



Digital Railway – GB Generic Customer Requirements Specification for Connected Driver Advisory System (C-DAS)

Prepared By:
Thomas Harrison
C-DAS Lead Architect

TH-260319-0009

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Reviewed By:
David Nicholson
System Integration and Interface Manager

DJN-26032019-0095

Date: 26/03/2019

Approved By:
Rubina Greenwood
Head of System Requirements & Integration

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Document owner: Rubina Greenwood, Head of System Requirements and Integration

Version History

Issue	Date	Comments
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1.0	27/04/18	Formal issue for signature
1.1	18/10/18	Updated to address comments against V1.0
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2.1	20/03/19	Updated to address comments against V2.0
3.0	26/03/19	Formatting corrected and Formal issue for signature

Exclusions

These are items currently missing from this version of the document that should be included in a later publication.

1. For a list of open points please refer to section 4.1

Assumptions

These are items upon which the validity of this document relies, and which will be delivered by others. Non-delivery of these items will necessitate a change to this document.

1. For a list of assumptions please refer to section 4.2

Dependencies

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There are items upon which the validity of this document depends. Any changes to the referenced document may require further changes to this document.

1. For a list of dependencies please refer to section 4.3

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ABBREVIATIONS, ACRONYMS AND DEFINITIONS

Abbreviations are explained in full on first use within this document. A comprehensive list of abbreviations and definitions is contained in the Glossary [R11]

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REFERENCES

Dependent References

An update to one of these references requires an update to this document

- RD1 Digital Railway – Integrated Concept of Operations. EB 000000-NWR-PLN-MPM-000005. Version 1.0
- RD2 Digital Railway – GB Generic System of Systems Customer Requirements Specification, 153819-NWR-SPE-ESE-000003, Version 3.0.
- RD3 C-DAS System Definition, 153821-NWR-SPE-ESE-000009, Version 2.0
- RD4 Digital Railway – GB Generic Interface Requirements Specification, 153821-NWR-SPE-ESE-000013, Version 2.0
- RD5 Digital Railway – Customer Requirements Specification – Requirements Management Plan, 153819-NWR-PLN-ESE-000006, Version 1.0.
- RD6 Digital Railway - Integration Fundamentals Handbook, 153819-NWR-GDN-MPM-000001, Version 1.0
- RD7 Digital Railway – Customer Requirements Deployment Policy, 153819-NWR-SPE-ESE-000002, Version 1.0
- RD8 Digital Railway Customer Requirements Change Control Process, 153819-NWR-SPE-ESE-000004, Version 1.0
- RD9 Digital Railway – SoS Data Specification, 153831-NWR-SPE-ESE-000001, Version 1.0
- RD10 GB Generic Customer Requirements Specification for Traffic Management Systems (TMS), 153821-NWR-SPE-ESE-000011, Version 2.0
- RD11 Digital Railway – GB Generic Customer Requirements Specification for ETCS Trackside, 153821-NWR-SPE-ESE-000007, Version 2.0
- RD12 Digital Railway – GB Generic Customer Requirements Specification for ETCS Onboard, 153821-NWR-SPE-ESE-000008, Version 2.0
- RD13 Digital Railway – GB Generic Customer Requirements Specification for Operations & Maintenance, 153819-NWR-PLN-ESE-000014, Version 1.0

Informative References

These references have no material bearing on the content of this document.

- RI1 Digital Railway – Glossary of Terms & Abbreviations, 153810-NWR-SPE-ESE-000001, v1.1, 31st August 2018

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1 Introduction

1.1 Purpose

The purpose of this document is to set out the generic Customer Requirements that apply to the Connected Driver Advisory System (C-DAS) when it is deployed on the GB national railway network. These generic Customer Requirements are intended as a baseline to ensure that the C-DAS solutions adopted on any individual deployment project will integrate and be compatible across route boundaries.

All deployment projects involving C-DAS will use this document as a basis of their requirements suite for this system.

1.2 Scope

This document provides the generic Customer Requirements for the C-DAS, including functional, non-functional and process requirements. It is aligned to [RD1], which describes how the GB railway is intended to operate where this system is deployed.

This system will not exist in isolation on the railway and will need to interact with a variety of other systems, which may include both existing and Digital Railway systems. The overall System of Systems architecture is set out in Figure 1. This document supports, and is reliant upon, the GB Generic National System of Systems Customer Requirements Specification [RD2].

