



Digital Railway – Customer Requirements – Deployment Policy

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Version History

Issue	Date	Comments
0.1	08/03/2018	Initial draft for AM & TB
0.2	15/03/2018	Updated draft from comments received from AM, TB & DH
0.3	22/03/2018	Updated draft for Peer Review
0.4	18/04/2018	Updated from comments by Dan Holder and Karl Dodsworth (Customers) and DJN, JB and JJE (Peers)
1.0	25/04/2018	First issue
1.1	15/03/2019	Annual update for review
2.0	21/03/2019	Re-issue

Exclusions

1. Generic Operational Test Scenarios [RI37] have yet to be produced.

Assumptions

There are no assumptions upon which this document relies.

Dependencies

There are no items upon which this document depends.

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ABBREVIATIONS

A comprehensive list of abbreviations and definitions is contained in the Glossary [R11]. Where they are unique to this document, they are defined in full on first use.

REFERENCES

Dependent References

- [RD1] Network Rail Requirements, NR/L2/INI/P3M/104 Issue 2
- [RD2] Network Rail Requirements Manual, NR/L3/INI/P3M/126, Issue 1
- [RD3] Integration Fundamentals Handbook, 153819-NWR-GDN-MPM-000001, Version 1.0

Informative References

These references have no material bearing on the content of this document. Unless otherwise stated, reference should be made to the most recent authorised version of the document.

- [R11] DR Glossary of Terms & Abbreviations, 153819-NWR-SPE-ESE-000001
- [R12] Digital Railway - System of Systems (SoS) System Definition, 153821-NWR-REP-ESE-000002
- [R13] Digital Railway – GB Generic Customer Requirements Specification for System of Systems, 153819-NWR-SPE-ESE-000003
- [R14] Digital Railway – GB Generic Customer Requirements Specification for ETCS Trackside, 153821-NWR-REP-ESE-000007
- [R15] Digital Railway – GB Generic Customer Requirements Specification for ETCS Onboard, 153821-NWR-SPE-ESE-000008
- [R16] Digital Railway – GB Generic Customer Requirements Specification for Traffic Management System, 153821-NWR-SPE-ESE-000011
- [R17] Digital Railway – GB Generic Customer Requirements Specification for Connected Driver Advisory System Requirements Specification, 153821-NWR-SPE-ESE-000010
- [R18] Digital Railway – GB Generic Interface Requirements Specification, 153821-NWR-SPE-ESE-000013
- [R19] Digital Railway – GB Generic Customer Requirements Specification for Operations & Maintenance, 158875-NWR-PLN-OPP-000001
- [R110] Digital Railway – Integrated Concept of Operations, EB 000000-NWR-PLN-MPM-000005
- [R111] Client Requirements Document, IP 724 – NR/PSE/FRM/0239, Issue 5.0
- [R112] Route Requirements Document, IP 726 – NR/PSE/FRM/0240, Issue 5.0
- [R113] ETCS - Baseline 3 - GB System Requirements Specification, NEPT/ERTMS/REQ/0005
- [R114] ETCS - Baseline 3 - GB Trackside Sub-system Requirements Specification, NEPT/ERTMS/REQ/0006
- [R115] ETCS - Baseline 3 - GB Onboard Retrofit Sub-system Requirements Specification, NEPT/ERTMS/REQ/0007
- [R116] ETCS - Baseline 3 - GB Onboard New Trains Sub-system Requirements Specification, NEPT/ERTMS/REQ/0038
- [R117] ETCS - Baseline 3 - GB Telecoms Sub-system Requirements Specification, NEPT/ERTMS/REQ/0008
- [R118] ETCS - Baseline 3 - GB Operations Sub-system Requirements Specification, NEPT/ERTMS/REQ/0009
- [R119] Traffic Management Requirements Specification, DR/TM/REQ/0003
- [R120] Interim System Requirements for Connected Driver Advisory System (C-DAS), C-DAS Requirements, 153821-NWR-REQ-ESG-000001
- [R121] Interim Railway Undertaking (RU) Subsystem Requirements for Connected Driver Advisory System (C-DAS), C-DAS Requirements, 153821-NWR-REQ-ESG-000007

