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Level 2

Tracklink 2/HSD2000 Platform Identification Beacon System (PIBS) for Selective Door Operation (SDO)

Endorsement and Authorisation

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Issue record

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Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 06/03/2010.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 4 to continue to comply with the Issue of any relevant Network Rail Standards current when GRIP Stage 4 was reached and not to comply with requirements contained herein, unless the designated Standard Owner has stipulated otherwise in the accompanying Briefing Note.

Reference documentation

NR/L3/SIG/10663	Signal Maintenance Specifications
NR/L3/SIG/11231	Signalling Maintenance Testing Handbook
NR/L2/SIG/30050	Signalling Power Circuit Principles
NR/SP/SIG/11201	Signalling Design: Production
NR/SP/ELP/21085	Specification for Design of Earthing & Bonding Systems for 25Kv AC Electrical Lines
NR/GN/SIG/11210	Signalling Installation
NR/L2/SIG/10173	TPWS Track Sub-system Installation Requirements
NR/SP/SIG/19812	Cross Track Cable Management
NR/L2/AMG/1030	Working Safely in the Vicinity of Buried Services
NR/L2/SIG/10661	Signal Maintenance Task Intervals

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1 Purpose

The purpose of this standard is to define Network Rail's role in the operation of the Platform Identification Beacon System (PIBS) that works in conjunction with the "base SDO system" on Class 377 Electric Multiple Units, which, in turn, is based on Global Positioning System (GPS) technology.

It should be noted that the functions that the system is intended to carry out on the trains are not the responsibility of Network Rail. However the system relies on Network Rail to carry out certain responsibilities for the equipment installed in the track, and this standard defines what they are.

2 Scope

The structure of this document has been designed to provide appropriate standards that will allow the design, installation and testing of the track-mounted Tracklink 2 PIBS equipment as a signalling infrastructure asset, within a defined fitment area. Network Rail's responsibilities defined in this standard are limited to ensuring that track mounted PIBS equipment is correctly designed, installed, tested, maintained and repaired. Network Rail's responsibilities do not include the functions that the trainborne systems are intended to carry out.

This standard is based on the system applied to Class 377 Electrostar units, although equivalent systems fitted to other classes of rolling stock are not excluded.

3 Definitions

Antenna	Trainborne hardware that receives the data packet from the beacon and passes it to the receiver.
Base SDO system	The SDO system which uses GPS to determine the location of the train.
Beacon	Infrastructure hardware which transmits data in the form of an electronic data packet, which contains information such as the ULI and platform length. (It is also known as a Track Loop.)
Black Location	A location where it is not possible to receive a GPS signal.
Default Release Code	This is the default release code indicated in the base SDO section of the database. This may not necessarily be the shortest platform within a station where the train operator has supplied mitigation for the location. See "PIBS Default Release Code".
Emergency Release	In the event of a beacon fault (not detected when expected or data mismatch) or the tracking being invalid, either the "PIBS Default Release Code" will be used or the driver will be asked to confirm the location. The "Emergency Release" will be available and the driver will have the option to open doors manually. If the "Emergency Release" button is pressed, any doors previously released will close whilst the driver selects the required doors to release.

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Grey Location	A location where it may be possible to receive GPS signals.
Non-GPS location	A location that does not have guaranteed GPS reception (Grey/Black locations).
PIBS Default Release Code	If PIBS is active (i.e. the SDO system is operational and the beacon data is present), this is the default release code indicated in the PIBS section of the database. This is for the shortest platform within a station. See “Default Release Code”.
Receiver	Trainborne hardware which receives the data packet from the antenna. The data is processed and then passed to the train management system.
Release code	A 12-bit code representing the door release pattern. Cars with doors to be released are represented as “1”, those not to be release are represented as a “0”.
Tracking Valid	The state when the tracking database agrees that it has been possible to track to the new beacon location or GPS location from the previous location. *NOTE Tracking will not be valid if the train is powered off and back on again. This is a “Base SDO” function.*
White Location	A location where it is always possible to receive GPS signals.

4 Abbreviations

IDU	Information Display Unit. This is a Man Machine Interface with a display and integral touch screen.
GPS	Global Positioning System
LRU	Line Replaceable Unit
PIBS	Platform Identification Beacon System
PIS	Passenger Information System
PDU	Passenger door Unit
SDO	Selective Door Operation
ULI	Unique Location Identifier, a number used to uniquely identify a location on the railway network. No two locations have the same ULI.

