Advice Note

Common Data Environment (CDE)

Revisions

Revision	Date	Description	Revised By	Issued To
P01	21.01.2019	First publication	RIAI BIM Subcommittee	RIAI

Purpose of Document

This document assists the Information Manager in establishing the Common Data Environment (CDE) in compliance with BS1192-2:2007+A2:2016.

ALL project participants, who are producing any information, must engage with the CDE, whether they are producing models, drawings, specifications, reports, schedules, bills of quantities, or other related documents (files) or not, so this document also provides information as to how the CDE is structured.

Scope

This document is intended to support the collaborative production, management and sharing of architectural, engineering and construction (AEC) information, using BIM level 1 maturity (mixture of 2D & 3D information), or BIM level 2 maturity, all 3D BIM work undertaken collaboratively between the design team members identified in the roles defined in PAS1192-2:2013. It is not the intention of this document to state how each organisation will implement BIM with their respective organisations, but organisations are encouraged to ensure that their internal procedures support the roles defined in this document in the interest of project quality control and improving collaborative processes.

Standards and Publications

1. BS 1192:2007+A2:2016 - Collaborative production of architectural, engineering and construction information - Code of practice.
2. PAS 1192-2:2013 - Specification for information management for the capital/delivery phase of construction projects using building information modelling.
3. PAS 1192-3:2014 - Specification for information management for the operational phase of assets using building information modelling
4. BS 1192-4:2014 - Collaborative production of information. Fulfilling employer's information exchange requirements using COBie. Code of practice.
5. PAS 1192-5:2015 - Specification for security-minded building information modelling, digital built environments and smart asset management.
6. PAS 1192-6:2018 - Specification for collaborative sharing and use of structured Health and Safety information using BIM.
7. Building Information Model (BIM) Protocol (Second Edition) - Construction Industry Council (CIC)
8. Outline Scope of Services for the Role of Information Management - Construction Industry Council (CIC)

- Note. BS1192 & PSA1192-2 are soon to be replaced by ISO/EU standards ISO 19650 parts 1&2.

RIAI BIM Committee

The BIM committee is working together to realise a unified, usable, co-ordinated approach to Building Information Modelling in a design environment.

Committee

Michael Earley (chair)	Scott Tallon Walker Architects
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Update Procedure

Proposed changes to this document should be submitted in writing with accompanying examples, discussion or other supportive material to info@riai.ie for the attention of the RIAI BIM Committee. Feedback will be gathered and continuously reviewed; they will be collated to form new revisions at appropriate intervals.

Copyright

This document includes direct references to BS1192:2007+A2:2016 & PAS1192-2:2013, the CIC BIM Protocol (Second Edition), 'The role of the Information Manager is defined in the Outline Scope of Services for the role of Information Management' (first edition 2013) drafted by BL Consult and Beale and Company on behalf of the CIC and the BIM Task Group and 'Best Practice Guide for professional Indemnity Insurance when using Building Information Models' produced by Griffiths and Armour on behalf of the CIC and the BIM Task Group.

It is important to note that this document 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 RIAI BIM Committee.

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.

Common Data Environment (general information)

The Common Data Environment (CDE) is the **digitisation** of the process which included printing documents and drawings and combining these with issue sheets to be distributed via the postal system. The same principles apply in that there must be an auditable trail of information where receivers of information can confidently rely on the content of that information. Faxes and more recently email have been a very successful means of communicating documents quickly and easily but this is “uncontrolled” (with no managed approval, acceptance or historical audit tail). As the number of documents increases, they become cumbersome to manage and do not provide necessary quality control to avoid mistakes due to latest revisions being issued for misinterpretation of purpose for why a document was issued. Security can also be a concern as emails can be distributed with any control by the originator.

Document Management systems have been in existence for many years in various forms from simple networked folders, ftp sites, Windows (or other operating system) based applications and more recently web based applications. The latter is expected to have the most transformative effect on the industry as they require limited technical knowledge or infrastructure to setup and provide very rich features for managing and controlling documents that is common to the entire project team.

