Asset Information Management Plan

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1 Purpose

This Asset Information Management Plan details the framework being used by Crossrail to specify, acquire and manage good quality asset information. It is based upon good practice approaches to asset information management, which will enable asset information deliverables to be delivered in a cost effective and timely manner.

1.1 Principles

This Plan has been developed based upon a number of key principles:

- Asset information is a key input to a number of Crossrail processes and systems;
- Asset information is a key enabler for short and long term asset management approaches by the Infrastructure Managers and should be provided in formats that support these objectives;
- The provision of asset information is a process that runs throughout the duration of an engineering project;
- Asset information, if not gathered at the appropriate point in a project, will be more expensive and difficult to retrospectively gather;
- Information provision processes shall be managed, assured processes with progress and issues visible to relevant stakeholders;
- Good practice approaches to asset information have been adopted where relevant and adapted to the requirements of Crossrail;
- Optimised processes and information delivery mechanisms should allow the overall cost of asset information provision to be delivered at optimum cost yet maintaining a world class standard of quality for the complete suite of asset information gathered;
- TfL require detailed information on the assets that have been provided as part of the Crossrail Programme.

1.2 Updates

This document will be reviewed and updated normally on a 6 monthly basis, but no longer than annually.

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2 Scope

The Crossrail Programme includes all the works and activities necessary for Crossrail Limited (CRL) to construct and commission a new railway from Maidenhead and Heathrow in the west to Shenfield and Abbey Wood in the east.

This Plan covers the provision of asset information from the Central Section Works (CSW) of the Crossrail Programme which includes the tunnelled section in central London, the new station construction and railway and communication system assets.

Asset information arising from enabling or interface works is also covered in the scope of this Plan, as is work undertaken by London Underground on behalf of Crossrail. The eventual handover of asset information as part of railway handover is also covered in the scope of this plan.

The term asset information is used as a generic term for:

- Asset inventory;
- Classification of assets;
- Attributes of these assets;
- Location and spatial information of assets;
- Relationships between assets;
- Design models (including schematics, 2D, 3D and 4D CAD models and related data);
- Documents, drawings and records of assets and systems including test certificates; and
- Photographs.

Asset information is being created as part of an overall BIM environment, as detailed in the Crossrail BIM Principles document (CR-XRL-Z3-RGN-CR001-50005).

The principal Industry Partners are:

- Transport for London (TfL)
- Rail for London (RfL)
- Network Rail (NR);
- London Underground Limited (LUL);
- Canary Wharf Group (CWG); and
- Contractors – this includes Framework Design Contractors (FDC), Design and Build Contractors and Construction Contractors.

This Plan is applicable to all the above parties when engaged in CSW delivery activities.

2.1 Out of Scope

- Management and utilisation of asset information once transferred to the Infrastructure Managers and the processes and software to achieve this;
- Work undertaken by Network Rail and handed over directly to RfL; and

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- Information relating to Over Site Developments (OSD) and street works.

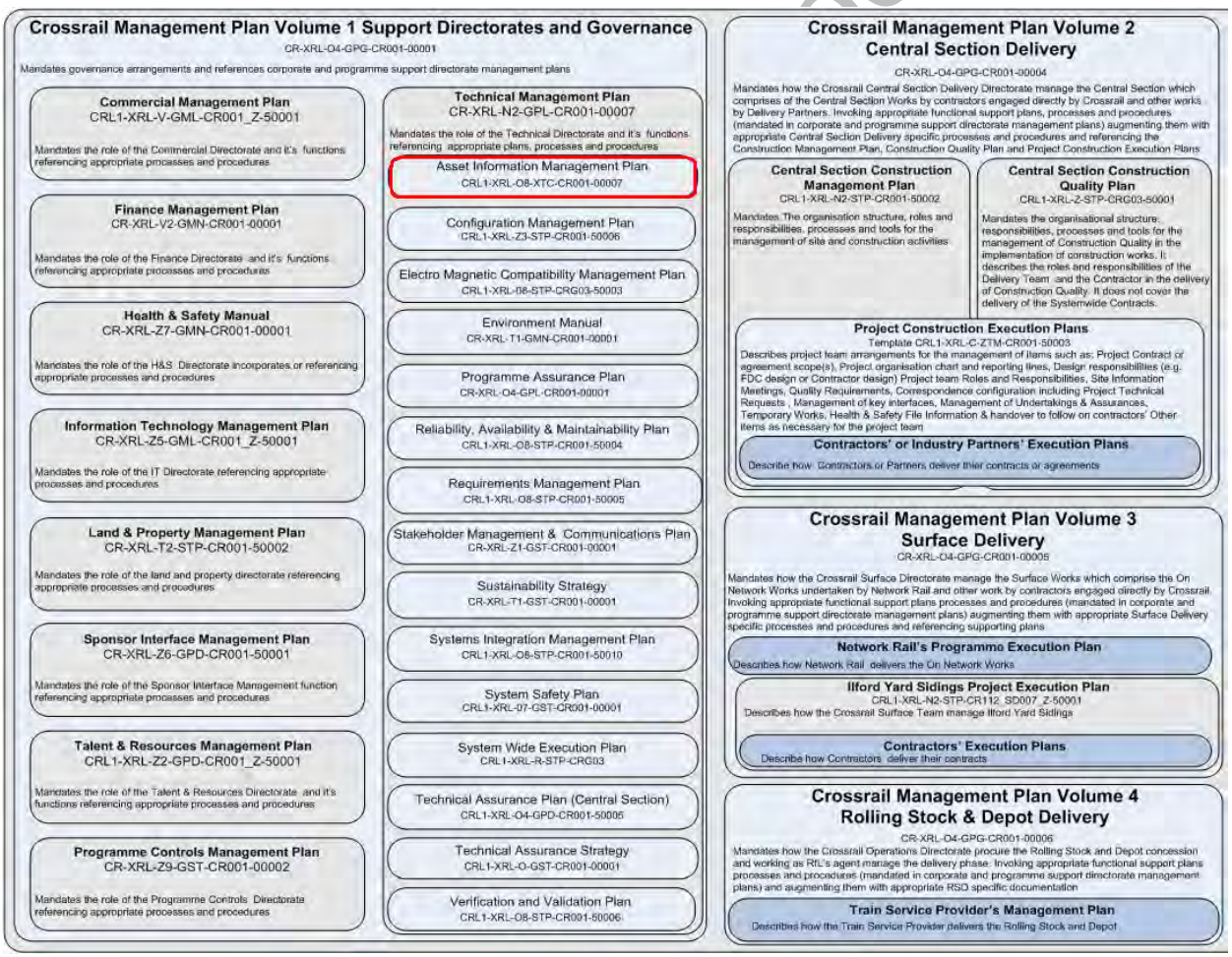
3 Definitions, Acronyms and Abbreviations

For an explanation of the Definitions, Acronyms and Abbreviations used in this document and by CRL when describing asset information related activities please refer to the Asset Information Glossary (CRL1-XRL-Z3-GUI-CR001-50012).

