ENG-1237 Sidings shall be secured with point machine(s) if the speed of the line exceeds 130 km/h, the point has rail weight ≥ 54kg, require multiple point machines or if the siding is commercially operated regularly by trains running on MA to/from the siding.

27.4 Centrally operated siding

Engineering of centrally operated siding.

ENI-SS-ENG-250 A centrally operated siding shall be engineered as a station. See figure below.



Distance to adjacent station

ENI-SS-ENG-255 If the distance from the entry/exit marker boards of the siding to the entry/exit marker board of a adjacent station is less than 500 m. The siding should be engineered as a part of this station.

Distance to adjacent block post

ENI-SS-ENG-1415 If the distance from the entry/exit marker boards of the siding to a adjacent block post is less than 500 m. The entry/exit marker boards can be combined with the block post marker boards.

Running in FS towards the last marker board

ENI-SS-ENG-1416 The boarder between the L2 area and non-supervised area (Non-interlocked PSA), shall be engineered with the possibility of running in FS towards the last marker board.

Comments: *According to the description in chapter PSA/PSA border/PSA is a non-interlocked area*

27.5 Train movement areas

Mode Profile

Rationale: *The Mode Profile will force the train into Shunting mode at the sign Signal 108: "Interlocked area".*

ENI-SS-ENG-268 A Mode Profile to SH-mode shall be engineered at the sign Signal 108: "Interlocked area".

Movement Authority

Rationale: *To hinder runaway rolling stock leaving the siding, the siding shall only be "open" when specific trains enter and leave the siding.*

ENI-SS-ENG-269 A route for a train entering a centrally operated siding shall not be set before the train is within a given distance from the siding.

Comments: *This will be solved by TMS.*

27.6 Locally operated siding

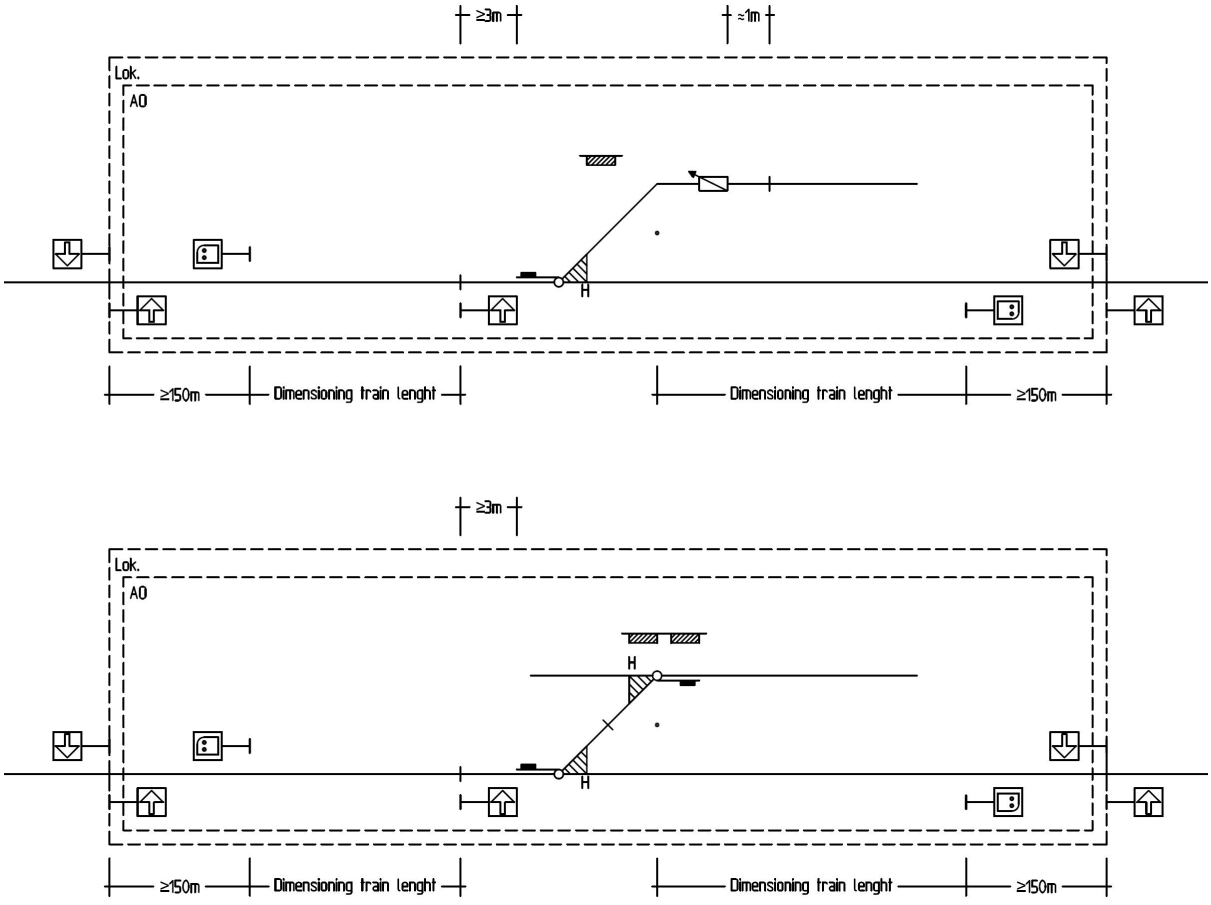
Engineering of locally operated siding

ENI-SS-ENG-260

A locally operated siding shall be engineered as a station. See figures below.

Comments: *Trains enters and leaves the siding in SH-mode using the TSA.*

The TSA for releasing the siding will only be activated when trains close to the siding. This will ensure that the points in the siding are "open" in a shortest possible time.



Distance to adjacent station

ENI-SS-ENG-265

If the distance from the entry/exit marker boards of the siding to the entry/exit marker board of a adjacent station is less than 500 m. The siding should be engineered as a part of this station.

Distance to adjacent block post

ENI-SS-ENG-1457

If the distance from the entry/exit marker boards of the siding to a adjacent block post is less than 500 m. The entry/exit marker boards can be combined with the block post marker boards.

28 STATION LAYOUTS SINGLE TRACK LINE

Some of the overall project goals are increased capacity, unified operational conditions, and improved flexibility. One way of achieving this is to create a standardised default station layout including simultaneous entry routes, which is presented as Alternative 1 below. Then, alternative layouts are presented in following chapters, as well as their criteria for selection.

Layouts defined below are shown for two track stations but can be extended to stations with more than two tracks.

28.1 Engineering of single track lines and stations

On single track lines, stations are typically divided by long block sections. Inside a station's borders (ahead of the entry MB) a catenary section break is established. This allows work to be performed on the catenary system in a station (powerless and earthed), while trains can still operate on adjacent line sections.

Evaluation priorities:
When schematic plans for single track lines shall be established, the following prioritization of evaluations shall be made:

- Marker Boards shall be placed according to standard layouts (as far as possible) given in Engineering Guidelines/Station layouts, which comprises placement of:
  - Entry Marker Boards at the station borders, outside the catenary section break, see ENG-286.
  - Exit Marker Boards at the same location as the entry Marker Boards, see ENG-283.
  - Inner Marker Boards typically located in the entry-/exit route and in platform tracks of a station (supporting simultaneous entry routes), see ENG-293, ENG-295 and ENG-296

Rationale: To ensure a logic placing of Marker Boards related to driver's expectations (increased safety) and to limit the number of axle counters (limit LCC and increase availability).

2) Marker Boards shall be placed more than 10 meters from the platform, in the direction of travel, se ENG-35

Rationale: to enable drivers to see the Marker Boards and it's ID when the train is stationary at a platform.

3) Marker Boards shall not be placed closer than the safety distance (e.g. 70 meters at 20 km/h release speed) before the platform in direction of travel where a train stops regularly, see ENG-1264.

Rationale: to avoid that an aft-running train, which is not able to stop ahead of the Marker Board in question, overpasses the Marker Board and hits the train in front which is stationary at the platform.

4) Based on 1), "Signal E39: Stop for shunting" board shall be placed at least with a safety distance from Entry Marker board, see ENG-1384,

   and inside the catenary section break to provide a safety zone between a shunting movement and an oncoming train headed towards the Entry Marker board of a station, see ENG-1470,

   and at least 250 m from the station outmost point, taking into account the train length of a double Flirt train set, see ENG-444.

5) Based on the above, naming of the Marker Boards shall be proposed (Entry-, Exit, Inner- and Block marker boards), based on the generic rules given in Engineering Guidelines/Naming convention.

6) Work Areas (WA) are engineered, based on rules given in Engineering Guidelines/Work Area.

7) Temporary Shunting Areas (TSA) are engineered, based on rules given in Engineering Guidelines/Temporary Shunting Area.

Dimensioning train length

ENI-SS-ENG-1255

Dimensioning train length is defined by the train's length + 15 meters.

Comments: *When engineering according to dimensioning train lengths the potential new train sets that in the future will operate the line shall be taken into consideration.*

Train type	Single	Double	Triple
BM 69			
BM 70	110 (+15)	220 (+15)	330 (+15)
BM 72	86 (+15)	172 (+15)	258 (+15)
BM 73	107 (+15)	214 (+15)	321 (+15)
BM 74	106 (+15)	212 (+15)	318 (+15)
BM 75	106 (+15)	212 (+15)	318 (+15)
BM 92	50 (+15)	100 (+15)	300 (+15)
BM 93	40 (+15)	80 (+15)	120 (+15)
EL 18 + wagons			

28.2 Alternative 1 - default layout

Two track station layout - default layout

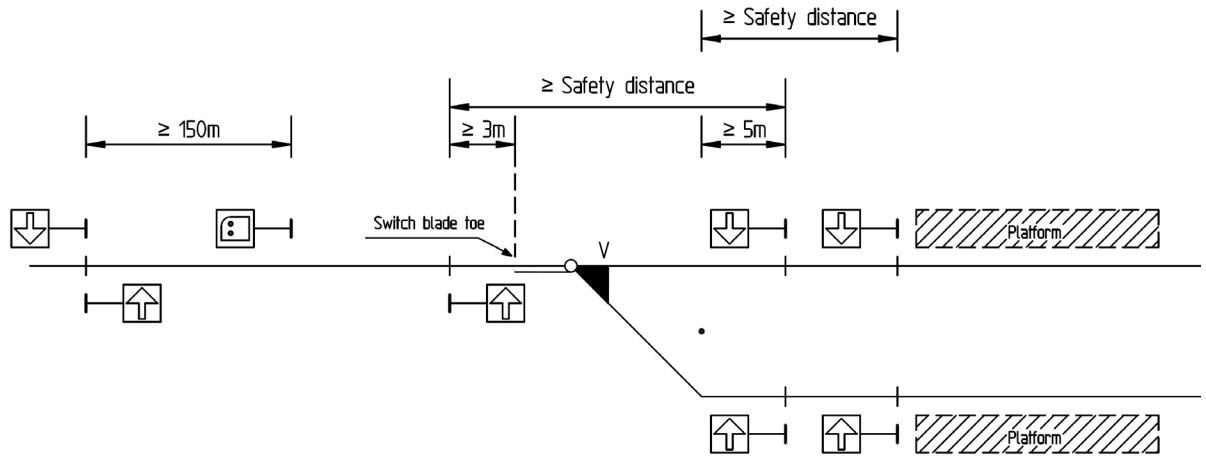
Rationale: *Unified operational conditions and efficient crossings of two trains.*

ENI-SS-ENG-525

The default layout for two track stations on single track line shall be according to layout below, and it includes simultaneous entry routes. It is depending on the following criteria

- long enough station tracks for crossing of shortest train, i.e. dimensioning train length for crossings
- no platforms at marker board locations
- placement and type of LX, see chapter /simultaneous train movements with level crossing(s) on station

Comments: *Principal engineering of this alternative is shown in 1000007957 Functional Schematic Layout - Single Track Line - Alternative 1.*



Please see chapter 2 Marker boards for more details on marker board placement.

ENI-SS-ENG-567

Intentionally deleted

28.3 Alternative 2 - short station tracks

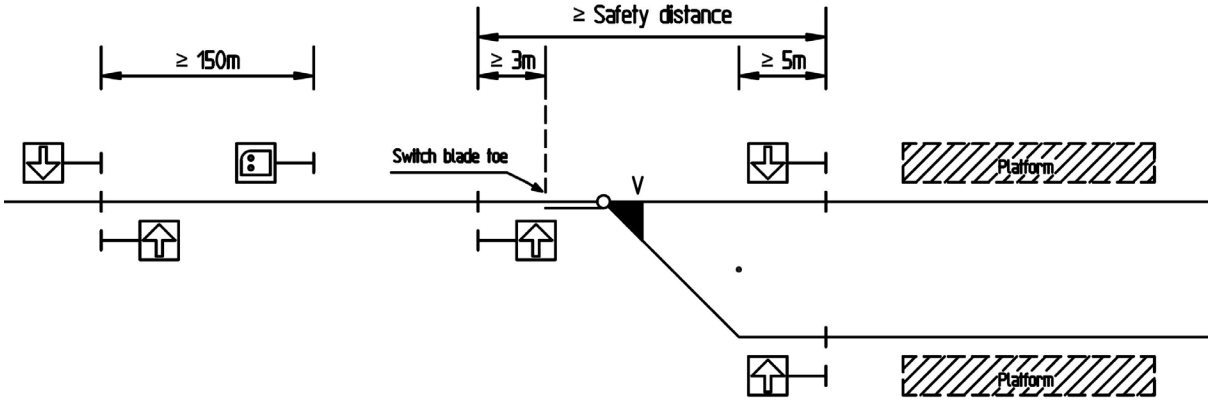
Two track station layout - short station tracks

Rationale: *To decrease crossing time by allowing the approaching train to move closer to the crossing location.*

ENI-SS-ENG-522 If the station tracks are too short for a dimensioning train to use simultaneous entry routes as defined in alternative 1, the layout below shall be used.

Comments: *This alternative is used when simultaneous entry routes are not possible due to space considerations. Simultaneous entry will not be possible.*

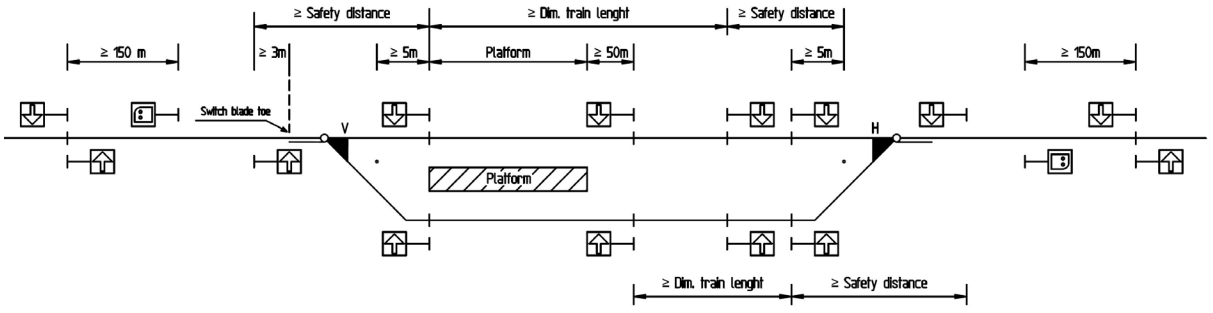
Principal engineering of this alternative is shown in 1000007962 Functional Schematic Layout - Single Track Line - Alternative 2.



28.4 Alternative 3 - platform in conflict with marker board

Two track station layout - platform in conflict with marker board

ENI-SS-ENG-569 If there is a platform in the end of the station, the layout below should be considered. This is independent on whether the platform is located on the outside of the tracks or between the tracks.



Dimensioning distances, platform at end of station

ENI-SS-ENG-570 The distance "Dim. train length" shall be at least as long as the dimensioning train(s) length.

Comments: *The dimensioning train(s) shall be defined in operational concept.*

Safety distances

ENI-SS-ENG-571 The safety distances shall be according to ENI-SS-ENG-816.

MB according to platform

Rationale: *The marker board shall be placed at a distance form a platform to avoid passenger walking from platform to train stopped ahead of the marker board*

ENI-SS-ENG-1257 The Marker boards in driving direction shall be located at least 50 meters from the platform edge.

Platform at end of short station

ENI-SS-ENG-576 If the station is too short to use the layout above, Alternative 2 - short station track shall be used.

28.5 Alternative 4 - local control panels for points

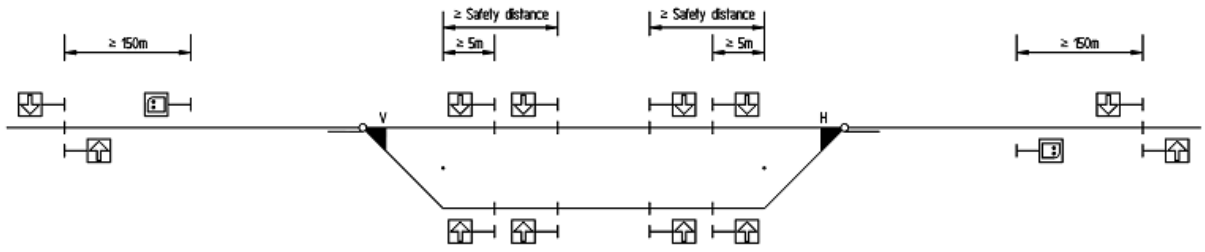
Two track station layout - local control panel for points

ENI-SS-ENG-516 If local control panels for points are required and the default layout is not applicable, the layout below should be considered.

Comments: *If the following layout is used, local control panels for points are required.*

Requirement ENG-1211 specifies where the local control panels are required.

Principal engineering of this alternative is shown in document 1000007967 Functional Schematic Layout - Single Track Line - Alternative 4.



28.6 Alternative 5 - level crossing in the middle of a station

Two track station layout - level crossing in the middle of a station

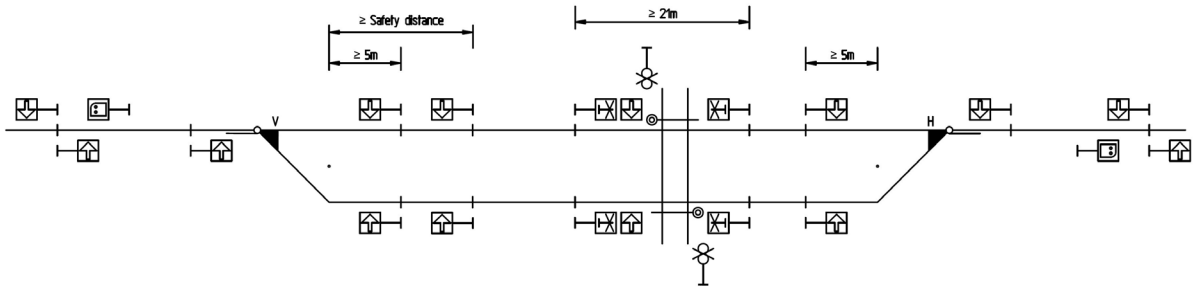
ENI-SS-ENG-535

If a level crossing is located between points in a station, the principle layout below shall be used.

Comments: *The use of simultaneous train movements is depending on type and placement of LX, see chapter /simultaneous train movements with level crossing(s) on station*

This alternative can be combined with the other alternatives.

Additional inner MBs can be placed ahead of LX to inhibit activation of LX for stopping/turning trains.



28.7 Alternative 6 - level crossing over point

Two track station layout - level crossing over point

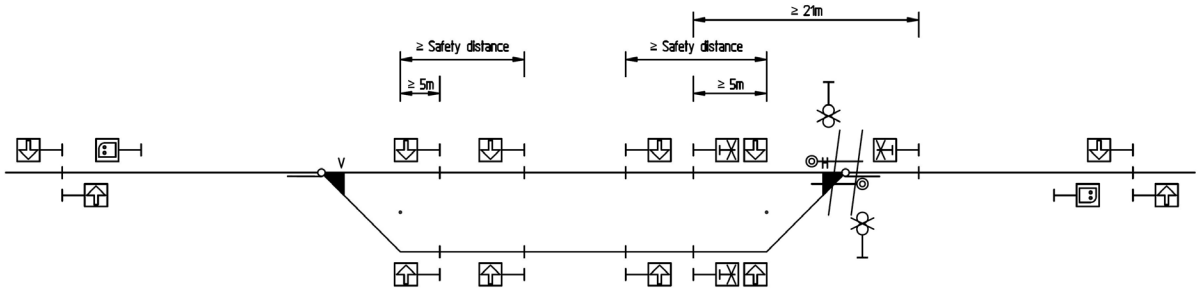
ENI-SS-ENG-536

If a level crossing is located over a point in a station, the layout below shall be used.

Comments: *The use of simultaneous train movements is depending on type and placement of LX, see chapter /simultaneous train movements with level crossing(s) on station*

This alternative can be combined with the other alternatives.

Additional inner MBs can be placed ahead of LX to inhibit activation of LX for stopping/turning trains.



28.8 Alternative 7 - level crossing between point and exit marker board

Two track station layout - level crossing between point and exit marker board

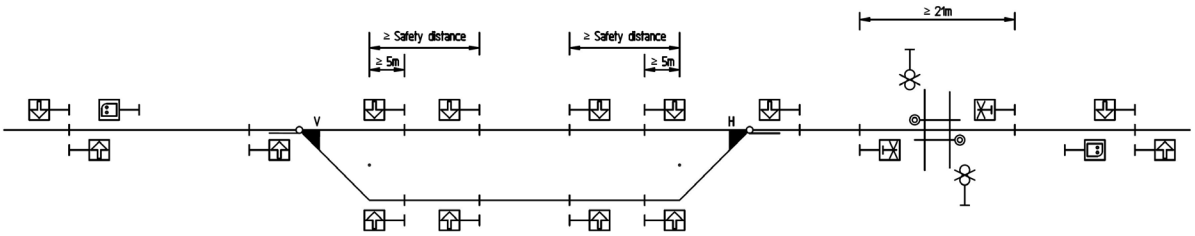
ENI-SS-ENG-537

If a level crossing is located between a point and the exit marker board of a station, the layout below shall be used.

Comments: *The use of simultaneous train movements is depending on type and placement of LX, see chapter /simultaneous train movements with level crossing(s) on station*

This alternative can be combined with the other alternatives.

Additional inner MBs can be placed ahead of LX to inhibit activation of LX for stopping/turning trains.



Level crossing between point and exit marker board

ENI-SS-ENG-1912

If a level crossing is located between signal 106 and the exit marker board, and signal 106 can be end point of a shunting route, then there shall be a marker board together with signal 106

Comments: *This is to prevent the level crossing for being activated when shunting route is set to signal 106. There shall be a separate TVP section between signal 106 and exit marker board*

28.9 Capacity for single track stations

Simultaneous train movement engineering.

ENI-SS-ENG-1215

Tracks in stations shall be engineered for simultaneous train movements to the extent required. The engineering shall ensure both the need for increased capacity (by simultaneous train movements) and the maximum possible usage of track lengths.

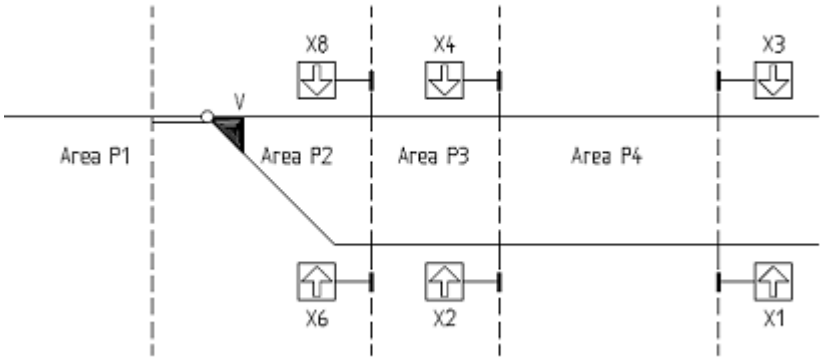
28.10 Simultaneous train movements with level crossing(s) on station

Simultaneous train movements and level crossings

ENI-SS-ENG-1196

Simultaneous train movements shall be permitted on stations with level crossing(s) if the correct conditions for placement and/or protection of the level crossing(s) are fulfilled.

Level crossings on stations are categorised in the following areas depending on their placement according to the figure below:



Simultaneous train movements and level crossings in area P1

ENI-SS-ENG-1198 If a level crossing is situated in area P1 – between entry MB and switch blade toe (or inner MB ahead of point), all simultaneous train movements shall be permitted if one of the following conditions are fulfilled:

ENI-SS-ENG-1199 a) If the level crossing is non-supervised, only one moving train shall be visible from the level crossing by the road user.

ENI-SS-ENG-1200 b) Level crossing is protected by a full barrier system.

Simultaneous train movements and level crossings in area P2

ENI-SS-ENG-1201 If a level crossing is situated in area P2 – between MB X6/X8 and switch blade toe (or inner MB ahead of point), all simultaneous train movements shall be permitted if the following condition is fulfilled:

ENI-SS-ENG-1202 a) Level crossing is protected by full barrier system.

Simultaneous train movements and level crossings in area P3

ENI-SS-ENG-1203 If a level crossing is situated in area P3 – between MB X2/X4 and MB X6/X8, simultaneous train movements shall be permitted if the following conditions is fulfilled:

ENI-SS-ENG-1204 a) Level crossing is protected by full barrier system.

Simultaneous train movements and level crossings in area P4

ENI-SS-ENG-1205 If a level crossing is situated in area P4 – between MB X1/X3 and MB X2/X4, simultaneous train movements shall not be used.

Level crossings for platform entry

ENI-SS-ENG-1395

In addition to placement, required measures for level crossings used for platform entry (Area P3 and P4) are divided into three categories based on number of passengers- and crossing trains per hour according to the figure below:

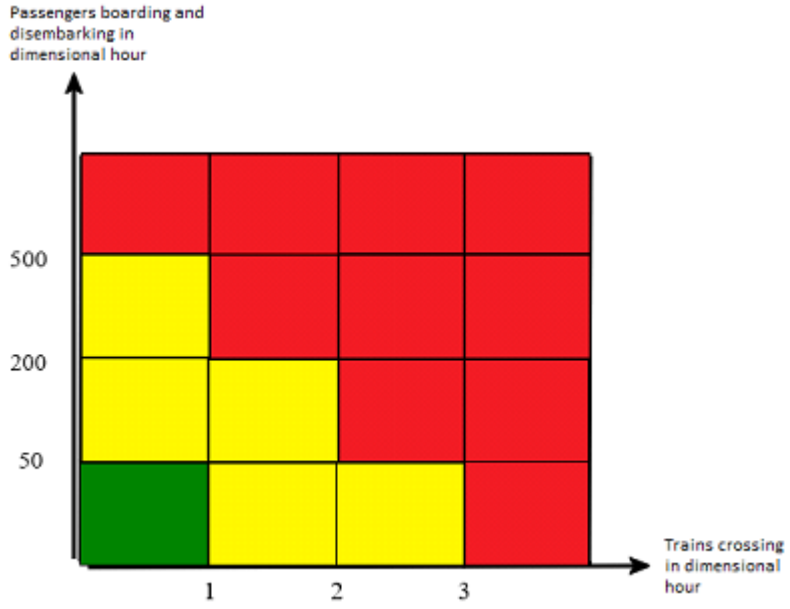
Comments: *The number of passengers using the platform entry are those who boards and disembarks at the platform.*

Train crossings where platform entry is not utilized shall not be considered in the amount of train crossing movements in dimensional hour. This could be:

- *Train crossing movements between two trains without passenger exchange*
- *Train crossing movements between one train without passenger exchange and one train with passenger exchange at the platform not using the platform entry.*

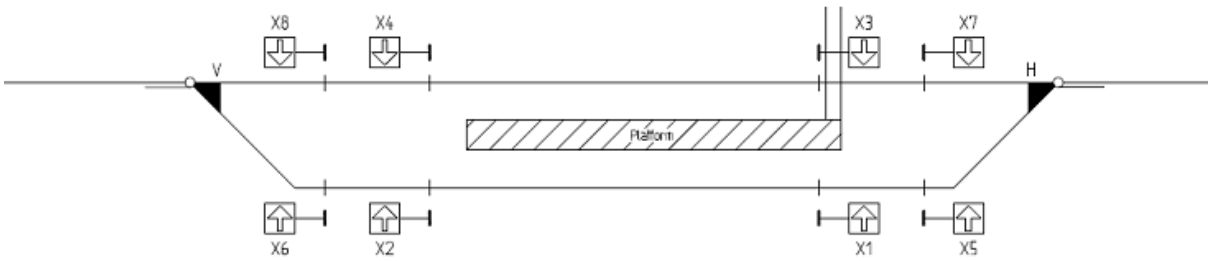
Dimensional hour is the hour according to timetable which has the most crossing movements and the most passengers boarding and disembarking.

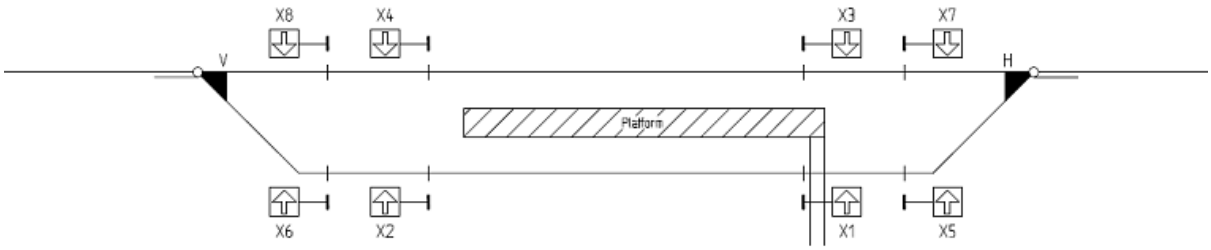
In the table below, the green area shows from 0 to 1 train crossing with 0 to 50 passengers boarding and disembarking in dimensional hour.



