



Anneuxre 1

Technical Assurnace Plan and Master Document List

MASTER DOCUMENT LIST

Document Ref.	Document Issue	Assurance Documentation Title	Assurance Gate					Responsibility for Document Production	Comments	
			AiP	AoD	AfT	AoA	CoC			
		Inspection & Test Reports (SAT)				Y		Contractor		
		Installation Certificates				Y		Contractor		
		Operation & Maintenance Manual				Y		Contractor		
		Health and Safety File				Y		Contractor		
		Construction Compliance Certificate				Y		Contractor		
		Handback Checklist and Certificate				Y		Contractor		
		Check Certificates				Y		Contractor		
		If no AfO gate - Confirmation of completed training and licensing				n/a		n/a		
		If no AfO gate - Confirmation of completed procedure updates				n/a		N/a		
		Stakeholder consultation comments sheets				Y		Delivery Manager		
Closure of Change		Planned CAP Date for CoC:								
		Final as-built drawings and documents					Y	contractor		
		Certificate of Final Completion					Y	contractor		
		Closed out Snagging List					Y	contractor		
		Fault Free Running Log					n/a	N/a		



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Integrated Management System

Fencing Refurbishment Programme

Technical Assurance Plan

2014 – 017

Template Information

Template Reference	DLR-IMS-SAMS-TMP-00006
Corresponding Business Critical Process	BCP-03 Joint Change Assurance Framework BCP-12 Assurance of Signalling Asset Changes BCP-14 Assurance of Non-Signalling Asset Changes
To be completed by	Delivery Manager in conjunction with the Designated Competent Person.
Notes	<p>This template has been developed as a generic template for all asset changes.</p> <p>The template should be completed in a way that is appropriate to the size and risk of the change.</p> <p>As a minimum, this Plan will be reviewed prior to each CAP Assurance Gate, to confirm that the content remains valid and acceptable.</p> <p>If the scope of the change is varied, then this plan is to be updated accordingly.</p>



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1. Introduction

1.1. Scope

The scope of this document is to describe the technical assurance arrangements for the change and the associated roles and responsibilities.

1.2. Definitions & Abbreviations

AiP	Acceptance in Principle
AoD	Approval of Design
Afl	Acceptance for Implementation
AfT	Acceptance for Test
AoA	Acceptance of Asset
BCP	Business Critical Process
CAP	Change Assurance Panel
CDM	Construction (Design & Management) Regulations
CAM	Change Assurance Manager
DCP	Designated Competent Person
DLRL	Docklands Light Railway Limited
LDCP	Lead Designated Competent Person
TAP	Technical Assurance Plan

2. Assurance Arrangements

2.1. Roles & Responsibilities

The following personnel have responsibilities as part of the assurance of this change:



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2.5. Additional Assurance Plans

The following assurance plans will be produced, in addition to this plan:

Work Package	Assurance Plan Title

Table 6: Assurance plans

2.6. Interface Management

This change interfaces with the following changes:

Change Title	Change Number
N/A	N/A

Table 7: Interfaces With Other Changes

This change will affect the following operational asset(s):

Assets	Location	Action/Affect on Asset(s)
Existing boundary fence line	LAP behind platform 1,	5m of 3m high 358 mesh installed
Existing boundary fence line	POP depot side of Radio cabin/mast, 40m of new fencing	40m of 3m high 358 mesh installed
Existing boundary fence line	CRO to MUD Down Road	155m of 3m high 358 mesh installed
Existing boundary fence line	LAP to DER Up Road	33m of 3m high 358 mesh installed
Existing boundary fence line	CAT to WST Down Road	300m of 3m high prison
Property demarcation line	LIM ARCH London end of LIS substation	40m of new 2.4 palisade installed

Table 8: Affected Asset(s)

2.7. Design Reviews

The assigned category of design checks is:



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Work Package	Category of Design Check
All works	1

Table 9: Design Check Categories

2.8. Special Assurance Arrangements

N/A

3. Reference Documents

BCP-03 DLR Joint Change Assurance Framework
BCP-14 Assurance of Non-signalling Asset Changes
BCP-02 Assurance of Maintenance Changes



Anneuxre 2

Pre-Construction Health and Safety Information



Health & Safety Pre-Construction Information

Project: Fenceline Renewals – 2014.017-2

Rev: 1

	Issue	Advisory Notes	Location
1	General	This table notes H & S issues required to be addressed and the location of the preconstruction information provided or otherwise available for the Works.	
2	Working on the Railway Manual	The WoRM is available in soft copy and details the procedures that apply to all staff & contractors engaged to carry out works on Docklands Light Railway.	DLR DORIS
3	Project Background & Description	<p>This project continues the work commenced under the Network Fenceline projects ref 365, 2011.089 and 2014-017-1.</p> <p>23 No new sites have been identified for replacement with new 3m high green steel mesh fencing. The principal locations are:</p> <ol style="list-style-type: none"> 1. North Route - Pudding Mill Lane to Langdon Park – 8 sites - 1360m length 2. Stratford International Route – 1 site – Stratford High Street – 35m. 3. East Route – Gallions Reach to Beckton – 700m and Beckton Depot – 1200m 4. London City Airport Route – Canning Town & Dock Road – 2 sites – 160m. 5. Central & South Route – Poplar & Crossharbour – 195m. 	DLR project records.
4	Existing Records and Plans	The most up to date record information is the DLR online GIS survey as recorded on the asset plans. Examples are included in the appendix. Legacy drawings of all areas can be provided on request.	Document Controller
5	Land Ownership Information	Estate plans for all sites are available showing land owned by DLR. Other information such as access rights will need to be raised and agreed with the DLR project manager.	DLR Property



		<ul style="list-style-type: none"> • Instructions for calling Fire/Ambulance services 	
11	Site Rules and Restrictions	<ul style="list-style-type: none"> • All operatives working must have demonstrated full competence in the jobs they are undertaking. • Ensure a suitable and sufficient site induction for the works at the commencement of every shift. • Strictly no smoking on site. Drug and alcohol tests to be operated. • Hard hats mandatory unless a written assessment under the Head Protection Regulations exists. 	
12	Welfare and Storage	<ul style="list-style-type: none"> • Meet the requirements of HSE Guidance doc C/S 59. 	HSE website
13	Other Works Adjacent to Site	<ul style="list-style-type: none"> • Possession coordination meetings occur every Thursday. Ensure that a representative attends unless agreed otherwise with the DLR PM.. • Advise all neighbours of intended activity. 	DLR PM
14	Continuing Liaison	<ul style="list-style-type: none"> • Regular co-ordination meetings with representatives of DLR will be required. • Agree and submit a schedule of regular meetings with agendae 	
15	Existing Services	<ul style="list-style-type: none"> • Known services are shown on the site plans. Record information has been researched as far as possible however the accuracy of existing drawings is not guaranteed and care in excavation must be taken on site. 	
16	Significant design and construction hazards	<ul style="list-style-type: none"> • Prepare a hazard log and Risk Assessment following the site walk. • Access to site – difficult, particularly North Route • Japanese knot weed previously found on North Route – must be professionally cleared if sighted. • Harmful materials – potential for materials in soil. • Live services – review latest utility information + site tests • Dust, noise, vibration – controls to be implemented • Working adjacent to signal & comms cables – ensure temporary works controls 	
17	Asbestos	<ul style="list-style-type: none"> • No definitive information re asbestos is available for structures prior to 2000. There are a limited number of area specific surveys from previous projects and any relating to this site are included in the works information. • A potential source of asbestos on this project is in soil arisings. Where asbestos is suspected by the Contractor work should be suspended and the appropriate intrusive survey undertaken. 	Works Information
18	Existing Structures	<ul style="list-style-type: none"> • Inspection reports on all structures are available. 	DLR
19	H&S FILE Content and Format	<ul style="list-style-type: none"> • Completion documentation to be BIM compliant and appropriate to the works. • As-built drgs to be DGN - Bentley V8i (SS2) applications, plus native format if not Bentley. • O & M Manuals in PDF plus hard copy where requested. 	DLR CAD guidance



	<p>20 APPENDICES</p>	<ul style="list-style-type: none"> • Example of Asset Plan. 	
		<ul style="list-style-type: none"> • Drawing List - tbc 	



Annexure 3

BIM Protocol



Engineering Standard

Mandatory

DLR BIM Standard

Reference: DLR-PRJ-NBIM-0910-STA-001

Issue: 0.2

Issue date: 10th April 2014

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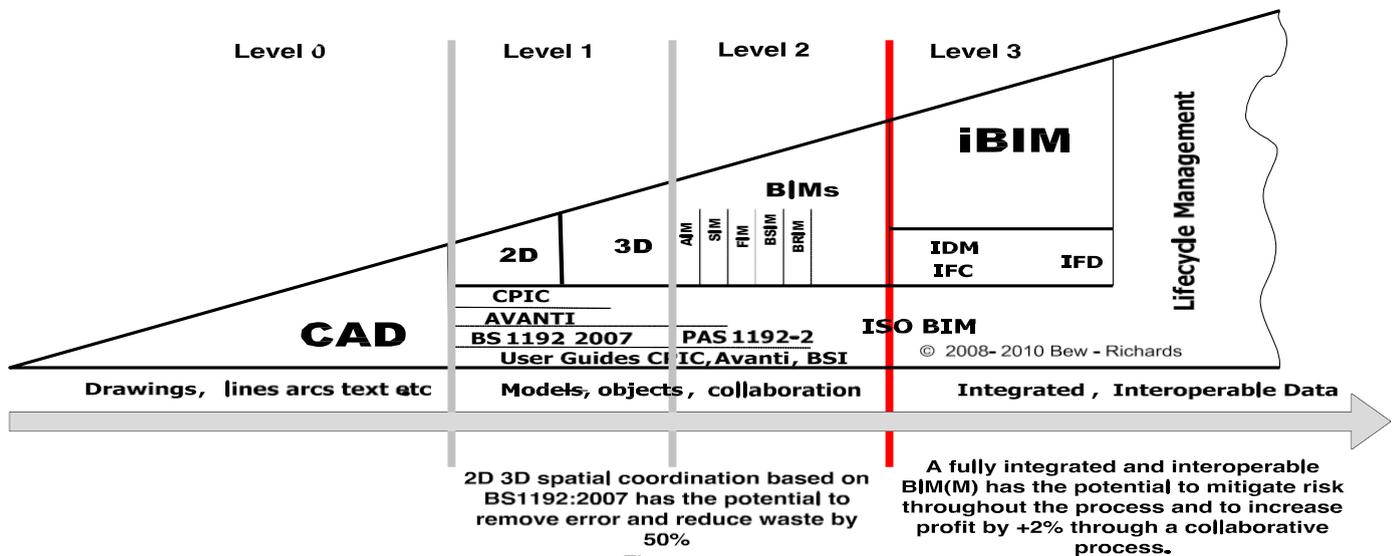
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Please Note: This document is available on request from the DLRL Document Manager.

