# Computer Aided Design
## Standards

Road Space Management

**MAYOR OF LONDON**

**TRANSPORT FOR LONDON**
EVERY JOURNEY MATTERS

**Document History**

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| D1.1 | October 2014 | Draft Issue for Comment | L. Rhoden | S. Barnes | - |
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# Contents

**Appendix A – RSM CAD File Naming Convention**

# 1.0    Purpose

The purpose of this standard is to define requirements for data contained within, and metadata associated with, Computer Aided Design (CAD) files and to facilitate consistent usage of CAD software over a large number of users.

These standards aim to ensure the processes and outputs associated with the production of CAD drawings is standardised and consistent for design teams working across Road Space Management (RSM).  Consistency in output will improve the quality and structure of drawings produced, offering cost savings to TfL's supply chain through efficiencies, promoting collaboration and reducing re-work.

This standard is aligned wherever possible with BS1192:2007 Collaborative Production of Architectural, Engineering and Construction Information, which defines the process for project collaboration and efficient data sharing.  A major constituent of collaborative working is the ability to structure, communicate, re-use and share data efficiently without loss or misinterpretation.

BS1192 is not only a means of delivering the two-dimensional drawing information that is required for a project, maintenance and operations, but it is also the basis on which information management and the delivery of three-dimensional models and their associated data should be delivered.

This standard also aligns with the PAS1192 document series, and supports the movement within the wider engineering and construction industry towards a model based BIM environment in accordance with the government mandate which specifies the use of Level 2 BIM for all centrally procured construction projects by April 2016.  Further advancements will be made in defining the BIM and Common Data Environment (CDE) across TfL as part of an ongoing project within Surface Transport programmed for 2015/16 and beyond.

References within this document are listed in Section 6, whilst definitions of the terminology used can be found in Section 7.

# 2.0    Scope

This standard applies to the production of CAD models and drawings within Road Space Management (RSM) and the generation or capturing of associated drawing metadata.  It is recommended as guidelines for adoption by other CAD and / or design teams within TfL Surface, and should be adopted as standard for CAD models, drawings and metadata captured by suppliers on behalf of TfL RSM.

An external web based solution will be established to enable a Common Data Environment (CDE) for the purpose of collaboration with our suppliers and other contracted organisations when the wider BIM implementation project has been finalised in preparation for BIM Level 2.

# 3.0    Requirements

### 3.1    General

3.1.1    All CAD model files and Drawing Definition files shall be delivered in DWG file format, and from July 2015, all CAD files should be produced to 2013 DWG file format (timescales are reliant on AutoCAD version upgrades planned as part of the Desktop Futures Programme).

3.1.2    Designs that have been developed using other CAD file formats shall have layers, line-types, line-weights, fonts and colours mapped to those fully compatible with AutoCAD 2013 DWG file format.

3.1.3    Ownership of the data contained within CAD files shall be clear (see paragraph 3.3.5).

3.1.4    CAD files should contain metadata ("data about the data") which describes the content, quality, condition, and other key characteristics of the data contained within.  Metadata is contained

within the drawing properties (required for model files) and the drawing frames (for plotable drawings).

3.1.5   Where CAD files are received from suppliers, the data received should be:

- Compliant with BS 1192:2007 Collaborative Production of AEC Information and the standards within this document.

- Compliant with the layering format as stipulated by CPIC Uniclass v2.0.

- Compatible with the AutoCAD 2013 DWG file format.

3.1.6   A CAD template file may be made available to the supplier to promote compliance to standards.

3.1.7   Each contracted organisation is responsible for the content of their CAD files. Information received should however be reviewed prior to acceptance to ensure it is fit for purpose (see Sections 5.1 and 5.2 regarding the control of incoming data).


## 3.2     Naming Conventions

3.2.1   This file naming convention will establish clear, concise guidance on an agreed set of rules to manage and share data (workflows) in a quality controlled environment.

3.2.2   Legacy project files which have already established naming conventions will not need to be renamed for use within a project. This standard will apply to all new projects which are commissioned following the publication of this standard.

3.2.3   Names assigned to CAD files and layers within the CAD file shall be structured by joining together codes in the specified fields, in the specified order, using only the "−" hyphen character. A hyphen is therefore not allowed anywhere else in the code.

3.2.4   The only exceptions to paragraph 3.2.3 shall be the use of underscores "_" which should be inserted to separate words used for the optional text at the end of file names (see File name Example 2 in paragraph 3.3.3). Underscores are also used as part of the Uniclass 2 code format.

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**Notes:**

The naming conventions are based on the following structures:

| **For CAD file naming:** | [Project Information]-[Drawing Information]  (see paragraph 3.3) |
| **For Layering:** | [Role]-[Classification]-[Presentation]-[Description] (see paragraph 3.4) |

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3.2.5   Codes shall be selected from either standard codes (defined within paragraphs 3.3 and 3.4) or project codes.

3.2.6   Codes shall not imply meaning that may be duplicated in other fields.

3.2.7   All characters shall be uppercase.


## 3.3     File Naming

3.3.1   A Quick Reference Sheet (which includes a worked example) is available in Appendix A of this document to enable CAD users to quickly establish the correct file name for their project.

3.3.2    The reference sheet summarises the following information contained within paragraphs 3.3.3 to 3.3.11.

3.3.3    CAD file names shall be composed by joining the fields shown in the table below:

**File naming Example 1 (drawing definition): 3004101-RSM-PRD-05-DR-TE-01-0001**

**File naming Example 2 (model file):            3004101-RSM-PRD-05-M2-TE-(OPTIONAL_TEXT)**

| | Project Information | | | | | Drawing Information | | | |
|---|---|---|---|---|---|---|---|---|---|
| Standard | Project | Originator | Asset | Location | | Type | Role | Option | Number |
| BS 1192 | Required | Required | Required | Required | | Required | Required | N/A | Required |
| TfL | Required | Required | Required | Required | | Required | Required | Required | Required |
| Clause | 3.3.4 | 3.3.5 | 3.3.6 | 3.3.7 | | 3.3.8 | 3.3.9 | 3.3.10 | 3.3.11 |
| eg 1 | 3004101 - | RSM - | PRD - | 05 - | | DR - | TE - | 01 | For DWG Definition Files |
| eg 2 | 3004101 - | RSM - | PRD - | 05 - | | M2 - | TE - | Optional text_20 characters | |

*Note – the coding above is explained within paragraphs 3.3.1 to 3.3.11 and summarised in the Quick Reference Sheet in Appendix A.*

### 3.3.4    Field codes - Project

3.3.4.1    Project ID codes identify a project, as defined in the TfL Master Projects Database (MPD), the Project Execution Plan (PEP) or the Traffic Project Database (TPD).  For the majority of projects, the ID code is derived by extracting the last seven digits numerals from the Project ID code (eg. TC.029.**3004101**) usually provided by RSM Sponsorship.

3.3.4.2    Project IDs should be requested for all commissioned project work to ensure a project contains a unique identifier.

3.3.4.3    Once assigned, the project code cannot be changed.

3.3.4.4    Project codes shall be from five to eight characters.

3.3.4.5    CAD files that do not belong to a specific project shall use the code: "**TFLCORE**".

### 3.3.5    Field codes - Owner / Originator

3.3.5.1    Owner organisation codes are unique and are used to identify the contracted entity (organisation or originator) legally responsible for the data within the CAD file.

3.3.5.2    Owner organisation codes shall be three characters.

3.3.5.3    The eight TfL Directorates within Surface Transport will form the internal originator codes, the most common of which will be Road Space Management, as shown below:

| Code | Description |
|---|---|
| **RSM** | Road Space Management (TfL) |

3.3.5.4    External suppliers will need to be assigned a unique code, which will be maintained by the Lead CAD Draftsperson (LCD) within Outcomes Design Engineering (ODE).

3.3.5.5    Codes for a selection of the most commonly used external suppliers are shown in the Quick Reference Sheet available in Appendix A of this document.

