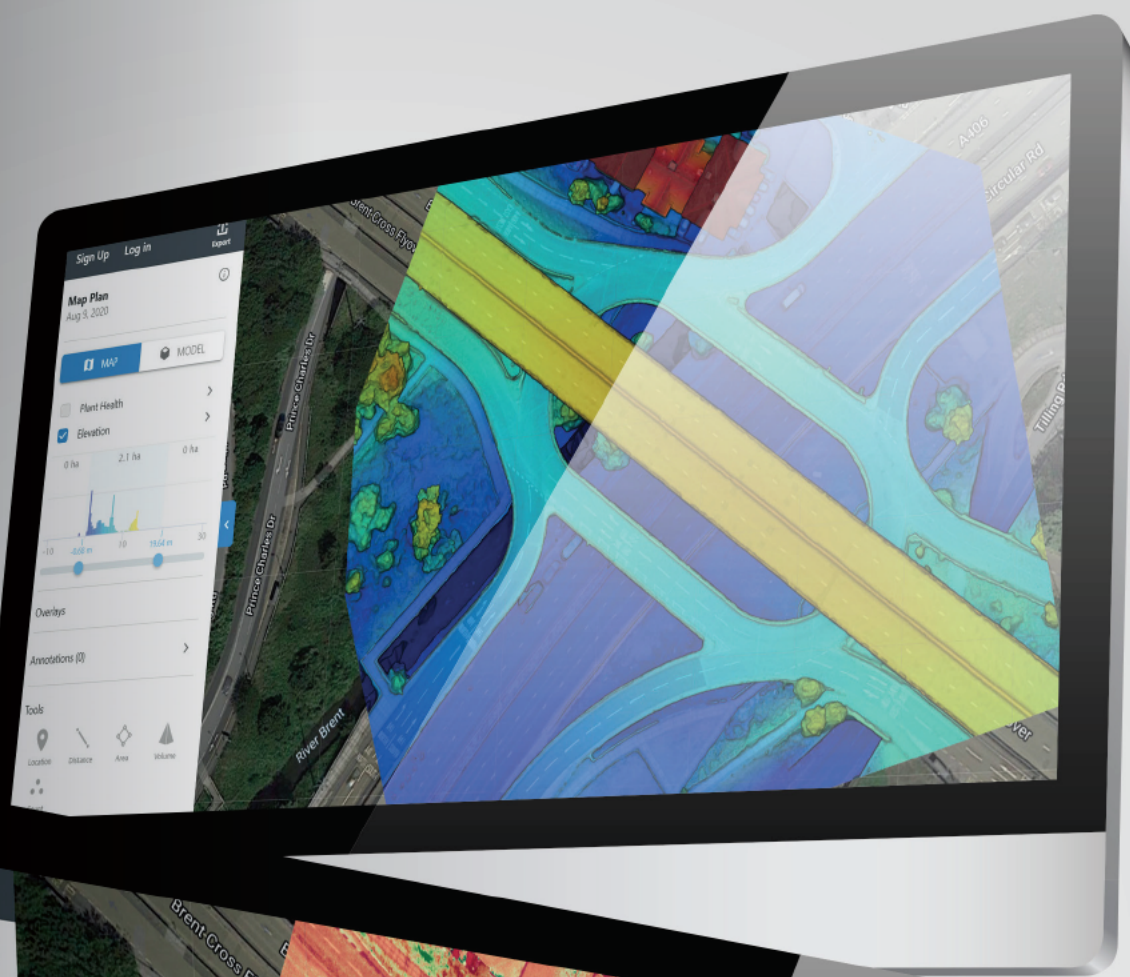


6

BIM



BIM Execution Plan (BEP)

Project	Brent Cross Structures Feasibility Study			
Reference	Tender			
Stage	Option Selection			
Responsible	Project Engineer			
	Signature	Date		
Accountable	Project Manager			
	Signature	Date		
Product History	Version	Date	Author	Summary of changes
	0.1	09/07/21		First draft

This document must be filed in accordance with the [document filing structure](#)

Product Context

Purpose	The BIM Execution Plan (BEP) is used to set out the approach the Contractor will take to deliver the information requirements set out in the EIR. A completed BEP is provided by the Contractor) during the Tender stage and used to evaluate capability of the organisation(s) to deliver information required in order to design, construct, and operate the asset(s).
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Applicability	The BIM Execution Plan (BEP) is required for asset development or renewal projects and programmes.
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Consult	Role	Detail
	Commercial Manager	Needs to understand the requirements and know that a BEP has been accepted by the Project in order to agree progression of procurement and manage the contract.
	Programme Manager / Project Manager	Needs to ensure the requirements are aligned to the programme and know that a BEP is in place to support the contract.
	Project Engineer	Needs to ensure the requirements are aligned to the programme and know that a BEP is in place to support the contract.
	TfL Programme BIM Manager	Will work with the Project Engineer to ensure that the BEP has been completed and meets the needs of the project.
	Information Manager	Needs to understand the BEP and ensure information delivery is consistent with the accepted BEP.

Inform	HSE Advisor	Needs to know that a BEP has been signed off and is in place for the project.
	Sponsor	Needs to know that a BEP has been signed off and is in place for the project.

Characterisation Table	Category Level			
	Simple	Standard	Significant	Major
1 Purpose	Required at all levels			
2 Building Information Modelling Objectives	Required at all levels			
3 Information Utilisation Planning	Required at all levels			



4 Standard Method and Procedure	Required at all levels
5 Information Management	Required at all levels
6 Digital Engineering	Required at all levels

Characterisation Notes:

- What is Characterisation? Find out [here](#).
- The amount of effort applied in the production of this product should be proportionate to the size, scale, risk and complexity of the project / programme. The Characterisation Table above states which sections are required to be completed based on the level at which the project / programme was categorised at. A guide to the amount of effort applied is as follows:
 - Simple – one to two sentences per sub-heading.
 - Standard – one to two paragraphs per sub-heading.
 - Significant – one to two pages per sub-heading.
 - Major – greater than two pages per sub-heading to separate documents per heading.
- Where a section has been characterised as not being required (shown by 'X' in the above table), the following note should be entered into the corresponding section in the Product – “not required by characterisation”.

General Notes:

The Employer must issue a BEP template to the Contractor as part of the tender documentation (ITT Stage).