2 Purpose

The process of building information management (BIM) generates Information Models and their associated information that are used throughout the lifecycle of building/infrastructure facilities or assets. The information delivery cycle is shown in Figure 1, below.



Docklands Light Railway

The guidance within this Standard builds on the existing code of practice for the collaborative production of architectural, engineering and construction information, defined within BS 1192:2007. This Standard focuses specifically on project delivery, where the majority of graphical data, non-graphical data and documents, known collectively as the Project Information Model (PIM), are accumulated from design and construction activities.

Commencing at the project brief and progressively working through the various stages of the information delivery cycle, the guidance within this document culminates with the delivery of the “as-built” Asset Information Model (AIM). This is handed over to the employer once the PIM has been verified against what has been constructed.

3 Scope and Application

The intended audience of this document includes organisations and individuals responsible for the procurement, design, construction, delivery, operation and maintenance of buildings (vertical), civil (ground covering) and infrastructure (linear) assets. Where possible, generic language has been used, but where necessary, specific definitions are provided in Section 12 of this document, Terms Definitions and Abbreviations.

4 Responsibilities

4.1 General information

- 4.1.1 At the induction meeting as many of the information management roles shall be identified and confirmed as possible. This may be done through a stage-based deliverables matrix and this shall be revisited during successive project stages as specialists and supply chain members join the delivery team.
- 4.1.2 The roles and responsibilities of individual team members shall be defined, as shall the schedule of responsibilities for deliverables of the overall team, bearing in mind that a person may deliver multiple roles.
- 4.1.3 The roles shall not be confused with the titles of the managers, which may differ from organization to organization, but the important factors are the ownership, responsibility and authority.
- 4.1.4 At the start of a project, roles shall be assigned and recorded and all contact information shall be listed against each role.
- 4.1.5 Roles and responsibilities shall be defined as appropriate per-project and per-task team.

NOTE All the roles defined in this Standard, and their respective responsibilities and authorities, are stated only in connection with information management. Other arrangements may be put in place for other aspects of the overall project.

4.2 Employer's Representative

The Employer's Representative has the delegated authority on behalf of the Employer. In certain situations there may be more than one Employer's Representative depending on the complexities of the project.

4.2.1 Responsibilities

- 4.2.1.1 Confirmation of key decision points.
- 4.2.1.2 Authorisation of information as contractual documentation.
- 4.2.1.3 Definition of information requirements.

4.3 Project Delivery Manager

This role shall be the keystone for timely delivery and the output at each of the information exchanges and key decision points.

4.3.1 Responsibilities

- 4.3.1.1 Provide assurance to the employer that the agreed information exchanges have the ability to be delivered against the agreed programme, such that delays and ambiguity do not creep into the programme.
- 4.3.1.2 Initial and on-going confirmation of suppliers' capability to deliver the information requirements.
- 4.3.1.3 Preparation and revision of the MIDP and constituent parts.
- 4.3.1.4 Initiate a project induction meeting to confirm resource capability, to identify training needs, to collaborate to develop the MIDP with reference to the team members MIDIs.
- 4.3.1.5 Make sure that all individuals working on the project know which role(s) they are providing and to whom they are responsible.

4.4 Project Information Manager

The Project Information Manager shall be responsible to the Project Delivery Manager. On a small project these may be the same individual.

4.4.1 Responsibilities

- 4.4.1.1 Provide the focal point for all information modeling issues in the project.
- 4.4.1.2 Ensure that the constituent parts of the Project Information Model is compliant with MIDP.
- 4.4.1.3 Ensuring that the constituent parts of the Project Information Model have been approved and authorised as “suitable for purpose” before sharing and before issuing for approval.

4.5 Lead Designer

The Lead Design shall be responsible for the coordinated delivery of all design information. In small and medium-size projects the Lead Designer may be combined with the Project Delivery Manager.

4.5.1 Responsibilities

- 4.5.1.1 Manage the design, including information development and approvals.
- 4.5.1.2 Confirm the design deliverables of the design team, establishes the zone strategy
- 4.5.1.3 (BS 1192:2007) and ownership.
- 4.5.1.4 Establish the structural grid and floor levels.

4.6 Task Team Manager

A Task Team Manager is often discipline-based, so is usually a discipline head, but tasks can also be work-package based, or time-based (particularly where the project involves multiple phases). All those providing this role shall be responsible to Lead Designer.

4.6.1 Responsibilities

- 4.6.1.1 Production of design output that facilitates the production of such elements of the design that relate to that task.

4.7 Task Information Manager

A Task Information Manager shall be appointed for each task and be responsible to the Task Team Manager when Work In Progress information is being prepared and responsible to the Lead Designer when Shared information is being prepared.

4.7.1 Responsibilities

- 4.7.1.1 Ensure that task information is produced using the agreed standards and methods.
- 4.7.1.2 Ensure that task information is delivered using the agreed project IT systems.

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4.8 Interface Manager

An Interface Manager shall be appointed for each task and be responsible to the Task Team Manager and to the Lead Designer. In a spatial sense, if more space is required – for example, the staircase – the staircase interface manager will have to discuss the need for increasing the staircase area, and negotiate with the interface manager(s) for each of the floors served by the staircase to discuss the impact of making further space available.

4.8.1 Responsibilities

- 4.8.1.1 Negotiation on behalf of the task team in relation to design coordination and/or space allocation.

4.9 Originators

Originators of project information shall be responsible to their respective Task Team Managers.

4.9.1 Responsibilities

- 4.9.1.1 Developing the constituent parts of the information model for their respective tasks.
- 4.9.1.2 Production of design output that facilitates the production of such elements of the design that relate to that task.

5 Information Delivery Requirements – Assessment

5.1 General

- 5.1.1 Information required by the employer shall be standardized wherever possible, but shall be consistent with the requirements set out in the project brief.
- 5.1.2 Information requirements shall be specific, measureable, achievable, realistic and time-bound against, for example the CIC Scope of Services, to enable suppliers to determine the most effective and efficient method of delivery.
- 5.1.3 Information requirements shall be documented in the Employer’s Information Requirements (EIR).
- 5.1.4 The EIR shall be incorporated into the tender documentation, to enable suppliers to produce their initial Supply Chain Information Execution Plan (SCIEP) upon which their proposed approach, capability and capacity can be evaluated.
- 5.1.5 The Employer, or the Employer’s Representative, shall be responsible for ensuring that information requirements are included in project contracts in such a way as to avoid duplication of responsibilities.

5.2 Production of the Employer’s Information Requirements (EIR)

- 5.2.1 The EIR shall include the following contents, as a minimum:
- 5.2.2 A schedule of the standards and guidance documents used to define the BIM
- 5.2.3 Processes and protocols to be used on the project;
- 5.2.4 A schedule of any software formats, including version numbers, that shall be used by the supply chain to deliver the project;
- 5.2.5 A schedule of any changes to the standard roles, responsibilities, authorities and competences set out in PAS 1192-2;
- 5.2.6 A description of how the standard information exchanges relate to the employer’s existing project process;
- 5.2.7 A definition of any co-ordinate origin/system (3 dimensions) that the employer requires to be used to place graphical models, for example Ordnance Survey locators;
- 5.2.8 A schedule of any specific information to be either excluded or included from information models; and
- 5.2.9 A schedule of any particular constraints set by the employer on the size of model files, the size of extranet uploads or emails, or the file formats that can define the size of a “zone”

6 General Compliance Requirements

Unless specifically authorised by DLRL, at all times organisations and individuals responsible for the procurement, design, construction, delivery, operation and maintenance of buildings (vertical), civil (ground covering) and infrastructure (linear) assets on the DLR shall comply with the requirements of BS1192 and BS1192 Part 2.

All organisations and individuals responsible for the procurement, design, construction, delivery, operation and maintenance of buildings (vertical), civil (ground covering) and infrastructure (linear) assets on the DLR are subject to audit for compliance with this Standard by DLRL.

7 Information Delivery Requirements – Procurement

7.1 General

7.1.1 The supplier shall submit a partial SCIEP, within their tender submission, sufficient to demonstrate their proposed approach, capability, capacity and competence to meet the EIR.

7.1.2 The SCIEP shall enable the employer to determine if the requirements within the EIR are achievable, allowing for adjustment or negotiation of the supply chain's capabilities if necessary.

7.1.3 Post award, the final version of the SCIEP shall be submitted to the employer confirming the supply chain's capabilities and the Master Information Delivery Plan, and signed by directors from all organizations within the supply chain – see 5.2.2 and Figure 6.

7.1.4 The SCIEP shall be submitted by the supplier to the employer on behalf of the whole supply chain and will include a summary of their capabilities and responsibilities.

7.2 Production of the Supply Chain Information Execution Plan (SCIEP)

7.2.1 The contents of the partial SCIEP shall consist of everything requested in the EIR plus the following information:

7.2.2 The Project Implementation Plan.

7.2.3 Project goals for collaboration and information modeling;

7.2.4 Major project milestones consistent with the project programme; and

7.2.5 Project Information Model deliverable strategy (for example the CIC Scopes).

NOTE An example partial template for the preparation of the SCIEP is shown in Annex C.

