



Project:

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BIM Execution Plan

Rotherhithe Tunnel Refurbishment Scheme and Blackwall Tunnel Southbound Refurbishment Scheme

Signature

Date

Prepared by

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Checked by

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Approved by

I confirm that this deliverable meets the requirements of the relevant Pathway Product Description and that all consultation comments have been addressed to the satisfaction of consultees.

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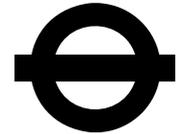
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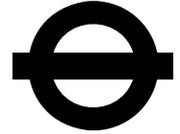
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BIM Execution Plan



1. Purpose

The purpose of this BIM Execution Plan (BEP) is to set out how the Employer's Information Requirements (EIR) will be achieved. The BIM Execution Plan (BEP) 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.

The purpose of this document is to record the agreed objectives, scope, responsibilities, structure, information exchange strategies and processes required for the successful adoption of BIM on the project. It is to serve as a reference and record of the collaborative process throughout the entire life of the project as described in the scope of works for Atkins.

Within this environment, it is important to establish and maintain a method of working to ensure that quality and standards are maintained. This document is to be used to support that environment of quality, documenting agreed approaches, and recording amendments made for the benefit of the project and ultimately the client. In this way it will be possible to support whole team collaboration working on an integrated Building Information Model.

Information Modelling and Management (IMM) is a Surface Transport-wide initiative to review and improve how data and information is gathered, used and stored by Surface Transport. IMM will introduce the technology and ways of working required to reach compliance with Building Information Modelling (BIM) Level 2 requirements. This will involve new ways of working, formalised information requirements and templates, and the introduction of a Common Data Environment (CDE) with supporting technology (e.g. enhanced search functionality, mobile capabilities and model creation and viewing).

At the completion of the Programme, IMM will be implemented across all capital, asset renewal, maintenance and operational works within Surface Transport.

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This Plan shall apply to all services carried out by Atkins under the contract. It shall apply to services provided by any operating units of Atkins providing services under this project.

This Plan forms part of a suite of plans, processes, procedures and manuals established for the delivery of the project, all of which are underpinned by the Atkins Business Management System (BMS). Figure 1-1 indicates the principal management control documents and systems to be employed in this project (brown shading indicates internal to Atkins) and the relative position of this BIM Execution Plan in the hierarchy.

Reference is made to other supporting documents, rather than repeating information in many documents in order to reduce the risk of information in the various sources becoming asynchronous.

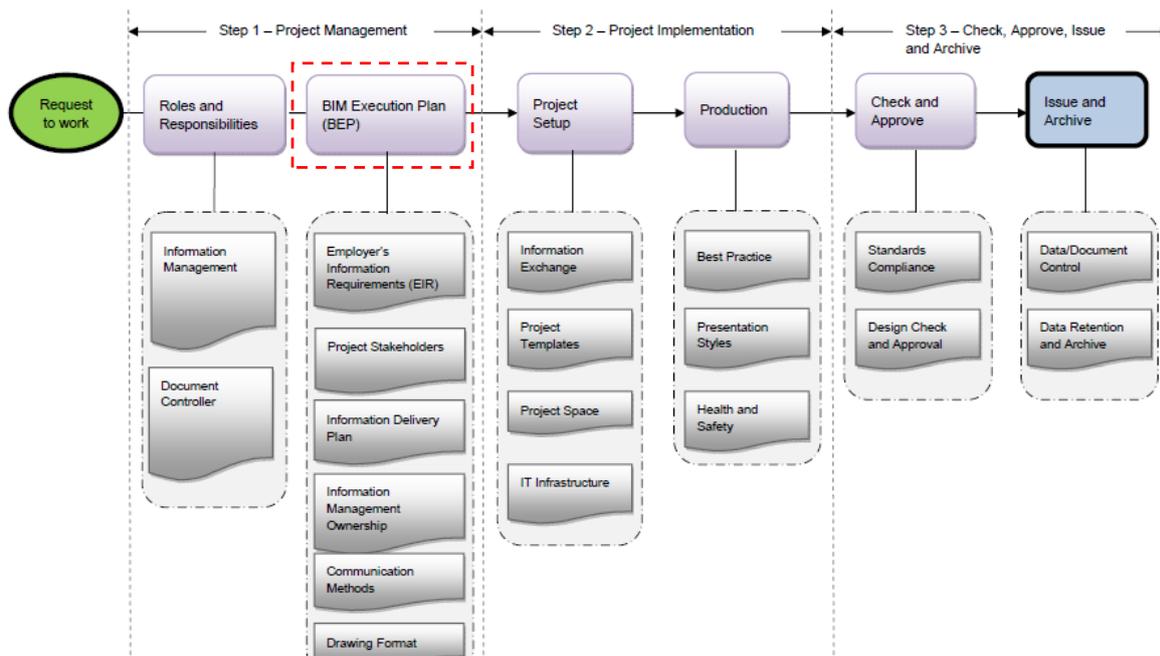
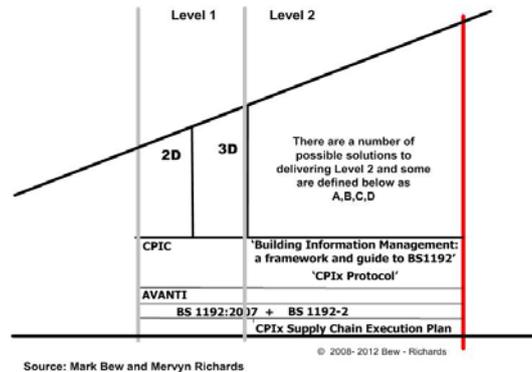
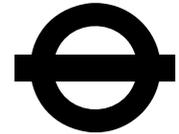


Figure 1-1

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2. Information Modelling & Management Objectives

2.1. Client objectives

Client objectives have been clearly documented within the EIR, therefore details are not repeated in this BEP.

Refer document : Annexure 4 of STIP 2 Blackwall Southbound and Rotherhithe Tunnel Investigate Works for Feasibility Study

2.2. Project Objective

Project objectives have been clearly documented within the EIR, therefore details are not repeated in this BEP.

Refer Annexure 4 of STIP 2 Blackwall Southbound and Rotherhithe Tunnel Investigate Works for Feasibility Study

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3. Information Utilisation Planning

3.1. Primary use of data / information

The primary use of data / information has been clearly documented within the EIR, therefore details are not repeated in this BEP.

Refer Annexure 4 of STIP 2 Blackwall Southbound and Rotherhithe Tunnel Investigate Works for Feasibility Study

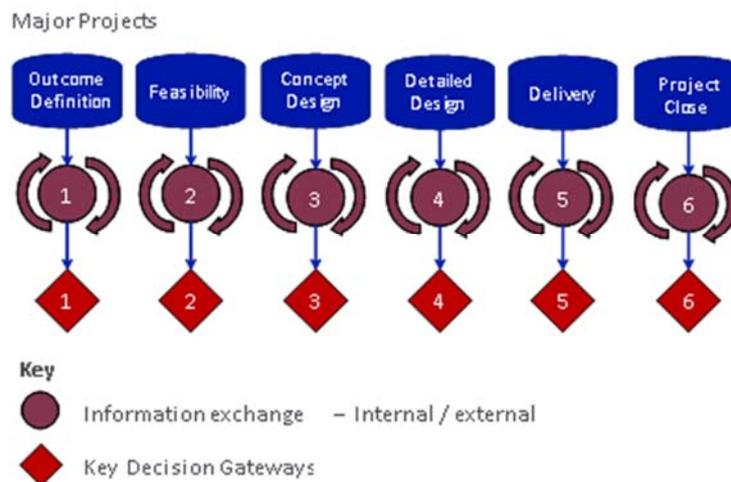
Data and information produced, by all parties, have been licenced for use by others for the purposes of delivering the *Project* and the primary uses as set out in Table 1 within the EIR.

3.2. Project Stage Gates

Project stage gates have been clearly documented within the EIR, therefore details are not repeated in this BEP.

Refer Annexure 4 of STIP 2 Blackwall Southbound and Rotherhithe Tunnel Investigate Works for Feasibility Study

For the purposes of this *Project*, the Task Team Information Delivery Plans (TIDPs) and Master Information Delivery Plan (MIDP) have been aligned with the *Employer's* stage gate process, as set out in Table 2 within the EIR.



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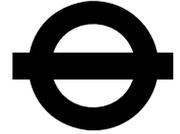


Figure 1- Key Decision Gateways

The illustration above showcases the various states or gates, information has to pass through to attain a certain degree of suitability of use. By defining both the state and suitability of information, the workflows we have implemented, ensure that it is clear who should have access to information and what it is suitable to be used for. This in turn facilitates clear ownership of Work in progress (WIP) information and processes for check and review required to be applied prior to sharing model data to the Team Shared and Common Shared area of the CDE for the purposes of sharing information for coordination and authorisation.

3.3. Model Production and Delivery Table (MPDT)

BEP requirements

Provide details to acknowledge that all parties have seen, understand and agree to the required deliverables set out in the MPDT (Appendix A of the EIR). Where appropriate suggest changes / additions to the required data and information that will help to reduce cost, project risk and enhance the quality of the data and information deliverables.

Provide details of any innovative methods that will be used to capture, produce and present the required deliverables and provide the requisite level of assurance required. As this is feasibility Pre-BEP document support. The work flow defined with getting the scanned data and converting to 3D BIM model. The requisite level will be LOD 200 that can be achieved as per the requirements mentioned in EIR.

Provide evidence of capability and capacity to deliver the required deliverables set out in the MPDT.

The MPDT, as set out in Appendix A of the EIR, has been agreed between all parties and appropriate TIDPs have been produced (refer to section 0).

“BIM is the **purposeful management of information** through the **whole life cycle** of an infrastructure project, not just for a building, and not just during design and

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construction. It is **starting with the end in mind** - the intent and context for that piece of asset, and how it will be **integrated, operated and maintained.**”

Atkins acknowledges and understands the deliverables required for Pathway stage 2 feasibility study phase as defined in this ITT proposal. These will be challenged and confirmed as part of our BMS process, Transportation Deliver Work, jointly with the TfL Client Project Manager prior to commencement of the project. The 3D models for each structure will be developed to the required level of detail for data and reporting required. Any changes or additions will be agreed in collaboration with the Project manager and operations team who will be the ultimate users of the model.

From our experience demonstrated in the competency assessment we have shown our use of innovative methods of data capture. In particular on the M4 elevated project we provided 3D models developed from as-built records and point cloud survey to log condition and predict deterioration and hence intervention strategies. The point cloud also provided an immediate and effective check on the accuracy of the modelling.

Standards for Managing Information on our CAD and BIM Projects are specified in EIR Annexure 4 – Table 6 Standards.

