Project:

Information Management and Modelling (IMM)

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Business Case Narrative

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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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Document History

Revision	Date	Summary of changes
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Glossary

Abbreviation	Term
BIM	Building Information Modelling
CDE	Common Data Environment
CDM	Construction Design Management
IMM	Information Management and Modelling (TfL Surface acronym for BIM).
Level 0 BIM	Unmanaged Computer Aided Design (CAD), prepared in 2D, with paper (or electronic paper) data exchange.
Level 1 BIM	Managed CAD in 2D or 3D format with a collaborative tool providing a common data environment with a standardised approach to data structure and format. Commercial data will be managed by standalone finance and cost management packages with no integration.
Level 2 BIM	A managed 3D environment held in separate discipline 'BIM' tools with data attached. Commercial data will be managed by enterprise resource planning software and integrated by proprietary interfaces or bespoke middleware. This level of BIM may utilise 4D construction sequencing and/or 5D cost information. 4D construction sequencing - using software programs such as Synchro, project teams are able to import data from design models and the project schedule to provide dynamic visualisation of the schedule to optimise the construction delivery process. It enables simulations to be run to test various schedule and risk scenarios to maximise the levels of productivity. 5D cost information – cost information forms part of the data fields of each object within a model. This enables cost modelling to be undertaken automatically.
Level 3 BIM	A fully integrated and collaborative process enabled by 'web services' and compliant with emerging Industry Foundation Class (IFC) standards. This level of BIM will utilise 4D construction sequencing, 5D cost information and 6D project lifecycle management information.
Trigger event	A planned or unplanned event that changes an asset or its status.

References

Standard	Title
BS 1192: 2007	Collaborative production of architectural, engineering and construction information – Code of Practice.
BS 8541-1: 2012	Library objects for architecture, engineering and construction Identification and classification. Code of practice.
PAS 1192-2: 2013	Specification for information management for the capital / delivery phase of construction projects using building information modelling.
PAS 1192-3: 2014	Operational Asset Management – Processes and data for the commissioning, handover, operation and occupation stages.
BS ISO 55000:2014	Asset Management
PAS 55:2008	Asset Management (This document will be withdrawn Jan 2015)
GSL	Government Soft Landings - April 2013. Soft Landings is the process of aligning the interests of those who design and construct an asset with the interests of those who use and manage it. It aims to improve client and user experiences, with reduced re-visits, and to give a product that meets and performs to client expectations. This is based on the Building Services Research and Information Association (BSRIA) soft landings framework.
BS 1192:4 2014	Fulfilling employers information exchange requirements using COBie – Code of Practice

1 Description

Information Management and Modelling (IMM) is an invest to save business improvement project. IMM is recognised as industry best practice and will be a government requirement from 2016.

1.1 What is IMM?

IMM, in simple terms, is better management, utilisation and sharing of information throughout an asset's life in order to improve delivery and reduce project and whole life costs. The IMM project covers people training, process improvements, contract amendments and technology developments - both in the delivery of new assets and in their ongoing operation and maintenance.

The Figure below provides an overview of the range of activities that IMM supports and ties together.

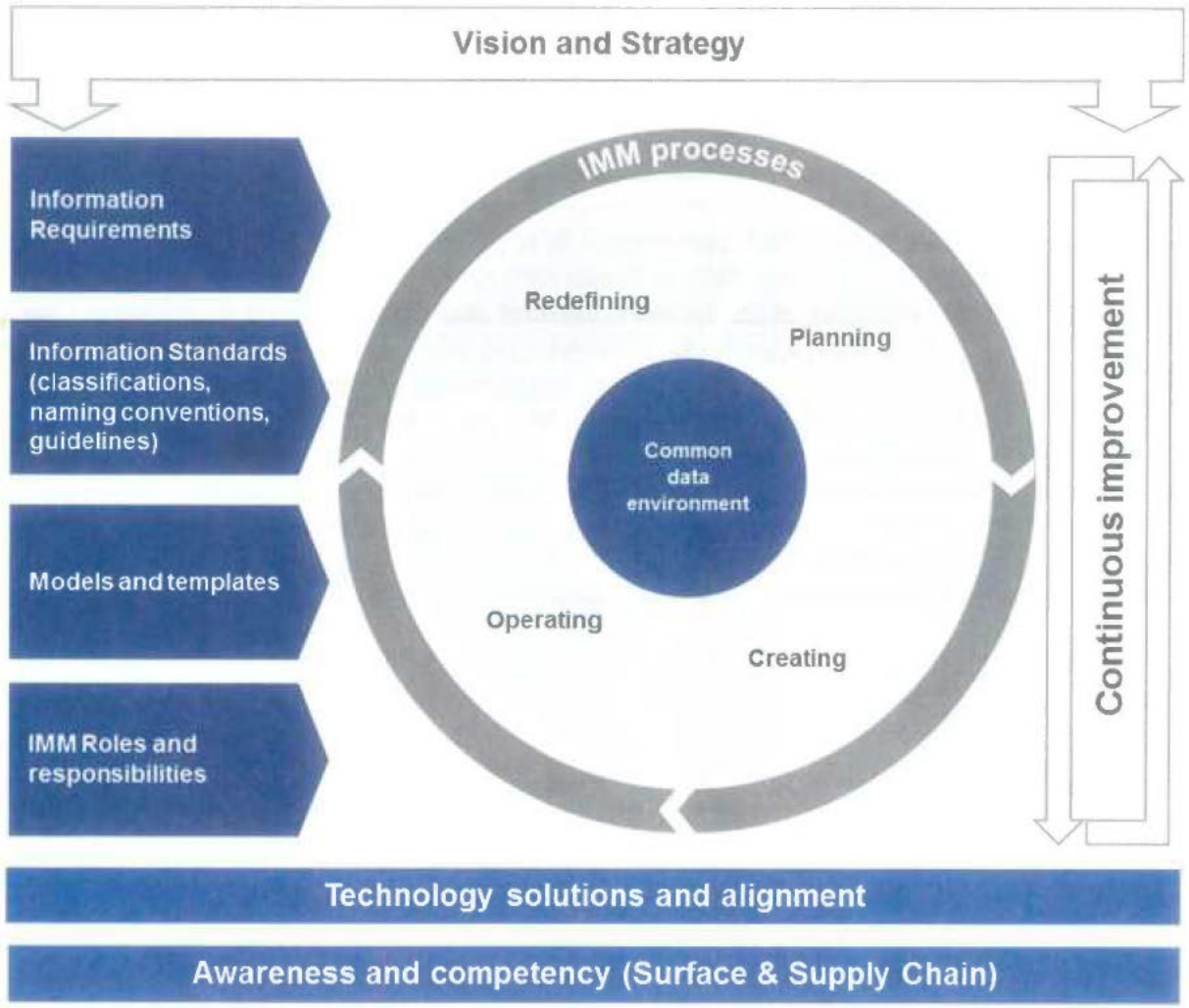


Figure 1: IMM activities and the asset life-cycle

During design and construction IMM will enable information to be easily shared between all parties as data requirements will be clearly defined and standard data protocols followed - as set down in the British Standards 1192-1 and 1192-2. This

removes duplicate data sources, and the errors they introduce, and speeds up the design and delivery process. It also means at project completion information is received in a usable format that is required for the lifecycle management of the asset.

Furthermore, the standardisation of data through IMM practices means 3D modelling capability can be fully utilised to visualise the asset and its changes through the construction phases. This reduces project costs and programme delays – for example, by using IMM the LU Bank Project identified 200 virtual construction clashes during the Concept Design phase alone. These are conflicts within designs, construction activities, scheduling etc. that were detected and resolved within a (virtual) modelling environment, thereby avoiding costs and delays that would have occurred during the construction phase.

This Business Case has been updated in June 2015 ahead of an Integrated Assurance Review (IAR) for the end of Pathway Stage 3 Concept Design. The previous version of the Business Case accompanied an IAR at the end of Pathway Stage 2 - Feasibility, which approved a preferred option and funding for Pathway Stage 3 only. This updated version of the business case has quantified benefits and sets these out against costs in the context of the Government's strategy for Level 2 Building Information Modelling (BIM) compliance and TfL's drive to improve the use and sharing of asset information.

The IMM project will deliver BIM level 2 compliance across Surface Transport, providing the standards, technology, processes and business mobilisation to support IMM.

The IMM project will also deliver potential financial efficiency savings (non cashable) to Surface Transport through reduced capital The cost of the project is assessed as £17.3m, with expected benefits of between £61.8m and £134.5m over the period 2014/15 to 2023/24. Full details are provided in Section 3 of this document.

The Surface Transport project is being developed and delivered in full collaboration with the Rail and Underground (R&U) BIM Team. Governance is provided by the TfL Asset Management Steering Group (AMSG).

London Underground are currently in the process of implementing BIM Level 2 on their capital works, with Victoria and Bank station upgrades for example, used to trial and test different BIM applications and implementations. The Asset Management Steering Group (AMSG) provides direction and oversight on delivery and commercial matters across TfL and will be fully informed and consulted during the development and implementation of the IMM project.

2 Strategy and Objectives

2.1 Strategic Context

This programme supports national, mayoral and TfL strategies.