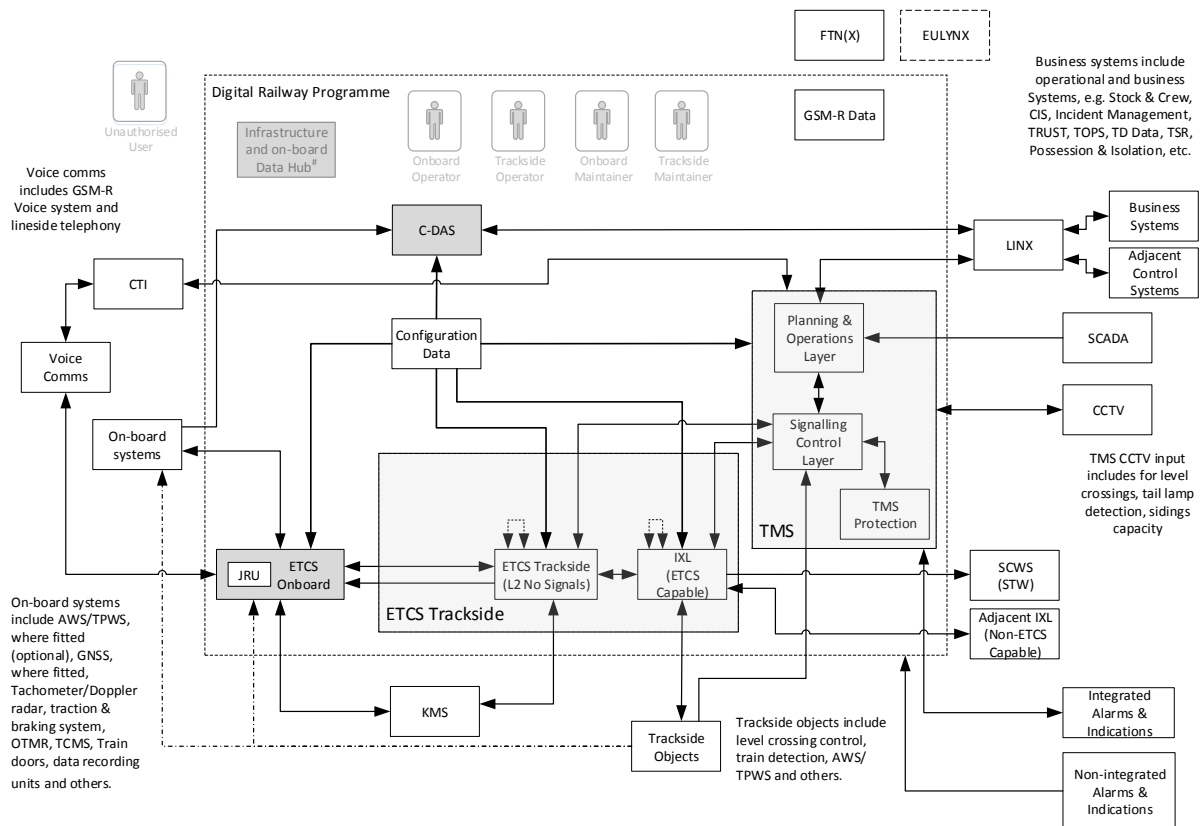


Figure 1 - System of Systems Architecture

The system boundary for the C-DAS is set out in the C-DAS System Definition [RD3], which also describes the generic environmental context in which the system is expected to exist.

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This document does not set out interface requirements between the C-DAS and other systems as these are separately documented in the Interface Requirements Specification [RD4]. The successful implementation of the C-DAS is reliant upon compliance with the relevant requirements in [RD4].

This document does not contain details of any deployment project-specific requirements. These may be found in deployment project-specific documentation, which is subordinate to this document. Guidance for producing these may be found in Appendix C.

Section 2.2 of this document sets out how a deployment project will identify which of the requirements in this document are relevant to its needs.

Nothing in this document obviates any legal requirement with which the parties using it must comply.

This CRS forms part of a suite of requirements specifications and therefore for a complete understanding of Digital Railway operation, should be read in conjunction with the CRSs/IRS for:

- System of Systems [RD2]
- Traffic Management System [RD10]
- ETCS Trackside [RD11]
- ETCS Onboard [RD12]
- Operations and Maintenance Readiness [RD13]
- Interface Requirements Specification [RD4]

1.3 Business Need for this Specification

There are many potential solutions for implementing the Digital Railway Strategy and realising the visions set out in the Concepts of Operations [RD1]. 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 the railway system boundaries. Compatibility issues of this nature would inhibit the GB railway's ability to meet the objectives set out above and must, therefore, be avoided. Examples of compatibility issues could include:

- One project's Traffic Management System solution being unable to provide a second project's Traffic Management System solution with all the information needed for effective management of train services crossing the boundary between them; or,
- a train driver having to learn and apply different sets of operational procedures relating to the same underlying system across different geographical areas.

The generic Customer Requirements 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. The generic Customer Requirements contribute to achieving this by setting out what capabilities the solutions must possess and what processes must be followed.

This document is one of a suite of generic Customer Requirements Specifications for the core CCS systems and is sub ordinate to the generic System of Systems Customer Requirements Specification.

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This CRS for C-DAS is complemented by the Digital Railway Requirements specifications for C-DAS which describe the constraints that apply to the application of the C-DAS

1.4 Document Maintenance

This document is owned by the Head of System Requirements and Integration within Digital Railway.

A process for the management of change to this document will be established by the document owner. This process will encompass the review of the document in response to lessons learnt through procurement and deployment experience and the management of formal change proposals from the GB rail industry or suppliers.

It is envisaged that the following criteria will be used to support the impact assessment of proposed changes with a view to determining whether any proposed change should be implemented:

- Ability to meet the business needs of the GB railway
- Ability to deliver the vision set out in the Concept of Operations
- Technical and operational compatibility with deployment projects procured against an earlier version of this document
- Ability for the supplier to be innovative

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2 Application of this Specification

2.1 Requirements Presentation

All requirements are in the following form:

<p><i>Safety</i> Requirement text.</p> <p style="text-align: right;">Unique-Identifier</p>

Source: Identifies where the requirement originated.

Status: Normative or Application-Specific. (See Section 2.2).

