



AEC (UK) BIM Protocol for Bentley AECOs^{im} Building Designer

*Additional detail and enhancements for implementation of the AEC (UK)
BIM Protocol for Bentley users.*

Version 2.0

September 2012

Re-published as a supplementary
document to the generic AEC (UK) BIM
Protocol

AEC (UK) BIM Protocol for Bentley AECOsims Building Designer

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1 Introduction

1.1 Background

The AEC (UK) BIM Standard was released in November 2009.

Version 2.0 of the AEC (UK) BIM Protocol was published in September 2012 to improve the process of design information production, management and exchange.

The general processes, workflows and standards applicable to BIM working are defined in the above AEC (UK) BIM Protocol document. The standards defined herein are supplementary to the AEC (UK) BIM Protocol and address the specific requirements of AECOsims Building Designer, operating as a core BIM authoring tool.

Copyright Notice:

It is important to note that this standard will only become truly useful if as many companies adopt it as possible. To that extent, it may be freely distributed and used in any format necessary, provided credit is given to the committee.

1.2 The Committee

The Bentley sub-committee has representatives from architectural, engineering and construction companies in the UK, large and small, hence the adoption of the AEC (UK) moniker. The BIM committee is working together to realise a unified, usable, co-ordinated approach to Building Information Modelling in a design environment.

Committee

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1.3 Disclaimer

All the advice outlined in this document is for information only. The authors and contributing companies take no responsibility for the utilisation of these procedures and guidelines. Their suitability should be considered carefully before embarking upon any integration into your current working practices.

None of the recommendations in this document are intended as a replacement for companies who already have an AEC (UK)-based or BS1192-compliant system.

1.4 Scope

This supplement is intended to support all BIM work undertaken using Bentley's AECOsims Building Designer across a practice, or on a specific project, unless otherwise dictated by the client.

The AEC (UK) BIM Protocol for Bentley AECOsims Building Designer builds on the procedures and methodologies defined in the AEC (UK) BIM Protocol and should be read in conjunction with that document.

Terminology and reference to functionality is based around the Bentley MicroStation/ABD platform.

1.5 Update Procedure

Proposed changes and additions to this standard should be submitted in writing with accompanying examples, discussion, or other supportive material to the Bentley sub-committee. Feedback will be gathered and continuously reviewed; they will be collated to form new revisions at appropriate intervals.

It is expected that this standard will undergo a relatively rapid evolution process, as the industry adapts to the implications and advantages of BIM methodology.

1.6 References

This standard is written with reference to the following documents:

- BS1192:2007
- PAS1192-2
- BS8541-1 and -2
- AEC (UK) BIM Protocol v2.0
- AEC (UK) CAD Standard for Layer Naming v3

1.7 Definitions

2 Best Practice

2.1 BIM

- Sub-divide Design Models between disciplines, and within single disciplines to allow effective access to the data at all times. A typical reference file approach should be taken. Refer to Section 5. All changes to the model shall be carried out as 3D modifications, rather than 2D 'patches' to maintain the integrity of the model.
- Where detail needs to be added over 'frozen' data, a Dynamic View should be referenced using Cached mode.

2.2 Drawing Production

3 Project BIM Execution Plan

3.1 Roles and Responsibilities

3.2 Project BIM Execution Plan

3.3 Project BIM Meetings

4 Collaborative BIM Working

4.1 Common Data Environment (CDE)

4.1.1 Work In Progress (WIP)

4.1.2 Shared

4.1.3 Publication and Document Issue

4.1.4 Archiving

4.2 Preparation for publication

Sheet Models from the BIM shall be published to PDF (preferred) or other non-editable format, where they can be checked, approved, issued and archived as traditional documents according to existing company procedures.