National Context

BIM evolved from the building sector but has now matured and is applicable to all asset types. As such, TfL has adopted the Information Management and Modelling (IMM) terminology from the latest industry guidance (PAS 1192). The terms BIM and IMM are interchangeable and have the same meaning.

The Government published its Construction Strategy in May 2011. It includes a number of recommendations which, if applied effectively, could deliver 15-20% savings on infrastructure projects. One of the recommendations is Building Information Modelling (BIM). The strategy states that the Government will require all publically funded capital investment projects to be Level 2 BIM compliant from April 2016.

BIM is one of a package of measures expected to deliver savings in the order of 15-20%, the packages include new models of procurement, digital soft landings (i.e. improved hand-overs of asset information) and introduction of Lean processes. The contribution of BIM to these savings is not explicitly stated, however cross-sector trial projects, industry and academic studies identify savings ranging from 7.5-18% in design costs and 5-27.5% (source "*Arcadis review of industry and academic studies of savings generated by application of BIM*") in construction costs depending on the scale and complexity of the works being delivered. It should be noted that Surface Transport are also implementing reviews of contract mechanisms, a Lean Review and other associated initiatives to maximise efficiency in the delivery of the investment programmes.

From April 2016 onwards, BIM Level 2 compliance is expected to be a relevant consideration when the government is making capital allocations for infrastructure. Not being compliant may therefore put TfL in a disadvantageous position when future grant funding is determined.

This Information Management and Modelling (IMM) project will ensure TfL Surface is Level 2 compliant, by putting in place the requirements specified by PAS 1192-2:2013 – 'Specification for information management for the capital/delivery phase of construction projects using building information modelling'.

Mayoral and TfL Context

IMM is also a contributor to the Mayor's Transport Strategy and is aligned to its goal 'to support economic development and population growth'. This is achieved through meeting the strategic challenge of 'delivering an efficient and effective transport system for people and goods' and in helping to deliver the TfL Surface Transport Outcomes, particularly the 'Reliable Roads outcome – ensuring reliable operation of London's road network while reducing congestion'. IMM will contribute to keeping London moving and connected by empowering people with the knowledge and tools that maximise the benefits of good asset information management. IMM will increase the resilience of transport networks by creating a better evidence base to support the capital, renewal

and maintenance programmes that keep Surface Transport's asset operating effectively.

The IMM Project will directly address existing gaps in meeting the requirements for the Portfolio, Programme and Project Management Maturity Model (P3M), including the creation of data standards and protocol, creating centralised roles for information management and improving the accuracy and completeness of information used for decision-making. The Delivery and Commercial Capability (D&CC) Board within TfL has set a requirement for Surface Transport to reach Level 3 maturity with an aspiration to achieve Level 4 maturity.

IMM is central to our asset information strategy. We have been working with IM and Rail and Underground (R&U) to develop a strategy for rationalising Asset Management Information Systems (AMIS) across TfL – there were over 70 at the last count. The work concluded that systems can be rationalised in Surface and R&U, but for this to be successful and to maximise benefits, two key areas need to be addressed up-front, namely (1) data standardisation, and (2) process standardisation. This is exactly what IMM will do. Therefore, even in lieu of IMM, our strategy to rationalise our AMIS systems will require data and process standardisation.

Summary

Table 1 overleaf shows how the IMM project supports government, Mayoral and TfL strategic goals and objectives.

Table 1: Alignment to Strategic Goals

Source	Duties, Goals or Objectives	How does the IMM project support these?
Government Construction Strategy	Achieve BIM Level 2 compliance by 2016	Operating under BIM Level 2 is part of a programme of measures expected to reduce public sector construction costs by up to 20%. IMM will enable Surface Transport to demonstrate the benefits of compliance on early adopter projects in preparation for full roll-out
Mayor's Transport Strategy	Improve transport opportunities and network resilience	IMM will reduce the overall length of project delivery programmes and reduce the risks of delays and overruns, including minimising construction clashes and build ability issues Improved management of asset data will reduce the risk of asset failure or delays in bringing assets into service following construction or emergency response
The Transport for London Story	People	IMM will clarify roles and responsibilities for information creation, maintenance, storage and transfer. Improved processes and mechanisms to share information will encourage more collaboration between TfL teams
	Delivery	Reducing design iterations, information management costs, programme durations and risks will enable Surface Transport to deliver its investment programmes more efficiently and minimise disruption caused by delays or over-runs
	Value for Money	IMM will support Surface Transport to maximise the savings generated from operating a BIM compliant approach Over time, improving information gathered on the condition and performance of assets will allow Business Intelligence to be generated from a reliable baseline of data and more robust investment decisions to be made and evidenced
Surface Transport Outcomes	Quality bus network Reliable roads More and safer cycling More and safer walking Safer and more efficient deliveries Reduced casualties Quality door-to-door transport Harnessing rivers' potential Reduced crime Improving the environment	IMM will support Surface Transport to design and deliver its investment programmes more efficiently, allowing Surface Transport to deliver more for the investments made and improving the quality and reliability of its asset base,
Surface Transport Asset Management Plan (STAMP)	Cost-effectively maintain assets to meet user expectations, maximise operational effectiveness and minimise asset related risks	IMM directly supports the policy aims set out in the STAMP. In particular IMM is designed to help 'identify, manage and continually improve the information that supports decisions, ensuring it is accessible and of the required quality'
Industry Standards and Best Practice	Undertake Asset Management activities in accordance with current industry standards and Best Practice	The IMM Project is being developed with reference to current industry standards (ISO and PAS) relating to asset and data management

2.2 Objectives and Benefits Criteria

The IMM project has three core objectives which are:

1. Achieving BIM Level 2 Compliance in line with the Government's construction strategy.
2. Improving the use and sharing of asset information in Surface Transport.
3. Reducing costs where appropriate.

These objectives are further broken down into ten sub-objectives below which form benefit themes. The benefit themes have been developed during Stage 3 Concept Design via a series of workshops and one-to-one sessions. The sessions have been used to identify the current challenges faced by the Surface Transport teams engaged in the planning, creation and operation of assets and to validate the expected benefits of the IMM Programme.

A Benefits Map, demonstrating how the IMM Project outputs are linked to these Objectives is included in Appendix H.

Table 2: Benefits Criteria

IMM Objectives	Expected Benefits
B1. Reduced capital project risks and costs	• Improved surety over programmes and reduced design iterations • Enhanced ability to identify clashes pre-construction • Shorter delivery timeframes • Reduction in funding requirement for project risk/contingency
B2. Improved supply chain management	• Greater leverage of supply chain information management capabilities • Greater transparency on works progress and supply chain performance • Effective information handover and works closure
B3. Improved asset data quality	• Improved asset knowledge and reporting • Routine updating of asset data throughout asset life cycle • A more accurate evidence base to support design and operational decisions
B4. Reduced whole life costs of asset data management	• Structured transfers of data from one system to another at handover points • Removal of data duplication or re-collection costs • Reduced manual reprocessing or transfers of data
B5. Improved information sharing and collaboration	• Common standards, format and requirements relating to data collection and storage • Reduction of data 'silos' within the business • Lessons learned transferred more easily to future projects • Improved decision making at internal and external touch points
B6. Improved assurance	• Data linked to TfL's H&S, legal and regulatory obligations is defined and robustly collected • Improved management of reputational risks • Reduced risk of disputes or claims relating to data and information supplied by TfL
B7. Improved operational processes	• Robust 'As-Built' vs. 'As-Designed' information put in place • Appropriate transfer of responsibility and accountability to the supply chain • Data requirements of the supply chain consistently met • Asset data routinely updated during operational activities (inspections, maintenance, renewals etc.)
B8. Reduced operational costs	• Improved condition and performance data available to support operational decisions • More efficient inspection and maintenance scheduling • Reduced frequency and impact of emergency interventions or critical asset failures
B9. Improved customer experience	• Ability to link customer service information to assets/locations • Improved capability to respond to customer feedback • Reduced impact of travel delay on road users
B10. BIM Level 2 Compliance	• TfL will be able to demonstrate to the DfT that capital and operational investment is managed in accordance with BIM Level 2 principles

2.3 Existing Arrangements and Business Needs

Work done prior to the previous version of the business case in October 2014 identified the current situation in terms of information management across Surface Transport. During stage 3 concept design, this work has been expanded to identify information requirements necessary to operate the IMM system. A comprehensive programme of engagement with 34 TfL stakeholder groups consisting of approximately 160 staff across 8 directorates in Surface Transport has been undertaken to:

- Understand the As-Is position and work with Surface Transport teams to identify the challenges and opportunities they face relating to information management;
- Identify consistent or high-impact issues or opportunities to drive benefit;
- Reflect this activity in a core set of Business Needs; and
- Assess the level of IMM maturity across Surface Transport to ascertain the gap to Level 2 compliance.

The following table summarises the output.

