Design guidelines

CAD Standard

RBDG-MAN-034-0102

28.11.2022

Contents

1. Introduction

These standards apply to all drawings (sketches, preliminary, detailed design, construction, shop drawings and as-built drawings) and CAD Data (2D or 3D) produced, but not to the drawings used as starting references, that will follow the National Standards.

The intent of these CAD standards is to provide guidelines to ensure that all drawings are prepared to a standard and uniform appearance and reflect high quality workmanship, and that data created by CAD systems is correctly structured and classified to facilitate re-use and understanding by others.

This document is not related to any particular Authoring Tool and it will be each Supplier who develops a specific practical standardization for the Authoring Tool to be used in their project, taking as a base this documentation. In other words, the Supplier will develop a CAD Manual, called the Supplier CAD Manual, which is an adaptation of this standard to its Authoring Tools and that, as defined in the BIM Manual, will be delivered after the Contract Award together with the Post-contract BIM Execution Plan (BEP) and the Master Information Delivery Plan (MIDP).

In order to help the Supplier, develop their specific CAD Manual, a basic template in DWG format is provided annexed to this document (RBR-DWG-BIM-BMA-0008_CADTemplate).

The delivery of the Supplier CAD Manual will include mock-up drawings to demonstrate that the Supply Chain has developed its CAD Manual for its authoring tool accordingly with this standard and to allow RB Rail AS to validate it.

2.   BIM Modelling and CAD Standards

2.1. Paper Size

Preferably drawings will be ISO Sizes, if custom sizes are needed, it must be informed and agreed with RB Rail.

All drawings shall be in landscape format. Drawing graphics or text are not to overlap or lie outside the drawing border.

ISO sizes allowed:

Format	Size (mm)
A0	841x1189
A0+	914x1292
A1	594x841
A1+	609x914
A2	420x594
A3	294x420
A3+	329x483
A4	210x297

2.2. Scales

Careful consideration should be given to the choice of scale. Factors affecting choice are as follows:

• Communication of the information for the work to be carried out.

• Economy of effort and time in preparation

• Maintaining the standard sheet size

From a CAD system it is simple to produce drawings at different scales showing the same graphics or data. Particular care should be taken to avoid this unless the larger scale drawings are clearly showing or conveying additional information.

The following drawing scales are to be used:

Scales		
1:1	1:2	1:5
1:10	1:20	1:50
1:100	1:200	1:500
1:1000	1:2000	1:5000
1:10000	1:20000	1:50000
1:100000	1:200000	1:500000

Typical scales for drawing types:

type	Scale
Corridor plans	1:50-1:1000
Building plans	1:20-1:200
Elevations	1:20-1:200
Sections and details	1:1-1:50
Schedules	1:1

The basic scale used on each drawing shall be noted in the Title Block. It is preferable to have only one scale used for each sheet, however on a drawing where multiple scales are used individual scales will be shown by notation directly below each section and detail and the words 'AS SHOWN' or 'AS INDICATED' entered in the title block. If an elevation, section, or detail is shown schematically and it is not intended to specify the scale, the view shall be noted "NTS" under its title or in the case of an entire drawing not drawn to scale, "NTS" shall be shown in the Scale Box.

If the vertical scale is different from the horizontal scale that is used in the same drawing, both scales shall be shown numerically, with each followed by either the letter "H" or "V".

Examples: 1:50 H; 1:100 V

2.3.   Drawing orientation

Every plan sheet shall include the standard north arrow.

Wherever possible the drawing shall be orientated such that the plan north arrow points approximately towards the top of the drawing sheet.

Drawings should be produced in accordance with the rules of orientation explained in this section. However, if these rules are likely to cause confusion with other drawings, then the clarity of the drawing should not be compromised.

Ideally building floor plans should be shown on one sheet. If they cannot fit on one sheet, the floor plan should be subdivided into convenient segments with match lines provided to continuation drawings.

The sides of buildings should be shown parallel to the sheet edge as far as is possible.

Civil plans may orient the drawing in a manner that will allow the site plan to fit within the sheet boundary at the appropriate scale. Orient the site plan in the same manner as the floor plans whenever possible.

Railway drawings shall be oriented so that the baseline stationing/chainage shall progress from left to right across the sheet. Plan sheets shall be oriented in a "snake" to align as closely as possible with the rail alignment shown on that sheet.