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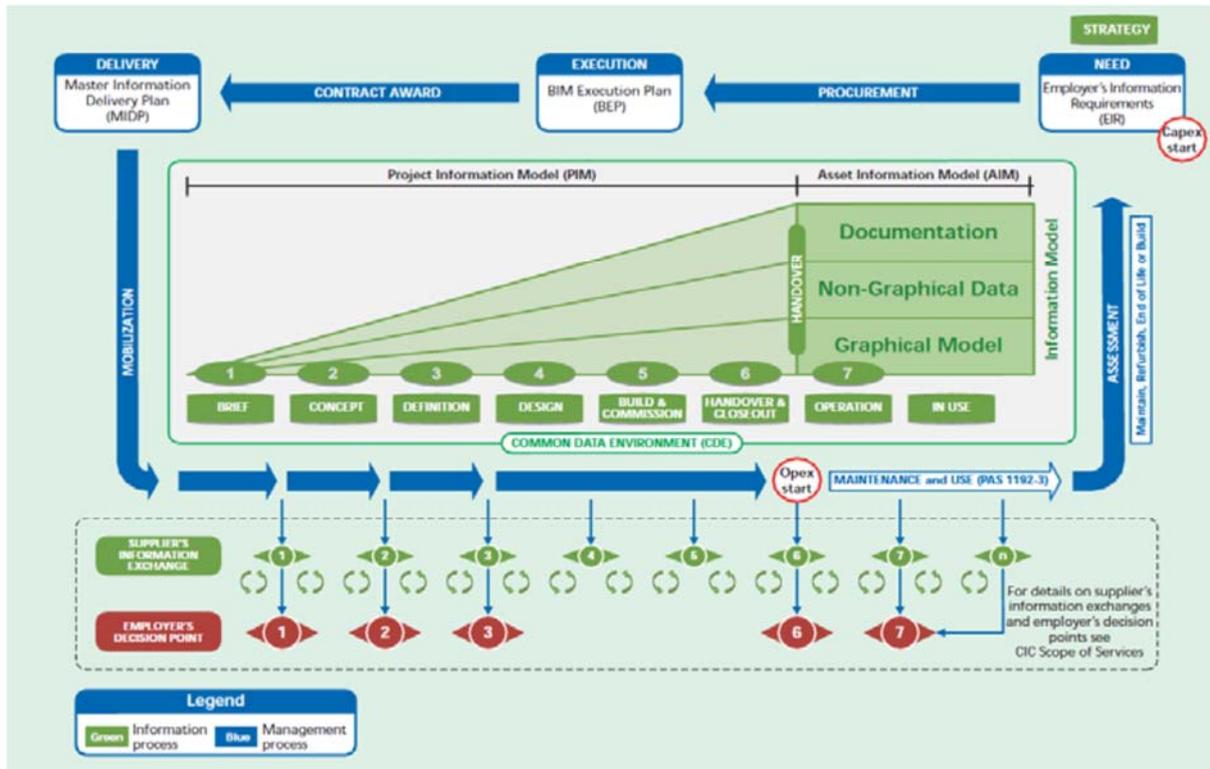
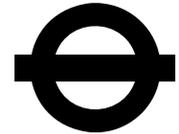


Figure 3.3 - Lifecycle of information for an asset (Reference PAS 1192:2)

An example of the lifecycle of information for buildings and facilities is shown in Figure 1 (taken from PAS 1192-2). The process of BIM generates models and associated information that are used throughout the lifecycle of that asset. Items in BLUE shows the generic process of identifying a project need (which may be for design services, for construction or for supply of goods), procuring and awarding a contract, mobilizing a supplier and generating production information and asset information relevant to the need. This cycle is followed for every aspect of a project, including the refinement of design information through the seven project stages shown in GREEN.

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3.4. Task Team Information Delivery Plan (TIDP)

BEP requirements

Provide details as to how the TIDPs will be managed and maintained throughout the duration of the *Project* – responsible parties and required approvals. As per EIR Annexure 4 - 2.7.2 the consultant will submit the MIDP compiled with TIDP with 8 No. of weeks of Contract Award.

Each task team has produced their TIDPs in accordance with the IMPDT, using the template provided. The TIDPs have been agreed by all parties and approved by the Lead Designer.

The TIDPs will be reviews at each project stage and any changes will be managed through project change control procedures.

The Atkins Project Manager will have the ultimate responsibility for ensuring the TIDP is prepared and maintained during Stage 2 Feasibility Study. He will also ensure the coordination with the preparation of the Contractor's TIDP. The Project Manager will be supported by the Consultant Information Manager, who will be responsible for all day to day processes and management of the CDE. Atkins' Technical Delivery Framework procedures include an independent Project Technical Reviewer, who can challenge and suggest improvements to all methodologies and deliverables including TIDP.

3.5. Master Information Delivery Plan (MIDP)

BEP requirements

Provide details of the MIDP, including who is responsible for keeping it current and managing it through change control. Provide details where the MIDP can be located and the file name.

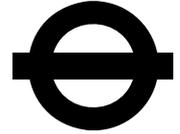
The MIDP has been produced using the approved TIDPs and is the responsibility of the Atkins. The MIDP identifies what is to be produced, maintained and managed,

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when the data and information is to be shared for *Employer* acceptance and who the responsible party is.

The MIDP will be reviewed at each project stage and any changes will be managed through project change control procedures.

The MIDP will be held at the highest level within the file structure of the CDE.

The Employer's Project Manager is responsible for compiling the individual TIDPs within the MIDP in accordance with 3.5 of the EIR. The lead designer will act as the delegated administrator. The Employers Project Manager is responsible for compiling the individual TIDPs within the MIDP in accordance with 3.5 of the EIR. The Project Technical Reviewer (see section 3.4) also plays an important independent role. The lead designer will act as the delegated administrator for this process, however the final format is dependent on the other Contractor Teams TIDP.

3.6. Key Decisions

BEP requirements

Provide details of what data and information will be provided (and how it will be presented) to support and inform the stage gate decisions.

Provide details of how the data and information will be used (and presented) in order to provide evidence of the requisite levels of assurance.

All data and information to be produced, maintained and managed throughout the project life-cycle have been captured within the TIDPs.

At each stage gate data and information will be provided as documented within the EIR and IMDPT.

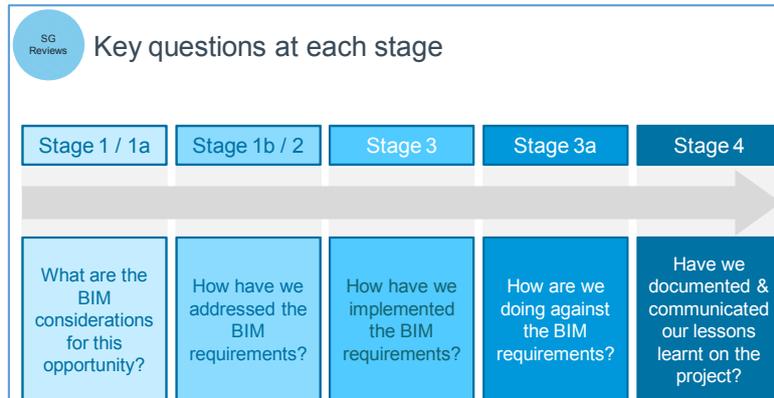
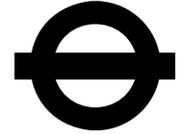
Federated models will be used for data simulation, visualisation and coordination – outputs from the activities will be provided as evidence for assurance purposes.

BIM way of working which brings new perspectives, new deliverables and new risks. Stage Gate Reviewers need to provide assurance that bid and project teams have considered relevant BIM aspects.

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3.7. Data Drops

Formats for data and information at each of the *Employer's* key decision gateways have been clearly documented within the EIR, therefore details are not repeated in this BEP.

At the *Employer's* key decision gateways (as set out in the EIR), the data and information (as set out in the approved TIDPs) will be shared (through the CDE) with the *Employer* in the formats captured in the section 2.2 of the EIR.

3.8. Levels of Development

Levels of Development have been defined with the EIR and captured, by the *Employer*, in the MPDT. Therefore details are not repeated in this BEP.

Each entry, within the TIDPs, has been assigned a LOD (at each project stage) aligned to the MPDT taking into account areas of risk and constraints where the LOD needs to be greater than identified in the MPDT.

Refer to section 4.5 for details of how we will ensure compliance with the specified LOD.

Levels of Detail comprise the following:

- Level of Model (graphical) Detail – the detail to which the physical characteristics, of the asset(s), are represented (as graphical data) within model files, at each stage of the Project; and

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- Level of Information – the type and amount of information (about the assets functional characteristics) which may be included as attributes (non-graphical data) within model files, at each stage of the Project.

The minimum level of detail needed by the team or the employer for each model’s purpose shall be defined. The level of graphical information and data (including Cobie) to be delivered at each information stage will be defined with reference to industry standards.

Model Name	Brief	Concept	Developed Design	Production	Installation	As Constructed	In Use
Systems to be covered	N/A	All	All	All	All	All	All
Graphical illustration (building project)							

FIGURE 3.8.1. Level of Model Information

Progressive Model Maturity - Levels of model detail (*Pathways stages mentioned in EIR Document can be aligned it with stages mentioned in standards in future*)

AIA LOD	PAS 1192 Levels of Model Information	Model Element Content Requirements
	Brief	At briefing stage, the graphical model will either not exist or will inherit information from the AIM (for work on existing buildings and structures)
100	Concept	The Model Element may be graphically represented in the Model with a massing diagram, symbol or other generic representation.
200	Developed Design	The Model Element is graphically represented within the Model as a generic system object, or assembly with approximate quantities, size, shape, location and orientation. Non-graphic information may also be attached to the Model Element. The concept design is developed in more detail to finalise the design and definition criteria, establishing detailed form, character and function. The cost plan is produced, Embodied and Operational Carbon is calculated and components are defined in terms of size, performance and outline specification. Integrated production information is produced enabling the production of manufacturing and installation information.

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AIA LOD	PAS 1192 Levels of Model Information	Model Element Content Requirements
300	Production	The Model Element is graphically represented within the Model as a specific system object, or assembly in terms of quantities, size, shape, location and orientation. Non-graphic information may also be attached to the Model Element.
400	Installation	The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of, size, shape, location and orientation with detailing, fabrication, assembly, and installation information. Non-graphic information may also be attached to the Model Element.
500	As Constructed	The Model Element is a field verified representation in terms of size, shape, location, quantity and orientation. Non-graphic information may also be attached to the Model Elements. The as-constructed model shall represent the as-constructed project in content and dimensional accuracy. In addition is 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.
	In use	An updated record of the asset at a fixed point in time incorporating any major changes since handover, including performance and condition data and all information for operation and maintenance. At the operation stage, the performance of the project shall be verified against the EIR and the brief. If the specification is not met and changes are necessary then objects that have been changed or replaced with different equipment shall be updated accordingly. 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.

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3.9. Digital Plan of Work

Digital Plan of Work

Provide details of how you will manage the digital plan of work provided by the Employer

Within Atkins, we are developing a Digital Plan of Works (DPoW), which will help clarify what information and to what level of detail it gets delivered at each project stage, for both graphical and non-graphical information.

This “purposeful management of information across the lifecycle” is informed by the **Digital Plan of Works (DPoW)** – which defines the level of definition i.e. of graphical information called level of Detail and of non-graphical information called the Level of Information at each stage of a project.

The DPoW provides a benchmark for a project to allow the Project Manager to discuss with the client what should be provided when and what it will look like. This manages expectations on both sides and should mean that we deliver only that which is requested – nothing more and nothing less – thus satisfying the customer information requirements for the decisions they need to make at a particular point and also ensuring we are paid for the work we do and do not erode our margin.

In summary, BIM is about information flowing through each stage – it is about:

- Creating an end to end process.
- Integrating all stakeholders to unlock efficiency.
- Integrating relevant & appropriate information at the right time for the right people.
- Creating & maintaining geometric models which link to relevant and appropriate data.
- Creating & maintaining a relevant single project data set, although not necessarily all in a single model.

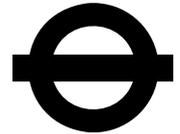
We can see that BIM is therefore a methodology, a way of delivering a project, and it not a system or technology - although technology is essential to support the methodology.

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Finally despite its title Building Information Modelling (BIM) – it is not limited to use on buildings or limited to just “modelling” but rather information “management” – and it is on a “wide range of infrastructure projects” – not just “buildings”.