The term *Contractor* is a collective term in this Management Plan used to refer to Framework Design Contractors, Design and Build Contractors, Construction Contractors or any other Contractor responsible for the design, build, creation, installation and commissioning of assets for the Crossrail programme.

4 Relationship to other Crossrail documents

The Asset Information Management Plan is a component of the wider Crossrail Management Plan (CR-XRL-O4-GPG-CR001-00001), see diagram below.



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Asset information and the activities described in this Asset Information Management Plan will also support other Crossrail activities detailed in the Crossrail Management Plan and other activities not necessarily listed above.

In turn, the Asset Information Management Plan is supported by a number of other documents and deliverables:

Asset Information Management Plan

CRL1-XRL-Z3-STP-CR001-50002

Discipline Specific Strategies

Crossrail BIM Principles document CR-XRL-Z3-RGN-CR001-50005

GIS Business Development Plan 2013 – 2015 CRL1-XRL-G-STP-CR001-50002 (Under Review)

Governance

Asset Information Governance Group Terms of Reference - CRL1-XRL-Z-STP-CR001_Z-50005

Specification

Works Information 2B, Civils (13.5) and Systems (29.2.10)

Asset Identification Standard CRL1-XRL-O6-STD-CR001-00031

Asset Data Dictionary AIM-ADD-001

Asset Data Dictionary Master Configuration CRL1-XRL-Z3-ADDSD-CR001-50186

CAD Standards CR-STD-005

Asset Information Glossary CRL1-XRL-Z3-GUI-CR001-50012

Acquisition

Contractors Information Pack CRL1-XRL-Z3-GUI-CR001-50006

Asset Information Provisioning Procedure CRL1-XRL-Z3-GPD-CR001-50004

Document Management Procedure CRL1-XRL-Z3-GPD-CR001-50001

Storage

AIMS User Manual CRL1-XRL-Z5-GML-CR001-50001

Asset Information Fundamentals CRL1-XRL-Z3-GPD-CR001-50007

Transfer

Section 11 of Asset Information Management Plan

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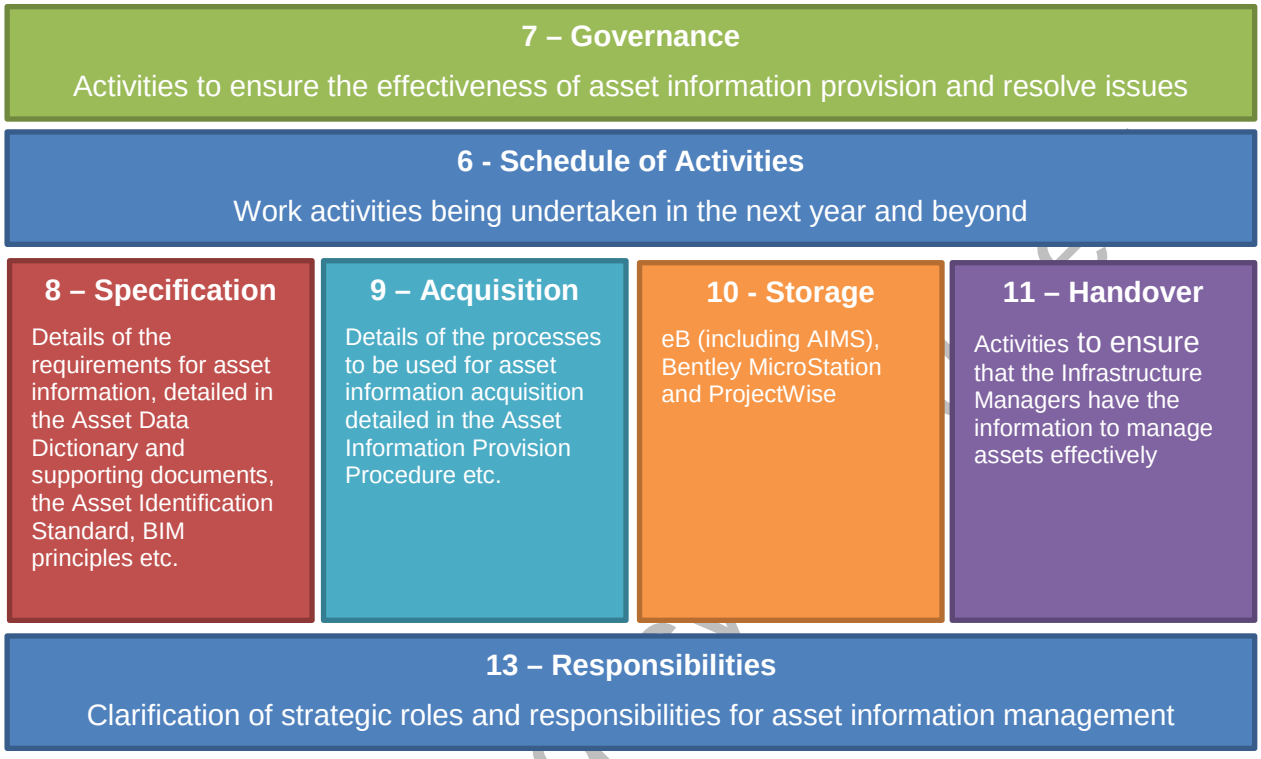
5 Document Structure

The overall structure of this document is illustrated below:



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6 Timescales

The diagram below provides an illustration of the high level timeline for the Crossrail programme. Monitoring of this high level programme will be undertaken to ensure that any changes that relate to asset information are taken account of.