Table 3: Business Needs

BIM Capability	TfL Current Situation	BIM Level 2 example
Information exchange	Information exchange is generally by email. Information is stored on internal Servers and various electronic document management systems, including 21 systems that are used across surface. Asite is currently being used for contract management. STIP (Structures and Tunnels Investment Portfolio) is trialling the use of Asite as an electronic document management system.	100% use of a Common Data Environment (CDE) for Capital Projects, Maintenance and Internal Work. The CDE typically comprises an electronic document management system and a data store. Information exchange, from Surface Transport and the supply chain, is via the CDE. This provides a full audit trail for information exchange and information approval / rejection etc.
Collaborative working	A willingness of people to be collaborative; however, systems, processes and technology are currently forming barriers to collaborative working.	Collaborative cultural behaviours supported by intuitive technology and simple efficient processes. The CDE provides a technology platform to enable information to be shared to facilitate collaborative working. Information standards ensure that information is recorded / produced in a standard way so that it can easily be found and used without additional manipulation / re-production.
Clear roles and responsibilities	Ambiguity in many data creation and management roles. Instances where approvals are being sought from individuals other than those who are responsible leading to increase in the number of design iterations and delay to the development of approved schemes. There have been instances where asset records that should have been provided by the supply chain, as part of their contractual obligations, have not been entered into the asset management systems.	Clearly defined roles and responsibilities, which are established using RACI charts, that cover all aspects of data creation, use, approval, storage and re-use. The defined roles and responsibilities will provide ownership ensuring that the defined information requirements are met by Surface Transport personnel and the supply chain.
Common naming conventions and information standards	Generally no common naming convention / information standards. Departments have their own naming convention or it is left to the individual. Capital renewals and major projects are generally using supply chain standards. Different naming conventions means that search results on existing servers / SharePoint sites may not locate the required information. Different information standards create additional cost when the files are used by other designers due to incompatible standards. CAD files have to be re-produced or heavily modified to make them compatible.	All data is created following a common naming convention, which is used internally and by all stakeholders. This includes classification and a work breakdown structure for operational and capital activities. There is a clear split between the file names and the required meta data, which is 'data about data'. This means that as files are modified there is complete traceability of the changes to a file. Having defined file names facilitates the searching for information. It also enables individuals to locate information on the CDE as they will be familiar with the standard. Information is created in accordance with defined standards to enable information to be efficiently re-used as well as integration checks to be undertaken. For example, where two design disciplines are working on the same

BIM Capability	TfL Current Situation	BIM Level 2 example
		scheme, following defined information standards supports the identification and resolving of interfaces including construction clashes.
Templates for recording data	Outside of the framework of Pathway products, templates are not always used to capture asset data. This is leading to variable digital information capture. Information is not always sufficient for the end-users needs, (such as programme development, performance monitoring and asset modelling) resulting in duplication and re-work.	There is a clear definition of the information requirements in terms of what is required by all parts of the business. Common templates used for data capture. Templates are produced so they meet the defined information requirements of all users.
Organised storage	Information is stored on servers and named and organised in individual bespoke ways. Largest area of waste is 'searching for information' and rarely being able to find what is required.	All data coded and stored in a central accessible location, which typically comprises the CDE. Individuals become responsible for the correct storage of information and are able to search for the information they require.
Visible clear information	Information is stored across a number of servers, SharePoint sites and asset systems. As there is not a defined naming convention and there are different storage locations, it is difficult to locate information created by others. No search functionality is available across different storage locations. A lack of defined naming conventions further hampers the searching for information. This leads to a reliance on others to find information.	All data coded and stored in a centrally accessible location, with an intuitive dashboard interface that allows logical searching. All data is created following a common naming convention, which is used internally and by all stakeholders. This should include classification and a work breakdown structure for operational and capital activities. There is a clear split between the file names and the required meta data. This means that as files are modified there is complete traceability of the changes to a file. This facilitates the searching for information. It also enables individuals to locate information on the CDE as they will be familiar with the standard.
Time efficient	The impact of the current state of 'visible clear information' is that it is taking staff extended periods of time to look for information and/or re-produce information which cannot be found.	The ability to search and find integral, checked and verified data, in a single entity will improve the efficiency of staff and the supply chain.
Information integrity	There are examples of good practice and examples of expenditure on collecting information where the quality is not assured. No common way to verify information. No tagging of data to demonstrate its suitability or verified state. No chain of custody of information from origin to current form.	BIM Level 2 places a reliance on a single source of accurate verified and updated data which is stored on the common data environment. Information requirements are clearly defined. The defined roles and responsibilities provides ownership to ensuring that the defined information requirements are met by Surface personnel and the supply chain, which includes the assurance of information.
Asset Management Technology	Currently, information management within Surface Transport is often reliant on inefficient, or soon to be outdated, asset information management practices and	100% use of a Common Data Environment (CDE) for Capital Projects, Maintenance and Internal Work. The CDE will have the ability to visualise construction phases through the

BIM Capability	TfL Current Situation	BIM Level 2 example
	systems. These add to project costs and timelines and do not allow information to be easily accessed, shared and maintained throughout the asset lifecycle. This is compounded by TfL operating a range of Asset Management Information Systems that evolved separately and have different data classifications, standards and processes Furthermore, an inability to utilise the latest technology to visualise construction phases and sequencing prevents us from realising the savings offered by IMM. For example, identifying construction clashes, reducing programme durations and identifying better ways to deliver works	development of the 3D models.

2.4 Scope and Service Requirements

The scope of the IMM project can be viewed in two categories:

- Strategic and high level scope, the core element of this stems from the principle's set out in the Government's industry guidance document PAS 1192-2 2013 document. Strategic scope also sets out the extent to which the IMM project outputs will apply to Surface Transport activities. It also sets out any underlying assumptions relating to business operating models.
- Delivery scope, which is how this project has taken the principles in PAS 1192-2 2013 and translated these into work streams and products that the project will need to deliver. This covers the scope of the technology.

2.4.1 Strategic and High Level Scope

The PAS 1192-2 2013 document sets out, at a high level, the fundamental principles for information modelling, which underpin Level 2 Compliance. These are outlined in Appendix G, along with the IMM project's interpretation of what they mean. This has formed the basis for the key products that the IMM project will deliver:

- File naming conventions, *a document detailing the file name conventions to be applied to information for the Project Information Model and Asset Information Model;*
- Modelling Standards, *a document detailing the CAD / modelling standard for TfL Surface*;
- Asset Naming and Classification System, *a document that collates asset naming conventions across Surface and details the classification system used to name model object*;
- Employers Information Requirements, *a document template which is modified to specify the technical, management and commercial details required for the model development*;
- Data schema exchange; *this refers to how data is 'mapped' between different systems to allow it to be transferred (e.g. from a project model into a TfL asset management system).*
- IMM execution plan, *a document template which is modified to define the expected IMM deliverables and guide the coordination of the project teams*

- Digital plan of work, *a document template which is modified to specify the data needs required from the supply chain*
- A Common Data Environment (CDE) and enabling technology to store and share information;
- People Change Plan, *a document which describes and identifies all the required activities to manage the people change aspects of project*; and
- Updated Process, *a series of process flow charts which describes the steps required to adopt IMM practises where applicable.*

The extent to which the IMM project applies to Surface Transport activities is outlined below along with other high level scope assumptions:

- The IMM project will apply to Surface Transport Capex and Opex activities involving assets only;
- The IMM project will not deliver Level 2 compliance to activities outside of Surface Transport in TfL's Corporate, London Underground and Rail or TfL Information Management (IM) divisions;
- The IMM project will not change any underlying business operating models, however process changes relating to asset information will be required;
- The IMM project is not looking to reduce Headcount; and
- The IMM project will cover the business mobilisation activities such as process, contracts, people, and training in addition to the technology.

The evaluation criteria is detailed on the table below

Level of Impact Score		Criteria	0	1	2	3	4
Areas of each Directorate being impacted	Process	Time required to reach BAU	N/A no impact on BAU	Between 0-10% people, information managed, technology owned, used or managed; critical processes or critical supply chain impacted by IMM project	Between 11-25% people, information managed, technology owned, used or managed; critical processes or critical supply chain impacted by IMM project	Between 26-50% people, information managed, technology owned, used or managed; critical processes or critical supply chain impacted by IMM project	Greater than 50% people, information managed, technology owned, used or managed; critical processes or critical supply chain impacted by IMM project
	Technology						
	Information	Level of complexity of assets and interdependencies between teams					
	People						
	Supply Chain						

	Information	Process	People	Technology	Supply Chain
Asset Management	3	3	4	2	4
Buses	0	0	2	0	0
EOS	0	0	2	0	0
Services	1	1	1	1	4
Project & Programmes	3	3	3	3	4
Road Space Management	2	2	2	1	1
Service Operations	1	1	1	1	2
Strategy & Planning	1	1	1	0	1

The Surface Transport assets that the IMM project applies to are summarised in the table below:

Included	Peripheral Assets (Light engagement during stage 3, however these assets will be able to use the IMM processes and technology)
Carriageway: TLRN	**Carriageway:** A13 DBFO, Borough Carriageways
Bus Shelters	**Bus Shelters:** privately owned bus assets
Bus Stations	**CCTV:** Non AMD assets
CCTV: AMD Assets	**Variable Message Signs:** Mobile
Variable Message Signs: Static	**Cycle Hire:** Signage and Docking
Drainage	**Technology and Systems Assets**
Green Estates	
Structures	
Footways and Cycle Routes	
Traffic Signals	
Tunnels	

Street Lighting

Over Height Vehicle Detection

Legible London Signage

River Assets

Bus Related Technology

2.4.2 Delivery Scope

The IMM project will deliver the key products (amongst others) outlined in Section 2.4.1, via 4 core work streams:

- Information Requirements & Standards;
- Business Mobilisation;
- Technology; and
- Stakeholder Management & Communications.