Validation of the BIM data prior to sharing shall check that:

- All references and extraneous views and elements shall be removed from the BIM;
- Model file has been compressed;
- File format and naming conventions conform to the project BxP,
- Data segregation conforms to the agreed project BIM methodology,
- Model files are up-to-date, containing all users' modifications,
- Any unnecessary reference files have been removed and any other associated data required to load the model file is made available,
- Model is correctly assembled through visual inspection,
- Any changes since the last issue are communicated to the project team.

4.3 Legal Stuff

4.4 Data Security & Saving

4.5 Reviewing BIM Data

Untrained users shall not open Bentley Building models directly. Instead, the model shall be reviewed using the publication of an i-model (.i.dgn) and viewed using the freely available Bentley View or, where interrogation and analysis of the model is needed, Bentley Navigator.

5 Interoperability

5.1 Introduction

5.2 Incoming CAD/BIM Data Management

- CAD data may need be shifted to within the Solids Working Area prior to import – see section 7.4.

5.3 Intended Use of Model

5.4 Data Transfer between Packages

6 Data Segregation

6.1 General Principles

A BIM model should not be thought of as a single file containing all the project data. Instead, maximum use should be made of Bentley's referencing capabilities to enable collaborative working in a BIM environment, including working practices and team management as well as the technological solutions covered by the remit of this document.

This section deals with the principles of subdividing a model for the purposes of:

- multi-user access,
- operational efficiency on large projects,
- inter-disciplinary collaboration.

The following practices shall be followed:

- No more than one floor or façade shall be modelled in a single Design file.
- A model file shall contain data from one discipline / project stakeholder only (although exceptions may apply for Building Services where multiple disciplines converge).
- Drawing Models will be published to separate files and should not be stored as multiple models within a single container file. No more than one Drawing Model will be stored in each file. This is to maximise the effectiveness of Bentley's referencing capabilities and to allow multi-user access to all aspects of the project.
- Sheet Models will be created as separate files and should not be stored as multiple models within a single container file. No more than one Sheet Model will be stored in each file to allow for data tracking and drawing management.
- In order to avoid duplication or co-ordination errors, clear definition of the data ownership throughout the life of the project shall be defined and documented. Element ownership may transfer during the project time-line – this shall be explicitly identified in the Project BIM Execution Plan.
- Where multiple models make up a single project, a container model should be considered, whose function is to link the various assemblies together for coordination/clash detection purposes.

The BIM will be made up of a series of **3D Design Files** (1).

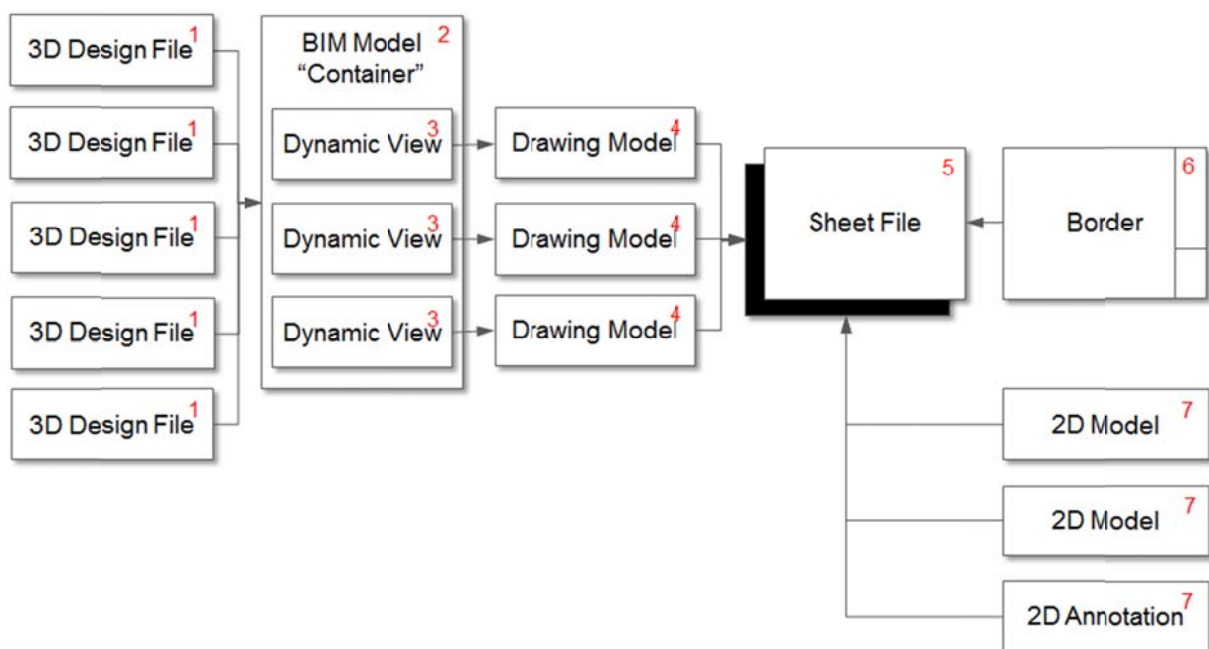
The relevant files are referenced into a single "**Container**" file (2). This is the location from where the **Dynamic Views** (3) are created. While it is possible to create Dynamic Views directly in the 3D Design File, from other Saved Views or even from a Sheet Model, using a Container file allows you to manage the Views more easily (you do not need to keep jumping between references) and it