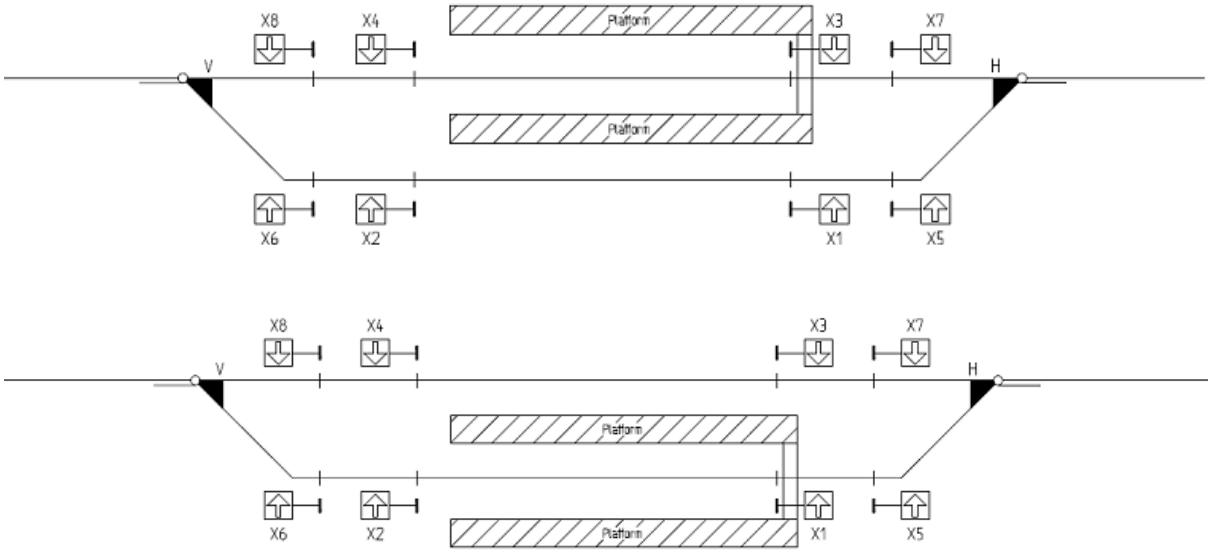
The figures below show different constellations for level crossings used for platform entry in area P3:

Mid platform (platform entry covers one track):

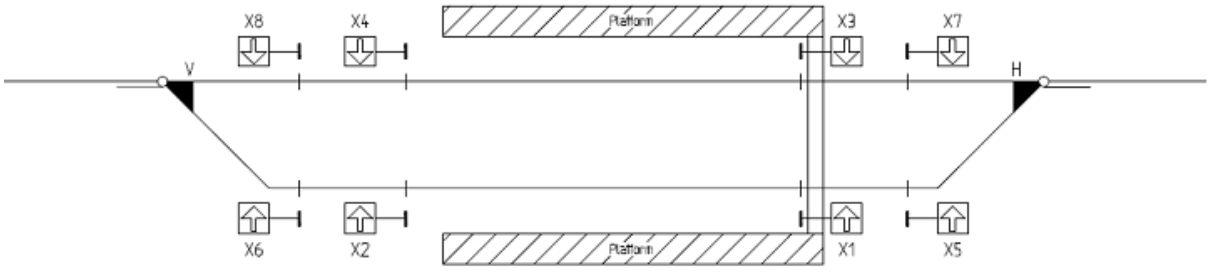




Mid and side platform (platform entry covers one track):



Two side platforms (platform entry covers two tracks):



Red category

ENI-SS-ENG-1230 The following requirement is applicable for level crossings, related to platform crossing in red category.

ENI-SS-ENG-1232 A level crossing system is not sufficient to safeguard at platform entry, so therefore other measures for this has to be implemented to allow simultaneous train movements (grade separated crossing).

Yellow category

ENI-SS-ENG-1231 The following requirements are applicable for level crossings, related to platform crossing in yellow category.

ENI-SS-ENG-1233 If level crossing for platform entry is protected by a barrier system (i.e. full- or half-barrier system), simultaneous train movements should be used.

ENI-SS-ENG-1610 If a platform entry is protected by a level crossing system **and** platform entry only covers one track **and** all trains stops ahead of the platform entry when this is used for passenger exchange, the applicable simultaneous train movements shall be permitted.
Comments: *Limitation of simultaneous train movements by train type and/or passenger exchange, shall be implemented in TMS, while engineering of the Interlocking shall allow all simultaneous movements*

Trains with passenger exchange shall use track with side platform avoiding passengers need to use the platform entry, and thus permitting the applicable simultaneous train movements.

Simultaneous movements for two trains without passenger exchange are always permitted

Train length board shall be placed 10-13 m. ahead of the platform entry.

Green category

ENI-SS-ENG-1234 The following requirements are applicable for level crossings, related to platform crossing in green category.

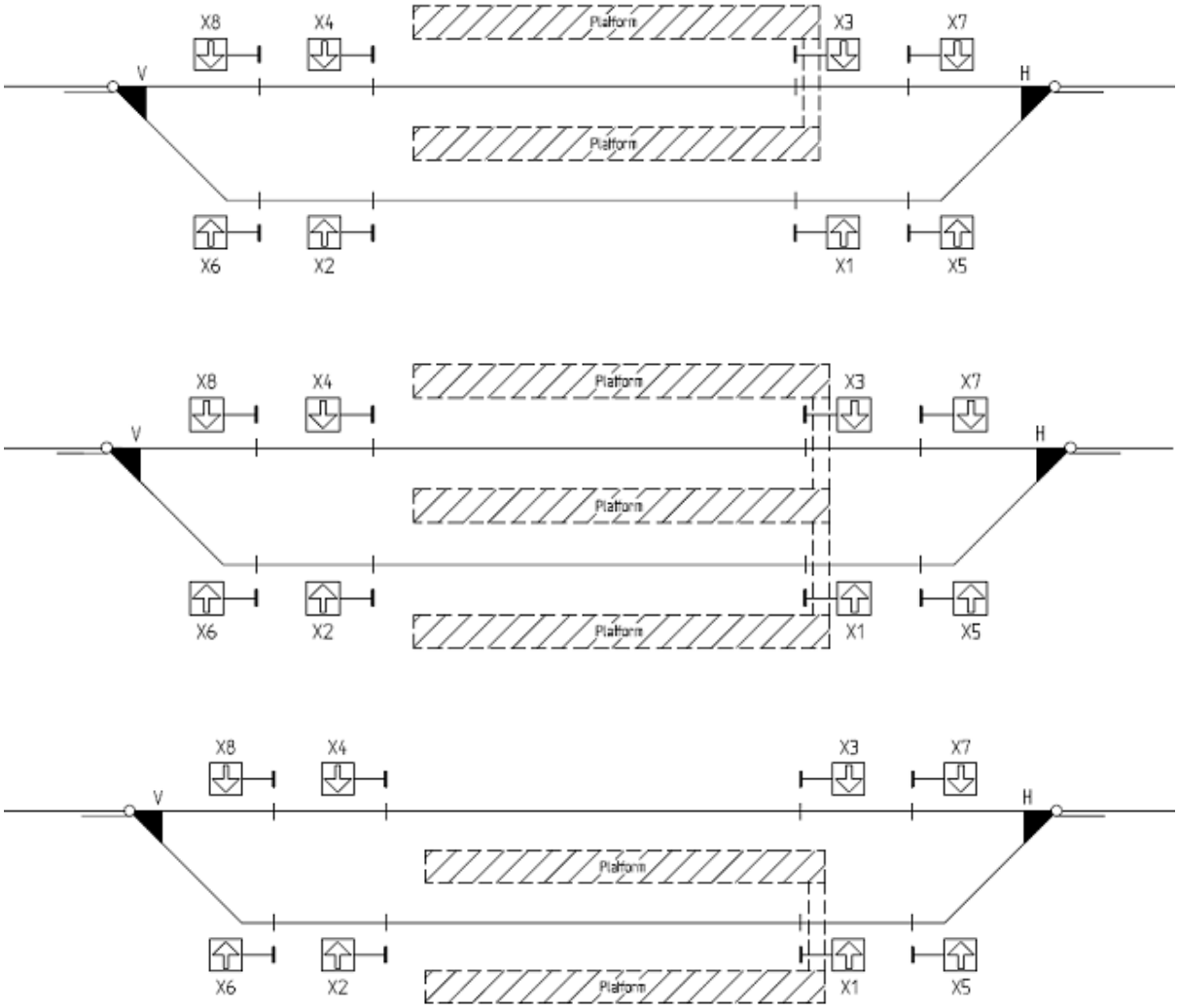
ENI-SS-ENG-1235 If level crossing for platform entry is protected by a road signalling- or barrier system (i.e. full- or half-barrier system), all simultaneous train movements shall be permitted.

ENI-SS-ENG-1209 If platform entry only covers one track **and** all trains stops ahead of the platform entry when this is used for passenger exchange, the applicable simultaneous train movements shall be permitted.
Comments: *Limitation of simultaneous train movements by train type and/or passenger exchange, shall be implemented in TMS, while engineering of the Interlocking shall allow all simultaneous movements*

Trains with passenger exchange shall use track with side platform avoiding passengers need to use the platform entry, and thus permitting the applicable simultaneous train movements.

Simultaneous movements for two trains without passenger exchange are always permitted

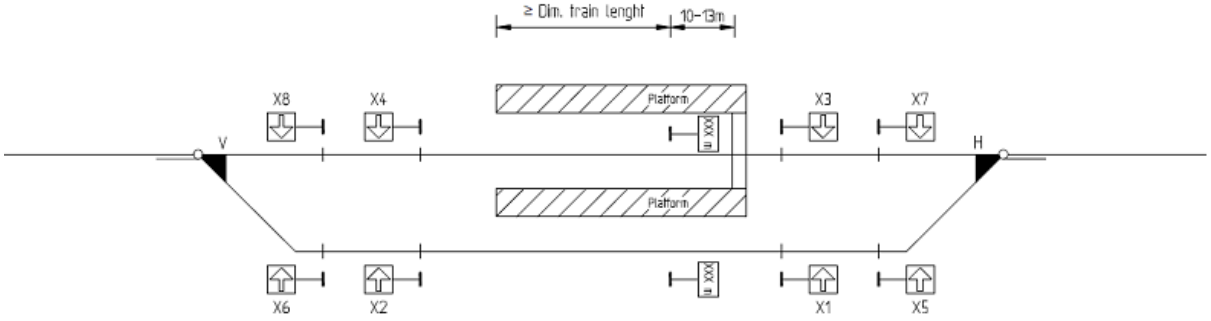
Train length board shall be placed 10-13 m. ahead of the platform entry.



Exceptions for level crossings as platform entry in area P4

ENI-SS-ENG-1611

If the dimensional train (w/passenger exchange) can stop >10 meters ahead of the platform entry by the use of train length boards (see figure below), the platform entry shall be considered as in area P3 thus permitting applicable simultaneous train movements, see ENG-1209.

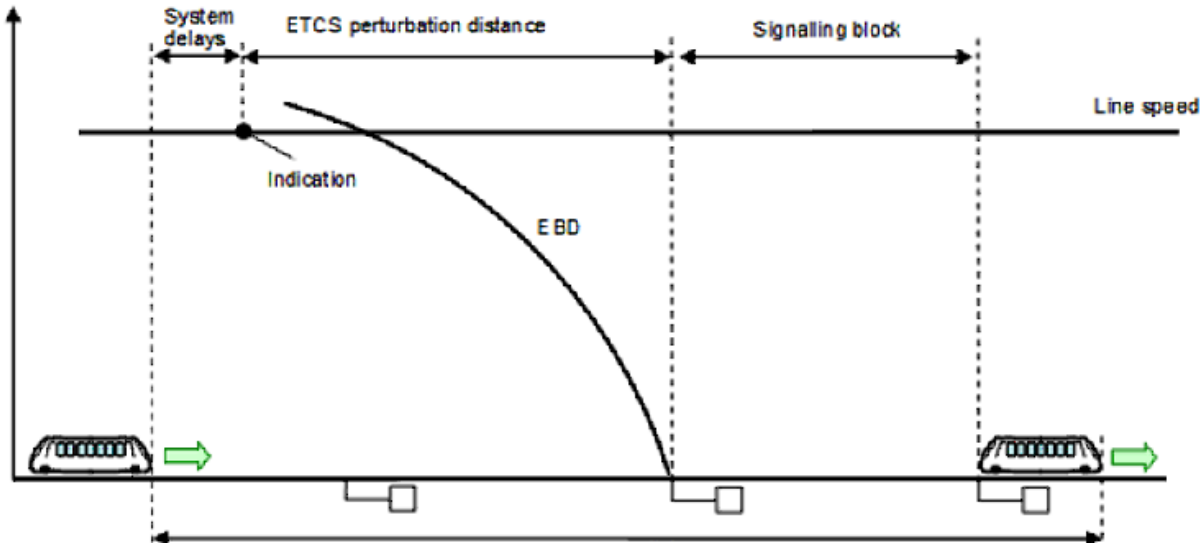


29 DOUBLE TRACK LINE

29.1 Capacity

There are ongoing discussions regarding placement of marker boards on double track lines.

The distance “Signalling Block” is the only variable that can be engineered.



Braking curves to determine headway distances are calculated with ERA Braking Curve Tool, using National Values given in chapter National Values.

Calculations are done under the assumption that the driver does not get indications/warnings in the DMI due to approaching the braking curve in normal operation.

Block sectioning

ENI-SS-ENG-452

A line shall be divided into block sections in accordance with capacity requirements.

Comments: *As defined in operational concept.*

Designing the length of block sections

ENI-SS-ENG-331

A line should be divided into block sections with the same section occupation time that is customized to headway requirements and stop patterns of trains (unified or mixed operations).

Comments: *This gives shorter block sections at lower speed and longer block sections at higher speed.*

Design of block sections according to headway

Rationale: *This is in order to retrieve delays.*

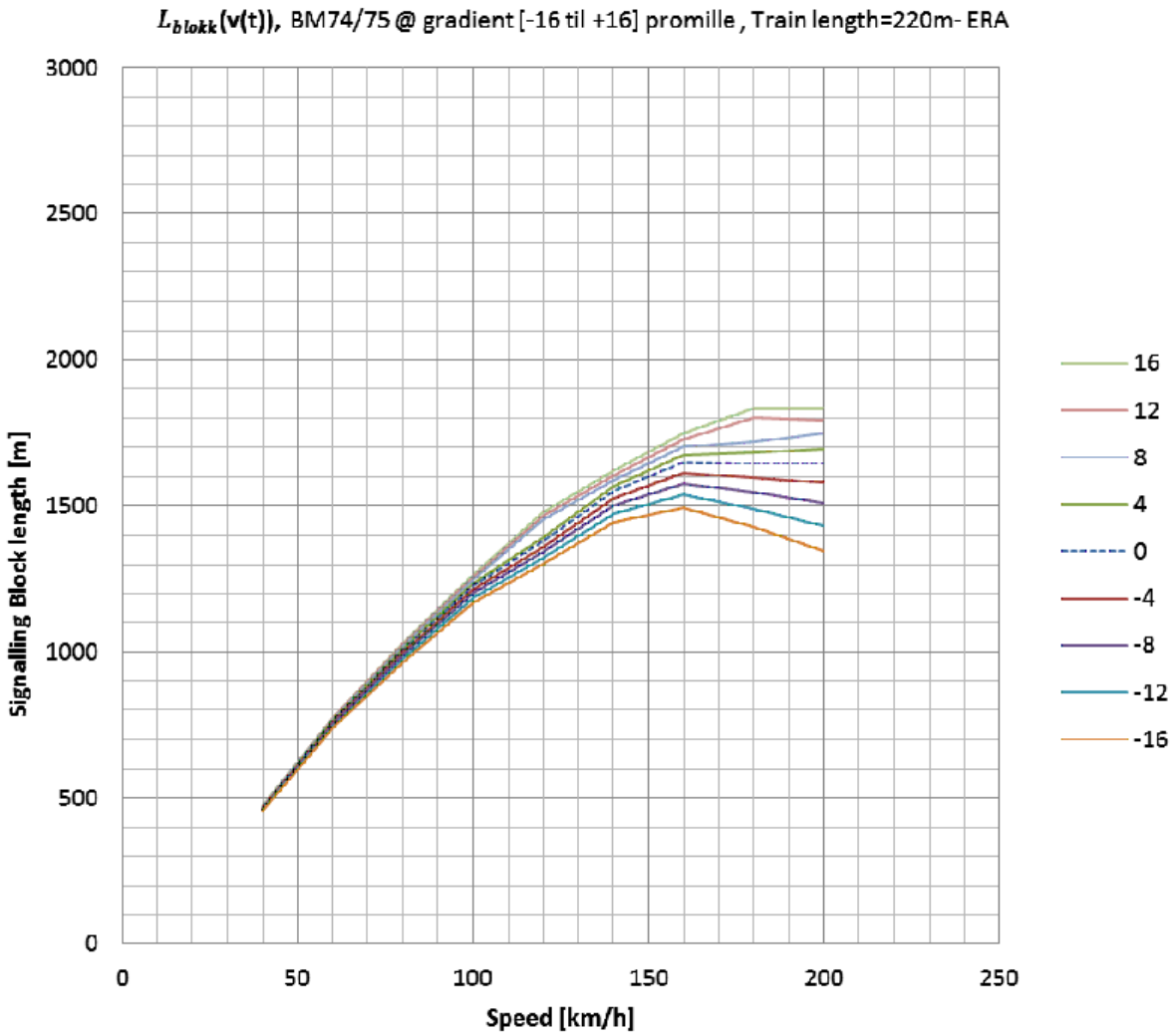
ENI-SS-ENG-332 The length of the block sections shall be designed according to the technical headway requirements.

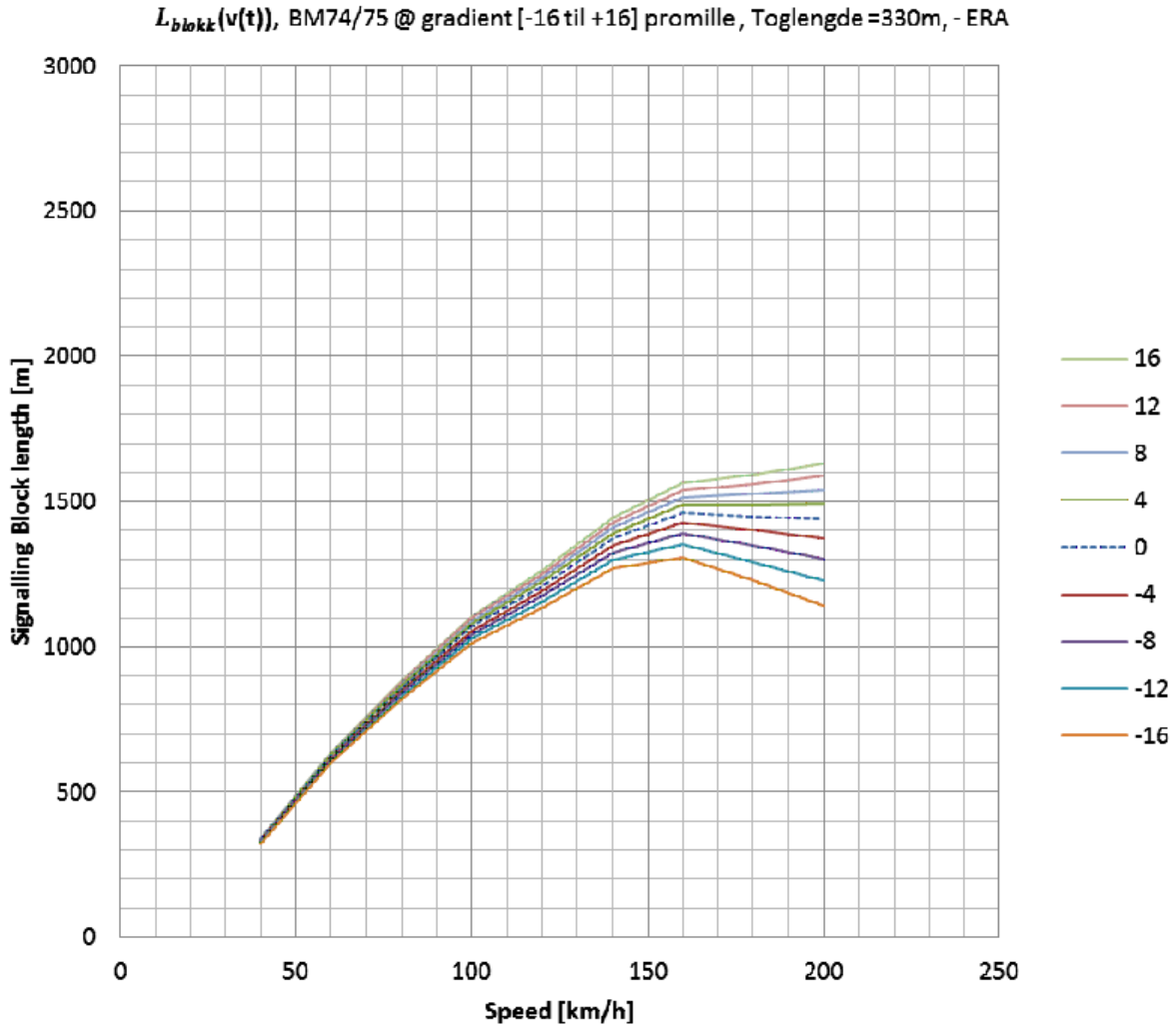
Comments: *According to operational concept.*

The IC guidelines require scheduled headway of 2 minutes and a technical headway of 90 seconds.

Block section length

ENI-SS-ENG-449 Block section length shall be determined using the pre-calculated graphs below.




L_{blokk}(v(t)), BM74/75 @ gradient [-16 til +16] promille, Toglengde =330m, - ERA
Signalling Block length [m]
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
Speed [km/h]
16
12
8
4
0
-4
-8
-12
-16

Engineering process

ENI-SS-ENG-461

The line between stations shall be equipped with signalling blocks according to the highest demand, thus as it was trafficked by high speed uniform passenger train sets with the required maximum headway separation, according to the following procedure.

Determine the speed profile, gradient profile of the line between major stations, that shall be divided into smaller signalling blocks.

Find maximum signalling block length for the required headway separation according to 1. and 2. below. This will allow for a long as possible signalling block satisfying the headway requirement. It is allowed to use a shorter signalling block length, this will result in more equipment, and shorter headway separation.

1. **2 min headway**: Speed vs signalling block length for Inner IC @ 90sec. headway separation for worst case gradients on the line.
   a. The speed vs signalling block length diagram shall be used for selecting maximum length of the signalling block for passenger trains.
      i. The topmost plot is valid for trains lengths =< than 220m (double Flirt length),
      ii. The other plot is valid for train lengths up to 330m.

2. **4 min headway**: Speed vs signalling block length for Outer IC @ 210sec. headway separation for worst case gradients on the line
   b. Select the length of a signalling block from one of two diagrams above.
      i. Add the extra travelled distance for 210 – 90 sec. = 120 sec. to the signalling block length.
   c. The speed vs signalling block length diagram shall be used for selecting maximum length of the signalling block for passenger trains.
      i. The topmost plot is valid for trains lengths =< than 220m (double Flirt length),
      ii. The other plot is valid for train lengths up to 330m.

Line speed above 200km/h:

Where maximum line speed shall be between 200km/h and 250km/h, there are no tools today of calculating the ETCS braking distance. Therefore a simplified approach has been used by increasing the required headway separation from 2min till 2min and 30s, allowing for an additional 30s braking distance compared to the one used for speeds up to 200km/h.

30s * 250km/h / 3,6 = 2083m. Use the readout from the diagrams for a speed = 200km/h for the signalling block length with a headway separation of 2m 30s. The margin is in the 2083m (or 30s) added.

Accelerations and decelerations out from and in to station:

Calculate the average of the speed profile and gradient profile over a signalling block.

Make sure there is at least one short signalling block in the acceleration or deceleration area bordering a full stop area. This may be covered in the layout of the station described in the following chapters. If not, add one short signalling block with the length of 200m.This will allow for a faster approach or departure of following trains.

200m signalling block length + length of train (220m) @ normal acceleration (0,75m/s*s) will result in a delta speed of approximately 85km/h.

29.2 Engineering of double track lines and stations

On double track lines catenary section breaks are NOT organized in the same structured way as on single track lines. Therefore, the approach to be used when engineering double track lines differs from the approach used on single track lines.

- Marker Boards shall be placed according to standard layouts (as far as possible) given in Engineering Guidelines/Double track line, which comprises placement of:
  - Entry Marker Boards at the station borders, independent of the catenary section break, see ENG-286.

Comment: The TMS will prevent locking of train routes into sections that are earthed.

b. Exit Marker Boards at the same location as the entry Marker Boards, see ENG-283.
c. Inner Marker Boards typically located in the entry-/exit route and in platform tracks of a station (supporting simultaneous entry routes), see ENG-318, ENG-325 and ENG-327

2) Marker Boards shall be placed for optimum headway/capacity, based on rules given in Engineering Guidelines/Double track line/Capacity

3) Marker Boards shall as far as possible, for both driving directions and both neighboring tracks, be placed at the same km (such as two Marker Boards shares one axle counter and that Marker Boards in the neighboring tracks are placed at the same km), see ENG-31 and ENG-924.

Rationale: To ensure a logic placing of Marker Boards related to driver's expectations (increased safety) and to limit the number of axle counters (limit LCC and increase availability).

4) Marker Boards shall be placed more than 10 meters from the platform, in the direction of travel , se ENG-34 and ENG-35.
Rationale: to enable drivers to see the Marker Boards and it's ID when the train is stationary at a platform.

5) Marker Boards shall not be placed closer than the safety distance (e.g. 70 meters at 20 km/h release speed) before the platform in direction of travel where a train stops regularly.
Rationale: to avoid that an aft-running train, which is not able to stop ahead of the Marker Board in question, overpasses the Marker Board and hits the train in front which is stationary at the platform, see ENG-1264.

6) Based on 1), Signal 106: "Stop for shunting" shall be placed with a safety distance from Entry Marker board and at least 250 m from the station outmost point, taking into account the train length of a double Flirt train set. The Stop-for Shunting sign might be placed on the mast of a Marker Board, see ENG-444, ENG-1384 and ENG-1470.

7) Based on the above, naming of the Marker Boards shall be proposed (Entry-, Exit, Inner- and Block marker boards), based on the generic rules given in Engineering Guidelines/Naming convention.

8) Work Areas (WA) are engineered, based on rules given in Engineering Guidelines/Work Area.

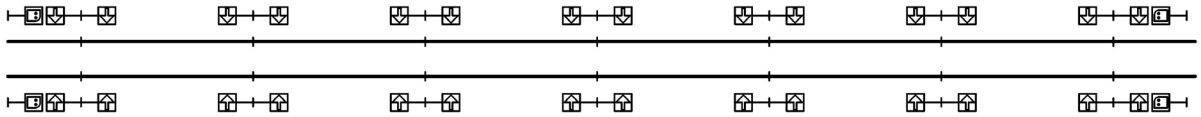
9) Temporary Shunting Areas (TSA) are engineered, based on rules given in Engineering Guidelines/Temporary Shunting Area.

29.3 Block posts

Block posts at double track line

Rationale: *On double track lines Marker Boards for each track shall be placed parallel related to both track and driving direction. This to avoid that drivers misunderstand their location and/or function (entry-/exit-/block MB).*

ENI-SS-ENG-924 Block posts at double track lines shall be engineered aligned as in the figure below.

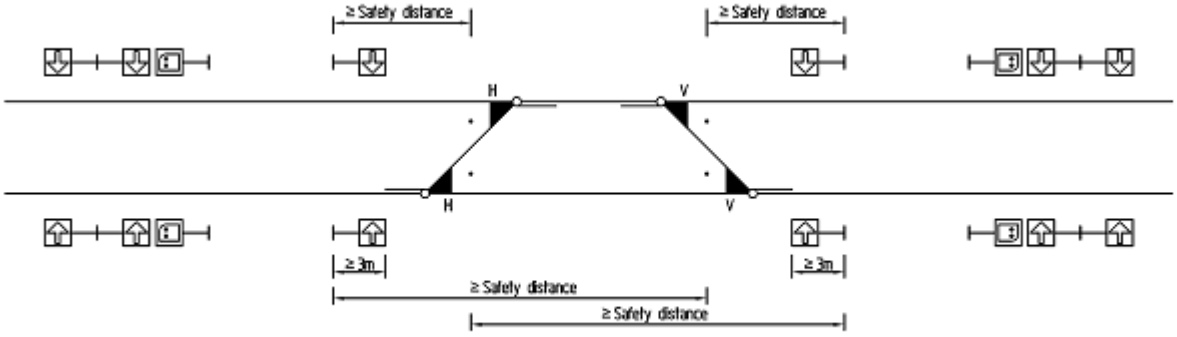


29.4 Double crossover

Inner marker boards at double crossover

Rationale: *A marker board ahead of the first facing point in a double crossover shall be placed in sufficient distance to ensure that the safety distance does not become a hindrance for train movement in both crossovers. Ref to ENG-1535 for distance between signal 106 and marker board for turning movement*

ENI-SS-ENG-318 Inner marker boards should be placed ahead of the points.



Distance between inner marker board and Signal 106: "Stop for shunting" board.