For drawings depicting track information (such as track layouts, plan views, elevations and sections of rail infrastructure), tracks shall be drawn horizontally on the sheet, with Poland on the Right. Label the end of the track as 'From …,' (the previous main railway station) and the other end as 'To …' (the next main railway station). Where it is necessary to orientate the drawing with Norway on the left, the orientation shall be clearly labelled.

2.4. Units

The models are always made at scale 1, objects are drawn at a scale of 1 = 1 meter. The unit of work is the meter.

In impression sheets or layout pages, entities are drawn at the drawing scale.

For meters, precision is three digits after the decimal point (the accuracy of the quoted values is two digits after the decimal point and three digits maximum), subject to the rules of each discipline.

The angles are in degrees, the accuracy is two digits after the decimal point, subject to the rules of each discipline.

Precision is defined in a local context.

It will be +/- 1 cm in planimetry and in altimetry in the phases of design.

A sub unit is defined when meters does not suit the project requirements, millimeters can be used when necessary.

Precision for millimeters is cero digit after the decimal point, subject to the rules of each discipline.

Decimal numbers usually indicate meters. Whole numbers indicate millimeters. Dimensions in millimeters requiring accuracy to a number of decimal places shall be expressed with the millimeter suffix, that is, '12.5mm'.
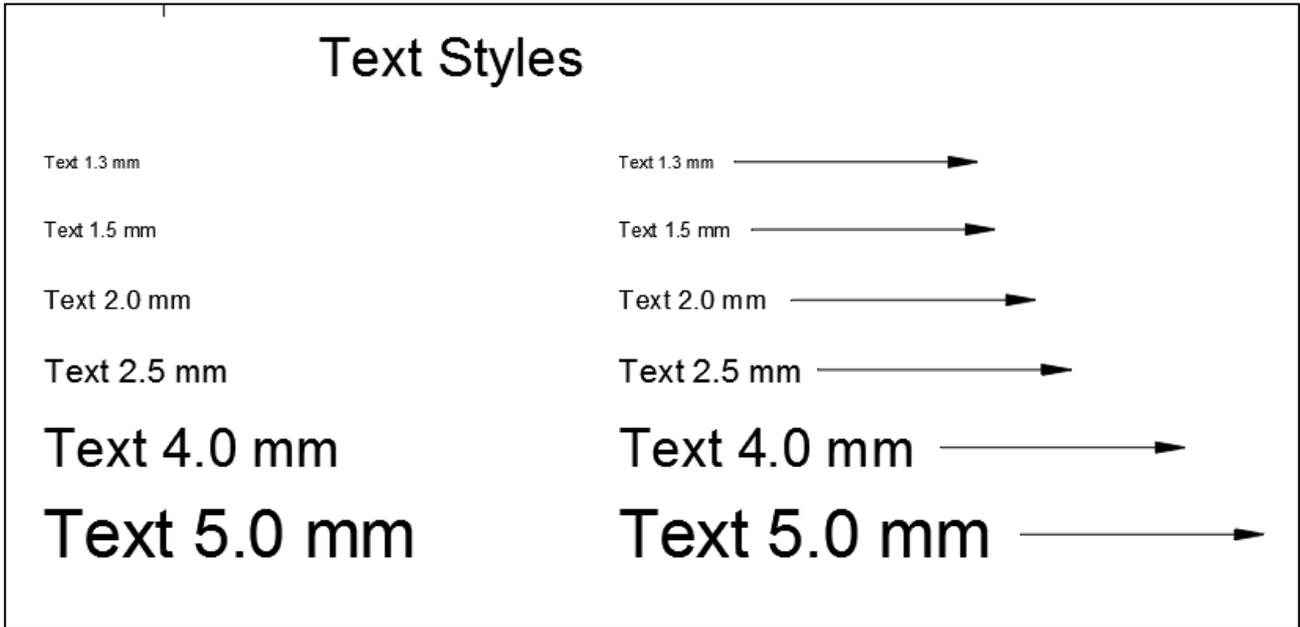
Track kilometrages are expressed in kilometers, for example, "64.987Km"

2.5. Legends and texts

For the use of texts in the models/drawings, clarity, readability and homogeneity are paramount.

Preferably lowercase except for the first letters of the proper names are recommended.