The concept of a Common Data Environment (CDE) was created with the publication of BS1192:2007 in 2007 which for most of us, preceded BIM, and was a code of practice for producing, managing and sharing “information” (predominantly CAD information at the time), in a structures and organised way, in a “central repository” (single source of truth). In fact, there is no mention of BIM or 3D in BS1192:2007 but the standard was deemed applicable by the BIM Task Group when preparing PAS1192-2:2013. The standard for later updated to BS1192:2007+A2:2016 mostly to align terms and improve small aspects that were not being adapted or were confusing. In relation to the CDE, BS1192:2007+A2:2016 prescribes how files are named, what revision system is used and how to delineate the status of the document (related to passing through defined “approval” gates), which is basically rules for an Issue Sheet but in digital format that is consistent for all participants.

The management of project information, goes well beyond using 3D CAD models or BIM, and involves all project participants who produce/manage any project related information (whether working in BIM or not). BS1192:2007 describes the Common Data Environments (CDE) as a shared/central project data repository for ALL project information (graphical, non-graphical, documents) – so it applies whether you are working on a BIM project or not, and it applies to all participants.

The CDE is the “single source of truth”, when it comes to ALL building information on the project (whether it is BIM or other). It should be the only place that participants put information, and the only place people go to look for information (the purpose is to have the latest information centralized in one place). You should never have to email documents, you should simply notify people that the CDE has been updated (or if you like, provide a link to the documents in the CDE).

The CDE contains:

- **Graphical Data** (models, drawings, IFC, photographs, video, etc)
- **Non-graphical Data** (schedules, databases, COBie, etc)

- **Documents** (contracts, minutes, RFI's, brief, specifications, reports, BOQ, inspection plans, commissioning certificates, product data sheets, user manuals etc, etc)

Collectively this information is called the **Project Information Model** (PIM) during design / construction phase, and once handed over, the **Asset Information Model** (AIM) for operations phase (the word "model" in these terms should not to be confused with only the 3D model – it is ALL information as described above). The PIM is progressively developed and delivered to the employer through a series of information exchanges at different stages of the project and these exchanges will contain contributions from all parties.

Types of Common Data Environment

PAS1192-2:2013 provides flexibility on the type of CDE that may be used. System types include:

- A network / project server may be suitable if one organisation is responsible for all disciplines. The network may be within a single location or connected to multiple locations via a WAN.
- A file based system is one in which the metadata about the file is stored only in the file itself. Examples are ftp, Dropbox, Google Drive, etc. (although the "approval" workflows and historical audit trail in some of the free/cheap online systems, may need to be manually handled).
- A database system is one in which additional metadata is stored about files. Revision and Status are examples of such metadata. More sophisticated systems automate the enforcement of file naming and management of file approvals.

A network / project server is only suitable within one organisation. A file based system may be suitable for small projects but as the number of files increases, they becomes difficult to manage.

A database system is the most robust system for medium to large size projects which will typically have a web based interface which provides additional features such as recording revisions, document status and workflows for sharing, publishing, approving, accepting and archiving files can save significant time and improved quality assurance for information.

There are numerous web based systems available which can be very simple or extremely sophisticated. Some allow models to be federated online which include tools to update data and synchronize back to the local models. On the most sophisticated CDEs, there is a trend towards all project information being on the CDE with local PCs only being used for authoring that information. Care must be taken with these systems to ensure that the security system allows data to be segregated for each organisation as otherwise there may be PI insurance concerns.

Aside from specific project requirements, an important criteria for any CDE is that it can comply with BS1192:2007+A2+2016. Most CDEs do not come with BS1192:2007+A2+2016 compliance as standard but tend to be flexible enough to provide means to ensure compliance which must be documented and managed by the Information Manager.

CDE Specification

A Common data Environment should provide the following functionality:

1. Include licenses to access the CDE for all task team members and the employer team.
2. Provide a secure login system.
3. Comply with security requirements in the EIR and additionally PAS1192-5:2015 where required.
4. Provide a means of recording metadata for files. At a minimum, the CDE should record the revision and suitability code for each file exchanged.
5. Allow current and previous revisions/versions to be viewed and downloaded.
6. Provide a system for approval of documents, in accordance with BS1192:2007.
7. The CDE should include a viewer for the federated model which can be accessed by registered and authorised users.
8. Provide an audit trail for files sufficient to determine:
    a. individual and organisation who shared the document
    b. date and time when the document was shared
    c. list of recipients and individuals who viewed, downloaded and approved documents.

The management of the CDE is usually done through a software solution. It should be agreed what software solution will be used, and who will bear the costs for procuring and providing the CDE at different stages – the cost of this should be included in the tender documents (client, design lead, contractor).