Rationale: *Enables moving the train in FS-MA between station tracks.*

ENI-SS-ENG-319 It shall be a distance of at least 250 meters between the inner marker board and the Signal 106: "Stop for shunting" board.

Comments: *A need for triple FLIRT-trains (317 meters) may be stated in operational concept for IC-lines, increasing this distance to 350 meters.*

Safety distance to flank

ENI-SS-ENG-1266 It shall be a safety distance from the inner marker boards to the flank of a conflicting train route.

Comments: *When the release speed is 20 km/h. The requirement for safety zone is 0 meters.*

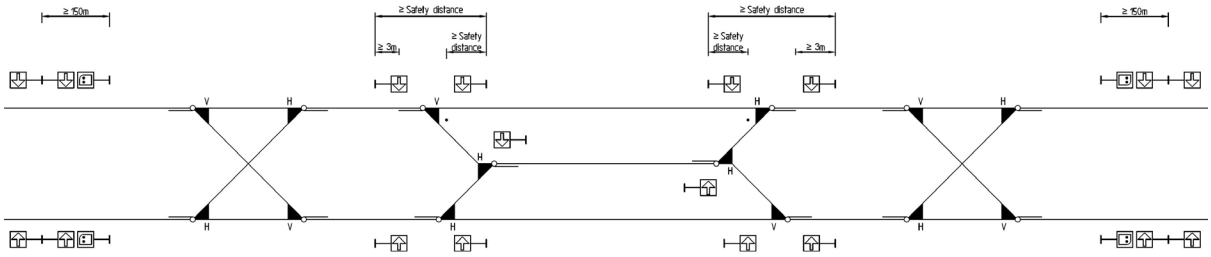
29.5 Three track station

Engineering a three track station - double track line

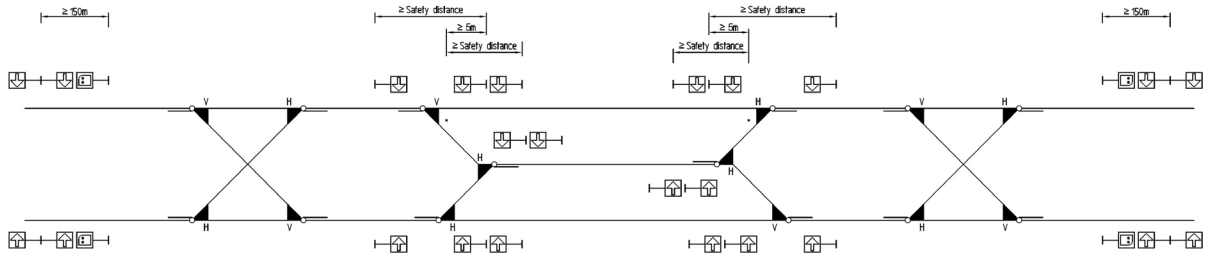
ENI-SS-ENG-325 A three track station shall be engineered as the figure below.

Comments: *Marker board for turning movements can be placed differently if defined in operational concept. Ref to ENG-1535 for distance between signal 106 and marker board for turning movement*

Please note that the inner marker boards are located closer towards the center in the figure below.



If the station tracks are too short to have simultaneous train movements for the longest dimensional trains, double MBs may be used to assure simultaneous train routes. Dimensioning train lengths are shown in ENG-1255.



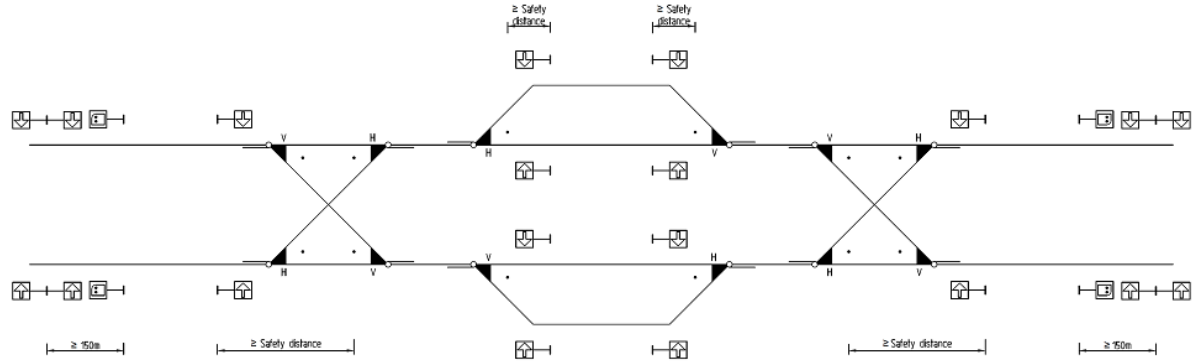
29.6 Four track station

Engineering a four track station - double track line

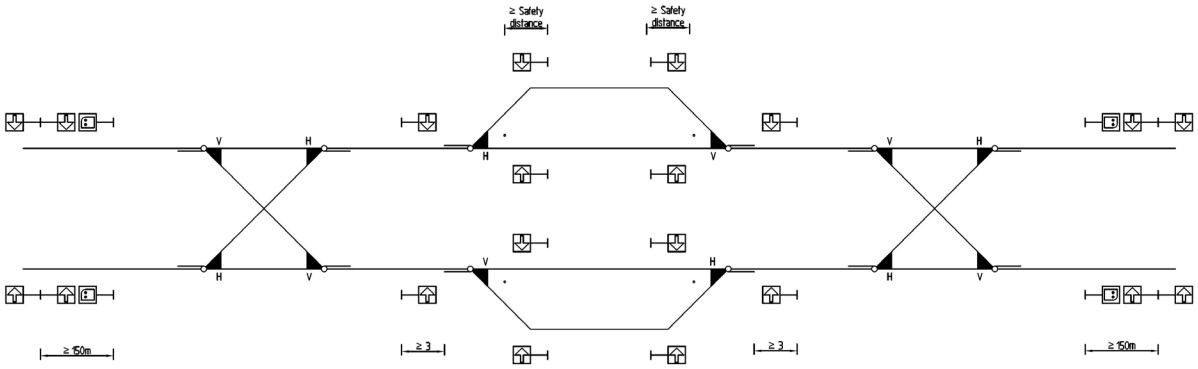
ENI-SS-ENG-327

A four track station shall be engineered as in the figure below.

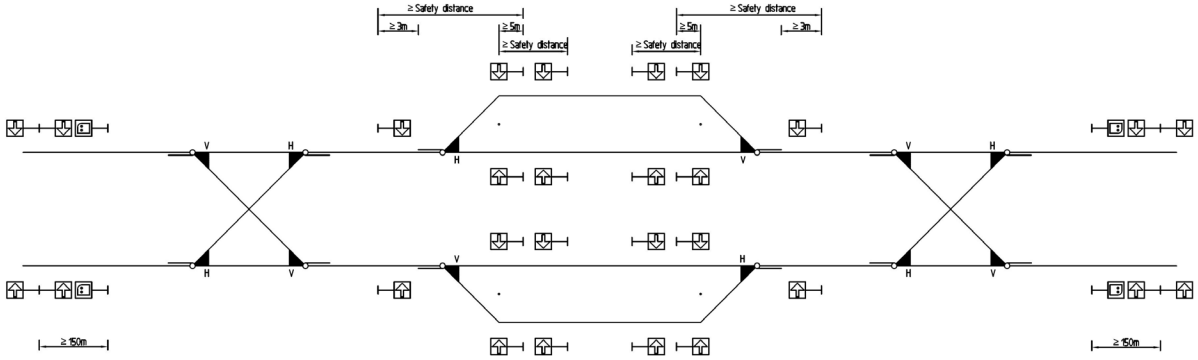
Comments: *Marker board for turning movements can be placed differently if defined in operational concept. Ref to ENG-1535 for distance between signal 106 and marker board for turning movement.*



Please note that the inner marker boards are located closer towards the center in the figure below.



If the station tracks is too short to have simultaneous train movements for the longest dimensional trains, double MBs may be used to assure simultaneous train routes. Dimensioning train length are shown in ENG-1255.



30 SAFETY DISTANCE, SAFETY ZONE, OVERLAP AND RELEASE SPEED

Safety distance is requirement from Bane NOR for a distance between the End of Movement Authority and other train routes, shunting routes or TSAs. The Safety distance is used for engineering and is not controlled by the interlocking.

Safety zone is requirement from Bane NOR for a distance between the End of Movement Authority and other WA or Occupied TVP sections. The Safety zone is controlled by the interlocking.

Overlap is solution from the supplier for controlling a piece of track free of train routes, shunting routes, TSA, WA and occupied TVP sections behind the End of Movement Authority. The purpose is to prevent a hazardous situation to occur, in case the train passes the end signal of a train route. An overlap is controlled by the interlocking.

A release speed is a speed limit which the train is allowed to run in the vicinity of the End of Movement Authority.

Restrictive breaking curves and low release speeds may result in trains, especially freight trains, having problems reaching the EoA close to the marker boards.

Safety distance, safety zone and release speeds

ENI-SS-ENG-816 The following safety distances and safety zones shall be used for ERTMS L2:

	Release speed (km/h)	Safety distance (m)			Safety zone (m)	
		Train routes	Shunting routes	TSA	WA	Occupied TVP section
Train routes	20	70[5,6]	70[5,6]	70[5,6]	55[1,2,5,6]	55[1,2,5,6]
	30	130[5,6]	130[5,6]	130[5,6]	110[1,2,5,6]	110[1,2,5,6]
	40/(40[4])	210[5,6]	210[5,6]	210[5,6]	175[1,2,3,5,6]	175[1,2,3,5,6]
Shunting routes	(40)	150[7]	0	0	0	0
TSA	(40)	150	0	0	0	0
WA	-	0	0	0	0	0

[1] – 0 m safety zone after entry MB towards Signal 106: "Stop for shunting".

[2] – 0 m safety zone after entry-, exit- and block MB.

[3] – 0 m safety zone for SR-route.

[4] – Limited speed in SR-route. Requirements for Safety distance and Safety zone shall be taken care of by operational routines and not by the interlocking

[5] – 0 m safety distance and safety zone in PSA type 1 and 2

[6] – Safety distance and Safety zone through a deviating point ending in the “gravel” or in a buffer stop is considered to have “infinite” length.

[7] – Safety distance can be reduced to 70m if accepted by analysis.

Consecutive routes

ENI-SS-ENG-1920 Safety distance and safety zone shall be 0m towards consecutive train and shunting routes.

Comments: *Typically routes on the line between stations.*

Uniformly engineered overlap and release speed

ENI-SS-ENG-790 *Intentionally deleted since overlap is removed from requirement*

Uniformly engineered release speed

Rationale: *To ensure no misunderstandings for the driver related to release speeds being different in equal situations*

ENI-SS-ENG-1923 Release speeds shall be engineered uniformly throughout the railway network

Safety distance and safety zone

ENI-SS-ENG-1268 Safety distances and safety zone shall be engineered according to the relevant release speed and gradients.

Release speed of 30 km/h

ENI-SS-ENG-1265 A release speed of 30 km/h could be used if necessary.

Comments: *If a release speed of 30 km/h will be used an application to Technical Management shall be complemented.*

30.1 Two track stations single track line

Release speed, safety distance and safety zone a on a two-track station

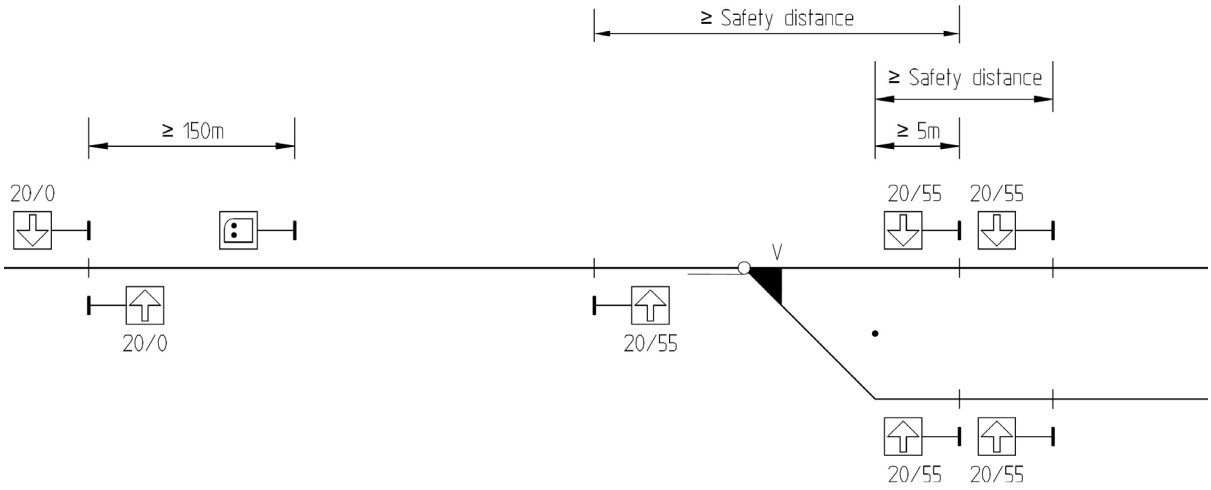
Rationale: *Station entrance and exit MBs are engineered with 20/0 for consecutive routes towards the station or the line.*

Inner MB ahead of point are engineered with 20/55 for consecutive routes towards the station. If simultaneous entry routes to the outmost inner MB for exit and to inner MB ahead of point are needed, the safety distance from the inner MB ahead of point to the outmost inner MB for exit, must be equal to the safety distance from the outmost inner MB for exit.

Inner MBs for exit are engineered respectively as 20/55 for simultaneous entry routes and 20/55 for longer trains without simultaneous entry routes.

ENI-SS-ENG-809 On a two-track station, release speeds, safety distances and safety zones shall be engineered as the figure below.

Comments: *Conflicting train movements towards same location are limited by generic function in IL.*



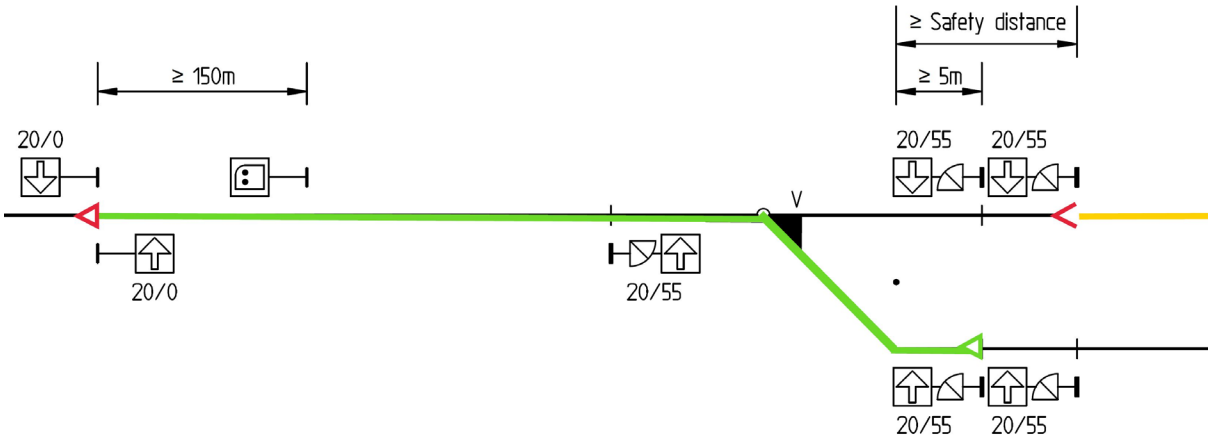
The figure above shows release speed and safety zone above/under each MB e.g. 20/0 being release speed of 20 km/h and 0 meters safety zone. Safety distances are given in meters where necessary.

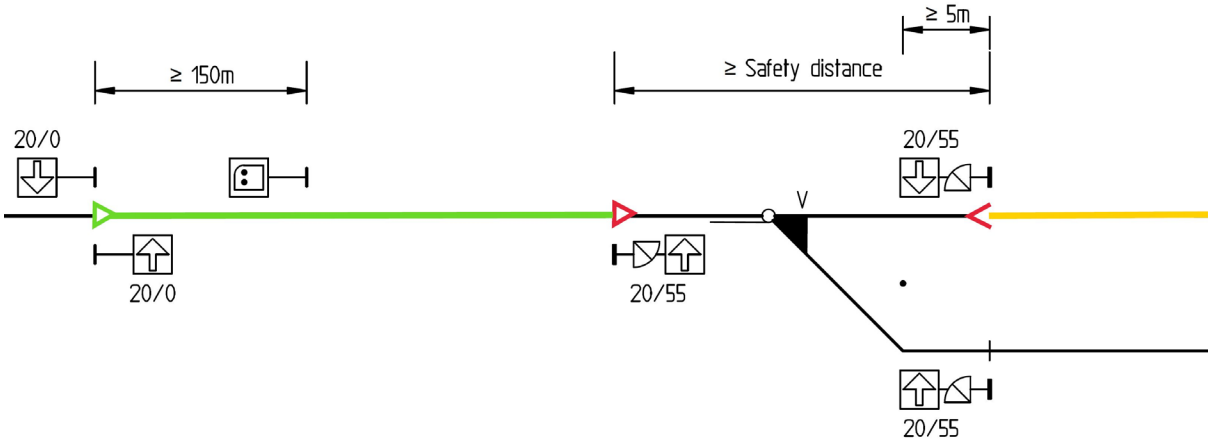
Safety distance for shunting routes

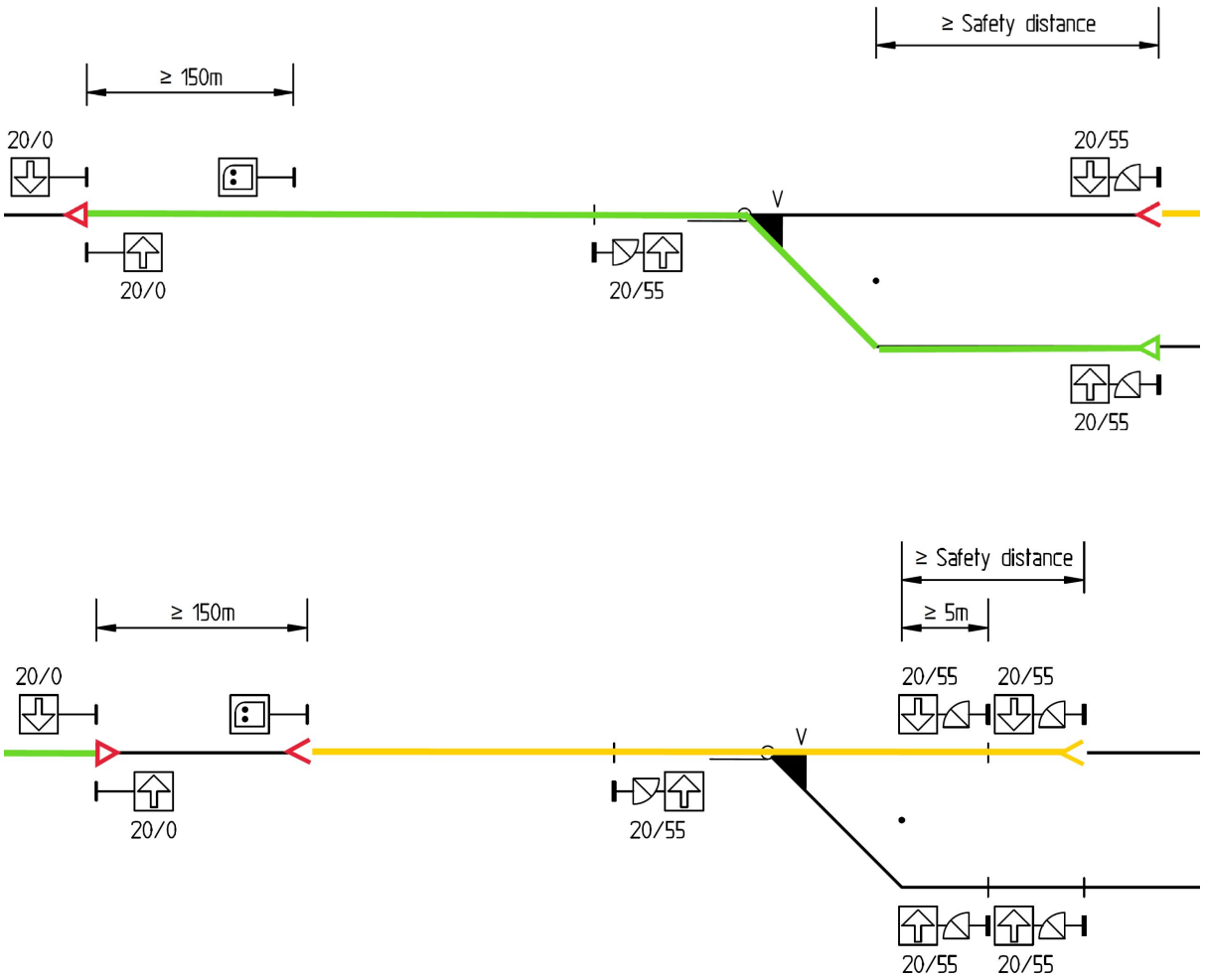
ENI-SS-ENG-1643

Shunting routes shall be engineered as shown in the figures below related to safety distance, safety zone and release speed .

Comments: *Ref to requirement for Safety distance in ENG-816*






≥ Safety distance
≥ 150m
20/0
20/55
V
20/0
20/55
20/55
≥ Safety distance
≥ 150m
≥ 5m
20/0
20/55
20/55
V
20/0
20/55
20/55
20/55

30.2 Four track station double track line

Release speed, safety distance and safety zone on a four-track station

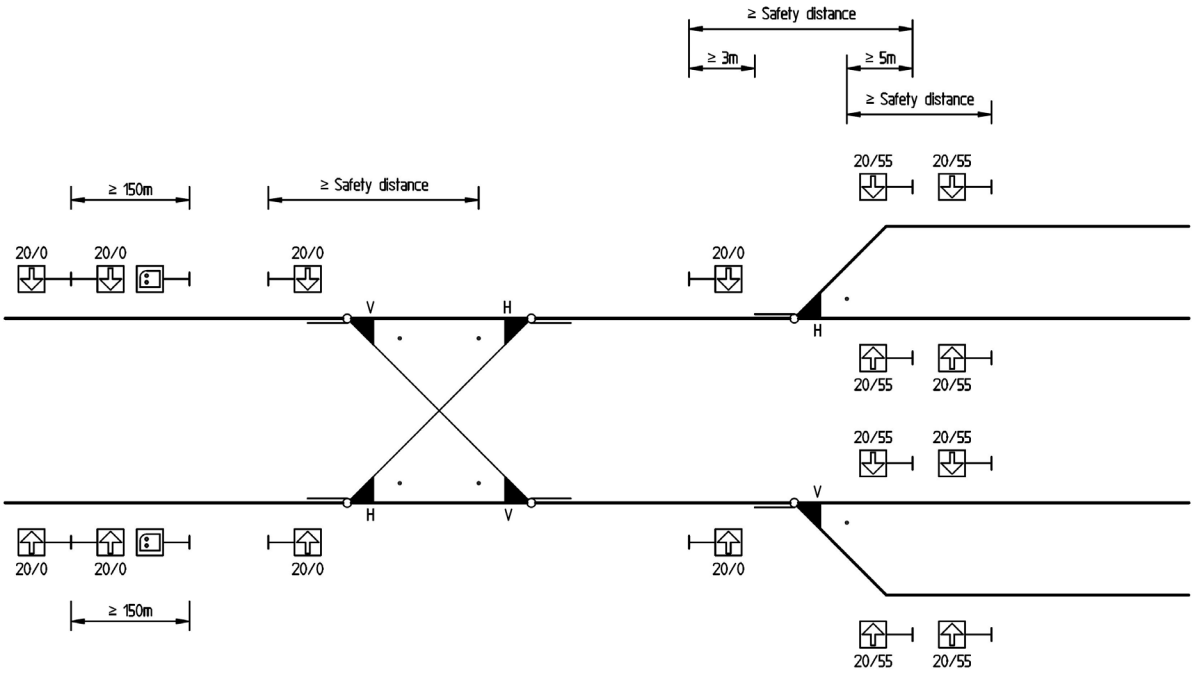
Rationale: *Station entrance and exit MBs are engineered with 20/0 for consecutive routes towards the station or the line.*

Inner MBs for entry are engineered with 20/0 for consecutive routes towards the station.

Inner MBs for exit are engineered respectively as 20/55 for simultaneous train movements and 20/55 for longer trains without simultaneous train movements. Note that on many stations on double track lines the distance from the MB having 20/55 to the point's fouling point is long enough to enable simultaneous train movements without double set of MBs.

ENI-SS-ENG-811 On a four-track station, release speeds, safety distances and saftey zones shall be engineered as the figure below.

Comments: *Conflicting train movements towards same location are limited by generic function in IL.*



The figure above shows release speed and safety zone above/under each MB e.g. 20/0 being release speed of 20 km/h and 0 meters safety zone.

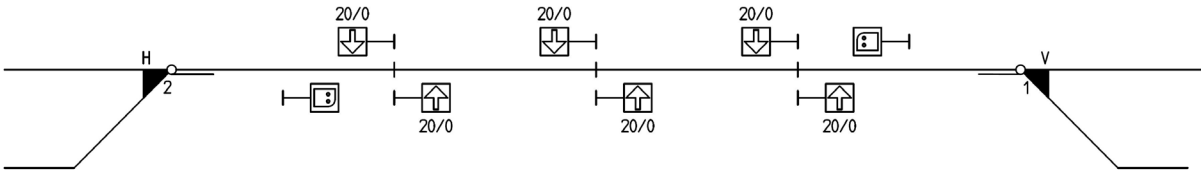
30.3 Single track line

Release speed and safety zone at block posts on single track lines

ENI-SS-ENG-812

On single track line the block posts' release speed and safety zones shall be engineered as in the figure below.

Comments: *Conflicting train movements towards same location are limited by generic function in IL.*



The figure above shows release speed and safety zone above/under each MB e.g. 20/0 being release speed of 20 km/h and 0 meters safety zone.

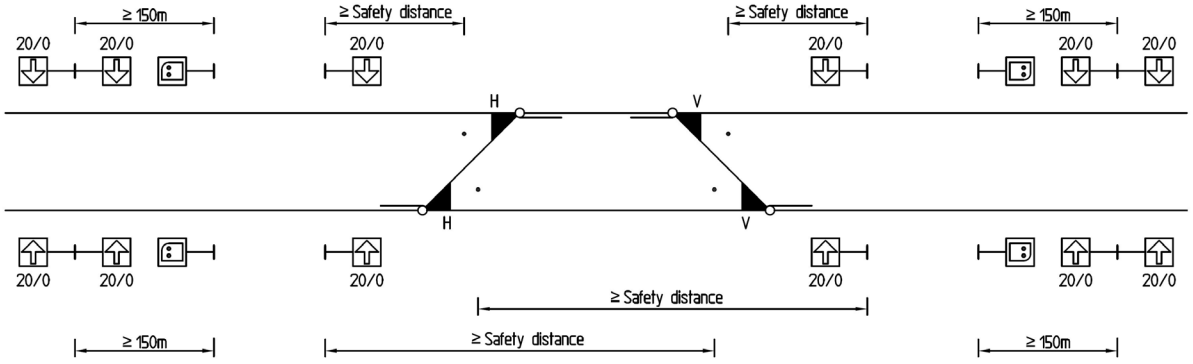
30.4 Double track line

Release speed, safety distance and safety zone at block posts on double track lines

ENI-SS-ENG-813

On double track line the block posts' release speeds, safety distances and safety zones shall be engineered as in the figure below.

Comments: *Conflicting train movements towards same location are limited by generic function in IL.*



The figure above shows release speed and safety zone above/under each MB e.g. 20/0 being release speed of 20 km/h and 0 meters safety zone. Safety distances are given in meters where necessary.

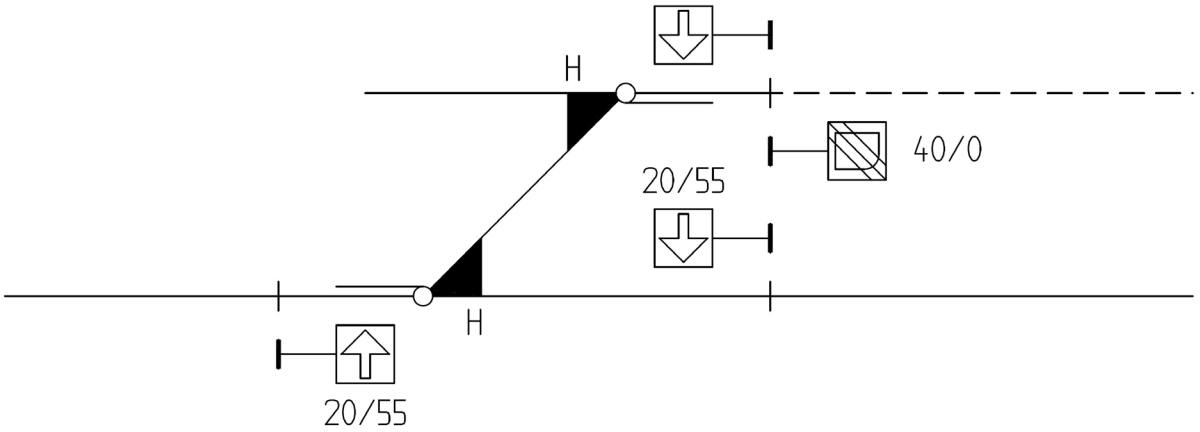
30.5 Border to PSA

Release speed and safety zone at border to PSA

Rationale: *The release speed for driving into the PSA is normally 40km/h. A lower release speed can be used, if maximum allowed speed in point is lower than 40 km/h.*

ENI-SS-ENG-815 At border to PSA release speed and safety zone shall be engineered as in the figure below.