Rationale: Shows applicability of the requirement, including why the requirement exists, who it is for, what industry benefit could be achieved, what the constraints are, and any other essential detail. Note: Cross-referencing should be used to avoid over-lengthy rationales.

Guidance: Supplementary information to support Requirement interpretation and satisfaction.

2.1.1 Safety Requirement

Where a requirement has been associated with a Safety Measure, this is identified and referenced to the hazard record number.

2.1.2 Unique Requirement Identifier

Each requirement has been identified uniquely. The requirement numbers have been generated within the DOORS database, which means that the requirement numbering may be neither sequential nor gap-free.

2.1.3 Requirement Status

Each requirement within this document is identified as either 'Normative' or 'Application-Specific'.

Normative requirements are mandatory for all deployment projects.

Application-specific requirements are mandatory for all deployment projects on which the issue or subject addressed by the requirement occurs.

2.2 Identification of Applicable Requirements

The generic Customer Requirements in this document are intended to cover the vast majority of circumstances that will be encountered on the GB rail network. However, not all circumstances will be encountered by every deployment project and some deployment projects may encounter local issues that are not covered by the generic Customer Requirements Specification.

Consequently, each deployment project must ensure that it establishes and documents the appropriate set of Customer Requirements for its circumstances. The process for doing so is

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covered in detail within the Integration Fundamentals document [RD6] and in detail for Infrastructure projects within the DRP Customer Requirements Deployment Policy [RD7] and may be summarised as follows:

1. The starting point is the generic Customer Requirements Specification (i.e. this document for the C-DAS).
2. All normative requirements within the generic Customer Requirements Specification are applicable to every deployment project.
3. Any application-specific requirements which relate to circumstances that do not apply to the deployment project in question may be deleted and marked as 'not required' along with the rationale for their non-inclusion.
4. 4. New Customer Requirements may be generated to address local issues which only apply to a specific deployment project but are not covered in the generic Customer Requirements Specification, provided that they do not compromise the achievement of cross-boundary compatible solutions. The rationale for the locally-developed requirement will be captured along with the requirement, including any reasons for not following a particular path.

Appendix A contains a template which deployment projects can populate to indicate which of the application-specific requirements are applicable to their particular circumstances (step 3 above).

Appendix B contains a template which deployment projects can use to record any new customer requirements they generate for their particular circumstances (step 4 above).

Note that a deployment project is not permitted to:

1. amend the wording of an existing generic Customer Requirement; or,
2. replace an existing generic Customer Requirement with a differently worded requirement relating to the same issue.

These restrictions are necessary to prevent the risk of generating a project-specific set of Customer Requirements that may not achieve a cross-boundary compatible solution.

If a deployment project considers that the wording or status of an existing Customer Requirement is incorrect, or wishes to add a new requirement to cover any local issues which apply to the deployment project but are not covered in the generic Customer Requirements Specification, then this should be raised with the document owner via the change request process for consideration at a national level, as described in section 1.4 and in detail in the DRP Customer Requirements Change Control Process [RD8].

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3 Customer Requirements

3.1 Functional Requirements

3.1.1 Principles

The C-DAS shall provide information that supports the driver in meeting the performance and energy efficiency needs of the railway.

CRS-C-1

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To assist drivers in implementing the Current Plan.

Guidance: In a Traffic Management System area, C-DAS supports train regulation by conveying the Traffic Management System's train regulation decisions to trains and translating them into advisory information that assists drivers in meeting the Current Plan, and improving energy efficiency. In non-Traffic Management areas, C-DAS information can assist drivers in implementing the timetable and promote improved energy efficiency but may not fully reflect the Current Plan. Information presented to the driver may include:

- Time-based or speed-based advice relating to the train schedule;
- Geographical prompts regarding the journey; and/or
- Train characteristics.

Duty Holders will be expected to identify detailed requirements relating to the display of information. The selection of which information to display may vary according to the service type (passenger or freight).

C-DAS shall only act upon data that lies within credible bounds.

CRS-C-5

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: Although C-DAS is an advisory system only, the provision of advisory or other information based on incorrect or incomplete input data could lead to hazardous situations or impact on network performance.

Guidance: Credible bounds will need to be determined on a Duty Holder basis. The input data required by the C-DAS comprises:

- a. Infrastructure Geography, i.e. data which describes the topography and topology of the network infrastructure for the routes on which C-DAS is to operate;
- b. Static Speed Profiles for the routes and train types / ETCS train categories on which C-DAS is to operate;
- c. Speed restrictions for the routes and train types / ETCS train categories on which C-DAS is to operate;
- d. The schedules to which the C-DAS fitted trains are to operate;
- e. Train-specific data for the C-DAS fitted trains, i.e. consist; operating capabilities (traction, braking, etc.); applicable train type(s) / ETCS train categories; and
- f. Current train location and speed.

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Safety

The C-DAS shall not perform any train control functions.

CRS-C-16

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: C-DAS is an advisory system only.

Guidance: All train control functions remain the responsibility of the driver or other train safety systems.

3.1.2 Driveability

The C-DAS information units displayed to the driver shall be consistent with those used for the display of equivalent information provided by the signalling system in operation.

CRS-C-8

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To avoid increasing driver workload and/or the driver becoming confused by the same type of information (for example speed, location, distance) being displayed in different units.