5 Background

Some stations have platforms that are shorter than the potential train length. Certain passenger doors therefore need to be rendered inoperable when the trains stop at such stations. This is known as Selective Door Operation (SDO) and is currently in use on Class 375 and 377 Electrostar trains.

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Currently GPS technology is limited in accuracy such that the base SDO system is unable to determine the platform within a station at which the train is standing. In order to ensure system safety, the SDO functionality defaults to what is generally the shortest known platform length at a given station.

For example, in a station with two platforms of 8 and 12 car lengths respectively, the GPS SDO system opens the doors on the leading 8 cars. So, even when stopping a 12 car train at the 12 car platform, passengers in the rear 4 cars would have to pass through the train in order to exit. The base SDO system mitigates any risks involved by automatically announcing the need for passengers to move forward before the train enters the station.

The Tracklink 2 track to train communication system (PIBS) has been developed to overcome these shortcomings and enable a train to make full use of the available platform lengths at a given location by maximising the number of doors that can be released in order to minimise train dwell times and passenger inconvenience. The system also allows positive identification of non-GPS (grey / black) locations and removal of driver intervention.

6 Appendices to this Standard

The following Appendices are mandatory:

Appendix A Train Interface Requirements

Appendix B Signalling Design Requirements

Appendix C Components

Appendix D Signalling Installation Requirements

Appendix E Testing and Commissioning Requirements

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Appendix A
Train Interface Requirements

A.1 Process for System Change

Initiation of change is generated either by the train operator or the infrastructure manager. Both parties shall agree a migration path to the new configuration.

A.2 Identification of Changes Necessary

It is necessary that the train database and track beacons are both changed in order to fully commission the new arrangement.

The migration path shall identify:

- any new beacons;
- any beacons to be recovered;
- any beacons with data changes (station identity and/or platform length);
- consequential changes to the train database.

A.3 Implementation Process

The agreed process shall cover, so far as is necessary:

- allocation of responsibilities for each phase of the process;
- production of location area plan and circuit diagram(s) for the change;
- design acceptance by interdisciplinary check;
- installation/recovery of beacons;
- integration of trackside and trainborne data changes;
- validation of the installation against the location area plan design;
- commissioning by means of a Signal Maintenance Testing method statement;
- data verification by train operation;
- production of final records.

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Appendix B
Signalling Design Requirements

B.1 System Description

1. The Platform Identification Beacon System (PIBS) comprises infrastructure equipment and trainborne equipment:
   - The infrastructure equipment consists of a Tracklink 2 beacon installed in the 4-foot at selected stations, a disconnection box and a Tracklink control panel in a trackside enclosure.
   - The trainborne equipment consists of an underframe mounted Tracklink 2 antenna and receiver module, and a database which is part of the computer based train management system.
2. The Trackside Control Panel transmits a very low frequency (VLF) signal to the beacon containing the Unique Location Identifier (ULI) and a numerical value derived from the associated platform length, both derived from a fixed Coding Plug on the Transmitter Control Unit.
3. The trainborne receiver decodes the transmission from the beacon. The train then revises the door selection in the base (GPS) SDO system to match the platform length setting received from PIBS.

   NOTE The Passenger Information System (PIS) message is chosen from a set of audio/visual announcements held in the database for that ULI, depending only on train length, and is not affected by the PIBS transmission. This is because there is insufficient time for a message after the train has passed the beacon. If the train is diverted to an unusual platform, a manual announcement has to be made by the driver.
4. Since the SDO system uses a hybrid of GPS and beacon, transmission failures are identified by the train, enabling it to revert to the default platform length for the station concerned before releasing the doors.

   NOTE If a beacon fault occurs, the "PIBS Default Release Code" will be used provided the tracking is valid, but the driver will only become aware that the "PIBS Default Release Code" is used when the doors are released. An "Emergency Release" will be available and the driver will have the option to open more doors. If the "Emergency Release" button is pressed, all doors previously released will close whilst the driver selects the required doors to release. If the tracking is not valid, the driver has to confirm or select the location before the doors are released.