Comments: *The MB used as a start point for routes from the siding does not require release speed or safety zone.*



The figure above shows release speed and safety zone above/under each MB e.g. 20/55 being release speed of 20 km/h and 55 meters safety zone.

30.6 Border to NTC

Release speed and safety zone at border to NTC

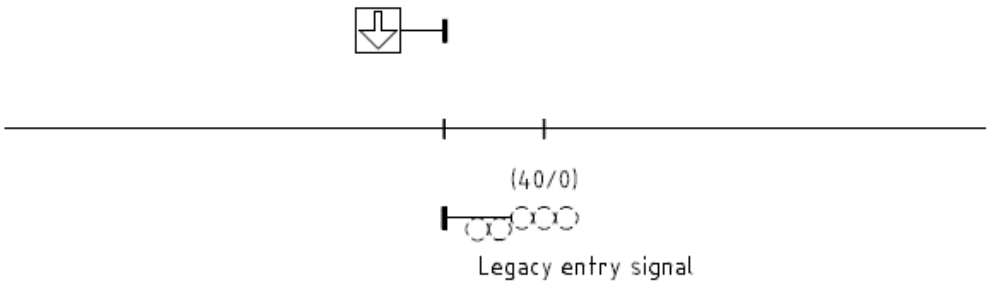
Rationale: *The release speed for driving into the NTC area is normally 40 km/h (legacy ATC)*

ENI-SS-ENG-1689

At border to NTC release speed and safety zone shall be engineered as in the figure below.

Comments: *Release speed is configured for the fictive signalling point at the signalling system border placed at the location of the legacy entry signal.*

The MB for driving into the L2 area will only function as a start point for train route and no release speed and safety zone is required.



The figure above shows release speed and safety zone e.g. 40/0 being release speed of 40 km/h and 0 meters safety zone.

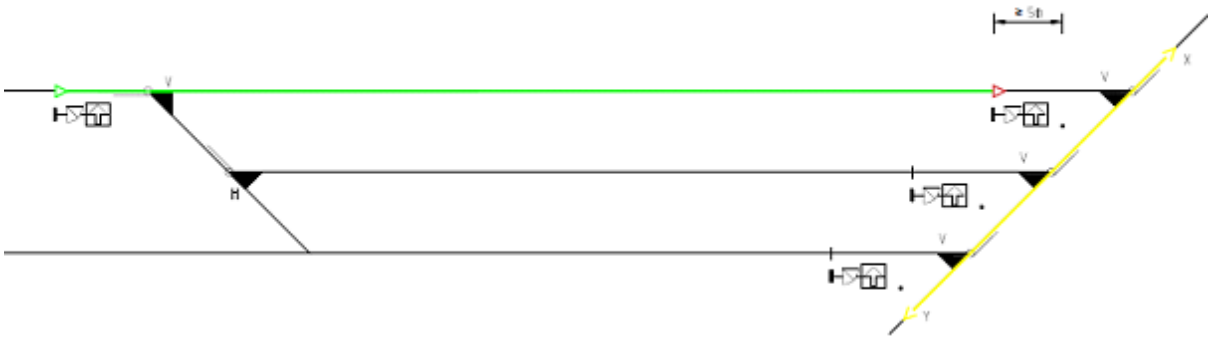
30.7 Train routes to shunting area

Train routes to shunting area

Rationale: *To be able to transfer railway vehicles to shunting areas supervised by train routes without reducing shunting capacity of shunting area.*

ENI-SS-ENG-1734

Train routes ending at shunting area and used according to defined mode of operation "Transfer of railway vehicles" may have a reduced safety distance according to the figure below.



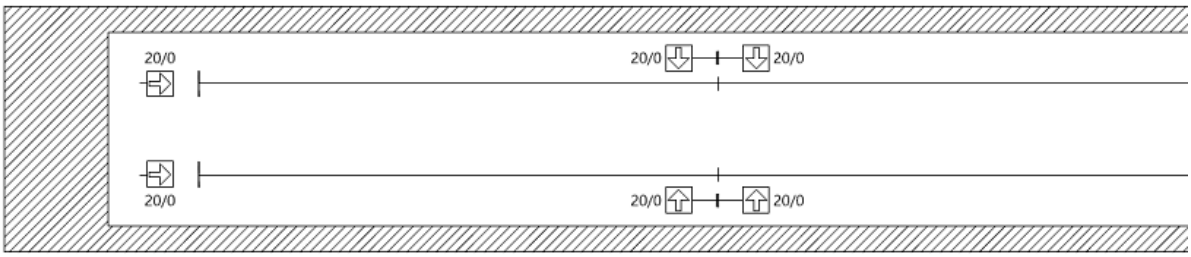
30.8 Dead end track

Release speed and safety zone in dead end tracks

ENI-SS-ENG-1392

In dead end tracks release speed and safety zone shall be engineered as in the figure below.

Comments: *Conflicting train movements towards same location are limited by generic function in IL.*



30.9 Safety distance when short block sections are used

Allowed intervals for block sectioning

Rationale: *To obtain required safety distance towards preceding train when short block sections are used.*

ENI-SS-ENG-1647

a) < 101 meters - used to achieve simultaneous train movements on stations

b) 171 ≤ 207 meters

c) > 277 meters

Comments: *a) is applicable for all lines.*

b) and c) is applicable at lines with short required headway (i.e. inner IC).

b) and c) is not applicable where safety zone > 0 meters is required for signalling point at end of section. This will result in always fulfillment of safety distance.

30.10 Parallel routes

The required safety distances and safety zones to conflicting train routes, shunting routes, TSA and WA according to ENG-816 also apply for parallel train and shunting routes with the two following exceptions.

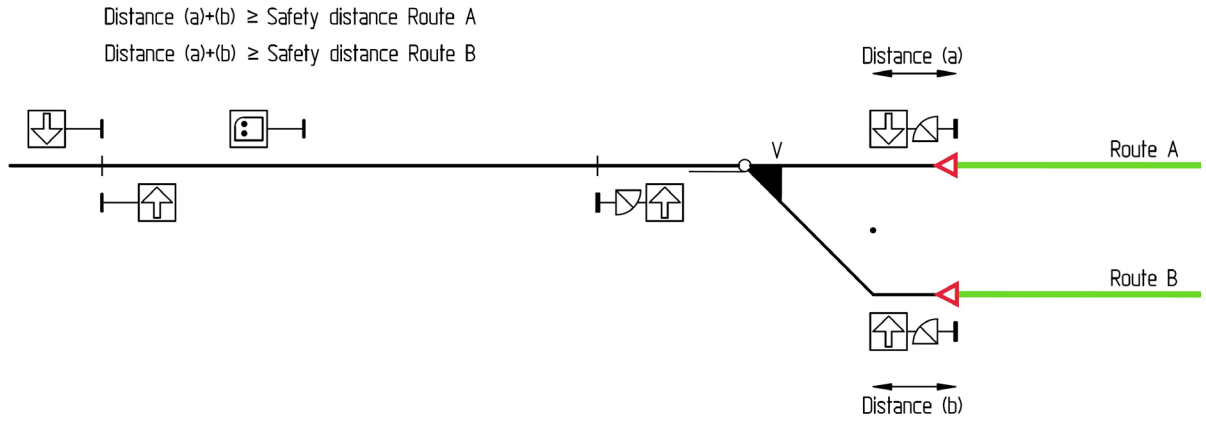
The requirements don't apply if the parallel train or shunting routs goes through the same points. In this case is impossible to set both complete routes at the same time. It is therefore not possible for two trains to approach the parallel end point of the routes at full speed at the same time.

The requirement also does not apply in cases where safety distances after one of the routes stops ahead of fouling point. In this case it is possible to have a trainroute through the point at the same time. If this is the case, it is not necessary to consider if safety distance after the other train route that goes via fouling point and into the parallel track where it passes the end point of the first route.

Parallel routes and safety distance

ENI-SS-ENG-1928

The safety distances in ENG-816 towards conflicting train and shunting routes shall apply to parallel routes via common fouling point.



Parallel routes - Exception

ENI-SS-ENG-1929

Exception: The safety distances in ENG-816 shall not apply for parallel routes going through common points.

Comments: *It is not possible to have train at full speed in two parallel routes ending in parallel Marker Boards if the routes are going through common points.*

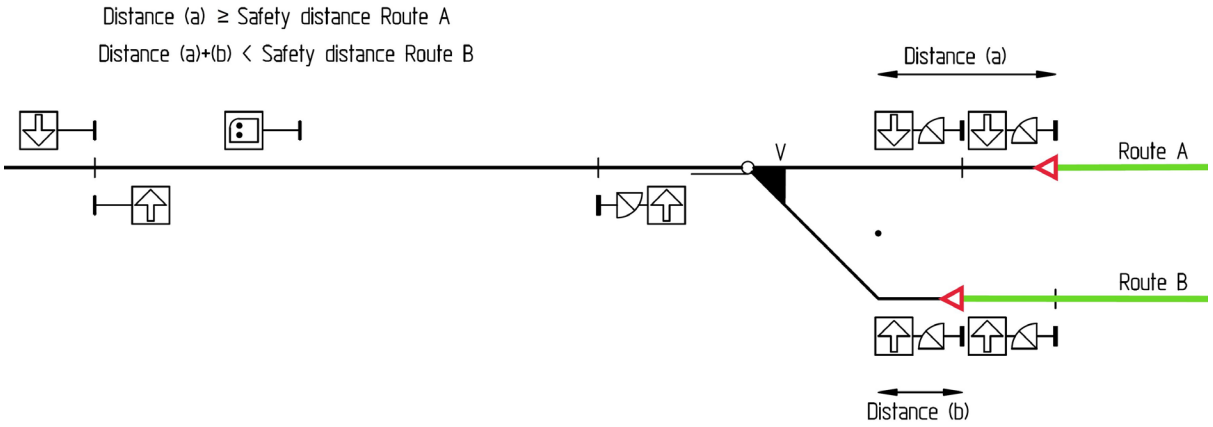
Parallel routes - Exception

ENI-SS-ENG-1930

Exception: The safety distances in ENG-816 shall not apply for parallel routes if safety distances for one of the routes stops before fouling point.

Comments: *Train and shunting routes is accepted thru a point in cases where safety distance after another route stops before fouling point. In these cases, safety distance thru the point is also accepted instead of train and shunting route.*

Figure below shows an example were the safety distance after one train route stops before fouling point. Therefore, the safety distance after the other train route can also go through the point and via fouling point past a opposite endpoint of route.



30.11 Compensation for gradients

The length of safety distance and safety zones shall be corrected for gradients according to the following requirements.

The calculations can be made with the Marker Board placed at a distance in relation to conflicts (according to ENG-816) that are not compensated for gradients. Moving the Marker Board to a position that is compensated for gradients does not require a new calculation to be made for the new location.

If the track ahead of the Marker Board is shorter than 700m, the available track length is used for the calculation.

In cases were both Bane NOR and other companies have calculated compensation with different inputs, it is possible to achieve different results. Acceptable difference is 1m at release speed 20 km/h and 4m at release speed 40 km/h.

Calculation of gradients for compensation

ENI-SS-ENG-1936 The following two calculations shall be used to determine the gradient. The most restrictive value shall be used as a basis for correcting the safety distance and safety lengths.

ENI-SS-ENG-1937 Gradients from a point 100 m ahead of the end point of the train route to a point 70/130/210 m behind the end point of the train route.

ENI-SS-ENG-1938 Gradients from a point 700 m ahead of the end point of the train route to a point 70/130/210 m behind the end point of the train route.
Comments: *A point 70/130/210 m behind the end point of the train route is depending on release speed 20/30/40 km/h.*
The calculation can be done from a position 100/700m ahead of the Marker Board and 70/130/210m behind the Marker Board that gives most fall regardless of whether there are significantly higher or lower parts of the track between these

Used combination of gradients

ENI-SS-ENG-1939 If there are several possible train routes towards a Marker Board, and several possible directions for safety distance and safety zones after the same Marker Board, the combination that gives longest safety distance and safety zones shall be used for all train routes ending in the Marker Board.

Compensation to safety distance and overlap

ENI-SS-ENG-921

For found gradients according to ENG-1936 the following compensation to safety distances and safety zones shall be done

Comments: *The calculated gradient shall be rounded so the most restrictive compensation is used.*

Gradients outside the scope of the table has to be handled separately.

Gradient [‰]	Compensation [m], with release speed [km/h]:			Gradient [‰]	Compensation [m], with release speed [km/h]:		
	20 km/h	30 km/h	40 km/h		20 km/h	30 km/h	40 km/h
-30.0	+39	+112	+250	+0.5	0	0	0
-29.5	+37	+108	+237	+1.0	0	-1	-1
-29.0	+35	+104	+225	+1.5	0	-1	-1
-28.5	+33	+100	+215	+2.0	0	-2	-1
-28.0	+31	+96	+205	+2.5	0	-2	-2
-27.5	+29	+92	+197	+3.0	0	-3	-2
-27.0	+27	+88	+190	+3.5	-1	-3	-3
-26.5	+25	+85	+182	+4.0	-1	-4	-4
-26.0	+24	+81	+173	+4.5	-1	-5	-4
-25.5	+23	+77	+162	+5.0	-1	-5	-5
-25.0	+22	+73	+150	+5.5	-1	-5	-5
-24.5	+21	+69	+137	+6.0	-1	-6	-6
-24.0	+20	+65	+125	+6.5	-1	-6	-6
-23.5	+19	+60	+115	+7.0	-1	-6	-7
-23.0	+18	+56	+107	+7.5	-2	-7	-7
-22.5	+17	+50	+99	+8.0	-2	-7	-8
-22.0	+16	+45	+92	+8.5	-2	-7	-8
-21.5	+15	+41	+86	+9.0	-2	-8	-9
-21.0	+14	+39	+82	+9.5	-2	-8	-9
-20.5	+14	+37	+78	+10.0	-2	-8	-10
-20.0	+13	+35	+75	+10.5	-2	-8	-10
-19.5	+13	+34	+73	+11.0	-3	-9	-11
-19.0	+12	+32	+71	+11.5	-3	-9	-11
-18.5	+12	+30	+68	+12.0	-3	-9	-12
-18.0	+11	+28	+65	+12.5	-3	-10	-12
-17.5	+11	+27	+62	+13.0	-3	-10	-13
-17.0	+11	+26	+59	+13.5	-3	-10	-13
-16.5	+11	+25	+56	+14.0	-3	-11	-14
-16.0	+10	+24	+53	+14.5	-4	-11	-14
-15.5	+10	+22	+49	+15.0	-4	-12	-15
-15.0	+9	+20	+45	+15.5	-4	-12	-15
-14.5	+9	+20	+43	+16.0	-4	-12	-16
-14.0	+8	+19	+41	+16.5	-4	-13	-16
-13.5	+8	+18	+39	+17.0	-4	-13	-17
-13.0	+8	+17	+38	+17.5	-4	-13	-17
-12.5	+7	+16	+36	+18.0	-4	-13	-18
-12.0	+7	+16	+35	+18.5	-4	-14	-18
-11.5	+6	+15	+33	+19.0	-4	-14	-19
-11.0	+6	+13	+30	+19.5	-5	-14	-20
-10.5	+6	+12	+28	+20.0	-5	-15	-20
-10.0	+6	+11	+25	+20.5	-6	-16	-21
-9.5	+5	+10	+24	+21.0	-6	-16	-21
-9.0	+5	+10	+23	+21.5	-7	-17	-22
-8.5	+5	+9	+22	+22.0	-7	-17	-22
-8.0	+5	+8	+20	+22.5	-7	-17	-23
-7.5	+5	+8	+19	+23.0	-7	-17	-23
-7.0	+4	+7	+18	+23.5	-7	-17	-24
-6.5	+4	+6	+17	+24.0	-8	-17	-24
-6.0	+4	+5	+16	+24.5	-8	-18	-25

-5.5	+4	+4	+16	+25.0	-8	-18	-25
-5.0	+3	+3	+15	+25.5	-8	-18	-26
-4.5	+3	+3	+14	+26.0	-8	-19	-27
-4.0	+3	+2	+12	+26.5	-8	-19	-28
-3.5	+3	+2	+10	+27.0	-9	-19	-28
-3.0	+2	+2	+8	+27.5	-9	-19	-29
-2.5	+2	+1	+6	+28.0	-9	-20	-29
-2.0	+2	+1	+5	+28.5	-9	-20	-30
-1.5	+2	+1	+4	+29.0	-9	-20	-31
-1.0	+1	0	+3	+29.5	-9	-20	-32
-0.5	+1	0	+1	+30.0	-9	-21	-33
0	0	0	0				

31 NAMING CONVENTION

31.1 Use of naming convention

The following points describe how naming convention is used:

- Underscore (_) is used for indication of space

Ex. AO_Area code → AO 1

- Addition (+) is used for indication of no space

Ex. W + Location number → W1

31.2 Area codes and line number codes

Area codes (stedskoder) are used to relate objects to a specific location.

Station area code

ENI-SS-ENG-943

Stations shall be given a specific two-three letter area code.

Comments: *Ex. Lillestrøm – LLS.*

Area codes are given here:
https://orv.banenor.no/sjn/doku.php?id=generell_del:1.1_jernbanenettets_inndeling#stedskoder

Block post area code on single track line

ENI-SS-ENG-1377

Block posts on single track lines shall have area codes given by the block post's name, a specific two, three or four letters abbreviation.

Block post area code on double track line

ENI-SS-ENG-1378

Block posts on double track lines shall have an area code based on the requirements given in ENG-1023, ENG-1024, ENG-1420 and ENG-1421.

Area codes on Marker board and schematics

ENI-SS-ENG-1238

Area codes shall only be used physically on the Marker board and on the top of the schematics.

Line number

Rationale: *To give an object a uniqe number relative to location.*

ENI-SS-ENG-1376

Line number shall be a 4 digit number used if an object needs this as a reference.

Comments: *Line number are given here:*
http://innsyn.banedata.no/Innsyn/spsrap_lokasjon.aspx

31.3 Marker Boards

31.3.1 Entry Marker Boards

Entry Marker Board naming

ENI-SS-ENG-950 Entry Marker Boards shall be named **Letter (1-2 letters) + Location number (1 digit) + Driving direction (1 digit) + Area code (2-3 letters).**

Entry Marker Boards in ascending kilometre

ENI-SS-ENG-951 Letters: A, C, E, G and K shall be used for entry Marker Boards in ascending kilometre.

Entry Marker Boards in descending kilometre

ENI-SS-ENG-952 Letters B, D, F, H and J shall be used for entry Marker Boards in descending kilometre.

Entry Marker Boards on double track line

ENI-SS-ENG-953 For double track lines letter U is added in front of the letter to the Marker Board in left track in ascending kilometre.

Entry Marker Boards driving direction

ENI-SS-ENG-954 Driving direction shall be – 1, for ascending kilometre (odd number), and – 2 for descending kilometre (even number).

The table below shows all available Letter + Location number combinations for entry Marker Boards in ascending kilometre:

Letter	A	UA	C	UC	E	UE	G	UG	K	UK
Location number + Driving direction	01	11	21	31	41	51	61	71	81	91

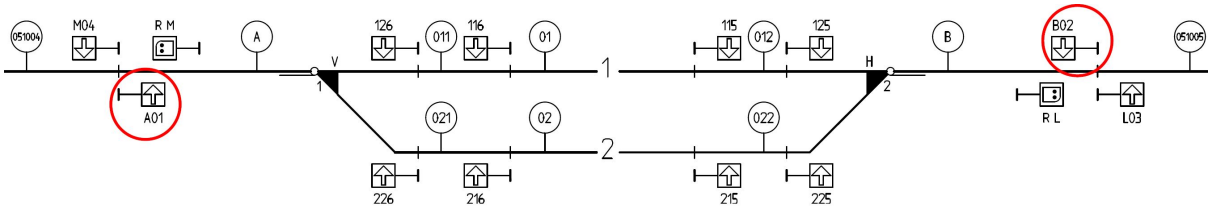
The table below shows all available Letter and Location number combinations for entry Marker Boards in descending kilometre:

Letter	B	UB	D	UD	F	UF	H	UH	J	UJ
Location number + Driving direction	02	12	22	32	42	52	62	72	82	92

Entry Marker Boards naming combinations

ENI-SS-ENG-960 Location numbers shall always be used in combination with the defined letter, as shown in the tables above.

Figure below shows an example of naming of entry Marker Boards in a two track station.



31.3.2 Exit Marker Boards

Exit Marker Boards naming

ENI-SS-ENG-964 Exit Marker Boards shall be named **Letter (1-2 letters) + Location number (1-2 digits) + Driving direction (1 digit) + Area code (2-3 letters).**

Comments: *This is also applicable for the exit signal placed next to the optical legacy entry signal at Signalling System boarders.*

Exit Marker Boards in descending kilometre

ENI-SS-ENG-965 Letters: M, O, S, Y and Æ shall be used for exit Marker Boards in descending kilometre.

Exit Marker Boards in ascending kilometre

ENI-SS-ENG-966 Letters L, N, P, T, X and Ø shall be used for exit Marker Boards in ascending kilometre.

Exit Marker Boards on double track line

ENI-SS-ENG-967 For double track lines letter U is added in front of the letter to the Marker Board in left track in ascending and descending kilometre.

Exit Marker Boards driving direction

ENI-SS-ENG-968 Driving direction shall use – 3, for ascending kilometre (odd number), and – 4 for descending kilometre (even number).

The table below shows all available Letter + Location number + Driving direction combinations for exit Marker Boards in ascending kilometre:

Letter	L	UL	N	UN	P	UP	T	UT	X	UX	Ø	UØ
Location number + Driving direction	03	13	23	33	43	53	63	73	83	93	103	113

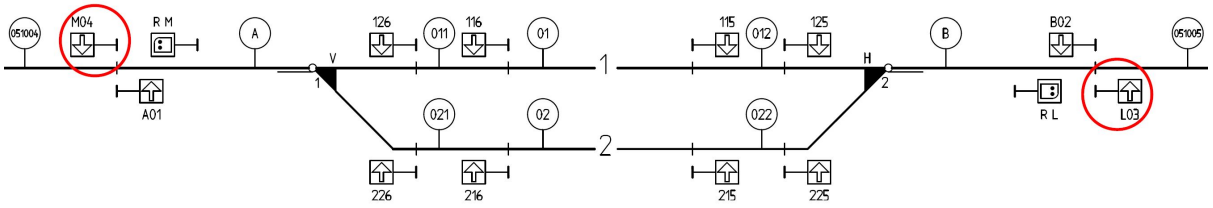
The table below shows all available Letter + Location number combinations for exit Marker Boards in descending kilometre:

Letter	M	UM	O	UO	S	US	Y	UY	Æ	UÆ
Location number + Driving direction	04	14	24	34	44	54	64	74	84	94

Exit Marker Boards naming combinations

ENI-SS-ENG-973 Location numbers shall always be used in combination with the defined letter, as shown in the tables above.

Figure below shows an example of naming of exit Marker Boards in a two track station.



31.3.3 Inner Marker Boards in platform/station track

Inner Marker Boards naming

ENI-SS-ENG-977 These Marker Boards shall be named **Track number (1-2 digits) + Location number (1 digit) + Driving direction (1 digit) + Area code.**

Inner Marker Boards track number

ENI-SS-ENG-978 Track number is the specific number of each platform/station track, starting from -1.

Inner Marker Boards location number

ENI-SS-ENG-979

Location number is the number that shows the Marker Boards location in the train running direction (first, second, third, … Marker Board in tracks engineered for simultaneous train movements).

Comments: *Ex: 115, 125, 135, …*

Inner Marker Boards driving direction

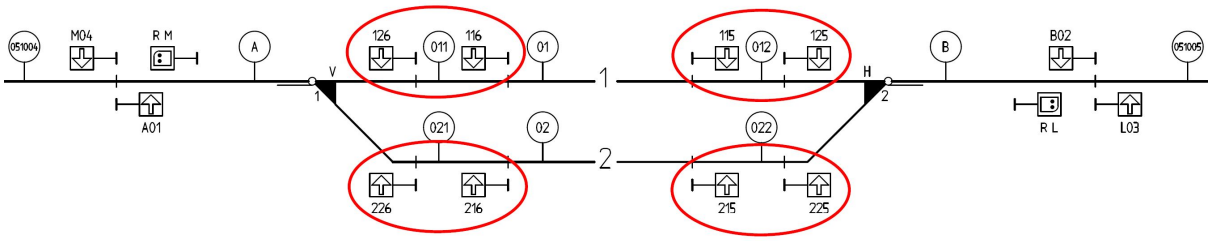
ENI-SS-ENG-980

Driving direction shall use – 5, for ascending kilometre (odd number), and – 6 for descending kilometre (even number).

The table below shows examples of Track number + Location number + Driving direction for these Marker Boards:

	«Outmost» Inner MB Ascending km.	«Most inner» Inner MB Ascending km.	Track	«Most inner» Inner MB Descending km.	«Outmost» Inner MB Descending km.
Track number + Location number + Driving direction	125	115	1	116	126
	225	215	2	216	226
	325	315	3	316	326
	425	415	4	416	426
	(n)25	(n)15	(n)	(n)16	(n)26
	(n+1)25	(n+1)15	(n+1)	(n+1)16	(n+1)26

Figure below shows an example of naming of these Marker Boards in a two track station.



Inner marker board on double track

ENI-SS-ENG-1730

Inner marker boards at station on double track line with less than three tracks shall be named according to ENG-986 "Marker Boards outside point naming".

31.3.4 Marker Boards located between the entry-/exit Marker Board and the first point in a station (that divide the platform/station tracks)

Marker Boards outside point naming

ENI-SS-ENG-986 These Marker Boards shall be named **Number series (1 digit) + Running number (2 digits) + Driving direction (1 digit) + Area code.**

Marker Boards outside point number series

ENI-SS-ENG-987 Number series shall be 9000.

Marker Boards outside point number series at large stations

ENI-SS-ENG-1613 Number series should be X000.

Comments: *In lager stations areas marker boards located in different parts of the station area may be divided into groups. X in the number series corresponds to the applicable group.*

Marker Boards outside point running number

ENI-SS-ENG-988 Running number shall be 0-99 and starts at the applicable station Boarder (A side - ascending kilometre and B side - descending kilometre), in right track (if double track), and continues in driving direction.

Marker Boards outside point running number at large stations.

ENI-SS-ENG-1614 Running number should be 0-99 and start at the station Boarder (A side - ascending kilometer and B side - descending kilometer), in right track (if double track), and continues in driving direction.

Comments: *Running number may follow a logical pattern not necessarily according to the kilometre.*

Marker Boards outside point driving direction

ENI-SS-ENG-989 Driving direction shall use – 5, for ascending kilometre (odd number), and – 6 for descending kilometre (even number).

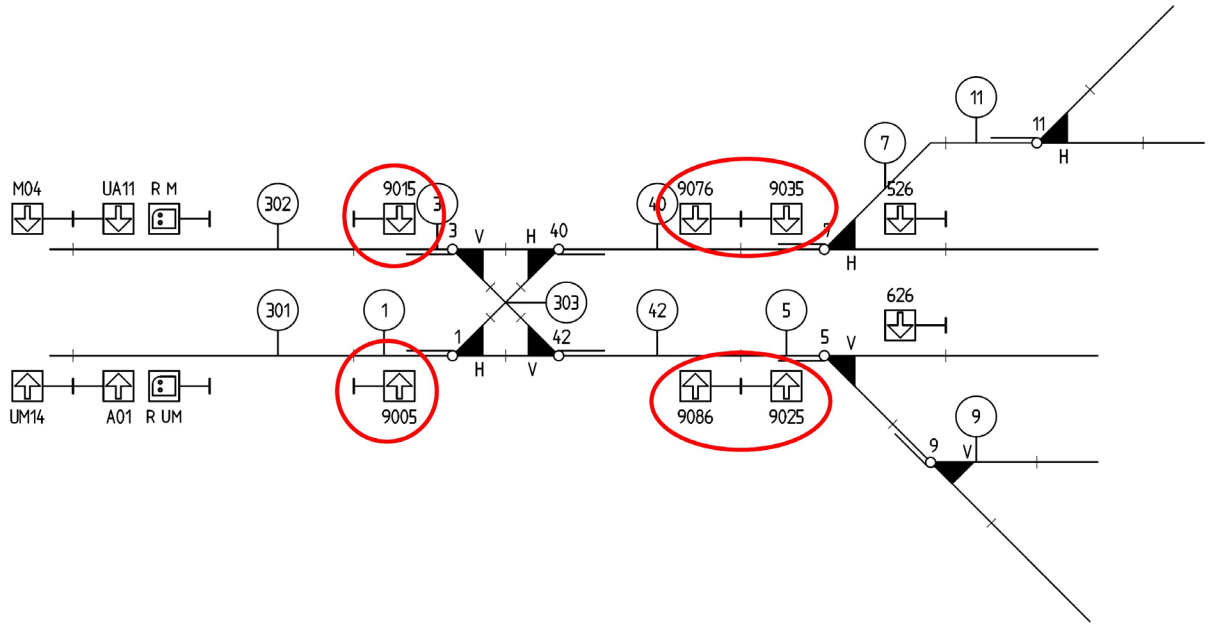
The table below shows examples of Number series (1 digit) + Running number (2 digits) + Driving direction (1 digit) combinations for these Marker Boards in ascending kilometre:

Number series + Location number + Driving direction	9005	9015	9025	9035	9045	9055	9065	9075	9085	9095	9105	9(n)5	9(n+1)5

The table below shows examples of Number series (1 digit) + Running number (2 digits) + Driving direction (1 digit) combinations for these Marker Boardin descending kilometre:

Number series + Location number + Driving direction	9006	9016	9026	9036	9046	9056	9066	9076	9086	9096	9106	9(n)6	9(n+1)6

Figure below shows an example of naming of these Marker Boards at a station.