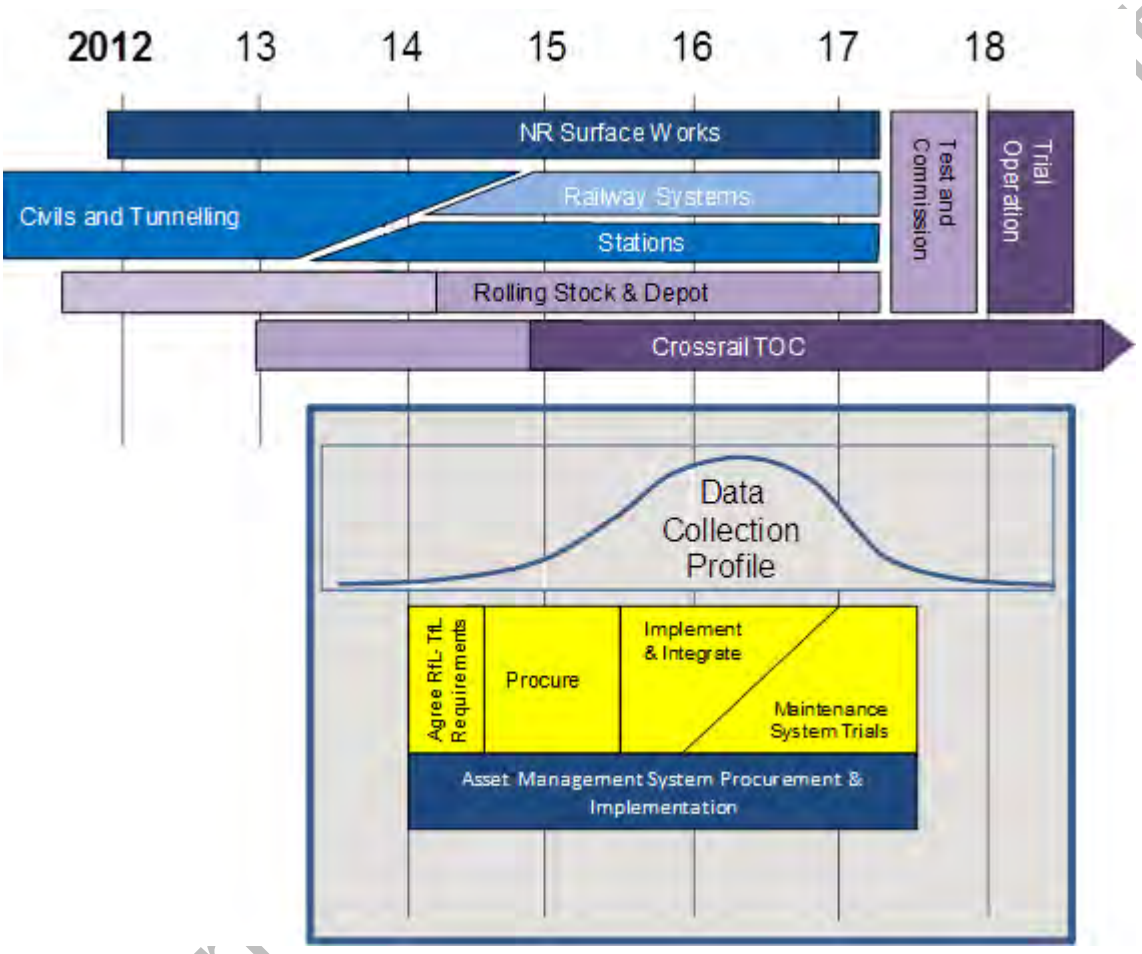

Figure 1 - Crossrail high level timeline

There are a number of activities that need to occur to support the efficient and effective specification and provision of asset information. These fall into two broad categories:

- One off enabling activities, for example, defining standards and procedures; and
- On-going 'Business as Usual' activities for actual asset information provision

For the one-off activities, details of those occurring over the next 12 months are included in Section 6.1. Progress will be reported and monitored at Asset Information Governance Group meetings.

For on-going asset information provision activities, the Asset Information Team utilise a range of planning and tracking tools. Progress on information provision will also be reported and monitored at a suitable level of detail at Asset Information Governance Group meetings.

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6.1 Schedule of activities

There are many activities involved in the specification, creation, acquisition, storage and utilisation of asset information. On-going 'Business as Usual' activities will have suitable monitoring and progress reporting established which are not detailed in this Plan.

The activities detailed below are a subset of discrete Crossrail activities relating to asset information that are due to be undertaken or completed over the next 12 months. Those that are likely to involve or impact Infrastructure Managers have been indicated.

No.	Activity	Description	Start date	End date	Responsible	IM?
1.	Asset Information Documentation revision	Periodic update and revision of asset information documentation, such as this Plan	Jan 14	Apr 14	[redacted]	Y
2.	Asset Data Dictionary	Initial development and acceptance of the Crossrail Asset Data Dictionary excluding Signalling and Communications assets		31/3/14	[redacted]	Y
3.	Asset Data Dictionary	Initial development and acceptance of the Crossrail Asset Data Dictionary for Signalling and Communications assets	Jan 14	Jun 14	[redacted]	Y
4.	Handover Strategy				Heather McPherson	Y
5.	O&M Documentation	Define approach and requirements for O&M information			Alec Chu	Y
6.	AMIS Requirements	TfL IM project to document business requirements for Asset Information Systems		Apr 14	Kostas Tsatsaris	Y
7.	RfL Systems Strategy programme	Programme of activities to specify, procure and implement suitable software systems that will support the operation of RfL as an organisation		Oct 14	Amie Ward	Y
8.	Document Management Process Review				Hugh Harrington	N

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No.	Activity	Description	Start date	End date	Responsible	IM?
9.	Document Control Technical Information Compliance Strategy				Beth Ruewell	N
10.	Quick Reference Guide updates				Beth Ruewell	N
11.	Interface Works document transfer pilot	To test out ways to improve the efficiency and effectiveness of transferring documents relating to Interface Works from eB to IM systems			Neill Pawsey	Y
12.	CAD standards review				James Holland	Y
13.	Appendix J updates				Stephen Smith	N
14.	CAD QA updates				James Holland	N
15.	Red Line/ As Built processes				Mark Humphrey	Y

There may be changes in priorities and resourcing as the programme continues – significant changes will be communicated to the Asset Information Governance Group (AIGG).

7 Governance

An Asset Information Governance Group has been established to provide ongoing governance of the standards, provision, storage and usage of asset information by Crossrail. The frequency of meetings is between 1 and 3 months.