These work streams consist of more detailed products, which progress towards the key products in Section 2.4.1. During Pathway Stage 3 Concept Design the following activities were completed and products created:

- As is and To Be Process Map and Change Plan;
- Outline of Information Requirements and Standards;
- Change Readiness Assessment Outputs and Recommendations;
- Communications Campaign and Plan for Stage 4 and 5;
- Initial Skill Assessment Outputs;
- Training Strategy;
- Mobilisation Plan (including mobilisation of Champions, Implementation Team, Job Descriptions etc.);
- Contract Review;
- IM Strategy and Overview; and
- Technology requirements.

The Project Execution Plan (PEP) has been updated at the end of Stage 3, which outlines the plan, products and activities moving into Stage 4 Detailed Design.

During Stage 3 the detailed scope for the technology, principally the CDE, has been firmed up via extensive workshops to identify the required functionality that will be delivered.

The table below lists those systems identified during TfL IM's business analysis stage as having a potential interface with the IMM supporting technology. The items listed in Section 1 of the table are those identified as key systems in scope for Common Data Environment interface in order to deliver the benefits and revised ways of working highlighted in the business case, these are considered mandatory and have been priced within the cost model.

The systems in Section 2 are out of scope, however they are considered value add items and will be included as possible options within the procurement exercise. These have not been priced within the cost model.

The systems in Section 3 are design tools which will interface with the Work In Progress element of the Common Data Environment, which will need no formal integration as such, and hence no costs have been allocated with the cost model.

Lastly, Section 4 of the table identifies those applications which have significant overlap with the technology being procured and are assumed to be decommissioned as part of the project, data migration costs have been included within the cost model.

Table 4: System Integration

Section	System
Section 1: In Scope - Mandatory Integration	GIS Integration (Playbook)
	Network Asset Management Systems (NAMS)
	Bridge Station / Tunnel Station
	HORUS
	CONFIRM Application
	Site Fault Management (SFM)
	Surface Enterprise Project Management (SEPM)
	Property Asset Register
	Pinpoint
	TfL Corporate Archives
	Asset Management On Street (AMOS)
	UK Pavement Management System (UKPMS)
	P3M
	SAP

Section 2: Out of Scope – potential value adding integration	Ordnance Survey / London grid data
	Remedy
	LLAMA (Legible London Advanced Mapping Access)
	Webcore
	Concept Evolution (CIFM)
	Building Management System (BMS)
	SharePoint
	Traffic Data Store
	Active Risk Manager (ARM)
	Traffic Accident Diary System (TADS)
	Surface Data Warehouse
Section 3: In Scope - No integration effort required	AutoCAD
	Traffic Modelling Design Tools
	Revit Clash Detection
	AutoDesk file and plugin viewer
	Revit
	NBS specification system
Section 4: In Scope - To be decommissioned	DORIS archiving tool
	Automatic upload into the DORIS archiving tool
	PPD Project Document Management System
	ShareX
	Workflow
	Apex reporting tool
	ASITE
	Health & Safety Repository

2.5 Constraints and Dependencies

2.5.1 Constraints

A core element of the IMM project is the procurement of the Common Data Environment (CDE). The CDE comprises an electronic document management system and a data warehouse for asset data against which reports can be run.

This technology will not come on line until the second half of 2016; however the project will demonstrate 80% capability by April 2016 and in order to maintain momentum it is proposed to create elements of the CDE on existing SharePoint sites / networked servers for one of the five early adopter projects ('STIP2' – Structures and Tunnels Investment Portfolio 2, Work Package 1).

2.5.2 Dependencies

The IMM project will have dependencies on the pan-TfL Asset Management Information Systems (AMIS) programme. The TfL Asset Management Steering Group (Chaired by Dana Skelley) governs the AMIS programme and the IMM project.

IMM depends on...	To deliver...	This is the responsibility of...	IMM manages this interface through...
TfL Integrated Service	An industry standard message bus platform that IMM will rely on to integrate existing asset management systems and use to connect systems and share data	IM	IMM Board Members – Principal Business Partner and Chief Architect as well as Enterprise Architect on the delivery team. IMM needs to register with the IM projects COE and the IMM team need representing on the board of TIS

3 Economic Analysis

3.1 Options

The business case in October 2014 picked a single preferred option to implement an IMM project to reach Level 2 maturity (option C below). The options considered were:

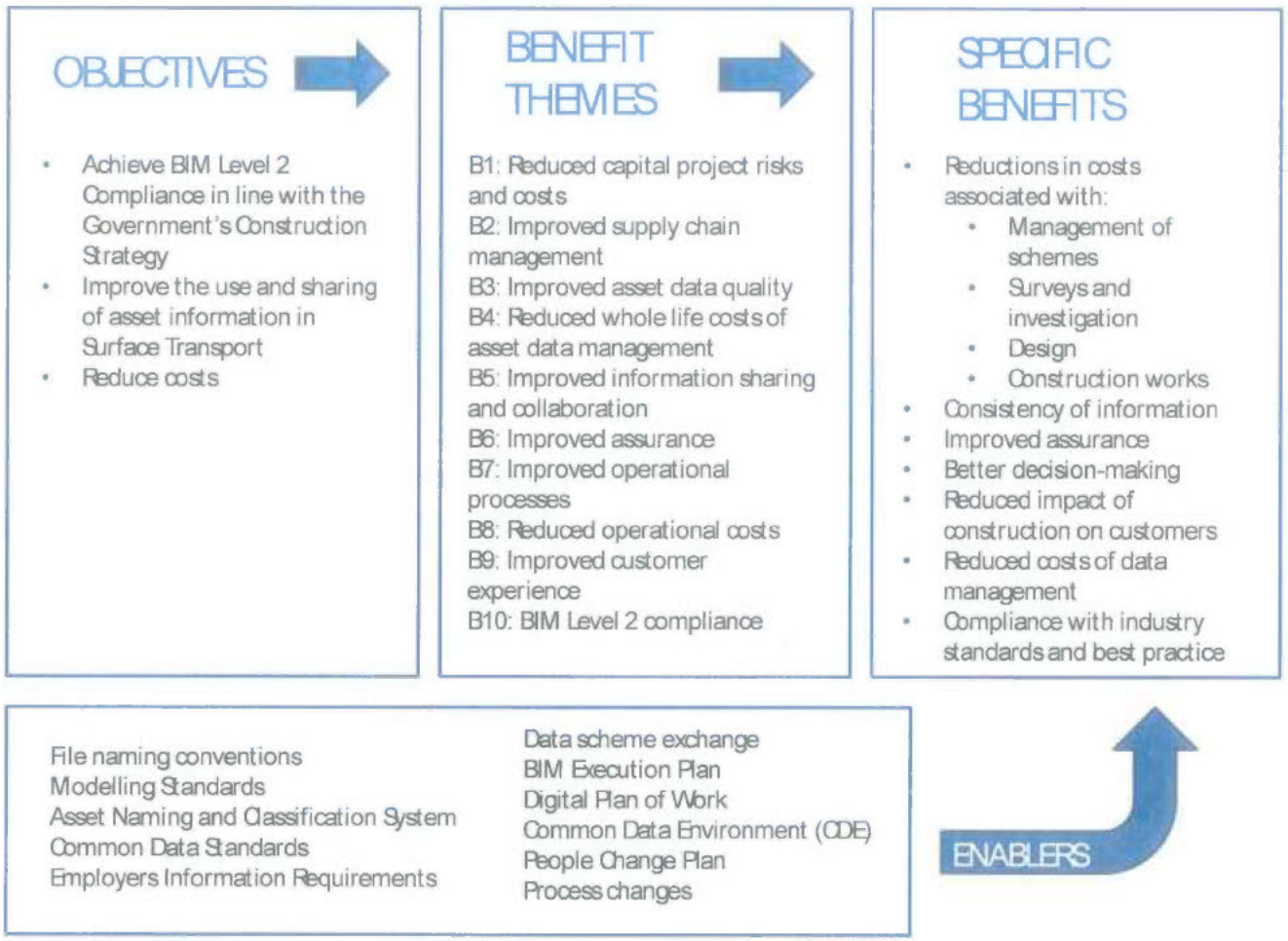
- A: Do Nothing
- B: Establish Information Governance teams within each Directorate emulating the pan-TfL Commercial Centre of Excellence Team. Clarify roles and responsibilities with regards to information management.
- **C: Implement an IMM project to reach BIM Level 2 maturity**
- D: Implement an IMM project to reach BIM Level 2 maturity and establish data links to existing asset management systems as part of the Level 2 works

This version of the Business Case does not repeat the options analysis here and Sections 3.2 onwards reflect the preferred option. The previous options are however summarised in Appendix F.

During Stage 3 of the IMM project, two technology delivery approaches have been explored within the preferred Business Case option. This process is summarised in a separate document, the IMM Technology Options Output Report.

This updated version of the Business Case is based on the preferred delivery route - an externally sourced technology solution.

The structure for Option C Objectives, Benefit Themes, Specific Benefits and Enablers is shown in the diagram overleaf.