31.3.5 Block post Marker Boards on single track line

Block post Marker Boards naming

ENI-SS-ENG-997 Block post Marker Boards on single track line shall be named **Letter + Location number (1-2 digits) + Driving direction (1 digit) + Area code.**

Block post Marker Boards ascending kilometre

ENI-SS-ENG-998 Letter A shall be used for block post Marker Boards in ascending kilometre.

Block post Marker Boards descending kilometre

ENI-SS-ENG-999 Letter B shall be used for block post Marker Boards in descending kilometre.

Block post Marker Boards driving direction

ENI-SS-ENG-1001 Driving direction shall be – 7, for ascending kilometre (odd number), and – 8 for descending kilometre (even number).

Block post Marker Boards location number

ENI-SS-ENG-1002 Location number is the number of the Marker Board, in each track, in ascending kilometre.

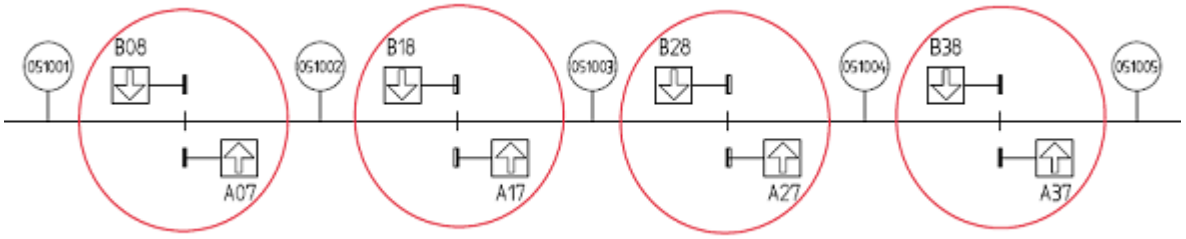
The table below shows examples of Letter + Location number (1-2 digits) + Driving direction (1 digit) combinations for block post Marker Boards on single track line in ascending kilometre:

Letter	A	A	A	A	A	A	A	A	A	A	A	A	A
Location number + Driving direction	07	17	27	37	47	57	67	77	87	97	107	(n)7	(n+1)7

The table below shows examples of Letter + Location number (1-2 digits) + Driving direction (1 digit) combinations for block post Marker Boards on single track line in descending kilometre:

Letter	B	B	B	B	B	B	B	B	B	B	B	B	B
Location number + Driving direction	08	18	28	38	48	58	68	78	88	98	108	(n)8	(n+1)8

Figure below shows an example of naming of block post Marker Boards on single track line:



31.3.6 Block post Marker Boards on double track line.

Block post Marker Boards on double track naming

ENI-SS-ENG-1010 Block post Marker Boards on double track line shall be named **Letter + Track number (1 digit) + Location number (1-2 digits) + Driving direction (1 digit) + Area code (4 letters).**

Block post Marker Boards on double track ascending kilometre

ENI-SS-ENG-1017 Letter A shall be used for block post Marker Boards in ascending kilometre.

Block post Marker Boards on double track descending kilometre

ENI-SS-ENG-1018 Letter B shall be used for block post Marker Boards in descending kilometre.

Block post Marker Boards on double track

ENI-SS-ENG-1019 For double track line, U shall be added in front of the letter to the Marker Board in left track in driving direction.

Block post Marker Boards on double track number

ENI-SS-ENG-1418 Track number shall be used to name the track on the right hand side seen from Oslo "1", and the track on the left hand side seen from Oslo "2".

Block post Marker Boards on double track location number

ENI-SS-ENG-1021 Location number shall be used for numbering the block post Marker Boards, in ascending kilometre between two stations.

Block post Marker Boards on double track driving direction

ENI-SS-ENG-1020 Driving direction shall be – 7, for ascending kilometre (odd number), and – 8 for descending kilometre (even number).

Block post Marker Boards on double track area code naming

ENI-SS-ENG-1023 Area code shall be **Line name (2 letters) + Line section (1 letter) + Running letter (1 letter)**

Block post Marker Boards on double track alternative area code line name

ENI-SS-ENG-1024 Line name shall be 2 specific letters for each line as shown in the table below.

Comments: *E.g. FL – Follobanen*

Line name	Abbreviation
Askerbanen	AS
Bergensbanen	BE
Dovrebanen	DV
Drammenbanen	DR
Follobanen	FL
Gardermobanen	GM
Gjøvikbanen	GJ
Hovedbanen	HV
Ringeriksbanen	RG
Sørlandsbanen	SØ
Vestfoldbanen	VE
Østfoldbanen	ØV

Block post Marker Boards on double track line section

ENI-SS-ENG-1420 Line section shall be used for naming the line section between two stations, in ascending kilometre.

Block post Marker Boards on double track running number

ENI-SS-ENG-1421 Running letter shall be used for naming the block post marker boards between two stations, in ascending kilometre.

The tables below show examples of **Letter + Track number (1 digit) + Location number (1-2 digits) + Driving direction (1 digit) + Area code (4 letters)** combinations for block post Marker Boards on double track line in ascending kilometre (the bold line represents a station):

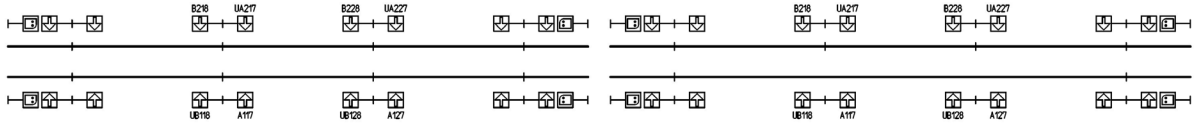
Letter	A	A	A	A	A	A	A	A
Track number, Location number, Driving direction	117	127	137	117	127	137	147	157
Area code	DRAA	DRAB	DRAC	DRBA	DRBB	DRBC	DRBD	DRBE

Letter	UA	UA	UA	UA	UA	UA	UA	UA
Track number, Location number, Driving direction	217	227	237	217	227	237	247	257
Area code	DRAA	DRAB	DRAC	DRBA	DRBB	DRBC	DRBD	DRBE

Letter	B	B	B	B	B	B	B	B
Track number, Location number, Driving direction	218	228	238	218	228	238	248	258
Area code	DRAA	DRAB	DRAC	DRBA	DRBB	DRBC	DRBD	DRBE

Letter	UB	UB	UB	UB	UB	UB	UB	UB
Track number, Location number, Driving direction	118	128	138	118	128	138	148	158
Area code	DRAA	DRAB	DRAC	DRBA	DRBB	DRBC	DRBD	DRBE

Figure below shows an example of naming of block post Marker Boards on double track line:



31.3.7 Stop for shunting boards.

Stop for shunting boards naming

ENI-SS-ENG-1035 Stop for shunting boards shall be named **Function name _ Letter (1-2 letters) _ Area code.**

Stop for shunting boards function name

ENI-SS-ENG-1036 Function name shall be R.

Stop for shunting boards letter

ENI-SS-ENG-1037 Letter shall be the same as for the following exit Marker Board.

The table below shows all available Function name and Letter combinations for Stop for shunting signals in ascending kilometre:

Function name	R	R	R	R	R	R	R	R	SH	SH	SH	SH
Letter	L	UL	N	UN	P	UP	T	UT	X	UX	Ø	UØ

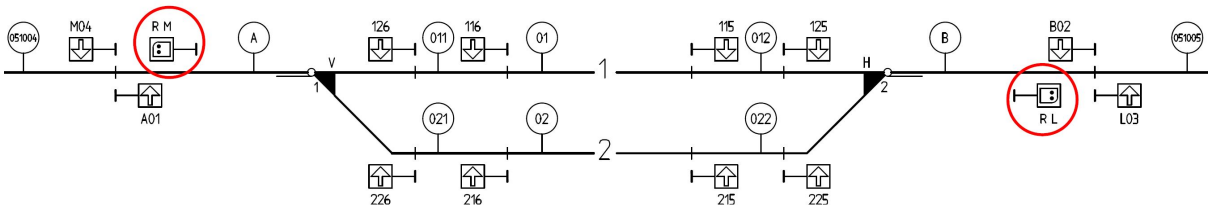
The table below shows all available Function name and Letter combinations for Stop for shunting signals in descending kilometre:

Function name	R	R	R	R	R	R	R	R	SH	SH
Letter	M	UM	O	UO	S	US	Y	UY	Æ	UÆ

Stop for shunting boards naming combinations

ENI-SS-ENG-1042 Location numbers shall always be used in combination with the defined letter, as shown in the tables above.

Figure below shows an example of naming of stop for shunting boards in a two track station.



31.3.8 Level transition board

Naming of Level transition boards

ENI-SS-ENG-1225 Level transition boards shall not be named.

31.3.9 Fictive end and -via point

Fictive endpoint naming

ENI-SS-ENG-1240 Fictive endpoint in ascending kilometre shall be named **Number series (1-2 digits) + Running number (2 digits) + Driving direction (1 digit) + >.**

Fictive endpoint naming

ENI-SS-ENG-1241 Fictive endpoint in descending kilometre shall be named **< + Number series (1-2 digits) + Running number (2 digits) + Driving direction (1 digit).**

Fictive viapoint naming

ENI-SS-ENG-1242 Fictive via point in ascending kilometre shall be named **Number series (1-2 digits) + Running number (2 digits) + Driving direction (1 digit) + >.**

Fictive viapoint naming

ENI-SS-ENG-1615 Fictive via point in descending kilometre shall be named **< + Number series (1-2 digits) + Running number (2 digits) + Driving direction (1 digit).**

Number series

ENI-SS-ENG-1243 Number series shall be 8000.

Number series at large stations

ENI-SS-ENG-1616 Number series should be 8X000.

***Comments: In** lager stations areas fictive endpoints and via points located in different parts of the station area may be divided into groups. X in the number series corresponds to the applicable group.*

Running number

ENI-SS-ENG-1244 Running number shall be 0-99 and starts at the applicable station Boarder (Single track line: A side – ascending kilometre and B side for descending kilometre. Double track line: in right track and continue in driving direction)

Running number at large stations

ENI-SS-ENG-1617 Running number should be 0-99 and start at the station Boarder (Single track line: A side – ascending kilometre and B side for descending kilometre. Double track line: in right track and continue in driving direction)

Comments: *If the station is divided into groups, the running number may follow a logical build up and not the kilometre.*

Driving direction

ENI-SS-ENG-1245 Driving direction shall use – 5, for ascending kilometre (odd number), and – 6 for descending kilometre (even number).

The table below shows examples of Number series (1 digit) + Location number (2 digits) + Driving direction (1 digit) combinations for endpoints in ascending kilometre:

Number series + Location number + Driving direction	8005>	8015>	8025>	8035>	8045>	8055>	8065>	8075>	8085>	8095>	8105>	8(n)5>	8(n+1)5>

The table below shows examples of Number series (1 digit) + Location number (2 digits) + Driving direction (1 digit) combinations for via points in descending kilometre:

Number series + Location number + Driving direction	<8006	<8016	<8026	<8036	<8046	<8056	<8066	<8076	<8086	<8096	<8106	<8(n)6	<8(n+1)6

31.4 Track numbering

Track numbering numeral system

ENI-SS-ENG-1045 Track numbering shall use Arabic numeral system.

31.4.1 Platform/station track numbers in stations

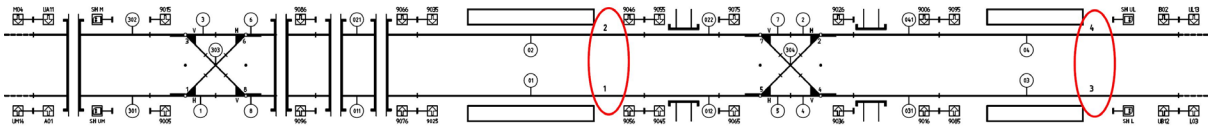
Platform/station track number

ENI-SS-ENG-1047 Each platform/station track within a station shall have a unique track number.

Platform/station track number double track line

ENI-SS-ENG-1379

Each platform track within a station on a double track line shall have a unique track number. Odd numbers in right track in ascending kilometre and even number in left track in ascending kilometre.

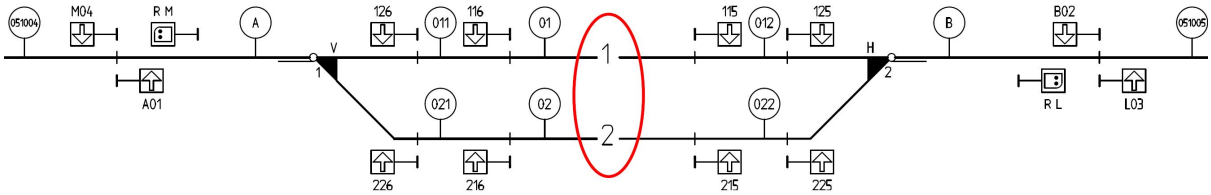


Parallel Platform/station track numbering

ENI-SS-ENG-1048

Parallel platform/station tracks shall be numbered consecutively starting at - 1 (track number 1 is normally/historically located closest to station building).

Figure below shows an example of naming of running track numbers in a two track station.



Comments: Changing exiting track numbering shall only be done if accepted by all relevant stakeholder, because this may lead to changes in other systems (e.g. the Train Planning System – TPS).

31.4.2 Numbering of other tracks in stations

Other station tracks numbering

ENI-SS-ENG-1053

Other tracks parallel to the platform/station tracks shall be numbered consecutively as a continuation of the numbering of platform/station track numbering.

Station track groups

ENI-SS-ENG-1054

On lager stations, tracks that are located in different areas of the station, may be numbered into different groups:

Comments: *For "Shunting track" the number series shall start at 20. Letters are only allowed at freight terminals/shunting yards*

Ex:

- *Group 1: 10, 11, 12….*
- *Group 2: 20, 21, 22….*

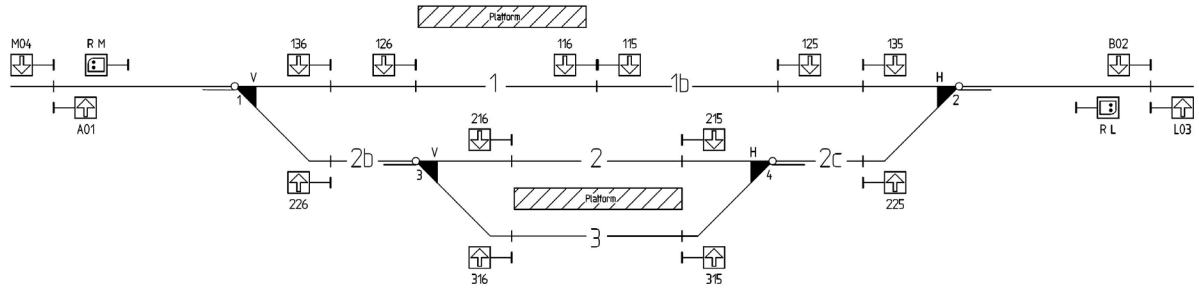
Station track group numbering

ENI-SS-ENG-1055 When there are several track groups within the same station, the group number starts from lowest kilometre.

Splitting of platform/station tracks

ENI-SS-ENG-1380 When there is asymmetric station layout and/or need to split platform/station track, the applicable track numbers shall be extended with a letter to separate the different areas of the track. See figure below.

Comments: *Letter extension shall not be added to platform track number. If letter extension only is needed on a track section on one side of the platform track "b" is used for this track section, independent of if it is on the side with lowest or highest kilometer. If letter extension is needed to be done on both side of the platform track "b" is used on the side with lowest kilometer and "c" on the side with highest kilometer*



31.4.3 Numbering of tracks in shunting yards

Tracks in shunting yards

ENI-SS-ENG-1057 Tracks in shunting yards shall be numbered as platform/station tracks.

Shunting yard track groups

ENI-SS-ENG-1058 On lager shunting yards, tracks that are located in different areas of the station, may be numbered into different groups:

Comments: *Ex:*

- *Group 1: G10, G11, G12….*
- *Group 2: G20, G21, G22….*

31.5 Numbering of TVP sections

TVP section numeral system

ENI-SS-ENG-1060 TVP sections numbers shall use Arabic numeral system.

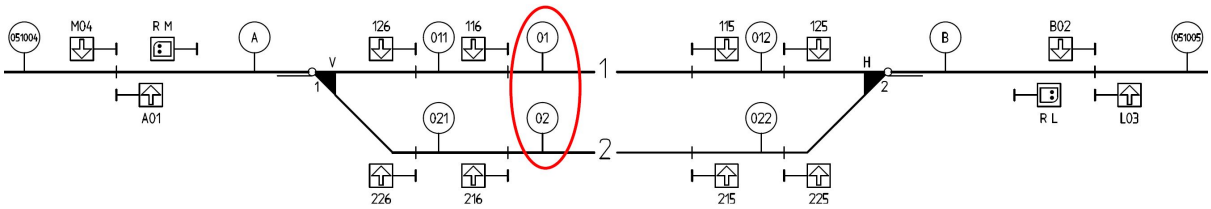
31.5.1 TVP sections in stations

31.5.1.1 TVP sections in platform/station tracks

TVP sections in platform/station tracks

ENI-SS-ENG-1063 TVP sections in platform/station tracks shall be named **0 + Track number (1-2 digits).**

Figure below shows an example of naming of TVP sections in station/platform track in a two track station.



Platform/station track from 11 and on

ENI-SS-ENG-1432 If the number of platform/station tracks from 11 and on, a 0 shall be added, **00 + Track number (2 digits).**

Comments: *To prevent equally named TVP sections*

31.5.1.2 TVP sections between Marker Boards within a platform/station track

TVP sections between Marker Boards within platform/station track

ENI-SS-ENG-1067 These TVP sections shall be named **0 + Track number (1-2 digits) + Driving direction (1 digit).**

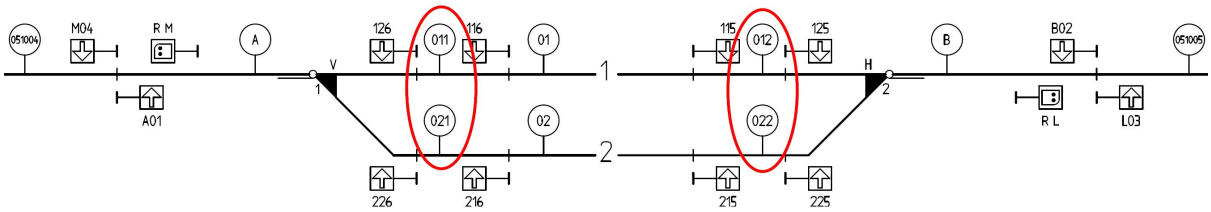
TVP sections between Marker Boards within platform/station track descending kilometre

ENI-SS-ENG-1068 Driving direction shall use odd numbers - 1, 3, 5,... for TVP sections in descending kilometre from platform tracks.

TVP sections between Marker Boards within platform/station track ascending kilometre

ENI-SS-ENG-1069 Driving direction shall use even numbers – 2, 4, 6, …, for TVP sections in ascending kilometre from platform tracks.

Figure below shows an example of naming of these TVP sections.



31.5.1.3 TVP sections covering points

TVP sections covering points

ENI-SS-ENG-1073 TVP sections covering points shall have the same number as the point.

Comments: *If several points share one TVP section, the lowest number of the applicable points shall be used. Manually operated points shall not affecting the numbering of TVP sections, as long as the numbering does not lead to two points with the same number.*

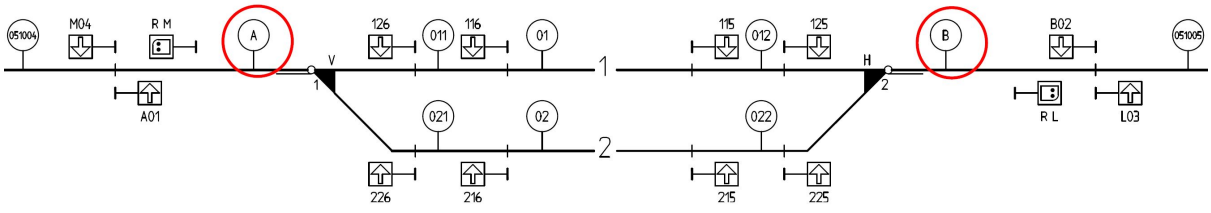
TVP sections in points two track station

ENI-SS-ENG-1074 Exception: For a two track stations, TVP sections from entry Marker Board to Marker Boards in the platform/station tracks shall be named A or B.

TVP sections in points two track station direction

ENI-SS-ENG-1075 A is used for TVP section closest to descending kilometres, B is used for TVP sections closest to ascending kilometres.

Figure below shows an example of naming of TVP sections in points in a two track station.



Additional TVP section in points two track station

ENI-SS-ENG-1386 If there is need for an additional TVP section in the point at a two track station, the sections between the point and the entry Marker Board shall be named A1, A2, A3 etc., or B1, B2, B3, etc.

Two TVP sections in points

ENI-SS-ENG-1076 If there are two TVP sections, one covering the point and one from the point to entry Marker Board. The TVP section covering the point shall have same number as corresponding point.

31.5.1.4 Other TVP sections

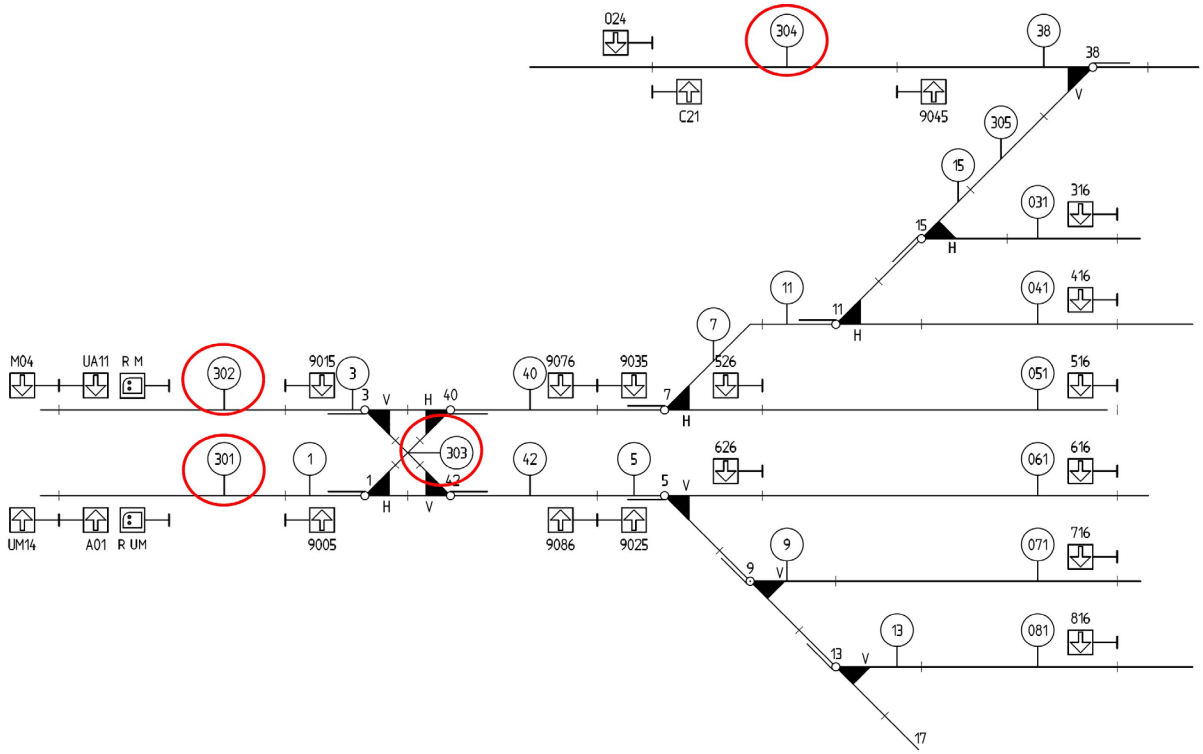
Other TVP sections

ENI-SS-ENG-1080 Other TVP sections in stations that are not covered by the requirements above shall be given numbers in the 300-series.

Other TVP sections numbering

ENI-SS-ENG-1081 Numbering of these TVP section starts with 301 at the stations A side and the numbering continuous in ascending order.

The figure below shows an example of naming of these TVP sections.



Other TVP sections in larger stations areas

ENI-SS-ENG-1082 In larger station areas, other TVP sections not covered by the requirements above should be given numbers in different X00-series.

Comments: *In lager stations areas TVP sections located in different parts of the station area may be divided into groups. X in the number series corresponds to the applicable group.*

31.5.2 TVP sections on single track line

TVP sections on single track line numbering

ENI-SS-ENG-1086 TVP sections on single track line shall be named using **Line number (4 digits) + Running number (2-3 digits).** TVP sections on single track line

TVP sections on single track line running number

ENI-SS-ENG-1087 Running number starts with 01 in ascending kilometres.

Comments: *Ex: 051001, 051002, 051003…*

Dividing TVP sections on single track line

ENI-SS-ENG-1088 If it in the future should be required to divide a TVP section in two or more sections, -1, -2, -3, -(n), (n+1)- can be added to the sections number in ascending kilometre.

Comments: *Ex: 051001-1, 051001-2….*

31.5.3 TVP sections on double track line

TVP sections on double track line naming

ENI-SS-ENG-1092 TVP sections on double track line shall be named using **Line number (4 digits) + Running number (2-3 digits).**

TVP sections on double track line odd running number

ENI-SS-ENG-1093 Odd running numbers is used for right track in ascending kilometres.

Comments: *Ex: 051001, 051003, 051005…*

TVP sections on double track line even running number

ENI-SS-ENG-1094 Even running numbers is used for right track in descending kilometres.

Comments: *Ex: 051002, 051004, 051006…*

31.5.4 TVP sections in sidings

TVP sections in sidings signalled as stations

ENI-SS-ENG-1382 Numbering of TVP sections at sidings shall in general be done according to naming conventions for stations.

31.5.5 TVP sections for level crossing systems

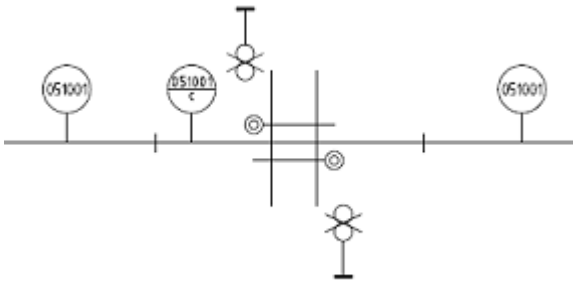
TVP sections for deactivating level crossing systems on line

Rationale: *TVP section for deactivation of level crossing systems is separated from TVP section of IL and shall therefor have its separated name.*

ENI-SS-ENG-1098 TVP section used for deactivation of a level crossing system on the line shall be named **"c"**.

Comments: *TVP section of the level crossing system, and the overlapping TVP section of the IL shall both be named.*

The figure below shows an example of naming of this TVP section.



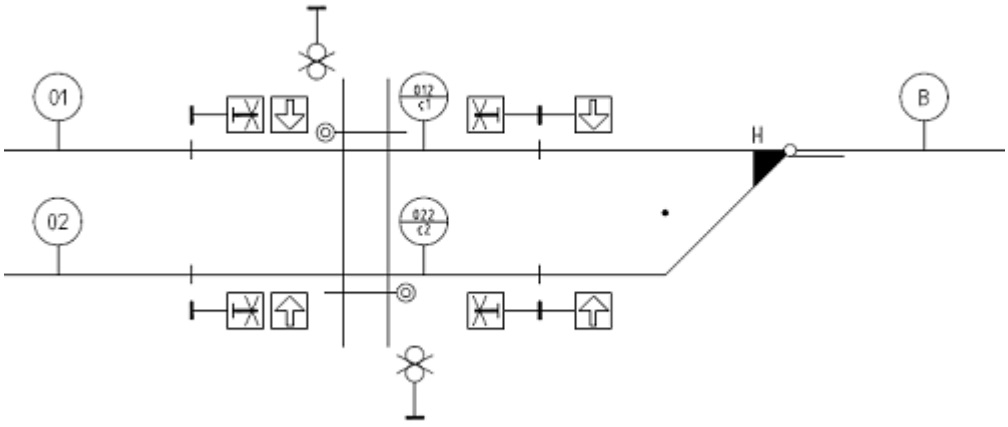
TVP sections for deactivating level crossing systems in stations

ENI-SS-ENG-1099 If a level crossing system spans over several tracks, TVP sections used for deactivation shall be named **"c1, c2, c3,..."**, starting at c1 at the lowest track number.

Comments: *TVP section of the level crossing system, and the overlapping TVP section of the IL shall both be named.*

TVP section of the level crossing system and for the IL can share the same axle counter.

The figure below shows an example of naming of these TVP sections.