avoids any problems with people removing or adding references to the working files.

When the Dynamic Views are created, a **Drawing Model** file (4) is also. You could create these within the Container file, but as these may need to be edited, or issued to external consultants, it is better to keep them as separate files.

The Drawing Models are then referenced into the Design Model of a **Sheet File** (5). This is necessary to provide DWG compatibility. As it is unlikely that any project contains only 3D data, **2D Model** data (7) can also be referenced into here if necessary.

The Design Model is re-referenced into the Sheet Model of the same Sheet File, producing “Paperspace” and “Modelspace”. The drawing **Border** (6) is also referenced so that the office details, project information and drawing titles can be added and a printed drawing produced.



6.2 Division

6.3 Referencing

References should be treated as read-only information for the purposes of iterative design. In no circumstances should elements be modified from another discipline's reference. In cases where information needs to be revised, two methods can be used: a design change request to the owner of the reference or by taking ownership of the elements:

- Users reference the information from the required file.
- The required elements are copied through into the active file and the Level remapped to identify new ownership.

- When first referencing the models together, '**World Coordinates**' shall be used as the orientation.
- When splitting a file into sub-models the information should be split out using the Copy/Move Fence Contents to New File tool. The Processing Mode should be set to Move.

6.3.1 Inter-Disciplinary Model Referencing

Each separate discipline whether internal or external, involved in a project shall have its own BIM model, composed of multiple references, and is responsible for the contents of that model. A discipline can reference in another discipline's models for coordination purposes.

- Coordinate systems and Project North rotation shall be agreed and documented at the outset. No deviation from these shall occur without permission of the BIM Co-ordinator. Refer to section 7.4 for full details.
- Details of any discipline-specific requirements, such as the difference between Finished Floor Level (FFL) and Structural Slab Level (SSL), shall be fully documented in the Project BIM Execution Plan.
- A single Floor Manager dgnlib should be defined and shared between each discipline to ensure conformance of levels.

Floor Manager is used to set the working planes of the building in the Z axis.

A project is divided into Buildings or Zones and Floor Manager should be set up to reflect the same demarcation with the same coding designation used for the naming of Buildings as used in the file naming.

Within a building , the primary floor levels should be set up as Structural Slab Level (SSL).

Floors will be named according to the AEC (UK) naming conventions.

i.e.	B2	Basement Level 2
	B1	Basement Level 1
	00	Ground Floor
	01	First Floor
	02	Second Floor
	etc...	