NAME	HEIGHT	WIDTH	THICKNESS	FONT	LEADER	PURPOSE
RBR_NOTES_1.3MM	1.3 mm	1.0	0.13	ARIAL	ARROW FILLED 20 DEGREE, 2.5 mm LONG	WORKING TEXT/SHEET NOTES AND LEGENDS
RBR_NOTES_1.5MM	1.5 mm	1.0	0.13	ARIAL	ARROW FILLED 20 DEGREE, 2.5 mm LONG	WORKING TEXT/SHEET NOTES AND LEGENDS
RBR_NOTES_2.0MM	2.0 mm	1.0	0.13	ARIAL	ARROW FILLED 20 DEGREE, 2.5 mm LONG	WORKING TEXT/CALL-OUTS/SHEET NOTES AND LEGENDS
RBR_NOTES_2.5MM	2.5 mm	1.0	0.13	ARIAL	ARROW FILLED 20 DEGREE, 2.5 mm LONG	WORKING TEXT/CALL-OUTS/SHEET NOTES AND LEGENDS
RBR_TITLE_4MM	4 mm	1.0	0.13	ARIAL	ARROW FILLED 20 DEGREE, 2.5 mm LONG	GRIDS, VIEW NAMES
RBR_TITLE_5MM	5 mm	1.0	0.13	ARIAL	ARROW FILLED 20 DEGREE, 2.5 mm LONG	TITLEBLOCK

Text Styles

Text 1.3 mm   Text 1.3 mm →

Text 1.5 mm   Text 1.5 mm →

Text 2.0 mm   Text 2.0 mm →

Text 2.5 mm   Text 2.5 mm →

Text 4.0 mm   Text 4.0 mm →
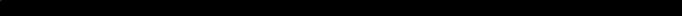
Text 5.0 mm   Text 5.0 mm →

If other fonts are needed, it must be agreed with RB Rail AS.

Abbreviations shall be in upper case letters. The drafter shall define it in the general notes sheet or provide a legend on each drawing in which it is used.

2.6. Line Weight

Line Weight	Plot thickness	Name	Uses (recommended)
1	0.13 mm	Extra fine	Fine detail which cannot be accomplished using a fine (0.18) line.
2	0.18 mm	Fine	Material indications, surface marks, hatch lines, patterns, Projection lines.
3	0.25 mm	Thin	Dimension lines, leaders, extension lines, section cross references and callouts, dotted lines, dashed lines, break lines, hidden objects, setback lines, center line, grid lines, schedule grid lines, Projection lines.
4	0.35 mm	Medium	Title block cut lines.
5	0.50 mm	Wide	Titles, edges of interior and exterior elevations, profiling, cut lines, property lines, section cutting plane lines, drawing block borders.
6	0.70 mm	Extra Wide	Large titles, footprints, title block borders, sheet borders, schedule outlines.
7	1.00 mm	XX Wide	Major title underlining and separating portions of designs, match lines.
8	1.40 mm	XXX Wide	…
9	2.00 mm	XXXX Wide	…

Line Weights

————————————	Extra fine 0.13
————————————	Fine 0.18
————————————	Thin 0.25
————————————	Medium 0.35
————————————	Wide 0.50
————————————	Extra wide 0.70
————————————	XX Wide 1.00
————————————	XXX Wide 1.40
————————————	XXXX Wide 2.00

2.7. Line Patterns

Following line patterns will be used:

Pattern name	type	Length (mm)	type	Length (mm)	type	Length (mm)	type	Length (mm)	type	Length (mm)	type	Length (mm)	type	Length (mm)	type	Length (mm)
Center	Dash	12.0	Space	6.0	Dash	6.0	Space	6.0								
Dash	Dash	3.0	Space	3.0												
Dash dot	Dash	6.0	Space	4.0	Dot	0.0	Space	4.0								
Dash dot dot	Dash	6.0	Space	4.5	Dot	0.0	Space	4.5	Dot	0.0	Space	4.5				
Dash dot2	Dash	3.0	Space	1.5	Dot	0.0	Space	1.5								
Dot	Dot	0.0	Space	4.0												
Dot 1mm	Dot	0.0	Space	1.0												
Dot 2mm	Dot	0.0	Space	2.0												
Double dash	Dash	15.0	Space	4.5	Dash	6.0	Space	4.5	Dash	6.0	Space	4.5				
Grid Line	Dash	12.0	Space	3.0	Dash	3.0	Space	3.0								
Hidden	Dash	4.0	Space	2.0												
Hidden2	Dash	2.0	Space	1.0												
Long Dash	Dash	9.0	Space	4.5												
Loose dash	Dash	3.0	Space	6.0												
Overhead	Dash	2.5	Space	1.5												
Triple dash	Dash	15.0	Space	4.5	Dash	6.0	Space	4.5	Dash	6.0	Space	4.5	Dash	6.0	Space	4.5