TVP sections for activating level crossing system

Rationale: *In case a Level crossing system is located in e.g. a PSA (without shunting routes), specific activation sections may be required to activate it.*

ENI-SS-ENG-1100 If TVP section for activating a level crossing system is common for interlocking system and level crossing system, the common TVP section shall be added an **a** (for activation on A-side of level crossing) or a **b** (for activation on B-side of level crossing) at the end of TVP section number**.**

Comments: *Ex: 301, **302a**, 303, **304b**, 305…*

31.6 Numbering of points

31.6.1 Points in stations

Numbering of points in stations

ENI-SS-ENG-1103 Single points in stations shall be named **Running number.**

Numbering of points in stations descending kilometre

ENI-SS-ENG-1104 Odd running number is used for points with switch blade toe in descending kilometres.

Comments: *Ex: 1, 3, 5…*

Numbering of points in stations ascending kilometre

ENI-SS-ENG-1105 Even running number is used for points with switch blade toe in ascending kilometres.

Comments: *Ex: 2, 4, 6…*

Numbering of additional points between entry Marker Board and first point dividing platform/station tracks

ENI-SS-ENG-1106 If there are additional points between entry Marker Board and first point dividing platform/station tracks, they shall be added **10** before the **running number (this rule is only applicable for single track lines)**.

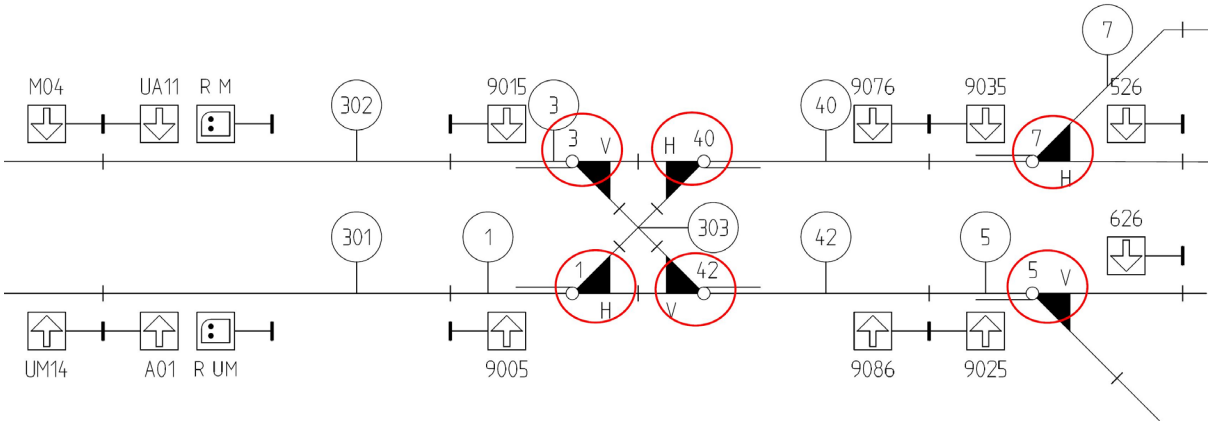
Comments: *Ex:*

- ***101**, 103, 105… (Switch blade toe in descending kilometres).*
- ***102**, 104, 106… (Switch blade toe in ascending kilometres).*

Numbering of double and single slip points

ENI-SS-ENG-1107 Double and single slip points shall be considered as two single points facing each other, and therefore numbered as single points.

Figure below shows an example of naming of points in stations on double track line.



Numbering of points in large station areas

ENI-SS-ENG-1618 Points in large station areas should be named **Group (1 digit) + Running number (1-2 digits).**

Comments: *In larger station areas points located in different parts of the station area may be divided into groups. Each group is given a 1-digit number.*

Running number may follow a logical pattern not necessarily according to the kilometre

31.6.2 Points on the line

Numbering of points on the line

ENI-SS-ENG-1111 Points on the line shall be named **Line number (4 digits) + Running number (2 digits).**

Comments: *Ex: 051001, 051002, 051003…*

Numbering of points on the line running number

ENI-SS-ENG-1112 Running number start with **01** and increases in ascending kilometre on that line.

31.6.3 Points in non-supervised areas

Numbering of points in non-supervised areas

ENI-SS-ENG-1427 Points in non-supervised areas shall only be renumbered if numbering of points in supervised area on the same station results in identical numbers.

Comments: *Renumbering of points in a non-supervised area are only done to avoid duplication of numbers.*

ENI-SS-ENG-1428 Intentionally deleted

31.7 Derailer

Naming of derailer

ENI-SS-ENG-1114 Derailer shall be named **Sp. + Running number.**

Naming of derailer on the line ascending kilometer

ENI-SS-ENG-1115 Odd running number is used for derailer with derailment in ascending kilometers.

Comments: *Ex: Sp.1, Sp.3, Sp.5…*

Naming of derailer on the line descending kilometer

ENI-SS-ENG-1116 Even running number is used for derailer with derailment in descending kilometers.

Comments: *Ex: Sp.2, Sp.4, Sp.6…*

Figure below shows an example of naming of derailers.

Naming of derailer in large station areas

ENI-SS-ENG-1619 Derailers in large station areas should be named **Sp. + Group (1 digit) + Running number (1-2 digits).**

Comments: *In larger station areas derailers located in different parts of the station area may be divided into groups. Each group is given a 1-digit number.*

Running number may follow a logical pattern not necessarily according to the kilometer

31.8 Key-locks

Naming of key-locks

ENI-SS-ENG-1120 Key locks shall be named **S.lås _ Running number.**

Comments: *Ex: S.lås 1, S.lås 2, S.lås 3…*

Naming of key-locks running number

ENI-SS-ENG-1121 Running number starts on the stations A-side with **1** and increases in ascending kilometer.

31.9 Crank cabinets

Naming of crank cabinets

ENI-SS-ENG-1123 Crank cabinets are named **Sv _ Running number.**

Comments: *Ex: Sv 1, Sv 2, Sv 3…*

Naming of crank cabinets running number

ENI-SS-ENG-1124 Running number starts at the stations A-side with **1** and increases in ascending kilometer.

Naming of crank cabinets outer points

ENI-SS-ENG-1125 When a station is only equipped with crank cabinets at the outer points in each end, then the running number equals the associated points number.

31.10 Naming of Work Areas

31.10.1 Work areas in stations

Naming of work areas that covers hole station

ENI-SS-ENG-1128 Work Areas that covers the whole station shall be named **AO _ Area code**.

Comments: *Ex: AO LLS*

Naming of work areas that covers platform/station tracks

ENI-SS-ENG-1129 Work areas that covers a platform/station track shall be named **AO _ Track number(1-2 digits)**.

Comments: *Ex: AO 1, AO 2, AO 3*

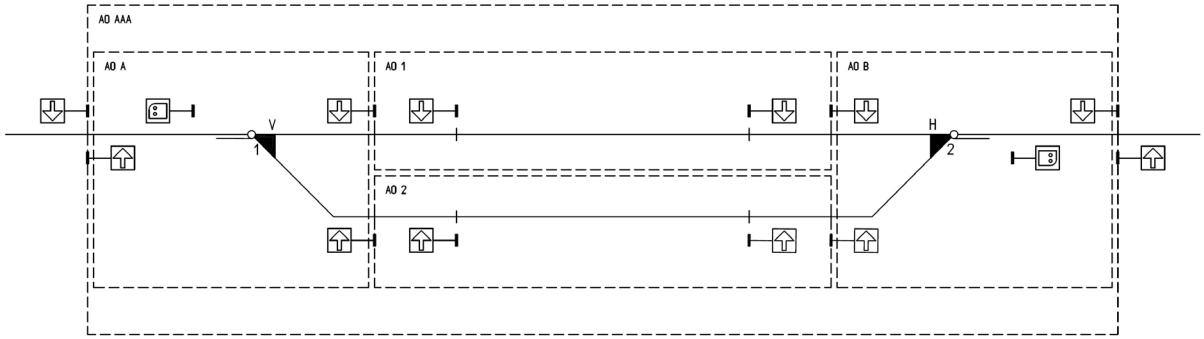
Naming of work areas at each end of station

ENI-SS-ENG-1130 Work areas at each end of a station shall be named **AO _ A or B**.

Comments: *Ex:*

- *AO A (located at the station's A-side)*
- *AO B (located at the station's B-side)*

Figure below shows an example of naming of Work Areas in a two track station.



Naming of work areas on stations on double track lines

ENI-SS-ENG-1133

Work areas on stations on double track lines shall be named **AO _ Running number(1-2 digits)**.

Numbering of work areas on stations on double track lines

ENI-SS-ENG-1134

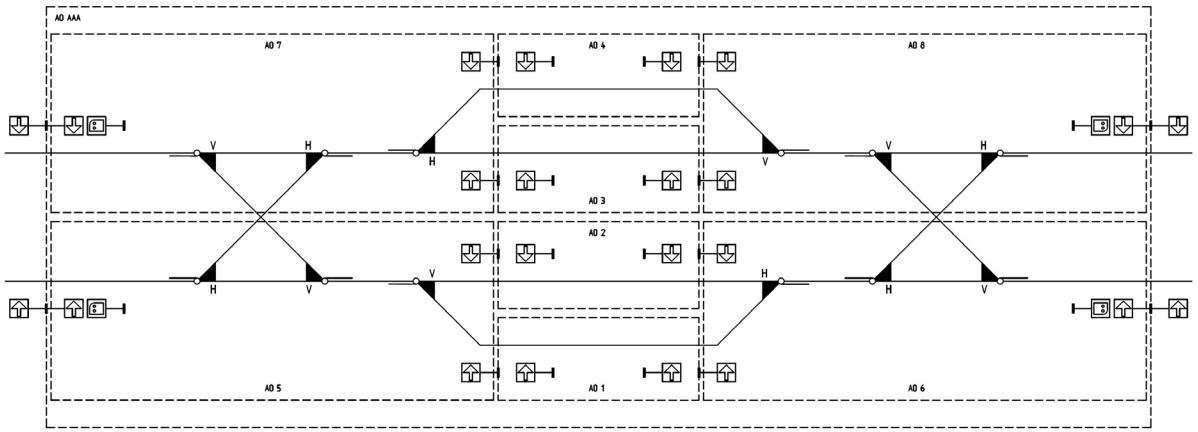
The numbering shall start with Work Areas covering the platform/station tracks and then the numbering shall continue in ascending order from the lowest kilometer with odd numbers in the right track and even numbers in the left track.

Comments: *This principle of numbering can also be used at stations on single track lines when needed due to increased amount of Work Areas.*

Ex:

- *AO 1, AO 2, AO 3, AO 4 (track 1, 2, 3, 4)*
- *AO 5 and AO 7 (right track)*
- *AO 6 and AO 8 (left track)*

Figure below shows an example of naming of work areas in a station on a double track line.



Naming of work areas in large station areas

ENI-SS-ENG-1620 Work areas in large station areas should be named **AO _ Group (1 digit) + Running number (1-2 digits)**.

Comments: *In lager stations areas, work areas located in different parts of the station area may be divided into groups. A 1-digit number in the name corresponds the applicable group.*

Running number may follow a logical pattern not necessarily according to the kilometer

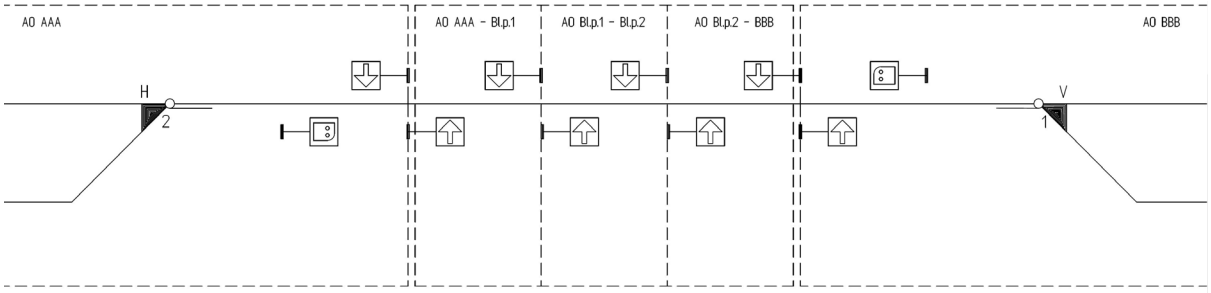
31.10.2 Naming of Work Areas on the line

Naming of work areas on the line

ENI-SS-ENG-1138 Work areas on a single track line shall be named **AO _ Area code for station 1/Block post 1 _ – _ Area code for station 2/Block post 2**.

Comments: *Ex: AO JEV – HVA*

Figure below shows an example of naming of Work Areas on a single track line.



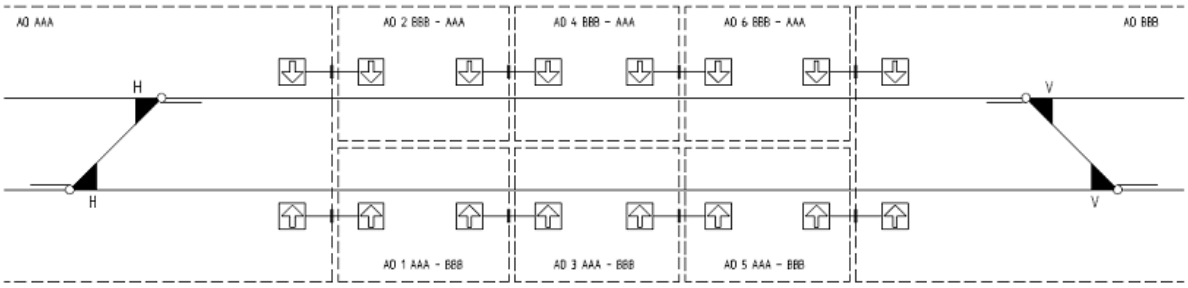
Naming of work areas on double track lines

ENI-SS-ENG-1141 Work Areas on double track lines shall be named:

ENI-SS-ENG-1218 **AO _ Odd running number _ Area code for station 1 _ - _ Area code for station 2**
For right track in ascending kilometers

ENI-SS-ENG-1219 **AO _ Even running number _ Area code for station 2 _ - _ Area code for station 1**
For left track in ascending kilometers

Figure below shows an example of naming of Work Areas on double track line.



31.11 Naming of TSA

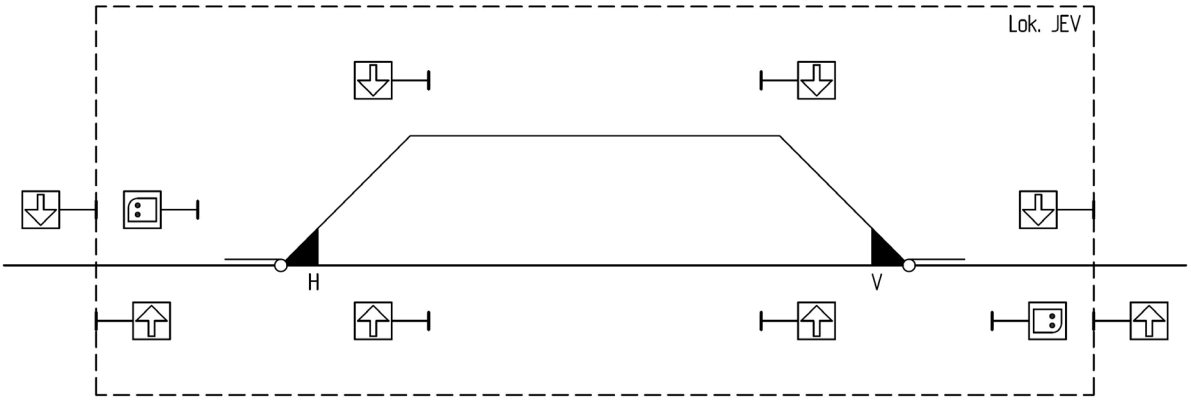
31.11.1 TSA in stations

Naming of TSA that covers hole station

ENI-SS-ENG-1144 TSA that covers the hole station shall be named **Lok. _ Area code**.

Comments: *Ex: Lok. LLS*

Figure below shows an example of naming of a TSA covering a two track station.

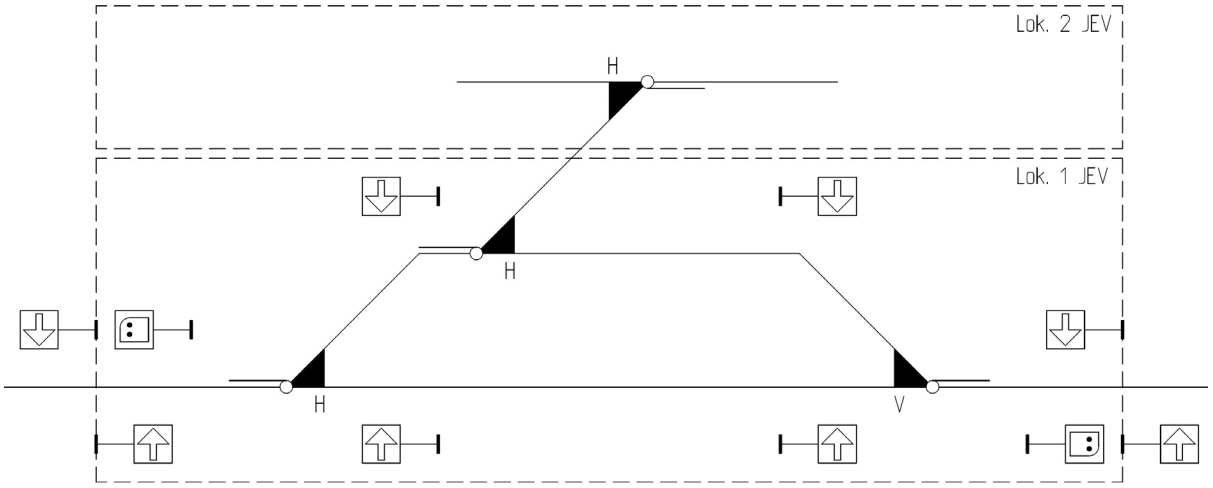


Naming of TSA that covers specific tracks

ENI-SS-ENG-1147 TSA that covers a specific section of track shall be named **Lok. _ Track number (1-2 digits) _ Area code**.

Comments: *Ex: Lok. 1 LLS, Lok. 2 LLS, Lok. 3 LLS*

Figure below shows an example of naming of TSAs within a station with more than one TSA.



Naming of TSA in large station areas

ENI-SS-ENG-1621 TSA that covers a specific section of track shall be named **Lok. _ Group (1 digit) + Track number (1-2 digits)**.

Comments: *In larger station areas, TSAs located in different parts of the station area may be divided into groups. A 1-digit number in the name corresponds to the applicable group.*

Running number may follow a logical pattern not necessarily according to the kilometer.

31.11.2 TSA on the line

Naming of TSA on the line

ENI-SS-ENG-1151 TSA on a single track line shall be named **Lok. _ Area code station 1/Block post 1 _–_ Area code station 2/Block post 2**.

Comments: *Ex: Lok. JEV – HVA*

Naming of TSA on double track line

ENI-SS-ENG-1152 TSA on a double track line shall be named:

- **Lok. _ Area code station 1/block post 1 _–_ Area code station 2/block post 2** for track in ascending kilometers.
- **Lok. _ Area code station 2/block post 2 _–_ Area code station 1/block post 1** for track in descending kilometers.

Naming of TSA that covers siding on the

ENI-SS-ENG-1153 TSA that covers a siding on the line between stations shall be named **Lok. _ Name of side track**.

Comments: *Ex: Lok. Bjørntvedt*

31.12 Naming of PSA

Naming of PSA

ENI-SS-ENG-1439 Kunde og Trafikkdivisjonen is responsible for naming of new PSAs.

31.13 Shunting signals

Naming of shunting signals on Marker Boards

ENI-SS-ENG-1155 For shunting signals placed on Marker Boards, the naming for the Marker Board is applicable.

Naming of shunting signals

ENI-SS-ENG-1156 Standalone shunting signals shall be named **R + Location number (1-3 digits).**

Different Location number on Shunting signals and Marker Boards

ENI-SS-ENG-1940 Standalone shunting signals shall not have the same Location number as a Marker Board in the same station.

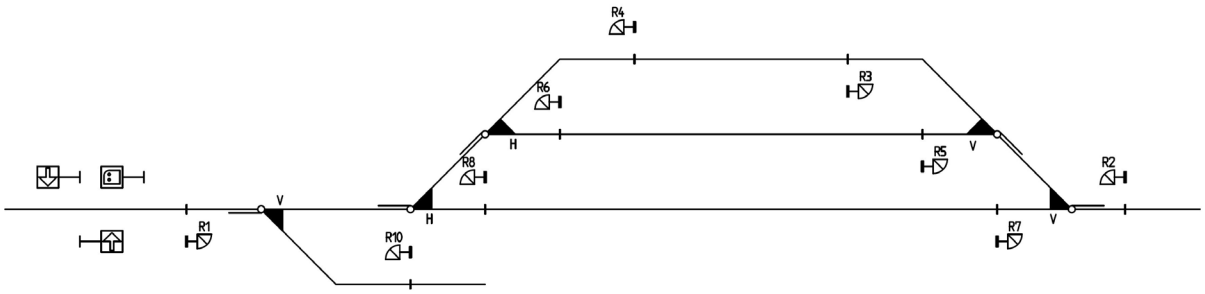
Naming of standalone shunting signals in ascending kilometre

ENI-SS-ENG-1157 Odd Location number is used for shunting signals in ascending kilometre.

Naming of standalone shunting signals in descending kilometre

ENI-SS-ENG-1158 Even Location number is used for shunting signals in descending kilometre.

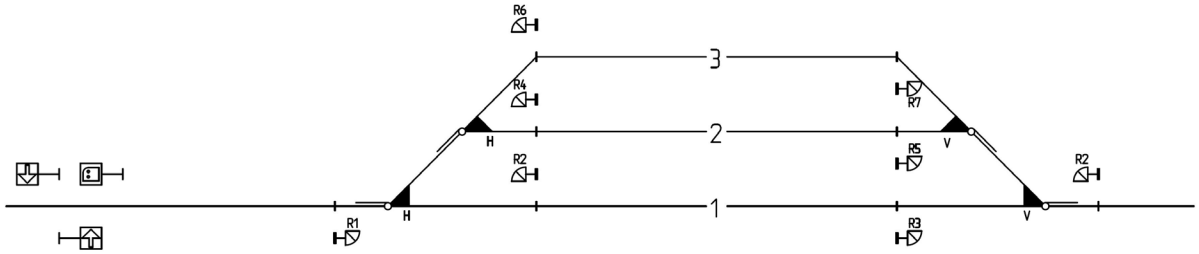
Figure below shows an example of naming of standalone shunting signals.



Naming of aligned shunting signals

ENI-SS-ENG-1161 If shunting signals are placed aligned, the Location number shall start from the track with the lowest track number.

Figure below shows an example of naming of standalone aligned shunting signals.



Naming of standalone shunting signals at larger stations

ENI-SS-ENG-1622 Standalone shunting signals shall be named **R + Group (1 digit) + Location number (1-2 digits)**.

Comments: *In larger station areas shunting signals located in different parts of the station area may be divided into groups. A 1-digit number in the name corresponds to the applicable group.*

Location number may follow a logical pattern not necessarily according to the kilometre.

31.14 Level crossing systems

Naming of level crossing systems

ENI-SS-ENG-1165 A level crossing shall be named **Location name + (Level crossing system configuration)**

Comments: *Ex: Vettlegrend (Ba.)*

31.14.1 Level crossing Boards

Naming of level crossing boards

ENI-SS-ENG-1168 Level crossing Boards related to a level crossing system shall be named with the use of **W + Location number.**

Naming of level crossing boards in ascending kilometre

ENI-SS-ENG-1169 Odd location numbers are used for Level crossing Boards in ascending kilometre, starting with the lowest track number.

Comments: *Ex:*

- *W1 (track 1)*
- *W3 (track 2)*
- *W5 (track 3)*

Naming of level crossing boards in descending kilometre

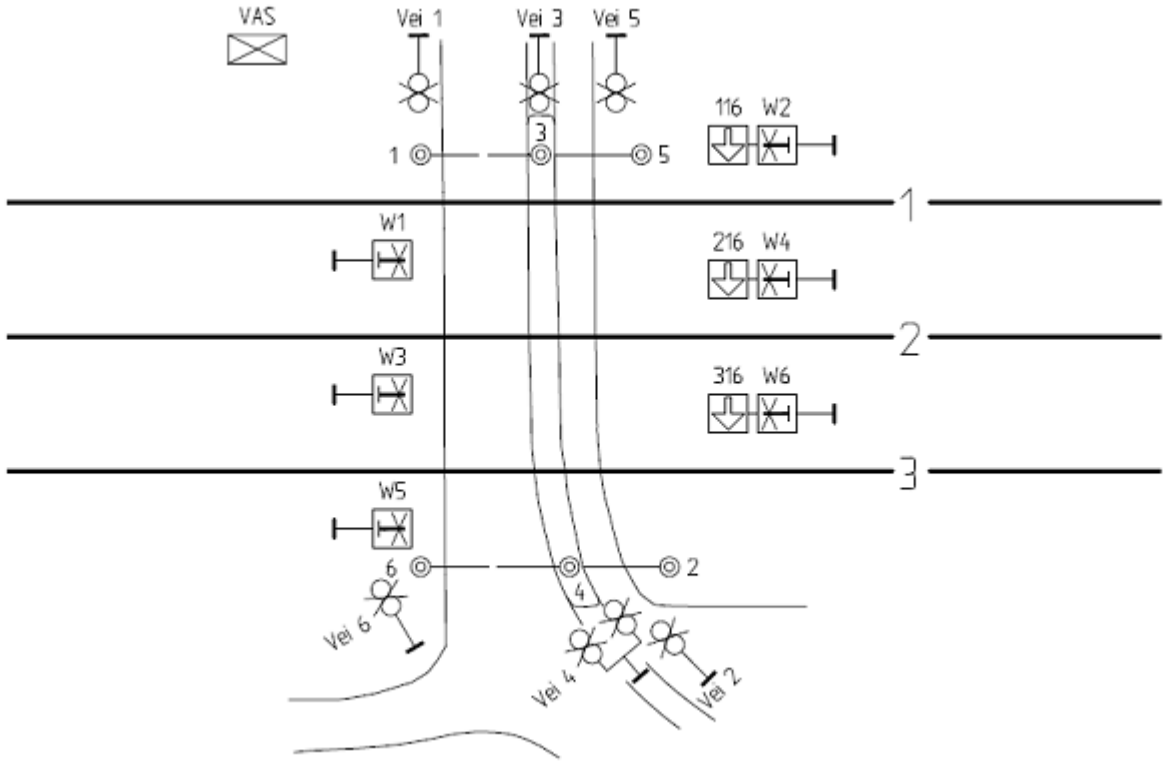
ENI-SS-ENG-1170

Even location numbers are used for Level crossing Boards in descending kilometres, starting with the lowest track number.

Comments: *Ex:*

- *W2 (track 1)*
- *W4 (track 2)*
- *W6 (track 3)*

Figure below shows an example of naming of Level crossing Boards.



31.14.2 Signals towards road users.

Naming of level crossing signals for level crossing systems

ENI-SS-ENG-1174

Signals towards road users shall be named with the use of **Vei _ Location number.**

Naming of level crossing signals in ascending kilometre

ENI-SS-ENG-1175

Odd location number is used for signals on left hand side of the track in ascending kilometre

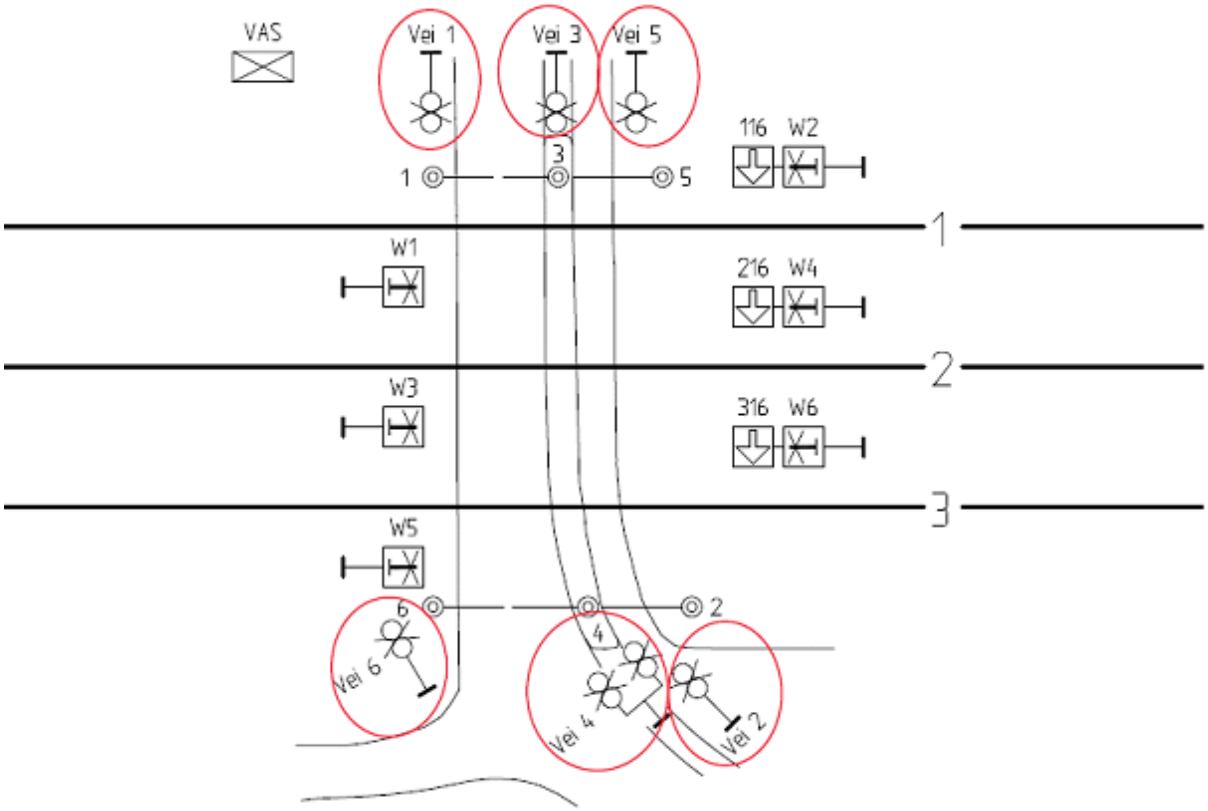
Comments: *Ex: Vei 1, Vei 3, Vei 5*

Naming of level crossing signals in descending kilometre

ENI-SS-ENG-1176 Even location number is used for signals on left hand side of the track in descending kilometre.