It is the role of the “Project Information Manager” (usually the lead designer at design stage, and the main contractor at construction stage) to ultimately manage the CDE, for the respective stage, but the cost of “provision” of the CDE system, setup and licences, is not deemed to be automatically included in the standard service of the lead designer, or main contractor (refer to CIC Outline Scope of Service for Information Management, 2013) - the costs related to the provision, setup and licences are additional.

Responsibility

In accordance with the Outline Scope of Services for the Role of Information Management - Construction Industry Council (CIC), the **Information Manager** is responsible for establishing the Common Data Environment.

Security

The CDE should include at least two named administrators who have full administrative access to the project on the CDE. The administrator should include the Information Manager and another person designated by the Information Manager which could be a Document Controller. Some CDEs may provide for limited administrative security access which can be granted to selected users e.g. Team Information Managers.

The CDE Administrator should have the following rights:

1. Grant and revoke access for user accounts to the CDE.
2. Create Distribution Groups and add/remove user accounts for each group.
3. Create Roles and add/remove user accounts for each role.
4. Create Roles and grant access for roles to folders.
5. Create forms and grant access to the forms.

6. Create Document Statuses based on BS1192:2007 and grant access to each status.

Where a security policy based on PAS 1192-5:2015 - Specification for Security-minded building information modelling, digital built environments and smart asset management is required, significant planning and specialist advice may be required which is not within the scope of this document.

Audit Trail

An audit trail is a standard requirement for all documentation regardless of whether external quality assurance systems require it. Put simply, all files that are shared with third parties should have a record or when, who and what reason they were shared. Any subsequent revisions should be tracked also ensuring that all recipients of the previous version understand that the previous version is superseded.

Many CDEs, stack revisions of documents on top of each other, only showing the latest version but allow you to see and compare all versions if required. Generally these CDEs use the file name to identify that the document is the same as a previous revision. As files are distributed to individuals or distribution groups, the CDE should record each individual distribution and the status of the document. The status should be one of the status codes prescribed in BS1192:2007+A2:2017.

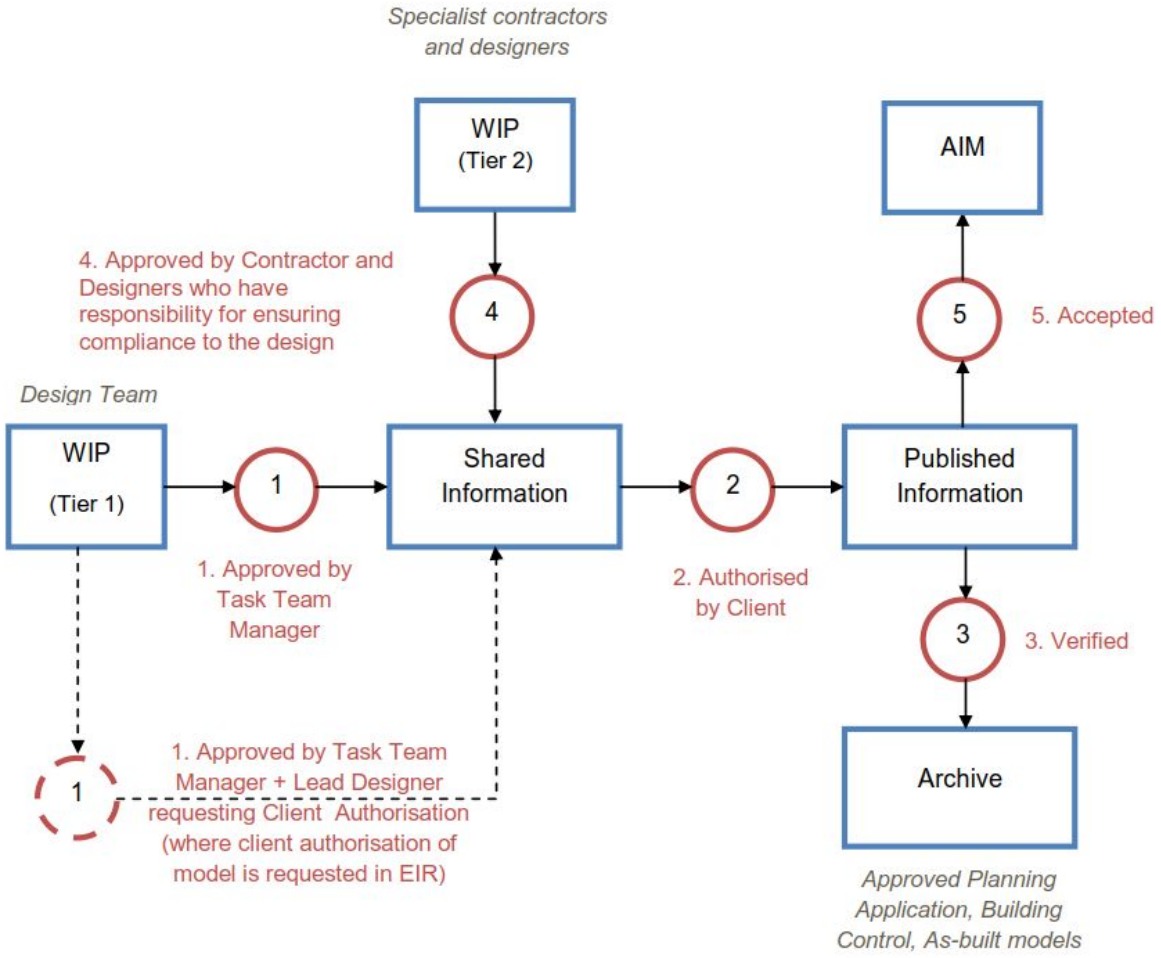
For audit or traceability purposes, the following additional information for each document should ideally also be tracked, and be able to be reported in some way:

1. Which Individual submitted the document
2. Date submitted
3. Which Individual approved the document (some approvals may be tiered – ie consultant approval followed by client approval etc)
4. Date approved
5. Which individuals viewed or downloaded the document
6. Date Viewed/Downloaded

NOTE If the Common Data Environment doesn't include an audit trail, you will need to keep manual records using traditional issue sheets which should be submitted with each distribution of files, which can be very onerous or time-consuming.

CDE Areas and Suitability Status

The CDE areas do not necessarily represent folders (in the traditional sense) which can be confusing. All files uploaded to the system have a Suitability or status code, which indicates to others to what level they can rely on or trust the information. Files issued for "sharing" are suitable for ongoing interdisciplinary collaboration, but not suitable or "accepted" or authorized by the client for major milestones (like planning, building control, tender, for construction, as-built handover etc). Files could theoretically all be in one location provided the CDE system allowed participants to view files for a status that is relevant to them. For example, the Employer will see all Published files and files issued for PIM authorisation whereas the Design Team may be able to view all shared files.



The CDE areas should align with the sections identified in figure 15 of PAS1192-2:2013. While various Common Data Environments have different technical solutions to achieving compliance with section 9.2.2 of PAS1192-2:2013, it is vitally important that information can be differentiated between WIP, Shared, Published and Archive. There should also be documented proof for each of the 5 authorisation gates.

The Status of each file is used to determine what a file can be used for. Examples:

- 'S2 - Suitable for Internal Review and Comment' means the file is distributed for review and comment but it cannot be used for any of the other statuses e.g. Tender. Subsequent to incorporating any comments, the originating team may upload a new revision and change the status to 'D1 - Suitable for Costing' if that is the status required. If there are no changes, the status of the file on the CDE could be simply changed to 'D1 - Suitable for Costing'.
- Status 'S6 - Suitable for PIM Authorisation' is used by the Design team for Employer at an Information Exchange. If the Employer accepts the Project Information Model, the status is changed to A1, A2, A3 or B1, B2, B3 depending on if the files are approved or partially approved.

Suitability Status

The status of a document indicates what the document (or container) is suitable for e.g. Information, Costing, Tender, Construction, etc. Statuses on the CDE should be named in accordance with BS1192:2007+A2:2016 using the prescribed fields. The Status should be selected on the CDE only from a prescribed list which is based on BS1192:2007+A2:2016. The status for each document can transition in the CDE under a controlled workflow. For

example, only the Employer should be able to change the status to A1, A2, A3, etc as Approved and accepted as stage complete.

Revisions

Revisions distinguish changes or amendments to a document and are a very common part of information control on projects. Revisions on the CDE should be named in accordance with BS1192:2007+A2:2016 using the prescribed fields. Revision should be added on the CDE only. Once a file is uploaded to the CDE, it is given a revision and only subsequent uploads have a newer revision e.g. P01, P02, P03, etc. Work in Progress files have a special revision which allows for multiple work in progress revisions leading to a standard revision e.g. P01.01, P01.02 leading to P01. Information Exchanges accepted by the Employer in full need to be updated to C01, C02, etc.