The BEP template must be used and completed. The template contains clear guidance:

- Black text is not to be deleted or amended in any way
- All red and blue text must be deleted prior to issuing the EIR

The Contractor must return a completed BEP for assessment as part of their Tender submission.

The BEP must be completed and submitted to the Project Manager for acceptance, prior to contract award.

All updates must follow project change control procedures.

The LU Programme/Project Team must:

- Ensure all LU project team members have been briefed on the BEP content



- Carry out verification activities to ensure that Production Information and Handover Information is being produced, managed and delivered in accordance with the Project BEP.

LU Suppliers (contracted organisation) must:

- Once accepted by the Project Manager, ensure all project team members (all tiers) have been briefed on the Project BEP.

If you have any queries, feedback or improvement suggestions about this product, then please contact tfipathway@tfl.gov.uk.



Table of Contents

1	Purpose	7
1.1	The purpose of this BIM Execution Plan (BEP) is to set out how the Exchange Information Requirements (EIR) will be met.....	7
1.2	Project Information can be found in the Project Execution Plan (PEP).	7
2	Objectives	7
2.1	Employers BIM Objectives	7
2.2	Project BIM Objectives	7
3	Information Utilisation Planning	7
3.1	Primary use of data / information	7
3.2	Project stage gate decisions and digital assurance.....	7
3.3	Technical / Design Reviews	8
3.4	Levels of Information Need	9
3.5	Value Engineering.....	10
3.6	Safety, Health and Environment & Construction Design Management	11
3.7	Delivery Strategy for Asset Information.....	11
3.8	Training Arrangements.....	12
4	Standard Method and Procedure.....	12
4.1	Standards.....	12
4.2	Security	12
4.3	Roles and Responsibilities	13
4.4	Naming Conventions	14
4.5	Classification	14
5	Information Management.....	14
5.1	System Performance and Constraints.....	14
5.2	Federation Strategy.....	14
5.3	Compliance Requirements	15
5.4	Common Data Environment.....	18
5.5	Collaboration Process	21
6	Digital Engineering.....	22
6.1	Software Platforms.....	22



6.2	Data Exchange Formats	23
6.3	Coordinates.....	23



1 Purpose

- 1.1 The purpose of this BIM Execution Plan (BEP) is to set out how the Exchange Information Requirements (EIR) will be met.
- 1.2 Project Information can be found in the Project Execution Plan (PEP).

2 Objectives

2.1 Employers BIM Objectives

Details covered within the EIR Section 1.2 and 1.3.

2.2 Project BIM Objectives

Details covered within the EIR Section 1.4.

3 Information Utilisation Planning

3.1 Primary use of data / information

Details covered within the EIR Section 2.1.

3.2 Project stage gate decisions and digital assurance

Details covered within the EIR Section 2.2.

Production Information and Handover Information, to be shared / delivered to support stage gate decisions and assurances, must be captured within the Master Information Delivery Plan (MIDP).

The Master Information Delivery Plan (MIDP) outlining the detailed deliverables at discipline level and deliverable dates will be aligned with the project programme clearly listing the deliverables at each pathway stage. This will be as defined as per the Technical Specification CI106SR. The key milestone will be as per Table 2-3 of the EIR which is also shown below.

Pathway Stages	Review
Stage 1 - Outcome Definition	Requirement Output Review
Stage 2 – Option Selection (Current Stage)	Feasibility Output Review
Stage 3 - Concept Design	Concept Design Review



Stage 4 - Detailed Design	20%
	60%
	95%
	Design Review
	Final Design Review
Stage 5 - Delivery	Validation Reviews

Formal submissions for will be checked, reviewed, and approved by task team managers, design co-ordination manager and the project manager alongside automated CAD quality assurance in ProjectWise, where applicable, prior to submission.

For all interim submissions, pdf copies will be printed from ProjectWise and submitted via the document control team. The interim stage models will be shared by discipline team managers on ProjectWise to achieve design co-ordination between disciplines and visibility of the progress for the project team.

3.3 Technical / Design Reviews

Details covered within the EIR Section 2.4.

Production Information and Handover Information, to be shared / delivered to support progressive model driven technical / design reviews, must be captured within the MIDP.

Handover review

Prior to commencing work, a full review of the handover information will be undertaken to ensure the adequacy.

Technical / Design Review

The design review processes will be tailored to meet TfL requirements for conducting technical reviews. Processes to be undertaken for internal design reviews and certification for managing design will be further detailed in the Quality Plan.

Where appropriate, multi-disciplinary technical reviews will be carried out. These technical reviews will be carried out in accordance with CI106SR and Table 2-3 of the EIR.



The above reviews shall be facilitated in part by joint review of an integrated project information model that encompasses the data available, including the point cloud data, while presenting design outputs as 'work in progress' or complete as appropriate. Minutes of the meeting will be taken and issued to ensure formal records are maintained and the actions have been tracked to closure throughout the design development process and prior to the pathway review.

Pathway Review

The objectives of all Pathway reviews are to ensure that the project is sufficiently mature to achieve the defined outcomes of the previous stage and optimally achieve the project objectives. Structured graphical information containers as per the MIDP will be submitted to TfL via ProjectWise. Non-graphical and unstructured documentation will be issued via Asite. These will be done in the form of .pdf copy and native file format to ensure project design sign off.

3.4 Levels of Information Need

As stated in the EIR, descriptions of Level of information need shall be delivered in line Table 2-4 of the EIR. This can also be found below:

Geometrical information	Alphanumerical information	Level Of Information need
Overall massing of construction entities; indicative of area, height, volume, location, and orientation.	Project requirements (form, function, cost, and schedule).	1
Discipline specific model files. Discipline task team allocated volumes. Architectural form and layout (including that reserved for MEP). Outline structural / civil spatial arrangements. Generic systems, assets or assemblies with approx. size, shape, location, and orientation.	General performance criteria (based on assumed asset). System types. Forecast cost data +/- 15%. Note: associated to the applicable modelled elements.	2
Discipline team specific model files.	Specific performance criteria. Forecast cost data +/- 10%.	3



Primary structural / civil elements developed and frozen. Specific systems, assets, or assemblies in terms of quantity, size, shape, location, and orientation.	Note: associated to the applicable modelled elements.	
Discipline team specific model files Graphically represented as a specific system, asset, or assembly in terms of quantity, size, shape, location, and orientation.	Actual performance criteria. Actual cost data. Note: associated to the applicable modelled elements.	4
Discipline team specific model files. Graphically represented as actual built / constructed / installed system, asset, or assembly in terms of quantity, size, shape, location, and orientation.		5

Table 6.3: Level of Information Need

3.5 Value Engineering

The use of a consistent design templates and information will ensure that material can be re-used across each of the structures being assessed removing the need to develop new material and delivering cost savings across the project.