Guidance: For example, on ETCS-fitted trains, the current and permitted train speed information on the ETCS Driver Machine Interface (DMI) may be displayed in either mph or km/h, depending on the ETCS operating level and area-specific requirements. On ETCS unfitted trains, current and permitted speed information is likely to be displayed in mph only.

The C-DAS information format displayed to the driver shall be consistent with that used for the display of equivalent information within the driving cab.

CRS-C-38

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To avoid increasing driver workload and/or the driver becoming confused by the same type of information (for example speed, time, location, distance) being displayed in different formats.

Guidance: One example of inconsistent formatting would be for one system to use a 24 hour clock and another to use a 12 hour clock.

3.1.3 Degraded Operations

None.

3.1.4 Other

None.

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3.2 Non-Functional Requirements

3.2.1 System Performance

None.

3.2.2 RAM

The C-DAS shall not adversely affect the Reliability, Availability and Maintainability (RAM) performance of existing systems with which it interacts.

CRS-C-24

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: Both safety and service performance are dependent upon equipment operating within its design parameters.

Guidance: Equipment failures, maintenance activities and power supply failures in the C-DAS should not affect existing systems. This also means that the functioning of the C-DAS in all operating conditions must have no effect whatsoever on the RAM performance of the existing systems.

3.2.3 Safety

The C-DAS shall not introduce an unmitigated hazard into the systems with which it interacts.

CRS-C-15

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To maintain safe operation of the systems with which C-DAS interacts.

Guidance: This covers interaction where there is an intentional interface with other systems, and equipment and interaction where there is no intentional interface. 'Interaction' includes environmental compatibility and electromagnetic compatibility, and both normal and degraded situations within the environment where C-DAS is expected to operate.

'Other systems and equipment' includes other railway infrastructure systems, non-railway systems and people.

Safety

The provision and use of C-DAS information shall not impact on the safe operation of the railway so far as is reasonably practicable.

CRS-C-37

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To ensure the provision of C-DAS information does not have an adverse effect on the safety of the railway or adjoining systems.

Guidance: Areas where C-DAS could impact on the safe operation of the railway include but are not limited to:

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- a. Level Crossings road closure times,
- b. Platform train interface;
- c. Changes in line speed.

3.2.4 Security

The C-DAS shall be designed to withstand intentional or unintentional threats to hardware, software and data elements that may result in damage or corruption.

CRS-C-19

Source: C-DAS Interim SRS V2.2

Status: Normative

Rationale: To preserve system availability.

Guidance: The design needs to be such that unintended damage or corruption can be avoided by militating against human error and considering risks to installations. Damage includes physical damage to system components and interfaces; corruption includes any software-based threats, such as incorrect data or network flooding with messages. Remote and direct access to systems must be controlled to avoid unauthorised access (either unintentional or deliberate).

3.2.5 Information Management

The C-DAS shall acquire all the data necessary to provide information to the driver.

CRS-C-3

Source: C-DAS Interim SRS V2.2 development.

Status: Normative

Rationale: To enable the train to be driven safely and efficiently, and in accordance with the Current Plan.

Guidance: The data required by the C-DAS comprises:

- a. Infrastructure Geography, i.e. data which describes the topography and topology of the network infrastructure for the routes on which C-DAS is to operate;
- b. Static Speed Profiles for the routes and train types / ETCS train categories on which C-DAS is to operate;
- c. Speed restrictions for the routes and vehicle / train types / ETCS train categories / axle loads / power modes on which C-DAS is to operate;
- d. The schedule to which each C-DAS fitted train is to operate;
- e. Train-specific data for C-DAS-fitted trains, i.e. consist; operating capabilities (traction, braking, etc.); applicable train type(s) / ETCS train categories;
- f. Current train location and speed; and
- g. Any relevant special conditions of travel (e.g. speed restriction details contained within RT3973).

'Acquire' in this context includes both obtaining the data from recognised data sources, as defined in the DR Interface Requirements Specification [RD4], and confirming that the data is appropriate to the Current Plan, route and vehicle.

C-DAS operational information shall be made available for use by other railway systems.

CRS-C-4

Source: C-DAS Interim SRS V2.2 development

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Status: Normative

Rationale: To support the optimisation of other railway system operations.

Guidance: C-DAS Operational Information includes:

- a) Changes to train consist or capability data resulting from an onboard fault or failure to support data alignment between other co-operating Digital Railway systems.
- b) Train position and speed, or C-DAS equipment status, for use in real-time train regulation or train planning activities or the provision of accurate passenger information.
- c) Train performance against schedule information to support network performance analysis.

Data exported by C-DAS will be published via LINX (Layered INformation eXchange) and available to any system that has registered to receive it.

C-DAS shall use industry standard interfaces for data communication. **CRS-C-12**

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To facilitate efficient operation between the Infrastructure Manager (IM) and multiple Railway Undertakings (RUs).

Guidance: Data interchange between the IM and RU subsystem is expected to use the standard interface defined in RIS-0711-CCS.

C-DAS shall only utilise data that has been obtained from the specified source. **CRS-C-20**

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To avoid inconsistencies in operation between C-DAS and other systems.

Guidance: The specified source is defined within the DR System of Systems Data Specification [RD9].

The C-DAS shall meet the data preparation, validation and storage targets set by the Deployment Project Team. **CRS-C-27**

Source: CRS-SoS

Rationale: Data needs to be stored to support current operations and incident management following failures.