Line Patterns

Pattern	Name
————————————————	Continous
——————— ——— ————————	Center
— — — — — — — ——	Dash
———— · ———— · ———— · ————	Dash Dot
———— · · ———— · · · ————	Dash Dot Dot
— · — · — · — · — · — · — · —	Dash Dot2
· · · · · · · · · ·	Dot
·· ·	Dot 1mm
· ·	Dot 2mm
———— —— —— ————	Double dash
———— — ———— — ————	Grid line
— — — — — — ——	Hidden
– – – – – – – – – – – – – – – –	Hidden2
——— ——— ——— ————	Long Dash
—— —— —— —— ——	Loose Dash
— — — — — — — — — —	Overhead
——— ——— ——— ——— ————	Triple dash
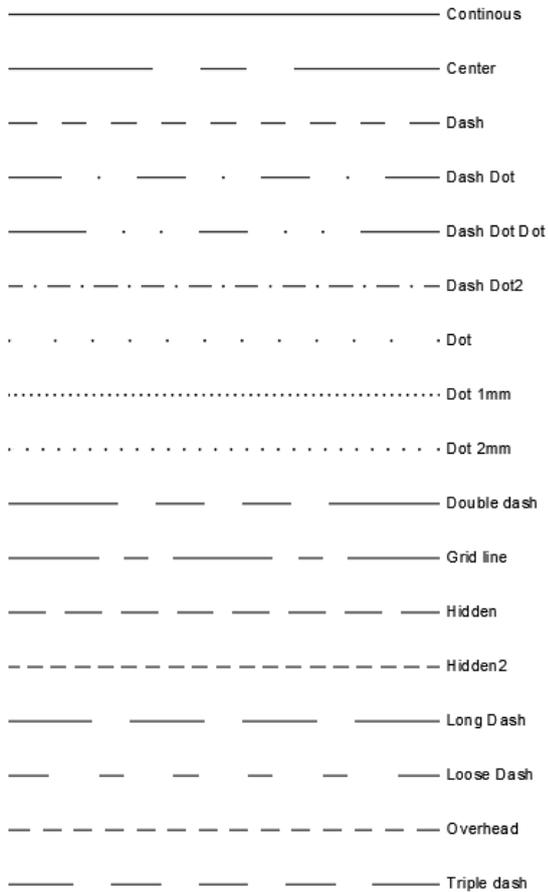
Line types will use the previous line patterns and will be named accordingly to the following criteria:

RBR-L-[Description]

Example:

RBR-L-Alignment

RBR-L-Rebar Projection

If other line patterns are needed, it must be agreed with RB Rail AS.

A legend with the line types used in the model will be placed in the general notes sheet or in a specific sheet for line styles, indicating its function within the project.

Basic colors should be assigned to the main meanings in the drawings for structures as follow:

• grey for existing structures

• dark yellow for structures that will be demolished

• black for new structures

• red for structures used during construction stage (for example temporal structure)

• green to indicate RB Rail land-plot/ RB railway protection zones

• blue for water

Colors also need to be indicated in legend.

2.8.   Annotations

For the use of annotations in the models, clarity, readability and homogeneity are paramount.

Written in sentence case to a consistent level of detail, using simple language avoiding abbreviations, colloquialisms and /or technical jargon unless recorded elsewhere and referenced in the notes

Where possible the annotation shall read in the same direction as the drawing or intended output, typically horizontally or vertically, unless placed, for example, along an element to indicate chainage.

Where possible, annotation shall not obscure drawing elements but may be placed over background mapping and other supporting information with or without a background.

Where possible annotation shall not be obscured or cut by the drawing content useable area and where drawings are tiled adequate space provided for complete annotation within the continuation area.

The space at the base of the title block shall be used for general notes, legends and any other criteria or special instructions. Where space is limited these notes may be placed in the drawing content useable area but shall be clearly distinguished from the drawing content and any other annotation, labelled appropriately and inserted with a background.