The Objective of the Crossrail Asset Information Governance Group (AIGG) is:

“The execution and enforcement of authority over the provision and management of asset information related to the Crossrail programme. These activities will ensure that asset information will support the long term management of these physical assets both whilst under CRL control and subsequently when transferred to the control of the relevant Infrastructure Managers.”

See separate AIGG Terms of Reference Document CRL1-XRL-Z-STP-CR001_Z-50005.

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8 Requirements

This Plan has been developed taking into account relevant requirements of the Crossrail programme.

8.1 Asset Information Requirements

Listed in the table below are the main asset information requirements, based on good practice approaches that Crossrail should fulfil along with a brief description of the way the requirement is, or will be, fulfilled.

No.	Requirement	Fulfilled by
1.	There shall be clear specification, management and oversight of the acquisition, storage and utilisation of Asset Information	CRL have a Technical Information Department who oversee the overall specification, creation and usage of all forms of asset information and the systems and processes used to achieve this. The department includes the Asset Information & Configuration Management Team, CAD team, GIS team and Document Control team.
2.	There shall be clear oversight of design related information	The CAD team to oversee both the configuration and usage of the shared Bentley CAD environment and the CAD data itself.
3.	There shall be clear oversight of document based information	The Document Control team oversee the configuration and usage of the Bentley eB system to specify, acquire and manage document based information
4.	There shall be clear oversight of geospatial information	The GIS team to oversee the development and usage of the GIS system and the usage of GIS data
5.	There shall be clear oversight of asset inventory information and configuration management information	The Asset Information & Configuration Management Team shall ensure that the requirements for the provision and maintenance of asset information shall be based upon the Crossrail Standards Baseline and the asset information templates and asset document requirements utilised by the Infrastructure Managers.
6.	There shall be clear oversight of the process for providing asset inventory information	The Asset Information Provision Team is responsible for the population and administration of the Crossrail Asset Information Management System (AIMS). The Asset Information Provision Team monitor and manage the process of asset information provision and ensure that good quality data is supplied consistently, and is compliant with the Standards Baseline
7.	Access to create and edit assets in AIMS will be tightly controlled	The Asset Information & Configuration Management Team will be the only people allowed to create assets and edit asset hierarchies in AIMS in order to maintain the quality and consistency of the information in AIMS

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No.	Requirement	Fulfilled by
8.	There shall be clear business ownership of the AIMS system	The Asset Information & Configuration Manager is responsible for the overall management and development of AIMS
9.	Information providers shall be given clear information over what information they shall provide and to what timescales	The Asset Information Provision Team shall provide Contractors with requests to supply asset information, details of the asset information to be supplied and the timescales for provision. For documents, the Crossrail Master Deliverables List (MDL) for each Contract will detail what needs to be provided and when
10.	Asset information shall be provided in a timely manner and in an agreed format	The Contractor shall provide the requested asset information in the format requested and to the required timescales to allow AIMS to be updated to reflect assets either under construction or as built
11.	AIMS shall be configured so that information is acquired and stored in ways that easily support future usage	AIMS shall enable storage and access of the following information to CRL standards which shall be reviewed and accepted by Infrastructure Managers: a) Asset Identification b) Asset Location c) Asset Classification to a Crossrail specific adaptation of the Uniclass standard d) Asset Status e) Asset Criticality f) Asset Attributes specific to the relevant class of asset and consistent with the attributes required by Infrastructure Managers. g) The capability to store identifiers to allow linkage to other information systems
12.	There shall be clear specification of the information to be provided	Asset Data Collection Spreadsheets are formatted to present the information requirements specified in the Asset Data Dictionary in a clear and intelligible manner
13.	Asset information shall be provided in a timely manner	The Asset Information Team will track maintain awareness of project progress and will align asset information provision activities with other relevant Crossrail activities, such as certification packages. Provision will be specified and controlled using the Asset Information Provision Process
14.	Crossrail shall comply with BIM Level 2 by 2016	The approach to the specification, acquisition and management of data compliant with BIM is detailed in the Crossrail BIM Principles (CR-XRL-RGN-CR001-50005).
15.	All assets shall have a unique Crossrail ID	AIMS configuration ensures that all assets, down to the line replaceable unit, shall have a unique identification number.

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No.	Requirement	Fulfilled by
16.	Assets shall have a human readable name and number that aligns with numbering in use at adjacent LUL facilities	Assets will have a clear asset name that conforms to the Crossrail Asset Identification Standard. Any asset numbers shall be based on local numbering conventions agreed with the relevant IM e.g. the first Crossrail escalator being escalator 6 in the overall station complex
17.	There shall be a clear and unambiguous method for identifying assets when on site	Asset identification shall be achieved through the use of standard format asset labels which include data matrix bar codes as specified in the Crossrail Asset Identification Standard (CRL1-XRL-O6-STD-CR001-00031). If there is a requirement to utilise RFID tags then these will be detailed in the relevant AD4 document
18.	There shall be clear safeguards for asset information that has been exported from Crossrail systems to Contractors to prevent loss or corruption	Throughout the contract, the Contractor shall be responsible for the safe storage and management of any extracts of AIMS supplied to them. They shall maintain suitable controls to prevent the loss, deletion, corruption or degradation of asset data consistent with current industry good practice
19.	There shall be clear ownership and control of asset information by Contractors	The Contractor shall nominate a relevant senior employee as Data Owner who shall be accountable for the management, storage and population of asset data. The Data Owner shall attend, and contribute to, Asset Information Governance Group meetings if requested (see Section 7)
20.	There shall be effective control of CRL reference data	If changes are required to CRL standard reference data, then the Data Owner or Contractor shall ensure that changes are submitted to the CRL change control process as soon as practicable
21.	Data provided by Contractors shall be of suitable quality	The Contractor shall ensure that all data population and updates are consistent with CRL quality requirements. This shall include ensuring that the accuracy, validity, precision, completeness and timeliness of asset information comply with CRL standards. Quality will be assured by relevant monitoring and audits
22.	Contractors shall demonstrate that they are providing asset information that meets CRL quality criteria	The Contractor shall instigate suitable checks and audits of data quality to demonstrate that CRL standards are being complied with and shall demonstrate the effectiveness and outputs of these processes to the Project Manager, when requested
23.	Information from Interface and Enabling works shall be provided to the relevant Infrastructure Manager	For Interface or Enabling works, the Contractor should follow existing Infrastructure Manager standards and processes
24.	There shall be clear recognition that CRL will not exist as an organisation once all the assets are handed over to the Infrastructure Manager(s)	Standards, processes and systems being developed to support handover to future operators and maintainers of Crossrail