7.2.1 The final version of the SCIEP, submitted to the employer post-contract, shall consist of everything requested in the EIR plus the following information:

7.2.2 Revised Project Implementation Plan confirming the capability of the supply chain

7.2.3 Agreed project goals for collaboration and information modeling;

7.2.4 Agreed matrix of responsibilities across the supply chain – see Annex B for an example;

7.2.5 Roles, responsibilities and authorities;

7.2.6 Major project milestones consistent with the project programme;

7.2.7 Project Information Model deliverable strategy (for example the CIC Scopes);

7.2.8 Project Information Model origin and orientation;

7.2.9 Survey strategy including the use of point clouds;

7.2.10 Existing legacy data use;

7.2.11 File naming convention;

7.2.12 Layer naming convention, where used;

7.2.13 Drawing sheet templates;

7.2.14 Annotation, dimensions, abbreviations and symbols;

7.2.15 Approval of information;

7.2.16 Project Information Model authorization process;

7.2.17 Software versions;

7.2.18 Exchange formats;

7.2.19 Project collaboration and EDMS;

7.2.20 Task Team Information Delivery Index;

7.2.21 Master Information Delivery Plan; and

7.2.22 Agreed construction tolerances for all disciplines.

7.3 Project Implementation Plan

7.3.1 General.

The Project Implementation Plan (PIP) shall be submitted by each organisation bidding for a project as part of the initial SCIEP.

NOTE! The purpose of a PIP is to help an employer assess the capability, competence and experience of individual organizations bidding for a project.

- 7.3.1.1 The PIP shall include the Supply Chain Capability Summary Form, incorporating:
- 7.3.1.2 The Supplier Building Information Management Assessment Form(s);
- 7.3.1.3 The Supplier Information Technology Assessment Form(s); and
- 7.3.1.4 The Supplier Resource Assessment Form(s);

NOTE 1 Templates of the documents listed in this section are included in the Construction Project Information Exchange (CPIx) Protocol, available via the CPI website – www.cpic.org.uk.

NOTE 2 Alternatively, project teams can submit their response online using CPIx Online (<http://www.cpic.org.uk/en/cpix-on-line-tools>). The CPIx Protocol Guide and Toolkit is a set of guidance notes, forms and checklists to help employers and their project teams develop a Construction Project Information eXchange (CPIx) Protocol for their projects.

NOTE 3 Use of the Supply Chain Capability Summary Form means that a supplier does not need to submit assessment forms from each supply chain organization.

7.4 Supplier Building Information Management (BIM) Assessment Form

7.4.1 General.

The Supplier BIM Assessment Form shall be completed by all organizations within the supply chain, so as to demonstrate their competence in and understanding of building information management and provide a comparable document by which to assess their capability.

- 7.4.1.1 The Supplier BIM Assessment Form shall comprise the following sections:
- 7.4.1.2 Gateway Questions – a set of key questions about willingness to exchange data and the quality of that data (an extract from a template is shown on CPIx Online);
- 7.4.1.3 Building Information Management Analysis – an opportunity for each organization to demonstrate its understanding of each of the analysis methods that could be used on the project;
- 7.4.1.4 Building Information Management Project Experience – an opportunity for each organization to highlight up to three projects where the benefits of building information management have been realised; and
- 7.4.1.5 Building Information Management Capability Questionnaire – a set of questions to help the project team to identify training, coaching and support requirements.

7.5 Supplier Information Technology (IT) Assessment Form

7.5.1 General.

Completed by all organizations within the supply chain, usually in conjunction with the organisation's IT department, the Supplier IT Assessment Form shall enable organizations to demonstrate their information exchange capability and IT maturity, and provide a meaningful method of assessing differences and similarities with the project IT systems.

- 7.5.1.1 The Supplier IT Assessment Form shall comprise of the following sections:
- 7.5.1.2 General Information and Company Policies on Information Exchange – intended to show what electronic data and information the company is willing to exchange (an extract from a template is shown on CPIx Online);
- 7.5.1.3 Technical Information on Software and Systems – intended to enable the company to give the project team confidence that IT Systems and procedures are mature and robust.
- 7.5.1.4 5.5.3 Problems of levels of interoperability shall be reviewed and resolved, and the solution to each problem entered into the SCIEP.

7.6 Supplier Resource Assessment Form

The Supplier Resource Assessment Form shall be used to assess an organisation's current resource capability and capacity. The form shall be completed by all organizations within the Delivery Team.

7.7 Supply Chain Capability Summary Form

The Supply Chain Capability Summary Form shall be used to facilitate rapid comparison of the information within the Team IT and Resource Assessment Forms provided by each organisation (an extract from a template is shown in CPIx Online)

8 Information Delivery Requirements – Contract Award

8.1 General

Suppliers shall ensure that information delivered by their supply chain is to a standard consistent with the contract (the employer information exchanges), and shall deliver information to their supply chain partners at pre-defined points during the project (the supply chain information exchanges).

8.2 Production of the Master Information Delivery Plan (MIDP)

8.2.1 Following contract award, the Project Delivery Manager (PDM) shall initiate a project induction meeting to confirm resource capability, to identify training and education needs, and to collaborate to develop the MIDP with reference to the team member's MIDIs.

8.2.2 The MIDP shall be used by the PDM to manage the delivery of information during the project.

8.2.3 The MIDP shall be managed via change control.

8.3 Master Information Delivery Index (MIDI)

8.3.1 Each task team manager shall compile his own MIDI, with its milestones. These shall be used to convey the responsibility for delivery of each supplier's information.

8.3.2 Milestones within each MIDI shall be aligned with the design and construction programmes to produce the MIDP.

8.3.3 For each deliverable, the MIDIs shall be used to indicate the team member responsible or to note that such responsibility has yet to be allocated.

8.3.4 The MIDIs shall be used to show how responsibility for the preparation of project documents transfers from one team member to another.

8.3.5 The MIDIs shall be used to take account of the required sequence of model preparation for any work packages used in the project.

8.3.6 The MIDI will be part of the SCIEP.

NOTE 1 A template for the preparation of the MIDI is shown in Annex A.

NOTE 3 A template for the preparation of a Responsibility Matrix is shown in Annex B.

8.4 Third Party Capability Assessment Form

8.4.1 The Third Party Capability Assessment Form shall be issued by the Project Delivery Manager to all third parties on the project, such as property agents and lawyers, for completion and reviewed for inclusion in the MIDP.

8.4.2 If employers can ensure that their project team produces information that can be read and processed easily by these third parties this will help with fast moving activities such as letting negotiations and due diligence.

NOTE 2 This form is for use where third parties' requirements and capabilities have not been already included in the project briefing stage and the EIR.

9 Information Delivery Requirements – Mobilisation

9.1 General

9.1.1 The agreed MIDP, and any subsequent changes, shall be communicated to all members of the Project Delivery Team.

9.1.2 The software, IT Systems and Infrastructure, including the Common Data Environment, identified within the MIDP shall be procured, implemented and tested as appropriate

9.1.3 The training and education needs of all members of the Project Delivery Team who are involved in the production, analysis and review of the PIM shall be assessed and appropriate action taken

9.1.4 The Project Information Model (PIM) shall be progressively developed and delivered to the employer through a series of information exchanges as defined within, for example, the CIC Scope of Services, at key points to coincide with the employer's decision-making processes.

9.1.5 The PIM shall be developed in accordance with the MIDP.

9.1.6 The PIM shall consist of graphical data and non-graphical data documents as defined in the MIDP.

9.1.7 Data delivery will include some, any or all of the following data entities, native (product-proprietary) file formats, COBie-UK-2012 and pdf to enable a complete level 2 project.

9.1.8 To ensure the data fidelity (maturity) is appropriate for each data exchange a process of delivery management is defined in 8.2. Further information is available on structures in the COBie-UK-2012 definitions available on the task force website.

9.2 Common Data Environment

9.2.1 General

The Common Data Environment (CDE) described in BS 1192:2007 and *Building Information Management: a framework and guide to BS 1192* (Richards, 2010) remains the core of the delivery process.

NOTE 1 The CDE is a means of providing a collaborative environment for sharing work and can be implemented through a document and data management system, an extranet, or the use of Windows Explorer. For the development of various forms of collaboration within organizations and across project teams refer to BS 11000-1 and -2.

NOTE 2 The information delivery cycle has two distinct points of entry, but they both lead to Gate 6. For stand-alone new-build projects, start at the top right box "Client shared area/Employers Information Requirements", as there is no legacy data from an existing asset. But for projects that are part of a larger portfolio or estate, or for projects working on existing buildings and structures, then the starting point will be with the existing Asset Information Model. An assessment will need to be made as to the need for a new build, rebuild, refurbishment or to demolish.

9.2.2 Functional Sections of the CDE

NOTE There are DLR "gates", or sign-off procedures, that allow data/information to pass between the sections. The naming of the gates is significant. See DLRL BCP-14 and BCP-03

9.2.3 The WORK IN PROGRESS section of the CDE shall hold unapproved information for each organizational role. It concludes with the Approval Gate ("1" in Figure 12) which represents the transition to SHARED, where the information is checked, reviewed and approved by the lead designer.

9.2.4 The SHARED section of the CDE shall hold approved information for sharing with other organizations for a defined purpose. It concludes with the Authorized Gate ("2" in Figure 12) which represents the transition to PUBLISHED DOCUMENTATION, where the information is authorized by the Employer's Representative.

9.2.5 The PUBLISHED DOCUMENTATION section of the CDE shall hold published information. It concludes with the Verified Gate ("3" in Figure 12), which represents the transition to ARCHIVE, where the information is re-measured and verified as part of the handover process.

NOTE "Archive" is a record of all progress as each project milestone is met and holds a record of all transaction and change orders to provide an audit trail in the event of a dispute.

9.2.6 In addition, an additional WORK IN PROGRESS section of the CDE shall be used to hold unapproved information for the specialist contractors and designers. It shall also conclude with the Approved Gate ("4" in Figure 12) which represents the transition to SHARED where the information is checked, reviewed and approved by the main contractor and the designers who have responsibility for ensuring compliance to the design.

NOTE The work processes in this activity replicate the status, revision and versions as for the professional design activities. There will be additional status for information that is issued to the fabrication or manufacturing workshops or directly to CNC machines.

9.2.7 There is a disciplined requirement to have a “change of ownership” procedure for the layers and objects that specialist sub-contractors introduce to replace the original designers’ intent such that the resulting graphical models can be used for fabrication, manufacture and installation. This change of ownership shall be fully understood. In the Project Information Model only the objects representing those elements or products that will actually be constructed by the specialist sub- contractors shall be included. The objects representing design intent shall not appear here but they shall appear in the project archive.

9.2.8 The Accepted Gate shall be used for information to be verified and validated when it is delivered as an Asset Information Model for use in operation of the facility.

NOTE This process may be iterative if the sign-off process finds that the requirements for the data drop have not been met.

9.3 Status Codes in the CDE

The specialist contractors and designers shall use the same processes and status as for the professional design development and coordination procedures.