Guidance: The Deployment Project Team will need to specify targets for: space, duration, volatility etc.

The scope of this requirement covers data which is internally and externally generated, and includes checking:

- a. that data acquired by C-DAS from an external source is complete and uncorrupted;
- b. the processes used to generate data acquired from an external source prior to use by C-DAS, including any transmission involved;
- c. that data provided to C-DAS has been prepared in accordance with

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appropriate assurance processes;
d. data entered directly into C-DAS, e.g. by the driver.

3.2.6 Ergonomics and Human Factors

The design of the C-DAS shall eliminate, or reduce to a level in line with best practice, the risk of users making an error when interacting with it.

CRS-C-26

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: Errors made during interactions with the system can impact on safety and performance.

Guidance: The C-DAS design should be in accordance with the relevant Ergonomics standards and Human Factors best practice. Particular attention should be paid to ensuring a safe and effective method of data entry in order to minimise risks arising from input errors.

Safety

The C-DAS shall be designed and installed to reduce the risk of distracting the driver from priority tasks in so far as is reasonably practicable (SFAIRP).

CRS-C-11

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: Distracting the driver from priority driving tasks could result in hazards being realised.

Guidance: Distraction could result from:

- High display refresh rates.
- Brightness levels being unsuitable for the cab environment, or rapid switching between different brightness levels.
- Overcomplicated or 'fussy' display design that increases the time required for drivers to identify and process the presented information.
- Complicated manual controls that prevent safe and efficient option selection
- Provision of C-DAS information in areas where it is not necessary or where the driver is required to focus on other driving tasks.
- Positioning the C-DAS display in such a manner that it obscures the view of safety-critical information.

3.2.7 Electromagnetic Compatibility and Environment

The C-DAS installation in the rail vehicle shall not adversely affect the vehicle's compatibility with the environment in which it operates.

CRS-C-29

Source: BS EN 50125-1:2014, BS EN 50121-3-2:2016

Status: Normative

Rationale: To avoid degradation of environmental capability applicable to the rail vehicle.

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Guidance: Rail vehicles should be able to operate satisfactorily after C-DAS fitment in the same environmental conditions as they could prior to C-DAS fitment. The Locomotives and Passenger Rolling Stock (LOC & PAS) Technical Specifications for Interoperability (TSIs) [RD10] contains information on the environmental conditions with which new build vehicles are expected to cope. Rail vehicles being retrofitted with C-DAS may have been built to cope with a different set of environmental conditions and it may, or may not, be feasible for them to achieve compliance with the environmental conditions specified in the LOC & PAS TSI [RD10] as part of the retro-fitment activity.

C-DAS equipment shall function correctly under the full range of environmental conditions in which it will operate. **CRS-C-30**

Source: Industry best practice

Status: Normative

Rationale: Both safety and performance are dependent on equipment operating correctly within the railway environment.

Guidance: Factors to be considered include electromagnetic compatibility, temperature, humidity, ultra-violet exposure and the risk of exposure to (or release of) hazardous materials. This requirement is intended to apply to all C-DAS equipment whether installed on a train, in a data centre, ROC or other location.

3.2.8 Health & Safety

None.

3.2.9 Operational Readiness

None.

3.2.10 Maintenance and Diagnostics

The C-DAS shall be designed to meet its maintainability target. **CRS-C-25**

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To ensure that the maintainability of the C-DAS is in line with the project requirements.

Guidance: The target is to be determined by the Deployment Project Team. Ease of maintenance and installation contributes to whole life cost reduction and improves the speed and ease with which an item can be restored to service after preventative or corrective maintenance activities.

The C-DAS shall provide users with C-DAS equipment status information. **CRS-C-35**

Source: C-DAS Interim SRS V2.2 development

Status: Normative

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Rationale: To enable users to understand the status of the C-DAS equipment and be able to infer the impact of faults.

Guidance: This will afford all users, competent authorised maintenance staff, and interfacing systems ready access to diagnostic and maintenance data. Diagnostic information is expected to be visual and easy to interpret and should be supported with meaningful maintenance messages explaining the action required to resolve outstanding issues.

The C-DAS application design shall facilitate maintenance, repair and replacement, and configuration control of components. CRS-C-31

Source: Industry best practice

Status: Normative

Rationale: Ease of installation and maintenance contribute to whole life cost reduction.

Guidance: The design should enable ease of installation and maintenance activities for rapid fault resolution. This should cover a range of activities in support of the Reliability, Availability and Maintainability (RAM) requirements, including the use of the correct pre-configured or system configured Line Replaceable Units (LRUs), site access, and local and remote access for diagnostics.

3.2.11 Competence and Training

A user training and competency management system shall be provided for all C-DAS operators and maintainers. CRS-C-33

Source: Industry best practice

Status: Normative

Rationale: User need to be competent to perform their assigned roles.

Guidance: The competencies of users should be aligned to the roles they are authorised to undertake. User training should provide the opportunity for users to train on a simulator and in groups to aid operation efficiency.

The competencies of the C-DAS user shall be actively managed. CRS-C-34

Source: Industry best practice

Status: Normative

Rationale: Regular assessment of user competencies will support operational efficiency.

Guidance: The competencies of any individual C-DAS user should be aligned with their role profile.

3.2.12 Whole Life Costs

None.

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3.2.13 Other

None.