### 3.3.6    Field codes - Asset / Classification

The code for each Asset (or Classification) shall be three characters as defined in the table below:

| Type | Code | Description | DMRB Series |
|---|---|---|---|
| FEASIBILITY / CONCEPT DESIGN | COL | Collision Data | 0000 |
| | EXG | Existing Layout | |
| | LEV | Existing Levels, Contours & Chainages | |
| | OSD | Ordnance Survey Data | |
| | TOP | Topographical Survey | |
| | FEA | Feasibility Design | 0100 |
| | COP | Consultation Plan | |
| | PRD | Preliminary Design | |
| | TMP | Traffic Management Plan | |
| DETAIL DESIGN | LON | Longitudinal Sections | |
| | SET | Setting Out & Levels | |
| | XSE | Cross Sections | |
| | SCL | Site Clearance | 0200 |
| | FEG | Fencing & Gates | 0300 |
| | STF | Street Furniture | 0400 |
| | DRN | Drainage | 0500 |
| | EAR | Earthworks | 0600 |
| | CAR | Carriageway | 0700 |
| | KFP | Kerbs, Footways & Paved Areas | 1100 |
| | TSL | Traffic Signs & Road Markings | 1200 |
| | STL | Street Lighting & Ducting | 1300 |
| | TRS | Traffic Signals & Ducting Layout | 1400 |
| | STR | Structures | 1700 |
| | GRE | Green Estate | 3000 |
| MISC | BOU | Geographic Boundaries | - |
| | CPZ | Controlled Parking Zones | |
| | LOC | Location / Key Plan | |
| | SPA | Vehicle Swept Path Analysis | |

### 3.3.7   Field codes - Location

The code for each Location classification shall be two characters as defined below:

| Code | Inner Boroughs |
|------|----------------|
| 00 | City of London |
| 01 | City of Westminster |
| 02 | Camden |
| 03 | Islington |
| 04 | Hackney |
| 05 | Tower Hamlets |
| 06 | Greenwich |
| 07 | Lewisham |
| 08 | Southwark |
| 09 | Lambeth |
| 10 | Wandsworth |
| 11 | Hammersmith and Fulham |
| 12 | Kensington and Chelsea |

| Code | Outer Boroughs |
|------|----------------|
| 13 | Waltham Forest |
| 14 | Redbridge |
| 15 | Havering |
| 16 | Barking and Dagenham |
| 17 | Newham |
| 18 | Bexley |
| 19 | Bromley |
| 20 | Croydon |
| 21 | Sutton |
| 22 | Merton |
| 23 | Kingston upon Thames |
| 24 | Richmond upon Thames |
| 25 | Hounslow |
| 26 | Hillingdon |
| 27 | Ealing |
| 28 | Brent |
| 29 | Harrow |
| 30 | Barnet |
| 31 | Haringey |
| 32 | Enfield |

| Code | Multiple Boroughs / None |
|------|--------------------------|
| ZZ | Multiple Boroughs |
| XX | No Boroughs |
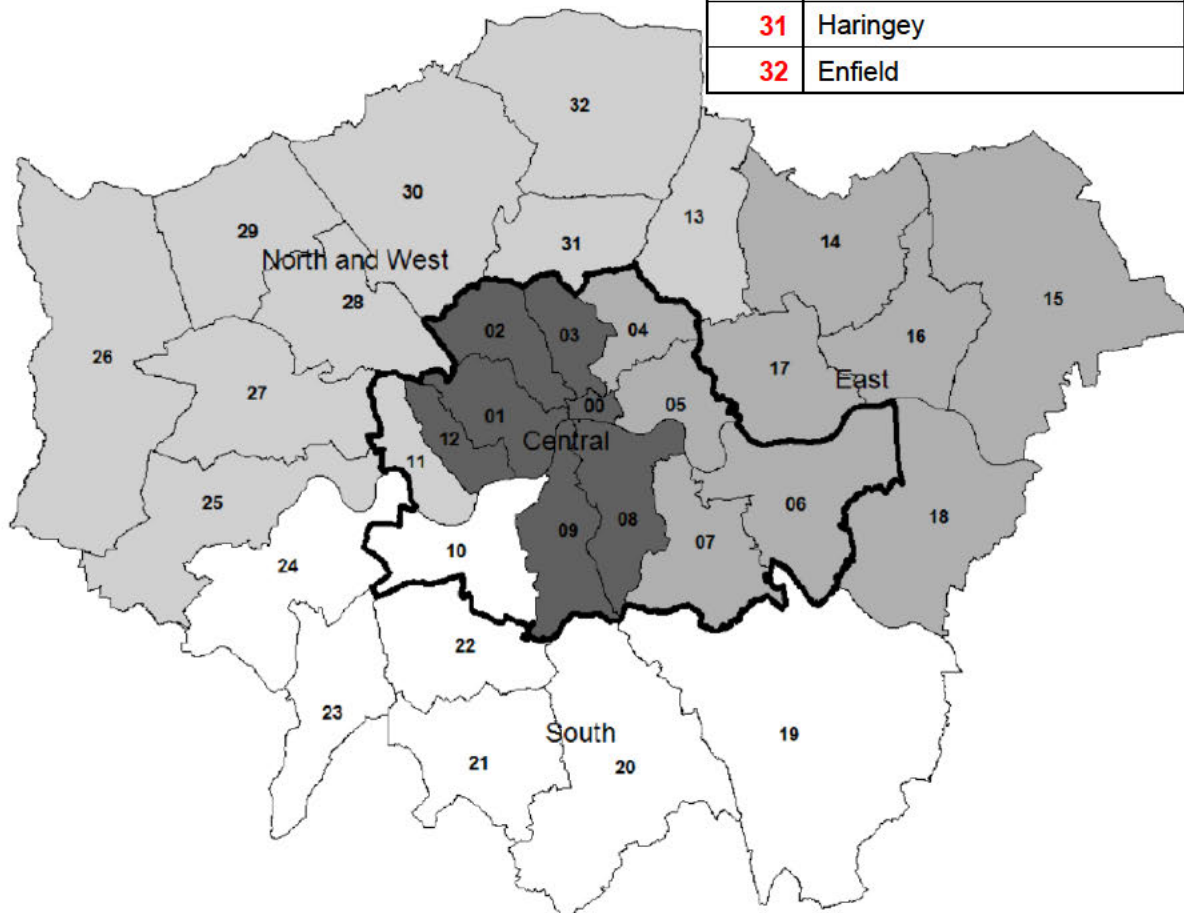
### 3.3.8 Field codes - Type

3.3.8.1 CAD files shall contain a single "Type" of information.

3.3.8.2 Type codes shall be two characters as defined in the table below:

| Code | Description | Notes |
|------|-------------|-------|
| DE | Detail File/Drawing | Non-geographical, standard details, not linked to model |
| DR | Drawing Definition | Sheet drawing / Plotable drawing with title block |
| SK | Sketch | Used to quickly illustrate idea, for internal use only |
| M2 | 2D Model File | 2D model content drawn to scale in co-ordinate system |
| M3 | 3D Model File | 3D model content drawn to scale in co-ordinate system |
| CM | Composite Model | Used for collaboration purposes only |
| VS | Visualisation | File used for visualisations, animations or rendering |

### 3.3.9 Field codes - Organisational Role

3.3.9.1 Owner organisations shall be allocated one or more roles.

3.3.9.2 Standard codes for the organisational role should be two characters as follows:

| BS1192:2007 Roles | | Additional Roles | |
|------|-------------|------|-------------|
| Code | Description | Code | Description |
| AR | Architect | GE | Geotechnical Engineer |
| BS | Building Surveyor | LE | Lighting Engineer |
| CE | Civil Engineer | **TE** | **Traffic Engineer** |
| DH | **Drainage, Highways Engineer** | EN | Environmentalist |
| EL | Electrical Engineer | AN | Acoustics & Noise |
| FM | Facilities Manager | PM | Project Management |
| GL | Geographical and Land Surveyor | **TM** | **Transport Modelling** |
| HV | Heating & Ventilation Designer | **UD** | **Urban Designer** |
| ID | Interior Designer | | |
| KC | Client | | |
| LA | Landscape Architect | | |
| ME | Mechanical Engineer | | |
| PH | Public Health Engineer | | |
| QS | Quantity Surveyor | | |
| ST | Structural Engineer | | |
| TC | Town and Country Planner | | |
| WC | Contractor | | |
| XS | Subcontractor | | |
| YD | **Specialist Designer** | | |
| ZZ | **General (Non-Disciplinary)** | | |

### 3.3.10  Option

3.3.10.1  Option number codes shall be exactly two integer numeric digits and be sequential, beginning at "01".

3.3.10.2  Option number codes can be used to identify design or drawing options as part of optioneering.

### 3.3.11  Number (for Drawing Definition or Plotable Drawings)

3.3.11.1  Number codes shall be exactly four integer numeric digits & be sequential, beginning at "0001".

3.3.11.2  Drawing number codes should be provided for Drawing Definition or Plotable Drawings, and are numbers used to identify the individual layouts.  They are not required for model files, including M2, M3, CM & VS file types.

