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Measurement of Signalling Distances

ESD-00-02

Applicability

ARTC Network Wide

SMS

Publication Requirement

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Primary Source

NSW Standard SDS 22 (v1.2)

Document Status

Version #	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.1	09 Jun 20	Standards	Stakeholders	Manager Standards & Manager Signalling Standards	General Manager Technical Standards 29/06/2020

Amendment Record

Amendment Version #	Date Reviewed	Clause	Description of Amendment
1.0	7 December 2016		First issue of standard to supersede SDS 22 Measurement of Distances on Signalling Plans (v1.2). Extended to network wide applicability, clarification of absolute and reference signalling measurements with respect to km posts, rebranded document template and minor editorial updates throughout.
1.1	09 Jun 20	1.3; 1.4; 1.5; 2.2; 2.3 & 4.2	Updated to provide a clear definition of standing room for the different type of loop arrangements. Other editorial changes throughout.

Table of Contents

1 Introduction to Signalling Measurements

This standard addresses the requirements for measuring signalling distances in the field, the annotation of signalling kilometrage & distances on signalling documents.

1.1 Purpose

Signalling distances will be measured with absolute measurements for the actual measured distance between two signalling objects but referential measurements where signalling objects are related to the position of kilometre posts. There are discrepancies in the position of kilometre posts, so there may be discrepancies between absolute and referential measurements. The distinction between the two measurements is to ensure accurate information is used in all systems.

1.1.1 Background

Traditionally, kilometrage posts marked on signalling plans are utilised to locate the position of signalling equipment. There may be short and long kilometres between posts. Figure 1 below is at the extreme of this situation, where the short half kilometre post is close to the kilometre post.

Figure 1: Short half kilometre

There are also network situations where there are two different paths from the Base Reference Point. The distance shall be measured from the correct post as detailed in this Standard. This is also the case for distance measurements at kilometre changeover points.

With the implementation of the GPS system and its use in systems to locate trains or a position i.e. train order territory, electronic train order territory and ICAPS, etc, the measurement of signalling location and distances needs to be on a consistent basis. The Train Order computer used in train Order working and electronic train order working requires consistent kilometrage measurements as reference points for determining authorities.

This standard sets out the requirements for measuring distances on Signalling Arrangement Plans.

1.2 Scope

This standard covers the requirements in identifying which measurements are 'absolute' and which are 'referential' and the process for measuring these.

It covers discrepancies in the position of km posts in relation to short and long physical measurements and how these are assessed and controlled during the signalling design.

This standard addresses the terms and definitions relating to those measurements and application of 'absolute' and 'referential' measurements for signalling designs & equipment positioning.

The scope includes all measurements used for all systems.

Refer to ESD-25-02 Signal Design Process for details on the initial signal arrangement plan and Design Report.

1.3 Document Owner

The General Manager Technical Standards is the document owner. Queries should be directed to standards@artc.com.au in the first instance.

1.4 Responsibilities

This section details the roles to be undertaken by various people. As the position titles of these people may alter over time, the generic role title has been used throughout this standard.

The Signal Design Engineer (or Signal Designer) is responsible for the implementation of this standard.

The Signals Project Manager is responsible for managing the process.

1.5 Reference Documents

Rules and Procedures applicable to the ARTC Network.

1.6 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
ARTC	Australian Rail Track Corporation Ltd.
Absolute	Accurate length or measurement of signalling asset or control requirement. Absolute distance between two signalling objects.
Base Reference Point	The point in each state used as the zero kilometrage reference.
Kilometrage	Longitudinal reference of signal equipment in x.xxxkm format from Base Reference Point.
City side kilometre	The kilometre post on the side of the signal equipment closest to the Base Reference Point.
CWP	Commissioning Works Package.
Down rail	The down rail is the right hand rail when standing in the middle of the track looking towards the Base Reference Point.
DSS	Detailed Site Survey.
GPS	Global Positioning System.

