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Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

Level 2

Specification for Computer Aided Design

Endorsement and Authorisation

Endorsed by:



Terry Allen, Working Group Chair

Authorised by:



Andrew Coombes, Steering Group Chair

Accepted for issue by:



Mick McManus, National Standards Manager

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Published and Issued by Network Rail, 40 Melton Street, London NW1 2EE.



Ref:	NR/L2/INI/EDT/CP0091
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Issue record

Issue	Date	Comments
1	March 2011	New standard which describes the requirements for the production of CAD models and drawings.

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 3 September 2011.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

NR/L1/INI/EDT/CP0090	Policy for Engineering Design Technology
NR/L2/TRK/2049	Track Design Handbook
NR/L2/TRK/2500	Technical Approval in the Design of Track Infrastructure
NR/L2/TRK/7004	Permanent Way Standard Drawings (RE/PW Series)
NR/SP/CIV/003	Technical Approval of Design, Construction and Maintenance of Civil Engineering Infrastructure
NR/L3/CIV/151	Technical Approval of Standard Designs and Details for Civil Engineering Works
NR/GN/SIG/11701	Signalling Design: Production Guidance
NR/GN/SIG/11201	Signalling Design: Production
NR/GN/SIG/11004	Symbols for use on Signalling Plans and Sketches Used in Signalling Applications
NR/GN/SIG/11205	Symbols for Signalling Circuit Diagrams
NR/L3/SIG/30018	Signalling Design: Technical Details – Level Crossings
NR/L2/SIG/30004	CAD Cell Library
NR/EE/SPE/0065	Generic Programme Specification, 3.3.1 Survey and Mapping
NR/ED/AR/SPEC/DOC001	Building Design Specification Number
A305/GSM-R/P/154	GSM-R Base Station Site Elements
A305/GSM-R/IMP/P-042	GSM-R Asset Data Management Procedure
SP/FTN(D&D)/017	FTN Specification for Asbuilt Records for Cables and Cable Routes

Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

SP/FTN/(D&D)/016	FTN Specification for Identification and Labelling of Network Elements
RT/CES/3/01315	Chief Engineer's Specification: Format and Standards of Network Rail Rail Vehicle Engineering Drawings
NR/GN/ELP/27309	DC Electric Track Equipment Drawing Index
NR/SP/ELP/27221	Overhead Line Equipment Master Index
NR/GN/ELP/27246	Data Held in the Overhead Line Master Index
NR/L2/ELP/27311	Technical Approval of Electrification and Plant Asset Design
NR/SP/ELP/27300	Specification for Computer Aided Design Formats for Electrification and Plant Documentation
NR/L2/ELP/21120	E & P Records Management Process
NR/L2/INF/02018	Specification for the Management of Safety Related Infrastructure Records
BS 1192:2007	Construction Drawing Practice
BS 8888	Engineering Drawing Practice
BS EN ISO 128-21	Technical Drawings – General Principles of Presentation
ISO 13567-2-2002	Technical Product Documentation. Organisation and Naming of Layers for CAD
UNICLASS	Unified Classification for the Construction Industry – RIBA Publications

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Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

Contents

1	Purpose	6
2	Scope	6
3	Roles and responsibilities	6
4	Definitions	7
5	Abbreviations	9
6	General information	9
6.1	CAD software	9
6.2	Supporting files	10
7	File structure and content	10
7.1	Seed files	10
7.2	Design compilation	11
7.3	3D files	12
7.4	Geospatial location	12
7.5	Reference files	12
7.6	Plans and Sections	13
8	Style and presentation	13
8.1	Title blocks	13
8.2	Scales	13
8.3	Sheet size	14
8.4	Text	14
8.5	Cells	15
8.6	Colour	15
8.7	Line styles	16
8.8	Dimensions	16
8.9	Construction lines	17
9	Levels classification	17
9.1	Mandatory scheme	17
9.2	Optional extended scheme	19
10	File names and numbering	20
10.1	Drawing numbers	20
10.2	File names	21
10.3	Revision numbers and issue status	21
10.4	Drawing deliverables	21

Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

11 Intellectual property	23
12 Ordnance Survey data	23
12.1 Service agreement	23
 Appendix A – Discipline Specific Drawings – Guidance regarding Exceptions	 25
Appendix B – Supporting Files	32
 Figure 1 – Typical Model and Drawing Compilation	 11
Figure 2 – Typical Project Compilation	12
 Table 1 – Scales to be Used	 14
Table 2 – Colour Convention	15
Table 3 – Mandatory Level Naming Scheme	17
Table 4 – Discipline Codes	18
Table 5 – Optional Extended Level Naming Scheme	19
Table 6 – Drawing Number Scheme	20
Table 7 – Revision Numbers & Issue Status	21
Table A.1 – Mandatory Level Naming Scheme for Architecture Drawings	25
Table B.1 – Supporting Files	32

Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

1 Purpose

The purpose of this standard is to specify requirements relating to the production of all Computer Aided Design files for models and drawings representing railway infrastructure and property.