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- [RI22] Interim Infrastructure Manager (IM) Subsystem Requirements for Connected Driver Advisory System (C-DAS), C-DAS Requirements, 153821-NWR-REQ-ESG-000008
- [RI23] Interim Exported Subsystem Requirements for Connected Driver Advisory System (C-DAS), C-DAS Requirements, 153821-NWR-REP-ESE-000003
- [RI24] Detailed Route Requirements Document, IP 728 – NR/PSE/FRM/0241
- [RI25] DR Requirements Management Plan, 153819-NWR-PLN-ESE-000006
- [RI26] Digital Railway – Customer Requirements - Requirements Change Control Process, 153819-NWR-SPE-ESE-000004
- [RI27] System Management Plan 153819-NWR-PLN-MPM-000002
- [RI28] Railway Application – the specification and demonstration of reliability, availability, maintainability and safety (RAMS) – Part 1, Generic RAMS Process, BSEN50126-1:2017
- [RI29] Engineering Management for Projects, NR/L2/INI/02009
- [RI30] Digital Railway Requirements - Traffic Management System, 153821-NWR-SPE-ESE-000014
- [RI31] Digital Railway Requirements - C-DAS Railway Undertaking Subsystem, 153821-NWR-SPE-ESE-000015-1
- [RI32] Digital Railway Requirements - C-DAS Infrastructure Manager Subsystem, 153821-NWR-SPE-ESE-000015-2
- [RI33] Digital Railway Requirements - ETCS Trackside, 153821-NWR-SPE-ESE-000016
- [RI34] Digital Railway Requirements - ETCS Onboard, 153821-NWR-SPE-ESE-000017
- [RI35] Digital Railway – SR&I Technical Note 1, 153819-NWR-MEM-ESE-000001, Version 2.0 dated 26 September 2018
- [RI36] Digital Railway – Introduction to the Requirements Structure, 153819-NWR-PLN-ESE-000012
- [RI37] Digital Railway - Generic Operational Test Scenarios, TBD

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1 INTRODUCTION

1.1 Background

The Digital Railway Programme (DRP) is intending to deploy a suite of digital technologies on the GB national railway network.

There are many potential solutions for implementing digital technologies. However, if left totally unconstrained, there is a risk that different deployment projects could independently generate solutions that were sufficiently different as to create technical or operational compatibility issues at railway system interfaces. Compatibility issues of this nature would inhibit the GB railway's ability to meet its objectives and must, therefore, be avoided. A suite of generic Customer Requirements Specifications (CRSs) that will apply when digital technologies are deployed on the GB national railway network is, therefore, being developed by the DRP.

The generic CRSs are intended to promote the development of technically, operationally and environmentally compatible solutions which are safe and secure, and which could be deployed across the GB rail network in order to maximise the benefits which the industry can reap from the adoption of digital technologies. They are also intended as a baseline to ensure that the system solutions adopted on any individual Project will integrate and be compatible across rail vehicle-to-infrastructure interfaces and across route boundaries, as specified in the System of Systems (SoS) System Definition Document [RI1].

The hierarchical structure of the generic CRS suite comprises the SoS CRS [RI3] and the following System-level CRSs:

- European Traffic Control System (ETCS) – Trackside [RI4] and Onboard [RI5]
- Traffic Management System (TMS) [RI6]
- Connected Driver Advisory System (C-DAS) [RI7]
- Interfaces [RI8]
- Operational & Maintenance [RI8]

Notes:

1. Data is in scope and will be included, as appropriate, within the CRS documents identified above; it will not comprise a separate document.
2. The ETCS Onboard Customer Requirements are not covered by this Deployment Policy but have been included for CRS suite completeness.