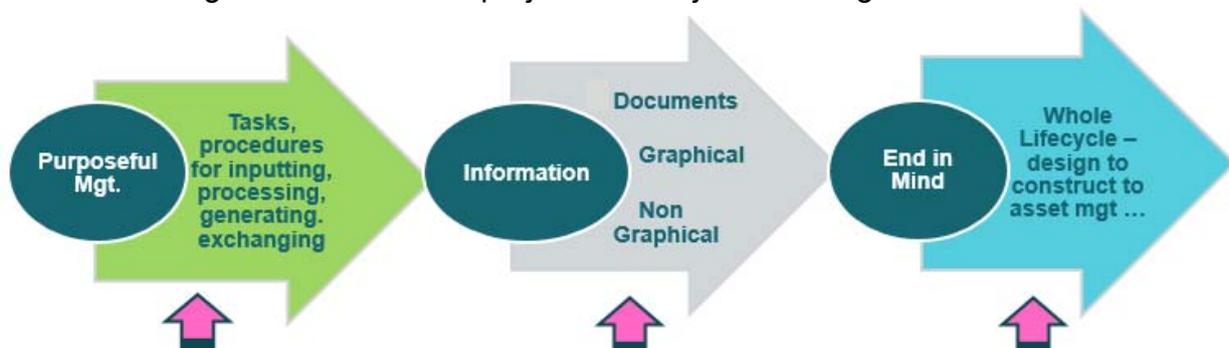


Figure 3.9.1 - Digital Plan of Works (DPoW)

3.10. Technical / Design Reviews

The types of reviews, when they occur and details of the questions to be answered at each review have been clearly documented within the EIR, therefore details are not repeated in this BEP.

BEP requirements

Clarify what Production Information and Handover Information (graphical data, non-graphical data or documentation) will be shared (and how it will be presented) to support and inform the technical / design review questions.

All output from the scheduled surveys and the resultant interpretative reports will be programmed with defined technical review periods, firstly internally as part of the Atkins BMS and secondly for input from the TfL technical approvals manager. This will be by formal submissions within the CDE. Outputs will be in the agreed software

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formats for the CDE, primarily in pdf format and / or the originating software format as required. Obviously, the model itself will be handed over as a navigable, intelligent portal to the data.

General note

Production Information and Handover Information, to be shared / delivered to support technical / design reviews, must be captured within the MIDPs.

3.11.Value Engineering

BEP requirements

Provide details of how Production Information will be:

- utilised to demonstrate the effectiveness of value engineering,
- presented at the review meetings; and
- approved as part of the review process.

Provide a schedule of review meetings – dates, times, attendees and desired outcomes.

Atkins' experience on the M4 Elevated Section has shown that the combination of accurate modelling and colour-coded presentation can be very effective in conveying the extent of remediation required. Viewing the same geometry while highlighting different defect conditions, or projected future deterioration, is invaluable when prioritising interventions and how best to combine them into work packages.

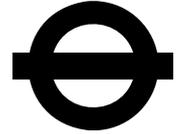
The model is a key part of Value Engineering. Different remedial options can be viewed and challenged for buildability, quantities, access and programme. The model can also be used for review meetings, task explanation, team training, or progress reporting.

As the model will be true to scale, it will be possible for the contractor's falsework, formwork, traffic management, plant and materials to be represented. A schedule of review meetings will be completed in the post-contract BEP.

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3.12.HSE & CDM

BEP requirements

Provide details of:

- the processes and activities that will support and provide evidence of meeting HSE and CDM obligations,
- the processes for integrating the construction plan with other components of the Production Information (only if contracted to carry out detailed design),
- how safety measurements will be validated; and
- how compliance with safety regulations will be checked.

General note

Through innovative methods, consider how the data and information can be used to:

- analyse potential health and safety issues (i.e. vehicle movement through sites, distribution and movement of materials etc.); and
- reduce hazards and risks and provide better safety management.

This section of the BEP contains the proposals for using BIM and the Common Data Environment to support the management of health and safety and CDM requirements. Generic text will be developed for this section, but insert text specific to your project if appropriate. Required in response to the EIR by PAS1192-2 Clause 5.3 a) 6)

This section of the pre-contract BEP contains the bidders' proposals for using BIM and the Common Data Environment to support the management of health and safety and CDM requirements.

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Safety-led design will form the basis of our approach, incorporating Health and Safety and CDM information into the model to illustrate potential hazards. The model will be used to illustrate Safe Systems of Working (SSoW), visually planning working methodologies and re-using construction sequences to demonstrate daily tasks and start of shift briefings. Potential hazards will be highlighted through the application of 'warning triangles', embedding simple 3D object signposts in the model which can be cut to the 2D drawings or incorporated into 4D sequences as applicable. Rules-based safety checks will also be implemented, for example checking for sufficient clearance around items that require maintenance or that edge protection is present when working at height. Where appropriate, weights will be reported against components to denote items that may require specific lifting methods or apparatus.

Clash checking shall be carried out during design and development of the virtual construction model, with particular focus on soft clashes (for example, positioning of insulation around ductwork and pipework). Checks can also be made for health and safety issues (for example trip hazards from low-level pipework and reach hazards relating to positioning of equipment such as valves).

For the purpose of CDM Regulations, TfL's ODE will be appointed as the Principal Designer for the whole scheme. ODE will be responsible for coordinating Designers including the independent engineering consultancy providing the structural investigation and concept design, environmental screening/EIA, and the unexploded ordnance assessment. CDM support will be provided to ODE by the TfL advisor from the CDM Health and Safety team. The Consultant will be required to undertake the role of Designer under the CDM 2015 Regulations.

The TfL Health and Safety Advisor will be involved in the review of the AIP and all design information to ensure health and safety risk management forms a part of the project Proposals.

Inclusion of a SHE box may not be appropriate on schedules, on drawings for public enquiry or exhibition purposes, or when a client requirement prevails. Notes should be included in the SHE box on detailed drawings, such as elevations, cross sections and RC detail drawings, only when the information is specifically relevant or is crucial to the effective communication of risk information.

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Risks identified in the SHE box may be numbered to enable clear cross-referencing to the Risk Register. The incorporation of the SHE box is a minimum requirement however, risks can be further clarified by adopting the Red, Amber & Green (RAG) list approach.

The 3D digital models will be available for the Principal Designer point of contact to be able to audit the project deliverables to ensure that the principles of CDM 2015 are adhered to together with all current HSE legislation.

Risk	Potential Impact	Typical examples
Low risk	<ul style="list-style-type: none"> • Would not cause reputational loss • Would not give advantage to competitors 	<ul style="list-style-type: none"> • Information on non-sensitive projects e.g. reports, designs • Publically available information • Information that the client deems not sensitive
Medium risk	<ul style="list-style-type: none"> • Reputational loss • Would give advantage to competitors 	<ul style="list-style-type: none"> • General personal information e.g. name and addresses • Information on sensitive projects e.g. reports, designs • Commercially sensitive project information e.g. contract rates • Information that the client deems to be sensitive
High risk	<ul style="list-style-type: none"> • Significant reputational loss • Gives significant advantage to competitors • Could result in fines and prosecution 	<ul style="list-style-type: none"> • Personal information of staff, e.g. health records • Information that the client deems to be private • Board papers • Information including that covered by Non-Disclosure Agreements (NDA)
Extreme risk	<ul style="list-style-type: none"> • A national security breach • Severe financial or reputational damage • Could result in fines and prosecution 	<ul style="list-style-type: none"> • Government information • Information relating to military and nuclear assets

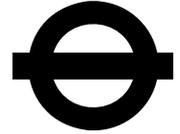
The security of information that falls into extreme risk must be protected and marked in accordance with the standards and requirements of the client. This may require additional accreditation and is therefore beyond the scope of the Information Assurance Standard. Please contact your local QSSE or SHE team for further advice if you are dealing with information of this type.

Atkins has broad experience of using 3D digital models for tunnel refurbishment and strengthening. We have collaborated with contractors to use models during the construction stage as safe training and management environments for:

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- Programme visualisation
- Condition visualisation
- Sequence constraints
- Temporary works
- Logistics planning
- Task planning

3.13. Training Arrangements

BEP requirements

Provide:

- details of nominated person(s) to be trained, as a 'Champion', by the *Employer* and a schedule for the 'Champion' to train *Others*,
- details (and reference to evidence) of current levels of capability and competency,
- details of training arrangements, including schedules; and
- details of how capability and competency will be monitored and managed throughout the duration of the Project.

This section will be completed in the post-contract BEP in collaboration with TfL for details of people to be nominated.

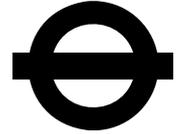
BIM has been aligned within the current [Business Management System \(BMS\)](#) Win Work and Deliver Work processes. An [Atkins Global BIM Process Guidance Document](#) is referenced from the BMS and provides further detail and links to supporting information e.g. Guidance, Training, and Templates. The scope of the document aligns with the Win Work and Delivery Work Process maps. The step by step guidance of BIM processes for a project are to be outlined in each Sector / Divisions' Technical Delivery Framework.

In order to align with current and planned collaborative working standards as the industry evolves towards BIM, this document aligns with British Standard BS

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1192:2007'Collaborative production of architectural, engineering and construction information – Code of practice'.

This Standard has been developed to address industry best practice irrespective of software platform. However, whilst recognising the wide range of software available to the business, this standard primarily focuses on the use of Autodesk and Bentley software products.

Atkins recognises and embraces the advantages of consistent, collaborative working within an information-enabled 3D environment. We also recognise the technological and behavioural changes required to do this properly, in collaboration with our clients and the supply chain.

As part of our BIM Programme we will review compliance to our BIM Standards periodically. The Atkins Business Management Systems (BMS) has defined “Check / Review / authorise” processes for 2D drawings derived from the 3D model and for the 3D model itself.

Atkins values continuous development and training forms a key element of staff continuous Personal Development, with many staff pursuing formal certification. The Annual PDR process identifies development needs and training requirements in addition to business wide initiatives.

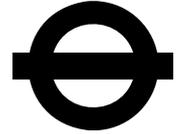
Atkins Knowledge site provides access to videos, white papers and a multitude of other useful learning documentation. Global e-learning Training Portal: this environment provides our CAD and BIM designers with direct on demand access to web-based training including self-paced courses, video tutorials, exercise files and assessments for the full line of Autodesk products as well as select Bentley products.

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3.14. Standards, Methods and Procedures

All standards to be adopted have been set out within the EIR, therefore details are not repeated in this BEP.

BEP requirements

Provide details of the process for checking / approving compliance to the Standards (as set out in the EIR). Details shall include:

- Process diagram(s) along with RACI
- Automated checks
- Manual checks
- Non-compliance reporting

Provide evidence of having worked in accordance with Industry Standards, as set out in the EIR.

All data and information will be checked for compliance to the Standards (as set out in the EIR) within the Task Team Data Environment(s) prior to being shared.

Evidence:

Atkins currently hosts over 70 highway projects on our Projectwise CDE, which has a configurable BS1192 module. With this we have set up standard configurations to meet the differing detailed requirements of our clients such as Highways England, Transport Scotland, Welsh Assembly and Transport for London.

The module handles the formal check and approval process when raising files to a higher status. It also checks the dependencies of referenced files, ensuring that none are at a lower status than that of the host file itself. For example, a drawing with title box cannot have Shared status if any of its referenced model drawings is still at Work-In-Progress.

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Each configuration sets rules for fixed and free parts of the fields that build file names, and can customise the list of suitability codes to be available.

Atkins own corporate CAD/BIM standards, and most of our clients' standards, include the same or similar stipulations to those laid out in the EIR sections 14-17. For the CDE implemented on this project, we will bring the knowledge and culture of working in accordance with BS1192 / PAS1192-2. Atkins is a corporate member of BuildingSmart UKI. Our staff serve on international committees and expert panels for the development of IFC definitions for road, rail and bridges. We are thus actively progressing the availability of open standards in the infrastructure sector.

Atkins have been using automated clash detection on tunnel projects.