NOTE 1 The specialist contractor and construction process status codes are shown in Table 1. NOTE 2 Additional codes have been introduced to allow for the delivery of the PIM and AIM plus the manufacturing models or documentation sign-off process.

NOTE 2 Status codes are provided by information originators to define how information may be used during different phases of the CDE. The SHARED suitability codes are stated as “Fit for...” but this does not infer any contractual or insurable purpose. Their purpose is to limit the reuse of the information at that stage. See also BS 1192 and Richards, 2010.

Table 1 – Status codes in the Common Data Environment

Status	Description	Graphical Data	Non-Graphical Data	Documents
Work in Progress				
S0	Initial status or WIP Master document index of file identifiers uploaded into the extranet.	√	√	√
Shared (Non-Contractual)				
S1	Fit for Co-ordination The file is available to be „shared“ and used by other disciplines as a background for their information.	√	X	X
S2	Fit for Information	X	√	√
S3	Fit for Internal Review & Comment	As required	√	√
S4	Fit for Construction Approval	X	X	√
S5	Fit for Manufacture	√	√	√
S6	Fit for PIM Authorization (Information Exchanges 1-3)	√	√	√
S7	Fit for AIM Authorization (Information Exchange 4)	√	√	√
D1	Fit for Costing	√	√	√
D2	Fit for Tender	X	√	√
D3	Fit for Contractor Design	√	√	√
D4	Fit for Manufacture/Procurement	X	√	√
AM	As Maintained	√	√	X
Published Documentation (Contractual)				
A	Fit for Construction	X	√	√
B	Partially signed-off: For Construction 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 resubmitted for full authorization.	X	√	√
AB	As-Built Handover documentation, PDF, native models, COBie etc.	√	√	√

NOTE 1 Additional codes S6 and S7 are highlighted.

10 File and Layer Naming Conventions

10.1 General

File and layer naming conventions shall be extended from those defined in BS 1192:2007.

10.2 File Naming

The standard file types to be used in naming files shall be extended to include file type “CR” for a clash rendition, and file type “IE” for information exchange files which would include COBie-UK-2012.

For example:

SH-CA-00-LG1-CR-A-00001

“SH” is the project location

“CA” is the two-character code for the originator

“00” indicates that the file covers more than one zone

“LG1” indicates the file relates to the Lower Ground floor level 1 “CR” indicates the file is a clash rendition

“A” indicates the discipline that created the drawing is an architect

“00001” is the unique number when concatenated with “file type” and “discipline”

SH-CA-00-LG1-IE-A-00001

“SH” is the project location

“CA” is the two-character code for the originator

“00” indicates that the file covers more than one zone

“LG1” indicates the file relates to the Lower Ground floor level 1

“IE” indicates the file is an information exchange, for example COBie

“A” indicates the discipline that created the drawing is an architect

“00001” is the unique number when concatenated with “file type” and “discipline”

10.2.1 The standard file types for drawings and models and for documents are shown in Annex D.

10.2.2 Any additional file types required for a particular project shall be defined and agreed at the start of the project and registered in the EIR and SCIEP.

10.2.3 All other aspects of file naming shall be as defined in BS 1192:2007 and as explained in section 6.1 of Richards (2010).

10.3 Layer Naming

The standard presentation codes for layers shall be extended from the existing list of single-

character codes listed in BS 1192:2007 to the two-character codes given Annex D.

NOTE The presentation codes for layers showing items above and beyond the cut plane can be used to assist compliance with BS 8541-2:2011.

10.4 Spatial Co-ordination

10.4.1 Each Task Team shall take ownership of their own WIP information and model(s) and check and review these with their Task Team Manager before issuing the information and model(s) to the SHARED part of the CDE.

10.4.2 If a clash is detected which cannot be resolved by the Task Team Interface Management then the Lead Designer shall be involved in the discussion to reach agreement and make the necessary changes to the models.

10.4.3 Once the Lead Designer is satisfied that clashes have been resolved and the COBie-UK-2012 files have been completed then they shall request a full set of SHARED information for Employer's Representative sign-off.

NOTE If separate COBie-UK-2012 files have been produced by each Task Team then these shall be co-ordinated prior to forwarding to the employer.

10.4.4 The employer or the Employer's Representative (who may be the Lead Designer or the Supplier) shall sign-off the information set and request publication.

10.4.5 Each Task Team Manager shall change the status of their team's signed-off information, update the revision and issue the information and model(s) to the PUBLISHED part of the CDE.

10.4.6 Revision numbering and version control shall be kept in step between any model and its related information, whenever either the model or the information is changed.

10.4.7 Specialist design, manufacturing and fabrication models shall be reviewed for clashes in the same way as described in Figures 13 to 16.

10.4.8 Clash checking shall be carried out during design, with particular focus on hard clashes and construction tolerances.

10.4.9 Clash checking shall be carried out during specialist design and development of the virtual construction model, with particular focus on soft clashes (for example, positioning of insulation around ductwork and pipe work) and proximity checks (for example, the placement of oxygen and other gases or flammable substances in hospitals).

NOTE Checks can also be made for health and safety issues (for example trip hazards from low-level pipe work and reach hazards relating to positioning of equipment such as valves)

10.4.10 Clash checking shall continue during the construction process as the models are updated with as-constructed information and checked against the construction tolerances specified in the contract. This shall culminate in the check against the point cloud survey at handover.

10.4.11 Defects or deviation or construction out of tolerance shall be measured and the models updated within a time agreed across the project (e.g. 24 or 48 hours) so that impact on following trades can be checked and appropriate decisions can be taken

NOTE 1 For example, if foundations have been cast too high or too low then changes may be required to the structural steel

frame before frame elements are fabricated to avoid site re-work and delays.

NOTE 2 If the actual construction is within tolerance then no report needs to be made to update the model.

10.5 Zones

10.5.1 On medium to large projects the project models shall be subdivided so that the amount of graphical and other information incorporated in each model file remains manageable.

10.5.2 Due note shall also be taken of estimated file size at all stages of the project: files will inevitably grow during the design and manufacturing process.

10.5.3 Zones allow multiple users to work on the project at any one time.

10.5.4 All members of the design team shall agree zones as fully as possible at the start of a project and publish them as a shared document. This document shall be reviewed at successive project stages and amended and re-published as necessary.

NOTE 1 See also "Building Information Management – a framework and Guide to BS 1192" for a set of examples.

NOTE 2 Individual design team members may require differing zones for their individual needs. A zone may be based on important aspects of design, such as structure or cores, on specialized functions such as HVAC (Heating, Ventilating and Air Conditioning) systems or on strategic elements such as cladding. Different sets of zones do not have to relate to the same areas or volumes of the project. See Figure 9 for a tunnel design example.

NOTE 3 Zones are not drawing areas, and do not relate to the amount of the project shown on any given drawing.

NOTE 4 Zones are the responsibility of the design team managers, not the CAD operators.

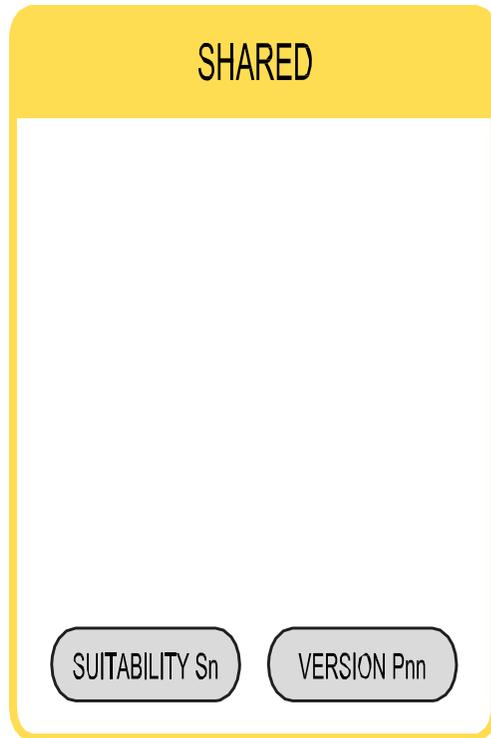
10.5.5 If a project is divided into a number of zones for modeling purposes, then COBie-UK-2012 files shall be issued from each discipline zone-specific model file at each employer information exchange and shall be combined into a single co-ordinated COBie-UK-2012 deliverable for the whole project, unless specified in the EIR.

10.5.6 An example of zones for spatial coordination in a tunnel design is shown in Figure 2, below. Zones are organised by discipline around the periphery of the tunnel (e. g. catenaries zone, evacuation walkway and emergency access way, etc.)





Figure 3 – Architect’s issue to Shared



- 1. Check model for stage completeness, dimensional accuracy and against modelling standards
- 2. Change model suitability to S1 (Fit for coordination) and set major revision
- 3. Publish clash rendition
- 4. Check information exchange (COBie) and documentation for stage completeness
- 5. Change information exchange and documentation suitability to S2 (Fit for information) and set major revision
- 6. Approve all design deliverables to be shared for selected suitability