The Annotation shall not be a broad reference such as 'See engineer's drawing' or 'Refer to specification'

The Annotation's element integrity is maintained against the authoring software's or target format's element type and not edited, dropped or exploded in any fashion

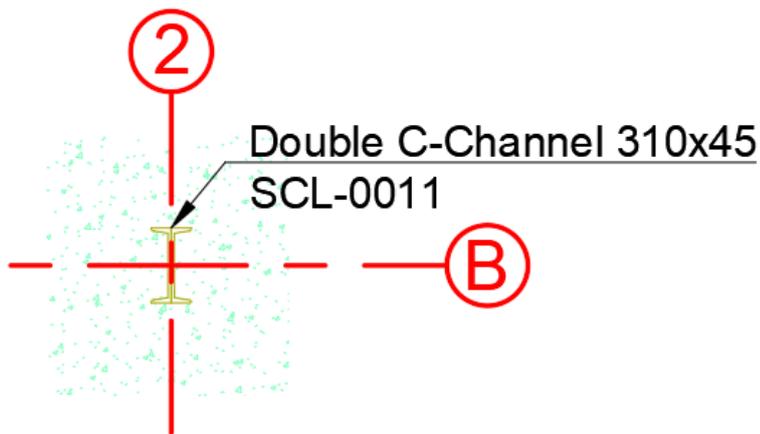Annotations must not cover each other, must be clearly readable without any obstacle.

All text is to be spell checked prior to any output or reproduction

2.8.1. Element tagging

Element tagging in drawings will be as follows:

First line: Technical information.

Second line: [**RBR-OCC**] [**RBR-Spec Code**] (If necessary, it can be split in two lines)

Exceptionally, and with the prior consent of RB Rail AS the attributes ([**RBR-OCC**] [**RBR-Spec Code**]) may be omitted when tagging (If including attributes cause confusion with other drawings, or the clarity of the drawing could be compromised).

Tagging shall be done with 2,0 or 2,5 mm text and 2,0 or 2,5 mm long 20 degree arrow, with underlining top line.

2.8.2. Dimensioning

For clarity, unique dimensions should be shown in one location in the drawing set and referred to from other drawings if necessary. Dimensions shall be shown using 2.5mm text.

Dimensions shall be lettered parallel to and above the dimension line and shall be shown to identifiable, finite points, or lines.

The extension of any dimensions shall accurately align with the feature being dimensioned.

No CAD or BIM generated dimension is to have the dimension value edited manually or the dimension entity dropped to its constituent line and text primitives.

Any change that includes a dimension change must ensure that the relative feature is changed, not just the dimension element and the integrity of both elements are maintained as above.

NAME	LEADER TYPE	TEXT HEIGHT	LINE WEIGHT
RBR_DIM_2.0	ARROW FILLED 20 DEGREE, 2.0 mm LENGTH	ARIAL 2.0 mm (RBR_NOTES_2.0MM)	3 (0.25mm)
RBR_DIM_2.5	ARROW FILLED 20 DEGREE, 2.5 mm LENGTH	ARIAL 2.5 mm (RBR_NOTES_2.5MM)	3 (0.25mm)
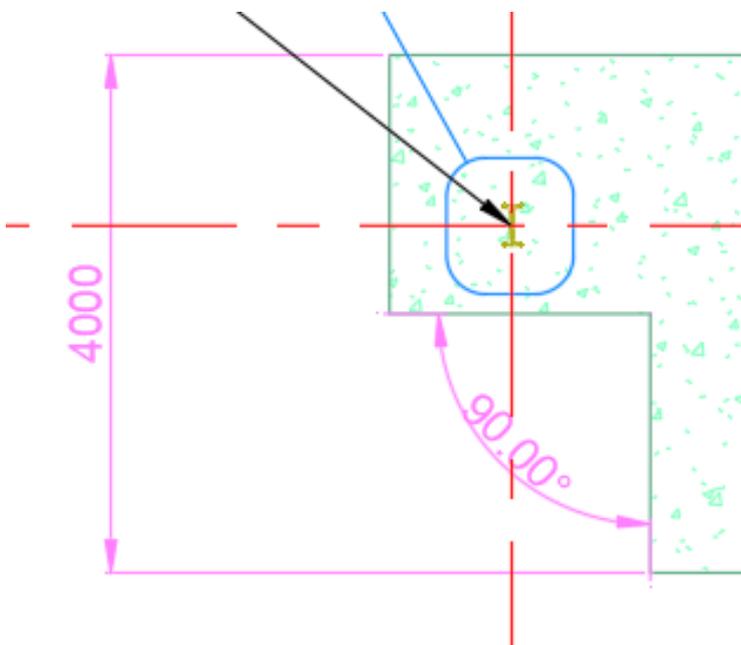
2.9. Layers

The objective is to define the scope for how Layer are to be named, as well as assignment of unique display properties for each named layer.