NOTE 1 BS1192:2007+A2:2016 introduced the concept of A1, A2, A3 and B1, B2, B3 statuses. A1 is the acceptance of the first Information Exchange, A2 is the second and so on. A5 maybe the construction version depending on what is required in the EIR. Status B files must be resubmitted so that all documentation achieves Status A although work may proceed except for areas marked in abeyance. There is no Status C.

NOTE 2 Work in Progress (WIP) files with a Status of S0 - Work in progress may be shared but at risk as they are not considered to be validated, checked or approved. All other files should be validated, checked or approved by the Team Manager prior to be submitted on the CDE.

The standard Codes for suitability as per Table 5 in BS1192:2007+A2:2016 are:

Status	Description	Revision Code	Graphical Data	Non-graphical Data	Documents
Work in Progress (Non-Contractual)					
S0	Work In Progress	P01.01, etc	✓	✓	✓
Shared (Non-Contractual)					
S1	Suitable for Coordination The file is available to be 'shared' and used by other disciplines as a background for their information.	P01, P02, etc	✓	X	X
S2	Suitable for Information	P01, P02, etc	X	✓	✓
S3	Suitable for Internal Review and Comment	P01, P02, etc	As Required	✓	✓
S4	Suitable for Construction Approval	P01, P02, etc	X	X	✓
S6	Suitable for PIM Authorisation (Stages 2a, 2b and 3)	P01, P02, etc	X	X	✓
S7	Suitable for PIM Authorisation (Stages 4 and 5)	P01, P02, etc	X	X	✓
WIP to Published Unauthorized and (Non-contractual) use at risk.					

D1	Suitable for Costing	P01, P02, etc	✓	✓	✓
D2	Suitable for Tender	P01, P02, etc	X	✓	✓
D3	Suitable for Contractor Design	P01, P02, etc	✓	✓	✓
D4	Suitable for Manufacture / Procurement	P01, P02, etc	X	✓	✓
Published (Contractual)					
A1, A2, A3, etc	Approved and accepted as stage complete (C= Contractual/Complete)	C01, C02, etc	✓	✓	✓
B1, B2, B3, etc.	Partially signed-off: with minor comments from the Client. All minor comments should be indicated by the insertion of a cloud and a statement of 'in abeyance' until the comment is resolved, then re-submitted for full authorization.	P01.01, etc	✓	✓	✓
Published for AIM Acceptance					
CR	As Construction Record documentation, PDF, Models etc	C01, C02, etc	✓	✓	✓