Between each primary floor Reference Planes may be set up as required to meet the design needs of the building. These may include, but are not exclusive to, the following:

Finish Floor Level (FFL)

Net Usable Level (NUL)

Suspended Ceiling Level (SCL)

Under Structural Slab (USL)

Name	Relative Elev	Elevation	Rotation
Building01			
RF	19000.00	19000.00	0.00°
04	15500.00	15500.00	0.00°
03	12000.00	12000.00	0.00°
02	8500.00	8500.00	0.00°
01	4500.00	4500.00	0.00°
01-SCL	3700.00	8200.00	0.00°
01-FFL	250.00	4750.00	0.00°
00	0.00	0.00	0.00°
B1	-3500.00	-3500.00	0.00°
B2	-7000.00	-7000.00	0.00°
Building02			
Building03			

- Ownership of elements shall be properly communicated and tracked through the project time-line (e.g. floors may be created by the Architectural team, but are then adopted by the Structural team to form part of the load-bearing structure).
- Each discipline shall be conscious that referenced data has been produced from the perspective of the author and may not be modelled to the required specification for other purposes. In this case all relevant parties, with input from the BIM Manager(s), shall convene to discuss the potential re-allocation of ownership.
- Should a team develop a 'starter model' for a partner discipline, such as defining the structural model in conjunction with the architecture, this shall be done in a separate model which shall then be referenced as required.
- This starter model may be passed to the partner discipline who shall then assume ownership of it. The partner discipline shall open this starter model and reference, by World Coordinates, the originator's model.
- With models produced for Building Services, several disciplines may be collated in a single model, as a single piece of equipment may require connection to various services. In this scenario, the model may be split in various ways. The BIM Co-ordinator shall be consulted in defining the project-specific strategy. In all instances the contents must be clearly identified through the model name.

7 Modelling Methodology

7.1 Model Development Methodology

An AEC(UK)-compliant dataset, Dataset_GB is available for download from Bentley's SELECT site. This Dataset_GB assists to develop projects in early stages

as it enables rapid model development and allows for very large models to be created with low hardware requirements.

7.2 Graded Component Creation

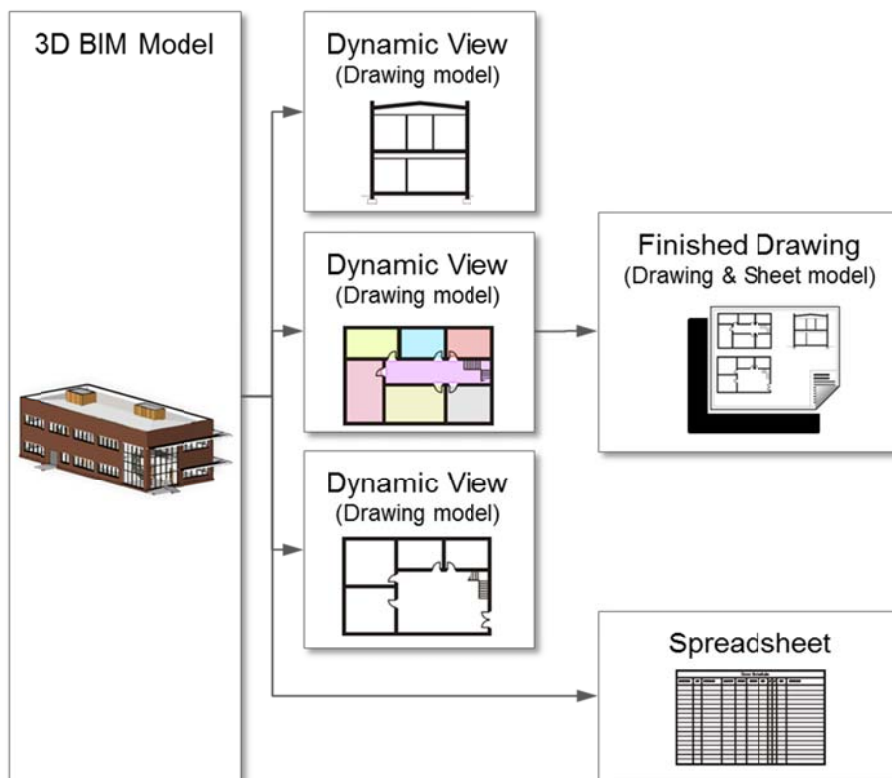
- A corporate or project-shared DataGroup Catalog is encouraged in order to maintain consistency of naming during content creation. (Refer to Appendix 11.2)
- In the early stages of a project, simple parametric objects should be used. The visual appearance should not be the prime concern at this point. Once locations and sizes have been confirmed objects should be swapped out for Compound Cells or custom DataGroup items to a higher level of visual detail.