Term or acronym	Description
Reference	In positional terms – the relationship of a signalling asset to a fixed marked structure or km post.
SAP	Signalling Arrangement Plan. This may have previously been referred to as the signal plan or track plan.
Signal Arrangement Plan	This is the plan which shows the track and the arrangement of signalling equipment. It is scaled along the length of the track but typically not scaled across the breadth of the track. It may show the track as a single line. It has symbols to represent equipment such as signals, point motors, track circuits, location cases and equipment huts, power supplies and other signalling equipment individually located within the rail corridor.
IRJ	Insulated Rail Joint (known as Insulated Joint in this document).
GIJ	Glued Insulated Joint (known as Insulated Joint in this document).
Departure Signal	Known as signal governing the departure in this document (also known as the starting signal).
Clearance Point	The nominated point where rail traffic is deemed clear of others at converging points or other locations. This point may or may not be delineated by signs or clearance posts.
Clearance Point Marker	Formerly known as Fouling Point Marker, Identifies the clearance point for two or more converging rail lines.
ICAPS	In Cab Activated Points System.

2 Requirements

2.1 General Requirements

The position of an item of signalling equipment or the distance between two items of signalling equipment is an important part of the signal design. It may be required to meet a signalling principle or to correspond to another part of the signalling design.

The distances referred to in signalling standards are always absolute distances. These may be for overlaps, clearances, signal spacing, timer tracks or other purposes. The required distance must be physically measured between the nominated items.

The location of an item of equipment is a referential position with regard to the lower kilometrage in relation to the equipment position.

Kilometre posts are laid out from nominated Base Reference Points as detailed in Table 1 below. There may be situations where the network loops around from 2 different directions to the one location. This results in different distances via each path to the location. There will be a protocol in each part of the network for the default direction for measuring the location.

Table 1: Base Reference Points

State	Base Reference Point
South Australia	1. Mile End station platform for Mile End to Wolseley and Mile End to Coonamia
	2. Coonamia for Coonamia to Kalgoorlie and Coonamia to Broken Hill
	3. Dry Creek for Outer Harbour Line
Western Australia	Coonamia for Coonamia to Kalgoorlie (exclusive)
Victoria	Southern Cross Station (Melbourne) buffer stop on platform 1
New South Wales	Central Station (Sydney) buffer stop on platform 1
Queensland	Central Station (Sydney) buffer stop on platform 1 for locations from New South Wales border to Acacia Ridge (exclusive)

2.2 Signalling General

The following items are absolute measurements:

- Length of track circuit,
- Distance between Boards or signal equipment,
- Spacing of signals, and
- Distances referenced in Signal Design standards.

2.3 Standing Room

There are four types of standing room definitions;

1 Typical Loop Arrangement Standing Room,

2 Simultaneous Entry Crossing Loop Arrangement Standing Room,

3 Non-track Circuited Loop Arrangement Standing Room, and

4 Dead-end Siding Arrangement Standing Room.

2.3.1 Typical Loop Arrangement Standing Room

When measuring the standing room length at a typical loop arrangement see Figure 2 below. The standing room length is defined as the distance between the signal governing the departure at either end of the loop subtract 3 metres.

Main and loop line standing room length may be different to one another, as the loop could be on a curve or signals could be positioned at different locations. Standing Room should be measured and recorded for both loop and main line.

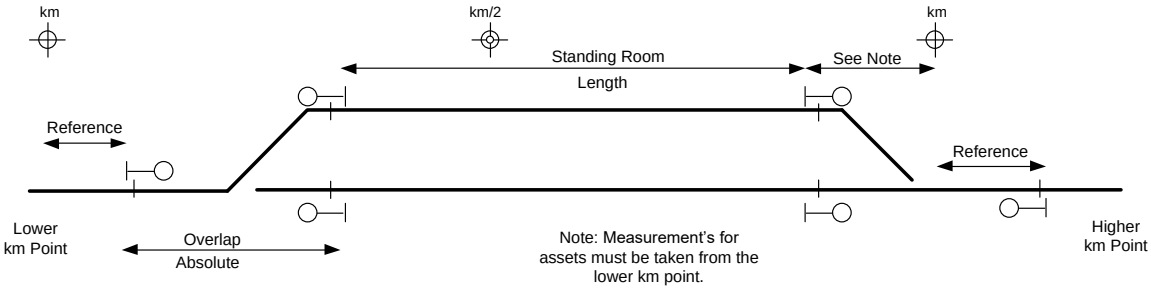

Figure 2: Typical Loop Arrangement

The distance from the front of train to the signal governing departure is not considered in the standing room measurement. This distance is typically 10 to 50 metres and depends on operator practices.

A kilometre or half kilometre post may be used to reference a fixed signal asset for kilometrage reference and identification. This referenced datum may be used as the starting or finishing point of the loop, however, the exact designed length must be measured out from this fixed point on the track using methods described in section 4.