Supplier Roles RACI

PAS 1192 Roles	Client Outcomes	Info Requirements	Collaboration & Comms.	BIM, IT & Resource Capability	Standards / Tools	BIM Commercials	PIM Plan & Processes inc Info Exchange	MPDT	Pre-Contract BEP	MIDP	TIDP	Post Contract BEP	Performance	Production of deliverables	Check, Approve, Authorise
Project Manager	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Design Co-ordinator	R	R	R	R	R	R	C	R	R	R	R	R	R	I	R
Technical Lead	R	R	R	R	R	R	C	R	R	R	R	R	R	I	R
Information Mgr.	R	R	R	R	R	R	R	R	R	R	R	R	R	C	R
Team Manager	R	R	R	R	R	I	C	R	C	I	R	C	R	R	R
Design Co-ordinator	R	R	R	I	R	I	C	I	I	I	C	C	R	R	R
Information Manager	R	R	R	I	R	I	C	I	I	I	C	C	R	R	R
Information Author	R	R	R	I	R	I	C	I	I	I	C	C	R	R	R

A = Accountable for defining, clarifying, confirming aspects with client + for delivery

R = Responsible for delivery aspect

C = Consulted about the aspect

I = Informed of the aspect

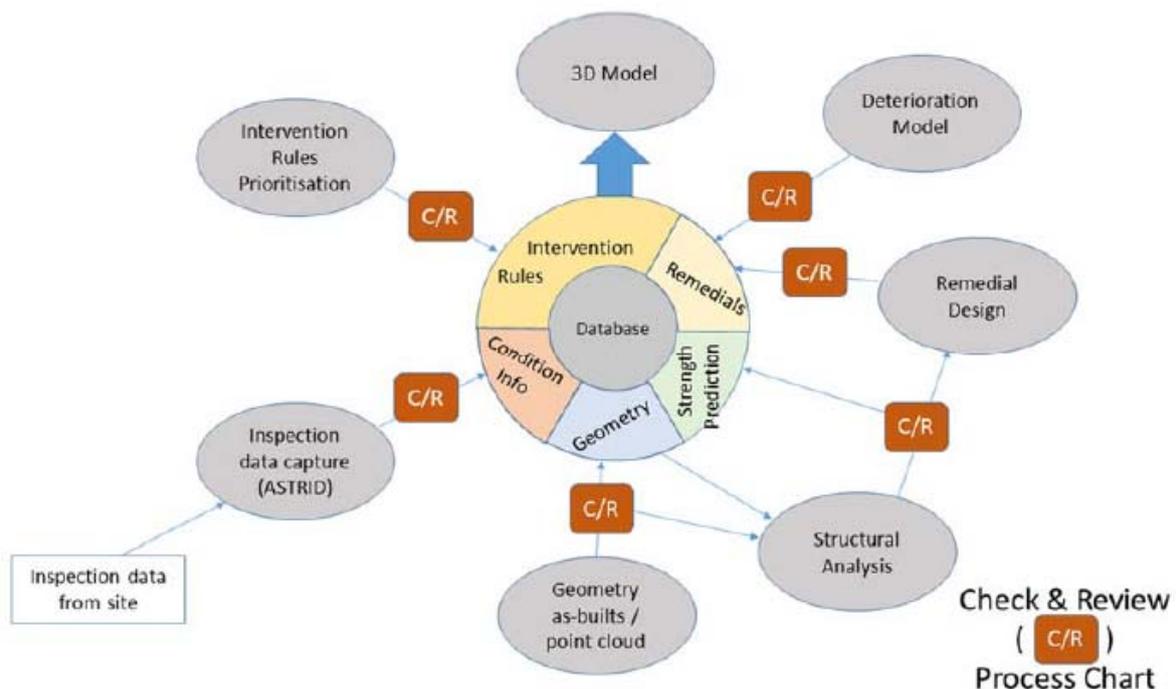
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This Table is here for illustration purposes rather than to read i.e. it illustrates that guidance is available on level of responsibilities for key information management roles – this can be found on the Global DEC Site.



Automated checks will include checks for units, file naming, level naming, and clashes between components.

Manual checks will include ensuring each file's content is in expected location, no disciplines missing, all contents match the current shared version, and cross discipline reviews and buildability / value workshops with the contractor.

Non-compliances will be reported to Atkins Project Manager or delegated Document Controller. Any files containing non-compliances will reset to a status of Work-in-Progress.

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Checks	Definition	Responsible Party	Software Program(s)	Frequency
Engineering design check	Drawings shall be reviewed to ensure that the content reflects the Level 2 design-intent .	All disciplines	n/a	Every issue
Visual	Drawings shall be reviewed to ensure high quality, consistent presentation is achieved	All disciplines	n/a	Every issue
Clash detection	Detect problems in the model where two building components are clashing.	All disciplines	Authoring Software/Navisworks	Coordination Reviews
BIM Standards	Compliance with Project BIM Standards.	All disciplines	Authoring software's internal cad standard checking tool	Formally published data
Model integrity/validation	That the model is fit for coordination.	All disciplines	Authoring software/Design Review	

Table: **3.14.1**: Strategy to be used to check standard and maintain quality control.

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3.15. Security

BEP requirements

Provide details of how:

- compliance with the 'TfL Information Security Classification' standard will be monitored and managed; and
- how PAS1192-5 will be implemented (as applicable).

Atkins corporate data security standards are designed to protect our clients' data from theft, loss and sabotage while held on our network. Our corporate laptops are encrypted to further protect the information when away from the office.

To further protect project information from misuse requires assessment against PAS1192-5. Atkins Project Manager will appoint a Security Manager to determine access to the data while it is in our control. All of these major Thames bridges could be considered as Sensitive Built Assets under PAS1192-5, and targets of hostile reconnaissance. Few aspects can be considered not already in the public domain, as they may be readily viewed from above or below. But detailed models, survey information, photographs and other information will be restricted to the project team, nor will they be transmitted by insecure means.

The utility services across the bridges will be treated as "need to know" information within the definition in PAS1192-5. We propose that all utilities be anonymised together as simplified bounding shapes, except for the security-vetted utilities coordination team who will control legitimate queries for more detailed information. This will achieve safety by maintaining a protected volume while obscuring detail from potentially hostile intent.

Any models that TfL may require for public or stakeholder information will contain only simplified structural forms, and no third party assets.

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Line Manager Briefing

Line manager briefing Subject: Information Assurance		
Call to action: Inform your teams of the importance of protecting our information and to complete the e-learning module as soon as possible.		
Atkins Baseline	Atkins Sensitive	Atkins Private
<ul style="list-style-type: none"> Consider the sensitivity of information 	<ul style="list-style-type: none"> Mark documents with 'Contains Sensitive Information' Consider who is permitted to have access to information 	<ul style="list-style-type: none"> Mark documents with 'Contains Private Information' Only share information with authorised recipients

To help you, we've defined an information classification system for Atkins. This quick guide provides you with practical advice to help you correctly classify information and assess how this should be shared.

The Atkins Group Code of Conduct makes clear that protecting our information and assets is vitally important to both us and our clients. From a business perspective, it's essential that information such as financial results, business plans, technical designs, or personal information is not compromised. Securing our physical assets is equally important and even a small scale security incident could leave us without access to critical equipment, services or IT systems for hours or days.

Certifications

Atkins businesses have either achieved or are working to the principles of the International Standard ISO 27001 (Information Security Management Systems) and other sector specific equivalents, as appropriate. Those businesses certified to ISO 27001:2005 are transitioning to ISO 27001:2013.

Atkins has obtained the new UK Cyber Essentials Plus certification, a new Government backed and industry supported scheme to guide businesses in protecting themselves against cyber threats.

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In a world where the security of data is a global concern for governments and companies alike, we at Atkins Group Information Systems (IS) have implemented a set of controls across the company to ensure our systems, networks and data are protected at all times.

So, you can be confident your information is safe when you work with us. Our measures include: firewalls and intrusion prevention systems protecting the Atkins Computing Environment (ACE) at its boundary with the Internet; controls against malware and viruses on our devices and servers; gateways for email and web browsing; information backups and clear policies on removing media, user accounts, access rights and password setting.

Intrusion Protection

We have firewalls and intrusion prevention systems protecting our network where it connects with the Internet. We are mindful of the different levels of security required in different situations and encrypt sensitive information depending on the risk of interception and the potential impact of this happening.

Organization of information security

We have a distributed team of qualified security professionals and Information Security is integrated into our Quality Safety, Security and Environment organisation to ensure that business requirements for security are identified and incorporated into the design of our systems and processes.

Mobile device policy

Our corporate email system will not allow mobile devices to connect until after a user has requested access, accepted terms of use and has configured their device to meet corporate standards. The terms include a right of Atkins to carry out a remote wipe of the device, a commitment by the user to report lost or stolen devices, authentication and encryption.

Screening

Screening is employed as required for the individual's role. Atkins has a vetting function to carry out screening and Group IS has a number of individuals screened for processing government classified work.

Terms and conditions of employment

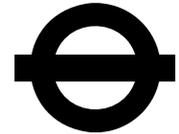
Staff are provided with a description of their responsibilities for security through information on the corporate Intranet and the company Code of Conduct booklet.

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Employees are informed that they are bound by employment contracts, the Information Security Standard and other relevant standards under the “Personnel & Information Assurance” standard.

Disciplinary process

Users are informed that failing to comply with the Information Assurance Standards may be subject to a disciplinary process which may include immediate dismissal for gross misconduct.

Management of removable media

Atkins employees are required to abide by the company policy on the use of removable media information storage media used remotely must at all times be appropriately physically protected from damage, theft and accidental loss.’ Where necessary we use encrypted USB storage. Group IS ensures that laptops and workstations returned to them are securely disposed of using overwriting technologies. We obtain proof of secure erasure as part of our disposal process.

Physical media transfer

The Encryption of Portable Devices & Removable Media standard provides guidance to indicate what information should be encrypted and makes staff and managers responsible for checking that any solution meets specific requirements mandated by their customer.

User access management

We ensure that user accounts are carefully controlled within the ACE and are only created after a formal request has been authorised by a manager. User accounts have limited privileges and initial access rights are determined by the employee’ line manager and are then implemented by Group IS system administrators. Additional privileges are only granted after a formal request has been authorised by a manager. As a further control, Group IS system administrators have a secondary account which grants them additional privileges, rather than have those privileges assigned to their normal user account.

Access rights for Group IS system administrators are managed by the owners of ‘team groups’. Each team group owner is responsible for the removal of rights from users that have moved, left the company or changed roles.

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User responsibilities

We enforce password complexity on Windows domains within the ACE. Users are advised on the selection and safeguarding of passwords through the User Identifiers and Passwords Directive on the corporate Intranet.

System and application access control

Wherever possible we work to the principle of “least privilege”. We minimise the privileges and access granted to users and deny access to functionality that is not required for staff to carry out their roles. This reduces the risk of unauthorised access and limits the damage that can be caused by accident or malware activity.

Management of privileged access rights

We use a specialist tool to enable the elevation of access rights for end-users. Staff with system administration roles are given a separate account for their administration duties.

This account has a specific set of terms of use and reduces the risk of malware running under privileged access.

We also use a privileged identity management solution to ensure that use of built-in, preconfigured (e.g. “Root”, “Admin” or service accounts can still be attributed to an individual at time of use and to ensure that the passwords are appropriately managed.

Use of privileged utility programs

Privileged utility programs are controlled by system policies and limitations on user privileges.

Removal or adjustment of access rights

Group IS disables user accounts and then deletes them based on information from line managers or as a result of automated feeds from the HR system.

Cryptographic controls

We ensure that sensitive information is encrypted when sent over public networks. By default, we encrypt all laptops at build time. This cannot be disabled by end-users. We evaluate encryption and hashing algorithms to ensure that security provided by cryptography is appropriate to the level of security required. Our current standard for bulk encryption at rest is AES-256 or stronger.

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Protection from malware

We have technical controls against malware/viruses which are enforced on hosts (e.g. PCs, Laptops, Workstations, and Servers) and gateways for email and web browsing. All hosts run centralised antivirus which includes antispysware. These are centrally managed and updated and are protected against attempts to modify or disable the service.