3.3 Process Requirements

3.3.1 Target Setting

The Deployment Project Team shall define the C-DAS Reliability, Availability and Maintainability targets. **CRS-C-28**

Source: C-DAS Interim SRS V2.2 development

Status: Normative

Rationale: To provide specific RAM targets which need to be achieved in order to meet the business needs of the project or Route.

Guidance: Reliability, Availability and Maintainability targets will be dependent on a number of factors, including volume of traffic, previous performance targets, resource allocation, budget, and business needs. These will be addressed as part of the business case activity for each project responsible for delivering digital products.

3.3.2 Standards

None.

3.3.3 Deliverables to be produced

None.

3.3.4 Governance and Approvals

None.

3.3.5 Other

None.

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4 Associated Information

4.1 Open Points

The open points for this generic Customer Requirements Specification are tabulated in **Table 1** below.

Table 1 Open Points

Number	Issue	Description	Identified in Version	Closed in Version
1	C-DAS use through level crossings.	Digital Railway should consider the impact of drivers following C-DAS providing advisory information in the vicinity of Level Crossings. For example, following advisory information could slow approaching trains sufficiently to unacceptably increase level crossing closure times and potentially increase the risk of level crossing misuse. This may introduce requirements on Traffic Management and/or time timetabling activities around scheduling of trains around level crossings. If Digital Railway decide that this is an issue that C-DAS needs to police then additional requirements will need to be developed.	1.0	3.0
2	Use of C-DAS for dynamic and fixed coasting areas	Through coasting areas (damaged OLE, dead sections etc), currently, drivers are requested to speed up on the approach to the area, lower the pantograph and coast through to the other side. C-DAS would need to know of coasting areas in advance and adjust the speed advice accordingly. Currently there is no provision for this and C-DAS will be suppressed (either manually or automatically) on the approach to the coasting area where a driver will rely on existing procedures to manage movement through the area. A decision needs to be taken to whether suppression is sufficient to	1.0	3.0

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3		manage this or if C-DAS needs to advise the driver how best to drive the train with respect to coasting areas.		
		A hazard arises from the non-provision of signalling information to C-DAS and the risk of the driver following advisory information over the signalling information on the approach to a signal at danger. The C-DAS project is awaiting the convening of a Hazard forum to determine whether measures proposed to mitigate the Hazard (C-H125) are sufficient to reduce the resulting risk to a tolerable level. If not, changes to requirements may be required.	1.0	

4.2 Assumptions

The assumptions made in connection with this generic Customer Requirements Specification are tabulated in **Table 2** below.

Table 2 Assumptions

Number	Issue	Assumption	Identified in Version	Closed in Version
1	Interface between C-DAS and ETCS	There will be no interface between C-DAS and ETCS in a System of Systems (SoS) deployment and therefore functionality which could exist if this interface were present is omitted from this system definition.	1.0	2.0
2	C-DAS Communications	Commercial communications networks will be suitable for C-DAS applications in both capacity and quality of service. No requirement exists to utilise the GSM-R network.	1.0	2.0
3	C-DAS in coasting areas	C-DAS will not receive information on areas where coasting is required (e.g. damaged OLE). Therefore, no C-DAS	2.0	3.0

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		functionality in this regard is required to adjust the advice speed accordingly.		
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4.3 Dependencies

The dependencies associated with this generic Customer Requirements Specification are tabulated in **Table 3** below.

Table 3 Dependencies

Number	Issue	Dependency
		None identified

4.4 Constraints

The constraints associated with this generic Customer Requirements Specification are tabulated in **Table 4** below.

Table 4 Constraints

Number	Issue	Constraint
		None identified

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Appendix A APPLICABILITY ASSESSMENT TEMPLATE

A.1 Guidance on Populating the Template

A deployment project wishing to record the results of their applicability assessment should copy this template into a new deployment project-specific document for population.

Insert project name into the relevant box near the top of the template.

For each Application-Specific requirement, insert the word 'Yes' in the 'Applicable' box if the issue or subject addressed by the requirement is relevant to the deployment project in question.

If the issue or subject addressed by an Application-Specific requirement is not relevant to the deployment project in question, insert the word 'No' in the 'Applicable' box.

It is not permissible to change the Applicability status of Normative requirements as these are mandatory on all deployment projects.

A.2 Feedback

Deployment projects are requested to send copies of their populated Applicability Assessment Templates to the Digital Railway System Requirements and Integration team. This will enable the team to assess the value that the industry is deriving from the Application-Specific requirements and will support future improvements to the generic Customer Requirements Specification.

A.3 Template

Deployment Project Applicability Assessment of GB Generic National Customer Requirements Specification for C-DAS			
Deployment Project Name			
Requirement ID	Type	Status	Applicable

Reference 153821-NWR-SPE-ESE-000010

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CRS-C-1	Functional	Normative	Mandatory
CRS-C-16	Functional	Normative	Mandatory
CRS-C-8	Functional	Normative	Mandatory
CRS-C-38	Functional	Normative	Mandatory
CRS-C-24	Non-Functional	Normative	Mandatory
CRS-C-5	Non-Functional	Normative	Mandatory
CRS-C-15	Non-Functional	Normative	Mandatory
CRS-C-37	Non-Functional	Normative	Mandatory
CRS-C-19	Non-Functional	Normative	Mandatory
CRS-C-3	Non-Functional	Normative	Mandatory
CRS-C-4	Non-Functional	Normative	Mandatory
CRS-C-12	Non-Functional	Normative	Mandatory
CRS-C-20	Non-Functional	Normative	Mandatory
CRS-C-27	Non-Functional	Normative	Mandatory
CRS-C-26	Non-Functional	Normative	Mandatory
CRS-C-11	Non-Functional	Normative	Mandatory
CRS-C-29	Non-Functional	Normative	Mandatory
CRS-C-30	Non-Functional	Normative	Mandatory