Note that reference distances are only made to the kilometre post or half kilometre post closer to the lower km point. They are not made to the higher km point.

2.3.2 Simultaneous Entry Crossing Loop Arrangement Standing Room

When measuring the standing room length at a simultaneous entry loop arrangement where the clearance point is spaced away from the signal governing departure, see Figure 3 below. The standing room length is defined as the distance between the signal governing departure to the insulated joint closest to the clearance point subtract 3 metres.

Main and loop line standing room length may be different to one another, as the loop could be on a curve or signals could be positioned at different locations. Standing Room should be measured and recorded for both loop and main line.

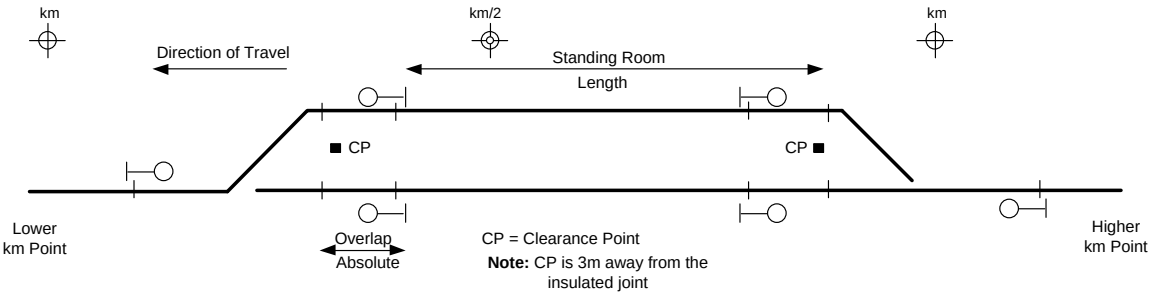

Figure 3: Simultaneous Entry Crossing Loop Arrangement

The distance from the front of train to the signal governing departure is not considered in the standing room measurement. This distance is typically 10 to 50 metres and depends on operator practices.

2.3.3 Non-track Circuited Loop Arrangement

When measuring standing room length at a non-track circuited loop arrangement see Figure 4 below. The standing room length shall be defined as the distance between the clearance point markers at either end of the loop subtract 3 metres.

Main and loop line standing room length may be different to one another, as the loop could be on a curve or clearance point markers could be positioned at different locations. Standing Room should be measured and recorded for both loop and main line.

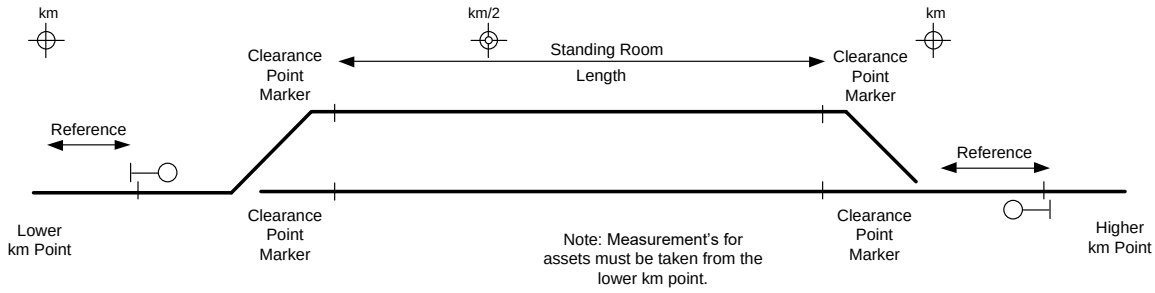

Figure 4: Non-track Circuited Loop Arrangement

2.3.4 Dead-end Siding Arrangement Standing Room

When measuring standing room length at a dead-end siding arrangement see Figure 5 below. The standing room length shall be defined as the distance between the clearance point to the buffer stop / end stop subtract 4 metres. If the siding has a signal at the entry/exit, then the standing room shall be defined as the distance between the signal to the buffer stop / end stop subtract 4 metres.