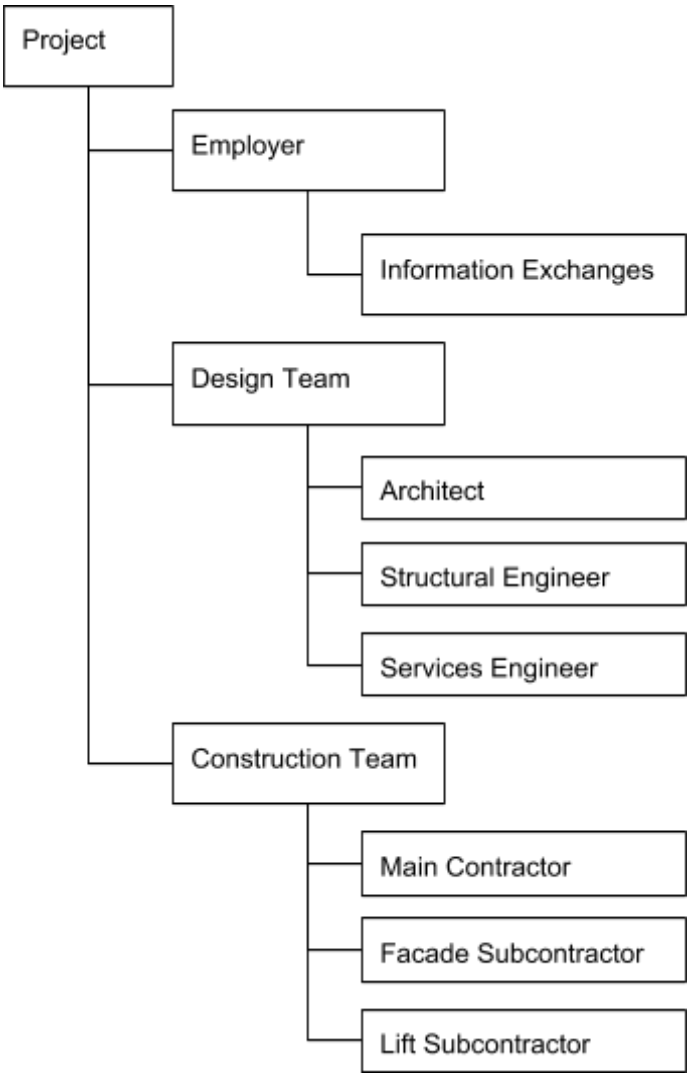
CDE Folders

Most CDEs have a concept of folders or containers to store files with common attributes. Most of us are familiar with folders and probably create far more folders than we need in the long run. There is no requirement to include folders on a CDE and there are valid arguments for keeping the number of folders to a minimum as folders increase the complexity for security. Some CDEs have predefined containers that must be used. Many web based database systems include filtering mechanisms which can be more powerful than folders which allow files to be grouped, filtered and sorted based on fields in the file name, the revision, status, construction package or other metadata about the file.

On a CDE, security is probably the only reason to use folders as security is best applied to folders rather than files to minimise complexity. At a minimum, the only folders required are ones for the Employer, Design Team, Construction Team (once appointed). Each of these could include folders for each Task Team. Security can then be controlled on the areas and then within the team folders. Typically, each team will have access to upload, view and download from their own folder but only rights to view and download from other folders.

If the CDE permits, revisions of files should be linked to the Employers folder for Information Exchanges. Otherwise, a Publication folder could be created where the files are copied. Where possible, the files should be in the same folder so that revision and status control can be maintained.

The following example could be used:



Only if further subdivision of team folders cannot be avoided, it would be advisable to ensure that folders are consistently named. If one organisation places models in 3D Models, another in BIM Models and another in models and so on, the CDE becomes difficult to manage. There is no standard for naming of folders in each Task Teams folder. In the interests of familiarity, a common system for naming folders should be used for each Task Team. The following example based on types of files defined in BS 1192:2007+A2:2016 could be used:

1. Shared Resources
    - 1.1. Employer Requirements
    - 1.2. BIM Execution Plan
    - 1.3. Surveys
2. Drawings and Models
    - 2.1. 2D Models (M2)
    - 2.2. 3D Model (M3)
    - 2.3. Animation Files (AF)
    - 2.4. Clash Rendition (CR)
    - 2.5. Combined Models (CM)

2.6. Drawings (DR)

2.7. Model Renditions (MR)

2.8. Visualisation Files (VS)

3. Documents

3.1. Bill of Quantities (BQ)

3.2. Calculations (CA)

3.3. Correspondence (CO)

3.4. Cost Plan (CP)

3.5. Health & Safety (HS)

3.6. Information Exchanges (IE)

3.7. Method Statements (MS)

3.8. Programmes (PR)

3.9. Report (RP)

3.10. Room Data Sheets (RD)

3.11. Schedule of Accommodation (SA)

3.12. Schedules (SH)

3.13. Specifications (SP)

NOTE 1 Provided files are named in accordance with BS1192:2007+A2:2016 and the CDE allows files to be filtered based on the fields in the file name, folders should not be required.

NOTE 2 Some correspondence may be better placed in forms where it can be tracked e.g. RFIs, Technical Submittals, etc.

NOTE 3 The Information Manager should become familiar with the selected CDE as early in the project as possible so that system dependent functionality can be optimised in the documentation of the CDE within the BIM Execution Plan.

Files

Files on the CDE should be named by all team members in accordance with BS1192:2007+A2:2016 using the prescribed fields. Project specific field codes should be established as part of the Standard Methods and Procedures (SMP) in the **BIM Execution Plan** by the **Information Manager** ensuring that there is a common file naming system.

A Common Data Environment (CDE) that complies with BS1192:2007+A2:2016, requires every document/file name to be comprised of a number of fields with codes of a prescribed length whose values are provided in BS1192:2007+A2:2016 or can be project specific in certain cases. Each field is delimited by a dash. Project specific codes should be recorded in the BIM Execution Plan, or specified in the EIR.

Mandatory fields:

- **Project** (2-6 characters) - The ‘project’ is an alphanumeric code that is used by the project team to identify the project. It should not be confused with the Project Contract number which may be different for each company working on the project.