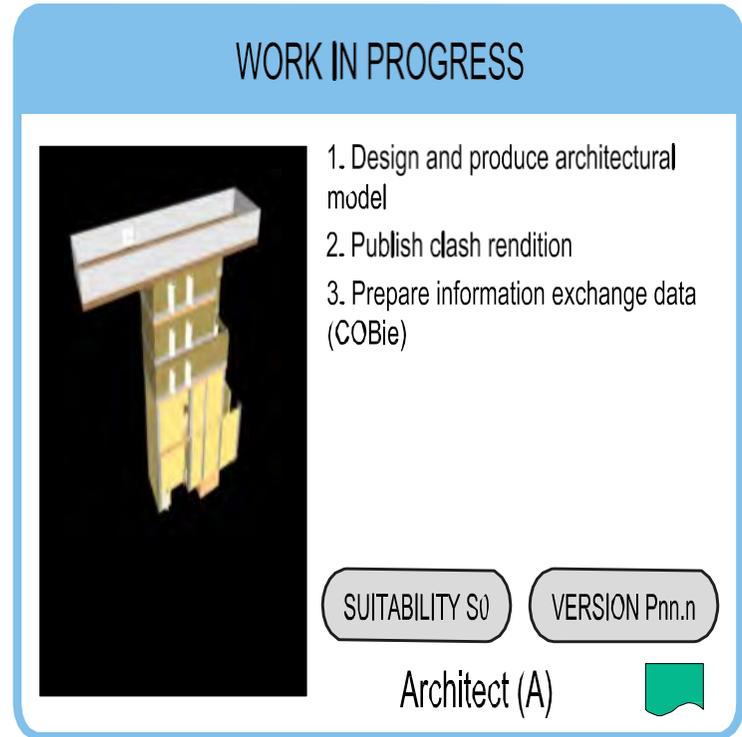




Figure 4 – Structural Engineer’s issue to Shared

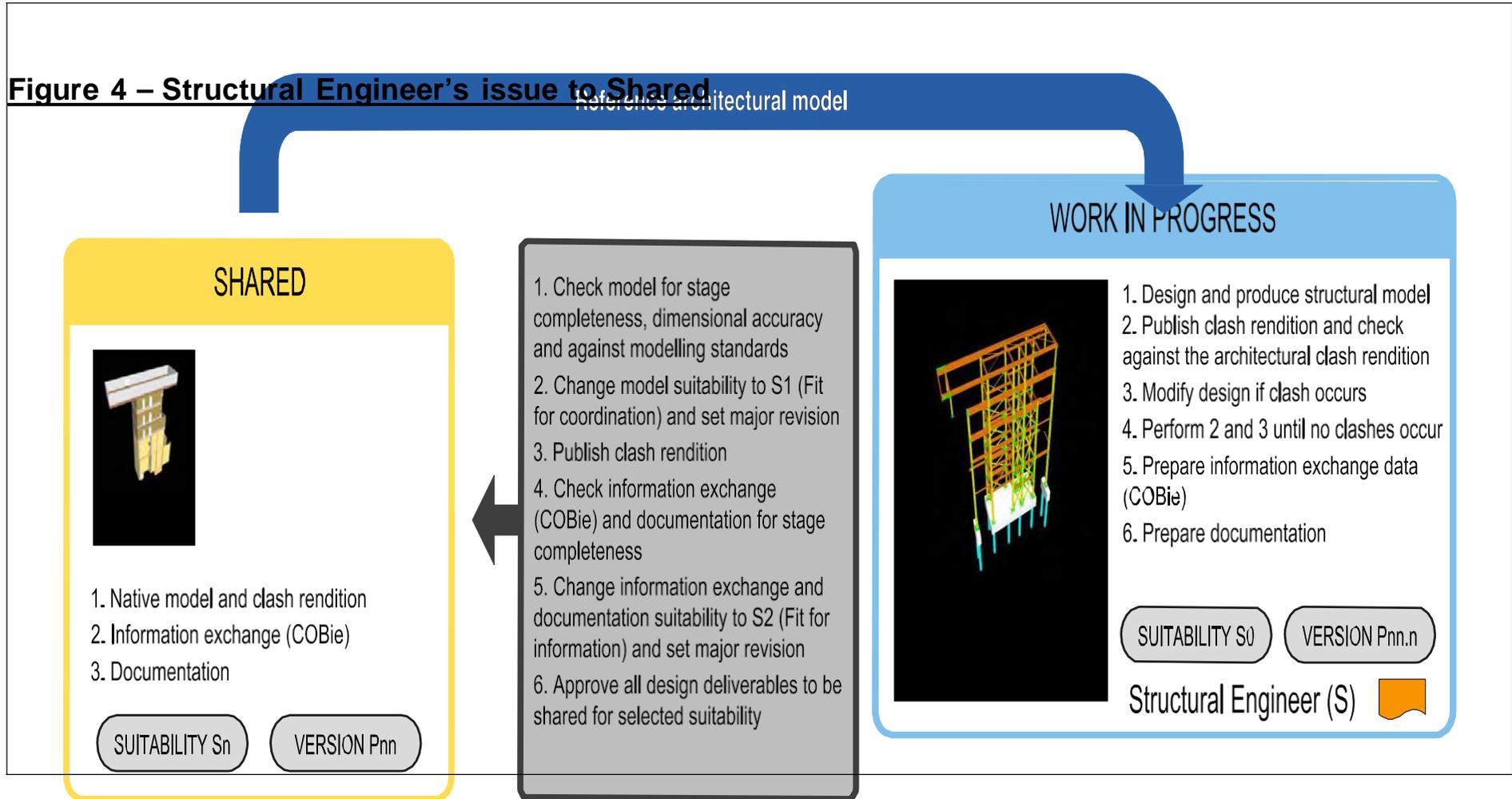




Figure 5 – MEP Engineer’s issue to Shared

Reference architectural and structural models

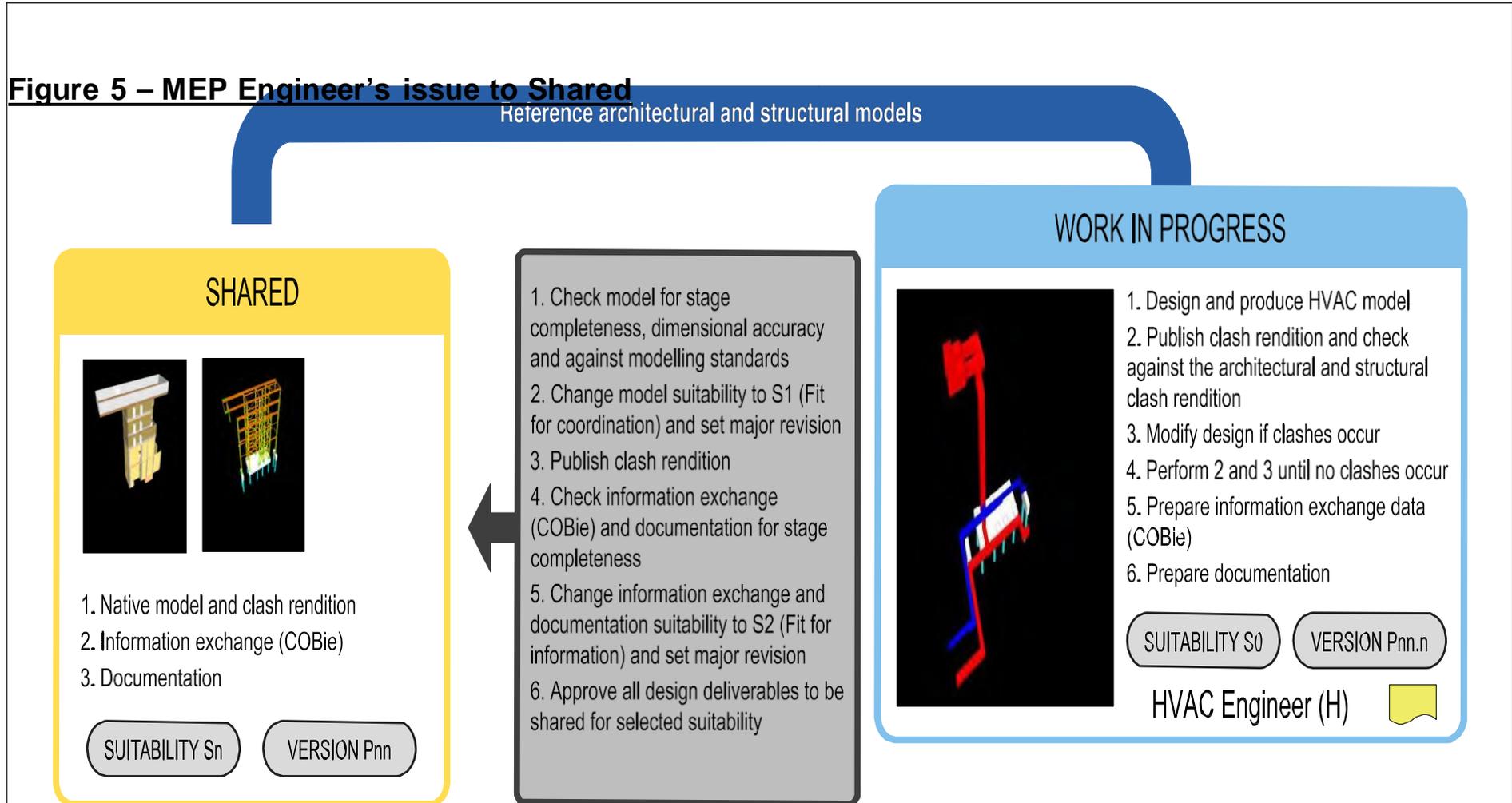
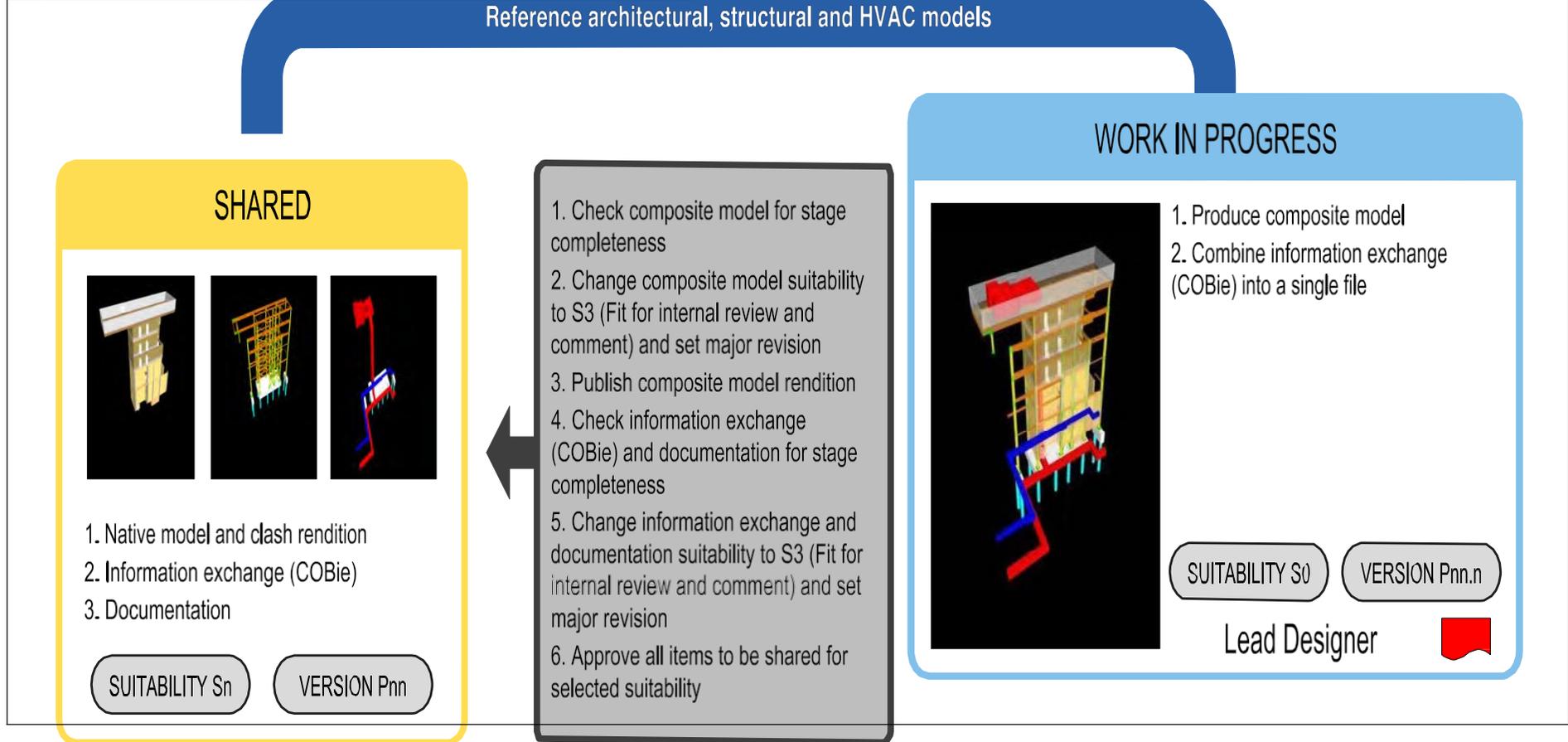