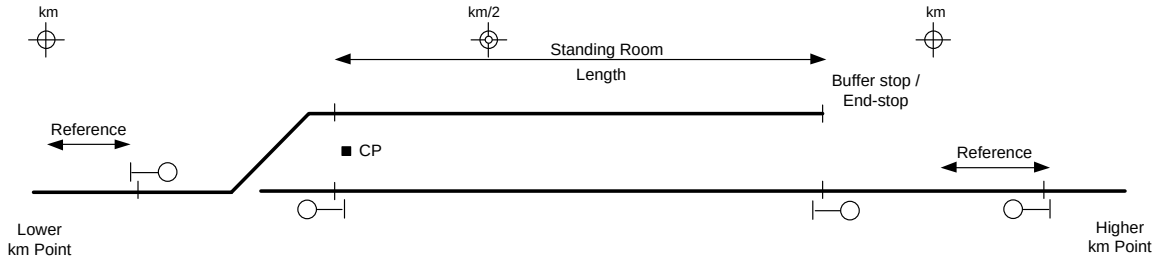

Figure 5: Dead-end Siding Arrangement

2.4 Overlap length

Overlap lengths shall be an absolute measured distance and may be determined as described above. The overlaps shall not be measured using kilometrage posts as the defining references for each end. When measuring overlaps the actual length shall be the distance between the fixed home & signal governing the departure at either end of the loop into the single line.

A kilometre or half kilometre post may be used to reference the fixed starting or finishing point of the loop however, the exact designed length must be measured out from this fixed point on the track using the methods described in section 4.

2.5 Signalling Equipment Positioning

Signal equipment positions shall have their kilometrage annotated on the Signalling Plan as a reference to identify its field location. This information can also be used in the asset management system. This kilometrage will be derived from the reference to the nearest kilometre or half kilometre post.

2.6 Signalling Signs Positioning

Some signal signs indicate a distance to a location. These signal signs must display the accurate measurement to the location. The sign should display the distance in metres. Metres may be abbreviated as ‘M’ on the sign.

Location Ahead Signs Extracts from ARTC documents

ARTC INDICATORS AND SIGNS
ANSG 604
Signals and Signs

LANDMARK and LOCATION signs cont.

Figure ANSG 604-15

Examples of LANDMARK and LOCATION signs.

ARTC Addendum to the Code of Practice for the Defined Interstate Rail Network

30 Track Side Signs and Their Meaning
CoP Reference 3.1

Whilst the Code of Practice for the Defined Interstate Rail Network details the colour and shape of track side signs, a number of signs will not be changed until such time as the reflectorisation fades such that they are no longer acceptable. In the interim there will be a mix of old and new signage and the table below indicates the old signage and meaning pending changing to that detailed in the new Code.

30.1 Location Ahead Sign (CTC and ABS Territory)
No Reference CoP

A caution sign with a plate indicating the name of a location or a signal identifier in CTC or ABS territory and the distance to the location or a signal.

Meaning - Provides warning of approach and distance to a location or signal and recognition by its designated name. Proceed being prepared to respond to the next signal indication. The next signal is at braking distance and may be at stop. When the next signal is sighted respond according to its indication.

or

NOTES

[1] A Location Ahead Sign may be placed in advance of a fixed signal in CTC or ABS territory to compensate for limited signal sighting distances,

or

[2] Location Ahead Signs are placed at a safe braking distance and no more than 3000m ahead of the Location or signal. 2500m is the standard advance warning distance for the Defined Interstate Rail Network and is shown as an example.