Doors example:

- During planning and design development stages, doors might be placed using A-G322-Doors-Single-Flush (a G1 grade object), regardless of vision panels. Sizes can be adjusted, and appearance is based on the 2D representation.
- A visually correct Compound Cell might then be used to replace the simple parametric doors for the construction stage. This would contain enough detail to prepare larger scale elevations (a G2 grade object), showing vision panels and basic representations of handles/hardware (use block modelling wherever possible for detail to improve the speed of Dynamic View generation and keep file sizes to a manageable minimum).
- Cells should be created and placed as User-defined DataGroup items. The use of Shared Cells should be avoided as Instance Data cannot be attached to a Shared Cell therefore the object cannot be scheduled or have automatic annotation rules applied to it.

7.3 Drawing Compilation

Drawing compilation and preparation for publication should be carried out using fully assembled compilations of views and sheets within the BIM environment (preferred) using Dynamic Views.



1. The model is compiled from its various references as a single container, specifically created for creating Views.
2. Dynamic Views are created for each plan, section and elevation in the container. These should be used to create an individual DGN files using the file creation tools available in ABD. These should comprise a single Drawing Model with a single View referenced in, for control of reference and level display, as well as the addition of manual annotation as required.
3. The Drawing Model should not be referenced directly to a Sheet, but instead referenced into the “Modelspace” of the Finished Drawing at 1:1. The “Modelspace” should be a Drawing Model to allow additional annotation as required.
4. The “Modelspace” is then referenced into the Sheet Model at a reduced scale to fit onto the sheet, and clipped using a non-plotting shape.

7.3.1 Sheet composition direct from within the BIM

Sheet composition from within a BIM environment shall be established through the creation and referencing of callouts, saved views and sheets fully within ABD but utilising reference files wherever possible.

Care shall be taken to ensure that any reference data is available and visible prior to the publication of documentation from the BIM.

7.3.2 Sheet composition from Views/Output files

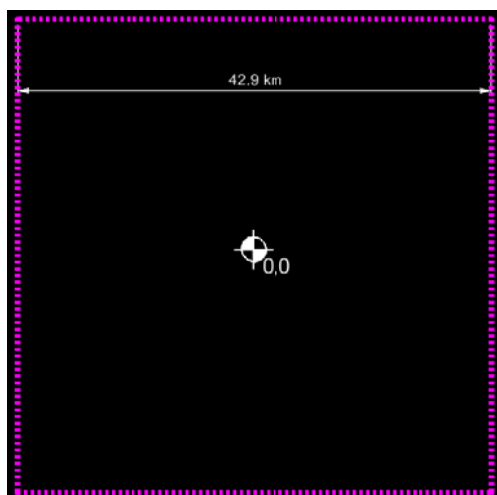
Output files are created from the BIM using Drawing Extraction Manager or by exporting cached Dynamic Views to merged files. MicroStation can then be used for further non-dynamic editing and sheet compilation.

If it is a requirement to export data from ABD in 'Real-World' co-ordinates, then the export operation must be performed from the Drawing Model (such as a floor-plan) and not from a compiled Sheet file.