The standard details structure, style and methods of presentation.

2 Scope

The standard provides a flexible framework for the production of CAD files and accommodates current practices employed within Network Rail at both Discipline and Programme level.

Use of the standard is mandatory for all Network Rail staff, contractors and consultants involved in the production of CAD files which represent railway infrastructure and property.

Discipline specific information, which is either additional to, or diverges from this standard, is included within Appendix A.

3 Roles and responsibilities

Engineering Design Technology (EDT) Steering Group

Network Rail Steering Group which identifies the EDT Strategy and defines the processes and systems used to support the engineering design process.

CAD Working Group

Network Rail technical committee which defines the CAD specification, reviews feedback and makes recommendation for revision to the EDT Steering Group.

CAD Managers (within Network Rail)

Note: CAD Manager is a collective term which includes Engineering Data Managers, Project Managers and Design Team Managers.

Provide verification that the production of all design files (both in-house and externally by the supply chain) conform to the requirements contained within this standard.

CAD Representatives (within Network Rail)

Provide point of contact for CAD liaison, usually on smaller projects without a defined CAD Manager position. Specific job titles may vary by project.

CAD Managers (Contractor/Consultant based)

Possess an understanding of the requirements contained within this standard regarding the supply of design files to Network Rail. Make sure that regular liaison with Network Rail CAD Managers or CAD Representatives takes place.

CAD Users (various roles may sit within this classification)

Required to comply with this standard and incorporate the technical files in normal work practice.

Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

4 Definitions

Note: This standard uses terminology and concepts from Bentley MicroStation CAD software, which apply, in principle, to other CAD software used in the production of models and drawings.

Autocad

Proprietary 2D/3D CAD software from Autodesk Inc.

Computer Aided Design (CAD)

A generic term for 2D/3D design production using specialist computer graphics software.

Computer Aided Engineering (CAE)

The design, analysis, communication, manufacture, testing, validation and management of engineering design using a range of computer systems (this includes intelligent model production based on actual engineering design standards).

Note: CAD is a subset of CAE.

CAD data

A generic term to describe all CAD model files and drawing files.

Design Management System (DMS)

The generic term for the system(s) which store Engineering Design Information throughout a project lifecycle (for example, CCMS, MOSS and ProjectWise).

Engineering Design Information

Includes, but is not limited to, drawings and design content, surveys, data models, component lists, specifications and datasheets, operations and maintenance manuals and testing records.

Engineering Design Technology (EDT)

A broader definition of the systems, processes and standards which are used throughout a project lifecycle to create, develop and manage Engineering Design Information.

Cell

Named graphic element representing complex shapes or symbols, that are stored within a cell library for repeated replacement into a design file.

Cell library

A unique CAD file containing a collection of cells, which can be attached to a design file.

Colour table

File that maps colours to graphic element colour codes.

Design file

Data file containing constituent CAD elements of models or drawings.

Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

Design view

The area of the drawing file where all design data is collated and models are attached as reference files.

DGN format

MicroStation software file format, commonly termed 'design file'.

Drawing

Graphical depiction of a design enclosed in an approved drawing border.

Drawing file

CAD file which contains the design view and sheet view from which a drawing is plotted.

Form A

A certificate for Approval In Principle; used as part of assurance for outline design.

Form B

A certificate of Design and Design Checking; used as part of assurance for detailed Design.

Level

Virtual plane or layer in the design file, which can be viewed individually or in any combination, and where the structure of graphical elements can be defined by colour, line weight and line style.

Master plan (or Engineering Integration Model)

Model file in a complex project comprising a number of discipline specific referenced design files.

MicroStation

Proprietary 2D/3D CAD application software supplied by Bentley Systems Inc.

Model file

CAD file containing the model view and title box view, which may be referenced into the drawing file to form the basis for designs and drawing production.

Model view

The area of the model file where 2D or 3D graphical elements, depicting an asset, scheme or layout are compiled, usually at 1:1 scale.

Packager

Bentley product within MicroStation that will produce a zipped folder of all source data and files in order to recreate models and drawings on another computer system.

Plot file

File containing plotter commands, which allows the selected design file data to be sent to an output device as a hard copy or an alternative image.

Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

ProjectWise

Software from Bentley Systems Inc. to enable engineering project team collaboration for design and data management.

Raster File

An electronic image made up of a pattern of dots (pixels).

Reference file

Design file that is displayed in read only mode for attaching to other design files.

Schematic

Drawing or model that does not contain geo-referenced spatial data or true dimensions.

Seed file

File used as a template with appropriate settings and attributes to create new design files to a required standard.

Sheet view

The area in a drawing file which acts as an electronic drawing sheet. Typically, design models are attached as reference files, then scaled or positioned into standard drawing borders in preparation for plotting; also known as Layout or Print View.