Comments: *Ex: Vei 2, Vei 4, Vei 6*

Figure below shows an example of naming of signals towards road users.



31.14.3 Barrier drives

Naming of barrier drives

ENI-SS-ENG-1180 Barrier drives shall be named with the use of **Location number.**

Naming of barrier drives in ascending kilometre

ENI-SS-ENG-1181 Odd location number is used for barrier drives on left side of the track in ascending kilometre.

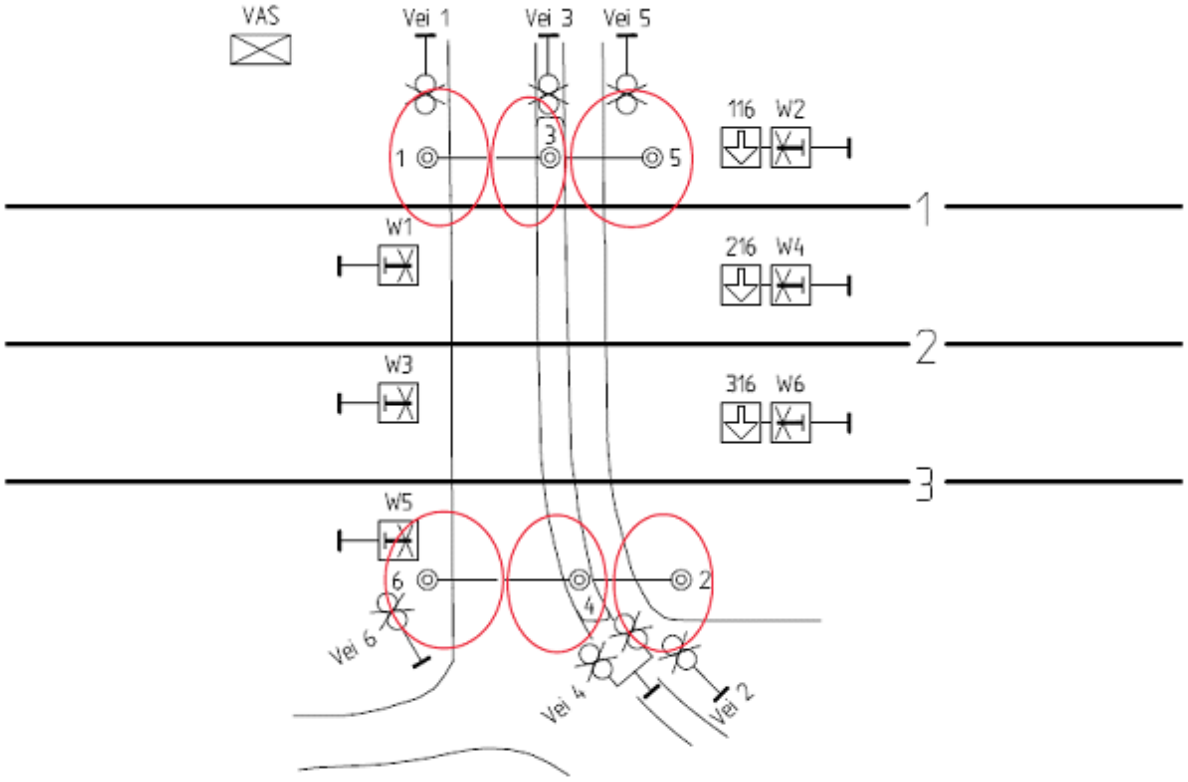
Comments: *Ex: 1, 3, 5*

Naming of barrier drives in descending kilometre

ENI-SS-ENG-1182 Even location number is used for barrier drives on the left side of track in descending kilometre.

Comments: *Ex: 2, 4, 6*

Figure below shows an example of naming of barrier drives.



31.14.4 Technical building for level crossing systems

Naming of technical building for level crossing systems

ENI-SS-ENG-1186 Naming of technical buildings shall be named with the use of **VAS _ Location number.**

Naming of technical building for one single level crossing systems

ENI-SS-ENG-1187 If only one level crossing system is located inside the area (ex. a station), **Location number** is not used.

Comments: *Ex: VAS*

Naming of technical building for several level crossing systems in one area.

ENI-SS-ENG-1188 It there are two or more level crossing systems located inside the area, these are numbered sequentially in ascending kilometer.

Comments: *Ex: VAS 1, VAS 2*

31.15 Naming of Technical cabinets

Naming of technical cabinets on station

ENI-SS-ENG-1190 Technical cabinets within a station area shall be named with the use of **AS _ Running number (1-2 digits).**

Comments: *Ex: AS 1, AS 2, AS 3…*

Naming of technical cabinets direction

ENI-SS-ENG-1191 The running number starts at a stations A-end and increases in ascending kilometres.

Naming of technical cabinets on the line

ENI-SS-ENG-1192 Technical cabinets on the line shall be named with the use of **AS _ Line number (4 digits) + Running number (2 digits).** Starting at the lowest kilometre.

Comments: *Ex: AS 100101, AS 100102, AS 100103…*

31.16 Naming of derailment indicator

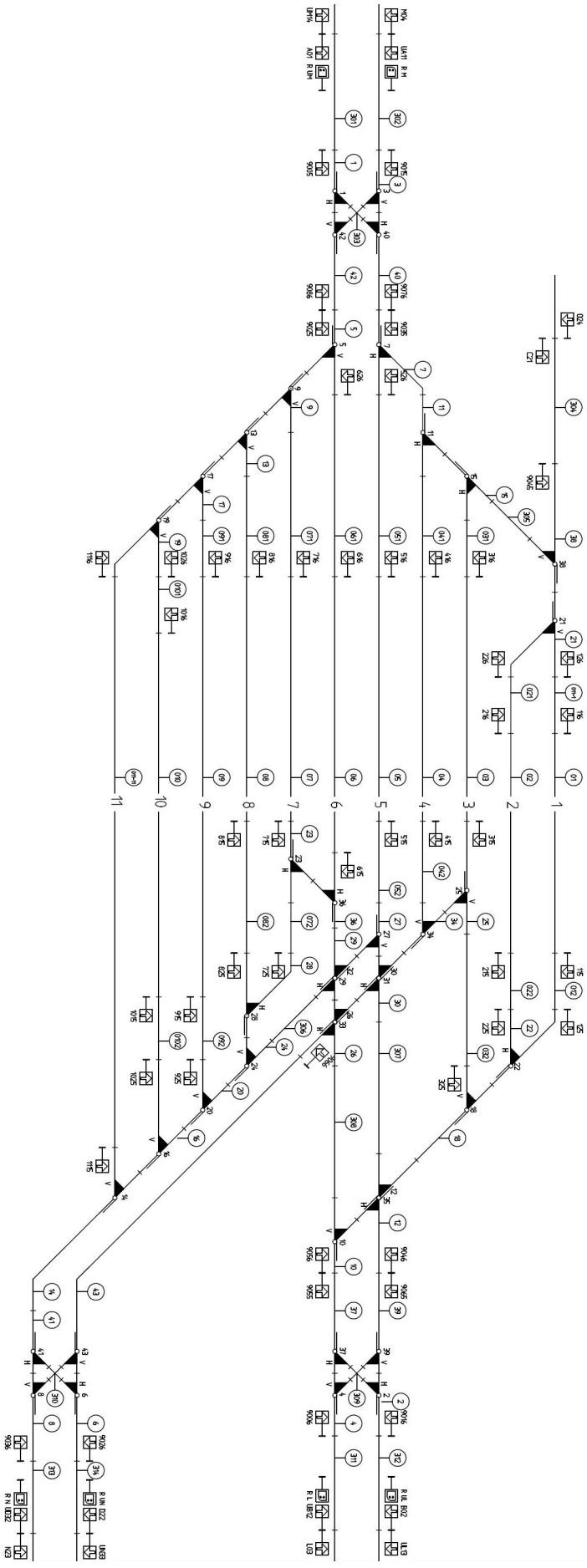
Naming of derailment indicator

ENI-SS-ENG-1624 Derailment indicators shall be named with the use of **Ai. + TUNNELNAME. + DIRECTIONOFTRAVEL.**

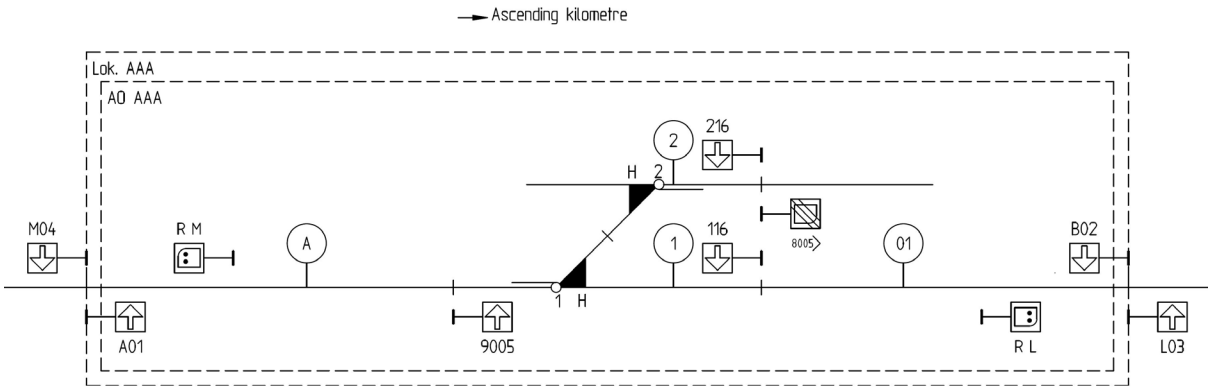
Comments: *Ex: Ai.LIERÅSEN.A, Ai.LIERÅSEN.UA*

31.17 Naming convention examples

The figure below shows an example of naming a multi track station



The figure below shows an example of naming a siding on the line engineered as a station



32 SIGNALS, BOARDS AND SIGNS

One of the benefits of ERTMS is "cab signalling", whereas most of the information to the driver is displayed in the driver cabin on the DMI instead of trackside signs/boards/signals. This means that some of today's trackside boards can be removed in favor of cab signalling when trains are under supervision by RBC, e.g. the board named "Lower pantograph". However, when trains are operating in Staff Responsible (SR) mode and Shunting (SH) mode, this information is not displayed by default, hence some of the boards might still be required for these operating modes.

Definition and meaning of signs, boards and signals are given Trafikkregler for jernbanenettet (TJN). https://orv.banenor.no/orv/doku.php?id=TJN

This chapter describes signs, boards and signals which are either new or that will be removed or relocated when ERTMS is taken into operation.

Signals on the same pole

ENI-SS-ENG-757 If more than one signal shall apply from the same location, the signals shall be placed on the same pole.

32.1 New signs, boards and signals

Signal E35: ETCS Marker Board

Rationale: *A marker board is located where the railway vehicle can have its end of Movement Authority, given by the Signalling System.*

ENI-SS-ENG-440

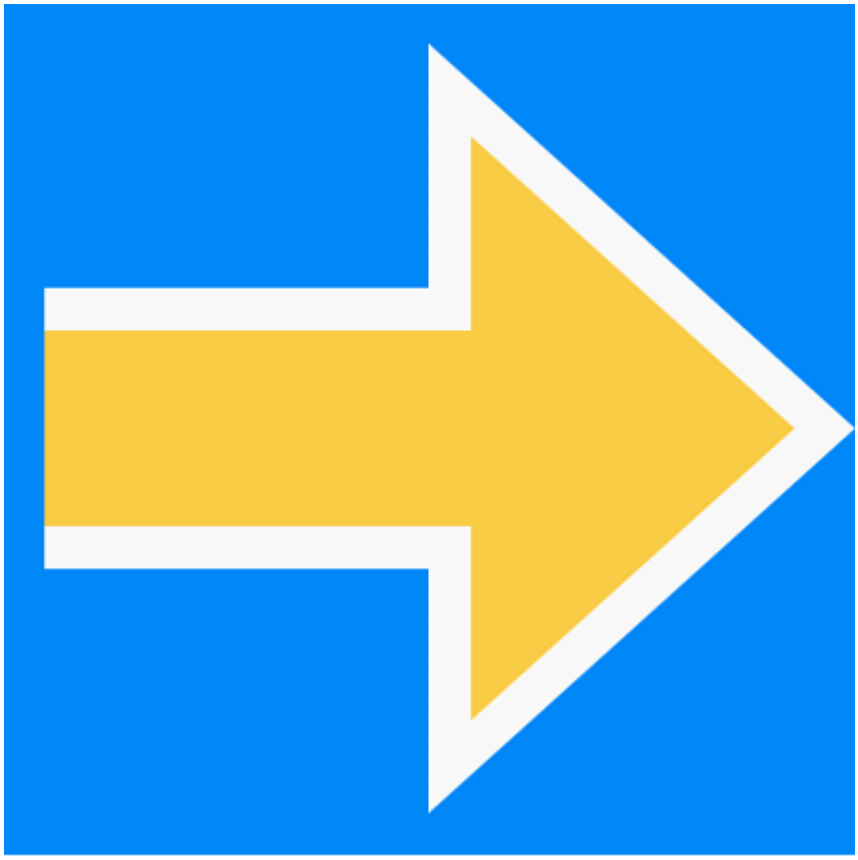
ETCS Marker Board

(Norwegian: “Stoppskilt”)

Comments: *Defined in NS-EN-16494.*

Design and dimensions are described in "Design requirements - signs and boards", doc.nr: 1000001649.

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1193655&dbrno=50&standalone=true



ETCS location marker

Rationale: *A location marker board is located where the railway vehicle can have its end of Movement Authority, given by the Signalling System.*

ENI-SS-ENG-342

ETCS location marker

Comments: *Defined in NS-EN-16494*

It is decided for the present that location marker boards shall not be used in Norway.

Signal E36: Level crossing

ENI-SS-ENG-766

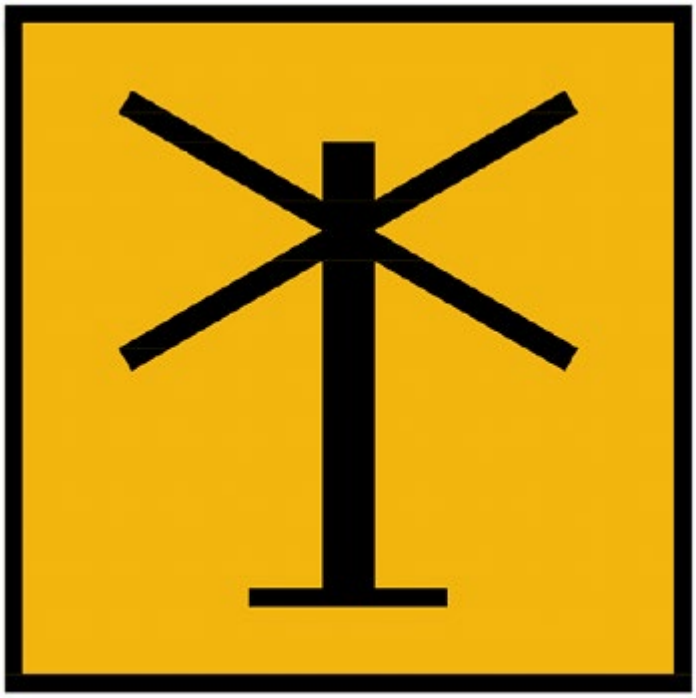
A level crossing board shall be used to inform the train driver of a level crossing. (Norwegian: "Veisikringsanlegg")

Comments: *ID-board required.*

Shall be placed aligned with the level crossing's TVP section.

Design and dimensions are described in "Design requirements - signs and boards", doc.nr: 1000001649.

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1193655&dbrno=50&standalone=true



Signal E37A: Level transition board

ENI-SS-ENG-343

Level transition board
(Norwegian: “Systemovergang”)

Comments: *Defined in NS-EN-16494*

Signal E37B: Level 0

ENI-SS-ENG-1941

Level 0
(Norwegian: “Nivå 0”)

Signal E38: Avalanche area

ENI-SS-ENG-1292

"Avalanche area" is used to indicate that you are entering an avalanche area. (Norwegian: "Rasvarslingsanlegg")

Comments: *ID-board required.*

Design and dimensions are described in "Design requirements - signs and boards", doc.nr: 1000001649.

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1193655&dbrno=50&standalone=true

Signal E39: Frost gate

ENI-SS-ENG-1664

"Frost gate" is used to indicate that a frost gate is approaching.
(Norwegian: "Frostport")

Comments: *ID-board required.*

Design and dimensions are described in "Design requirements - signs and boards", doc.nr: 1000001649.
https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1193655&dbrno=50&standalone=true

Signal E61: Distance sign ERTMS

Rationale: *To warn the driver that the train is approaching a marker board.*

ENI-SS-ENG-359

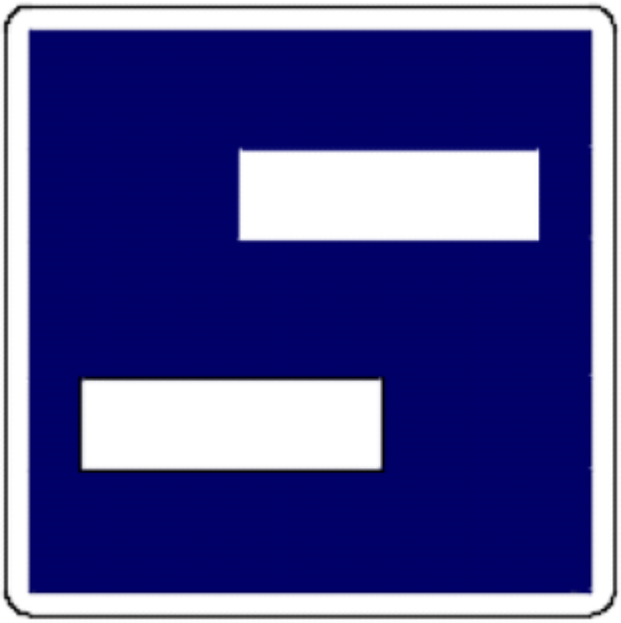
Distance sign ERTMS (Norwegian: "Avstandsskilt 4") shall be used before a marker board if the sight distance to this marker board is less than required.
(Norwegian: "Avstandsskilt ERTMS")

Signal E65H: Lower pantograph

ENI-SS-ENG-344

Lower pantograph
(Norwegian: "Varsel om senking av strømavtaker")

Comments: *Defined in NS-EN-16494*

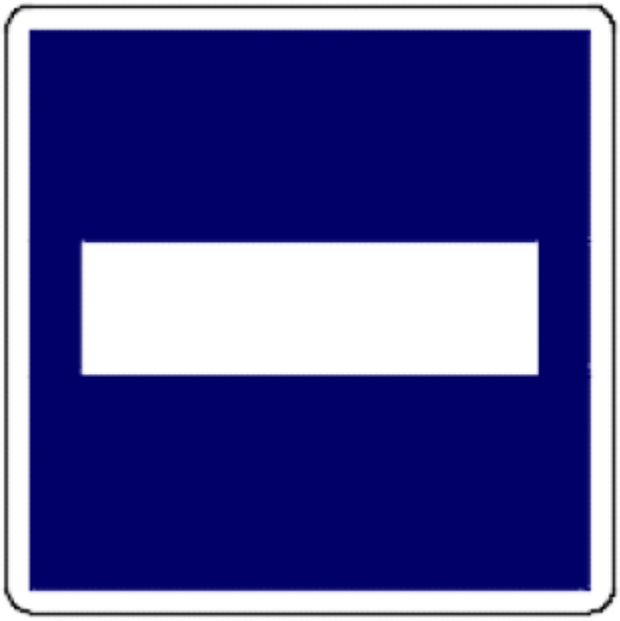


Signal E65J: Pantograph lowered

ENI-SS-ENG-345

Pantograph lowered
(Norwegian: "Senket strømavtaker")

Comments: *Defined in NS-EN-16494*



Signal E65K: Raise pantograph

ENI-SS-ENG-346

Raise pantograph
(Norwegian: "Heving av strømavtaker")

Comments: *Defined in NS-EN-16494*

Signal E65L: Neutral section announcement

ENI-SS-ENG-347

Neutral section announcement
(Norwegian: "Varsel om død seksjon")

Comments: *Defined in NS-EN-16494*

Signal E65M: End of neutral section

ENI-SS-ENG-349

End of neutral section
(Norwegian: "Utkobling foran død seksjon»)

Comments: *Defined in NS-EN-16494*

Signal E65N: Neutral section

ENI-SS-ENG-348

Neutral section

(Norwegian: "Innkobling etter død seksjon»)

Comments: *Defined in NS-EN-16494*

Signal E68A: Reduced line speed

Rationale: *Is used to ensure that a speed restriction below 40 km/h can be shown to the driver when running in SR/SH-mode, since ERTMS only supervise the speed to 40 km/h in these modes*

ENI-SS-ENG-1943

Reduced line speed

(Norwegian: "Hastighetsrestriksjon»)

Comments: *This signal indicates both reduction of permanent line speed and temporary reduced line speed below 40 km/h.*

Signal E68B: End of reduced line speed

ENI-SS-ENG-1945

Reduced line speed

(Norwegian: "Hastighetsrestriksjon opphører»)

Comments: *This signal indicates end of speed reduction both for permanent line speed and temporary reduced line speed below 40 km/h.*

Signal 101: Identification board

ENI-SS-ENG-762

Identification board.

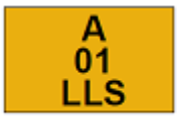
(Norwegian: “Identifikasjonsskilt”)

Comments: *Installation of the Identification board is described inn document “1000001649 Design requirements – Signs and boards"*

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1193655&dbrno=50&standalone=true

ENI-SS-ENG-1947

Entry Marker Boards shall have a yellow rectangular identification board to indicate station boarder



ENI-SS-ENG-1949

Exit Marker Boards shall have a yellow round identification board to indicate station border

ENI-SS-ENG-1951

Inner Marker Boards shall have a white rectangular identification board

ENI-SS-ENG-1953

Block Marker Boards shall have a white round identification board

ENI-SS-ENG-1955

“Stop for shunting” shall have a white rectangular identification board

ENI-SS-ENG-1957

“Interlocked area” shall have a white rectangular identification board

ENI-SS-ENG-1959

“Level crossing” shall have a white rectangular identification board

ENI-SS-ENG-1961

“Avalanche area” and “Frost gate” shall have a white rectangular identification board

Signal 106: Stop for shunting

Rationale: *Shunting vehicles shall stop ahead of the signal.*

ENI-SS-ENG-454

Signal 106 shall be placed to define the border for shunting movements in a shunting area.

(Norwegian: "Stopp for skift")

Comments: *ID-board required.*

Design and dimensions are described in "Design requirements - signs and boards", doc.nr: 1000001649.

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1193655&dbrno=50&standalone=true

Signal 107: Non-Interlocked area

Rationale: *The signal indicates to the driver that the vehicle approches a non-supervised area with manually operated points and/or derailers.*

ENI-SS-ENG-396

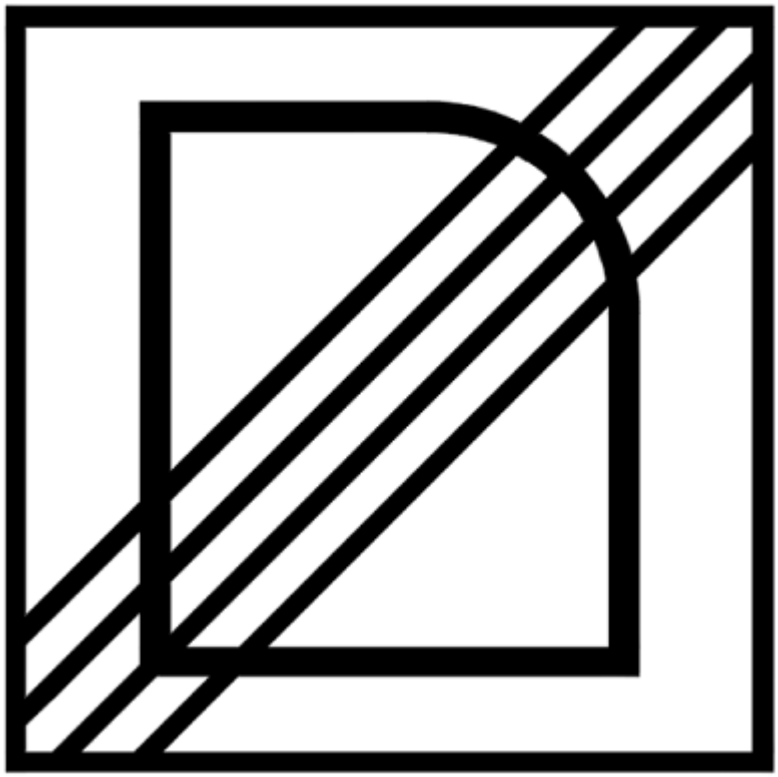
A Signal 107 is used at the border between a supervised area and a non-supervised area.

(Norwegian: "Sikringsanlegg slutter")

Comments: *ID-board not required.*

Design and dimensions are described in "Design requirements - signs and boards", doc.nr: 1000001649.

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1193655&dbrno=50&standalone=true



Key-lock

ENI-SS-ENG-1363

Signal 107 shall not be used if the non-supervised area is protected by a key-lock.

Signal 108: Interlocked area

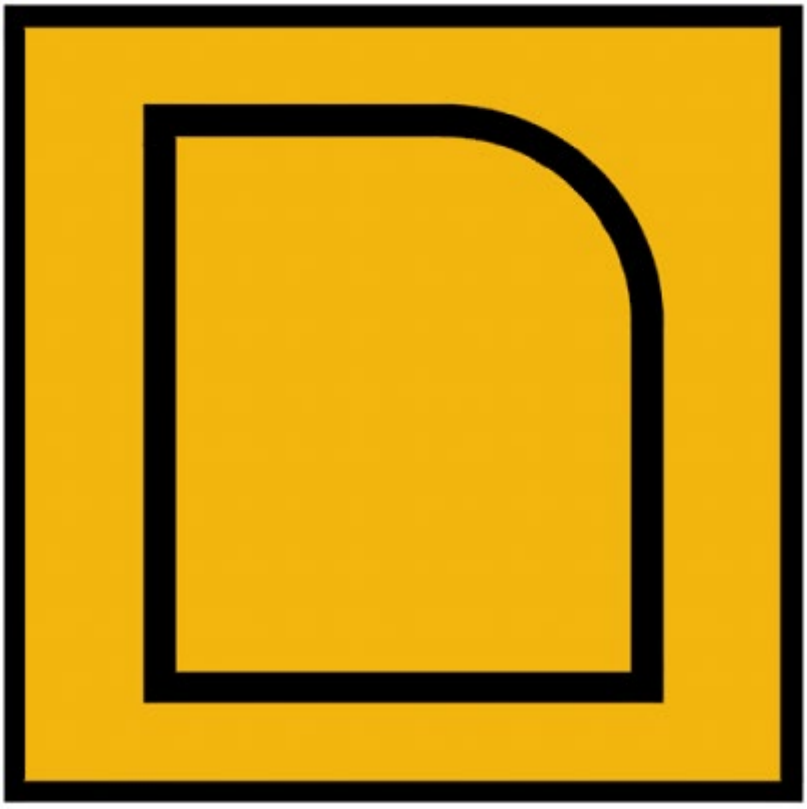
ENI-SS-ENG-394

Signal 108 is used at the boarder to an interlocked area.
(Norwegian: "Sikringsanlegg begynner")

Comments: *ID-board required.*

Design and dimensions are described in "Design requirements - signs and boards", doc.nr: 1000001649.