3.3.11.3  Where drawings are setup with multiple paperspace layout tabs, drawing numbers should **not** be used in the file names.  The four digit sequential drawing number should be removed from the file name and used to number the layout tabs within the drawing file.  The CAD file name and Layout Tab numbers auto-populate the Drawing Number field within the templates created for the drawings frame(s).  It should be noted that these can be over written if required.

As shown in the example below, the following numbering convention should be applied:

| CAD file name example: | 3004101-RSM-PRD-05-DR-TE-01.dwg |
|---|---|
| The (first) Layout Tab would be: | 0001 |
| The (first) Drawing Number would be: | 3004101-RSM-PRD-05-DR-TE-01-0001 |

### 3.4  Layer Naming

3.4.1  Layer names within CAD files shall be composed by joining together the fields shown in the table below:

**Layer Naming Example: TE-PR_35-M-ROADMARK_WHITE_PR**

| Standard | Role | | Classification | | Presentation | | Description / Alias |
|---|---|---|---|---|---|---|---|
| BS1192 | Mandatory | | Mandatory | | Mandatory | | Required |
| TfL | Required | | Uniclass2 | | Required | | Required |
| Clause | 3.3.9 | | 3.4.3 | | 3.4.4 | | 3.4.5 |
| | TE | - | PR_35 | - | M | - | ROADMARK_WHITE_PR |

### 3.4.2  Role (for File names and CAD layers)

3.4.2.1  The coding for the Role is the same as the Organisational Role as detailed previously in section 3.3.9.

### 3.4.3  Classification (for CAD layers only)

3.4.3.1  Each layer within a CAD file shall be classified by a single code to accurately describe the individual assets represented.

3.4.3.2    Classification codes shall be a minimum of 5 characters.

> **Notes:**
>
> I.    The UK implementation of BS ISO 12006-2 is Uniclass2.
>
> II.    CPIC is the co-ordinating body responsible for maintaining and updating the Uniclass classifications.  Reference should be made to their website http://www.cpic.org.uk for updates.

3.4.3.3    Classification codes shall be selected from BS ISO 12006-2 (Uniclass 2.0)  The codes can be found online at http://www.cpic.org.uk/uniclass2/ and will be embedded within the model files as part of the standard templates.

### 3.4.4    Presentation (for CAD layers only)

3.4.4.1    Each layer within a CAD file shall be consistent in its presentational conventions, distinguishing between graphical and textual content etc.

3.4.4.2    Presentation codes shall be one character as defined in the table below:

| Code | Description |
|------|-------------|
| D | Dimensioning |
| H | Hatching and Shading |
| M | Model related elements |
| P | Plot / Paper related elements |
| T | Text / Annotation / Legend or Key Text |

### 3.4.5    Description / Alias

3.4.5.1    Descriptive text shall correspond with the published Uniclass 2.0 definition to assist in identification, and are suffixed with  "**_PR**" for Proposed features, "**_EX**" for Existing features or "**_RM**" for Removed features where appropriate.

### 3.5    Status: Suitability & Revisions

3.5.1    Drawing Definition (DR) files shall be assigned a status, consisting of:

    a) Suitability (see paragraph 3.5.2); and

    b) Revision (see paragraph 3.5.3).

> **Notes:**
>
> III.    The Suitability and / or Revision codes must NOT be added to the end of the file name. When the CAD files or renditions are formally issued as a major revision, these should be saved as an E-Transmittal. *The Revision code should be added to the file name of the ZIPPED file ONLY at this stage*, which must also contain a copy of the Drawing Issue Register.
>
> IV.    This information must NOT otherwise be added to ANY file names (as this would affect the Drawing Rendition numbering and potentially affect the model xrefs (M2/M3) linked within).

### 3.5.2 Suitability

3.5.2.1 Drawing Definition files shall carry the metadata of "Suitability", to indicate the approved use of the contained information. This information will be contained within the drawing file only and will not be reflected in the drawing file name.

3.5.2.2 Suitability codes shall be one or two alpha-numeric characters and shall be reserved for use with a specific phase of the collaboration process, as defined in the table below:

| Code | Description | Model Files | Drawing Rendition |
|---|---|---|---|
| **Work in Progress (non-contractual)** | | | |
| S0 | Non-verified design<br>The file is Work in Progress, unchecked and not to be shared with others. | YES | YES |
| **Shared (non-contractual)** | | | |
| S1 | Co-ordination (for use)<br>The file is shared and can be used by others for the purpose of design coordination and / or TfL acceptance. | YES | NO |
| S3 | For Comment<br>The file is shared and is to only be used, by others, to identify and communicate potential impacts of the change to the design. | YES | YES |
| **Published (contractual)** | | | |
| D3 | Fit for Contractor<br>The file content has been accepted by TfL as meeting the requirements for the stage deliverable and can be passed to a contractor. A record of all issued deliverables shall be maintained in softcopy format as a minimum. | YES | YES |
| A | For Construction<br>The file content has been accepted, by TfL as meeting the requirements for construction. A record of all issued deliverables shall be maintained in softcopy format as a minimum. | NO | YES |
| AB | As Built<br>The file content has been accepted by TfL as being verified as to what has been built / installed. | YES | YES |

**Notes:**

V. *Worked example:* A topographical survey provided by a supplier as a 2D / 3D model (after having been checked and deemed fit for purpose) would be designated as "S1" when incorporated within design drawings. By definition, the survey file has been accepted by TfL and is being shared for the purpose of design co-ordination.

VI. "For Information" has been removed to prevent ambiguity around the suitability of use of that data / information. "For Comment" should be used instead.

### 3.5.3   Revision

3.5.3.1   Drawing Definition files shall carry the metadata of "Revision", indicating the issue sequence of the contained information.

3.5.3.2   As with suitability codes, different sets of revision codes shall be reserved for use within each section of the defined Common Data Environment (CDE) process (see paragraph 3.10).

3.5.3.3   Within "Work in Progress", preliminary revisions shall be P00.1, P00.2…, or P01.1, P01.2…, etc. The suffix (.1, .2 etc) is refers to a "minor version" and shall be used to track the iterative progress of the file prior to being approved for sharing.  These minor revisions are for internal operations only (such as the presentation of drawings for an informal meeting with stakeholders or client for purely discussion purposes), and it will be at the discretion of those responsible for the output(s) as and when a minor version is required.

3.5.3.4   CAD files approved for sharing shall carry a preliminary "major version" revision using sequential numbering (ie. P01, P02, P03, etc.) which is preceded by the letter "P".

3.5.3.5   CAD files accepted on behalf of TfL for the purpose of construction shall carry a contractual "major version" revision using sequential numbering (ie, C01, C02, C03, etc.) which is preceded by the letter "C".

3.5.3.6   CAD files accepted on behalf of TfL for As-Builts shall carry a final "major version" revision using sequential numbering (ie, Z01, Z02, Z03, etc.) which is preceded by the letter "Z".

| Stage | CDE Process Gate | Revision |
|---|---|---|
| WIP | Work in Progress | P00.1, P00.2, P00.3, P00.4 etc. |
| Pre-Construction | Shared | P01, P02, P03, P04 etc. |
| For Construction | Published | C01, C02, C03 etc. |
| As Built | Published / Archive | Z01, Z02, Z03 etc. |

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**Notes:**

VII.   The "C" notation indicates that the file has been accepted, as a deliverable, by (or on behalf of) the Client.

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### 3.6   Drawing & Data Checking, Approval and Issuing Process

3.6.1   Before every issue the CAD files must go through the following three stage Quality Assurance checking and approval process (see 3.7.3, 3.7.4, & 3.7.5)

3.6.2   The three levels of checking must be carried out by three different personnel, with the initials only added to the drawing once the drawings have been appropriately checked and approved.