7.4 Spatial Location & Co-ordination

BIM data modelled more than 21.45km from the origin (in any plane) shall be shifted to 0,0,0 prior to importing or referencing into Bentley products to avoid accuracy issues. This shift shall be agreed, consistent and identified in the Project BIM Execution Plan.

When starting any BIM project, it is critical that the information falls within a certain area of the DGN file. The "Solids Working Area" is approximately 42.9km around 0,0.



If the project is drawn to Real World Coordinates, it will, more than likely, fall outside of the SWA. This can cause errors when copying information, it may be noticeable to a very small degree that measurement is inaccurate, but Dynamic Views and Drawing Extractions may be generated inconsistently.

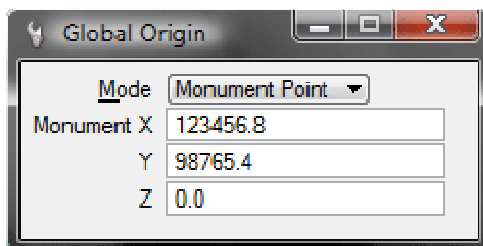
So that you have accurate elements and your information is set out to the survey, we recommend you follow the instructions below to set up the correct location and coordinate systems for your project:

1. Identify a known location for your project. This may be a grid intersection, a site setting out point, a survey station, or a physical object such as the corner or a building.
2. Ascertain the OS coordinates for this point, or the local grid if the project is not in the UK.

3. You need to reassign the 0,0 point in your seed file to these coordinates.
4. Keyin "GO=" (or "active origin") to reposition the file's "Global Origin".

The Global Origin is exactly in the centre of the Solids Working Area. By default this is labelled 0,0. All we are effectively doing is changing the label (the X and Y coordinates) of that point.

5. In your Tool Settings window, make sure Mode is set to Monument. Enter the X, Y and Z co-ordinates of your setting out point.



6. Your status bar prompt will now read:

Global Origin > Identify the monument at x,y,z in the design.

7. Snap onto the setting out point and click to accept. The Global Origin will be repositioned to suit this setting out point.
8. Save settings.

Your project will now be accurate and also set out to the correct site coordinates.

The project will now be physically located at the centre of the DGN file. Other files will still be in the old location, which means the information may not line up when referenced. You either need to reposition the information in every file (which may not be practical) or tell MicroStation to use the coordinates to align your references.

When attaching a survey file you will need to make sure that you use Coincident World method to align the global origins.

This can be set up to always attach references Coincident World by default using the configuration variable:

```
MS_REF_DEFAULTSETTINGS > attachMethod=world
```

Use > in case you have other values for MS_REF_DEFAULTSETTINGS defined elsewhere.

7.5 Units and Measurement

- Models shall use consistent units and measurement across the project. **Master units** and **sub units** shall be millimetres with two decimal places in order to display accuracy when using the measure tools.

Master unit:	millimetres
Sub unit:	millimetres
Accuracy:	0.12
Resolution:	1000 per Distance millimetre

- CAD data should always be attached at True Scale when referencing into the BIM environment.

8 Folder Structure and Naming Conventions













8.1 Introduction

8.2 Project Folder Structure

8.2.1 Central Resource Folder Structure

Standard seeds, titleblocks, datagroup catalogs and other non-project-specific data shall be held within the server based Central Resource Library, with restricted access.

```

-  <SERVER NAME>\Resources\
  -  Bentley
    +  V8i
    +  V8iSS3
      -  Workspace1
        -  BuildingDatasets
          +  Bentley Dataset
          +  Company Dataset2
        +  Interfaces
        +  Projects
        +  Standards
        +  Users
  
```

1. To configure this correctly, point `_USTN_WORKSPACEROOT` to this location.
2. To add company-specific data to the configurations of ABD, create a `COMPANY_DATASET` variable to point to this location. You will need to prepend or append the standard configurations such as `BB_LEVEL_DGNLIBLIST`, `DG_CATALOGS_PATH` or `TFDIR_PART` to include this dataset.