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CRS-C-25	Non-Functional	Normative	Mandatory
CRS-C-35	Non-Functional	Normative	Mandatory
CRS-C-31	Non-Functional	Normative	Mandatory
CRS-C-33	Non-Functional	Normative	Mandatory
CRS-C-34	Non-Functional	Normative	Mandatory
CRS-C-28	Process	Normative	Mandatory

Reference	153821-NWR-SPE-ESE-000010
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Appendix B NEW CUSTOMER REQUIREMENTS TEMPLATE

B.1 Guidance on Populating the Template

A deployment project wishing to draft new Customer Requirements should copy this template into a new deployment project-specific document for population. New requirements should not be added to Appendix B of the generic Customer Requirements Specification itself.

Text in italics prefixed '*GN*' forms guidance for the user of this template.

Further guidance may be found in the Customer Requirements Management Plan [RD5].

B.2 Feedback

Deployment projects are requested to send copies of any additional Customer Requirements generated to the Digital Railway System Requirements and Integration team. This will enable the team to identify future improvements to the generic Customer Requirements Specification.

B.3 Template

Safety

The requirement text goes here.

GN: It must be a clear, concise and unambiguous statement of what is required. It must include the word 'shall'.

Unique-Identifier

Source: Source statement goes here.

GN: This is a statement which identifies where the requirement originated to provide traceability of the requirement's origin. This could include references to a Concept of Operations, System of Systems Customer Requirements Specification, hazard record, or other document that sets out a high-level expression of what this system needs to achieve.

Status: Normative or Application-Specific.

GN: This will be 'Application-Specific' unless this template is being used to propose a change to the generic Customer Requirements Specification in accordance with the change process set out in section <1.x>.

Rationale: Rationale statement goes here.

GN: This explains why the requirement is needed and its application, including why the requirement exists, who it is for, what industry benefit could be achieved, what the constraints are, and any other essential detail. Cross-referencing to other documentation to avoid the need for lengthy explanations is acceptable.

Guidance: Guidance statement goes here.

GN: The guidance statement contains any supplementary information that may be of value in assisting with the interpretation of the requirement or in determining how the requirement could be satisfied.

Reference	153821-NWR-SPE-ESE-000010
Issue/Ver:	3.0
Date:	26/03/2019

Appendix C WHAT DOES GOOD LOOK LIKE

Each requirement is likely to be supported by fairly substantial rationale and guidance statements in its final form. The purpose of the rationale statement for a requirement is to explain why this is a necessary requirement. The purpose of the guidance statement for a requirement is to provide background and context as to how it may be achieved. This could perhaps include textual references to the more detailed documents that describe possible means to achieve the desired outcome. Additional explanation is given in section 2 above.

Some examples are provided below. The examples are primarily focused on Functional Requirements at present.

C.1 System of Systems (SoS)

The Digital Railway System shall determine a safe optimal speed at which a rail vehicle should travel.

Unique-Identifier

Rationale: In order to provide the driver with a safe, optimal, recommended speed, the Digital Railway System must determine the ideal speed at which the rail vehicle must travel to achieve the Current Plan schedule and ensure that the recommended speed derived from this ideal speed maintains compatibility between the rail vehicle and infrastructure over which it is to operate.

Guidance: Following optimisation of the train movement a recommended speed for the train will be generated. Travelling at the recommended speed would allow the train to achieve the Current Plan while also minimising the impact to other services. Speed recommendation should take into account a Movement Authority and not simply suggest the driver travels at full speed.

The Digital Railway System shall allow an appropriate authority to request a possession.

Unique-Identifier

Rationale: Possessions can only be managed by personnel with an appropriate competence. These competent personnel must have the means to remotely request authorisation to proceed with a possession from the signaller.

Guidance: A Person in Charge of a Possession (PICOP) is the appropriate authority who would be at trackside near a planned possession. A PICOP will request a possession from a signaller. They must ensure that the necessary conditions have been met to allow a possession to be taken i.e. trackside staff must be ready for the possession. A possession will not start unless a request is made and the signaller approves it. For example, remote terminals, such as those which may be carried by trackside staff, can request a possession be applied when they are ready to commence work.

C.2 ETCS On Board

The ETCS On board shall fully support operation at System Version 2.1.

Unique-Identifier

Rationale: To ensure compatibility across all ETCS deployments within the GB Railway.

Reference	153821-NWR-SPE-ESE-000010
Issue/Ver:	3.0
Date:	26/03/2019

Guidance: It is intended that ETCS Trackside deployments delivered in accordance with the generic DR requirements will be configured with a System Version of 2.1 and this requirement is therefore necessary to ensure that the ETCS On board will be compatible with the ETCS Tracksides over which it will operate.

It shall be possible to operate the train safely, with relevant controls and indications available to the driver, on lines fitted with a lineside signalling system when the ETCS On board has been isolated.