The Layer name format is an organized hierarchy of data fields separated by dashes. The following illustrates the syntax for a layer name. All general and discipline layer will use a hyphen delineated name format. Up to Six Fields may be used. A hyphen "-" is the field delineation character. The fields shown in BLUE are required, all other fields are optional.

Originator	Role	Major Content Item	Optional 1	Optional 2	Optional 3
ABC	BR	ABCD	QWER	TYUI	H

Originator: (Required, 3 characters, see RBR-DAT-BIM-BMA-0004_CodificationTables)

Role: (Required, 2 characters, see RBR-DAT-BIM-BMA-0004_CodificationTables)

Major Content Item: (Major Group ,Required, 4 characters, Supply chain defined). Is a four-character field that identifies a major project object, part, system (wall, road, pipe, etc). The Major Group field codes (four-character abbreviations) will be logically grouped with specific discipline designators.

Any Major Group may be combined with any prescribed Role Designator, provided that the definition of the Major Group remains unchanged. Therefore, any reasonable combination of the prescribed Role Designators and Major Groups is permitted.

Optional 1: (Optional, 4 characters, Supply chain defined). A four-character field to further refine the Major Group. For example, A-WALL-FULL denotes Architectural, Wall, Full-height.

A Minor Group name may be used to modify any Major Group.

Any reasonable combination of the prescribed Major and Minor Groups is permitted.

Consistent use of common minor group names across all disciplines will enhance the day to day tasks of editing and Reviewing content.

Optional 2: (Optional, 4 characters, Supply chain defined). A second four Characters minor group may be used for further refinement of the data defined by the major and minor 1 field.

For example, A-WALL-FULL-TXN1 indicates an architectural full-height wall annotation layer.

Optional 3: (Optional, 1 character, Supply chain defined). The status field is an optional single-character field that distinguishes the data contained on the layer according to the status of the work or the construction phase.

2.10. Grids

Vertical Grid Lines shall be labeled at the top, with numeric references reading from left to right.

Horizontal Grid Lines shall be labeled on the right, with alphabetic references reading from bottom to top.
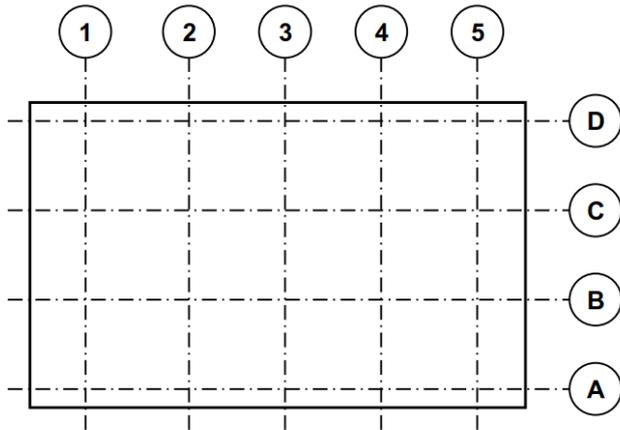
To eliminate confusion with the numerals 0 (zero) and 1 (one), do not use letters O or I.

Each Volume-System will share the same Grid system across all discipline models. If architectural discipline is involved, it will be its responsible to establish the grid system and share it with the other teams.

•Line pattern: Grid Line

•Line Weight=3 (0.25 mm)

•Circle Diameter=13 mm

•TEXT: RBR_TITLE_4MM

2.11. Levels

• Line Pattern: Center

• Line Weight=3 (0.25 mm)

• Text: RBR_NOTES_2.5MM for Level name and Elevation
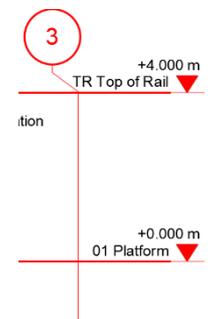
2.12. Tables

Tables or schedules are not restricted.

It is forbidden to use external objects (text / table), these must be native objects of the model or linked or inserted in the native function of the software.

The style of tables or schedules is not restricted.

They are named in such a way as to give as much information as possible about their uses and / or characteristics.

The decimal point is the comma ",". It is forbidden to use the following symbols: - _ , ; ! ? / \

The units must be carried by the format and not entered in the parameter field: example "m²" is carried by the characterization of the parameter on the surface and not by a text.

• Text: RBR_NOTES

2.13. 2D elements

The 2D elements in the models are not restricted, but must be avoided as much as possible.

As much as possible detailing must be extracted from the 3D model.

2.14. Reference elements

The elements referenced in the models, such as CAD, 3D or other BIM models, are not restricted.