PROJ_DATASET can be used to include project-specific items included in the Project BIM Resources Library (refer to suggested folder structure, Appendix **Error! Reference source not found.**).

Refer to Bentley documentation for full details on configurations.

8.2.2 Local Project Folder Structure

8.3 General Naming Conventions

- Where custom files are created for configuration of Bentley products, they shall adopt the naming convention of existing elements and prefix with a 3-character abbreviation to identify corporate author.

Examples:

Existing name	Custom name
Standards.cfg	ABC_Standards.cfg
Sheetsizes.def	ABC_Sheetsizes.def
bb_annotation.cel	ABC_bb_annotation.cel

8.4 Model File Naming

8.5 Division Naming

8.6 Library Object Naming

8.7 Object Property Naming

8.8 View Naming

Not included as part of the view name, the View description field should always be completed to assist in clarification of the view's purpose.

8.9 View List Scheduling

8.10 Data Organisation

The Project Explorer in MicroStation provides an organisational structure to the views and files within the BIM environment. The following rules should be adopted to help organise, identify and share the BIM model effectively:

- Design files should contain only one Design Model. Multiple models can lead to confusion and are not able to be worked on by more than one person at a time.

- Drawing files should be kept in a separate folder, away from the production information. That way manual changes to the data can be avoided, maintaining the efficiency of the Dynamic View / Hypermodel concepts.
- Drawing files should contain only one Drawing Model.
- If Drawing Models are created manually, the model name should be identical to the view that it will contain.
- All Sheet files should be kept in a separate folder.
- All Sheet files should contain only one Sheet Model, representing the single drawing that will be printed from that file.
- All Sheet Models must be named to match the drawing number it contains. There should never be models named “Sheet” or “Untitled Sheet”. Refer to 8.11 below.

8.11 Sheet Naming

Sheet Models shall be named based on the Document and Drawing Numbering protocols established for the project. These names must match the text as it appears in the title block and any schedules.

9 Presentation Styles

9.1 Introduction

Black & White drawings will always be produced using MicroStation’s Level Overrides. These should be set to colour 0, white, and turned on in the Sheet where monochrome output is required.

Colour areas should be displayed by turning the override off for that level.

9.2 AEC (UK) Compliant Materials

A generic UK dataset, Dataset_GB, is provided by Bentley as part of the AECOsım Building Designer product. These datasets provide an alternative basis for new parts and datagroups, consistent with the AEC (UK) protocols, BS1192 and Uniclass.

9.3 Annotation

9.4 Text Assignment

Where annotation is placed in 2D or 3D Design Models or Drawing Models, Annotation Scale shall always be applied.

9.5 Line Weights

There are 32 model line weights. Each can be given a plotted thickness across the range of drawing scales in .pltcfg files.

- Line weights shall be assigned ByLevel project-wide using a project-specific DGNLIB. These can be overridden in each Drawing or Sheet Model as required. Overriding should be kept to a minimum to aid consistency.

9.6 Line Patterns

9.7 Line Styles

Linestyles will be defined in the associated dataset's dgnlibs as a company or project default. Typically only standard MicroStation styles 0 – 7 should be used for BIM models. Any additional custom linestyles shall not be used without clarification in the Project BIM Execution Plan as these will be required by all project participants.

9.8 Hatching and Filled Regions

- Where possible, patterns and fill should be created using the relevant Part definition, rather than created as 2D hatching/patterning.
- Care shall be taken to ensure that the priority and transparency settings of filled shapes are appropriate to the situation so as not to cover required graphical information.
- Transparency and graded fills shall be avoided in normal circumstances to avoid issues with rasterised printing.