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No.	Requirement	Fulfilled by
25.	There shall be recognition that some assets owned by one organisation may be located in premises owned by a different organisation	Approach to asset information handover being established to minimise the challenges and risks associated with documents and designs, in part, covering more than one IM
26.	There shall be allowance for multiple asset identification codes to be utilised for some assets to allow them to appear in more than one organisation's asset registers	eB configured to support multiple Asset IDs, if required, in addition to an assets unique ID
27.	There shall be the ability to export and validate all relevant data to the Infrastructure Manager(s) prior to handover of assets	Approach to asset information handover being established to ensure information is available to IMs when required
28.	There shall be capability to be able to codify assets against asset location standards in use in NR, RfL, LUL and the CRL programme itself	eB configured to support different location recording standards
29.	There shall be allowance for the fact that assets will be at different stages of their lives	Recognition that some assets will still be in the design stages and designs may not be confirmed for some time, nor will some assets be constructed for some time. Processes and overall approach developed to align to project progress

Requirements specific to Contractors have been specified in Works Information 2B, however, depending on when a Contract was let, different versions of the clauses may have been used:

- WORKS INFORMATION Volume 2B – General Requirements (Civils), section 13.5 'Asset Management & Traceability'; and
- WORKS INFORMATION Volume 2B – General Requirements (Systems), section 29.2.10 'Asset Management & Traceability'

Specific requirements associated with the process of Asset Information Transfer are detailed in Section 11.

8.2 Standards baseline

The Standards for the central section of Crossrail are defined and specified in the Crossrail Standards Baseline. This baseline contains an agreed subset of standards from the Industry Partners and CRL. These standards are fixed in accordance with the Standards Management Procedure (CRL1-XRL-06-GPD-CR001-50001) sections 3.2 and 3.3.

The Baseline includes standards for both the definition and the provision of asset information which must be complied with by relevant parties. Additionally, Guidelines are specified in the Baseline which should also be complied with, where possible.

Relevant LUL asset information related standards in the Baseline include:

- 1-034 (A1) - Station Area Identification
- 1-035 (A2) - Location Coding System
- 1-037 (A1) - Computer Aided Design Data

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- 1-041 (A1) – Provision of Engineering Asset Information

Relevant NR asset information related standards in the Baseline include:

- NR/L2/AIF/001 – Asset Data Management
- NR/L3/AIF/002 – Changing reference data in asset registers
- NR/L3/AIF/003 – Asset data management for Ellipse and GEOGIS
- NR/L3/AIF/005 – Management of Asset Data and Information in the Rail Vehicle Asset Register for Ellipse and GEOGIS
- NR/L3/MTC/089 - Asset Management Plan
- NR/L2/MTC/02020 - Ellipse for Network Rail Work Management

Additionally, asset class, asset attribute and other core asset information requirements which are not detailed in specific Infrastructure Manager Standards shall be specified and recorded consistently with the latest requirements of the relevant Infrastructure Manager.

Any deviation from relevant standards will be by agreement with the relevant Infrastructure Manager.

LU Standard 1-035 “Location Coding System” permits the allocation of LCS Level 1 Codes to (i) stations, (ii) the sections of railway between stations, and (iii) depots only. LU has formally issued LCS Level 1 Codes to Crossrail on this basis. Crossrail have also assigned codes to shafts, portals, and other structures that are offset from the railway. LU does not recognise these codes as LCS Level 1 Codes, however LU has no objection to the codes being used.

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9 Asset Information Acquisition

For different Asset Information types, business processes have been developed to populate and manage asset information. Different asset information types may require different levels of management in order to ensure that the required information is specified, provided and meets overall requirements.

9.1 Asset Inventory Information

Figure 2, below, provides an overview of the main generic process being adopted by CRL and its supply chain for the provision of asset inventory information.