Our malware solution also uses host intrusion prevention and a cloud based reputation service to address new and emerging malware which might evade traditional signature detection.

Limitations on user privileges provide additional protection against malware.

We use gateways for email and web browsing to inspect incoming traffic for malicious code. Check Point internet gateways are configured to block and detect attempts to 'Command & Control' devices on the Internet.

Backup

We protect against loss of data through scheduled backups of information on our servers. The backup schedule is derived from standards and an analysis of the requirements for recovery times, with test restores carried out on high impact/high risk services.

Technical vulnerability management

We monitor key sources for notification about security vulnerabilities, evaluate these and apply security hotfixes or other mitigations as required.

Security of network services

A centralised networking team manages network service providers, creates wide area connections using MPLS or IPsec as appropriate and manages wireless networking. Staff outside of Group IS are forbidden to connect wireless routers/access points to the corporate network. Group IS ensures that authorised wireless routers are configured to require authentication and to ensure that connections are encrypted.

Network segregation

We ensure that the production network is separated from the Internet and other untrusted networks using firewalls and routers. Services which are published to the Internet are hosted in a DMZ or published using a reverse proxy. In exceptional cases we can create dedicated and separated areas for highly confidential projects.

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Securing application services on public networks

We use encryption and data authenticity mechanisms to protect information from interception and alteration. This is typically in the form of TLS or IPsec.

Availability of information processing facilities

We assess the availability requirements of systems as part of our development process. Where appropriate systems use replication and redundancy to provide high availability or rapid failover in the event of a major outage at a given location.

Independent review of information security

Information security is covered as part of Atkins audit regime.

3.16. Roles and Responsibilities

Roles and Responsibilities relating to the production, use and management of the Production Information and Handover Information have been set out within the EIR, therefore details are not repeated in this BEP.

BEP requirements

Provide a schedule of contact information of the named persons assigned to specific roles and responsibilities (as set out in the EIR).

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	<p>Project Mgt Roles: Project / Bid / Commercial Manager, Project Delivery Manager</p>	<ul style="list-style-type: none"> • Client opportunity & information requirements. • Response to client requirements. • Project resources (capacity and capability). • Project Assurance (technical + commercial).
	<p>Technical Roles: Technical Lead, Design Lead, Lead Designer, Chief Engineer</p>	<ul style="list-style-type: none"> • Spatial sub-division & Information Delivery Plan. • Delivery to Design Standards . • Authorise project information through the CDE process. • Assure design clash resolution.
	<p>Information Mgt Roles Information Manager, BIM Manager, CAD Manager</p>	<ul style="list-style-type: none"> • IT Facilities & Systems. • Interoperability across all data (models, drawings, etc). • Model compliance & assurance. • Information security requirements. • Information exchange set up.
	<p>Team Mgt Roles: Team Manager, Discipline Lead, Work Package or Task Team Manager</p>	<ul style="list-style-type: none"> • Task Information Delivery Plans. • Team resources (capability & capacity). • Delivery in line with Standards/Protocols. • Assure collaboration & info exchange.
	<p>Information Authoring Roles: Information Author, Engineer, Architect, Technician</p>	<ul style="list-style-type: none"> • Create information models & deliverables. • Follow agreed standards, tools, templates, libraries. • Meet the design requirements. • Escalate errors & clashes.
	<p>Design Co-ordination Roles: Design Co-ordinator, Interface Manager</p>	<ul style="list-style-type: none"> • Facilitate Design Co-ordination Meetings. • Assure a co-ordinated design (inc. clash avoidance). • Manage project design interfaces.

Atkins is a large organisation with projects of multiple natures, we have provided examples of key roles that support the main activities in this diagram. We recognise that in different sectors and regions roles may called other names. At this point we should remind ourselves of the principles around roles i.e. that roles are not job titles, and that more than one person can do a role, and that a role may be done by more than one person. Thus what is really important is “to identify who is responsible for each responsibility and that all responsibilities are covered by some named person”.

Information Management Roles & Responsibilities – Key Principles

- Everyone’s job.
- Roles are not job titles.
- A role can be undertaken by more than one individual.
- An individual can undertake more than one role.
- Not all projects will have all these roles.

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- Whilst not all roles are essential – all responsibilities are.

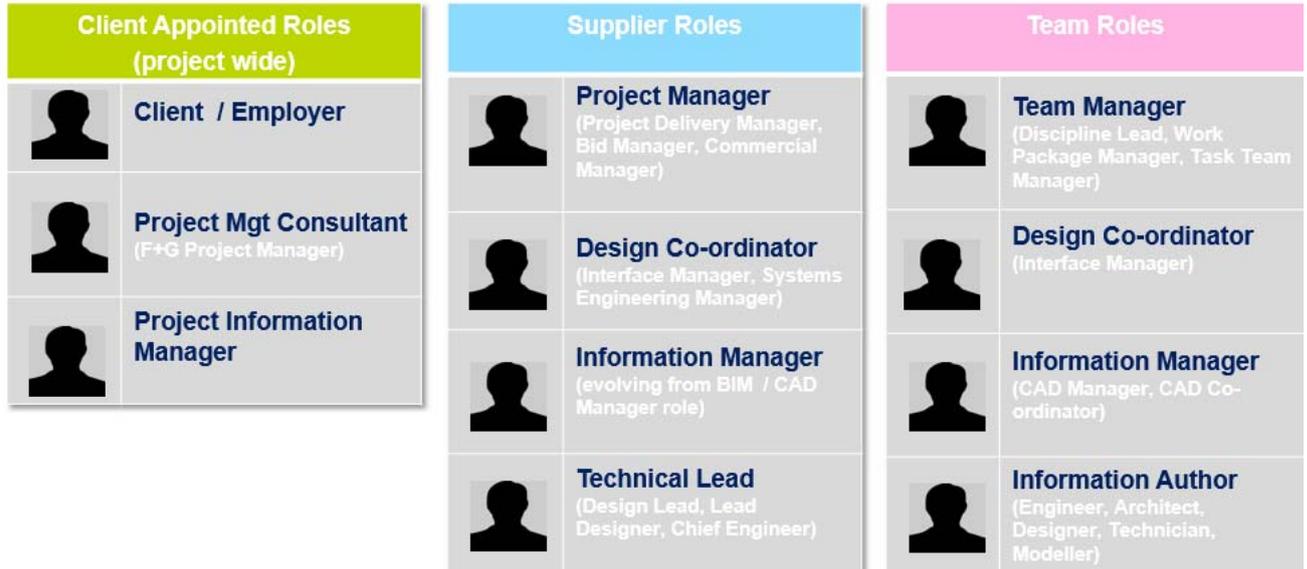


Figure 3.16.1 Key Information Management Roles

Role	Name	Email	Phone
BIM Coordination Management (design lead / contractor lead)	[REDACTED]	[REDACTED]	
Information Management (design lead / contractor lead)	[REDACTED]	[REDACTED]	

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Table 3.16-2– Roles Task Team 1 – *[INSERT NAME]*

Role	Name	Email	Phone
Task Information Manager			
Task Information Manager(s)			
Interface Manager(s)			
Information Authors			

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Table 3.16-2– Roles Task Team 1 – *[INSERT NAME]*

Role	Name	Email	Phone

3.17. Naming Conventions

Naming convention details have been set out within the EIR, therefore details are not repeated in this BEP.

BEP requirements

Provide details of how compliance to the naming convention will be checked prior to files being shared.

Our Projectwise setup enforces the use of the TfL standard naming convention. A template file will be prepared that contains the file naming convention required. This will be checked against the list supplied by TfL, and any additional layers agreed with the PM.

3.18. Metadata

Metadata requirements have been set out within the EIR, therefore details are not repeated in this BEP.

BEP requirements

Provide details of how each file will be validated as carrying the required metadata fields (as set out in the EIR), that the fields have been completed and how each entry will be checked for the correct format.

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Atkins will develop the project within our Revit Server with Clarity Projectwise CDE. Its configuration can handle the additional metadata such as status, and include this in transmittals to the client CDE.

Metadata can range from providing information about the whole file, like creation date, author/designer, application, file name, file size, etc.), to information about assemblies and elements (or families and instances), like keynotes, manufacturer, model, cost, assembly code, description, etc. Metadata can be scheduled or extracted and/or exported to text files from original applications. The purpose of using metadata –in general- is to provide a structure for identifying, sorting and searching information. In BIM models, more information is always welcome- in moderation- to paint a clear picture of the project; through generating accurate schedules and cost estimates, compare design options and create a comprehensive database for facility management.

3.19. Attribute Data

Attribute data requirements have been set out within the EIR, therefore details are not repeated in this BEP.

BEP requirements

Provide details of:

- The process which will be followed to convert the scan data to an LOD 200 model,
- how attributes will be checked,
- what additional attributes (where required) will be captured to enable assessment of asset performance, data simulation and scheduling.

Atkins proposes to deliver AutoCAD 3D solid and mesh models/Revit model/ NWD NavisWorks model. TfL's list of Uniclass 2015 codes will be included in the layer names, which will be set up in a standard, checked template for the whole project.

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The granularity of the modelling must be compatible with the detailed condition data that is to be gathered and analysed.

The precise methodology to meet TfL's requirements in the most efficient manner is being evaluated. We will ensure that both the proprietary and the IFC format deliverables carry the appropriate property data without double entry.

3.20. Classification

BEP requirements

Provide details of how classification applied to data and information will be checked against the *Employer's* approved classification systems (and codes).

Provide evidence of having worked with British / International classification standards; include details of how these have been applied at each stage of a project.

Only classification systems (and codes) approved by the *Employer* will be applied.

Evidence:

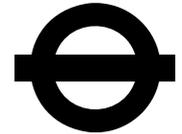
Atkins was lead author for CAD and BIM Standard, which implemented BS1192 and PAS1192-2.

Atkins is already involved in design of M6 Managed Motorway and A14 Cambridge to Huntingdon projects for Highways England that implement IAN184. And our work on A9 for Transport Scotland, and M4 at Newport for the Welsh Government have similar requirements as a part of infrastructure.

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4. Information Management

4.1. System Performance and Constraints

BEP requirements

Provide details, including that of sub-contractors, of any restrictions or limitations on the production, use and management of the Production Information and Handover Information.

Provides details, describing restrictions and / or limitation(s) on (but not limited to):

- File size,
- Others IT systems,
- Compatibility of software versions; and
- Security issues.

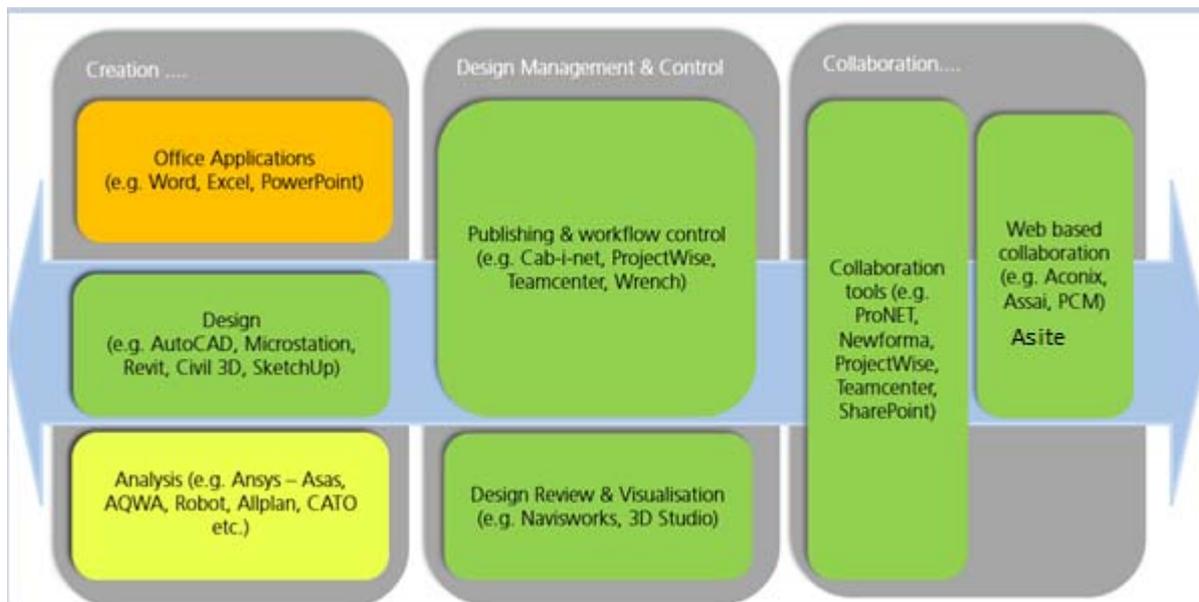


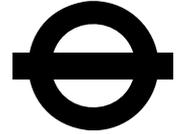
Figure 4.1.1 Shows how the data is created and maintained between various software.