MIDP information will automatically be tracked within the project CDE using extracted data. Analysis will then be undertaken using PowerBI to ensure project compliance and to monitor progress of files through workflows. This approach will ensure that optimum procedures are maintained delivering value to all parties.

The project will have a defined level of information needed to ensure well-integrated design solutions are developed, adopting digital asset management techniques to identify areas of deterioration and proposed refurbishment solutions. To add further value 3D models or Point Cloud data can be used to develop virtual reality images to demonstrate the asset conditions during design reviews.



3.6 Safety, Health and Environment & Construction Design Management

Prepare the initial Health and Safety File

Arcadis will identify all the information that will be required for the file, who will be responsible for providing it and an indicative programme for this. While much of the information will only be available towards the end of construction stages, the Principal Designer will provide key information such as the structural principles, loadings etc. and identify the information from the pre-construction information that will still be relevant at the end of the project.

The Principal Designer will also produce an initial draft in line with TfL requirements, populate with available information, and include placeholders to indicate the information yet to be obtained.

HAZARD Identification and management of CDM Risk

The team will work collaboratively with the stakeholders to assist and support our design team to identify and mitigate operational risks. Hazard identification and risk management will be driven through hazard identifications sessions. Arcadis will compile the hazard log and a detailed CDM log. These hazards will be closely reviewed with the project team and their stakeholders including the end user in the interdisciplinary design check and review process as well as other sessions as appropriate. Throughout this process of stakeholder input, Human Factor input will be considered to ensure safety measurements will be validated and compliance with safety regulations. Any residual risks need to be passed to the end user will be agreed through the process.

3.7 Delivery Strategy for Asset Information

Asset information is expected to be produced and uploaded to Bridge Station and SAMIS.

When asset information is generated, it will be provided in .xls format as specified in the EIR. The appointed party shall populate the Appointing Party's excel template with the asset information in accordance with the agreed 'level of information need' for the project stage in the BEP.

The management of Asset Information and the vehicle for delivery of the required Information will be in line with clause 2.12 of EIR table 2-5. Extent of asset capture needs to be agreed post contract award.



3.8 Training Arrangements

BIM Team

All BIM Team members have undertaken a BIM capability check prior to joining the BIM Team. All staff will be expected to undertake internal training, including a BIM module from the Arcadis training portal and expedition DNA base camp training. Further additional training shall be provided across the team, should this be required.

Project Execution

The Project's requirements can evolve as well as the processes and procedures in line with implementing the latest technology in ways to deliver them efficiently and always looking to improve the processes. All staff are provided with regular training to keep up to date with Arcadis BIM methods and procedures which shall benefit the project. Thus, throughout the project we will provide regular training to all staff as and when required, to ensure they are up to date on the latest BIM aspects.

The Project Information Manager (s) will monitor the project developments, training, and competency of the relevant staff, to ensure that training is planned and carried out accordingly. The provision of adequate training will ensure consistency and quality of Production Information and Handover Information for the duration of project delivery.

On Boarding

Throughout the project's lifespan, resources fluctuate to suit the projects requirements. It is critical that as new staff join the team, they can be 100% productive and effective as soon as possible. To enable this occurs, we will carry out 'on-boarding' training including inductions to the project, business management systems and the project CDE.

4 Standard Method and Procedure

4.1 Standards

Details covered within the EIR section 3.1.

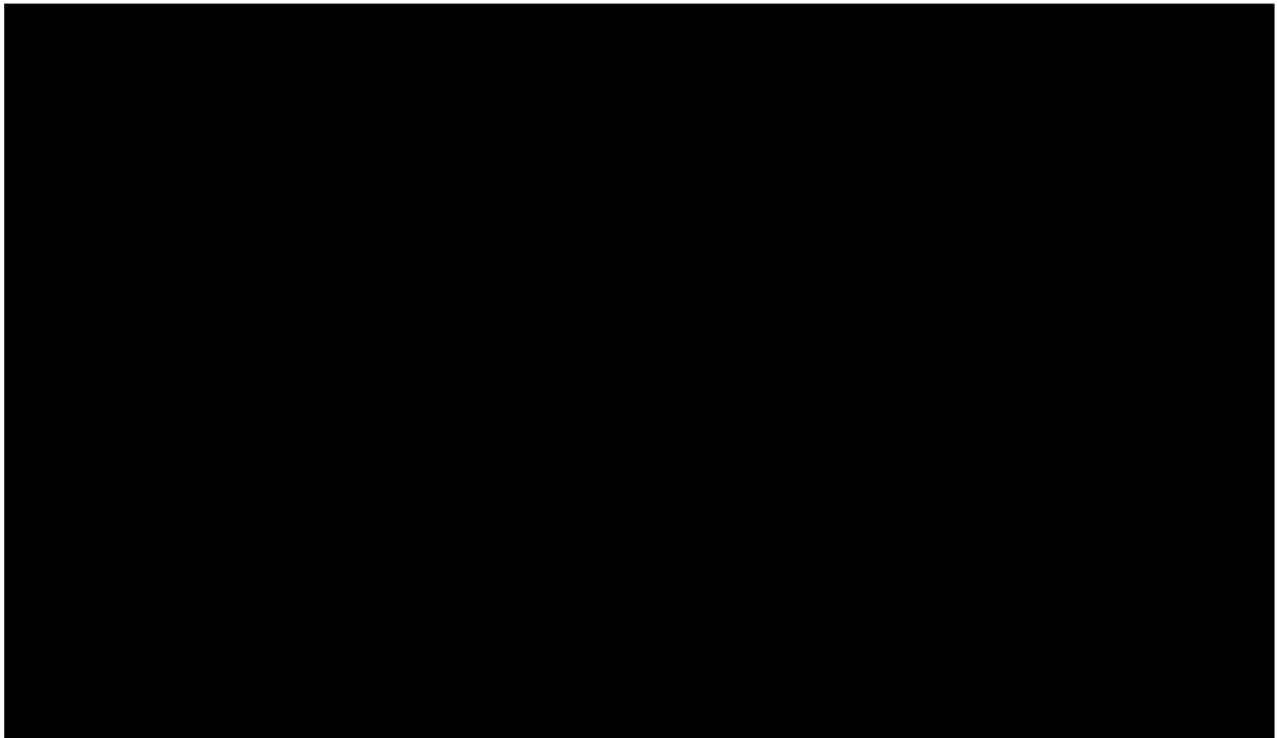
4.2 Security

Information security controls will be existent within ProjectWise. Only Project participants who are approved to work on the project will have access to ProjectWise. Subsequent access control will be applied to each ProjectWise user to ensure access to the latest data appropriate to their role and responsibility within the Project.