- **Originator** (3-6 characters) - The 'originator' is an alphabetic code that represents the company responsible for that aspect of the work. The codes must represent the company name, and not the discipline.
- **Volume / System** (1-2 characters) - The 'volume' is an alphabetic code that represents a building volume or system. The codes should be unique across the project e.g. 01 is Structural Frame, 02 is Steel Framing, 03 is Facade, 04 is HVAC systems, etc. Volumes / Assets are not drawing areas, and do not relate to the amount of the project shown on any given drawing. Volumes are the responsibility of the Lead Designer.
- **Level / Location** (1-2 characters) - The 'level' or 'location' code is a 2 character alphanumeric code that represents the level or storey of the building, or the chainage location of a linear construction (road/rail etc).
- **Document Type** (2 characters) - The 'type' is a two- character alphanumeric code that indicates the type of file from a prescribed list of types for Models & Drawings and a separate list for Documents which can be extended with project specific types.
- **Discipline** (1 character) - The 'discipline' code is a single character indicating the discipline e.g. A for Architect, S for Structural Engineer, etc.
- **Number** (exactly 4 digits) - The numbering for standard coding should be exactly four integer numeric digits, used sequentially. Leading zeros should be used.

Optional Fields:

- **Classification** (2 or more characters) - The code should be two characters or more. A single code from Uniclass 2015 should be used.
- **File Description** - a plain english ile description in CamelCase text can be included preceded with an underscore character.

Examples:

Model - Architectural model

Project	Originator	Volume/System	Level	Type	Discipline	Number
PRJ	FLR	ZZ	ZZ	M3	A	0001

Drawing - Structural plan at level 01

Project	Originator	Volume/System	Level	Type	Discipline	Number
PRJ	FRK	ZZ	01	DR	S	1001

Schedule - Sanitware schedule at Level 01

Project	Originator	Volume/System	Level	Type	Discipline	Number
PRJ	TBA	74	01	SH	A	0001

BS1192:2007+A2:2016 notes that the number should ensure that the filename is unique in the context of the preceding fields. While it is practical to ensure that no two files have the same name, this system could result in a lot of files ending with the number being 0001 as any change to one of the preceding fields ensures uniqueness.

It is recommended that numbers are be arranged in blocks to help plan sets of deliverables. Example:

Architectural	
General	0001 - 0999
GA Plans	1001 - 1999
GA Elevations	2001 - 2999
GA Sections	3001 - 3999
Assembly Drawings	4001 - 4999
Details	5001 - 5999
Room Layouts	6001 - 6999
Project Specific	7001 - 9999

BIM software and CDEs generally have functionality to sort, filter and group files based on fields or the first few characters or digits in a field, so blocking numbers makes this an ideal way to manage files.

Volume could be used to differentiate packages of information for tender. Example:
32 is the doors volume, so the following is a detail drawing of a door.

Project	Originator	Volume/System	Level	Type	Discipline	Number
PRJ	FRK	32	ZZ	DR	A	0801

NOTE The revision and suitability status code should not be appended to the file name as many CDEs rely on the file name being consistent for version control.

Roles

Where the CDE system permits, roles should be used to grant access to folders or containers. In addition to the administrator role, the Information Manager should add a role for each Task Team e.g. Architect, Structural Engineer, etc. Additional roles may be created for specific functions e.g. BREEAM.

Where possible, folders should not be granted rights based on individual accounts as this can become unmanageable as the number of users and folders grows.

Distribution Groups

Distribution Groups allow actions on the CDE to be targeted at the appropriate people. For example, a Design Team distribution group may be created to ensure all design team members are notified.

The following information should be recorded for each Distribution Group:

- Distribution Groups
- Action
- Length of Time to respond for each action.

The Information Manager should maintain the list of users in each distribution group.

The Action should be 'For Information' for most distribution groups. 'For Comment' should be selected for individual users when documents are being distributed. Many CDEs send an email automatically when information is distributed. Options for collating distributions into a single daily email or receiving notifications for certain actions should be reviewed by the Information Manager.

CDE Forms

Where possible, forms should be used to automate recording of correspondence especially where there is a requirement for multiple parties to track progress and ensure decisions are made in a timely manner. Forms can be used to record and track progress on Requests for Information (RFI), Technical Submittals, Design Issues and many other types of correspondence. Some CDE systems will have systems for creating forms and may have predefined forms for common workflows.