3.6.3   Drawings which are to be published should be printed to the intended drawing scale and checked as colour hard copies (to ensure accuracy of scaling and legibility for all drawing assets).

3.6.4   When all three levels of checking have been achieved, the CAD Operator must ensure all signatures are in the relevant boxes before preparing the CAD files for issue.

3.6.5   The CAD files should be recorded on a Drawing Register and the register must be sent with the data when formally issued.

3.6.6   Where appropriate, it is recommended that the Drawing Register is attached to the front of the Drawing Renditions (such as when transmitted via pdf) as best practice.

**3.7        CAD File Requirements**

3.7.1      CAD file requirements shall apply to Model Files, Composite Models and Drawing Definition (Plotable Drawing) files.

3.7.2      Document numbers shall be assigned following the CAD file naming convention (see paragraph 3.3).

3.7.3      Drawing Definition files shall carry the metadata: "Drawn" (DRN), to identify the author who is responsible for the accuracy of graphical and non-graphical elements within the CAD file at each "major version" revision, and compliance with this standard.  The CAD Operator should self-check and review, before placing their signature in the "DRN" box.

3.7.4      Drawing Definition files shall carry the metadata: "Checked" (CHK), to identify who has checked the CAD files to be shared and used for the suitability (see paragraph 3.5.2) indicated at each "major version" revision.  This maintains an audit trail to capture the checks and reviews carried out to gain approvals.  The Design Engineer (DE) or Lead Design Engineer (LDE) responsible for the design must check the design is accurate and fit for purpose, before placing their signature in the "CHK" box.

3.7.5      Drawing Definition files shall carry the metadata: "Approved" (APP), to identify the approver who is responsible for the project on behalf of TfL.  The Approver authorises (by accepting / rejecting) the CAD files submitted for publishing for the suitability (see paragraph 3.5.2) indicated at each "major version" revision.  The Lead Design Engineer (LDE) or Design Manager (DM) responsible for the project must check the design is of sufficient quality and meets the design intent, before placing their signature in the "APP" box.


**3.8        Model File (External Reference) Requirements**

3.8.1      Model files (excluding Composite Models) shall contain a single design option only.

3.8.2      All model files (including Composite Models) shall be given a title to identify the contents, captured as file metadata, and must be saved in the respective "M2" or "M3" model file folder accordingly.

3.8.3      Spatial data, contained within a model file, shall be associated with one Asset or Classification (see 3.3.5.5).

3.8.4      All graphical elements which represent the physical location of Assets shall be placed in the model file in modelspace at a scale of 1:1, and coordinated to the British National Grid.

3.8.5      The paperspace (layout) area of a model file (M2 or M3) should not contain any model elements.

3.8.6      All model files must be referenced in OVERLAID not Attached (with the exception of OS Base TQ Tiles which should be Attached into one OS Base CAD file) and using RELATIVE file path (the host CAD file must be saved before RELATIVE will be available as an option).

3.8.7      The model files must be correctly geo-referenced and scaled.


**3.9        Drawing Definition Requirements**

3.9.1      Drawings shall be composed through the use of a "Drawing Definition" file, which contains only the relevant annotation, dimensions etc; with all design information attached as external reference files (see Section 4.2 for the recommended drawing structure).

3.9.2      All Drawing Definition files (ie. Plotable Drawings) shall be given a title to identify the contents, captured as file metadata.  This can be captured through the drawing frame title block.

3.9.3   Drawing frame title blocks shall be inserted into paper space of the drawing definition file at a scale of 1:1.

3.9.4   Annotation, dimensioning etc. shall be placed on presentational CAD layers as defined in paragraph 3.4.

3.9.5   Dimensions shall be associative for all and "drawn to scale".


**3.10    Collaborative Working (Common Data Environment)**

3.10.1  The Common Data Environment (CDE) is a means of allowing information to be shared efficiently and accurately between all members of the project team (internally or externally) – whether that information is 2D or 3D.  The CDE enables multidisciplinary design teams to collaborate in a managed environment, where build-up and development of information follows the design and construction sequence.

3.10.2  A CDE approach allows information to be shared between all members of the project team.

3.10.3  The fundamental requirement for producing information through collaborative activity is to share information early, and to trust the information that is being shared as well as the originator of that information.

3.10.4  There are four functional areas of the CDE and "gates" (or sign-off procedures) that allow data / information to be passed between each section as illustrated below:
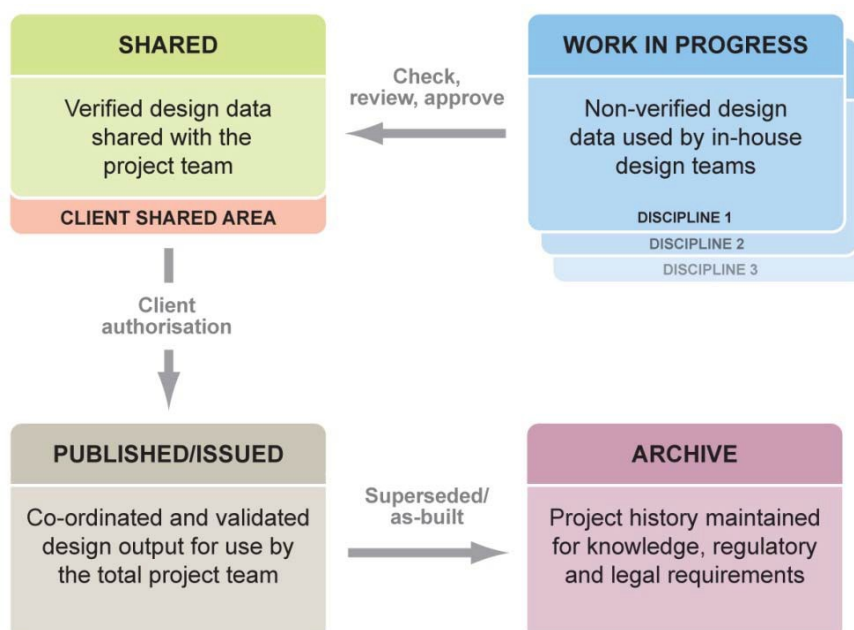


3.10.5  In the absence of an automated electronic document management system (EDMS) or CDE enabling software, the CDE environment will be created through directory folders on the TfL network shared drives to best replicate the CDE structure.

3.10.6  Further advancements will be made in defining the CDE for the whole of TfL as part of an ongoing project within Surface Transport programmed for 2015/16 and beyond.  This is expected to include an EDMS which will facilitate automated file naming, data sharing and the drawing audit process.