3.2 Explanation of Costs, Cost Savings and Revenues

3.2.1 Overview

The Project costs cover the initial capital costs and on-going operational cost for implementing the Project through to 2023/24, at which point the IMM capabilities are expected to be part of Business As Usual activity. A breakdown of costs is provided in Section 3.2.2 and a summary in the following table:

Table 5: IMM Project Costs

Cost Heading	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	TOTAL
Project Costs	386,499	2,017,058	2,972,364	782,494	27,600	-	-	-	-	-	6,186,015
Operating Costs	-	14,088	712,864	1,215,893	1,257,506	1,314,369	1,359,416	1,406,035	1,454,279	1,504,209	10,238,659
Avoided Operating Costs				141,333	212,000	212,000	212,000	212,000	212,000	212,000	-1,413,333
Risk Allocation	-	693,300	1,155,500	462,200	-	-	-	-	-	-	2,311,000
TOTAL	386,499	2,724,446	4,840,728	2,319,254	1,073,106	1,102,369	1,147,416	1,194,035	1,242,279	1,292,209	17,322,341

A summary of the expenditure where IMM can deliver cost savings is outlined in Table 9 in Section 3.3.1 for the same appraisal period to 2023/24.

The following table combines these to show the high-level summary of costs and financial efficiency savings for the IMM Project:

Table 6: Financial Efficiency Savings

Financial Efficiency Savings (non – cashable)	Risk	Benefits	Project Costs	Operating Costs	Total Costs
Lower	£2.3m	£63.2m	£6.2m	£8.8m	£17.3m
Higher	£2.3m	£135.9m	£6.2m	£8.8m	£17.3m

A cost comparison of between the October 2014 and the June 2015 Business Case is provided in the table below. The result is an overall increase of £1.971m. The main reasons for the variance are an increase in risk and project costs and a decrease in elements of the operating costs:

Table 7: Variance between October 2014 and June 2015 costs

PROJECT COSTS	Oct-14 BC	Jun-15 BC	Variance	Variance Explanation
STAFF				
- TfL Project Team	450,729	898,310	447,581	Two additional PPD resources added to support the project and validation of rates matched directly to SAP.
- Implementation Team	606,000	625,218	19,218	
PROJECT				
- External Partner	1,904,280	2,506,126	601,846	Stage 3 Concept Design costs delivered within budget, but planning for Stage 4 has determined that the effort durations in the previous version were too low for Stage 4 and hence additional resource is required. Day rates are generally less than was budgeted previously. The contract was let against a TfL cost model with fixed number of days, so the impact would be the same or potentially higher with other supplier.
- Technology CDE Supplier	300,000	640,000	340,000	Further market engagement has increased the allowance for this cost, whilst allowance has also been made for the supplier to specify and build the API's to integrate TfL systems.
- IM Integration and Systems		1,024,150	1,024,150	During Stage 3 Concept Design knowledge on the requirements for the CDE has enhanced significantly now that there is a IM IMM Strategy. The CDE will need to integrate to existing systems at TfL. IM will do this work.
- IM Staff Time (Procurement and General)	600,000	101,900	- 498,100	Staff time for IM has reduced because the CDE will be delivered by an external supplier, which PPD will lead on the procurement. Some IM staff time is still required for engagement and support during procurement, design & delivery.
- Training	-	197,400	197,400	Provision for external training facilities has been provided for full roll out across Surface Transport, whilst the hire of two trainers for 1 year has been allowed to 'walk the floor' from October 2015 for early adopters and full roll out.
- External Legal Support	-	192,912	192,912	Stage 3 Concept Design has determined that the approach to amend contract will require contractual changes rather than using a standard Construction Industry Council (CIC) protocol. This has been agreed as the CIC protocol is primarily designed for capex contracts and not fit for purpose for opex contracts
- Desks (In Oct-14 BC, not in Jun-15 BC)	55,000	-	- 55,000	
- Inflation (seperate line in Oct-14 BC) **	113,968	-	- 113,968	Inflation seperated in Oct-14 figures but included inclusive in all Jun-15 figures, hence no line entry for those on inflation
TOTAL PROJECT COSTS	4,029,977	6,186,015	2,156,038	
RISK	852,000	2,311,000	1,459,000	Due to the nature of IMM/BIM being a growing concept, the maturity of the project has grown during Stage 3 Concept Design, which has developed the detailed scope and requirements further. The original risk value was too low and the QRA has been updated to reflect the innovative and complex nature of the project.
TOTAL PROJECT COSTS + RISK	4,881,977	8,497,015	3,615,038	

OPERATING COSTS	Oct-14 BC	Jun-15 BC	Variance	Variance Explanation
STAFF				
- Implementation Team	2,298,739	3,750,687	1,451,948	Implementation increased from 5 FTE to 6 FTE to ensure IMM can be maintained as BAU, following work in Stage 3 Concept Design. In addition the salary grade split of this time has been changed following Stage 3 work and market testing with London Underground. Inflation has also added to figures.
OTHER				
- Technology CDE Supplier	4,446,168	5,317,617	871,449	Increased for the provision of clash detection software and work in progress areas. These are licence costs. This is off set heavily by the reduction in cost in Design and Engineering tools below, so overall estimate has reduced.
- IM Support Costs		1,170,355	1,170,355	During Stage 3 Concept Design knowledge on the requirements for the CDE has enhanced significantly now that there is a IM IMM Strategy. The CDE will need to integrate to existing systems at TfL. This cost is for IM support of the interfaces.
- Design and Engineering digital tools	3,724,110	-	- 3,724,110	These costs are not required as TfL has sufficient licences already which has been validated in Stage 3 concept design.
TOTAL OPERATING COSTS	10,469,017	10,238,659	- 230,358	
TOTAL PROJECT & OPERATING COSTS	15,350,994	18,735,674	3,384,680	
AVOIDED OPERATING COSTS	-	-1,413,333	-1,413,333	Detail on avoided costs not available for Oct-14 BC, but added in Jun-15, as the integration element of the CDE will replace some existing systems.
TOTAL PROJECT & OPERATING & AVOIDED	15,350,994	17,322,341	1,971,347	

3.2.2 Project Costs

The capital costs for the IMM Project are as follows:

Table 8: IMM Project Costs

	2014/15	2015/16	2016/17	2017/18	2018/19	TOTAL
STAFF						
- TfL Project Team	81,446	307,219	332,619	177,026	-	**898,310**
- Implementation Team	-	154,738	470,480	-	-	**625,218**
PROJECT						-
- External Partner	305,053	1,021,739	1,039,820	139,513	-	**2,506,126**
- Technology CDE Supplier	-	-	460,000	180,000	-	**640,000**
- IM Integration and Systems	-	216,683	562,308	217,558	27,600	**1,024,150**
- IM Procurement Support	-	101,900	-	-	-	**101,900**
- Training	-	21,867	107,137	68,397	-	**197,400**
- External Legal Support	-	192,912	-	-	-	**192,912**
TOTAL PROJECT COSTS	**386,499**	**2,017,058**	**2,972,364**	**782,494**	**27,600**	**6,186,015**
Risk	-	693,300	1,155,500	462,200	-	**2,311,000**
TOTAL PROJECT COSTS + RISK	**386,499**	**2,710,358**	**4,127,864**	**1,244,694**	**27,600**	**8,497,015**

These costs are made up of the following elements:

TfL Project Team

The costs of the TfL project management staff and Subject Matter Expert input required to implement the IMM Project.

TfL Implementation Team

A number of permanent new roles within Surface Transport to implement embed and maintain IMM capability within the business.

External Partner

External consultancy and technical support to the IMM Project.

Technology CDE Supplier

The costs to configure, test and implement the Common Data Environment (CDE) into Surface Transport.

IM Integration and Systems

IM support for the integration of the CDE and associated technology; to existing Surface Transport asset management systems and onto the TfL network.

IM Procurement Support

IM support for the development of specifications, tender material etc; during the procurement for the external CDE supplier.

Training Costs

Delivery of a programme for staff training on the new technology and ways of working required by IMM. This is anticipated to cover around 1,500 members of TfL staff as well as representatives of the supply chain. Full details of the proposed training requirements are provided in the IMM Training Plan.

External Legal Support

External legal support required during the procurement of the external CDE supplier and the development and implementation of contract amendments to embed the requirements of the BIM Protocol within Surface Transport's contractual arrangements.

3.2.3 Operating Costs

The following table summarises the operating costs for the IMM Project:

Table 9: IMM Operating Costs

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	TOTAL
STAFF										
- Implementation Team	-	-	475,599	494,382	513,907	534,205	555,306	577,242	600,046	**3,750,687**
OTHER										
- Technology CDE Supplier	-	598,000	615,940	634,418	653,451	673,054	693,246	714,043	735,465	**5,317,617**
- IM Support Costs	14,088	114,864	124,354	128,707	147,011	152,157	157,482	162,994	168,699	**1,170,355**
TOTAL OPERATING COSTS	14,088	712,864	1,215,893	1,257,506	1,314,369	1,359,416	1,406,035	1,454,279	1,504,209	**10,238,659**
AVOIDED OPERATING COSTS	-	-	-141,333	-212,000	-212,000	-212,000	-212,000	-212,000	-212,000	**-1,413,333**

In order to deliver the project and realise the on-going benefits, the established headcount will be increased by 6 FTE. Following review of the requirements and resources required to undertake the Implementation Team roles one additional FTE has been added to the requirement submitted in the previous version of the Business Case. The costs of these resources are included in the project costs until April 2017, at which point they become part of the ongoing operational costs for the project.