4.3 Roles and Responsibilities

Details covered within the EIR Section 3.1.



RACI – Responsible/Accountable/Competent/Informed

	Project Manager	Design Co-ordination Manager	Task team Manager	Information Manager	Interface Manager	Appointing Party
BEP – Information Execution Plan	A	A	R	R(A)	I	I
MIDP - Master Information Delivery Plan	R	A	R	R	I	I
TIDP - Task Information Delivery Plan	I	R	A	R	R	I
CDE – Common Data Environment	R	R	R	A	R	I
PIM – Project Information Model	R	A	A (Dis)	R	R	I
EIR – Exchange Information Requirements	I	I	I	I	I	A
CAD (QA/Competences)	I	I	I	A	R	I

Table 4.2: RACI – Responsible/Accountable/Competent/Informed



4.4 Naming Conventions

Details covered within the EIR Section 3.4.

4.5 Classification

Details covered within the EIR Section 3.5.

All model elements shall be identified by a standard system of classification which in accordance with S1760 is Uniclass2015.

All model elements are identifiable by their design status, which is used to verify the current level of design development reached and checking of the model integrity.

The status defines the work stage of the document or model being issued. It should be carefully selected to ensure consistency with the relevant project stage in line with work stages. The suitability codes to be adopted for this project are stated in TfL Standard S1037

5 Information Management

5.1 System Performance and Constraints

The elements of production that are within the Arcadis hosted CDE will comply with the appointing party's system guidelines and standards.

As part of this process IT assessment forms will be completed.

Arcadis will manage, share, and assure document information during the design lifecycle prior to publishing to the appropriate TfL Common Data Environment.

5.2 Federation Strategy

The Federation strategy for existing, new design works and third-party assets, where applicable, will follow the engineering design strategy. That is, the works will be split into appropriate modelling disciplines. Disciplines will further divide their tasks into logical areas or segments, as necessary, in conjunction with the BIM co-ordinator to reflect a logical package of work. The BIM co-ordinator will oversee the co-ordination of the Information Models and how they form the various composite Models.

All models pertaining to a specific discipline will be developed in such a way that they can be referenced together to form a single, geospatially correct, composite discipline model. The single discipline models will then be able to be referenced



together to form a master composite model (federated model) that will give an overall representation of the design.

All the discipline models will be owned by the relevant lead discipline engineers. They will be used to prove engineering concept and for co-ordination within a single discipline and package. The overall master composite model will be owned by the BIM Co-ordinator who will utilise this model for proximity / clash detection and multidisciplinary co-ordination.

Multi-disciplinary Information will be shared regularly, as agreed, via the CDE and workflow. This will promote inter disciplinary design co-ordination across the project.

Along with clash detection workshops, at agreed stages or frequencies, to review specific volumes/integration between volumes of the project in line with the design programme. With the primary objective of checking progress and reviewing design co-ordination issues.

The 3D models will be structured in such a way that the information attached to each model component will meet the requirements of the design at any given stage of the project, as per the design scope. All geometry will be derived from 3D/composite models but further 2D information may be included to facilitate understanding and provide context.

A federation strategy will be agreed amongst team members at project outset and detailed within the BEP. It is clearly understood the vital importance of the volume strategy with reference to spatial co-ordination.

The project will be broken down into a number of distinct volumes, by discipline, by system, by zone, by floor as required. Each design team will be responsible for their volume. Due regards are to be given to the volume/file size to minimise download time and hardware issues.

5.3 Compliance Requirements

To achieve the targeted BIM uses, the quality of the model must meet the acceptance criteria. The overall quality depends both on the quality of the digital data that is used and the way the design process is organized. To guarantee the quality of the models, it is important that the models are frequently verified through various checks and pass these checks.

The design models are intended to be used as a tool to assist the project team in identifying co-ordination issues, and through federation, the models can be used spatial co-ordination, verification, and resolution tools.



BIM 2D & 3D model files shall be subject to automatic compliance checks throughout the ProjectWise workflow to ensure a fully compliant proposal in accordance with the Employer's BIM (CAD) Standards.

To ensure that the model, drawing files, and spreadsheet extraction are adequately checked, the quality control procedures will need to be followed by all parties, including the Lead appointed party to approve and sign-off the development of the design information for the project. Each discipline BIM Co-ordinator shall manage the intra-disciplinary quality control checks.

Validation of BIM data prior to model sharing, shall check that:

- All extraneous model files (i.e., those deemed to not be a deliverable) have been removed from the BIM model.
- The model has been audited and purged.
- File format and naming conventions conform to the Project standards and remain constant for the life span of the project.
- Data segregation conforms to project requirements.
- The 3D model(s) and 2D drawings are up to date and that the 2D information has been derived from the 3D model(s).
- All objects in a 3D default view must be made visible.
- Any associated data required to load the model file is made available.
- All ownership of model worksets has been relinquished.
- All models to use the co-ordinate system defined at the outset of the project.

The table below summarises the Quality Control Procedures for this project.

Checks	Definition	Responsible Party	Software Program(s)	Frequency
Automated Check	Dependent on Automated QA check available within CDE. Scripts developed and applied as appropriate.	All	TBC	TBC
Manual Checks: CAD Audit	To include but not limited to: Used Levels composition Text style, font, and size Dimension style, font, and size Reference file attachment modes Nesting level of reference	Discipline BIM Coordinator	Native Software – Bentley or Autodesk products	At agreed



Clash Detection	Detect problems in the model where two components are clashing: including soft and hard clashes.	Project BIM Manager	Authoring Software used Autodesk Navisworks	Coordination Reviews
Visual Reviews of Models/data	At the regular release of revised Model's data across the team, a visual interrogation of the models is to be carried out	Discipline Engineers and BIM Coordinators	Autodesk software	As agreed

Table 5.1: Quality Control Procedures

Approval of information is also maintained through a process of '**Production, Check, Review and Approval (PCRA)**'

The process uses a four level sign off for technical deliverables known as PCRA. Every deliverable must incorporate a four level sign off to provide the requisite level of assurance.