T&RS Consortium

Any design organisation, either in house or employed externally via the supply chain process, involved in the production of traction and rolling stock designs.

5 Abbreviations

GIS	Geographical (or Geospatial) Information System
GRIP	Guide to Railway Investment Projects
ISO	International Standards Organisation
Pdf	Adobe Acrobat portable document format
PW	Permanent Way
RE	Railway Executive
SRE	Standard Railway Equipment

6 General information

6.1 CAD software

6.1.1

MicroStation is the preferred CAD software for Network Rail. Projects/disciplines may agree use of AutoCAD or other approved CAD software depending on specific

Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

requirements. In such cases the electronic files supporting this standard shall be transformed accordingly to the approved software file format.

If other approved software is used, files supplied to the project shall be in native format compliant to this standard or, if agreed, an accurate conversion to MicroStation.

6.1.2

The versions of CAD software to be used for the production of models and drawings shall be as approved by Network Rail's Engineering Design Technology Steering Group, as specified in NR/L1/INI/EDT/CP0090.

6.2 Supporting files

6.2.1 Standard items for supporting files

6.2.1.1

Network Rail shall supply a set of supporting electronic files to be used for the production of CAD models and drawings. These include seed files, border files, cell libraries and level naming. The available files are listed in Appendix B.

6.2.2 Additional items for supporting files

6.2.2.1

Projects may adopt new level names or cells within the framework defined in this standard. Such additions/new items shall be limited to a particular project and shall be agreed with the CAD Representative.

6.2.2.2

They shall not become part of the standard until they are approved by the Network Rail CAD Working Group and included in the supporting files.

6.2.2.3

Network Rail shall issue any updates to the supporting files in accordance with the requirements contained in NR/L2/EBM/STP001.

7 File structure and content

Note: This Clause particularly refers to the use of model files for geospatial design integration, which is critical to the management of the project. Schematic diagrams, however, may use similar principles within drawing files.

7.1 Seed files

All new design drawings shall be created using the relevant seed files supplied in the supporting files.

7.1.1 Models

The seed files, NRmodelseed3d.dgn and NRmodelseed2d.dgn shall be used for all design models.

Ref:	NR/L2/INI/EDT/CP0091
Issue:	1
Date:	5 March 2011
Compliance date:	3 September 2011

These files contain two views:

- the model view to compile the graphical elements of the design data;
- the title box view to contain only the title block information.

No other CAD models shall be created within the model file. Each model file name shall represent only one CAD model.

7.1.2 Drawings

The seed file NRdrawingseed.dgn shall be used for all design drawings.

These files contain two views:

- the design view to compile all required reference models;
- the sheet view to compile sheet borders, annotation and title block details at the required plot scale, clipped to the sheet border and aligned to the required orientation of the project.

Note: A typical arrangement for a model and drawing is specified in Figure 1.

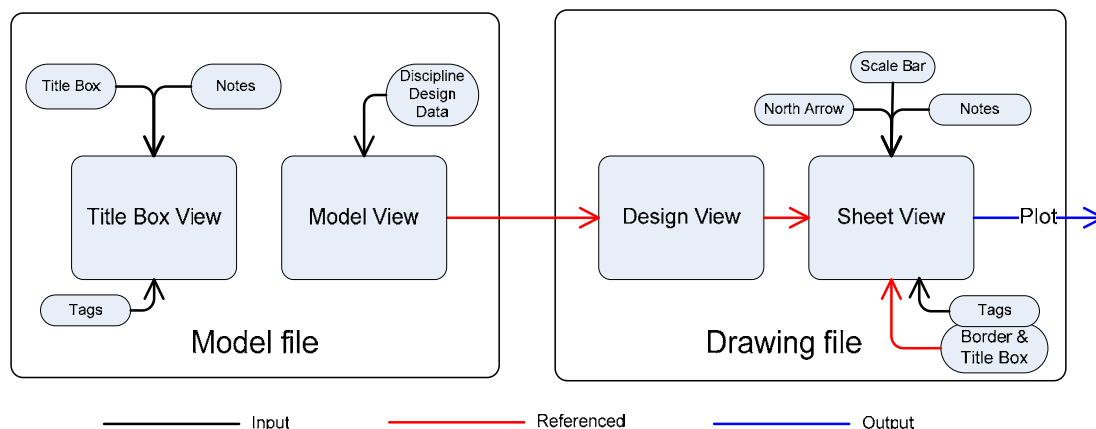


Figure 1 – Typical Model and Drawing Compilation

7.2 Design compilation

7.2.1

For complex projects a Master Plan (or Engineering Integration Model) shall be created to assemble all required discipline specific reference models. This is for use as version control of updates and to make sure that project teams have access to consistent data.

Note: A typical arrangement for a general railway engineering project is specified in Figure 2.