3.2.4 Impact on Revenue

There is no expected impact on revenue as this project will not generate revenue or directly impact on revenue generating activities.

3.3 Summary of Cost Savings

The IMM project team has worked closely with stakeholders to review both the quantifiable and non-quantifiable Benefit Themes detailed in Section 2.2.

For the purpose of quantifying benefits the focus is on the first Benefit Theme – *B1. Reduced capital project risks and costs.* This is explained in Section 3.4. A number of the other Benefit Themes support this either directly or indirectly, for example through improvements to the quality of data available to delivery teams or improvements to the workflows and processes used. These are summarised in Section 3.5.

Benefit Theme B1 – Reduced Capital Project Risks and Costs (additional savings generated from the replacement of the CDM data store and workflows by the CDE functionality), are quantified financial efficiency savings (non-cashable).

To understand the likely impact of IMM on Surface Transport expenditure, the total budgeted expenditure within Surface Transport's Business Plan covering the period from 2015/16 to 2023/24 has been examined.

For the purpose of this Business Case, the spend that is directly impacted by the IMM Project is considered to be:

- Major Capital Schemes including major capital programmes (e.g. STIP, TLRN Major Projects etc. and other large capital schemes (e.g. Bus station development, Safety Camera replacement, River Services, other TLRN schemes etc.)
- Asset Capital programmes (including Asset Renewals)
- Maintenance and operational costs (though potential cost reductions have not been quantified at this stage)
- Operational costs of CDM data store and workflow

The total Surface Transport spend linked to the delivery of Major Capital Schemes, Asset Capital programmes and Maintenance/Operation of assets equates to £4.3bn for the period being assessed.

Testing of IMM products will commence during the Detailed Design stage as 80% of IMM capability will be in place from April 2016. Roll out of IMM capability across Surface Transport will commence from April 2016 on selected early adopter projects, September 2016 for capital renewal works with full roll out from April 2017(i.e. applicable to all capital and operational works).

The phasing is based on the assumption that Major Projects typically operate on a 3 year Design and Build lifecycle and Asset Capital programmes on a 2 year cycle. The phasing of benefits therefore take into account that a number of projects and programmes will be too advanced to benefit from IMM implementation at the initial roll-out date.

The relevant spend is therefore phased as follows:

Table 10: Benefits Phasing

	2014/15	2015/16	2016/17	TOTAL
Capital Schemes	Early adopters	33%	66%	100%
Capital Programmes		50%	100%	100%

Source: Business Plan spend profile, IMM Team analysis

At the point of full implementation the IMM Project will impact on a wide range of Surface Transport teams, asset types and activities that generate and use information and data. It has therefore been necessary to extrapolate from evidence of the impacts of IMM on current processes and ways of working to estimate likely savings across the large and varied programmes of future work.

The relevant spend for Major Capital Schemes includes the following cost headings:

- TfL Management costs
- Design
- Survey
- Utilities diversions

- Traffic management
- Main works (structures, superstructures, highways)

The following cost headings have not been included in these calculations, though this does not preclude IMM enabled efficiencies being delivered within them:

- ECI
- Employer's supervision
- Other enabling works and services (site clearance, demolitions, preliminaries etc.)
- Temporary works
- Network Rail costs
- Land costs
- Other charges

The result of calculating the part of Surface Transport spend impacted by IMM and applying the phased introduction of IMM capabilities into capital works is shown in the following table.

Table 11: Breakdown of relevant Surface Transport spend

Spend	Total Spend 2015/16 – 2023/24	Relevant IMM Spend Before Phasing	Relevant IMM Spend after Phasing
Major Capital Schemes	£2,376.4m	£1,182.9m	£863.8m
Capital Renewal Schemes	£928.0m	£881.6m	£665.4m
Maintenance/Ops	£997.9m	N/A	N/A
TOTAL	£4,302,3m	£2,064.5m	£1,529.2m

Source: Surface Transport's Business Plan, IMM Team analysis

This Business Case focuses on major areas of spend where estimates of quantifiable cost savings have been identified. Supporting evidence for the expected level of benefit has been collated in the 'Benefits Framework for Business Case and Benefits Management Strategy' and 'Benefits Evidence from IMM Workshops' documents produced separately.

To quantify the benefits the IMM project team has engaged with a wide range of stakeholders to validate the potential scale of time, resource or cost savings that the improved capabilities of IMM will deliver. The range of teams engaged with during the Concept Design stage is shown in Appendix I.

The quantified estimates of financial benefits are summarised in this section and link to the IMM Enabled Savings in the following table:

Table 12: IMM Enabled Savings

Cost Saving Heading	Description	Expected Benefit Range applicable to relevant cost	Total Relevant Spend (2014/15-2023/24) after Phasing	Total Benefit over assessment period (2014/15-2023/24)
	MAJOR CAPITAL SCHEMES			
TfL Management Costs	A reduction in TfL Management Costs for major capital schemes due to improved information management processes and reduced overall scheme durations	2.3%-9.6%	£71.0m	£1.6m-£6.8m
Survey and Investigation Costs	A reduction in the costs of surveys and investigatory works through the reuse of survey and As Built information and undertaking validation work	5%-10%	£4.2m	£0.2m-£0.4m
Design Costs	A reduction in Design Costs through operating more efficient design processes and reducing errors and delays in submissions and approval processes	2.6%-5.1%	£140.6m	£3.6m-£7.2m
Cost of Main Works	A reduction in the cost of construction works on major capital schemes following the full implementation of BIM Level 2 capabilities - improved clash detection, construction sequencing and management of build ability issues	6.4%-12.8%	£595.8m	£38.2m-£76.4m
Cost of Traffic Management	A reduction in the cost of Traffic Management through improved sequencing, scenario-planning and co-ordination of contractor and sub-contractor works and reduced overall scheme durations	5%-10%	£52.3m	£2.6m-£5.2m
Contractor risk allocation	A reduction in the risk allocation built into lump sum and target cost tenders	0%-0.5%	Included in Main Works	£0m-£2.8m
Approval times	A reduction in scheme approval times bring schemes to site more quickly, averting construction cost inflation	0.8%-2.4%	Included in Main Works	£4.7m-£14m
	CAPITAL RENEWALS SCHEMES			
Survey and Investigation Costs	A reduction in the costs of surveys and investigatory works through the reuse of survey and As Built information and undertaking validation work	5%-10%	£35.0m	£1.8m-£3.5m
Design Costs	A reduction in Design Costs through operating more efficient design processes and reducing errors and delays in submissions and approval processes	5%-10%	£70.0m	£3.5m-£7m
Cost of Main Works	Improved clash detection, construction sequencing and management of build ability issues. Improved surety of scope and programme	1%-2%	£560.3m	£5.6m-£11.2m
TOTAL ESTIMATED SAVINGS			**£1,530.5m**	**£61.8m-£134.5m**

TfL Management Costs

Estimates of the reduction in TfL management costs on major projects are based on a typical 3 year project life-cycle. It is assumed that a reduction in the duration of time or resource required to carry out core activities will equate to a similar overall reduction in costs.

The activities that will be impacted by IMM and the cost savings ranges used in the project Cost Model are as follows:

Table 13: TfL Management Cost (Savings Range - £1.6m-£6.8m)

TfL Management Costs				
Activity	**Current cost/duration impacted by IMM**	**Estimated Reduction**	**Weeks Saved (low)**	**Weeks Saved (high)**
Initial collation of data	Ranges from 1-4 months depending on scheme complexity	25%-50%	0.5	8.0
Regular reporting	Resource required to manage regular reporting, distribute data etc. is >10% of total PM time	10%-25%	1.6	3.9
Data distribution and transfers	Inefficiencies due to e-mail based distribution of data and documents with limited workflow processes	Included above	Included above	Included above
Data hand overs and approvals	Variable delays at gates and info hand over points due to limited workflow processes and reworking of submissions	Included above	Included above	Included above
Defining info requirements, protocols etc.	2-3 weeks FTE effort at Concept Design, Detailed Design and Delivery stages	25%-50%	1.5	1.5
Typical Scheme Duration (weeks)	155			
% Saving (low)	2.3%			
% Saving (high)	9.6%			

Surveys and Investigation

Estimates of the savings that can be made in the survey and investigation element of scheme development are based on the current inability of Surface Transport staff to locate or verify the accuracy of existing survey and As-Built data. This results in a level of duplication of topological surveying and other investigative works at the outset of schemes.

Table 14: Survey and Investigation (Savings range - £200k-£400K)

Surveys and Investigation		
Activity	**Current cost/duration impacted by IMM**	**Estimated reduction**
Reuse of current surveys/as built information	Extremely limited reuse of information to avoid unnecessary survey and investigation costs at Feasibility/Concept Design phases of schemes	5-10%

Source: Example major projects, workshops and interviews, IMM team analysis

Design

Estimates of the savings that can be made in the Design phase are based on reducing the duration of the design process and increasing the accuracy of design work. This will be achieved through improving the provision of base data used and reducing errors and rework through the use of well-defined standards and protocols within a BIM compliant design process. Operating within a Common Data Environment will also enable validation checks and workflows to be built into the submission and approvals process to reduce delay and rework.