Unique-Identifier

Rationale: The non-availability of ETCS On board functionality should not prevent the normal operation of the train in areas where the train does not need to operate in ETCS Levels 1-3. This will enable the train to be deployed productively on services in a non-ETCS area until such time as it can receive maintenance attention to place the ETCS On board in a functional state.

Guidance: When the ETCS is Isolated, the controls and indications relevant to operation with the lineside signalling system available to the driver will include:

- Current train speed information
- Class B system status information
- Controls to acknowledge warnings and interventions from class B systems

C.3 ETCS Trackside

Safety

The ETCS Trackside shall be designed so that trains operate in the highest available level of supervision.

Unique-Identifier

Rationale: The safe operation of trains is a prime objective of the industry. Legislation requires passenger trains to be operated with an active train protection system.

ETCS levels 1 to 3 provide ATP functionality and are therefore preferable to Level NTC (TPWS).

Guidance: Within ETCS levels the modes provide different levels of supervision of the train and support to the driver. FS assures the driver that the line is clear and provides speed and distance to go supervision - this is the preferred mode. OS requires the driver to confirm that there are no obstructions however it supervises speed and distance to go.

SH may be necessary to meet the operational needs but it has limited supervision and needs additional trackside and operational controls.

SR is the last resort for when a movement authority cannot be issued, and the trackside should offer trains a movement authority as soon as the reasons for SR have been resolved.

The ETCS Trackside shall provide the on-board with sufficient information for the safe management of the train by the driver.

Unique-Identifier

Reference	153821-NWR-SPE-ESE-000010
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Rationale: When operating with cab signalling, all the information required by the driver should be provided on the cab display.

The requirement for route knowledge or reference to a route book should be minimised.

The need for the driver to identify and interpret lineside signage should be limited to those occasions when the information cannot be provided in the cab.

For operational reasons the driver should not be encouraged to react by reducing speed purely because information is not available on the cab display.

The meaning of a movement authority to a driver needs to be agreed with a consistent set on underlying rules for the issue of the MA (interlocking principles).

Guidance: The driver needs information on the permissible speed of the train, the distance to travel, the route the train will follow (where critical), and any track related actions (e.g. neutral sections).

There are scenarios when a message may be displayed at the entry to OS or FS requiring the driver to manage the speed of the rear of the train - these should be minimised.

The extent of a movement authority sent to the on-board needs to be of sufficient length (subject to availability) to allow the driver to continue to manage the train at the permissible speed or at the advisory speed from C-DAS - the update of the movement authority needs to avoid the driver misinterpreting how far the train may travel.

C.4 TMS

The TMS shall enable the user to obtain information about the current capabilities of any section of line within their area of interest.

Unique-Identifier

Rationale: To enable the user to make informed decisions about managing the train service they need to be able to establish the capability of the parts of the network that they have a responsibility for or an interest in.

Guidance: Capabilities of interest to the user include the following:

- Current maximum permissible line speed
- Status of traction electrification sections
- Lines subject to line blockages, possessions, etc.
- Other operational restrictions such as defective infrastructure.

This information would be used both manually by the user, and automatically by the TMS, to inform the current plan and make decisions on train routing and train regulation.

The TMS shall use the information available to it in order to check that a train is not incompatible with the infrastructure over which it is planned to run before requesting routes to be set for that train.

Unique-Identifier

Rationale: When trains are routed over infrastructure with which they are incompatible (for physical, electrical, operational or environmental reasons) there is a risk of infrastructure damage or personal injury and the likelihood of significant service disruption while the situation is resolved.

Reference	153821-NWR-SPE-ESE-000010
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The risk of a mis-routing event occurring can be reduced by using the information which the TMS possesses about the characteristics of both train and infrastructure to establish that there are no known incompatibilities. Route requests are only made for the train on routes where there is no evidence of an incompatibility existing.

As it will not always be possible for the TMS to know all the information necessary to do a comprehensive check of train to infrastructure compatibility the objective is to establish that there is no evidence of incompatibility in the available information rather than to prove that the train and infrastructure are definitely compatible.

Guidance: Train to infrastructure incompatibility is a form of conflict and should be managed accordingly within the TMS when an instance is identified.

C.5 C-DAS

C-DAS shall provide updated advisory information to the driver when the train schedule is amended whilst the train is within an area controlled by a Traffic Management System.

Unique-Identifier

Rationale: To convey information on the schedule for the train based on the current plan, to the driver thus enabling them to become aware of any changes arising from train regulation decisions. This increases the likelihood of the driver managing their train in a way which supports the accurate delivery of the current plan.

Guidance: The TMS makes predictions about future train running in order to make train regulating decisions. By providing the driver with updated advisory information it is possible for them to adjust their driving actions in accordance with the assumptions made by the TMS to deliver the current schedule efficiently. It may also assist them to identify when routing errors have been made. If the driver were unaware of the changes made to the schedule they could invalidate the assumptions made by the TMS resulting in sub-optimal performance outcomes and the need for further adjustments to the current plan.

C.6 Operations & Maintenance Readiness

The Onboard Operator shall drive the train in accordance with the information provided by the on board Digital Railway systems.

Unique-Identifier

Rationale: The onboard operator remains in charge of train movements and uses the information to understand the operating intent of the signaller and train controller.

Guidance: Such information is likely to include ETCS information on the DMI, advisory information on the C-DAS DMI as well as any other information provided by the existing on board systems.

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