

Data Preparation Overview

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Amendment Record

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4.1	07/12/1999	Amended as a result of a review of Issue 4. Principal changes are: Text amended in sections 1, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.2.2, 2.2.3, 2.2.4, 2.2.6, 2.2.11, 2.2.14, 2.3.1, 2.3.2, 2.3.3, 8.1, 8.2 and 14.1; DIS changed to SDS/DIS where appropriate; Train Describer changed to TD; semicolons deleted from list items; Figure 1 and text in section 16 moved to section 2.2, and section 16 deleted.
4.2	22/12/1999	Typographical corrections made in sections 2.2, 2.2.3, 2.2.4, 2.2.7, 3.5.3 and 3.5.4 as a result of document review.
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5	23/05/2001	Amended to cover the CD-ROM facility.
6	02/04/2003	Railtrack amended to Network Rail. Section 1.1 heading removed. New section 2.1.4 added for SPAD Alarm. Sections 2.2.2, 2.2.4, 2.3.2, 3.5.1 and 3.5.2 amended to cover SPAD Alarm. Section 2.2.8 (IGS) deleted. Sections 5 and 5.1.1 amended to cover SPAD alarm data. New section 6.4 added for SPAD Alarm data. Section 10 (IGS) deleted. RII renamed as Remote Interlocking Interface. Descriptions of IFP, IGS, PCS and RDF removed. Figure 1 amended to remove IGS and PCS. Minor typographical corrections.

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1 Introduction

This document introduces a reader who already understands railway signalling, engineering and its terminology to the Integrated Electronic Control Centre (IECC) and its data preparation.

It begins by explaining the background to the IECC and the components from which it is built. Section 3 describes the data preparation process in abstract, explaining why it is needed and what is required to undertake it. Subsequent sections discuss each type of data preparation in detail.

Because this document is an overview, it is not exhaustive and does not discuss many minor variations from the norm. In addition, it does not describe the physical design of any data preparation software.

Since this document was first written, work has been completed on a more cost effective way to prepare IECC data, called Automated Data Preparation or ADP. It is assumed that ADP will now be used for all future data preparation. However, where necessary, descriptions of the original tools and methods used to produce data manually have been retained in this and subsequent documents.

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2 Background

This section describes what an IECC is and does, and the components which it contains.

2.1 IECC FACILITIES

The IECC offers the Network Rail operators four main facilities.

2.1.1 Panel Replacement

Most obviously, IECC replaces the conventional NX panel operated by a team of signallers. The information which in the past has been provided on the panel is now shown on four or five colour monitors mounted in a desk-like workstation. The signaller can select up to eight different views for the controlled area: some are Overviews and others are Detailed (or Close Up) Views.

Instead of pressing buttons or turning switches, the signaller uses a trackerball to set routes and operate other controls. As an example, to press the equivalent of a slot button, the signaller uses the trackerball to move a cross-hair on to a round symbol on one of the views and presses a button mounted in the workstation next to the trackerball. To set a route, this action is done twice: once on the entry signal and once on the exit signal. Alternatively, the signaller may type commands into a keyboard to give the same effect.

2.1.2 Train Describer

The IECC also offers a Train Describer (TD), integrated into the same display system in order that the signaller can interpose and cancel using the same trackerball and keyboard controls. The TD offers a flexible communications interface to other systems, such as adjacent signal boxes, ATRs, and TOPS.

One of the colour monitors, the General Purpose VDU, provides windows in addition to the signalling display views, which :

- display standard TD maps showing stepping which is not available on the signalling displays
- display responses to TD enquiries on the contents of berths, or the whereabouts of trains
- report TD alarms, such as non-described trains
- display responses to commands entered by the signaller
- report signalling and other alarm messages e.g. interlocking control failures.

2.1.3 Automatic Routesetting

A signaller knows which routes to set by correlating the TD information with a paper copy of the timetable (simplifier). Automatic routesetting does the same, using an electronic copy of the timetable, and does so not only while trains are running to schedule but also during major disruptions. The signaller may turn automatic routesetting on or off for some or all of a controlled area, and enquire on individual routesetting decisions.

2.1.4 SPAD Alarm

The IECC offers a facility to detect Signals Passed at Danger (SPADs) and to report them using a unique audible alarm and indications on the General Purpose VDU and overview and detailed view screens. The signaller is thus alerted to the occurrence of a SPAD and can take appropriate action. The signaller has facilities to acknowledge and clear SPAD alarms and to inhibit the generation of SPAD alarms.

2.2 IECC SUBSYSTEMS

The facilities described above are not implemented on one computer, but several, linked over communications networks which, in the main, are in the form of a 'ring' connecting the computers together. This section describes what each computer 'subsystem' does. Data preparation is different for each kind of subsystem, so it is important to understand the role each plays. Figure 1 gives a diagram of a typical IECC. It shows the individual IECC subsystems and how they are connected via Signalling and Information networks.