Figure 6 – Design review of models in Shared



NOTE 1 The individual Shared models may be combined for design review by the Lead Designer. Design decisions or clashes that cannot be resolved by the Interface Managers can then be reviewed and resolved.

NOTE 2 Clash avoidance and detection is a continuous process, but in particular should happen at three stages during design: during design development; during specialist design; and during installation and in the preparation for handover.

10.6 Design for Bespoke Manufacture

When the design requires manufacturing of bespoke products, a placeholder shall be used in the model such that the ZONE (volume) allocation is adequate for final installation, including necessary connections (interfaces) and access for installation, maintenance and replacement.

NOTE 1 This follows a “process engineering” workflow and procedure.

NOTE 2 Use of placeholders for bespoke products allows the design team and the manufacturer to work in parallel and avoid unnecessary updates to the spatially co-ordinated model.

NOTE 3 It is not necessary for the virtual construction model to contain the level of detail required in the manufacturing process of a bespoke product where each and every component making up that product may need to be modelled for manufacturing purposes.

10.7 Levels of Model Definition

10.7.1 General

Levels of model definition shall only provide the minimum level of detail needed by the team or the employer appropriate for each model's purpose, rather than as much detail as the modeling tools can achieve.

NOTE 1 Key to the success of Information Management is clear definition of requirements as defined by the COBie information exchanges.

NOTE 2 It is wasteful for the supply chain to deliver a greater level of detail than is needed.

10.7.2 Each level of model definition shall be defined in terms of the minimum level of graphical and information to be delivered, and the types of data or information to be delivered at each information drop.

10.7.3 The levels of model definition shall be articulated in the SCIEP and need to be fully understood by all relevant members of the project team.

10.7.4 Levels of model definition shall satisfy the EIR;

10.7.5 the scopes of works set out by the CIC Scope of Services, for example, related to the project stages; and

10.7.6 the Uniclass classification tables regarding the relationship of systems, products and elements with the specification and the cost plan.

NOTE The Uniclass tables shall define the progressive maturity of the model from outline, spaces and volumes, to design elements and finally to products. See Table 2 for cross-reference of CIC stages and Uniclass table

10.8 Levels of model definition example (see Figure 7)

10.8.1 Brief

At briefing stage, the graphical model will either not exist (for a new build) or will inherit information from the Asset Information Model (for work on existing buildings and structures).

10.8.2 Concept

At concept design stage the graphical design shall only specify a symbol in 2D to represent a generic element.

NOTE See BS 8541-2.

10.8.3 Developed Design

At developed design stage the object shall be represented in 3D with relevant specification attached.

NOTE See BS 8541-1, BS 8541-3 and BS 8541-4.

10.8.4 Production

At production stage the object shall be a generic representation of the element. The specification properties and attributes from design allow selection of a manufacturer's product, unless the product is nominated, free issue or already selected.

10.8.5 Installation

At installation stage any generic object shall be replaced with the object procured from the manufacturer.

NOTE 1 In the first two stages, the level of detail should at a minimum represent the space allocation for the product's access space for maintenance, installation and replacement space in addition to its operational space, For example, the space required to turn on or turn off valves.

NOTE 2 The selection of the product shall give further detail about flanges and connections so that final positioning of pipework and ductwork can be defined.

NOTE 3 Although minimum levels of graphical detail can be specified at each design stage, care shall be taken that adequate detail is provided to convey design intent and installation requirements. See Churcher, 2009 for an example of the full process relating to building services.

10.8.6 As-constructed

At the as-constructed stage everything about the product shall be known and defined in the handover document and attached to the commissioning and handover documentation. The as-constructed model shall represent the as-constructed project in content and dimensional accuracy.

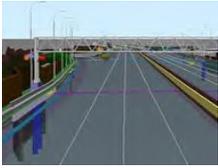
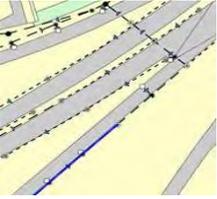
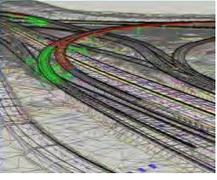
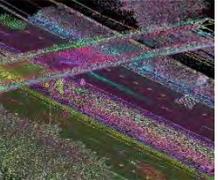
In addition all the manufacturer's maintenance and operation documentation, commissioning records, health and safety requirements, the final COBie information exchange, as-built models in native format and all relevant documentation shall be known.

10.8.7 In use

At the in-use stage, the object's information shall be updated with any supplementary information such as maintenance records or replacement dates, and objects that have been changed or replaced with different equipment shall be updated accordingly.



Figure 7 – Levels of Model Definition for Infrastructure Projects

Model Name	Brief	Concept	Developed Design	Production	Installation	As Constructed	In Use
CIC Stage	1	2	3	4	5	6	7
Systems to be covered	N/A	All	All	All	All	All	All
Graphical illustration (building project)							
Graphical illustration (civil or infrastructure project)							

Docklands Light Railway



Output	Project brief and procurement strategy	Refined project brief and concept approval Design contingency of 20-25%	Approval of co-ordinated developed design Design contingency of 10-15%	Integrated production information Design contingency of 5-10%	Complete fabrication and manufacturing details, system and element verification, operation and maintenance information Design contingency of 2-5%	As constructed systems, operation and maintenance information Building Log Book Information gathered as key elements are completed to feed Installation information for the later packages	Agreed final account In use performance compared against Project Brief Project process feedback: risk, procurement, information management, Soft Landings
Parametric information	Project needs updated: definition of function(s), operation, quality and time. Benchmarking updated: capital cost, maintenance cost, time, health & safety, risk procurement contract Performance requirements: priorities and aspirations for: Function, mix of uses, scale, location, quality, performance in use, cost (Capex & Opex), value, time, health & safety, embodied and in use carbon, energy and resource needs, standard designs. Site constraints: geo spatial, available site information.	Sufficient data to estimate per square meter rates and other similar metrics. Wireframe or surfaces / solids Concepts, site context Placeholder/volume s/ package zones, System routings, Site selection, datum points & levels Integrated concept for the project setting scope, scale, form and primary design criteria: architectural form and spatial arrangements, structural / civil philosophy and spatial arrangements, services philosophy and special arrangements preliminary	Co-ordinated Developed Design for the project setting: generic systems, objects, or assemblies represented with, detailed form, function, cost, defining all components in terms of overall size, typical detail, performance and outline specification, primary geometry frozen, integration of standard designs and systems, builder's work strategy for significant interfaces, energy use, embodied and in use carbon. Maintenance plan.	Production Information for the project: specific systems, objects and assemblies accurate in terms of specification, size, form, function and location. Critical interfaces flagged. Fixing methodology. Confirmed clash free. Detailed production programme sequence. Updated: energy use and embodied and in use carbon, detailed design and construction programme.	Production record for the project: specific systems, objects and assemblies accurate in terms of specification, size, form, function and location with detailing, fabrication, assembly, and installation information. Detailed routing of systems. Fixings and interfaces details to be used. Updated: energy use and embodied and in use carbon, detailed design and construction programme.	Update d: Geometry and installed product information, "as constructed" Accuracy/resolution of information. Commissioned performance for: Opex, energy, and carbon. Detailed maintenance methodology. Snagging actions status.	Revisions for modifications to the facility during its life.