The CRS suite is supported by a suite of Digital Railway Requirements (DRRs) as follows:

- ETCS Trackside [RI33]
- ETCS Onboard [RI34]
- C-DAS Railway Undertaking Sub-system [RI31]
- C-DAS Infrastructure Manager Sub-system [RI32]
- TMS [RI30]

Deployment Project Teams are expected to use appropriate documents from the CRS and DRR suite to identify the differences between their proposed systems architectures and then select the requirements necessary to form the basis of their own requirements specifications. Further detail on this approach would be provided within the Integration Fundamentals Handbook [RD3], Technical Note 1 [RI35], Introduction to the Requirements Structure [RI36], and the generic System of Systems Architecture, as covered by the SoS System Definition Document [RI2].

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1.2 Purpose

The purpose of this Policy is to provide clarity for Infrastructure Deployment Project¹ Teams on how to achieve a specific set of requirements that constitute a suitable basis for scheme development, option selection, and inclusion within 'Invitation to Tender' (ITT) and Contract documentation, yet which allow scope for innovation and creativity, whilst meeting the overall needs.

The DR CRSs and DRRs must also be suitable for use by the supplier in developing their Systems Requirements Specifications (SRSs), which can then be verified against the ITT requirements, thereby enabling the foundation for the acquisition of evidence to provide satisfaction that the resulting system has been delivered and functions correctly.

The overall concept is that it should be possible to develop a single suite of customer requirements that can be continuously improved, such that the requirements can be used many times to achieve a functionally consistent Deployment, thereby reducing the risk of technical or operational incompatibility issues at railway system interfaces.

This Policy document describes the generic and specific processes, principles, structure, roles, and responsibilities associated with the pragmatic ownership, management, and continuous improvement of the DR CRSs and DRRs being developed as part of the DR Programme, in order to facilitate their continued use in support of Deployment Project Teams. It should be read in conjunction with the Integration Fundamentals Handbook [RD3], which provides wider guidance to Deployment Project Teams on the use of DRP's generic output.

1.3 Scope

1.3.1 Requirement Scope

The scope covered by this Policy comprises the entire requirements input for a specific Deployment Project Team, including the System of Systems (SoS) CRS [RI3] and the following CRSs:

- ETCS – Trackside [RI4] and Onboard [RI5]
- TMS [RI6]
- C-DAS [RI7]
- Interfaces [RI8]
- Operations & Maintenance [RI9]

The CRS suite is supported by the following DRRs:

- ETCS Trackside [RI33]
- ETCS Onboard [RI34]
- C-DAS Railway Undertaking Sub-system [RI31]
- C-DAS Infrastructure Manager Sub-system [RI32]
- TMS [RI30]

1.3.2 Process Scope

The processes covered by this policy include:

- Application of the standard 'V' diagram;

¹ In this Policy document, a 'Deployment Project' is defined as any Project implementing DR technology on Network Rail infrastructure, using requirements derived from DR's CRSs and DRRs.

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- Filtering Principles;
- Verification & Validation; and

Continuous Improvement.

2 CUSTOMER REQUIREMENTS – DEPLOYMENT POLICY

2.1 Application of the Standard ‘V’ Diagram

The Requirements Management Strategy will follow an adaptation of the standard ‘V’ diagram (see Figure 1 overleaf).

Notes:

1. Some Deployment Project Teams intending to incorporate DR technologies will be adding the CRSs and DRRs to a development process that has already been executed for a conventional solution. Where possible, existing documentation and processes should be revised rather than created, provided the revised documentation and processes follow the principles contained within the Integration Fundamentals Handbook [RD3].
2. All Network Rail Infrastructure work needs to apply the principles contained within the NR Requirements document [RD1] and the Requirements Manual [RD2].

2.1.1 Deployment Business Requirements

A specific Deployment Project Team will need to compose, or include, its needs within a Deployment Business Requirements document; this will encapsulate the highest level of customer need and the implemented system which, when the digital railway technologies are accepted and in operation, will be used to validate these requirements (see [RD1] and [RD2]).

2.1.2 Deployment Concept of Operations (ConOps)

The DR Integrated ConOps [RI10] will be adapted by the Deployment Project Team in order to create, or revise, a Deployment ConOps. This Deployment ConOps will detail how the route is to be for operated, and the commissioned system will be used to validate the concepts contained within this Deployment ConOps.