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The following key principles shall be followed:

Models may initially be created as isolated, single-user files. The model will be subdivided as it becomes larger or additional members of the design team are introduced. No more than one building shall be modelled in a single file.

A model file shall contain information from one discipline only (although exceptions may apply for Building Services where multiple disciplines converge).

Further segregation of the geometry may be required to ensure that model files remain workable on available hardware. (As a basic guide, files exceeding 50MB possible further sub-division. Ideally files shall not exceed 100MB).

In order to avoid duplication or co-ordination errors, clear definition of the data ownership throughout the life of the project shall be defined and documented within the BEP.

Element ownership may transfer during the project lifecycle.

Where multiple models make up a single project, a container model should be considered, whose function is to link the various assemblies together for coordination/clash detection purposes shall be reviewed with respect to performance.

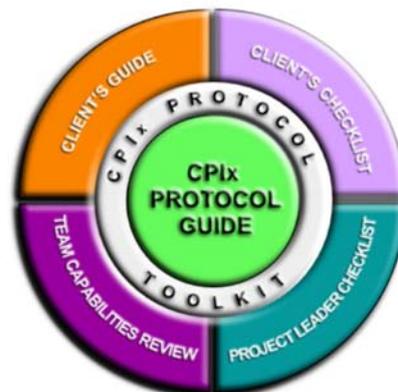


Figure 4.1.2 CPIx Protocol

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4.2. Planning and Work Segregation

Massing Strategy

BEP requirements

Provide details of the massing strategy and how it will be developed and maintained throughout the duration of the Project.

Provide evidence of having produced and used a Massing Strategy on previous project. Evidence should include when it was first produced, how it developed throughout the duration of the project, who was responsible and the process for updates and approvals.

An initial massing model will be produced, by the Lead Designer, during the early feasibility stage to identify the shape, location and orientation of the works in relation to the built environment, using the site information provided.

The massing strategy proposed for the project is to subdivide the 3D solid modelling to a level of granularity that corresponds to the condition data being gathered, and the remediation that results from analysis of that data. This data structure will continue to serve this purpose for inspection and maintenance activities in the future.

Atkins innovative approach to the M4 Elevated Section, as part of Connect Plus' M25 DBFO Concession is a very relevant example of a massing model that also has the granularity to present condition data, remediation methods, progress etc. Each type of crosshead was constructed in AutoCAD as a contiguous set of faces corresponding to the breakdown of the historical inspection records. Instances of the relevant crossheads were located at the correct coordinates, assigned unique IDs, and verified against laser point cloud data. This massing model was imported to NavisWorks and linked to the historical and ongoing data in tabular form. NavisWorks's appearance Profiler could then be used to present any desired analysis.

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Modelling Strategy

BEP requirements

Provide details of the modelling strategy, how it will be developed and maintained throughout the duration of the Project and how it aligns with the *Employer's* modelling standard.

Provide evidence of having produced and worked to a Modelling Strategy. Evidence should include how it was compliance was monitored and managed.

The division of models will follow the requirements as set out in the *Employer's* modelling standard.

Further sub-divisions have been determined based on assigned tasks, work packages and programmed activities, this has been reflected in the TIDPs.

In relation to the graphical data, Composite Models will be used to bring together the individual model files for a number of activities including coordination, analysis and drawing definition production.

All model files will be constructed to enable automatic extraction of cost data, schedules and other required asset information (to the agreed Level of Detail and Level of Information at each project stage / milestone) and to enable the creation of multiple options during early design phases. All attribute data will be verified and validated prior to the extraction of any documentation

Model Federation and Volume Strategy

BEP requirements

Provide details of how and when volumes will be developed, the responsibility of each task team in relation to creating and maintaining the volumes and their responsibility for the interface / coordination between the volumes.

Provide evidence of having produced and worked to a Volume Strategy. Evidence should include when volumes were developed, responsible parties, how interface /

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coordination was managed through the use of volumes and how compliance was monitored and managed.

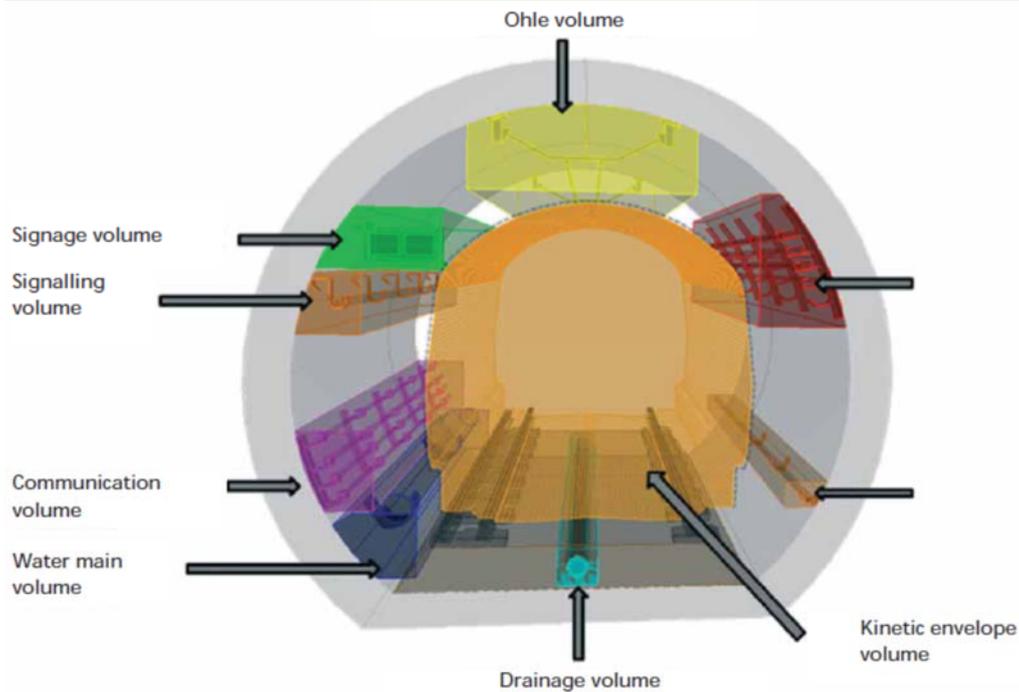


Figure 4.2.1 Model volumes for a tunnel project.

The volume strategy also achieves spatial co-ordination during the design process. Each volume or subdivision is a reference file. This subdivision also becomes important when using extranets, as it allows the files to be kept to a manageable file size.

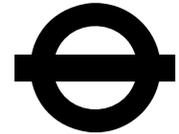
Soft Volumes shall also be taken into account for spatial co-ordination. Such items as the “kinetic envelope” should be provided and owned.

Volumes are rather like two- or three-dimensional jigsaw pieces. They are NOT a pastry-cut through the model so that every discipline’s volumes cover the same area. Different disciplines’ volumes can interface in different ways.

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They do not have to be square; they simply have to fit exactly with all the adjacent pieces of the same discipline, without overlapping or leaving any gaps. If other disciplines' volumes are then overlaid, a composite of multi-authored information will produce the complete project model.

In other words, a volume defines the extent of model files, and one or more model files (referenced files) can relate to a volume.

As the design develops the overall massing will be divided in to volumes (spaces) to represent areas assigned to the task teams in order for them to space proof their design – the volumes will be used for early coordination activities between task teams.

As the design progresses the volumes will become a more realistic, representing the space requirement of the physical assets, in terms of shape and size; tolerances for operational and maintenance space will also be included.

During the early stages of design the volumes will be used to manage change control. Proposed changes, that have an impact to the size and /or orientation of the allocated volume (including change in location of connections / fixings associated to the allocated volume) will be shared with the suitability code, 'S3 – For Comment and Review' to allow those affected to assess the impact and agree on appropriate action. Where changes to the volume model(s) are agreed, the revised files will be shared (following the approval process) with the suitability code, 'S1 – Coordination (for use)' and will become the baseline moving forward.

The task team interface managers are responsible for the interface / coordination between the spaces.

Atkins pioneered multi-discipline 3D clash detection on major highways with the M25 DBFO in 2008 onwards. We routinely apply this approach now. For example, on the A14 each discipline has a modelling input statement that sets out their methodology for modelling their components. It includes access space and swept space, such as the working width of safety fences or hinged lighting columns. These volumes are assigned volume and location codes in the file names, and classification codes in the layer names so that specific clash tests may be carried out.

Ideally each discipline is assigned a geometric volume through standard cross section details. However, highway verges are often very congested, requiring many

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individual solutions where point assets (manholes, sign foundations etc.) obstruct linear assets.

Ideally each discipline is assigned as geometric volume through standard cross section detail, however tunnel approaches are often very congested, requiring many individual solutions where point assets, obstructs linear assets.

4.3. Common Data Environment (CDE)

Information relating to the CDE processes have been set out within the EIR, therefore details are not repeated in this BEP.

BEP requirements

Provide details of the systems and process that will be used for the Task Team Data Environment(s) and processes for publishing data and information to the shared area (as provided by the *Employer*).

Provide details, including systems and processes, of how data and information will be shared / exchanged between your organisation and your supply chain.

Provide evidence of having collaborated and managed data and information through the CDE process (as set out in PAS1192:2).

All data and information will pass through the CDE in accordance with the EIR.

Each contracted party will utilise their organisations systems and tools to provide their Task Teams with a Work in Progress area (Task Team Data Environment). Prior to being published to the shared area (as provided by the Employer), each Task Team will check and approved all data and information as being appropriate for the purpose for which it is being shared.

Atkins currently hosts PAS1192-2 CDE on Projectwise for many infrastructure transportation Projects.

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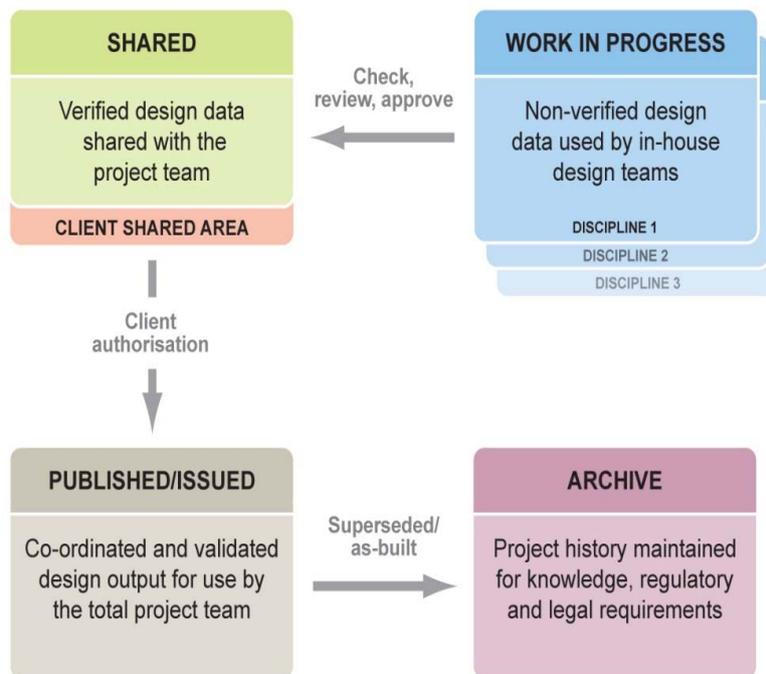
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We propose that the Task Team would use the Projectwise environment that they are already familiar with, configured to the specific requirements of TfL. Atkins supply chain would have access and training to use the task team CDE.

