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Function:	Signalling
Document Type:	Standard

Measurement of Signalling Distances

ESD-00-02

Applicability

ARTC Network Wide

SMS

Publication Requirement

Internal / External

Primary Source

NSW Standard SDS 22 (v1.2)

Document Status

Version #	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.0	7 December 2016	Standards	Stakeholders	12 December 2016	Acting General Manager Technical Standards 13 December 2016

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.

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, specifically in Train Order areas.

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 Signalling and Train Order systems.

1.1.1 Background

Traditionally, kilometrage posts marked on signalling plans are utilised to locate the position of signalling equipment. After many years the railway network has often had changes to the track route resulting in a change in the length of the line at locations. Rather than reposition all kilometrage posts, there may be short and long kilometres between posts. The example below is at the extreme of this situation.

Diagram 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.

With the implementation of the GPS system and its use in Train Order territory, ICAPS and other systems to locate trains or a position, the measurement of signalling location and distances needs to be on a consistent basis. The Train Order computer used in 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 signalling and Train Order 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 Manager Standards is the Document Owner and is the initial point of contact for all queries relating to this standard.

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.

1.4.1 Responsibilities

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.

1.4.2 Field Engineers

It is the responsibility of the Signal Maintenance Engineer or Signal Maintenance Manager or Signals Team Leader to inform the Signal Design Engineer when the distance between kilometre posts on signalling plans are found to be substantially (>10%) different to measured distances for installed signalling arrangements.

On signalling plans where it is known that the kilometre posts are inconsistent with the actual measurements, it shall be highlighted as in 3.2 below.

1.5 Reference Documents

The following documents support this standard:

- Track & Civil CoP Section 11 – Railway Operating Signs
- ETG-11-01 – Railway Signs
- ETF-11-01 – Permanent Trackside Signage
- ANSG 604 – Signals & Signs
- ESD-25-02 – Signal Design Process

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 Sydney Central Station or Melbourne Spencer St or Mile End (SA) or nominated 0 km location .
City side kilometre	The kilometre post on the side of the signal equipment closest to the Base reference point for that state.
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 (eg Sydney).
DSS	Detailed Site Survey.
GPS	Global Positioning System.
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.

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 kilometrage on the City side of the equipment.

Kilometre posts are laid out from a nominated Base Reference Point in each state as detailed 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.

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

Table 1 – Base Reference Points

2.2 Signalling General

The following items are absolute measurements:

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

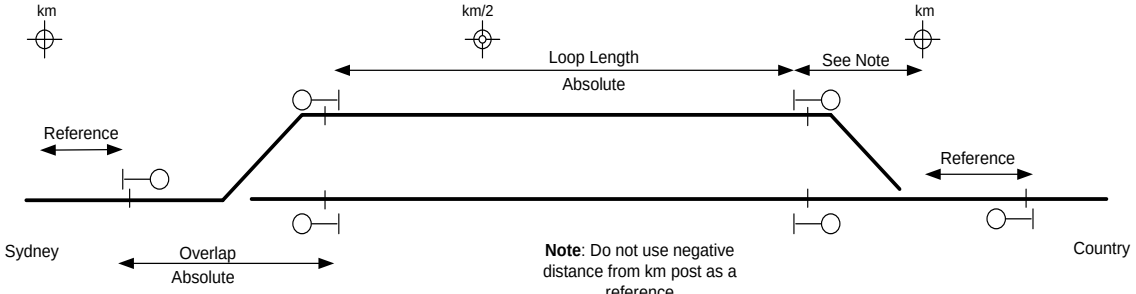


Figure 1 – Typical Loop Arrangement

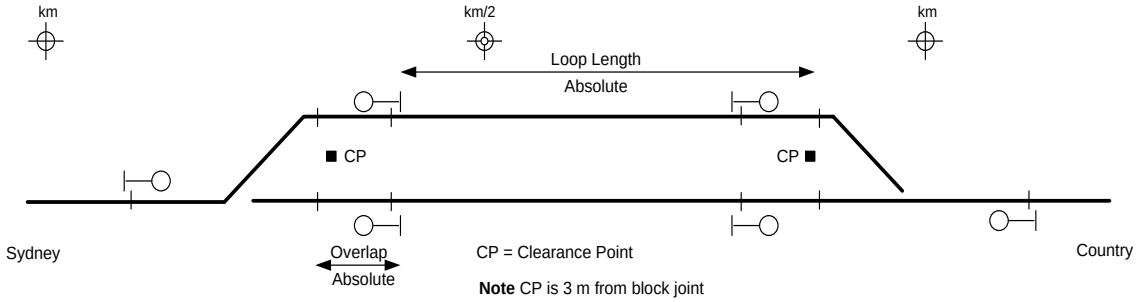


Figure 2– Simultaneous Entry Loop Arrangement

The example references Sydney but is equally applicable to Melbourne and Adelaide.