The steps are detailed below

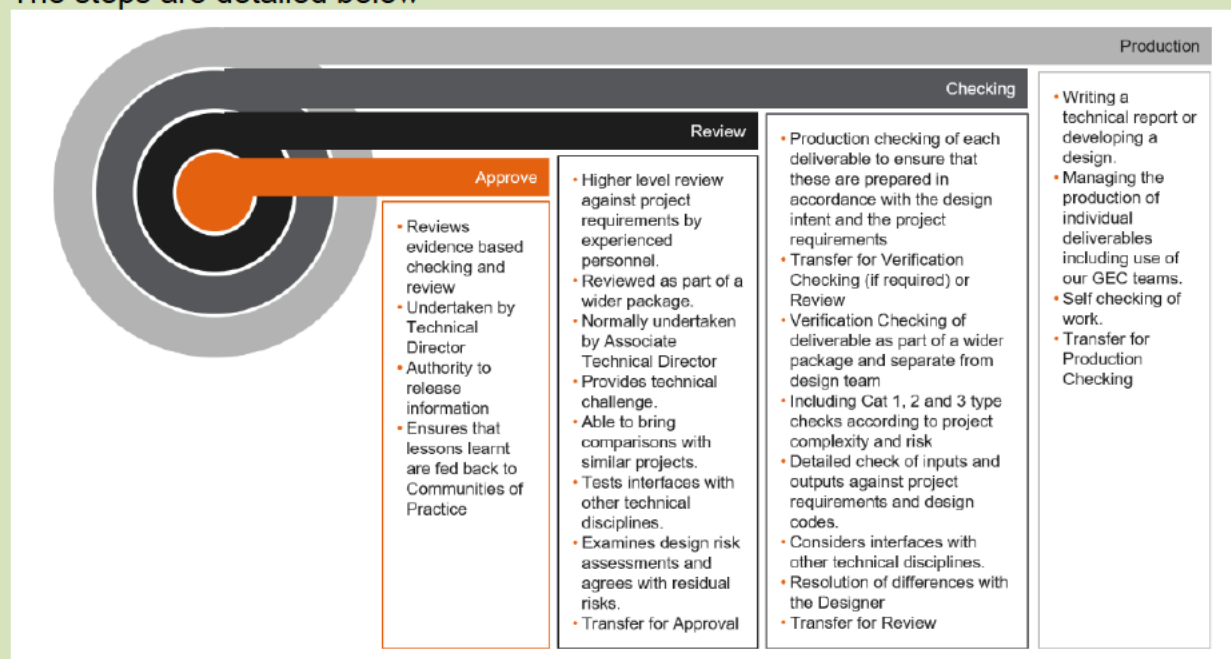


Figure 5.2: PCRA



5.4 Common Data Environment

Arcadis will work, design, and deliver graphical information within Bentley ProjectWise Common Data Environment (CDE). Managing the iterative development of design information to achieve full integration and spatial coordination of the design.

The CDE will act as the central repository to hold and share design information across the Project team. Within the CDEs we will ensure accurate records of design information by the use of the workflow to enable information to flow correctly to all parties. These workflows will facilitate the sharing/exchanging of information. This approach enables all members of the team to track and audit documents through their lifecycle, providing transparency and visibility on progress and status of project elements. This facilitates scrutiny on a shared basis and makes it easy to check and approve submittals for delivery.

ProjectWise Workflow configuration:

- Folder structure to align with ISO19650
- Users are assigned to a discipline user list.
- Project access is enabled through membership of a Project User Group.
- Users shall access their own discipline's WIP data in their own projects.
- Shared data will be accessible in the same project.
- Document environment configured for automatic file naming in line with TfL Numbering system using Document Creation Wizard.



Workflows

Workflows will be established within the CDE to allow for the sharing of information. These will follow the process set out below.