A potential solution for the client CDE would also be Projectwise. The client CDE could be either the same Projectwise datasource, or an independent one with the same configuration. In the first case, publishing would involve passing data through the formal checking and approval processes to make a status that is visible to the client. For an independent datasource there would then be formal transmittals to the client CDE, but this is straightforward. Provision for IFC viewing would be via freely available client-side tools.



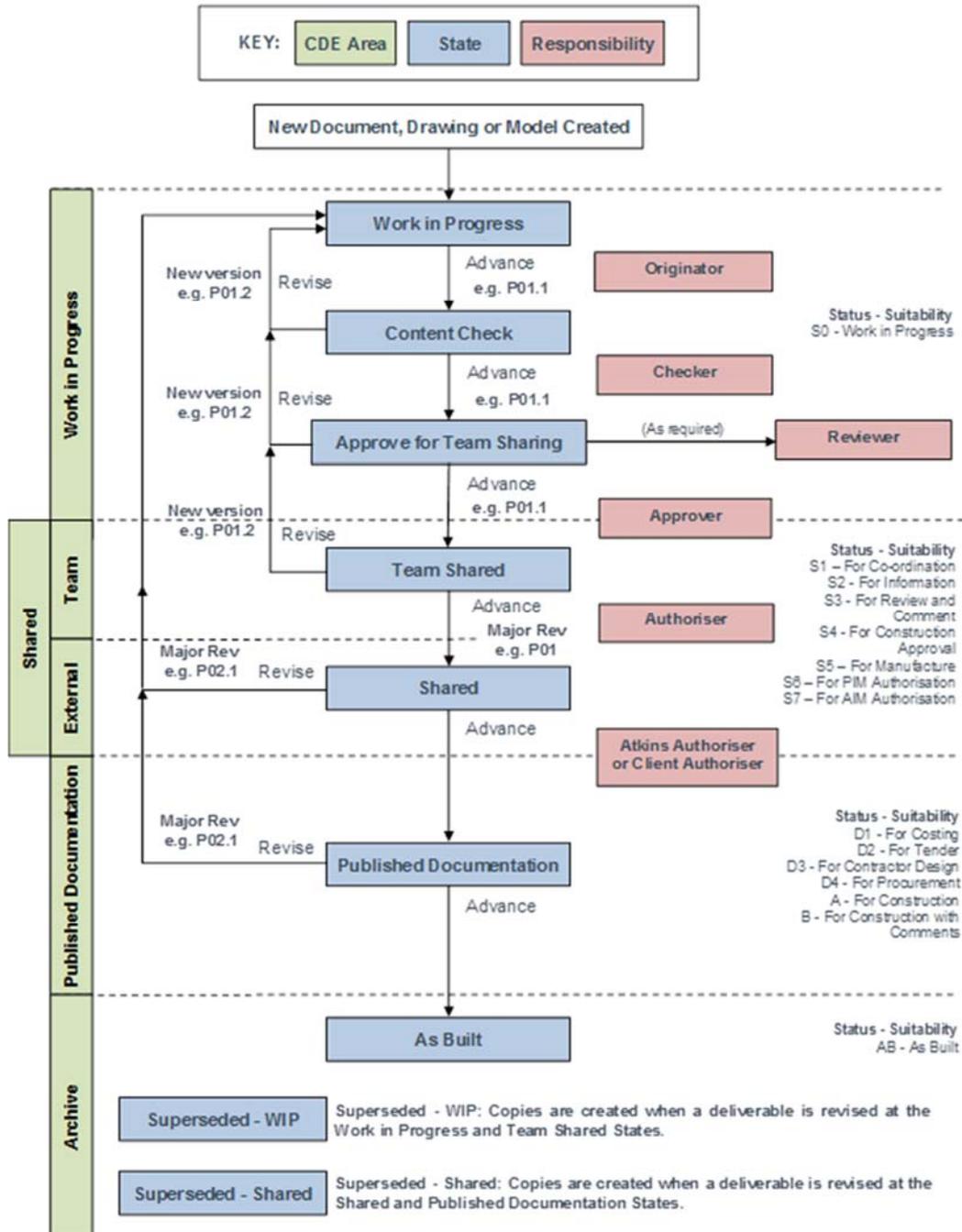
Functional Sections of the CDE (Generic)

- Work in Progress (WIP)
- Shared
- Published Documentation
- Archive

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4.3.1. BS1192 Workflow within Projectwise (Within Atkins)

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4.4. Collaboration Process

BEP requirements Collaboration process have been clearly documented within the EIR, Annexure 4 therefore details are not repeated in this BEP.

Provide a schedule of interactive design review and coordination meetings/workshops. Schedule should include:

- frequency and purpose of each review and coordination meeting/workshop,
- the objective of the review and coordination meeting/workshop,
- attendees (roles),
- how the Project Information Model will be utilised; and
- how issues are captured, assigned and resolved.

Atkins' Projectwise CDE includes the BS1192 module, which we would configure to the workflow appropriate to STIP2, taking TfL's standards in to account. We have made similar customisations for our infrastructure projects in England, so have the experience. Each deliverables must be formally submitted for check, review and authorisation by a suitably qualified person before it can achieved shared status. No deliverables that itself references unauthorised contents may be submitted for shared status.

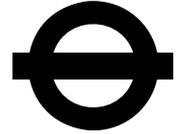
Each discipline is responsible for the accuracy and completeness of its own 2D and 3D content, and for maintaining the current version on the CDE. Atkins envisages using only AutoCAD 2013 dwg, Revit 2016 or later version in *.rvt format (which remains the current format), along with IFC files exported from Revit.

Federation will be undertaken by the BIM Coordinator, who will convene design reviews and coordination workshops as necessary. The 3D model will be updated to the latest shared-status (or higher) versions before any workshop, and at any design milestone. A suitable frequency for coordination workshops would be assessed and agreed with TfL, along with attendance lists.

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4.5. Compliance Plan

BEP requirements

Provide details of how you will ensure that all Production Information and Handover Information, delivered through the CDE at each project stage (and as notified by the *Employer*), is:

- Verified and validated against Project Requirements (including the EIR):
 - provide details of any software utilised to carry out validation checks; and
 - provide details of methods and processes for verifying and validating Production Information and Handover Information.
- Progressed to the agreed Level of Development as set out in the TIDPs:
 - provide details of any software utilised to validate against Level of Development at each project stage.
- Spatially coordinated in relation to assets physical space, operational space and maintenance space:
 - provide details of methods, processes and any software utilised to verify spatial coordination.
- Useable by the software platforms as set out in the EIR (and in the formats as set out in the EIR)
- Checked and approved for technical content (in accordance with the Design Management plan).

Each contracted organisation will perform quality assurance audits for their designs according to their quality assurance procedures.

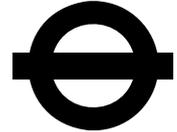
As the design progresses the content will be checked to ensure it has been produced in accordance with the applicable standards; this will be carried out by the authors and will be the minimum level of checking performed prior to data and information being shared with suitability, 'S3 – For Review and Comment'.

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For data and information shared with any other suitability (than S3), technical checks will be carried out which will include:

- **Technical Content** – check the data / information is developed to the applicable level of maturity for the particular project stage; data / information is representative of the current design and is aligned to meet project requirements.
- **Quality Analysis** – check that all data and information are cross-referenced and aligned; check graphical elements are aligned to spatial requirements (physical, functional, maintenance spaces), check conflicts between graphical elements (interdisciplinary and cross-disciplinary clash detection), check data and information comply with fire regulation requirements and planning requirements.
- **Quality assurance** - check points have been included within the programme; sufficient time has been allocated for potential corrections.

Project templates are provided in support of this standard and shall be used wherever possible. There are a number of standards checking tools available from within core CAD and BIM software applications. These tools can check if a user attempts to create non-standard compliant elements within a file and warn the user accordingly. The project CAD/BIM Manager must ensure that relevant standards checking files and tools are correctly configured and set for project use as defined by this standard and the BEP.

Required in response to the EIR by PAS1192-2 Clause 5.3 a) 4) This section of the pre-contract BEP contains the bidders' proposals for managing the co-ordination process. The requirements for co-ordination are stated in PAS1192-2 Clause 9.4. Define the processes and requirements for spatial co-ordination of model information generated by design team that enables a fully coordinated design model and enables effective clash avoidance/detection.

Spatial coordination of building information models is an essential component to successful project coordination in particular to ensure all Critical Dimensions set out in the Compliance drawings are achieved. Generated model data, whether 2D or 3D, shall be created in accordance with:

- The agreed project Coordinate system in accordance with TfL Surface standard
- True height above project datum.

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This will ensure that each discipline's model data can be effectively shared and fully coordinated within the project's information database to enable design review, coordination and clash avoidance/resolution to be undertaken.

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5. Digital Engineering

5.1. Software Platforms

A list of the software platforms used by the Employer' has been set out within the EIR, therefore details are not repeated in this BEP.

BEP requirements

Provide details of:

- the software platforms (and the common data exchange formats) that will be utilised to carry out the following activities:
 - Data authoring – creation of Production Information and Handover Information.
 - Data capture – collecting, from various sources, Graphical Data and Non-Graphical Data relating to asset(s).
 - Data visualisation – visually representing Graphical Data and Non-Graphical Data to support decision-making.
 - Data coordination – use of the Graphical Data and Non-Graphical Data, about the asset(s), to virtually assure and evidence coordination across all Task Teams, existing infrastructure and adjacent works.
 - Data simulation – use of the Graphical Data and Non-Graphical Data to virtually test the design, construction, operation and maintenance of the assets.
 - Data validation – rule based tools used to check and validate all Production Information and Handover Information against the EIRs and Standards.

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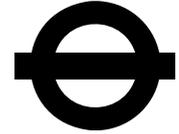
- how Production Information and Handover Information will be prepared and shared, from data authoring tools, such that it can be utilised by the software platforms identified in the EIR.

	Use	Platform	Version
Data authoring	Non-Graphical Data	Excel	2007
	Graphical Data	Surface	
		AutoCAD	2013
		AutoCAD Civil 3D	2013
		Revit	2013
Esri (GIS)			
Data capture	Laser Surveys	Recap Pointools	2013 SS2
Data visualisation	Documentation	Adobe PDF	11
	Graphical Data	Surface Navisworks	2013

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Use		Platform	Version
Data simulation	Graphical Data Non-Graphical Data	Surface Navisworks	2013

Table 5-1 - Software Platforms

5.2. Data Exchange Formats

BEP requirements

Provide details of how the following will be identified, addressed and managed:

- interoperability issues; and
- how the file exchange format requirements will be met.

Provide evidence of having extracted data and information into a common exchange format such that it can be easily interrogated and used by other parties.

The interoperability interfaces are between:

- Survey contractor and Atkins

To minimise the survey duration and corresponding risks and restriction to traffic it is likely that a point cloud solution will be the most appropriate survey method.

Technologies such as hand-held laser scanners, or multiple high-resolution digital photographs could offer savings in time, and thus reduce risks to personnel and obstruction to traffic on the roads or river.

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Conversion of point-cloud data to a segmented geometric model represents a minor interoperability interface. However, it also presents a valuable validation tool between model and reality.

- Inspection and BIM model

The correlation of condition data to the BIM model relies on correct component names. A logical and simple convention is the key to avoiding errors.