### 3.11    Folder Structure: Data Management

3.11.1   Standard Project Folder Structure (top level)

| | |
|---|---|
| 📁  -  **3004101** | [Example Project Folder] |
| 📁   -  Drawings | [CAD/Modeling Data Repository] |
| 📁   + 01-WIP | [Work In Progress (WIP)] |
| 📁   + 02-Shared | [Shared data] |
| 📁   + 03-Published | [Published/Issued data] |
| 📁   + 04-Archived | [Archived Data] |
| 📁   + 05-Incoming | [Incoming CAD Data] |

3.11.2   Project Folder Structure (detail)

| | |
|---|---|
| 📁  -  **Job Folder** | **[Project Folder]** |
| 📁   -   Drawings | [CAD/Modeling Data Repository] |
| 📁   -   **01 WIP** | **[WIP Data Repository]** |
| 📁   + DR | [Drawing Definition/Plotable Drawing] |
| 📁   + EXP | [Export data e.g. gbXML, images] |
| 📁   + M2 | [2D Models & Images (incl. "modified")] |
| 📁   + M3 | [3D Design Models (incl. "modified")] |
| 📁   + PDF | [PDF Drawings (incl. "for review")] |
| 📁   + SK | [Sketch Files] |
| 📁   + VS | [Visualisation Files] |
| 📁   -   **02 Shared** | **[Verified Collaboration Data]** |
| 📁   + CM | [Composite Models] |
| 📁   + DR | [Drawing Definition/Plotable Drawing] |
| 📁   + M2 | [2D Models/Output & Image files] |
| 📁   + M3 | [3D Design Models] |
| 📁   -   **03 Published** | **[Published Data]** |
| 📁   + YYYY-MM-DD_Description | [Issued folder - PDF] |
| 📁   -   **04 Archived** | **[Archived Data Repository]** |
| 📁   + YYYY-MM-DD_Description | [Archive Folder - eTransmit] |
| 📁   -   **05 Incoming** | **[Incoming Data Repository]** |
| 📁   -   Source | [Data originator] |
| 📁   + YYYY-MM-DD_Description | [Incoming folder] |

## 4.0    Drawing Composition & Presentation

### 4.1    Drawing Construction Method

4.1.1   CAD data shall be prepared as "fit for purpose", taking into account the requirements of any recipient software applications, to ensure that error free, accurate data is exchanged (e.g. link to analysis packages or interface with GIS).

4.1.2    It is important to ensure that the CAD file structure makes transfer between different CAD and GIS systems easy, minimising data loss and time taken to incorporate the data into each other's design applications.

4.1.3    Recommendations for dealing with typical interoperability issues and general consistency are presented in the following table:

| Issue | Recommendation |
|---|---|
| Annotation / labeling | Use multi-leader in preference of quick leader for annotation. |
| Data is drawn full size in model space | Scaling and rotating to fit the page layout must be carried out within paper space (ie. 'dview' command), not by rotating the model. |
| Associative Hatching | Where used, a closed polyline must be created around all hatched areas which must be associative.  Otherwise hatched areas may be created without a polyline. |
| Annotative Hatching | Annotative hatching must NOT be used. |
| Circles should not be used as point features | Point objects must only be represented by a block or point feature. |
| Items drawn in paper space are generally not accessible to other applications | Paperspace should only be used for layout information, such as frames, titles, north points, cutlines & cutline text and viewports.  All other objects should be drawn in model space. |
| Managing External References (xrefs) | Additional data such as base mapping that is not part of the main drawing model should be stored in separate drawing models and linked in via reference. |
| Efficient use of models | Layers representing specific types of features (e.g. utilities, drainage, street lighting) should be stored within separate model files. |
| Use of CAD "Line" | Use of CAD "Line" features must be avoided and polylines used in preference of lines. |
| Layers | Layers within the model file are to follow layer naming convention as defined in these standards.  Users should ensure objects reside on the correct layer. |
| Images | To use imagery within GIS applications, it must be provided as separate image files with accompanying geo-referencing information. |
| Coordinate systems | All models are to be created using the British National Coordinate system. |
| Simplify objects | Avoid the use of complicated CAD objects where appropriate. Keep data to point, polyline and closed polygons. |
| Unwanted objects | Ensure all unwanted objects are removed from the model by purging unused layers/levels and blocks / cells. |
| Grouping entities into blocks/cells | Blocks / cells to be constructed in a containing object with data / attributes as appropriate. |
| Smaller models | It is easier to work with multiple smaller models rather than one large model. |
| Duplication | Avoid duplication of objects within CAD. Duplicate objects can be removed through the use of cleaning tools in CAD. |
| Unnamed blocks should be avoided | Unnamed Blocks (created by copying and pasting from and to another CAD file and prefixed by "A$") should not be used.  Blocks should be brought into the model / drawing using the tool palette or the insert command. |

## 4.2    CAD Data File Structure

4.2.1    The standard governing the structure of the CAD data file is illustrated in the diagram below:
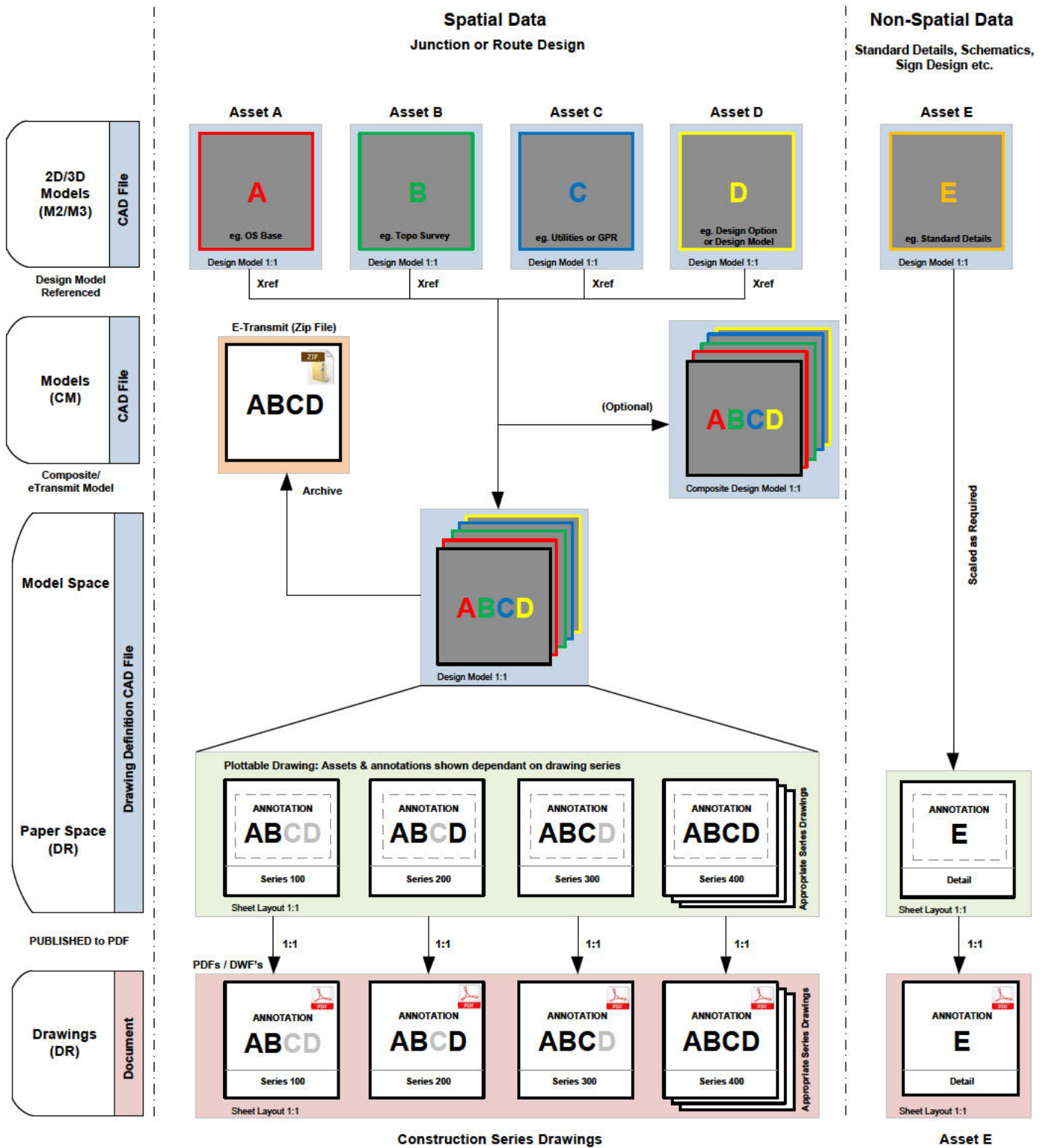
## 5.0　Control of Incoming & Outgoing Data

### 5.1　Data Control

5.1.1　The procedures defined herein aim to achieve the following objectives:

　　a) The current copy is easily identifiable throughout the project.

　　b) A record set of all documentation is retained in its original form to guarantee that the information is viewed as it was intended.

　　c) Referenced information is not accidentally overwritten upon receipt of new and issued documentation.