A more effective understanding and review of scope by the Client and stakeholders (i.e. only build what is needed) will be supported by the use of BIM visualisation tools and the ability to carry out scenario modelling more quickly and effectively.

The cost impact is relatively conservative due to the split between lump sum elements and time charged elements within the design process and the need for more complex design tools and processes that may, initially at least, restrict the capacity to deliver efficiency savings.

Table 15: Design (Savings Range - £3.6m-£7.2m)

Design				
Activity	**Current cost/duration impacted by IMM**	**Estimated Reduction**	**Weeks Saved (low)**	**Weeks Saved (high)**
Collation of existing data	Typically 1-2 weeks to gather design information	Overall 2-4 week reduction	2	4
Revision of drawings during design	Up to 8 week process for more complex revisions			
Approval of Concept and Detailed Designs	Up to 6-9 month process from initial submission to approval			
Use of 3D modelling and object libraries	N/A - expected to reduce overall design time (e.g. resource/time required to produce drawings)			
Transition from Concept to Detailed Design	Significant rework currently occurs due to incompatible standards/data validation etc.			
Typical Design Duration (weeks)	78			
% Saving (low)	2.6%			
% Saving (high)	5.1%			

Source: workshops and interviews conducted across Surface Transport during Stage 3; IMM team analysis

Main Works

External literature identifies cost savings of 5%-27.5% in the Construction phase of trial BIM projects. Although these tend to relate to building construction many of the same efficiency savings can be realised within the type of infrastructure projects carried out by Surface Transport, particularly through improving the co-ordination of works between sub-contractors and third parties, many of whom are responsible for their own design. IMM will support the development of more resource efficient sequences of construction to reduce construction durations and lower the costs of temporary works, traffic management etc.

The 2014 UK Industry Performance Report issued by the Department for Business, Innovation and Skills suggests that 43% of UK construction projects are delivered over budget and 33% take longer than the planned duration at the outset of the construction phase. Providing more surety of programme and budget through the IMM capabilities can therefore impact on accuracy and improve budget management.

The benefits of IMM relate to improving the construction process and minimising the likelihood of delay or over-run in order to reduce the duration of works on site. Engagement with internal stakeholders has been used to estimate the impact that IMM is likely to have across a typical major scheme.

Table 16: Main Works (Savings Range - £38.2m - £76.4m)

Main Works				
Activity	**Current cost/duration impacted by IMM**	**Estimated Reduction**	**Weeks Saved (low)**	**Weeks Saved (high)**
Clash detection	Reduced construction time due to identification and resolution of clashes, build ability issues and construction issues during scheme Design phases	Overall 5-10 week reduction	5	10
Use of 3D models for construction planning and phasing	Reduced construction time due to ability to resolve construction issues in model environment rather than site environment			
Use of 3D models to manage design changes	Reduced construction time due to ability to rework design and construction drawings as a result of change requests or unforeseen site conditions			
Approval times	Reduced construction costs due to greater certainty of programme (avoiding delays or temporary measures)			
Typical Design Duration (weeks)	78			
% Saving (low)	6.4%			
% Saving (high)	12.8%			

Source: Example major projects, workshops and interviews: IMM team analysis

In arriving at these estimates we have reviewed external benchmarks for savings generated by BIM-enabled projects, examined the lessons learned on TfL trial projects (particularly within the Structures and Tunnels Investment Portfolio - STIP), considered how IMM would be applicable to issues experienced on non-BIM enabled capital projects that Surface Transport has delivered (or is in the process of delivering) and discussed these with Surface Transport staff in a series of workshops and interview sessions.

IMM approaches have been shown to have maximum impact through enhancing design and modelling capabilities - clash detection, construction sequencing, optioneering etc. which reduce construction times and reduce the number of errors, changes and delays that can affect works once they reach site. Examples of this on STIP schemes include the modelling of more complex construction activities, such as bearing replacements and strengthening works, to optimise the construction approach.

Over a typical major project with a 78 week construction period it is estimated that IMM efficiency improvements can reduce the duration of works by 5-10 weeks, with a proportionate reduction in construction costs associated with Main Works and Utilities diversions (approximately 40% of the total scheme cost). It is assumed that this saving is representative for the types of schemes that Surface Transport will deliver during the assessment period.

In addition to the above benefits, IMM will also have an impact on the amount of risk allocated by suppliers, traffic management costs and the time taken to get a project to build stage. The following table outlines the potential benefits associated with these costs.

Table 17: Other Construction benefits (Savings Range - £7.3m - £22.0m)

Other Construction Costs		
Activity	**Current cost/duration impacted by IMM**	**Estimated reduction**
Risk reduction	A reduction in risk allowances included within target cost or lump sum contracts should occur as contractors gain confidence in the improved data and information provided through IMM. Risk allowances are typically 3-5%.	0.50% from 2019/2020
Optimised Traffic Management	Improved sequencing, scenario-planning and co-ordination of contractor and sub-contractor works and reduced scheme durations will reduce Traffic Management costs	5-10%
Approval times	Elimination of delays in approvals accelerates time to site by 3-6 months. Equivalent of 1-2% increase in costs due to construction inflation	1-2%

Source: Workshops and interviews: IMM team analysis

A similar rationale for the target savings applies to Asset Capital schemes, with the benefit ranges amended to reflect the smaller and less complex nature of these schemes. Target savings following full implementation of IMM are summarised as follows:

Table 18: Capital renewal programmes (Savings Range - £10.9m - £21.7)

Cost Heading	Target Savings
Design	5%-10%
Survey and Investigation Costs	5%-10%
Build Costs	1%-2%

Source: Workshops and Interviews, Value Manager review, IMM Team analysis

System Decommissioning

The CDE functionality will enable the decommissioning of the current CDM data store and workflows which have an operating cost of £190,000 per annum. This benefit is assumed to accrue from August 2017.

Other legacy asset management systems may also be able to phased out as the CDE technology is embedded into the business. The cost and benefit of these are not included within this Business Case, as these are anticipated to be assessed and managed by specific asset teams and system owners.

3.4 Explanation of Social and Strategic Benefits

This Business Case is based on a cost impact of reduction in the risks, costs and programme durations of major infrastructure projects and Asset Capital schemes. In addition it will enable an element of the contingency held against major capital infrastructure projects

to be reduced and released for use by the business. As such, the social or strategic benefits have not been quantified within the cost model, but there are a number of additional strategic benefits that IMM will deliver.

These benefits are summarised in this section.

3.4.1 Improved Supplier Management & Reduced Operational Costs

Provision of more complete and accurate asset information from schemes and suppliers will provide opportunities to generate efficiencies within operational and maintenance activities.

For example, Surface Transport have difficulty in preparing tender specification documentation for maintenance term contracts for bus stations (>£500K per year), partly because of a lack of asset information available to provide to tenderers. This means that the incumbents are favoured, and should a competitor provide a better price it is difficult to assess whether this is due to improved efficiency, or merely that they didn't know something crucial.

Updates of asset management systems are currently inconsistent, leading to the potential for Compensation Events due to incorrect information or abortive works. For example, it is understood that during the financial year 2014/15 no data was updated in Bridgestation following Capital Renewal works for structures.

Over time, defined information requirements linked to amended contract requirements will improve the accuracy of the asset information that operational and procurement decisions are based upon.

3.4.2 Improved Asset Data Quality - Consistency of information

Consistent information standards, naming conventions and data protocols across Surface Transport and, where possible, across TfL will contribute to:

- Information being more easily located and retrieved
- Information being re-used without excessive manipulation or manual processes of entry or re-processing
- Information being provided in the right format at Pathway products and stage gates

These benefits will enable staff to work more productively, using more of their time to carry out value-adding activities. This benefit will increase over time as more project and asset data is incorporated into a Common Data Environment (CDE) and the accuracy and completeness of updates to existing asset management systems improves.

3.4.3 Reduced Costs of Data Management

Managed storage of information within a Common Data Environment will enable Surface Transport staff to:

- More easily and quickly search for and retrieve existing information required for reporting and planning tasks
- Improve the traceability and assurance of information

- Provide audit trails of comments and approvals
- Support data validation at the point of publication
- Reduce the use of email to communicate project and asset information and manage reviews and approvals
- Reduce the un-structured storage of information

These benefits will also enable staff to work more productively, using more of their time to carry out value-adding activities.

3.4.4 Standard data and information requirements

IMM will provide an environment where requirements for data and information are defined and enforced more rigorously. Having these requirements clearly defined, communicated and built into Surface Transport's commercial arrangements will ensure that:

- The right information is delivered at each approval point and to the right quality
- Surface does not over specify the level of information required for each approval point, which adds costs
- Operational information requirements for assets are defined at the outset of schemes
- Handovers to operations are smoother and more efficient and structured data transfers to asset management systems and asset inventories occurs where possible

3.4.5 Improved Information Sharing and Collaboration

Improved collaborative working internally and with the supply chain will help to drive cost reduction and promote the elimination of waste.

For example, Surface Transport will be able to participate more fully in pan-London programmes such as Drain London and share data and modelling results that will help to co-ordinate and improve the Capital Asset and maintenance programmes.

Greater visibility of design decisions and will improve stakeholder consultation and management processes and reduce delays to approvals. Where major capital projects include features to meet the needs of stakeholders – e.g. acoustic and visual barriers, planting etc. to minimise the impact of the scheme - using visualisation to demonstrate to stakeholders what the impact of the scheme will enable these elements of the design to be optimised.