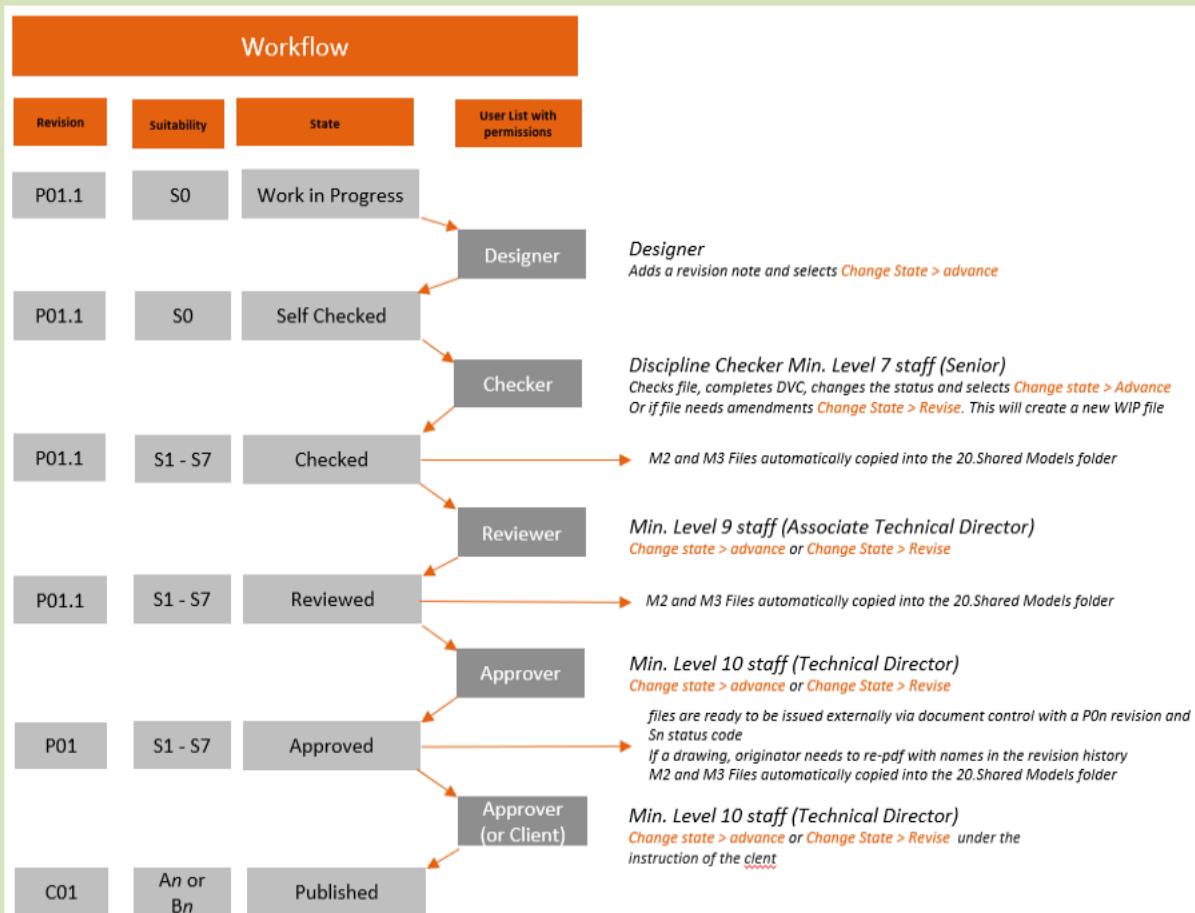


Figure 5.1: CDE Workflow

Workflow State

Workflow State – Work in Progress

Information containers being developed by originators appear as Work in Progress and are viewable in ProjectWise only by originators, checkers and approvers from the discipline that owns that individual design.

Workflow State – Self Checked

Originators review their own work and revise or update to the point that they consider the content is suitable for progression to the next state. At this point, they change the state of the file in ProjectWise to Advance and email the Discipline Checker to



undertake a check. At this point, the design status in ProjectWise will appear as Self Checked.

Workflow State – Checked

The Discipline Checker reviews the content for adherence to design, project standards and engineering principle.

If the content needs amending, the Discipline Checker revises the file and advises the Originator of what changes are required. If the content is satisfactory, then the Discipline Checker advances the file. At this point, the design status in ProjectWise will appear as Checked.

Workflow State – Reviewed

The Discipline Approver confirms that the file has gone through the necessary checks and processes (such as technical reviews) and undertakes a high-level review of the content. After this has been done the state will appear as 'Engineering Approved.' For this project, this role can be undertaken either by the Discipline Checker or Project Approver.

Workflow State – Shared

The Design State in ProjectWise appears as 'Shared' once the Project approval team has reviewed the file and is satisfied that it is suitable to be issued for coordination, review, and comment or for acceptance.

Workflow State - Published

The Design State in ProjectWise appears as 'Published' once the appointing party has advised the Project Approver that the design is authorised to be issued for construction.

M2/M3 File Sharing

When an M2 or M3 file is advanced to either Checked, Reviewed, Shared or Published a read-only version is automatically copied into the 'Shared Models' folder in ProjectWise and is viewable by all the design team for reference or co-ordination.

CDE Training

At the start of the project, each member of the project team will be on-boarded to the project CDE through a series of on-line training sessions. These sessions will be recorded and made available for other new members of the team.



Project members will also be issued with a user-guide relevant to the ProjectWise they are accessing.

5.5 Collaboration Process

- Formal sharing of data at IDR/For Approval/etc
- Internal sharing of data for coordination/federation/review/clash & avoidance checks/etc

Each party will issue the agreed information at the agreed dates making it available to the other design disciplines by issuing the information through the CDE. Each discipline BIM Co-ordinator is responsible for the compatibility of their hardware and software with all requirements as stated in this BEP.

Each design discipline is responsible for using the most up-to-date version of the issued information; any queries or any inconsistencies identified should be communicated to the Project Information Manager. At agreed dates, each discipline BIM Co-ordinator issues revised information and each design discipline updates their model accordingly before the next agreed issue.

Based on a joint responsibility for the quality of the information, each receiving party will check the information upon receipt. Any discrepancies or concerns must be reported to the Project Information Manager and relevant originator as soon as possible. These issues will be reviewed as soon as required to maintain the timely BIM workflow, at the latest at the next co-ordination meeting.

Sharing protocol:

- Model sharing at each design change.
- Files progressed from WIP to Self-Checked straight away and notification circulated across the design team using project circulation list, including the ProjectWise hyperlink.
- The information, once checked by the task team manager, will then be made visible to all parties.



6 Digital Engineering

6.1 Software Platforms

Activity/ Discipline	Software	Version	Native Format	Exchange Format	Comments
Bentley – ProjectWise	CDE	10.00.03.434	-	-	CDE – Graphical and Non-graphical data
Non-graphical data	Word		Office365	docx	Non-graphical data
Asset Data (Non-graphical data)	Excel		Office365	xlsx	Non-graphical data
Adobe	Pdf		Adobe	PDF	Documentation
Structures	Revit	2021	.rvt	.rvt & .nwd	Production of structures models and drawings
General	AutoCAD / Civil3d	2021	.dwg	.pdf	Production of general arrangement, detail drawings etc.
Drainage	Micro- drainage	2021	.sws .fws	sws, fws	Drainage analysis model
Drainage	Civil 3D	2021 UKIE	.dwg	.nwd & IFC	Drainage model and documentation production
Street Lighting	Lighting Reality	1.8	.rtma	.dxf	Lighting analysis and modelling
Street Lighting	Civil 3D	2021	.dwg	.nwd & IFC	Production and delivery of model
Spatial Coordination	Navisworks Manage	2021	.nwc .nwd .nwf	.nwd	Production and delivery of federated (combined multi- discipline) model
Highways	Line Design Pro	8.4	.dwg	.nwd & IFC	Production of White line models
Highways	Sign Design Pro	9.21	.dwg	.nwd & IFC	Production of signage models



6.2 Data Exchange Formats

Formats as noted in section 6.1 and summarised below

Data / Information	Exchange Format
Asset data (Non-Graphical Data)	XLS
Native models (Graphical Data)	dwg, rvt
Point Cloud Data	IMP, PTS, POD
Federated models (Graphical Data)	NWD
4D Simulation (Graphical Data and Non-Graphical Data)	NWD
Cost Data (Non-Graphical Data)	XLS
Programmes	XER, PLF, PDF, MMP
Documentation	PDF

Table 6.2: Data Exchange Formats

6.3 Coordinates

All CAD Files produced shall be to London Survey Grid and shall be in the London Height Datum (realised as OS Newlyn datum – 100.000m)

To ensure information is produced and modelled within the correct geospatial location, all models will begin from the SEED files stored on ProjectWise.