### 5.2　Incoming Data

5.2.1　A copy of all incoming CAD / Drawing data shall be stored in its original format within the "05-Incoming" project folder.  These folders are to be further subdivided into sub folders named <Originator> then followed by another sub folder named < YYYY-MM-DD_Description >.  Date formats should adopt the  ISO 8601 standard YYYY-MM-DD.

5.2.2　Under NO circumstances should any file be x-referenced directly from the Incoming directory.

5.2.3　Before received data is used in any way, it should be copied back into the WIP folder in the relevant model directory and purged, audited and then renamed (if necessary) in accordance with the standard CAD file naming convention (see paragraph 3.3).

5.2.4　Workflow for incoming data:
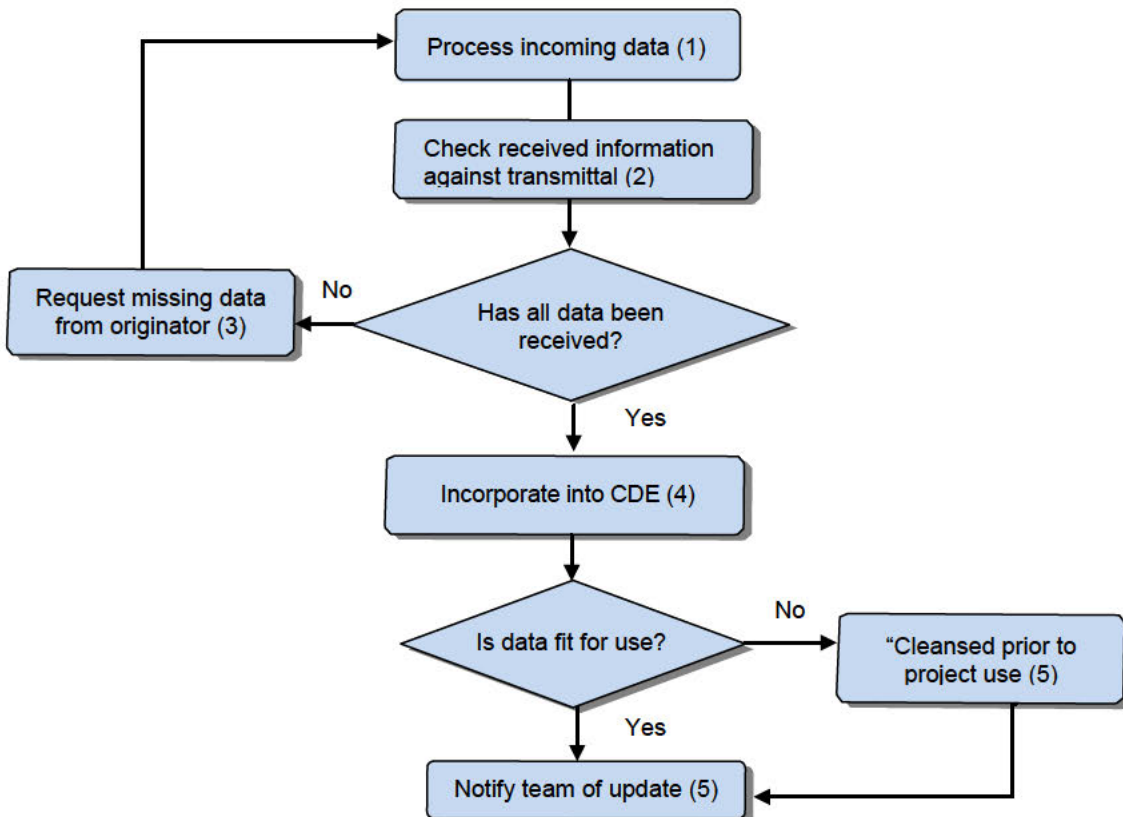
5.2.5    Workflow process explanation for incoming data:

1.  Incoming CAD / drawing data shall be logged in accordance with the project's data / document control management procedures.

2.  Check receipt of data, ensuring the dataset is complete against sender's transmittal.

3.  Where data set received is incomplete, request missing data from the originator.

4.  A copy of all incoming CAD / drawing data shall be stored in its original format within the project "05 INCOMING" folder.  These folders should be further subdivided into sub folders named according to the originator who sent the information, and further divided into dated received sub folders using the date format specified.

5.  The Project CAD Lead / Operator shall verify the suitability of incoming data prior to making the data available project-wide through the project Shared area of the CDE.

6.  Relevant project stakeholders shall be notified of updated incoming data as appropriate.

---

**Notes:**

VIII.    It  is preferable that received CAD data be used "as is" (ie. unmodified), however in certain circumstances data may need to be "cleansed" prior to importing or linking to the CAD model to remove any irrelevant or extraneous data which may destabilise the CAD database.

IX.    Ownership of cleansed data is transferred from the originator to the discipline responsible for cleansing the data.

X.    Cleansed data is stored within the WIP area unless deemed appropriate to share project-wide, in which case it is stored in the Shared area.

XI.    Responsibility for ensuring that cleansed data is current lies with the party making the modifications.

XII.    Modifications of incoming CAD data shall be kept to the absolute minimum and only be carried out where the received data format prevents design progress. Modifications shall only be carried out with the approval of the Lead CAD Draftsperson (LCD).

## 5.3    Outgoing Data

5.3.1    Workflow for Outgoing data:

```
              ┌──────────────────────────┐
              │ Information checked and   │
              │   approved for issue (1)  │
              └──────────────────────────┘
                           │
                           ▼
                      ◇─────────◇
                     CAD Data              dwg
                  (dwg) or Drawing ──────────────────┐
                     Rendition                        │
                      (pdf)?                           │
                      ◇─────────◇                      │
                           │ pdf                       │
                           ▼                           │
              ┌──────────────────────────┐            │
              │  Prepare Rendition (2)    │            │
              └──────────────────────────┘            │
                           │                           ▼
                           ▼               ┌──────────────────────────┐
              ┌──────────────────────────┐ │   Prepare CAD data (3)   │
              │  Record copy stored (4)  │◄│                          │
              └──────────────────────────┘ └──────────────────────────┘
                           │
                           ▼
              ┌──────────────────────────┐
              │  Raise transmittal (5)   │
              └──────────────────────────┘
                           │
                           ▼
┌───────────────────┐ ┌──────────────────────────┐   ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│ Hard copy archive │◄│        Issue (6)         │───  Comply with Document
│       (7)         │ │                          │    Control procedures
└───────────────────┘ └──────────────────────────┘   └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
                           │
                           ▼
              ┌──────────────────────────┐
              │       Archive (8)        │
              └──────────────────────────┘
```
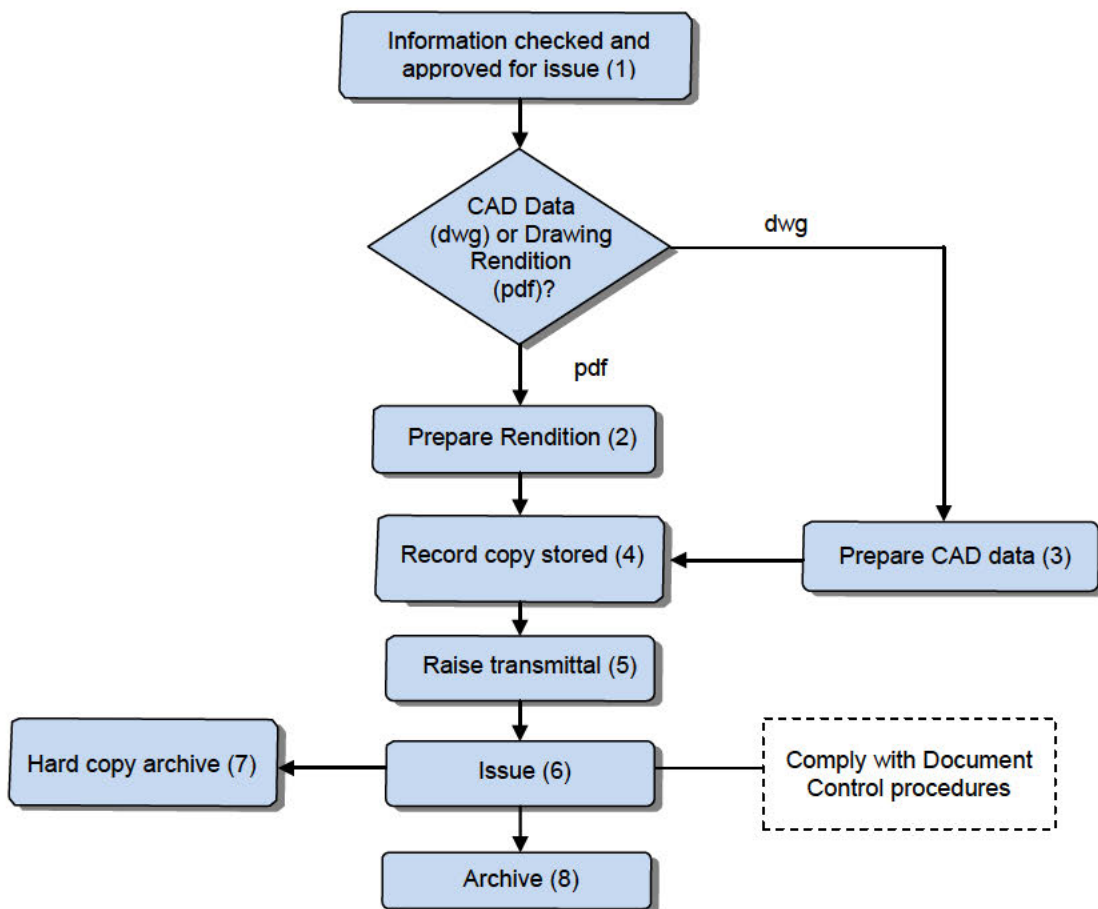
5.3.2    Workflow process explanation for outgoing data:

1) All issued CAD data and drawings shall undergo checking, approval and "sign-off" (see paragraphs 3.7.3, 3.7.4 & 3.7.5).

2) Where the issue is a rendition of a drawing, the file created shall provide a reasonably secure non-editable format that guarantees replication irrespective of the device used to plot it (eg. pdf or .dwf).  In general, an original size rendition of the issued drawing shall be maintained within the CDE as a digital archive record of what has been issued.  In most cases it will be required to retain the issued drawing in its original native CAD file format (eg. via e-transmittal).

3) Where CAD files are issued they shall be checked to ensure that:

    a)   All necessary references are attached and switched on,

    b)   Any references not required are detached or switched off,

    c)   The main view window clearly shows the full extents of the file,

    d)   File is compressed / audited & purged.

    Drawings retained in their original CAD format shall comprise of the sheet file and all associated model files.  These files should be left in their "as issued" state (i.e. not merged

or bound).  E-transmit tools available within AutoCAD are recommended to collate and store the contents of drawings in their original state.

4) All issued CAD Drawings and data shall be stored in the Published area of the CDE. Specific folder named according to the recipient and further dated sub folders shall be created to store the data. This folder may be further sub divided to differentiate between the rendition and CAD file format of the issued drawing.

5) All issued deliverables shall be accompanied by a Drawing Issue register containing an accurate record of what was issued, to whom, on what date.  Where appropriate, it is recommended that the Drawing Register is attached to the front of the Drawing Renditions (such as when transmitted via pdf) as best practice.

6) Drawings issued via the designated media shall be carried out in accordance with project document control procedures (e.g. CD, DVD, Project Extranet, EDMS).

7) A hard copy of the drawing may be saved in a hard copy archive (optional).

8) Upon completion of a project, all data shall be archived in accordance with TfL Data Management and Archive procedures.

## 6.0    References

| Document no. | Title |
|---|---|
| BS 1192:2007 | Collaborative Production of Architectural, Engineering, and Construction information – Code of Practice |
| PAS 1192-2 2013 | Specification for information management for the capital / delivery phase of construction projects using building information modeling. |
| PAS 1192-3 2014 | Specification for information management for the operational phase of assets using building information modeling. |
| BS 1192-4 2014 | Collaborative Production of Information Part 4: Fulfilling employer's information exchange requirements using COBie – Code of Practice. |
| BS 8888 | Technical product specification – Specification. |
| BS EN ISO 128-20 | Technical drawings – General principles of presentation Part 20: Basic conventions for lines. |
| BS EN ISO 5455 | Technical drawings – Scales. |
| BS EN ISO 3098-5 | CAD lettering of the Latin alphabet, numerals and marks. |
| BS EN ISO 12006-2 | Unified Classification for the construction industry (Uniclass). |
| BS EN ISO 5457 | Sizes and layout of drawing sheets. |

## 7.0    Definitions

| Term | Definition |
|---|---|
| Asset Class | Classification of TfL Surface Assets, in relation to construction information detailed. |
| CAD (Computer Aided Design) File | Electronic file produced by a CAD application (such as AutoCAD or MicroStation).  Examples of CAD files include Drawing Definitions and Model  Files. |
| Classification | Systematic arrangement of design and construction activities and assets, including construction elements, systems and products. |
| Common Data Environment (CDE) | A designated environment with a defined process used to manage all relevant information amongst parties.  A CDE may comprise of one or more systems  supporting a consistent collaborative approach. |
| Composite Model | Computer Aided Design (CAD) file that contains one or more Model Files, as references, for the purpose of spatial coordination; there is no "live" geometry within the file. It may form part of a Drawing Definition. |
| CPIC | Construction Project Information Committee. |
| CTB | Color dependent plot style tables which use an object's color to determine characteristics such as lineweight. Every object of the same colour in a drawing is plotted the same way. |
| Data | Set of digital values stored, but not yet interpreted or analysed (un-processed), in a form that is convenient to move or process. Data is generally represented in a structured and often tabulated form (rows and columns). Note:  "Raw Data" is a relative term and therefore not used. |
| DMRB | Design Manual for Roads and Bridges. |

| Term | Definition |
|------|------------|
| Document | Information recorded for a specific purpose, providing a means to communicate a briefing, design, construction, operation, maintenance or decommissioning of an asset. This includes, but is not limited to, correspondence, Drawing Renditions, schedules, specifications, calculations, spreadsheets.<br><br>Note: Documentation must either be in an immutable format or incorporate a means of controlling changes. |
| DE | Design Engineer (TfL job role). |
| DM | Design Manager (TfL job role). |
| Drawing Definition | Or Plotable Drawing (ie. paperspace layout or sheet drawing) – A file created solely for the purpose of creating a Drawing Rendition. Content is built from a composite of referenced models for the specific purpose, viewed at a scale within a presentation title frame. Includes paperspace layouts through which model information is presented or plotted.<br><br>The graphical content of the drawing definition is contained in other CAD files (e.g. Model Files and/or Composite Models) which are externally Referenced (XREF) into the Drawing Definition. Only annotation and dimensions are kept "live" within the Drawing Definition file. |
| Drawing Register | An electronic (or hard copy) file which tracks the formal issue of controlled drawings. |
| Drawing Rendition | An electronic file, in an immutable format such as .pdf, derived from a Drawing Definition or Plotable Drawing at a specific version and status. Drawing Renditions are key deliverables at the end of a supplier contractual obligation. |
| Drawing Sheet | CAD file containing the graphics of a blank drawing border and title block, of predefined paper sizes. Used as a reference by all Drawing Definitions or Plotable Drawings. |
| DWG | Proprietary AutoCAD Drawing file format. |
| EDMS | Electronic Document Management System. |
| External Reference (Xref) | An Autodesk AutoCAD term meaning a CAD file attached to another CAD file such that all or part of its graphical content is visible but not editable in the file to which it is attached. |
| Information | Data which has been interpreted and processed (such as formatting and printing) to take on meaning in some context for its intended receiver. |
| Layer | A means in which to segment or group data within a drawing. Synonymous with the layer functionality in the AutoCAD DWG format. |
| LCD | Lead CAD Draftsperson (TfL job role). |
| LDE | Lead Design Engineer (TfL job role). |
| MPD | Master Projects Database. |
| Metadata | "Data about the data". Metadata describes the content, quality, condition, and other characteristics of data. Information is held in attributed data stored in Plotable Drawings (within the title block) & Model files (within an attributed block stamp). Example of the types of metadata include: type of document, author, date created, purpose etc. |