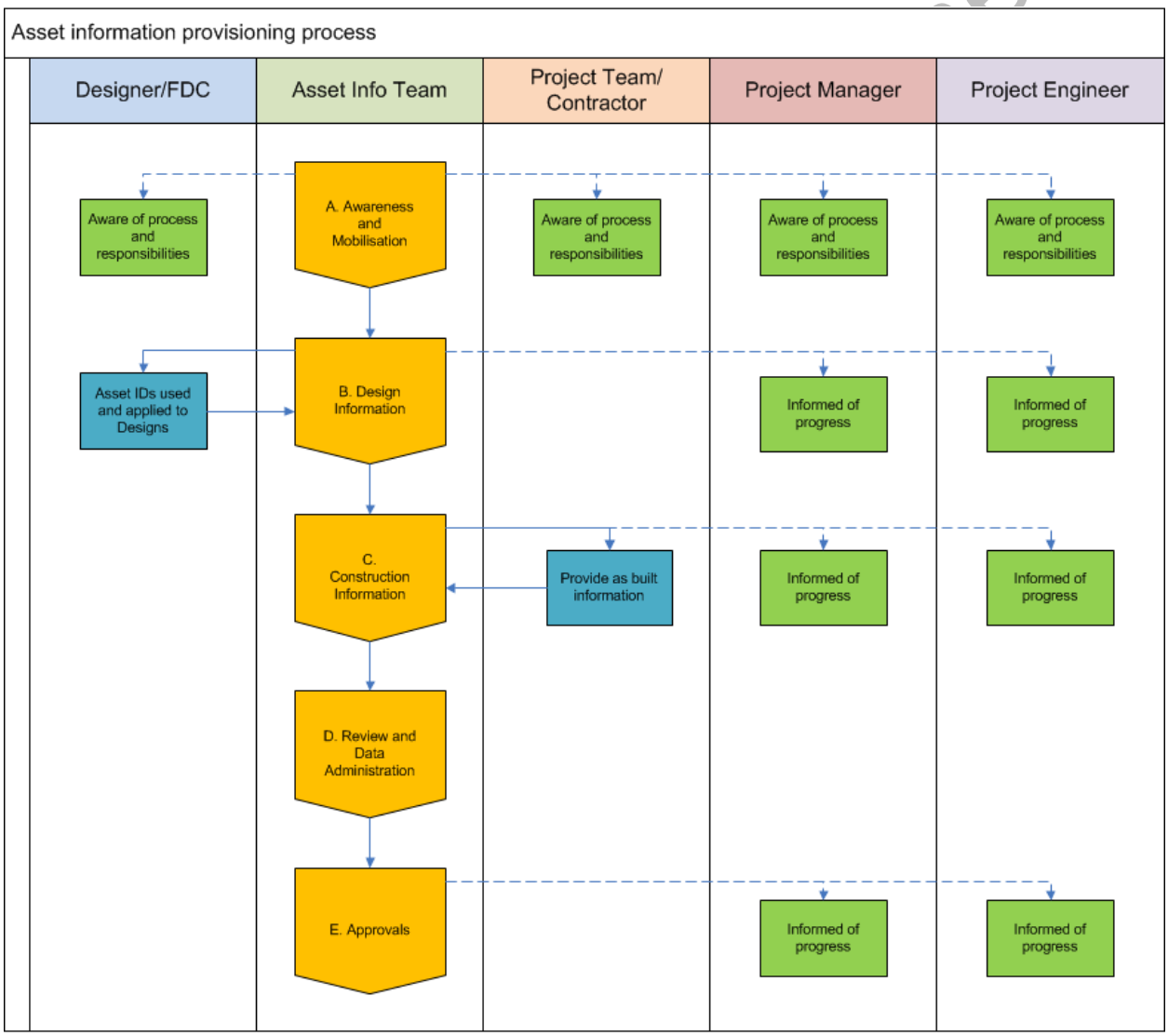

Figure 2 - Generic high level process

A number of more detailed processes have been developed to support individual activities, however, for simplicity; they are not replicated in this document.

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Business processes may change over the life of the programme in order to maintain the effective provision of asset information. The processes to be adopted will be reviewed and agreed by the AIGG, where necessary.

9.2 Data quality checking processes

At different parts in the business processes and on a periodic audit basis data quality checks will be undertaken. These checks will include:

- Data completeness, validity and desktop accuracy checks
- Data consistency checks
- Physical asset accuracy checks

The results of data quality checks will be communicated at Asset Information Governance Group meetings. This will allow any required corrective action to be agreed and monitored. The nature and frequency of data quality checks will evolve over the life of the programme as capability to analyse data increases and the nature and quantity of actual data quality problems becomes known.

10 Data Storage

Crossrail uses a number of software systems supplied by Bentley and other suppliers to specify, acquire and manage Asset Information:

- Bentley eB – Document management, asset inventory (AIMS Asset Information Management System), Configuration management
- Bentley ProjectWise – Design creation and management
- Oracle Spatial/ Geo Web Publisher– Geospatial data

For more information on the approaches being used to store Asset Inventory information in AIMS, please see the Asset Information Fundamentals document (CRL1-XRL-Z3-GPD-CR001-50007).

Where necessary data storage approaches will support the current and future needs for utilisation of the information, for example, the use of Master Data Management to link different data sets relating to a particular asset.

11 Asset Information Transfer

The provision of all asset information (including all asset registers, models, designs, drawings, certificates, documents etc.) into suitably configured systems is a key part of the overall process to hand over the new railway to the agreed Infrastructure Manager(s) to allow them to operate and manage the railway effectively.

These requirements are in addition to on-going activities to hand over information relating to Interface Works which is currently being enabled through the London Underground Mandatory Asset Information Deliverables (MAID) process and Asset Data Management Framework (ADMF) templates as part of the wider TfL Pathway/PMF framework. Opportunities to improve the efficiency and effectiveness of these activities are being explored.

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11.1 Requirements

In the sections below the MoSCoW Method has been used to prioritise requirements:

- Must – A requirement that must be satisfied by the solution
- Should – A high priority requirement that should be included in the solution, if possible
- Could – A requirement that is desirable but not necessary
- Won't – A requirement that will not be implemented, but may be considered in future

11.1.1 Business requirements

1. Data must be available to Infrastructure Managers in compatible data structures by the time Stage 3 Trial Running/Trial Operations commences, which is Quarter 1 2018 at the time of production of this document
2. Infrastructure Managers must have suitable systems and enablers in place to accept transferred data and allow its utilisation in Trial Running/Trial Operations activities
3. Must allow on-going population of asset data by Crossrail until Handover is completed and all asset information supplied
4. Must allow on-going population of 2D design data by Crossrail
5. Should allow on-going population of 3D design data by Crossrail
6. Must fit into Crossrail's overall timescales i.e. to be ready to support testing and trial operations by January 2018
7. Must not introduce constraints between organisations, such as an application upgrade in one organisation adversely impacting another
8. Must not increase delivery risk for any party
9. Must avoid the same data existing in more than one place, e.g. a drawing of an LUL station containing RfL assets potentially being stored and updated by both organisations
10. Must align with strategies and approaches being adopted by TfL/RfL/London Underground
11. Must not constrain future TfL operating models by artificially creating data silos based upon current organisational configurations
12. The data transfer process must not reduce the 'richness' of the data collected by Crossrail – Infrastructure Managers will accept the data that they can process ignoring data that they cannot process
13. Must allow both data objects and the links between those data objects to be transferred
14. Should allow changes to data classifications and standards to be quickly and effectively propagated
15. Should utilise a pilot of an existing TfL business area, e.g. East London Line to remove implementation/configuration issues
16. Changes to systems or configuration in one organisation should not adversely impact other organisations

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17. Should allow two way transfer of information e.g. asset data to IMs plus fault data back to Crossrail (this capability may be required for some time after handover)
18. Should have minimal impact on Crossrail's supply chain either from a technology or a process/understanding perspective
19. Could allow transfer/interoperability of other data types in future
20. Could provide a framework that can be utilised by other rail and infrastructure organisations
21. Won't require instant/'real time' alignment of data

11.1.2 Technology solution requirements

22. Must use tried and trusted technologies and standards available as standard commercial services
23. Must provide suitable control and security over the data that is published to minimise the risk of inappropriate or unapproved access
24. Should require no custom application coding
25. Should align with Crossrail's Master Data Management (MDM) solution
26. Must have providers able to provide solution support
27. Should have a clear solution development 'road map'

11.2 Enabling activities

In order to support the proposed handover approach, a number of activities have been put in place across different parts of TfL in order to ensure that the required asset information is available to the required parties in order to support the construction, testing, handover and operation of Crossrail. Key parties involved include:

- CRL IT
- TfL Information Management (IM)
- LU Information Management (IM)
- RfL

Activities include:

- Assessing and ensuring alignment of Information Systems/Management strategies across different organisations;
- Developing views of possible 'end states' in order to help visualise the 'To Be' state;
- Timelines and system availability– In order to ensure that relevant systems are available for use to support trial running of Crossrail in Q1 2018, IMs need to ensure that the required systems are available, implemented and are licensed to include Crossrail data;
- Implementation approaches – Consideration to reduce the risk of implementation problems, possibly through early adoption of proposed systems and approaches by other parts of RfL;
- Target system configuration stability – In order to prevent avoidable problems on data handover, there cannot be uncontrolled configuration changes taking place in target systems. This could include changes to asset classes, metadata, workflow, permissions etc. There clearly will be requirements to undertake changes in configuration whilst this

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Plan is in use – it is essential that such changes are discussed and agreed with relevant parties before any changes take place as part of on-going governance processes; and

- Governance - Whilst the AIGG will provide Governance over the acquisition of asset information and onward data transfer to IMs, there will be other governance groups whose responsibilities overlap with those of the AIGG. It is important that suitable links are established between different governance/steering groups to support the successful handover of Crossrail Asset Information

The Asset Information Governance Group will maintain awareness of these enabling activities and will instigate corrective action, if required.

11.3 Implementation programme

It is important to ensure that the overall process of asset information handover successfully enables all required asset information to be available in advance to support both trial running (currently expected to start in Q1 2018) and substantial completion. In order to achieve this, CRL, RfL and LU need to ensure that IM strategies, transformation plans and business activities support reaching this objective. This may involve creation of specific plans or adjustment of existing plans.

This section provides an overview of Crossrail's intended approach to enabling asset information handover. Ongoing monitoring will be utilised to ensure that Crossrail activities align with relevant ones being undertaken by the IMs.

A structured implementation programme will be required to ensure that all the required enablers to support the initial (and ongoing) running of Crossrail are available to Infrastructure Managers. The Digital Railway enabling project will help identify and address key factors, such as:

- Timescales and dependencies
- Technical architecture
- Procurement and Implementation activities
- Governance
- Stakeholders
- Anticipated costs
- Funding arrangements

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11.4 Overall indicative technical architecture

Figure 3, below, provides a simplified illustration of an indicative technical architecture which would support the 'Digital Railway (N.B. The final solution that is implemented may differ from this conceptual diagram).

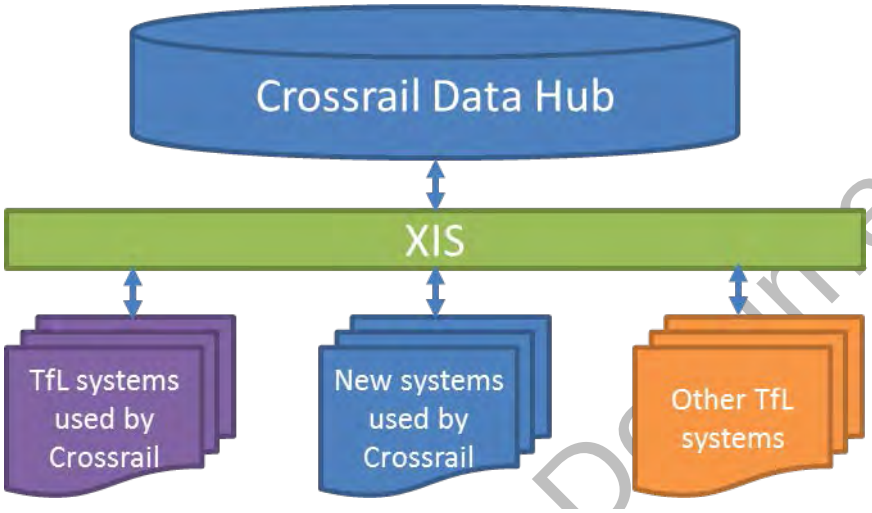

Figure 3 - Illustration of possible Digital Railway architecture

Key components of the architecture are:

- Crossrail Data Hub – Single logical store of Crossrail master/reference data that will support TfL requirements for asset information and will act as a 'single source of the truth';
- XIS (Extensible Integration Service) – TfL Data Integration solution that will be used to enable key systems to share data in an efficient and effective manner;
- TfL systems used by Crossrail – For a number of business needs, there are existing TfL business solutions that could be adopted by Crossrail. These may require configuration changes in order to be suitable for use by IMs operating and maintaining Crossrail;
- New systems used by Crossrail – Where existing systems do not exist, or are not suitable for use by Crossrail, then new systems will need to be specified and procured. This may include systems currently utilised by Network Rail which may need to be used by IMs operating and maintaining Crossrail; and
- Other TfL systems – Where existing TfL systems/processes may need access to Crossrail information and vice versa.

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11.5 Solution options

There are three basic options that apply when considering how to make Crossrail Asset Information in specific systems available to support ongoing operation and maintenance of Crossrail:

	Option	Observations
1.	Transfer ownership of the existing Crossrail system to the relevant Infrastructure Manager	• Relevant when the Infrastructure Manager does not have a suitable system for this data or wishes to implement the Crossrail system • The software system may remain on its current hardware and the only change would be security/access permissions • There may need to be consideration of how to split usage of the system if it is applicable to more than one Infrastructure Manager
2.	Crossrail system is maintained as a 'live' system with relevant data transferred to the relevant Infrastructure Manager system(s) on an on-going basis	• Relevant when the Infrastructure Manager has relevant software system to provide required business functionality, but may store data at a lower level of 'richness' than Crossrail Ltd • On-going data transfer could utilise TfL XIS integration architecture • When/if the richness of data stored by the Infrastructure Manager is comparable to that utilised by Crossrail, then Option 3 may next be considered • Responsibility for maintaining the system, if it is required once Crossrail is handed over, will need to be agreed
3.	Transfer of asset information to new/existing Infrastructure Manager software and then possible decommissioning of Crossrail software	• Recognised data migration methodology, such as PDM v2[1], to be followed • Destination system must be capable of storing the extent and 'richness' of Crossrail data • If the data will not be required by Crossrail/TfL as a record of project activities, then the system can be considered for deletion

These different solution options should be assessed on a case by case basis for each asset information type, and possibly also by asset type, in order to ensure that the most suitable approach is identified and agreed.

[1] Practical Data Migration Version 2 by Johny Morris - ISBN: 9781906124847

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For Options 2 and 3 it is suggested that an information model is developed that maps Crossrail asset information to Infrastructure Managers approach to asset information. Suitable governance and change control will be required in order to ensure that uncontrolled changes by any party do not lead to information transfer problems.