As each model and the relevant drawing production proceeds, the graphical data will feed back to a master federated file that enables the information to be validated for its geospatial location. This process enables all information to be constantly checked, providing confidence that shared information is located correctly within the site.



This section is for the use of the TfL PMO Process & Guidance Team only

Product Details

Name:	BIM Execution Plan
Document No:	PD0238
SME:	TfL BIM Manager
Owned by:	Senior Process & Guidance Manager
Review Date:	March 2023

Product Version History

Revision	Date	Reason for Change
A1	06/03/2018	Pathway Refresh. Changes approved under CR-10013. Changes to reflect rationalisation of Product Descriptions PD0181 A2 & PD0203 A1 and Templates F7615 A2 & F5685 A1 into one product. Also, change in terminology to use BIM instead of IM&M.
A2	02/05/2020	Updated to align with new international standard ISO19650. Terminology change and update reference to other Pathway products; TMS-CR-12905.



7

Health and Safety



7.1 Principal Contractor

FM Conway will be the Client appointed Principal Contractor to discharge the responsibilities of Principal Contractor (PC). Using knowledge and experience gained from acting as PC on LoHAC and similar projects such as Rochester Bridge Refurbishment, we will ensure adequate measures are in place to proactively mitigate H&S risks during pre-construction and to manage residual risks on site. We will have access to proven Construction Phase Plans (CPPs) and Risk Assessment and Method Statements (RAMS), helping us develop our own documents, and ensuring that exemplary Health and Safety (H&S) is maintained with minimal disruption to the wider TLRN.

HSE Leadership and Culture: *Strong leadership and behavioural safety culture to drive 'track to zero' incidents and accidents*

Our HSE approach will be driven by effective leadership, ownership, a learning organisation mindset and collaborative engagement with stakeholders. We will provide dedicated people with the right skills, behaviours and attitudes to drive "safe by design" and planning, and effective management of all on site activities. Our nominated PC, [REDACTED] will use his extensive experience delivering LoHAC works to lead the team and ensure safety first during site delivery.

We will set clear expectations around behavioural safety and we will lead and empower people to make the right decisions at the right time – thinking about the full asset lifecycle. This includes initiatives such as our stop work authority – giving everyone, regardless of grade or role, the power to stop their own work (or that of others) if they believe it to be unsafe.

Effective Coordination and Liaison with other CDM Duty Holders: *Early and continual engagement to mitigate and control risks*

Our integrated delivery team consists of Arcadis (Principal Designer), FM Conway (Principal Contractor) and Henderson Thomas Associates (investigation specialist). Through collaborative planning we will work closely, as PD and PC, with TfL as the Client, to identify H&S hazards and actions to mitigate these. We will engage with Duty Holders through pre-start meetings, monthly collaborative Risk Assessment (RA) reviews and H&S workshops to ensure we capture risks early and manage them effectively throughout delivery. We will use a common data environment, such as ProjectWise,

to enhance the coordination of information and provide a single version of the truth. Data will be published in hard copies and available to import to TfL's information models via Asite and AMIS, to ensure clarity and prevent data loss. The H&S file will include structural principles and calculations, key material details, design drawings, geo-referenced imagery of intrusive survey inspections, operation and maintenance information, and any residual risks.

Risk Management: *Systematic application of the principles of prevention*

Our risk management process follows our BSI accredited Integrated Management System, our ISO 45001 certification and our 'TRACK to Zero' initiative. We will produce dynamic RAs, informed through continual engagement across the delivery team to identify all H&S risks and apply the principles of prevention throughout delivery. We will also maintain decision logs and incident summary reports that will be available to TfL. For activities involving unavoidable risks we operate a 'Permit to Work' system, ensuring an approved safe system of work is in place. We also empower our staff to "Stop Work" at any time if they feel it is unsafe to continue.

Construction Phase Plan (CPP): *Defined arrangements to manage health and safety*

As PD we will engage with the PC during investigation planning, ensuring Pre-Construction Information is available to inform the CPP. The PC will produce the CPP in accordance with Regulation 12 of CDM 2015, drawing on FM Conway's experience of maintaining TfL structures for the last eight years and completing major schemes on the A406 and A41. The CPP will be developed following a thorough review of all Pre-Construction Information, collaboration with TfL, and engagement with local stakeholders. We will use knowledge of previous investigations, effective traffic management options, and lessons learned to certify safety, optimise whole life benefits, and minimise disruption to the network. The CPP will be a live document, subject to regular reviews and revisions, and distributed to all on site personnel.

Competency and Training: *Maintaining healthy and safe work sites*

We will produce competency matrices across our workforce to verify personnel are competent for their role and deliver project specific training to address knowledge gaps. All on site personnel will hold the required Site Supervisory Safety Training (SSST) and Construction Skills Certification Scheme

(CSCS) qualifications. We will carefully audit the H&S credentials of all subcontractors to stated standards during their selection.

Professional Health and Safety Advice:

Independent advice, monitoring and audit

Our NEBOSH and IOSH certified HSE Manager, [REDACTED] will provide professional advice and independent reviews to ensure exemplary H&S standards are maintained throughout delivery. The HSE Manager will conduct regular site visits and audits to review performance, ensuring we continuously improve our safety performance.

CONTINUOUS IMPROVEMENT:

[REDACTED] our HSE Manager will capture safety performance data including incidents and near misses. He will use PowerBI SHE dashboards to hold data-driven conversations with PD and PC staff, analyse trends and discuss performance, supporting open and timely understanding of improvements.

Welfare Facilities, Site Rules and Security:

Protecting the public and workforce

Welfare facilities will be provided, as per Schedule 2 of CDM 2015, including additional measures to avoid the spread of COVID-19, and safety boards outlining the site rules, RAs and CPP. Work areas will be segregated, secured from all traffic, and maintained on a 24/7 basis, using crash tested varioguard vehicle restraint systems, intelligent alert cone sensors and Impact Protection Vehicles.