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1193655&dbrno=50&standalone=true



GSM-R network border marker

ENI-SS-ENG-350

GSM-R network border marker

Comments: *Defined in NS-EN-16494*

The letter 'N' represents the example of Norway

32.2 Signs, boards and signals to be removed

- Lyssignaler (Light signals)
  - Hovedsignaler (Main signal)
  - Forsignaler (Distance signal)
  - Repetersignaler (Repeater signal)
  - Enkle innkjørsignaler (Simple entry signal)
  - Signal 32: Forsiktig kjøring (Careful driving)
  - Signal 35B: Til angitt linje eller sporområde (Line signal)
  - Togsporsignal (Track signal)
  - Høyt skiftesignal (High shunting signal)
  - Dvergsignaler (Existing shunting signal will be replaced by another type)
  - Signal 68C: Avvikende hastighet (Divergent speed)
  - Planovergangssignal (Level crossing signal), (with exception of areas where ERTMS is not used to control the level crossing)
  - Forsignal for planovergangssignal (Distance signal for level crossing), (with exception of areas where ERTMS is not used to control the level crossing)
  - Rasvarslingssignal (Avalanche signal)
  - Bru- og frostportsignal for frostport (Bridge- and Frost gate signal)
  - Signal 4C: Middelkontrollampe (Position lamp)

- Signal 60A «ATC forsignal»
- Signal 60B «ATC repeter målpunkt»
- Signal 60C «ATC nødbrems»
- Signal 60D «ATC repeter hastighet»
- Signal 60E «ATC varsel»
- Signal 60H «ATC slutter»
- Signal 61A «Avstandsskilt 1»
- Signal 61B «Avstandsskilt 2»
- Signal 61C «Avstandsskilt 3»
- Signal 64B «Seksjoneringsstolpe»
- Signal 64F «Dvergsignalstolpe»
- Signal 65B «Varselsignal for kontaktledningssignal» (existing signal will be replaced by another type)
- Signal 65C «Utkobling foran død seksjon» (existing signal will be replaced by another type)
- Signal 65D «Innkobling etter død seksjon» (existing signal will be replaced by another type)
- Signal 65E «Senking av strømavtaker» (existing signal will be replaced by another type)
- Signal 65F «Heving av strømavtaker» (existing signal will be replaced by another type)
- Signal 66 «Togvei slutt»
- Signal 68A «Nedsatt kjørehastighet»
- Signal 68B «Økt kjørehastighet»
- Signal 68C «Avvikende hastighet»
- Signal 68D «Markeringsmerke»
- Signal 68F «Tilleggshastighet»
- Signal 68G «Hastighet for krengetog»
- (Signal 69A «Midlertidig nedsatt kjørehastighet»)
- (Signal 69B «Midlertidig hastighet opphører»)
- Signal 70 «Planovergangsskilt» (with exception of areas where ERTMS is not used to control the level crossing)
- Signal 73 «Rasvarslingsskilt»

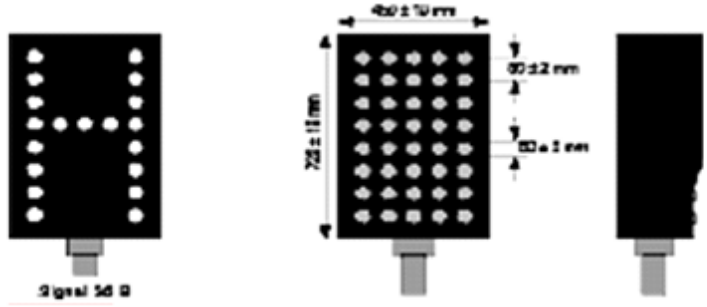
Signal 35B: Line signal

Rationale: *Signal 35B is used to indicate to the driver which line the train is currently running on, such that the driver can tell the train dispatcher early on if the train has been sent on the wrong line. Indicated by lights forming the shape of the first letter of the line (e.g. "H" for "Hovedbanen").*

ENI-SS-ENG-355

Signal 35B informs the driver of which line the train route is set for.
(Norwegian: "Linjesignal")

Comments: *Replaced by a text message, or to be completely removed if new TMS can ensure fewer errors in route settings.*

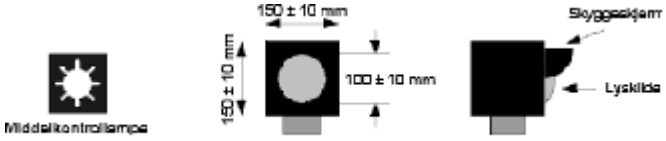


Signal 4C: Position lamp

Rationale: *Signal 4C ensures that trains have moved out of the point's fouling point before stopping at a crossing loop.*

ENI-SS-ENG-354

Signal 4C Position lamp/fouling point free of occupation (Norwegian: "Middelkontrollampe") will be replaced by functionality in RBC (text message).



32.3 Signs, boards and signals that shall remain

The following signs, boards and signals will not be affected by implementation of ERTMS and shall not be removed

Signal 51: Point signal for single point

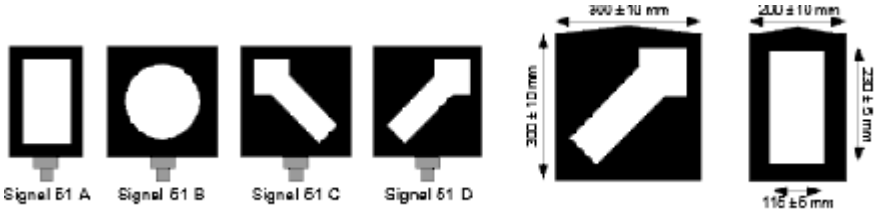
Rationale: *Signal 51 is used to indicate to the driver the current position of the point ahead.*

ENI-SS-ENG-356

Signal 51 may be used in shunting areas where route setting is not possible.

(Norwegian: "Sporvekselsignal for enkel sporveksel")

Comments: *If used: shall be placed on a dedicated pole close to the point so that it is clear which point it applies to.*



Signal 52: Point signal for slip point

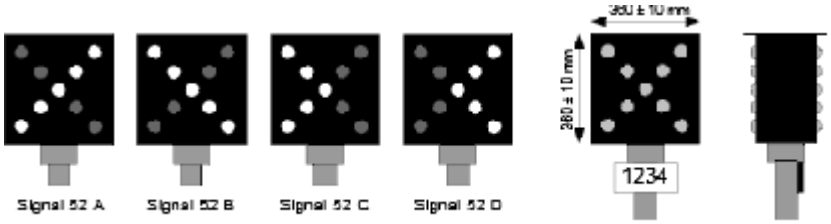
Rationale: *Signal 52 is used to indicate to the driver the current position of a single or double slip point.*

ENI-SS-ENG-357

Signal 52 may be used in shunting areas where route setting is not possible.

(Norwegian: "Sporvekselsignal for kryssporveksel")

Comments: *If used: shall be placed on a dedicated pole close to the point so that it is clear which point it applies to.*



Signal 53: Derailer signal

Rationale: *Signal 53 is used to indicate to the driver that the derailer is on or off the track. If there is a shunting signal on the same location as derailer, signal 53 may not be used.*

ENI-SS-ENG-358

Signal 53 may be used in shunting areas.

(Norwegian: "Sporsperresignal")

Comments: *If used: shall be placed on a dedicated pole close to the derailer so that it is clear which derailer it applies to.*

Signal 60F: FATC

Rationale: *Displays where the FATC line section begins.*

ENI-SS-ENG-1964

FATC

(Norwegian: "FATC")

Comments: *Will be used on the border between Level 2 and NTC*

Signal 60G: DATC

Rationale: *Displays where the DATC line section begins.*

ENI-SS-ENG-1966

DATC

(Norwegian: "DATC")

Comments: *Will be used on the border between Level 2 and NTC*

Signal 63A: Decline gradient profile board

Rationale: *The gradient profile is not shown in the DMI when trains are running in SR-/SH-mode*

ENI-SS-ENG-360

Decline gradient profile board

(Norwegian: "Fallviser")

Comments: *Used to indicate the decline gradient to the driver, in order to sufficiently apply the brakes for trains running in SR-/SH-mode*

Signal 63B: Incline gradient profile board

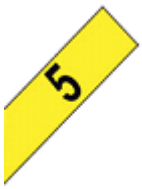
Rationale: *The gradient profile is not shown in the DMI when trains are running in SR-/SH-mode*

ENI-SS-ENG-361

Incline gradient profile board

(Norwegian: "Stigningsviser")

Comments: *Used to indicate the incline gradient to the driver, in order to sufficiently apply engine power for trains running in SR-/SH-mode*



Signal 64A: Limit pole

Rationale: *Used as location marker for several operational scenarios, including limit of shunting area outside outmost points at station, location of axle counter that activates the level crossing, limit of engine shed, and fouling point between two tracks.*

ENI-SS-ENG-362

Limit pole

(Norwegian: "Grense-/innkoblingsstolpe")

Signal 64C: Avalanche detection pole

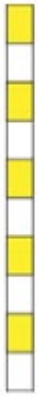
Rationale: *Placed trackside next to the avalanche fence so that the driver knows where the area of speed restriction (10 km/h) is valid if an avalanche has been detected.*

ENI-SS-ENG-363

Placed ahead of an avalanche detection area, to indicate to the driver that special operational rules apply in this area

(Norwegian: Rasvarslingsstolpe)

Comments: *The avalanche danger zone is the area which is protected by avalanche detection fences.*



Signal 64D: Deceleration pole

Rationale: *Indicates the point where brakes can be applied to automatically reach the correct stopping position at a platform*

ENI-SS-ENG-364

Deceleration pole

(Norwegian: "Bremsestolpe")

Signal 64E: Technical equipment pole

Rationale: *To mark technical equipment placed in the track.*

ENI-SS-ENG-365

Technical equipment pole shall be placed to mark the following equipment:

- derailment indicator or other sensors
- balises that are not placed next to a marker board
- axle counter detection units that are not placed next to a marker board

(Norwegian: "Teknisk stolpe")

Comments: *Colors: white and blue.*

Installation and the use of this signal is described in document "GUIDELINES FOR PLACEMENT OF TECHNICAL POLES AND SIGNS"

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1261927&dbrno=50&standalone=true

Signal 64G: Movable frog

ENI-SS-ENG-1968

Movable frog

Comments: *Indicates a point with movable frog.*

Signal 65A: Earthed section

ENI-SS-ENG-366

Earthed section

(Norwegian: "Jordet seksjon")

Signal 65G: Stop for electric traction unit

ENI-SS-ENG-372

Signal 65G: Stop for electric traction unit.
(Norwegian: "Stopp for elektrisk lokomotiv")
Comments: *May on long term be*

Signal 67A: Orientation signal

ENI-SS-ENG-373

Orientation signal
(Norwegian: "Orienteringssignal")

Signal 67B: Orientation signal for level crossing

ENI-SS-ENG-374

Orientation signal for level crossing
(Norwegian: "Orienteringssignal for planovergang")
Comments: *Train horn shall be blown*

Signal 67C: Orientation signal for platform

ENI-SS-ENG-375

Orientation signal for platform
(Norwegian: "Orienteringssignal for holdeplass")
Comments: *Train horn shall be blown*

Signal 67D: Orientation signal for level crossing and platform

ENI-SS-ENG-376

Orientation signal for level crossing and platform
(Norwegian: "Orienteringssignal for planovergang og holdeplass")

Comments: *Train horn shall be blown*

Signal 67E: Orientation signal for daytime

ENI-SS-ENG-377

Orientation signal for daytime
(Norwegian: "Orienteringssignal for dagtid")

Comments: *Train horn shall be blown*

Signal 70: Level crossing signal

Rationale: *The sign may be used in areas where ERTMS is not used to control the level crossing system*

ENI-SS-ENG-1970

Level crossing signal
(Norwegian: "Planovergangssignal")

Signal 72A: Start of Centralized traffic control

ENI-SS-ENG-1972

Start of Centralized traffic control
(Norwegian: "Strekning med fjernstyring")

Comments: *Will be used on the border between Level 2 and a line section with centralized traffic control (and NTC supervision).*

Signal 72B: End of Centralized traffic control

ENI-SS-ENG-1974

End of Centralized traffic control

(Norwegian: "Ikke fjernstyrt")

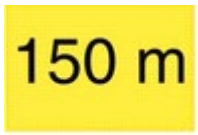
Comments: *Will be used on the border between Level 2 and a line section with NTC and no centralized traffic control.*

Signal 74: Train length board

ENI-SS-ENG-381

Train length board marks where a train of the indicated length should stop at platforms.

(Norwegian: "Toglengdeskilt")

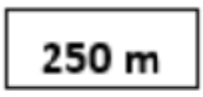


Signal 74B: Train length board

ENI-SS-ENG-1976

Train length board indicates where a train should stop in a parking area

(Norwegian: "Lengdeskilt")



Signal 75A: Track kilometre board

ENI-SS-ENG-382

Track kilometre board

(Norwegian: "Kilometerskilt")

Signal 75C: Raise snow plough

ENI-SS-ENG-383

Raise snow plough shall be placed at locations where the snow plough must be raised.

(Norwegian: "Hev sporrenser")

Comments: *Installation and the use of this signal is described in document "2000002459 GUIDELINES FOR PLACEMENT OF TECHNICAL POLES AND SIGNS"*

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Signal 75D: Lower snow plough

ENI-SS-ENG-384

Lower snow plough shall be placed at locations where the snow plough can be lowered again.

(Norwegian: "Senk sporrenser")

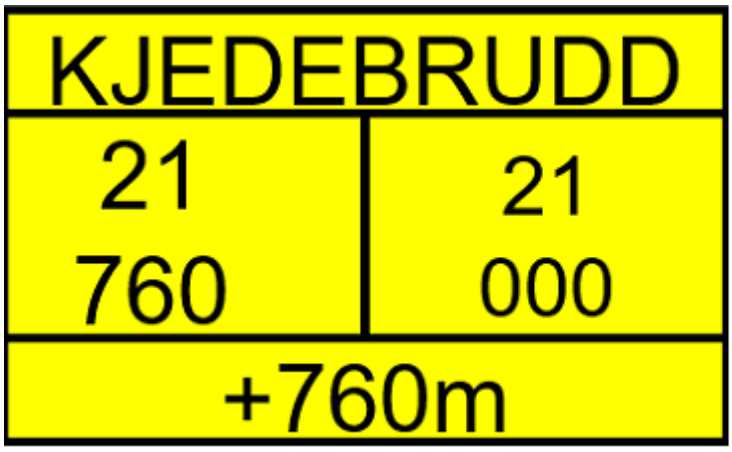
Comments: *Installation and the use of this signal is described in document "2000002459 GUIDELINES FOR PLACEMENT OF TECHNICAL POLES AND SIGNS"*

https://proarc.banenor.no/locator.aspx?name=Document.Details.50&module=Document&docrno=1261927&dbrno=50&standalone=true

Signal 75E: Chainage discontinuity

ENI-SS-ENG-1978

Chainage discontinuity
(Norwegian: "Kjedebrudd")



Signal 102: Arrow board

ENI-SS-ENG-385

Arrow board indicates which track a signal applies for.
(Norwegian: "Pilskilt")

Comments: *May be used for shunting signals, Distance sign ERTMS, Train length sign, Stop for shunting, Non-interlocked area and Interlocked area. Shall not be used on shunting signals please together with marker boards*

Signal: Siding board

ENI-SS-ENG-386

Signal: ID board for siding
(Norwegian: "Sidesporskilt")

Comments: *Placed at sidings on the line.*

Signal 104A: Beginning of Shunting yard

Rationale: *Shows the start of an area where trains can be moved by uncertified drivers.*

ENI-SS-ENG-1980

Beginning of Shunting yard

(Norwegian: "Driftsbanegård begynner")

Signal 104B: End of Shunting yard

Rationale: *Shows the end of an area where trains can be moved by uncertified drivers.*

ENI-SS-ENG-1982

End of Shunting yard

(Norwegian: "Driftsbanegård slutter")

Work area board

ENI-SS-ENG-392

A "work area" board may be used to indicate the border of each work area unless the work area is not border protected by a marker board.

(Norwegian: "Arbeidsområdeskilt")

Comments: *The work area board shall be placed alongside the track facing the track it applies to. Work area boards are normally not used at small stations (typical 2 track station design) but are mandatory in larger and more complex stations.*

Signal 68C: Deviant line speed

ENI-SS-ENG-379

Intentionally deleted

33 NATIONAL VALUES

For further information regarding the variables, please refer to Subset-026, chapter 7.5.

Q_NVDRIVER_ADHES

Rationale: *According to existing operational rules.*

ENI-SS-ENG-401 Modification of adhesion factor by driver:

Allowed

V_NVSHUNT

Rationale: *According to existing operational rules.*

ENI-SS-ENG-402 Shunting mode speed limit:

40 km/h

V_NVSTFF

Rationale: *According to existing operational rules.*

ENI-SS-ENG-403 Staff Responsible mode speed limit:

40 km/h

V_NVONSIGHT

Rationale: *According to existing operational rules.*

ENI-SS-ENG-404 On Sight mode speed limit:

40 km/h

V_NVLIMSUPERV

Rationale: *LS not to be used and movements in LS shall be forbidden.*

ENI-SS-ENG-405 Limited Supervision mode speed limit:

0 km/h

V_NVUNFIT

Rationale: *According to existing operational rules.*

ENI-SS-ENG-406 Unfitted mode speed limit:

80 km/h

V_NVREL

Rationale: *NV will be superseded with value provided with MA. If no other value is provided, 0 km/h shall apply.*

ENI-SS-ENG-407 Release Speed:

0 km/h

D_NVROLL

Rationale: *Increased to allow movements in order to avoid freezing of brakes when waiting at crossing loops.*

ENI-SS-ENG-408 Distance to be used in Roll Away protection, Reverse movement protection and Standstill supervision:

20 m

Q_NVSBTSMPERM

Rationale: *To ensure operational capacity. See Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-409 Permission to use service brake in target speed monitoring:

No

Q_NVEMRRLS

Rationale: *Speed and braking curve supervision is also used to LoA or speed restrictions in the speed profile. Braking to standstill will cause performance loss in these cases. Revoking of emergency brake, because the permitted speed limit is no longer exceeded is very unlikely when braking to an EoA unless ETCS-equipment has received an MA extension. Anyways, revoking the emergency brake command when the permitted speed limit is no longer exceeded does not have an impact on safety but may contribute largely to performance.*

ENI-SS-ENG-410 Permission to release emergency brake:

When permitted speed is no longer exceeded

Q_NVGUIPERM

Rationale: *There is neither benefit in safety nor in performance, of displaying a guidance curve to the driver. To reduce the wear, it is recommended to set this qualifier to "yes".*

See also Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.

ENI-SS-ENG-411 Permission to use guidance curves:

Yes

Q_NVSBFBPERM

Rationale: *Using this feature, braking intervention may occur later and the train can move longer with higher speed. This might be operationally useful, but is totally depend on the vehicle equipment and therefore not predictable from trackside. This qualifier is relevant, when service break is used in target speed monitoring. It is completely independent from trackside. Currently the use of the service brake curve is not decided, but since this value is independent from trackside the proposed value is "yes". See also Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-412 Permission to use the service brake feedback:

Yes

Q_NVINHSMICPERM

Rationale: *The fact that the estimated speed may be lower than the actual speed must be regarded either in track design or in breaking curve calculation. At the moment, speed measurement inaccuracy is respected already in the trackside margins. This concept shall also be true for the layout in ETCS. Consequently considering speed measurement inaccuracy when calculation the braking curves as well is not necessary. See also Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-413 Permission to inhibit the compensation of the speed measurement inaccuracy:

Yes

V_NVALLOWOVTRP

Rationale: *Overriding is a safety relevant action that shall only be executed when permitted by the dispatcher. Consequently this shall only be executed at standstill. It's proposed to use 5 km/h (the minimum possible speed higher 0) for the maximum speed to allow override trip function, since speed measurement errors or beginning of roll-away shall not disrupt override procedure.*

ENI-SS-ENG-414 Speed limit for triggering the override function:

5 km/h

V_NVSUPOVTRP

Rationale: *According to existing operational rules.*

ENI-SS-ENG-415 Override speed limit to be supervised when the "override" function is active:

40 km/h

D_NVOVTRP

Rationale: *It is assumed, that a train usually will stop 20m ahead of marker board, but there might be situations, especially for heavy freight trains, to stop 100m ahead of the signal, because of the low speed allowed by ETCS. The override function is used to pass the "former" EoA or a balise group containing "Stop if in Staff Responsible". Using a too small value for D_NVOVTRP might result in tripping the train in spite of initial override, because the distance supervision starts at the location where override was activated.*

ENI-SS-ENG-416 Distance for train trip suppression when override function is triggered:

200 m

T_NVOVTRP

Rationale: *The value shall not be too restrictive to allow the driver to pass the stop marker. It is used to deactivate override in very rare cases, where the driver change its mind and will not pass the marker board.*

ENI-SS-ENG-417 Max. time for train trip suppression when override function is triggered:

90 s

M_NVDERUN

Rationale: *For changing drivers at a station, entering the new driver ID improves the operational performance. Consequently changing driver ID while the train is running shall be allowed. Changing driver ID is not a safety relevant action.*

ENI-SS-ENG-418 Change of driver ID permitted while running:

Yes

M_NVCONTACT

Rationale: *To apply the emergency brake has disadvantages for the restart of train, since the brake pipes have to be filled up first. To do nothing is not safe. Therefore the value shall be set to apply service brake.*

ENI-SS-ENG-419 System reaction if radio channel monitoring time limit expires (T-Contact):

Service brake

T_NVCONTACT

Rationale: *According to risk analysis performed for pilot line, T_NVCONTACT is set to 90 seconds. This is derived from the need to pass a tunnel of 1000 m with a speed of 40 km/h without a radio connection.*

ENI-SS-ENG-420 Maximum time since creation in the RBC of last received telegram:

90 s

D_NVPOTRP

Rationale: *A tripped train might come to standstill in a conflicting route. The corresponding train will be stopped by an emergency message then. The resulting risk might be reduced by moving out of this conflicting route. It is recommended that D_NVPOTRP shall not exceed the most common length of overlaps which is 150 m.*

ENI-SS-ENG-421 Distance to be allowed for reversing in Post Trip mode:

0 m

D_NVSTFF

Rationale: *It might be reasonable to limit the distance to one or two track sections. The length of track sections can be very different in Norway. To define this value, the largest track section could be applicable since there is no standard track section length. But, limiting the distance will not lead to a safety benefit due to the different section lengths. The value can therefore be set to infinite.*

ENI-SS-ENG-422 Max permitted distance to run in Staff Responsible mode:

∞

Q_NVLOCACC

Rationale: *To get an operational benefit, the value for Q_NVLOCACC shall be less accurate than Q_LOCACC. Therefore the default value of 12m is recommended.*

ENI-SS-ENG-423 Default location accuracy of a balise group:

3 m

M_NVAVADH

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-424 Weighting factor for available wheel/rail adhesion:

1

M_NVEBCL

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-425 Confidence level for emergency brake safe deceleration on dry rails:

8

L_NVKRINT

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-426 Train length step used for the integrated correction factor Kr_int:

N/A

M_NVKRINT

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-427 Train length dependent integrated correction factor Kr_int:

Kr=1

V_NVKVINT

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-428 Speed step used for the integrated correction factor Kv_int:

60 km/h

M_NVKVINT

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-429 Speed dependent integrated correction factor Kv_int:

Kv0=0.82
Kv1=0.94

M_NVKTINT

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-430 Integrated correction factor for brake build up time:

Kt=1.3

A_NVMAXREDADH1

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-431 Maximum deceleration value under reduced adhesion conditions (1):

0.65 m/s^2

A_NVMAXREDADH2

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-432 Maximum deceleration value under reduced adhesion conditions (2):

0.65 m/s^2

A_NVMAXREDADH3

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-433 Maximum deceleration value under reduced adhesion conditions (3):

0.4 m/s^2

A_NVP12

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-434 Lower deceleration limit to determine the set of Kv_int to be used:

N/A

A_NVP23

Rationale: *See: Proposal for national values for ETCS braking curves in Norway.pdf: ERP-30-S-00044.*

ENI-SS-ENG-435 Upper deceleration limit to determine the set of Kv_int to be used:

N/A

34 CHANGE HISTORY

Rev.	Change		Date
018	General	Updated word in many requirements for clarification without affecting the consequences of the requirements	07.12.2021
	General	Changed symbol for signal 106 in all figures	
	General	Changed from level crossing to level crossing systems were relevant	
	ENG-1544	Application for deviation can be written in English and Norwegian	
	Chapter 1.7	Updated English - Norwegian translation	
	Chapter 2.2	Updated requirement for sight distance to signs	
	Chapter 4	New requirement to avoid disturbance in axel couther from balise antenna under train	
	Chapter 4.2	Updated figures with relevant distances and references to relevant requirements	
	Chapter 12.2, ENG-777	Removed requirements for warning lamp	
	ENG-132	Removed requirements for half barrier level crossing systems	
	ENG-1387	Removed requirements for Simplified Road system	
	ENG-1520	Changed from 1 to 2 keys in a key lock for two points	
	Chapter 10	Added new requirement to not have local control panel for derailers	
	ENG-769	Added comment regarding use of signal E36	
	Chapter 17.3	Added requirements for releasing of trainroute	
	Chapter 17.4	Changed requirement for alternative route path	
	Chapter 17.5	Added requirement for Position Indication Massage	
	Chapter 18	Moved requirements for cancellation and release of shunting route to chapter 18.3	
	Chapter 18.3	Added requirements for releasing of shunting route	
	Chapter 19.1	Clarified requirements for PSA types	
	Chapter 19.4	Updated requirements for PSA borders	
	Chapter 21	Updated requirements for entering freight terminals	
	Chapter 22	Added requirement for WA border	
	Chapter 22.6	Added requirement for dependency between WA and catenary section brake	
	Chapter 23.4	Added requirement for Ai in parallel tracks and number of Ai that can affect UESA	
	Chapter 24.7	Updated figure for LT	
	Chapter 24.8	Added heading for chapter concerning LT to Level 0	
	ENG-1449	Removed requirement for TSR	
	Chapter 28.8	Added requirement for Lx between signal 106 and exit marker board	
	ENG-1395	Added explanation for use of tables for platform entry	
	Chapter 29.7	Added requirement for maintenance level crossing	
	Chapter 30	Divided in Safety distance, Safety zone and overlap an updated explanation	
	ENG-1643	Removed possibility for shortening safety distance to 70m with two shunting signals	
	ENG-816	Updated table for safety distance and safety zone and added footer 5-7	
	Chapter 30.10	Added new chapter for parallel routes	
	Chapter 30.11	Added new chapter for compensation of gradients	
	Chapter 31.6.3	Updated requirement for numbering of points in non-supervised areas	
	Chapter 31.13	Added requirement for standalone shunting signal	
	Chapter 32	Updated chapter with signs, boards, and signals	
017	Minor changes as typos, clarifications of text etc., naming of signs and boards, changes on alternatives for station layouts single track line, correction of requirements for better understanding, removed all information/requirements about dimensions for signs, naming/numbering of objects and naming of work area, numbering of tracks on double track line, chapter for level transition and PSA updated and sight distance to other signs and boards. Change description in this document is replaced with a document for change description, ERP-30-S-00097_017_004 change description.		16.12.2020

16E	Definition relative to objects, clarification on MB close to platform, clarification of TVPs in points, scenarios for replacement of point machines, LX conversion table, fictive flank protection, description of overlap, description of route release, updated boarder UN-L2, derailment indicator, boundary between TVP systems, reference to principle engineering of station layouts, clarifications for simultaneous movements and level crossings in stations, added large station areas in naming convention and minor corrections to text and figures according to comments.	07.04.2020
15E	How to use document, change description, update of figures according to guidelines for drawing of schematick plans, Axle counter at signalling point, TVP section in points, Description of key lock function, local control panel for points and compensation when this is not used, Level crossing configurations, release speed at boarder to unfitted area, fixed balises with "Danger for SH", Simultaneous train movements and level crossings for platform entry, Release speed 20, Naming of TVP for deactivation of LX and minor correction to better understanding.	05.02.2020
14E	Prioritising MB placement (left, right, above track), Occupation of flank protection area, PSA borders (Non-interlocked PSA, interlocked PSA and Unfitted), Locally operated siding, Engineering of single track line, Engineering of double track line, Some figures updated according to drawing guidelines.	05.11.2019
13E	Updated: 40x40 MB in areas with limited space, TVP sections in points, crank cabinets, manually controlled points/derailer, safety distance double cross-over. Added: Predefined TSRs, entry MB close to LX, reference to gradient compensation not covered by tables in EG, prioritising of MB placement. Minor corrections to text and figures according to comments.	05.09.2019
12E	Small changes in: TVP sections group of points, Cranks and cranck cabinets, Alternative flank protection, Boarder to unsupervised PSA, Splitting of block posts. Added: Naming of station/platform track, naming of points in non-supervised areas, Naming conventions example.	21.06.2019
11E	Updated naming convention for block posts on double track line, overall clean up – removed doubled requirements, figures updated, rephrasing and corrections. Engineering of centralised operated siding updated. Engineering of TVPs for group of points removed, update will follow in next release.	03.05.2019
10E	Added engineering of TVPs for group of points. Updated overlap, safety distance and release speeds, level crossing, work area non-supervised area, naming conventions, level crossings and simultaneous train movements, dead end track. Other minor corrections according to comments.	08.03.2019
09E	Added/altered engineering of Avalanche detection, Moveable bridge, Avalanche detection, Placement of Marker boards relative to curves, LC, bridges and tunnels, Freight terminal areas, dead end tracks, flank protection, Sub routes and non stopping areas. Added some minor updates according to comments. Some updates of Naming conventions	20.12.2018
08E	Added dimensioning train length. Added 30 km/h release speed. Added safety distance. Updated distance from LX to block post. Updated Introduction text. Updated figures. Updated according to comments from Engineering. Updated according to comments from Kunde og Trafikk.	01.11.2018
07E	Added new overlap and release speeds. Added minor changes.	14.09.2018
06E	Added naming convention	31.08.2018
05E	Added Signal E38, E39, E47. Added new overlap distances. Added crank cabinets. For more details see red line mark-up document	29.06.2018

04E	Updated after comments. Updated signaling for sidings on the line. Added Overlap and release speed. Added Emergency stop areas. Added PSA. Added Single track line.	04.05.2018
03E	Added criteria and layots for work areas, added criteria for level transition, added criteria and layout for shunting signals in Level 2 areas, added English-Norwegian translations, new chapter structure and added figures for marker boards, updated figures for double track lines etc.	22.12.2017
02E	Including "stop for shunting" board, new station layouts, etc	02.11.2017
01E	Updated figures, new figures, added national values etc.	11.09.2017
00E	First draft	12.12.2016