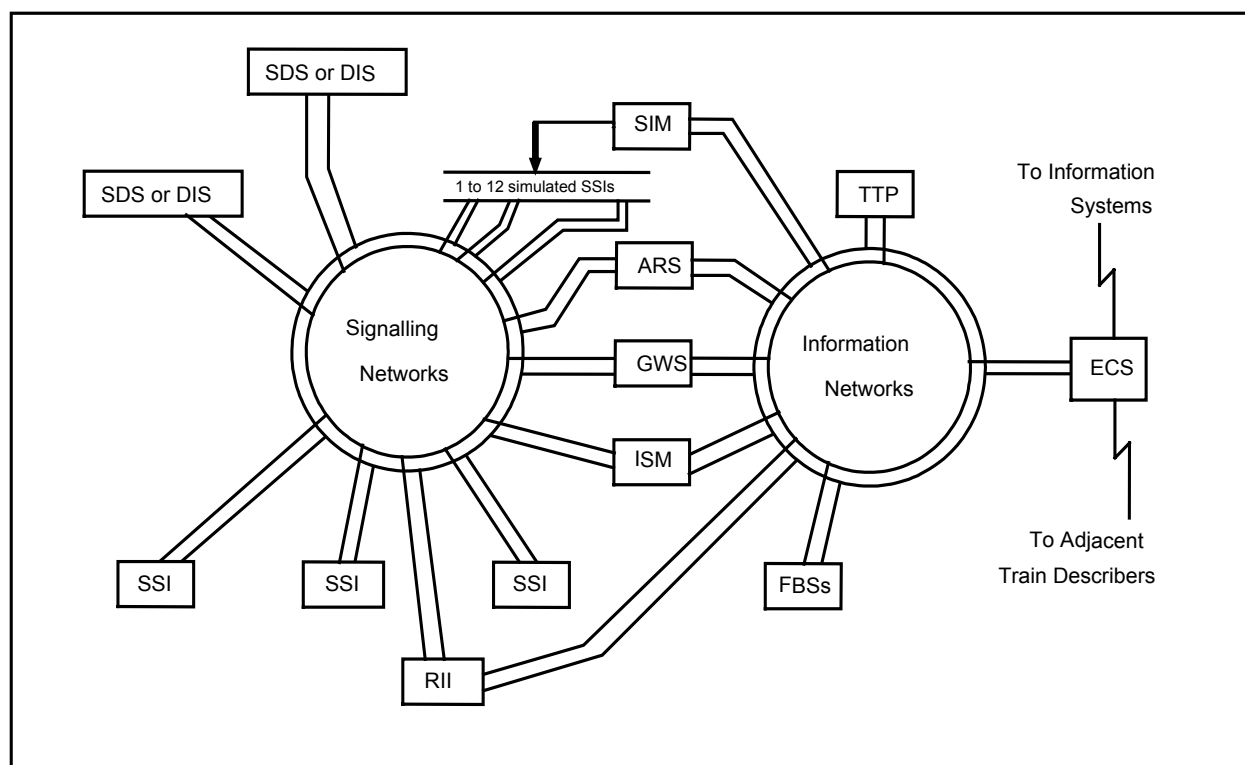


Figure 1 - IECC Subsystems

The Signalling Network is used to transmit signalling information only between the various subsystems connected to it. It can be heavily used in peak periods so the Information Network is also provided. This allows communications between those subsystems which need to transmit timetable and other information between themselves and other systems external to the IECC e.g.

adjacent signal boxes, other TDs, passenger and staff information systems, track to train radio etc.

2.2.1 Interlockings

The interlockings are the IECC's interface to the railway. All events at the trackside are reported by the interlockings, and all controls used at the IECC are executed through the interlockings, which check that the control is being operated safely. An IECC may operate up to 12 interlockings.

IECC was designed primarily to communicate with computerised Solid State Interlockings (SSIs). However, it can be connected to route relay interlockings (RRIs) if required, using a Remote Interlocking Interface subsystem (RII). The RII interfaces the IECC and the route relay interlockings and makes them appear to be one or more SSIs to the IECC.

Originally, an Interface Processor (IFP) which used SSI-type hardware and software provided this interface role. RIIs have now replaced IFPs and use IECC-type hardware and software. Their data is prepared mostly using SSI data preparation techniques.

It should be noted that the interlockings are not part of the IECC. They are, however, extremely important to the IECC and therefore to the data preparation activities.

2.2.2 Signalling Workstations

Signalling Display Subsystems (SDSs) or Flexible Display Subsystems (DISs) provide the colour monitors and controls for the signaller, and also incorporate the TD. An IECC may have one, two, or three SDSs/DISs, depending on the size of the area it controls. They are connected to the interlockings and Automatic Routesetting Subsystem (ARS) via the Signalling Network, over which they can :

- issue commands, for instance to set a route
- receive changes of state from the interlockings as track circuits become occupied, points move, signals change etc.
- receive SPAD alarm notifications from ARS and issue SPAD alarm clearances to ARS (DIS only, not available on SDS)

Each change of state is checked to determine whether it should affect the indications on the signaller's monitors, and is then passed to the TD in case it acts as a trigger or a condition for a step.