| Term | Definition |
|---|---|
| Model File | A 2D or 3D spatially coordinated representation of the physical characteristics (may also include functional characteristics) of the design produced at a scale of 1:1 and developed through a process of co-ordination, review and approval with interfacing project teams.  It may be referenced into a Composite Model and / or Drawing Definition.<br><br>Note: Models are key deliverables at the end of a supplier contractual obligation. |
| Model Rendition | Electronic file, in an immutable a format such as .pdf, which is derived from a Model  File or Composite Model. |
| OD | Outcomes Delivery (TfL department within  Road Space Management) |
| ODE | Outcomes Design Engineering (TfL team within outcomes Delivery). |
| PC3 | A plotter configuration file which contains all the settings required for the plotter to function. |
| Plotable Drawing | Similar definition as "Drawing Definition" - A CAD file including paperspace layouts through which drawing / model information is presented or plotted. |
| Printed Drawing | Static, hard-copy document, derived from a Drawing Definition (as an exact copy) or Drawing Rendition. |
| Profile | An Autodesk AutoCAD term meaning a file that contains a preset working environment with basic support paths and search parameters. |
| Project | A unique set of co-ordinated activities, with definite starting and finishing points, undertaken by an individual or organisation to meet specific objectives within defined schedule, cost and performance parameters. |
| RSM | Road Space Management (RSM); TfL Directorate within Surface Transport. |
| Status | Defines the suitability of information. |
| Spatial Data | Geometry aligned to the physical location of an asset, to a specified grid system. |
| TfL | Transport for London. |

# RSM CAD File Naming Convention

**The rules governing the composition of the CAD file naming are summarised below:**

- Names assigned to CAD files and layers within the CAD file shall be created by joining together codes in the specified fields, in the specified order, using only the "–" hyphen character.
- Hyphens should otherwise not be used elsewhere in the filename structure.
- Underscores should only be used to separate words used as part of the optional descriptive text (see Filenaming Example 2 below)
- Codes shall be selected from one of two sources; project codes or standard field codes.
- Codes shall not imply meaning that may be duplicated in other fields.
- All characters shall be uppercase.
- The ODE CAD Team can provide assistance in the generation of new codes as required.

**CAD file names shall be composed by joining the fields shown in the tables below:**

| Project | | Owner / Originator | | Asset / Classification | | Location | | Type | | Organisational Role | | Option | | Number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 - 8 characters | | 3 characters | | 3 characters | | 2 characters | | 2 characters | | 2 characters | | 2 digits | | 4 digits |

**Project**

| Project Number |
|---|
| ie. 3004101 |

or for non-project work:

| TFLCORE |
|---|

**Owner / Originator**

| Code | Description |
|---|---|
| RSM | Road Space Management (TfL) |
| CVU | CVU |
| CWA | Conway AECOM |
| EMH | EM Highways |
| RWJ | Ringway Jacobs |
| ACM | AECOM |
| AMU | AMU Surveying |
| DWS | David Webb Surveys |
| ECH | EC Harris |
| ELS | E.L.S Land Consultants |
| FSN | 40Seven |
| HYD | Hyder Consulting |
| JCB | Jacobs |
| JKG | JK Guest |
| KYZ | KYZ Land Surveys |
| MSN | Masons |
| PJC | Project Centre |
| PSL | Premier Surveys Limited |
| SBS | Subscan |
| SHS | Sunhill Surveying |
| SVS | Survey Solutions |
| TNG | Technics Group |
| TSM | 3 Sixty Measurement |
| TSS | 360 Surveys |

**Asset / Classification**

| Type | Code | Description | DMRB Series |
|---|---|---|---|
| FEASIBILITY / PRELIMINARY DESIGN | COL | Collision Data | 0000 |
| | EXG | Existing Layout | |
| | LEV | Existing Levels, Contours & Chainages | |
| | OSD | Ordnance Survey Data | |
| | TOP | Topographical Survey | |
| | FEA | Feasibility Design | 0100 |
| | COP | Consultation Plan | |
| | PRD | Preliminary Design | |
| | TMP | Traffic Management Plan | |
| DETAIL DESIGN | LON | Longitudinal Sections | |
| | SET | Setting Out & Levels | |
| | XSE | Cross Sections | |
| | SCL | Site Clearance | 0200 |
| | FEG | Fencing & Gates | 0300 |
| | STF | Street Furniture | 0400 |
| | DRN | Drainage | 0500 |
| | EAR | Earthworks | 0600 |
| | CAR | Carriageway Resurfacing | 0700 |
| | KFP | Kerbs, Footways & Paved Areas | 1100 |
| | TSL | Traffic Signs & Road Markings | 1200 |
| | STL | Street Lighting & Ducting | 1300 |
| | TRS | Traffic Signals & Ducting Layout | 1400 |
| | STR | Structures | 1700 |
| | GRE | Green Estate | 3000 |
| MISC | BOU | Geographic Boundaries | MISC |
| | CPZ | Controlled Parking Zones | |
| | LOC | Location / Key Plan | |
| | SPA | Swept Path Analysis | |

**Location**

| Code | Inner Boroughs |
|---|---|
| 00 | City of London |
| 01 | City of Westminster |
| 02 | Camden |
| 03 | Islington |
| 04 | Hackney |
| 05 | Tower Hamlets |
| 06 | Greenwich |
| 07 | Lewisham |
| 08 | Southwark |
| 09 | Lambeth |
| 10 | Wandsworth |
| 11 | Hammersmith and Fulham |
| 12 | Kensington and Chelsea |

| Code | Multiple Boroughs |
|---|---|
| ZZ | Multiple Boroughs |
| XX | No Boroughs |

| Code | Outer Boroughs |
|---|---|
| 13 | Waltham Forest |
| 14 | Redbridge |
| 15 | Havering |
| 16 | Barking and Dagenham |
| 17 | Newham |
| 18 | Bexley |
| 19 | Bromley |
| 20 | Croydon |
| 21 | Sutton |
| 22 | Merton |
| 23 | Kingston upon Thames |
| 24 | Richmond upon Thames |
| 25 | Hounslow |
| 26 | Hillingdon |
| 27 | Ealing |
| 28 | Brent |
| 29 | Harrow |
| 30 | Barnet |
| 31 | Haringey |
| 32 | Enfield |

**Type**

| Code | Description |
|---|---|
| DE | Detail File / Dwg |
| DR | Drawing Definition |
| SK | Sketch |
| M2 | 2D Model |
| M3 | 3D Model |
| CM | Composite Model |
| VS | Visualisation |

**Organisational Role**

| Code | Description |
|---|---|
| AN | Acoustics and Noise |
| AR | Architect |
| BS | Building Surveyor |
| CE | Civil Engineer |
| DH | Drainage, Highways Engineer |
| EL | Electrical Engineer |
| EN | Environmentalist |
| FM | Facilities Manager |
| GE | Geotechnical Engineer |
| GL | Geographical and Land Surveyor |
| HV | Heating and Ventilation Designer |
| ID | Interior Designer |
| KC | Client |
| LA | Landscape Architect |
| LE | Lighting Engineer |
| ME | Mechanical Engineer |
| PH | Public Health Engineer |
| PM | Project Management |
| QS | Quantity Surveyor |
| ST | Structural Engineer |
| TC | Town and Country Planner |
| TE | **Traffic Engineer** |
| TM | Transport Modelling |
| UD | **Urban Designer** |
| WC | Contractor |
| XS | Subcontractor |
| YD | **Specialist Designer** |
| ZZ | **General (non-disciplinary)** |

**Option**

| Option |
|---|
| ie. 01 |
| Sequential |

**Number**

| Layout Number |
|---|
| ie. 0001 |
| Sequential |

**Filenaming Example 1 (Drawing Definition ie. with framed title block):** 3004101-RSM-PRD-05-DR-TE-01-0001

**Filenaming Example 2 (2D Model):** 3004101-RSM-PRD-05-M2-TE-(OPTIONAL_TEXT_MAX_20_CHARACTERS)

(The codes highlighted in green in the tables above show the composition of the Filename Example 1)