- Assessment and BIM model

Assessment of appropriate interventions involves applying criteria and judgement to the condition data. Again the naming convention is the key link to display the assessment in the model.

- Contractor and BIM model

The contractor is also likely to use the component names for planning, records, progress etc.

- Atkins and TfL at intermediate data drops and final handover.

File exchange requirements are for an Autodesk proprietary format, with corresponding IFC files. Atkins proposes to create the modelling as AutoCAD 3D solids and meshes. In AutoCAD we have full control over the layering and block naming, so are able to ensure that the TfL standards requirements are met. The 2016 version of Civil3D added direct IFC export of the relevant entity types to ensure compatibility between the two formats. Data and information will be shared as editable electronic files (in their native format as set out in the TIDPs) between all parties, throughout the project life-cycle.

The only exception is when data and information is shared for the purposes of carrying out specific activities, in which case the exchange formats identified in Table 5-2 will be used.

Data / Information	Exchange Format	Version
NAMS, Confirm, SFM, BridgeStation, Ellipse, Maximo Asset data (Non-Graphical Data)	XLS	2007
Native models (Graphical Data)	Native Format	

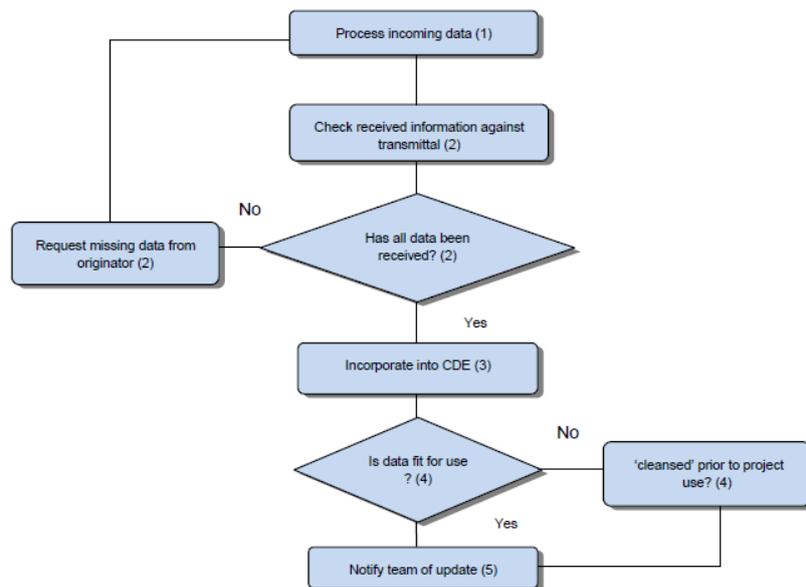
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Federated models (Graphical Data)	NWD	2013
4D Simulation (Graphical Data and Non-Graphical Data)	NWD	2013
Cost Data (Non-Graphical Data)	XLS	2007
Programmes	XER	P6
	PLF	P6
	PDF	11
	MMP	2010
Documentation	PDF	11



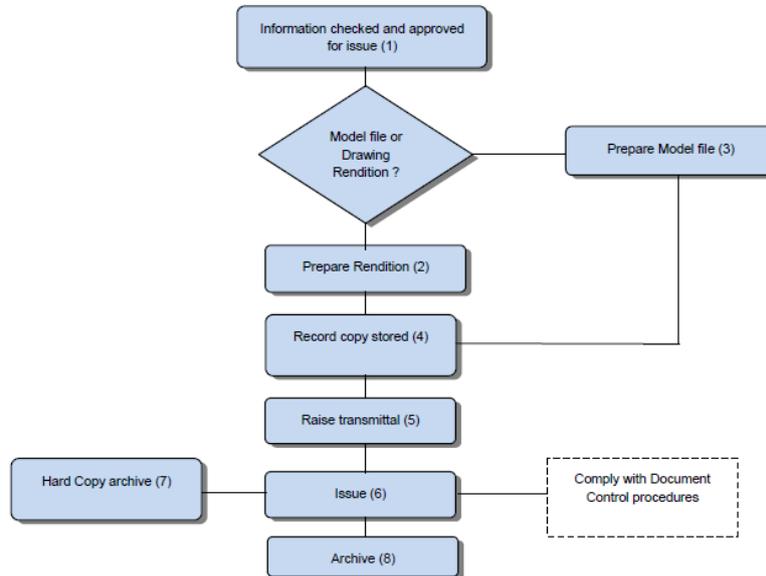
Workflow: Control of Incoming model/drawing files

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Workflow: Control of outgoing model/drawing files

5.3. Library of Objects

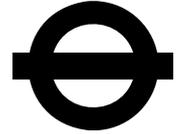
- 1.1.1 Consultant shall, if used, provide a Library of Objects through the CDE for approval for use and inclusion within TfL's Library of Objects.
- 1.1.2 Objects provided by Consultant shall be delivered through the CDE in their native format.
- 1.1.3 Consultant shall ensure (and provide evidence that) all objects provided by Consultant and their Sub-contractors and sub-consultants of any tier, are compliant with BS8541-1, BS8541-2, BS8541-3 and BS8541-4.
- 1.1.4 Consultant ensures that the minimum attribute data (non-graphical data), as set out in section is attributed to the objects at each stage of the project.

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5.4. Coordinates

BEP requirements

Provide details for how survey information (including mapping), Production Information and Handover Information (representing the fixed geographical location of assets) will be validated against OSG prior to being shared through the CDE.

As per Atkins Corporate Standard for Managing Information on our CAD and BIM Projects Section 3 – Information Model Management Coordinates are based on the Cartesian coordinate system. Points can be defined by the coordinates of the point of intersection of three reference planes (normally two vertical and one horizontal) normally given as x,y,z of a point. Inaccuracies in setting out on site can often be attributed to incorrectly positioned digital model data and errors in dimensioning e.g. dimensions added as ‘text’ or project data input using incorrect or inconsistent units of measurement.

- All models should be created at a scale of 1:1 and spatially positioned to the agreed project coordinate system.
- All dimensions to be derived automatically using the dimensioning tools of CAD systems. Do not manipulate the dimensions as ‘text’.
- Common units of measurement must be agreed by the project team and determined at the outset of the project.
- e.g. Infrastructure projects - Meters (m)
- Building projects - Millimetres (mm)

The Coordinate Reference System (CRS) for location is British National Grid as defined by EPSG:27700. The horizontal datum is the OSGB36 datum as defined by EPSG:27700 (British National Grid) The vertical datum is the Ordnance Newlyn Datum.

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6. Commercial Requirements

6.1. Execution Plan

This BEP has been produced using the template supplied by the *Employer*, the format of which has not been altered.

6.2. Supply Chain Assessment

PAS 1192-2 suggests that a **Supply Chain Capability Summary** (SCCS) forms part of the project implementation plan and should be submitted by prospective suppliers as part of their pre-contract BIM Execution Plan. The pre-contract BIM Execution Plan is prepared in response to the Employer's Information Requirements which form part of the tender documentation for the project.

A supply chain capability assessment is carried out by the principal supplier to verify that there is suitable human resource and IT capability in the various organisations that make up the supply chain. The **Supply Chain Capability Summary** form summarises the assessment of the organisations in the supply chain, enabling capabilities to be compared during the sub-contract procurement process.

The **Supply Chain Capability Summary** form is prepared based on Supplier Resource Assessment Forms completed by each relevant organisation in the sub-contract procurement process, enabling assessment of their resource capability and capacity.

Supplier Resource Assessment Forms are in turn derived from Supplier Information Technology Assessment forms and Supplier BIM Resource Assessment forms:

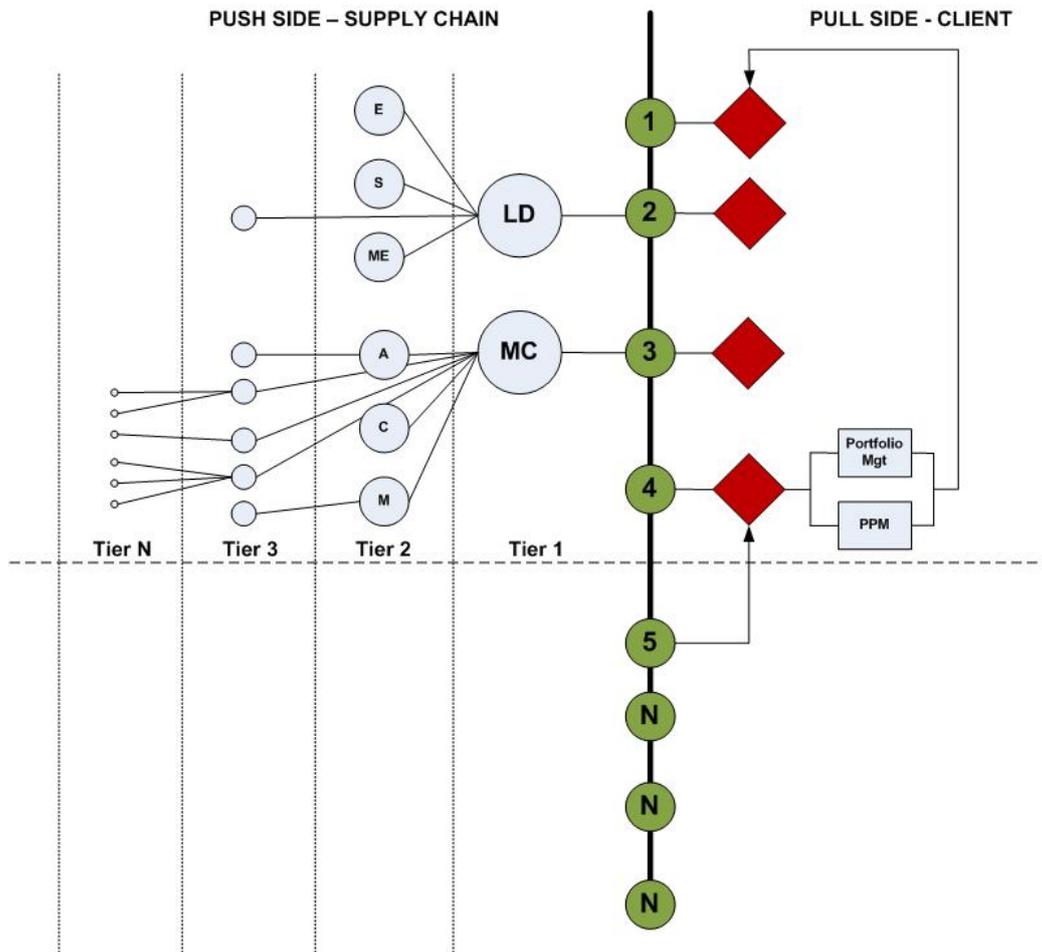
- A Supplier Information Technology Assessment form is completed by each individual supplier, describing their general IT resources and policies.
- The Supplier BIM Resource Assessment form is completed by each individual supplier, demonstrating their BIM competence, experience and their willingness and capability to exchange data.

This assessment process may mean that the principal supplier has to resolve potential issues, agree solutions and identify training and support requirements before the final BIM Execution Plan is submitted.

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Atkins will provide supply chain according to BIM assessment form is referred to in PAS 1192-2 clause 6.4. It provides a means for organizations to demonstrate their competence and understanding of BIM in a document that can be used to compare and assess their BIM capability.

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Appendix A – Task Team Information Delivery Plan Template

List all models, document and data files to be produced by the team for their responsibilities defined in the EIR.

							<i>Model / drawing/data title</i>	<i>Delivery Milestones</i>				
<i>Project</i>	<i>Originator</i>	<i>Zone</i>	<i>Level</i>	<i>File type</i>	<i>Discipline</i>	<i>Number</i>		<i>Milestone 1</i>	<i>Milestone 2</i>	<i>Milestone 3</i>	<i>Milestone 4</i>	<i>Etc.</i>

Status:

Date: 20/11/2015