The preferred methods to reference models will be those that do not overload the model.

However, they must be transmitted together with the BIM Model for each delivery.

2.15. Referencing other Drawings and documents

2.15.1. Referencing Details

A feature shown on a drawing that needs to be detailed shall be identified by a circle or rectangle drawn sufficiently large to cover the feature and connected by a line to an identifying reference. Details shall be designated by numerals. Wherever practical, details shall be listed consecutively, 1, 2, 3, etc., from left to right and from top to bottom on the sheet on which they are drawn.

2.15.2. Referencing sections and elevations

A section taken through a feature shown on a drawing shall be identified by a line broken at its middle and extended beyond the limits of the section by at least 12mm. Sections shall be designated by letters and should be identified such that the letters progress in consecutive order of the alphabet (A, B, C,…, AA, AB, AC…) from left to right and from top to bottom of the drawing.

Reference in the same drawing:

Rail Baltica
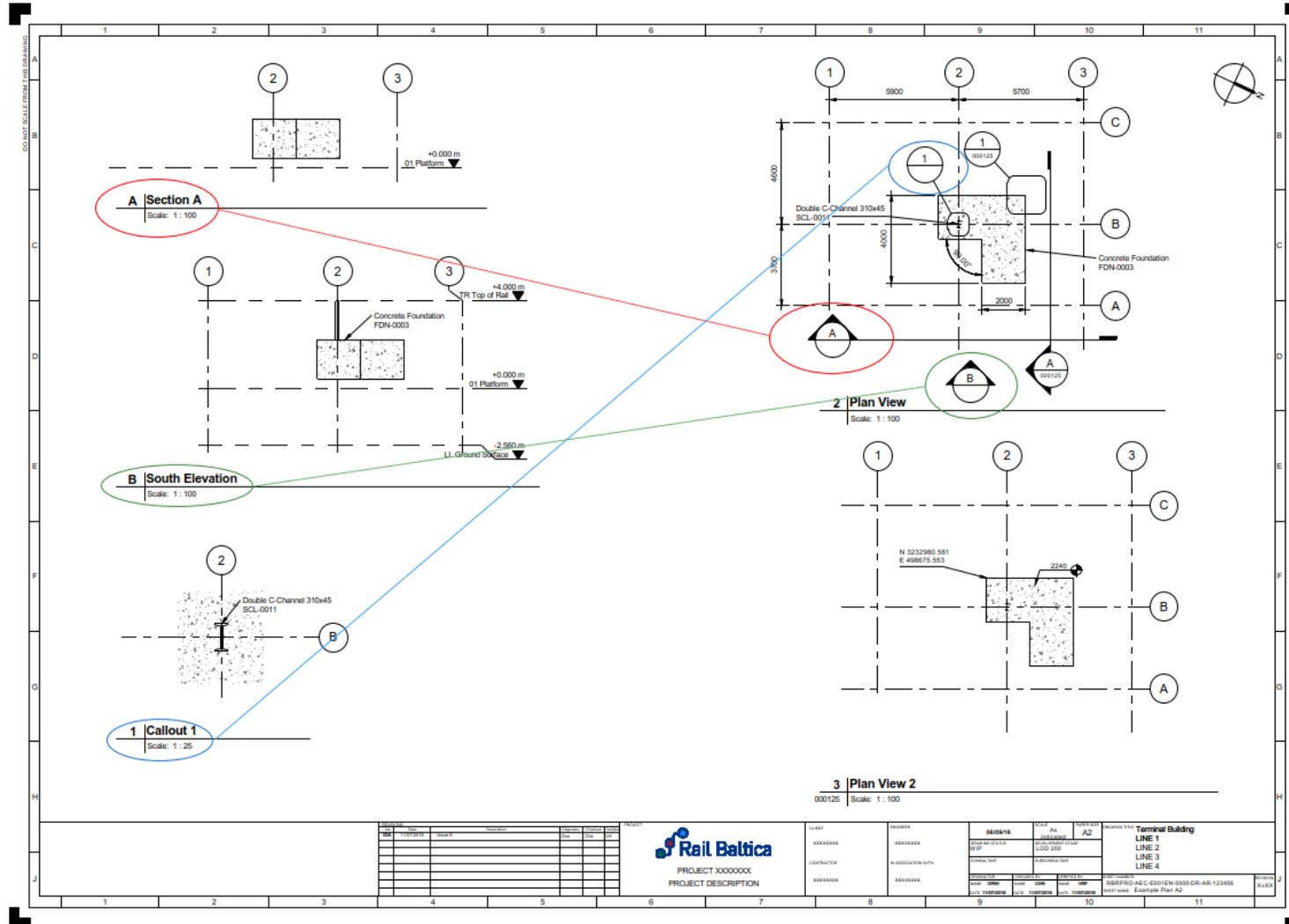
Reference in other drawing:
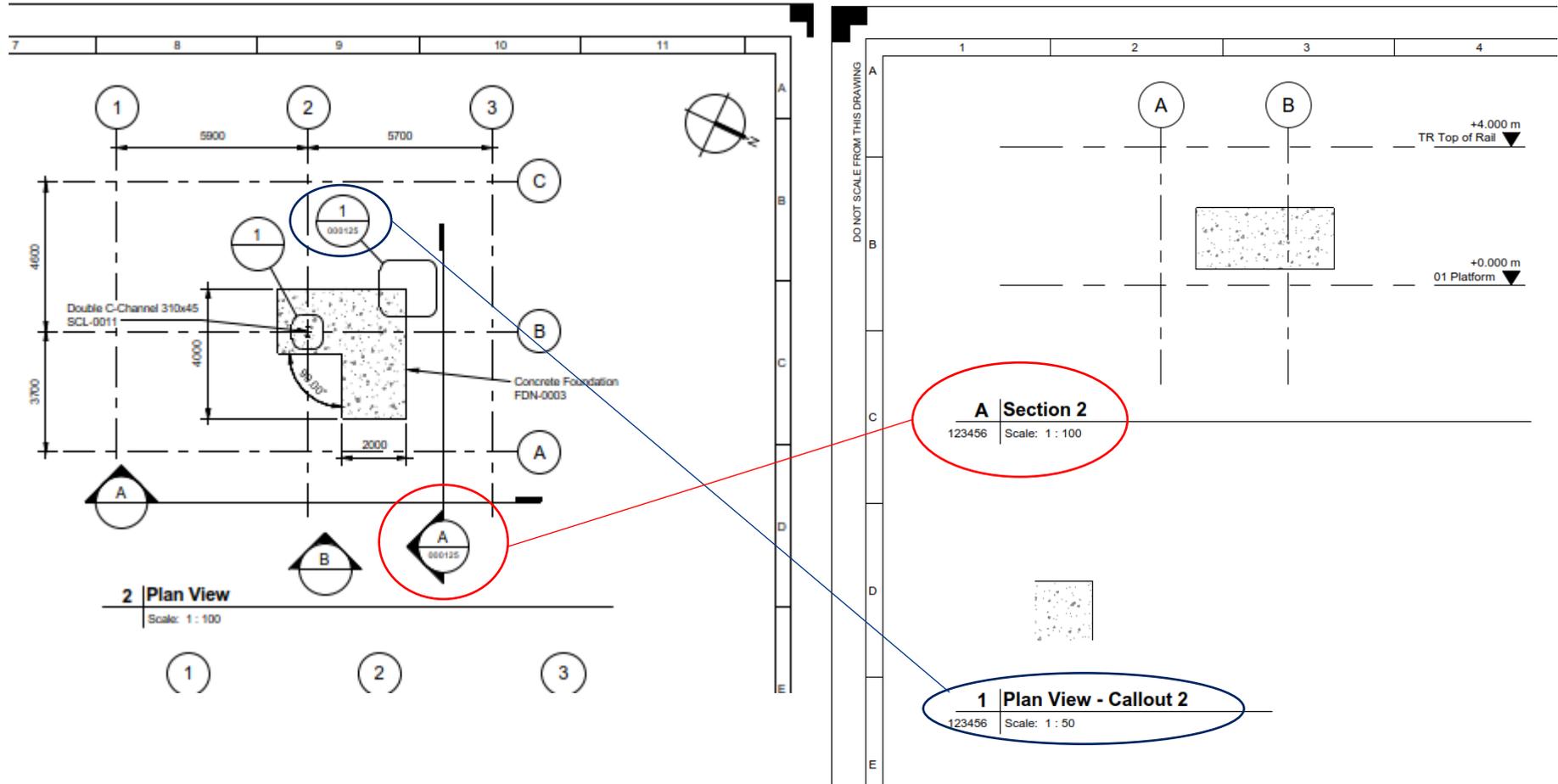
2.16. Templates

As RB Rail As has adopted an Open standard approach, each supplier will be responsible for developing templates according to its authoring tool based on the guidelines given in this standard.