SDS and DIS provide equivalent functionality, with the exception that SDS does not support the SPAD Alarm facility. New IECCs or upgrades to existing IECCs use DIS, as the hardware required for SDS is no longer available.

A Testing Display Subsystem (TDS) is similar to an SDS but only provides communications to a number of SSIs. It makes use of a desk on which two monitors, a keyboard, trackerball and buttons are placed. It is used for testing purposes only.

The data preparation for DIS, SDS, and TDS is the same, except that DIS has an extra data structure for the Ethernet IP address. DIS does not have any specific data structures for the SPAD alarm, as the data required can be written using the existing data structures.

2.2.3 Information Workstations

The Regulator's Display Workstation (sometimes known as the 'Back Desk'), and information workstations are intended for supervisors, train announcers etc. They provide a small number of colour monitors, displaying only Overviews, and without either trackerball or keyboard controls. They are implemented almost entirely in hardware, and therefore have a minimal effect on data preparation.

2.2.4 Automatic Routesetting Subsystem (ARS)

The Automatic Routesetting Subsystem (ARS) is connected to the interlockings and the signalling workstations over the Signalling Network and to the Timetable Processor Subsystem (TTP), from which it receives up-to-date timetables, over the Information Network.

It receives all changes of state issued by the interlockings, and builds up an internal 'map' of the state of the railway in a similar way to SDS/DIS. It also receives train movement information from the TD of SDS/DIS.

It receives an electronic version of the timetable at least twice a day. It compares this with the actual movements of trains, and determines when a route should be set for a train and how to regulate conflicting moves. When it requires to set a route, it transmits a request to the interlocking, in exactly the same way that SDS/DIS does. When the interlocking responds to ARS's request, it transmits signalling changes of state on the Signalling Network. Both ARS and SDS/DIS receive these changes of state, allowing ARS to determine whether its request has been actioned, and SDS/DIS to display what ARS has requested on the signalling views.

ARS also uses its train movement information and signal aspect information to detect SPADs. When ARS detects a SPAD it issues a SPAD alarm notification to DIS, and can clear the SPAD alarm in response to a clearance notification received from DIS.

2.2.5 Gateway Subsystem (GWS)

As part of the IECC functionality, it is necessary to transfer signalling information to subsystems which communicate on the Information Network and external (TD) information to subsystems which communicate on the Signalling Network. This is achieved through the Gateway Subsystem (GWS), which is connected to both networks. It thus transmits information in two directions :

- (a) It receives transmissions from the interlockings and the TD within SDS/DIS on the Signalling Network, and records their up-to-date state in a database. It then transmits this information on to subsystems on the Information Network that require it
- (b) It also transmits information from some Information Network subsystems across to Signalling Network subsystems. This type of information is explained in more detail below.

2.2.6 External Communications Subsystem (ECS)

One of the most important roles of the Information Network is to communicate with TDs at neighbouring signal boxes in order that the descriptions of approaching or departing trains may be passed from one signal box to another without being re-entered by the signaller.

It is also necessary to communicate with other external information systems and, in some cases, transmit signalling information to them as well as TD information.

This is achieved through the External Communications Subsystem (ECS) which converts information data formats used within the IECC to those understood by the neighbouring systems.

2.2.7 Fringe Box Subsystem (FBS)

A fringe box is a signal box, normally on the edge of an IECC area, where either :

- there are no TD facilities; or
- train movements to and from the neighbouring area is so low that an automated link is not justified.

The IECC provides a Fringe Box Subsystem (FBS) for such sites, consisting of a colour monitor and a keyboard linked to the IECC Information Network via a telecommunications line. In some cases, an FBS may be linked to the IECC through ECS.

FBS represents a cut down version of a display subsystem and consists of just the General Purpose VDU, but with a limited number of windows. It allows the fringe box signaller to interpose and cancel train descriptions from selected berths which are then automatically copied into the equivalent berths within the IECC. The monitor can also display a TD map showing berths from within the IECC area. FBS does not have any TD stepping ability of its own.

FBS monitors may also be used to warn staff at Level Crossing Gate Boxes of approaching trains.

2.2.8 Information Systems (IS)

In IECC terminology the generic term 'Information System' is used to indicate any other external system connected to the Information Network, including :

- Automatic Train Reporting systems (ATR)
- Automatic Train Reporting by Exception systems (ATRE)
- Central Information Systems (CIS)
- Passenger Information Systems (PIS)
- Staff Information Subsystems (SIS)
- Track-to-Train Radio systems (TTR)
- Interfaces to nationwide systems such as TRUST.

Such systems may be connected either directly to the IECC Information Network, or via the ECS.

2.2.9 Timetable Processor Subsystem (TTP)

The Timetable Processor Subsystem (TTP) is responsible for generating the electronic copy of the timetable used by ARS.

It provides terminals at which each timetable may be edited before it is transmitted to ARS over the Information Network. It is also connected to the Train Service Data Base (TSDB) via a high speed data link which provides timetable information on a national level.

2.2.10 Remote Interlocking Interface Subsystem (RII)

An RII is provided wherever it is required to connect a Route Relay Interlocking (RRI) to an IECC.