2.1.3 Deployment Client Requirements Document (CRD)

The Deployment Business Requirements and ConOps will be used to create, or revise, the Deployment High-Level Requirements, which will be included within the Deployment’s CRD.

The responsibility for populating the CRD Template [RI11], and its subsequent issue, resides with the Deployment Project Team.

2.1.4 Deployment CRS suite

The DR SoS will be adapted (using the filtering principles contained in Section 2.2 below) to provide the Deployment CRS suite. These documents will detail what is required for developing the system, and the resulting integrated system will be used to validate that these requirements have been met.

2.1.5 Deployment Route Requirements Document (RRD)

The Deployment CRSs will be used to populate Section 3 of the Route Requirements Document (RRD).

The responsibility for populating the RRD Template [RI12], and its subsequent issue, resides with the Deployment Project Team.

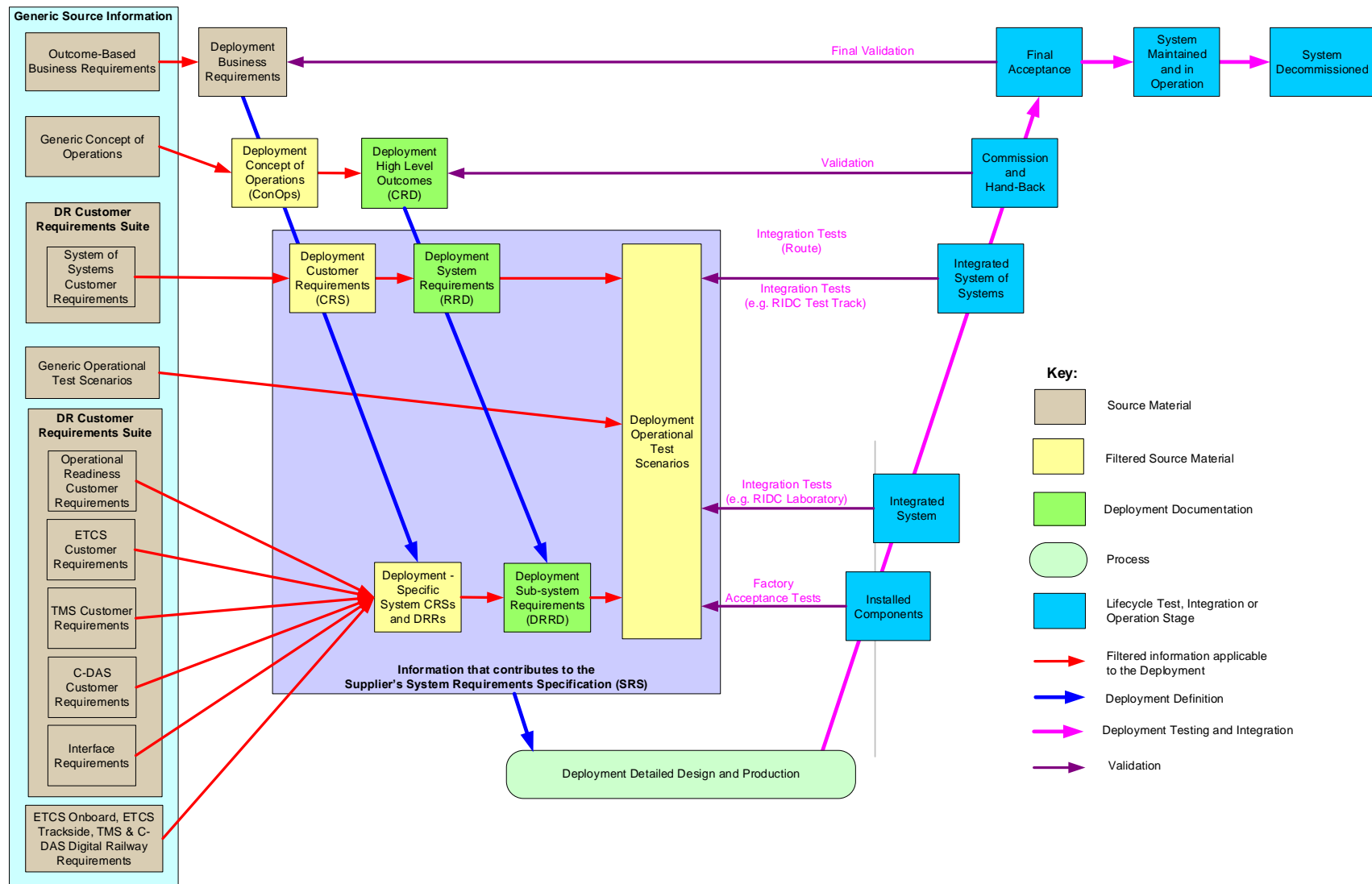


Figure 1- Simplified adaptation of the Standard 'V' Diagram

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2.1.6 Deployment-Specific System CRSs DRRs

The System CRSs and DRRs will be selected to support the Deployment Sub-system Requirements. The selection of these DRRs, and individual sections, where applicable, will specify the requirements that need to be satisfied.

2.1.7 Deployment Detailed Route Requirements Document (DRRD)

The Deployment-Specific System CRSs and DRRs will be used to populate Appendix D of the DRRD.

The responsibility for populating the DRRD Template [RI24], and its subsequent issue, resides with the Deployment Project Team.

2.1.8 Operational Test Scenarios

The output from the RRD and DRRD will be developed into a suite of Operational Test Scenarios that can then be used, either by physical testing or by modelling, to verify and validate installed components, the Integrated System, and an Integrated SoS. The creation and use of the Operational Test Scenarios will need to be defined in the Deployment Test Plan.

Note: The Generic Operational Test Scenarios [RI37] have yet to be produced.

2.1.9 Supplier's System Requirements Specifications (SRSs)