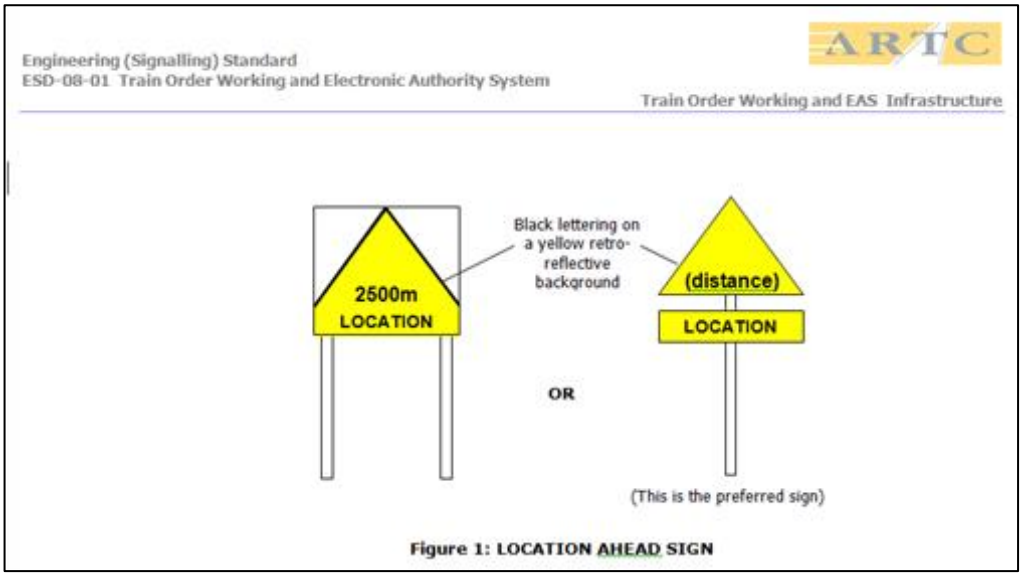

Figure 1: LOCATION AHEAD SIGN

3 Signalling Documents

3.1 Drivers diagrams, Litho or Signal Diagram

The Drivers diagram or litho is produced to aid train drivers to understand the track and signal network.

The kilometrage shown on these diagrams shall be field checked against Certified Construction Copy (CCC) of the Signalling Arrangement Plans and Network Information Books (NIBS). Any updates should be published as a Safe Notice or Standing Notice.

3.2 Signalling Arrangement Plans

Signalling Arrangement Plans should contain sufficient information from the design to cover the requirements listed above. In addition, they should indicate the discrepancies, if any, between the measured length and the kilometrage posts.

Any discrepancies shall be annotated in brackets directly below the kilometre or half kilometre symbol on the plan. If a half kilometre is short, the direction that it is short should be detailed.

(460m)

If there is no half kilometre post located between kilometre posts then the measured kilometrage between kilometre posts should be documented. An accumulative actual kilometrage may also be added, again in brackets, below the kilometre or half kilometre symbols.

The signalling arrangements proposed for each design shall be verified as correct before a detailed design can commence

3.3 Cable Routes, Track Insulation & Bonding Plans

Cable Routes, Track Insulation & Bonding Plans should correlate with the Signalling Arrangement Plans with regards to all signalling asset references.

Track circuit measurements should be absolute and drawn to scale where possible using the down rail of the main line as the datum.

3.4 Site Surveys

It is normal practice to measure from the lowest kilometre post out during initial site surveys prior to any design commencing.

During this activity it is recommended that the distance recorded is the measured distance between kilometre posts, i.e. measuring the distance between each post to reduce the likelihood of any summation errors.

4 Measurements

4.1 Measurements

All rail measurements must be taken along the surface of the down rail of the main line and distances read across, perpendicular to the rail to the centre line or other datum point of the signalling equipment.

Track circuit measurements shall be taken from block joint to block joint or theoretical centre position of tuned areas as required by the design.

4.2 Measuring Equipment

Short measured lengths may be determined by using a non-metallic tape measure but generally a trundle wheel is the most common method of longitudinal measurement.

Any trundle wheel used must have a valid calibration label. Alternatively, the accuracy of the wheel should be checked against a marked 10m section of rail determined by an accurate steel tape measure. Any discrepancies between the two measurements should be noted for adjustment to measured values recorded.

When operating the trundle wheel along the rail head, specifically through Points & Crossings ensure the wheel does not slip off the rail. If the trundle wheel does slip the entire section should be re-measured. A trundle wheel fitted with a form of rail guide will assist in reducing this likelihood.

The trundle wheel is not an applicable measuring instrument for measuring standing room. Standing room should be measured using a device capable of performing to an accuracy of 1m over the entire standing room length, an example system being GPS centreline data.

4.3 Reading from Drawings

Generally, signalling drawings are not accurately scaled. Thus, they do not permit the user to measure off the drawings by scaling. However, the drawings do contain specific information as to distances. For example, the Signal Arrangement Plan has specific lengths of track circuits recorded. It also has the position of the signals and other equipment recorded as a kilometrage. The Signal Arrangement Plan is not to be used to determine the distance between two items by scaling off the drawing.

5 GPS Measurements

The processes for using GPS measurements are detailed in the standards for the respective signalling technology.

6 Compliance Indicators

The following items are indicators of compliance with this standard. They may be used by auditors or managers when reviewing performance.

a. Design Report includes reference to field survey of short and long kilometre sections;

b. Commissioning Work Package includes verification of distance from kilometre post and of absolute distances;

c. Detailed Site Survey includes all distances as absolute or referenced.