Induction and Workforce Engagement: Collective ownership for health and safety

Site inductions will be delivered to inform the onsite team of the H&S arrangements, project objectives and their responsibilities. Workforce engagement will be retained through daily briefs and debriefs, toolbox talks, H&S forums, and our Integrated Observation tool (the 'near miss' app) for reporting safety observations live from site.

Examples of similar work: Directly comparable works on the TLRN in the North

B550 Colney Hatch Lane Bridge Bearing

Replacement, 2020: As PC, FM Conway successfully replaced all existing bearings, and completed concrete repairs and joint replacements.

The scheme was delivered with **zero accidents or incidents**, due to the clear and thorough plan that

was implemented early and followed throughout. The plan applied the hierarchy of controls to eliminate key risks, such as working adjacent to live traffic. Traffic cones with movement detection technology mitigates the safety risks relating to vehicle incursions. The CPP clearly defined significant residual risks and outlined rigorous H&S standards to effectively control risks on site. Before each shift, we completed detailed off-site safety briefings across the entire delivery team outlining the scope of work, key risks, and responsibilities of each Duty Holder. Permit to Work systems were implemented for all specific activities.

Westway Post-Tensioned Special Inspection

(PTSI) Scheme, 2021: FM Conway was appointed as PC to complete post-tension system investigations across the Westway Flyover covering over 30 structures on the A40. See Appendix E for project CPP and RAMS.

Investigations successfully carried out include:

- Intrusive Longitudinal Post-Tensioning System Investigations: Duct and Tendon Exposures (DTEs) of post-tensioned PSC Multi/single strand systems housed in grouted ducts. DTEs were undertaken across various locations and through trial pits.
- Intrusive Vertical Post-Tensioning System Investigations: End Anchorage Exposure (EAE) of post-tensioned Macalloy bars through trial pits.
- Corrosion Testing and Visual Examination.
- Corrosion Test Areas (CTAs) to the concrete at DTE and EAE locations, followed by visual examinations of the CTAs.
- Visual examination of Macalloy tie-bars with endoscopes inserted into the expansion joint.

The following significant H&S risks were identified in the CPP: Striking electrical utilities, Asbestos, Confined Spaces, Segregation of vehicles/ pedestrians, Dust / Particulates. To manage the risks, we used C2 surveys and issued a 'Permit to Dig' before any excavations, appointed qualified Asbestos surveyors, and set up TM in accordance with Ch.8 of the Traffic Signs Manual.

To ensure clear communication of H&S arrangements to all, we conducted daily site inductions, weekly toolbox talks and promoted the use of our 'near miss' app. We also produced live H&S documents distributing them to all Duty Holders, including TfL, to communicate H&S matters.

7.2 Hazards and Risks

Our ambition is to ensure zero harm during the delivery of this scheme. Working collaboratively as an integrated team, Arcadis (Principal Designer), FM Conway (Principal Contractor) and Henderson Thomas Associates (investigation specialist) have jointly developed a risk register specific to this project and identified the top five hazards and associated risks in Table 7.2.1.

Controlling the risks: Robust pre-construction planning to mitigate risks

Our PD, [REDACTED], will own the Design Risk Management Schedule (DRMS) showing all hazards, developed from the risk register at tender stage. We will conduct desktop studies using previous inspection reports and collate all pre-construction information on each structure, clearly identifying site constraints and potential hazards. Through regular Early Contractor Involvement and risk workshops, our PD will engage with the FM Conway and HTA, TfL and key stakeholders to capture local knowledge, assess risks and discuss mitigations. Workshops will interrogate FM Conway's photogrammetric model of each structure, and use lessons learned from previous schemes to apply the Principles of Prevention (eliminate, replace, reduce, and control) to designing out risks and developing control measures. We will refine the DRMS throughout scheme development, capturing decisions and assumptions in the Decision Log, and clearly detailing any residual risks in the DRMS and pre-construction information pack (PCIP).

Communicate risk assessment to those affected: Seamless integration to ensure risks are clearly communicated and understood

Our integrated team will work closely during the planning and design stage, ensuring any risks and mitigating actions are fully understood by the contractor and supply chain. We will discuss risks with TfL and key stakeholders to inform them of any potential impacts during and after inspections, agree our mitigation approach and provide regular progress updates. The PCIP will be issued to the PC including the DRMS and Decision Log, capturing all necessary information to inform development of the CPP and effectively control residual risks on site. A handover meeting will be facilitated to ensure the residual risks and control measures are clearly communicated and agreed. During handover, the PD and PC will also agree a communication approach to ensure any

third parties impacted are well informed throughout delivery.

All on site staff will be inducted using the CPP and a site induction prior starting work, which will clearly communicate the hazards and risks on site. All site supervisors and appointed persons will be SSSTS certified to ensure they effectively communicate risks with a diverse workforce. Key communication methods will include daily briefings, RAMS, 'peer to peer' toolbox talks and H&S forums.

Weekly work plans will be issued to TfL and the site team, covering all risks associated with the work and outlining the control measures in place. Any H&S hazards to the general public (e.g., lane closures, speed restrictions) will be communicated to TfL and Highways England to ensure the public are informed, and that suitable signage and diversions are in place prior to work starting.

Implementation and Monitoring: Clear ownership to ensure effective implementation

Ownership of all risk controls will be defined early in delivery and outlined within our RAMS and Appointed Persons registers, approved by both Arcadis and FMC and submitted to TfL. Compliance with mitigation measures will be regularly monitored by qualified supervisors and supplemented by independent SHEQ audits using our customised "iAuditor" app. Additional intensive 'big risk audits' will be applied to the most severe risks to provide a performance rating and inform continual improvement. Through our 'TRACK to Zero' initiative we encourage proactive hazard recognition, risk assessment and control to prevent accidents across the workforce. We also empower our employees to take ownership of H&S and submit observations via our 'near miss' app and engage in maintaining a safe working environment for themselves and their colleagues.

Examples of similar work: The design risk registers of our recent work are shown in Appendix F.

West Smithfield bridge refurbishment, 2020: we worked with the contractor via early contractor involvement through design developed to identify key risks and mitigations.

CAW/6 Intersection Bridge Cricklewood span reconstruction, 2021: we used collaborative safety risk and constructability meetings and regular constructability reviews to identify risks early and design for safety and construction.