Loop lengths shall be an absolute length and shall not be measured using kilometrage posts as the defining reference. (refer Fig 1)

When measuring loop lengths the published standing room shall be the distance between the starting signals at either end of the loop, less 15m for sighting or less 30m if one or more of the signals is gantry mounted.

Where the Clearance Point is spaced away from the starting signal as per Fig 2, then the Loop Length is measured from the starting signal to the clearance point in the rear.

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 capital city reference point. They are not made to the next kilometre post further away.

2.3 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 & starting signals 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.

2.4 Signalling Equipment Positioning

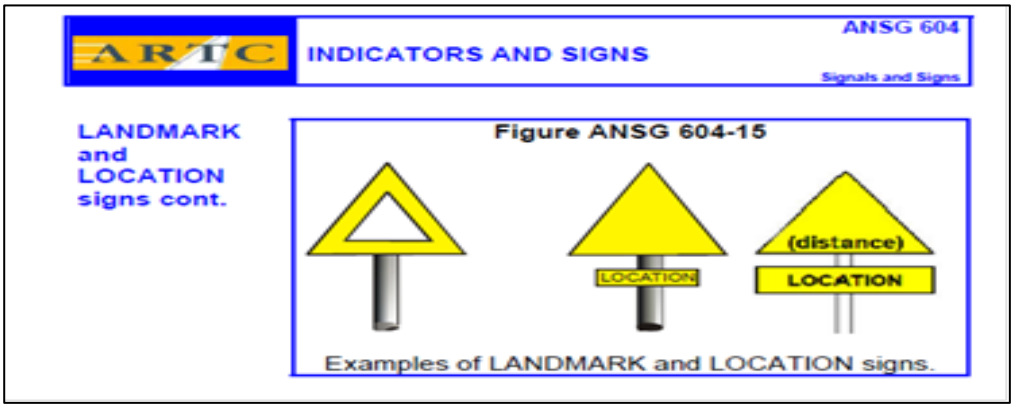
Signal equipment positions shall have their kilometrage annotated on the Signalling Plan as a reference to identify its field location. This information can also be used in the asset management system. This kilometrage will be derived from the reference to the nearest kilometre or half kilometre post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

2.5 Signalling Signs Positioning

Some signal signs indicate a distance to a location. Where these distances are greater than 1000 metres, then the value should be rounded to 100 metres in the distance shown on the sign. This is for ease of reading by the train driver. The sign should display the distance in metres. Metres may be abbreviated as 'M' on the sign.

Where a standard distance is used such as the 2500 metres for the Location Ahead Sign, then the distance of 2500M is considered as being + or – 100M. Otherwise, the rounding will apply from the actual distance.

Extracts from the Standards of Signalling 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.

Engineering (Signalling) Standard
ESD-08-01 Train Order Working and Electronic Authority System

Train Order Working and EAS Infrastructure

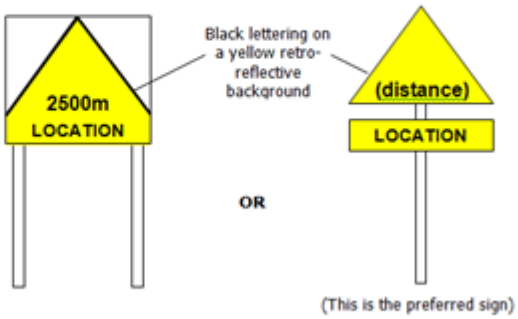


Figure 1: LOCATION AHEAD SIGN

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 for Train Order areas shall be field checked against Certified Construction Copy (CCC) of the Signalling Arrangement Plans and updates before being published as a Safe Notice or Weekly Notice or Standing Notice.

Other areas should update kilometrage in the normal certification and updating process.

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 parenthesis directly below the kilometre or half kilometre symbol on the plan.

(460m)

An accumulative actual kilometrage may also be added, again in parenthesis, 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 Track Insulation & Bonding Plans

Track Bonding & Insulation 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 the distance between half kilometre and kilometre posts, during initial site surveys prior to any design commencing.

During this activity it is recommended that the surveying engineer records the actual distance between km posts and then zeroing the pedometer at each post to reduce 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.

4.3 Cautions

Care should be exercised when operating the trundle wheel along the rail head, especially through Points & Crossings to ensure the wheel does not slip off the rail and continue revolving. By keeping an eye on the recorded distance it may be possible to recover the actual distance should this occur. If in any doubt that whole section should be re-measured.

A trundle wheel fitted with a form of rail guide will assist in reducing this likelihood.

4.4 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.