9.9 View Templates

For consistency of appearance and to standardise working methods across all projects, pre-defined Dynamic View and Drawing Model seeds shall be provided in the Central BIM Resource Library. Where these are not suitable:

- A project-specific DrawingSeed.dgnlib shall be created and stored in the Project BIM Resources Library. MS_DRAWINGSEEDLIBLIST should then be edited in the relevant PCF to locate this file.
- Where critical to the consistent appearance of output, Saved Views created prior to view seed modifications must have view attributes re-applied or be recreated completely in order to display changes.

9.10 Dimensioning

9.11 Drawing Borders and Title Blocks

- Title blocks are available from the 'Cells' folder of the central Workspace.

- Alternative client-specific versions may also be available from the same location.
- Project-specific borders and title blocks shall be created and stored in the Project BIM Resources library.

9.12 Symbology

9.12.1 Section and Detail Marks

Section and Detail marks shall be accessed from within the Detailing Symbol Styles dgnlib of Bentley Building's default dataset, the company Workspace or the Project BIM Resources Library.

9.13 Copyright

10 Resources

10.1 Introduction

10.2 Software

10.3 BIM Content / Resource Libraries

- Bentley Building supplied datasets are available through the Central Resource Library / Workspace as read-only. Any elements from this library which require modification prior to utilisation shall be copied to the Project Resource Library.

10.3.1 Project BIM Resource Library

This shall be the repository for the storage of project specific standards where deviation from this standard is required due to project or client requirements.

- Standards, seeds, title blocks, parts, datagroup catalogs and other data produced in the process of completing the project shall be held within the Project BIM Resource Library (refer to Appendix 11.2).

10.3.2 Central BIM Resource Library

10.4 Keynotes

- A default Keynote file is provided with Bentley Building and can be found in the BuildingDatasets 'keynote' folder within the Workspace.
- Refer to NBS Building for UK-specific keynotes.

10.5 Custom metadata

- The corporate DataGroup Definitions files are held in the DataGroupSystem folder within the central resource.
- When the creation of project-specific catalog items requires the creation of custom definitions, a file shall be created within the project's resource folder. This is especially important in the case of list type definitions, otherwise Bentley Building will attempt to create them in the central dataset's enumlookups file.

Once this content is approved for the corporate library, the associated .xml files can be added to the central dataset.

10.6 Keyboard Shortcuts

Only delivered Bentley keyboard shortcuts shall be used.

11 Appendices

11.1 Model File Naming Codes




















11.2 Project Folder Structure

The folders below are a suggested structure for the Project BIM Resources Library relevant to ABD-based projects.

This is provided as an example only and should not be used in preference to or replace any internal company quality assured standard folder structures. Always consider your company processes and procedures, especially if ISO accreditation is involved before adopting change.

Only use the folders that will contain custom data. Do not leave empty folders in your Component Library.

The relevant configuration variables are shown in brackets.

-  **06-Resource [Project BIM Resources Library]**
 -  Bentley
 - +  Cell (ATFDIR_CELL)
 - +  CPart (TFDIR_CPART)
 - +  Data (STRUCTURAL_SHAPES) For section sizes only
 - +  DatagroupCatalogs (DG_CATALOGS_PATH)
 - +  DataGroupLayouts (DG_SCHEDULE_LAYOUT_PATH)
 - +  DataGroupSystem (DG_PATH)
 - +  Dgnlib (MS_DGNLIBLIST, BB_FLOORMASTER_DGN, BB_LEVEL_DGNLIBLIST)
 -  Frame (ATFDIR_FRAME)
 - +  Casework
 - +  Doors
 - +  Shelving
 - +  StairComponents
 - +  Windows
 -  Materials (MS_MATERIAL)
 -  Part (ATFDIR_PART)
 -  Rules (ATFFILE_DRAWINGRULES, STFFILE_MODELSTYLES, STFFILE_DRAWINGRULES)
 -  Seed (MS_DESIGNSEED, TFBXS_SEEDDIR)
 -  Setting (TFANNOTATION_OVERRIDES)