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<p>Critical interfaces and logic</p>	<p>N/A</p>	<p>Environmental control philosophy and special allocations for ventilation; Availability of the site and outline construction methodology assumptions; Services capacity for the site; Permitted working hours on site.</p>	<p>Assumed procurement package performance and spatial boundaries; Other relationships between procurement packages; Assumed design codes regarding dimensional tolerances of related systems; Foundation tolerances for use of off-site modular systems. Assessment of predicted movements (thermal,</p>	<p>Allocated procurement package relationships, performance and special boundaries; Actual dimensional interface requirements; Records of any derogations approved; Actual on-site to off-site interface specifications.</p>	<p>Progressive capture of actual dimensional data for critical interface dimensions. Progressive capture of information for calculating material requirements for follow on packages. Capture of object status for progress reporting and collaborative planning.</p>	<p>As constructed 3D scan. Element performance test results. System commissioning status.</p>	<p>As modified survey data</p>
<p>Construction requirements (examples)</p>	<p>N/A</p>	<p>Crane use zones; Traffic diversions.</p>	<p>Confirmed crane (or other lifting system) zones. Formwork details. Traffic diversion details</p>	<p>Actual crane (or other lifting system) zones and movement sequences. Construction methodology, sequence and movements, critical to how the production design is developed.</p>	<p>Status of construction requirements. Safety briefing information. Construction methodology, sequence and movements, critical to installation. Formwork details including install and removal sequence. Actual</p>	<p>Confirmed status that the construction aids have been removed.</p>	<p>Design of any construction requirements, EG: temporary safety supports or restraint systems if structural defects have been discovered.</p>
<p>Project logistics and off-site activities</p>	<p>Client requirements, EG to avoid impact on other operations</p>	<p>Assumed access and egress points; Potential delivery and lay down zones.</p>	<p>A feasible logistics sequence for the construction sequence; Confirmed modular strategy (volumetric, panelized, hybrid or</p>	<p>Finalized logistics sequences. Details of actual off-site system to be used.</p>	<p>Object status progress recording to initiate demand pull signals for deliveries.</p>	<p>Remote monitoring systems status</p>	<p>Remote monitoring systems status</p>
<p>Project facilities (welfare, IT infrastructure, security etc.), on site and off-site (examples)</p>	<p>Collaboration tools; Data standards</p>	<p>Assumed access and welfare zones; Design team colocation</p>	<p>Confirmed access zones and design team colocation</p>	<p>Finalized, costed plan. Critical lead times confirmed. Off-site manufacturing capacity reserved</p>	<p>Recording status of security critical areas (EG unchecked, sweep in progress, screened and secured)</p>	<p>Security system operational, potentially using model information for lines of sight from cameras, PAVA zone controls etc.</p>	<p>Security system operational. Facilities management systems running on model generated information. Geometry for letting activities accessed</p>

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<p>Notes and associated project documents, based on model information</p>	<p>Management systems for information and decision making Approval policies Performance requirements: priorities and aspirations for: Function, mix of uses, scale, location, quality, performance in use, cost (Capex & Opex), value, time, health & safety, embodied and in use carbon, energy and resource needs, standard designs. Site constraints: geo spatial, available site information.</p>	<p>Technical strategy studies Commissioning philosophy NRM1 capital cost plan NRM3 maintenance cost plan Placeholder/volumes/ package zones, System routings, Site selection, datum points & levels Integrated concept for the project setting scope, scale, form and primary design criteria: architectural form and spatial arrangements, structural / civil philosophy and spatial arrangements, services philosophy and special arrangements preliminary assessment of energy use and embodied/ in-</p>	<p>Provides the basis for Integrated Production Information to be produced on a package basis with limited risk of changes to primary coordination. Room Information sheets, Detailed construction methodology NRM2 and NRM3 cost plans Health and safety risk management Risk management plan terms of overall size, typical detail, performance and outline specification, primary geometry frozen, integration of standard designs and systems, builder's work strategy for significant interfaces, energy use, embodied and</p>	<p>Updated: maintenance plan, risk management plan, detailed construction methodology, NRM2 procurement pricing schedule, NRM3 maintenance cost plan, health and safety risk management plan, risk management plan Critical interfaces flagged. Fixing methodology. Confirmed clash free. Detailed production programme sequence. Updated: energy use and embodied and in use carbon, detailed design and construction programme.</p>	<p>Detailed construction methodology, Updated health and safety risk management plan NRM3 maintenance cost plan with detailing, fabrication, assembly, and installation information. Detailed routing of systems. Fixings and interfaces details to be used. Updated: energy use and embodied and in use carbon, detailed design and construction programme.</p>	<p>Approximate final account Maintenance procurement pricing Remedial works, handover and maintenance programme performance for: Opex, energy, and carbon. Detailed maintenance methodology. Snagging actions status.</p>	<p>N/A (project closed)</p>
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11 Classification

11.1 General

Models, documents, project information, cost information and specifications shall all be organized using a classification system, which shall not be confused with an object naming convention that may contain the classification code.

NOTE A classification system provides a common terminology and structure to which all project documents and information can be related. The use of classification is required in information exchange and in the COBie-UK-2012 templates.

11.1.1 The tables used in the Uniclass Classification system may be superimposed onto project processes used within the construction industry. Table 2 shows the relationship between Uniclass tables and the CIC Scope of Services as an example.

Table 2 – Cross-reference between Uniclass and CIC project stages

Uniclass Number		20	25	30	35	40	45	50	55
CIC Stages		Complexes	Activities	Entities	Spaces	Elements	Systems	Work results	Products
1	Brief								
2	Concept								
3	Developed design								
4	Production								
5	Installation								
6	As constructed								
7	In use								

Key: Dark-shaded boxes indicate Uniclass tables most likely to be used at each project stage, light- shaded boxes indicate Uniclass tables that may be useful at each project stage.

NOTE 1 As the project progresses from Stage 1 to Stage 7 the information required for the project increases in detail. This information is classified according to different tables in Uniclass.

NOTE 2 The cost plan and specification required at appraisal is progressively defined throughout the lifecycle.

NOTE 3 The classification system aids the co-ordination of the levels of elemental cost and the levels of specification to be managed.

NOTE 4 For more information about the origins, operation and use of the Uniclass classifications system, see the CPI website (www.cpic.org.uk)

12 Information Delivery Requirements – Asset Information Model (AIM) Maintenance

12.1 General

Information exchange between contractor and employer or within the supply chain may be achieved using a number of different formats or protocols. COBie-UK-

12.1.1 CoBie-UK-2012 is the recommended format for information exchange. Employers and delivery teams may decide to use one or more alternative formats as defined in the EIR.

12.1.2 COBie-UK-2012 is a data schema for holding and transmitting data to support the delivery and operation of a facility. It is formally defined as a subset of the Industry Foundation Classes, but can also be conveyed using worksheets or relational databases.

NOTE 1 During traditional projects, most of the data required by COBie-UK-2012 is already delivered in unstructured form. COBie-UK-2012 gives the opportunity to input critical data just once, allowing it to be re-used in many outputs, be tested in many ways and be delivered to many applications including facility management and asset management systems.

NOTE 2 For a detailed definition of the COBie-UK-2012 schema, see <<www.bimtaskgroup.org>>.

12.2 Handover process between Capex and Opex

The effective transfer of structured information between the asset lifecycle stages produces significant value. To enable this, formal handover processes shall be as defined in the EIR. This defines the structure, processes and content of information to be exchanged. A more formal process such as Soft Landings (see <http://www.bsria.co.uk/services/design/soft-landings>) may, in some cases, support this. In addition, a Point Cloud survey shall be provided to verify the completeness of the as-constructed model.



13 Terms, Definitions and Abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply;

- 13.1.1 AIM/ Asset Information Model. Maintained information model used to manage, maintain and operate the asset
- 13.1.2 CIC Scope of Services. Multi-disciplinary scope of services published by the Construction Industry Council(CIC) for use by members of the project team on major projects.
- 13.1.3 Classification. Systematic arrangement of headings and sub-headings for aspects of construction work including the nature of assets, construction elements, systems and products
- 13.1.4 COBie-UK-2012. Structured facility information for the commissioning, operation and maintenance of a project often in a neutral spreadsheet format that will be used to supply data to the employer or operator to populate decision-making tools, FM and asset management systems.

NOTE Templates for the preparation of COBie information exchange files can be downloaded from the website: www.bimtaskgroup.org.
- 13.1.5 CDE/Common Data Environment. A single source of information for any given project, used to collect, manage and disseminate all relevant approved project documents for multi-disciplinary teams.
- 13.1.6 Data. Information stored but not yet interpreted or analysed
- 13.1.7 Document. Information for use in the design, construction, operation, maintenance or decommissioning of a construction project, including but not limited to correspondence, drawings, schedules, specifications, calculations, spreadsheets. NOTE! Documents must either be immutable or incorporate a means of controlling changes.
- 13.1.8 Drawing. Static, printed, graphical representation of part or all of a project or asset.
- 13.1.9 EIR/Employer's Information Requirements. Document setting out the information to be delivered by the supplier as part of the project delivery process to the employer.
- 13.1.10 Employer. Individual or organization for which the contract is executed and delivered.
- 13.1.11 Graphical data. Data conveyed using graphical figures.
- 13.1.12 Information. Representation of data in a formal manner suitable for communication, interpretation or processing by human beings or computer applications.
- 13.1.13 Information exchange. Structured collection of information at one of a number of pre-defined stages of a project with defined format and fidelity.

- 13.1.14 Information management. Tasks and procedures applied to inputting, processing and generation activities to ensure accuracy and integrity of information.
- 13.1.15 Information model. The information model comprises three constituent parts: documentation, non- graphical information and graphical information. The model is conveyed using pdf, COBie and native model files.
- 13.1.16 Information modeling. Use of data to provide information through better understanding, by applying logic or mathematical functions to derive new data.
- 13.1.17 Levels of model detail. Description of graphical content of models at each of the stages defined for example in the CIC Scope of Services.
- 13.1.18 Levels of model information. Description of non-graphical content of models at each of the stages defined for example in the CIC Scope of Services.
- 13.1.19 MIDI/Master Information Delivery Index. Federated lists of information deliverables by each task, including format, date and responsibilities.
- 13.1.20 MIDP/Master Information Delivery Plan. Primary plan for when project information is to be prepared, by whom and using what protocols and procedures, incorporating all relevant MIDIs.
- 13.1.21 Non-graphical data. Data conveyed using alphanumeric characters.
- 13.1.22 PIM/Project Information Model. Information model developed during the design and construction phase of a project
- 13.1.23 PIP/Project Implementation Plan. Statement relating to the suppliers' IT and human resources capability to deliver the EIR.
- 13.1.24 Project delivery team. Group of organizations or individuals contracted either directly or indirectly to deliver services or products to the project.
- 13.1.25 SCIEP/Supply Chain Information Execution Plan. Plan prepared by the suppliers to explain how the information modelling aspects of a project will be carried out.
- 13.1.26 Supplier information modelling assessment form. Form conveying the capability and experience of a supplier to carry out information modelling in a collaborative environment.
- 13.1.27 Supplier information technology assessment form. Form conveying the capability and IT resources of a supplier for exchanging information in a collaborative environment.
- 13.1.28 Supply chain capability assessment form. Form summarizing the human resource and IT capability of each organization in a supply chain.

13.1.29 Third party capability assessment form. Form conveying the information management and IT capabilities of non-design, non- construction organizations in a supply chain.

13.1.30 Zone. Manageable spatial subdivision of a project, defined by the project team as a subdivision of the overall project that allows more than one person to work on the project models simultaneously and consistent with the analysis and design process

NOTE 1 Each zone or subdivision is a reference file. When one or more referenced files is viewed, the full floor plan or site plan may be represented. This subdivision also becomes important when using extranets, as it allows the files to be kept to a manageable file size.