It is anticipated that the Supplier Team(s) could become involved, within a collaborative framework, in order to assist the Deployment Project Team with the derivation of the Deployment Requirements Specification and Operational Test Scenarios documentation, all of which becomes, effectively, the Supplier SRS(s).

The Supplier SRS(s) will comprise the RRD, DRRD, and Operational Test Scenarios, supplemented by any additional requirements needed at the Supplier level in order to design and build their production system.

2.1.10 Deployment System Definition Document

Whilst not shown in Figure 1 above, the Deployment System Definition Document is another key document that will be required for use in support of Deployment Safety Management activities.

2.2 Filtering Principles

The Generic Source Information will be filtered according to the following principles:

1. All 'Normative' requirements will be adopted.
2. 'Application-Specific' requirements may be adopted or disregarded depending on the intended solution, e.g. if there are no level crossings, then all requirements associated with this capability may be disregarded.
3. No amendment will be made to any requirement text.
4. There will be no requirement substitution.
5. Requirements considered in need of amendment or addition to the generic suite will need to be submitted through the Requirement Change Control Process.
6. Applicable Standards Catalogues will be identified.

Notes:

1. 'Normative' and 'Application-Specific' are terms defined in the DR Requirements Management Plan [RI25].

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- The steps to achieve filtering are explained in more detail within the individual CRS documents.

2.3 Continuous Improvement (CI)

2.3.1 Change Management

Requirements can, and do, change during the lifetime of a system, and also during the course of a Deployment Project. All changes to the requirements contained within the Source Information must be made in a controlled manner using Continuous Improvement techniques.

Continuous Improvement, as an essential contributor to overall Quality Assurance, demands an ongoing effort to improve products, services, or processes. In this case, CI will be applied as a gradual, continual process to assess and improve the quality of the Generic Source Information to ensure that it remains current, correct and complete.

The Review, Identify, Change Manage, Promulgate cycle is shown in Figure 2 below.