3.4.6 Improved Assurance

Clear roles and responsibilities with regards to information management and re-engineered project processes, linked to a CDE workflow engine, will further help to eliminate waste and delays.

IMM will provide more robust validation and assurance of the data and information collected by Surface Transport thereby reducing the reputational and financial risks associated with the transfer of incomplete or inaccurate data to the supply chain or others.

Examples of risks relating to data quality and information management include the following:

1. CDM data stores are used to hold details of site hazards and buried infrastructure - this is not an effective way to capture and share this information.
2. Lack of robust asset data places a reliance on operational staff to act as an 'early warning system' and react to issues.
3. The contractor (on an LU scheme) failed to handover the complete as-built information and assurance documentation, notwithstanding that this is a contractual obligation and Completion requires provision of these documents.

   This is affecting the infrastructure maintainer's ability to maintain the new works, which could have a health and safety implication. Therefore the business is considering paying the Contractor's sub-consultants directly to obtain the as-built and other information.

   The situation on site has become contentious and therefore the Contractor may be withholding this information for tactical reasons. Had there been a more organic and continuous collection of information which the Employer had access to at all times, the situation may have been different.

   The business is in the process of finding out the cost of procuring the as-builts directly, but this is obviously also taking up unnecessary resource and time to resolve.
4. Procurement strategies are reactive and set gate by gate. Defining EIRs and standards at a scheme level will assist the Commercial teams with developing a procurement strategy for the whole scheme.
5. The current lack of asset information makes it challenging to manage CDM requirements and ensure consents are being met.
6. TfL have duties under the Flood Management Act which are challenging to meet with current levels of asset information.
7. Roles and responsibilities around benefits realisation are not well defined, with delivery teams moving on at scheme close out. Reasons why expected scheme outcomes have, or haven't been, achieved are not always captured for future use.
8. Two H&S incidents - in December 2014 and April 2015 - involved the same contractor, the same issue and the same general area. Incident monitoring and lessons learnt processes need to improve in order to avoid the recurrence of incidents.

3.4.7 Customer Experience - Minimising Impact of Works

The value to the travelling public of minimising the duration of construction works and any delays and overruns is based on the Appraisal values of time. Assuming average daily traffic flows on the Transport for London Route Network (TLRN) are around 30,000-50,000 and works typically create a 0.5 hour delay to road users (assumptions based on discussion with TfL stakeholders), the value of reducing the duration of construction works by a day (for car users only) can be calculated as follows:

Resource Cost of car occupant = £8.05 per hour (Source: Business Case Development Manual)

Average car occupancy = 1.6 (Source: National Travel Survey)

Estimated average daily traffic flow = 40,000 (Source: volumes for a representative scheme, this varies considerable based on the type and scale of scheme)

Impact of 0.5 hour delay during works	= 0.5 x £8.05 x 40,000
	= £161,000
Adjustment for overnight works	= £161,000 x 20%
	= £32,200

Similar benefits are applicable to other road users (taxis, cyclists, freight, bus users etc.) with hourly resource costs ranging from £8-£18. The figures above are therefore indicative of overall impact.

To put this in context, a reduction in the total duration of works for carriageway schemes (around 50 per year with predominantly overnight working) by 5 days would have a value under this measure of approximately £150,000. The reduction in duration of works on a major scheme by 5 days would have a value under this measure of approximately £800,000.

Compliance with BIM Level 2

Compliance with the Governments Construction Strategy will eliminate the risk of the DfT grant being reduced by the Cabinet Office due to failure to adopt Level 2 BIM. It should be noted that the impact of *not* meeting this requirement is currently unclear, and is therefore not quantifiable. Non-compliance could, however, lead to financial or reputational impacts for Surface Transport.

3.5 Key Assumptions

The key assumptions in this assessment are:

Costs and Benefit Calculation Assumptions

- The typical lifecycle of major capital schemes is 3 years and lifecycle for Asset Capital schemes is 2 years. Full roll-out of IMM capabilities will therefore cover all relevant spend by the time these durations are complete.
- The breakdown of Surface Transport spend is a reasonably accurate estimate of relevant expenditure for the period to 2023/24;and
- The identified potential cost savings are applicable across the full range of capital works implemented by Surface Transport.

General Project Assumptions

- The Common Data Environment (CDE) and core supporting technology capabilities will be in place from September 2016.
- CDE integration with a limited number of existing asset management systems (search and retrieval functionality) will be in place at September 2016, additional system integration work will take place following this date.
- Limited migration and cleansing of data from existing asset management systems will take place (other than the CDM data store) under the IMM project – in general, this will be managed under the AMD Systems Strategy.
- IMM will provide reporting and monitoring tools linked to the information and workflows within the CDE but will not provide more sophisticated Business Intelligence tools.
- Staff will undertake IMM training requirements as part of Surface Transport staff's normal business activities. No additional costs have been included for the removal of staff from their 'day jobs' or providing additional cover.
- External consultant support ramps down from 2016, with part-time resource only from this time. This external support will cease from April 2017; and
- The supply chain will implement the required contractual amendments and these will be passed down through sub-contractor arrangement without this incurring a material cost premium on future tenders or costs.

3.6 Feasibility, Risk

The Top 5 risks identified in the Quantified Risk Assessment are:

Table 19: Quantifiable Risks

Risk Number	Risk Description	Mitigation
1	There is a risk that the cost of implementing the CDE is higher than budgeted for this is due to inaccurate ROM cost estimates, which could lead to an increase in the projects EFC.	Detailed engagement with IM has taken place and detailed costs estimates have been produced. Further market engagement will be carried out to validate cost estimates.
2	There is a risk that the operational cost of the CDE by IM is higher than budgeted for as a result of inaccurate costings, this could mean an increase in the project EFC.	Detailed engagement with IM has taken place with weekly progress meetings in place. IM will provide a dedicated PM and robust reporting will be in place in line with the TfL governance framework
3	There is a risk that the EC Harris costs increase due to delays in programme. This will result in an overall increase in project costs.	Ongoing tracking of the programme to monitor any delays and target any areas that may slip and cause the need for extra resources.
4	There is a risk that the project will not be able to roll out capital projects onto the CDE in time for August 2016 due to the tight timescales planned. This would cause a delay of one year until April 2017 when the next tranche of capital renewal projects commence.	Monitoring any slippages and tracking any delays that may impact to ensure early sight of this. Investigating alternative options for rolling out to Capital Renewals should the delay occur.
5	There is a risk that the integration costs more than expected due to inaccurate estimating or a higher level of effort being required. This will result in project costs increasing to cover the additional amount.	Engaging regularly with IM about the integration services and what systems will be need to be integrated.

3.7 Outcome of Quantified Analysis

Full details of the financial assessment are included in the separate Cost Model for the IMM Project. The outcomes of this assessment are as follows.

Table 20: Cost Model Outputs

	Higher Benefit Range	Lower Benefit Range
ROI	677%	257%
Payback (years)	3.1	3.8
IRR	108.7%	57.5%
NPV (£m)	90.2	33.5

3.8 Measures of Success / Benefit Realisation

The monetised measures of success for the project are as follows:

- Reduction in the contingency held against capital projects delivered with IMM capabilities of 3.3%-7.3% of the total costs. This value may be increased should implementation on IMM early adopter projects demonstrate that larger cost savings are achievable
- 1.6%-3.1% efficiency improvement in annual Asset Capital schemes enabling Surface Transport to deliver more for the same

The strategy for tracking and validating the success of the IMM Project is detailed in the IMM Benefits Management Strategy. It is intended that the financial efficiency savings will be monitored and tracked.

4 Summary

4.1 Overall Assessment

IMM is driven by the Government's Construction Strategy and Level 2 compliance and TfL's drive to improve how asset information is used and shared across Surface Transport. Continuing with the project will ensure that TfL achieves Level 2 compliance and will not be put in a disadvantageous position when future grant funding is determined.

This updated Business Case has also shown via extensive analysis that the IMM project can achieve financial efficiency savings (non cashable) based on conservative figures of £61.8m over the life of the project up to 2023/24, at a cost of £17.3m. The IMM project therefore represents good value for money and is an essential enabler to keeping London moving and connected by empowering people with the knowledge and tools that maximise the benefits of good asset information management.

The expected savings in costs will enable Surface Transport to deliver more for the same as more efficient delivery is reflected in lower capital costs for major schemes and capital renewals programmes. It should be noted however that, as lower costs will be reflected in the setting of budgets and forecast costs, the IMM payback will not provide directly cashable savings.

4.2 Next Steps

It is recommended that project authority of £7.26m (£1.24m of project authority already exists, this is deducted from the £8.50m Project Costs in this business case\) is granted to take the project through to closure and initially undertake Pathway Stage 4 – Detailed Design, which will:

- implement the required standards,
- procure the technology CDE to underpin the IMM project (including Procurement Authority to issue OJEU notice at the end of September 2015),
- undertake business mobilisation including process and contract changes for early adopter projects that will use the CDE from early October 2016,
- Use an early adopter pioneer project from April 2016 to deploy the standards only.

Stage 4 will run from August 2015 to September 2016, with contract award for the CDE in April 2016.