NOTE 2 A different definition of “zone” is used in connection with COBie-UK-2012.

14 Supporting Information

14.1 General Information.

The production of co-ordinated information is a task- and time-based process, independent of which procurement route or form of contract is used. For the mutual benefit of all those involved each task must be carried out in a particular order, otherwise known as “collaborative working”. In a collaborative working environment, teams are asked to produce information using standardized processes and agreed standards and methods, to ensure the same form and quality, enabling information to be used and reused without change or interpretation. If an individual, office or team changes the process without agreement, it will hinder collaboration – an individual insisting on “my standard” is not acceptable in a collaborative working environment.

This approach does not require more work, as this information has always been required to be produced. However, true collaborative working requires mutual understanding and trust within the team and a deeper level of standardized process than has previously been experienced, if the information is to be produced and delivered in a consistent timely manner. If tasks are not carried out in a timely manner delays can occur, which in turn gives rise to disputes over who is responsible, and associated additional cost.

Wherever possible, the principles of “Lean” should also be applied to reduce the expenditure of resources for any goal other than the creation of value for the employer. For example, BS 1192:2007 promotes the avoidance of wasteful activities such as:

- waiting and searching for information;
- over-production of information with no defined use;
- over-processing information, simply because the technology can; and
- defects, caused by poor co-ordination which require rework.

However, for the production of information to be truly “Lean”, it is critical to understand its future use. This is achieved by “beginning with the end in mind” and identifying the downstream uses of information, to ensure information can be used and re-used throughout the project and life of the asset. It is to this end that PAS 1192-2 has been

produced.

It is anticipated that this document is of equal value to small practices as well as large multi-nationals. The impact of poor information management and waste is potentially equal on all projects. Where appropriate we have offered some advice as to how the process and methods described here can be implemented in a scalable fashion to suit all organisations.

This information is published as guidance of a general nature and BSI accepts no liability for any use to which it may

14.2 Background and Context of the DLR BIM Standard.

In May 2011, the UK Government published the Construction Strategy aimed at reducing the cost of public sector assets by up to 20% by 2016. The strategy calls “for a profound change in the relationship between public authorities and the construction industry to ensure the Government consistently gets a good deal and the country gets the social and economic infrastructure it needs for the long-term”.

Basic problems exist with procuring public assets, which have been known for over 100 years, but little as yet has been achieved in resolving them. The Construction Strategy defines a number of strategic objectives, which collectively will overcome these problems. In particular, a strategic objective has been set to achieve maturity level 2 BIM on all public sector asset procurement, with equal applicability to private sector building, civil, infrastructure, refurbishment and new-build projects. This will address the problem of information that is inaccurate, incomplete and ambiguous and results in unnecessary additional costs amounting to 20-25%. It was envisaged that the advent of Computer Aided Design solutions had the potential to improve the consistency of information, but at best it has only served to perpetuate the problem.

This additional 20-25% is considered waste and can be eliminated if the standards, processes and procedures outlined in BS 1192:2007 and this document are implemented.

PAS 1192-2 is one of a number of documents published in support of these strategic objectives. These are as follows:

- CIC Scope of Works;
- Information Management;
- COBie-UK-2012, etc.

Additional information can also be found on the BIM Task Group website www.bimtaskgroup.org.

The maturity model setting out the progression from CAD ultimately to level 3 BIM is shown in Figure 1. More detail regarding level 2 is given in **0.3**.

The DLR BIM Standard borrows heavily from and is intended to satisfy the ethos of PAS 1192-2. It has been adapted to align with DLR's BIM methodologies, and as such should be



read in conjunction with;

- DLR BIM Document Control Guidance, DLR-PRJ-NBIM-0910-GDN-00002.
- DLR BIM Document Numbering Guidance, DLR-PRJ-NBIM-0910-GDN-00003.
- DLR BIM CAD Guidance, DLR-PRJ-NBIM-0910-GDN-00004.
- DLR BIM IT Configuration Guidance, DLR-PRJ-NBIM-0910-GDN-00005.
- DLR BIM Design Collaboration Guidance, DLR-PRJ-NBIM-0910-GDN-00006.
- DLR BIM Health & Safety File Guidance, DLR-PRJ-NBIM-0910-GDN-00007.
- DLR BIM Asset Capture Sheet Guidance, DLR-PRJ-NBIM-0910-GDN-00008.

Where conflict or ambiguity is found to exist between the DLR BIM Standard and its Guidance documents the DLRL BIM Manager's ruling will be final.



Annex A (informative)

Table A.1 – Example federated Master Information Document Index

Project	Originator	File identifier				Discipline	Number	Model or drawing title	Delivery milestones				
		Zone	Level	File type					Milestone 1	Milestone 2	Milestone 3	Milestone 4	Etc.
WH	RW	01	LG1	M	M	00001	Lower Ground Floor 1 Plant room and Riser Location						
WH	RW	01	GF	M	M	00001	Ground Floor Plant room And Riser Location						
AW	NG	02	GF	M	E	10001	Electrical Services Containment Layout						
AW	NG	02	G1	M	E	10001	Electrical Services Containment Layout						
AW	NG	03	ZZ	DR	E	10001	Power Distribution & Earth Schematic						
SH	CA	00	LG2	DR	A	00001	1:500 Level LG2 Plan						
SH	CA	00	LG1	DR	A	00001	1:500 Level LG1 Plan						
SH	CA	00	GF	DR	A	00001	1:500 Level G Plan						
SH	CA	00	01	DR	A	00001	1:500 Level 1 Plan						
SH	CA	00	02	DR	A	00001	1:500 Level 2 Plan						
SH	CA	00	03	DR	A	00001	1:500 Level 3 Plan						
AW	AR	12	F1	DR	S	00001	Foundation layout						
AW	AR	14	F1	DR	S	01001	RC Retaining wall, ramp and slab layout						



Annex B (normative) Responsibility matrix

Table B.1 – Responsibility Matrix

Model Authoring	Example Software	Native Format	Exchange Format(s)	1 Brief	2 Concept	3 Developed Design	4 Production	5 Installation	6 As Constructed	7 In Use
Space Planning	Affinity			A	A					
Site, Urban Design Context	Sketch Up			T	T	T				
Site and Existing Buildings	AutoCAD			G	G					
Architectural Model	Revit Architecture			A	A	A	A	A		
Structural Design Model	Revit Structure				S	S	S	S		
HVAC Design Model	Revit MEP				H	H	H	H		
Building Services MEP Design Models										
Lighting Design Model						E	E	E		
Electrical Design Model	Revit MEP					E	E	E		
Hydraulics Design Model	Revit MEP					Y	Y	Y		
Interior Layouts and Design Model						I	I	I		
HVAC Fabrication Model	CAD Duct					X	X	X	X	X
Structural Steel Fabrication Model								X	X	X
Curtain Wall Fabrication Model								X	X	X
Road and Civil Design	1 2D					D	D	D		
Landscaping and External Works	Architerra					L	L	L		

Docklands Light Railway

Annex C (normative) Example partial structure of the SCIEP

C.1 Project information

Table C.1 – Project information

Project Name	
Project Address	
Project Number (Employers Project Number or reference)	
Contract Form	
Project Description (EIR)	May be an additional document, please reference.
Project Brief and CDM requirements	
Project Deliverable (Employer) (see the CPIX Protocol)	May be an additional document, please reference.

C.2 Agreed project goals for collaboration and BIM

The major goals and objectives for the BIM implementation shall be considered and stated in a project strategy document, appended to this document, and the main items shall be listed in the chart below.

Table C.2 – Agreed project goals for collaboration and BIM

Brief	Concept	Scheme	Design	Construct	Handover
Employer Brief		Finalize			
	Design	Finalize			
	Concept Planning	Finalize			
	Cost models	Finalize	Cost estimates	Costs	
	Survey				

C.3 Roles and responsibilities

The roles and responsibilities of the design teams shall be identified at the start of a project. These shall reflect the roles defined in **6.5**.

Annex D (normative)

Standard codes for files and layers

D.1 Standard codes for drawing and model files

Table D.1 – Revised file types for drawings and models

Code	File Type
AF	Animation file (of a model)
CM	Combined model (combined multidiscipline model)
CR	Clash rendition (specific for the clash process)
DR	2D drawing
M2	2D model file
M3	3D model file
MR	Model rendition file for other renditions, e.g. thermal analysis, etc.
VF	Visualization file (of a model)

D.2 Standard codes for document files

Table D.2 – Revised file types for documents

Code	File Type
BQ	Bill of quantities
CM	Comments
CO	Correspondence
CP	Cost plan
DB	Database
FN	File note
HS	Health and safety
IE	Information Exchangefile (e.g. COBie-UK-2012)
MI	Minutes/action notes
MS	Method statement
PP	Presentation
PR	Programme
RD	Room data sheet
RI	Request for information
RP	Report
SA	Schedule of accommodation
SC	Structural calculations
SH	Schedule
SN	Snagging list
SP	Specification
SU	Survey
TQ	Technical query

D.3 Standard codes for layers

Table D.3 – Revised presentation codes for layers

Presentation Code	Description	Line Type
A	Annotation (tags, arrows, etc.)	
D	Dimensions	
H	Hatch	
M	Model related graphics	
M2	2D Model graphics	
M3	3D Model graphics	
MA	Model analysis	
MC	Model cut plane (section/details/plan)	Thick line
MF	Model forward. Items that need to be shown forward of the cut plane	Fine line
MG	Model grids (grids, reference planes, reference lines)	
MH	Hidden lines, items hidden beyond cutting plane (BS 8541-2:2011 item 1.304)	Hidden line
MM	Model mirrored/reflected information (ceilings, ductwork, etc.)	
MN	Model on-visible elements, behind/above cut plane (BS 8541-2:2011 item 1.302)	Dashed dot dot line
MV	Model visible items behind/above the cut plane (BS 8541-2:2011 item 1.301)	Dashed dot line
P	Plot/page related graphics	
T	Text	



15 Standard Approval

Custodian Name	Signature	Date
Martin Collett DLRL Head of Engineering		

16 Technical Content Manager

Custodian Name	Signature	Date
Martin Collett DLRL Head of Engineering		

17 Document History

Rev	Date	Description
0.1	December 2013	Draft; First issue
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End of Document