B.2 Station Fitment

The following station platforms within the defined fitment area shall be fitted with PIBS beacons:

1. at Non-GPS locations - each station platform used by rolling stock fitted with PIBS equipment,
2. at GPS white locations - each platform used by rolling stock fitted with PIBS equipment at stations with multiple length platforms.

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B.3 System Constraints

This section defines the assumptions and operational constraints of the PIBS:

1. A site survey is required when positioning a Tracklink 2 beacon. It shall not be installed within 1m of a TPWS beacon or within 3m of a conductor rail gap, in order to prevent electro-magnetic interference. It shall also be positioned clear of physical obstructions in the 4-foot (e.g. AWS and check rails), other equipment where it might impede maintenance access (e.g. Reed loops), and shall not be located within 300mm of switch rails.
2. The train only reads beacons located in the 4-foot, i.e. the train cannot read a beacon on an adjacent track.
3. Beacons are multi-directional, i.e. a train receives information from a beacon regardless of the direction of travel, provided it is not travelling in the “reverse” direction.
4. The train also ignores beacon data received after the train has split.
5. Beacons cannot be detected by the trainborne system in the event of a trackside power failure.
6. It is assumed that all rolling stock that requires the use of SDO is fitted with PIBS equipment.
7. Only the antenna on the multiple unit with the active cab detects the beacon.
8. No more than four different beacon release codes can be held in the trainborne database for a given location, including the “PIBS Default Release Code”. For a transmitted code to be validated it has to match one of those in the database.

B.4 Positioning Beacons

B.4.1 General Rules

The following requirements apply when designing the beacon positions:

1. The beacons shall be located so that the antenna on the unit with the active cab passes over the beacon, e.g. if an 8 car train (two 4 car units) enters a location, only the antenna on the leading 4 car unit will need to pass over the beacon. Consideration of the antenna position on each type of fitted unit will be required, noting that receipt of this data is essential to the train receiving the correct door release code.

   NOTE If split, the train only uses beacon data received from the unit that had an active cab on arrival at the location for door release.

   NOTE If joining and the trains detect beacons with the same platform lengths, the train uses the beacon release code for door release. If joining and the trains detect beacons with different platform lengths, the train reverts to the “PIBS Default Release Code” for door release.

2. If the location has GPS reception, the beacons shall be located within the station’s GPS zone (approx. 300m from the station centre).

   NOTE This does not mean GPS reception is essential.

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3. Beacon detection can only be guaranteed if the train speed does not exceed 50mph, so this shall be considered when locating beacons at non-GPS locations where it is possible for the train to proceed at speed without stopping. If the train fails to read the beacon, the SDO position tracking system data will become invalid and manual door operation will be required at the next location.

   NOTE This is not an issue provided the next stopping station is a GPS white location, since GPS takes priority over beacons for tracking purposes.

4. Bi-directional platforms may have beacons located at both ends of the platform. If the beacons contain different platform length data, they shall be placed such that when a train enters from either direction, the antenna will only pass over the correct beacon.
5. The distance between the beacon at the exit of a location and the stop point of the next location, has to be greater than 400m. Refer to B.4.2.
6. The maximum distance between the beacon at the entry to a platform and the stop point of the same platform has to be less than the PIBS Data reset distance of 300m. Refer to B.4.3.
7. The minimum distance from a beacon to the stopping point shall be 80m. Refer to B.4.4.
8. The minimum distance between beacons depends upon the train speed over the beacons. Refer to B.4.5.

B.4.2 Distance from Beacon at a Previous Location

This scenario illustrates B.4.1 requirement 5.

The distance between the beacon on the exit of a location and the stop point of the next location, has to be greater than 400m. This ensures that if the train fails to detect the beacon on entry to a location, the data received at the previous location will have been reset and cannot be applied to the new location.

EXAMPLE

NOTE In the examples in this appendix the encircled figures represent beacons showing length settings in number of cars.

Referring to Figure B.1:

1. If the train does not detect the 5 car beacon at the entry to the platform of the black location B, due to excessive speed or equipment failure, the receiver data relating to the 7 car beacon, will be reset by the time the train has reached the stop point.
2. As the train has no receiver data, it will not know the location it has arrived at and the driver will have to confirm the location before releasing the doors.

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