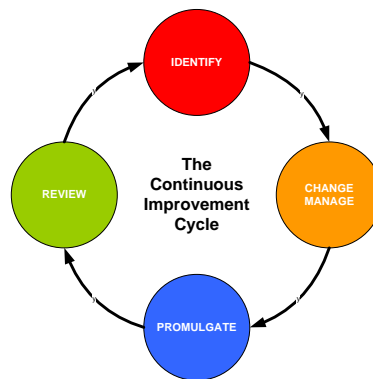


Figure 2 – The CI Cycle

Review

The Generic Source Information quality, accuracy, appropriateness, and completeness will need to be assessed every time the Requirements are filtered for application.

Deployment Requirements and filtered CRSs and DRRs that have been derived from the Generic Source Information will need to undergo continuous review until Final Acceptance.

Identify

Any problem arising from the Review phase may be managed in one of two ways: modification of the Deployment to meet the Requirements, or modification of the Generic Source Information. Modification is not permitted to any Deployment requirement that has been filtered from the Generic Source Information – see Section 2.2.

Change Manage

Should a Requirement within the Generic Source Information need to be changed, then the Requirement Change Management Process will need to be invoked, depending on the Requirement source – see Sections below.

Promulgate

An essential step of the cycle is to inform all affected Deployment Project Teams. This will be as directed by the DR System Authority.

2.3.2 Changes to CRSs and DRRs

The Requirement Change Control Process [RI26] covers the identification of a change, through impact assessment and endorsement of the change. It also covers the timing of the change promulgation to affected Deployment Project Teams.

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Should a consequential change to the Generic ConOps be required, then the DR Requirements Management Team will need to seek endorsement from the DR System Operations Board before the Generic CRS can be updated.

2.4 DR Programme (DRP) Systems Engineering Responsibilities

2.4.1 Life Cycle

The DRP is limited in the provision of support to DR technology Deployment Project Teams. The scope (explained in the DR System Management Plan [RI27]) follows a life cycle compliant with BSEN50126 [RI28] up to, and including, Phase 5, as follows:

- Phase 1 - Concept
- Phase 2 - System Definition and Operational Concept
- Phase 3 - Risk Analysis and Evaluation
- Phase 4 - Specification of SoS and System Requirements
- Phase 5 - Architecture and apportionment of SoS and System requirements

Note: The DRP may be engaged to provide Requirement Engineering and Integration (RE&I) support to a Deployment Project Team, but this would be in addition to the generic DRP work completed during the phases identified above.

2.4.2 Generic Source Information

The DRP is responsible for managing the Generic Source Information. This will be achieved through creation of a Generic ConOps, a Generic Suite of CRSs and DRRs, and associated documentation.

2.5 Deployment Systems Engineering Responsibilities

The following Phases, identified in BSEN50126 [RI28] that will implement the application of the DRP output, are outside the DRP's scope; therefore, systems engineering provision for these deployment-specific phases is assumed to be provided by the Deployment Project Team:

- Phase 2 - System Definition and Operational Concept
- Phase 3 - Risk Analysis and Evaluation
- Phase 4 - Specification of SoS and System Requirements
- Phase 5 - Architecture and apportionment of SoS and System requirements
- Phase 6 - Design and Implementation
- Phase 7 - Manufacture
- Phase 8 - Integration
- Phase 9 - System Validation (including Safety Acceptance and Commissioning)
- Phase 10 - System Acceptance
- Phase 11 - Operation and Maintenance, and Performance Monitoring (including data management)
- Phase 12 - Decommissioning

Note: Phase 2 to 5 appear to be repeated for both DRP and The Deployment project Team, but Phases above are specific to a particular Deployment.

Engineering Management for Projects [RI29] describes the processes, and roles and responsibilities of staff responsible for the management of the technical and engineering requirements of projects for, and on behalf of, Network Rail.

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2.6 Ownership

2.6.1 DR Head of System Requirements & Integration (SR&I)

The DR Head of SR&I is responsible for managing all Customer System Requirements and Digital Railway Requirements.

2.6.2 System Authority Responsibility

The System Authority will manage any changes to Requirements that arise from the CI process.

The System Authority will also accept the Deployment CRS against the SoS architecture. This is to ensure that any requirement additions and / or deletions do not compromise the ability to integrate the solution into the GB railway or incur unnecessary additional whole-life costs.

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