Consideration will be given to establishing a pan-TfL group to promote and support the development of a common data hub for TfL.

11.6 Technical solution options

Depending on which of the three Solution Options detailed in Section 11.5 is relevant to a particular data type, then a different technical solution will be required. The generic approaches are illustrated below.

11.6.1 Option 1 – System transfer

This option is probably the simplest technical option – initially, if CRL provides access to the IM for the required system, then they should be able to access the system as required. In time, then the relevant software and/or hardware may be transferred to a different location.

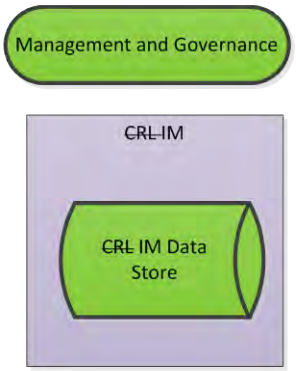

Figure 4- Illustration of system transfer

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11.6.2 Option 2 – Data transfer

Figure 5, below, illustrates a possible technical solution that is applicable where it is not appropriate to transfer an entire system or all data to the IM. This solution is particularly relevant where the level of 'richness' of data that can be stored and utilised by the IM is less than the level available from Crossrail.

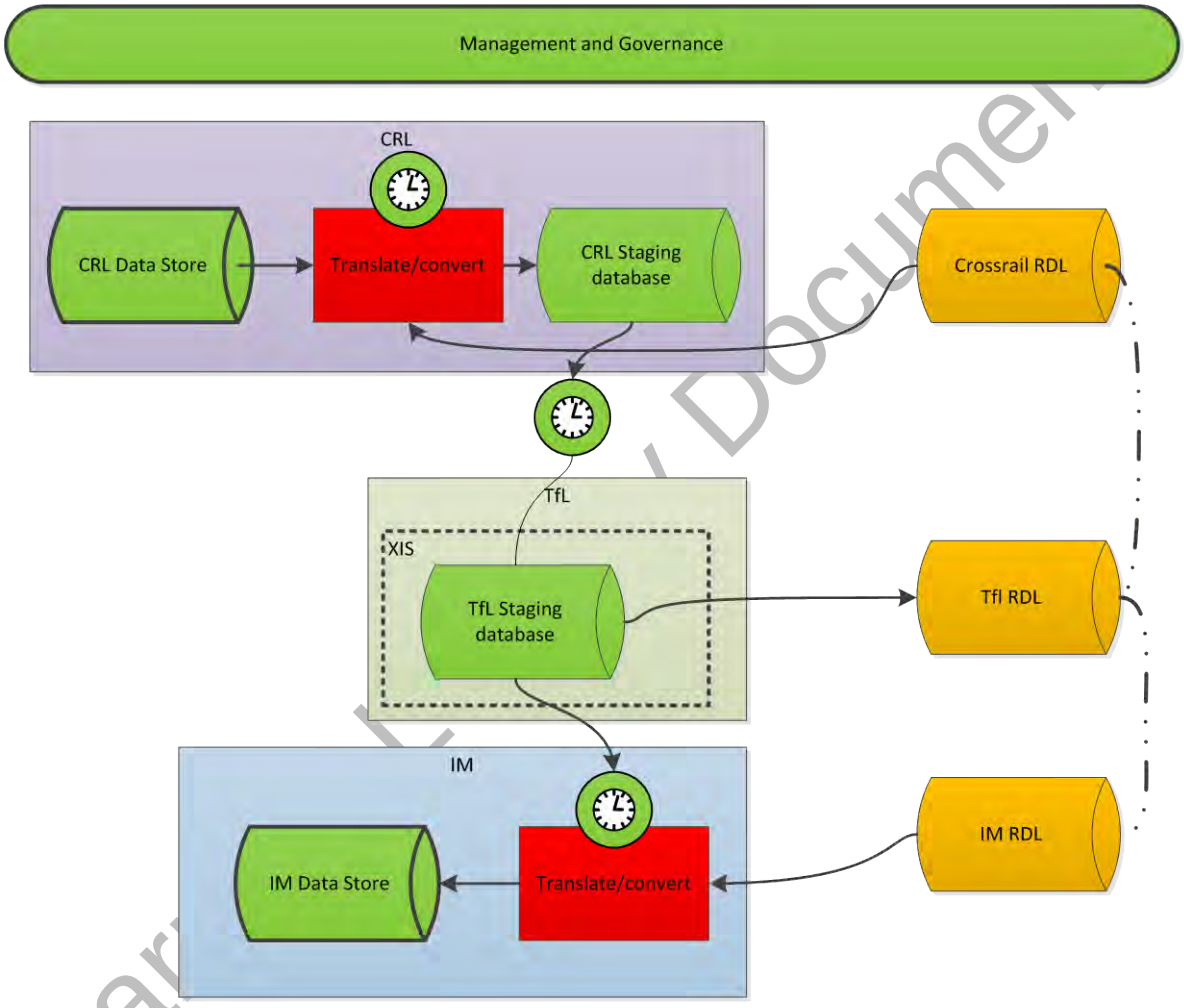

Figure 5 - Possible architecture of data transfer solution

It is proposed that this solution would utilise the TfL XIS Integration solution currently being developed and deployed. This approach would need to include a 'staging' database in CRL to ensure that the data transfer to TfL can operate as a data copy with no translation or manipulation of data. This transferred data would be stored in a TfL staging database as part of XIS to allow receiving systems to extract the data they require at the optimum time, which could be 'on demand', nightly or weekly.

To support this approach a linked Reference Data Library would need to be created in order to store the mappings of data entities in one organisation to another. See Section 11.8 for more information.

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This approach would mean that the data held by the IM may be a day behind the data held by Crossrail; however, due to the low volatility of this data, it is not expected to lead to any system or operational issues. Responsibility for ongoing operation and maintenance of this infrastructure would need to be agreed.

11.6.3 Option 3 – Data migration

If an IM system already exists that can store all the data to be transferred from Crossrail, then it is proposed that a data migration approach is adopted. If the source system, on completion of data migration, no longer contains data that is required for ongoing usage, then the system should be considered for decommissioning and removal.

It is proposed that a recognised data migration methodology, such as PDM v2, is utilised in order to minimise the risk of a failed data migration. The PDM methodology is based upon a business led approach supported by technical tools and that data migration should not be treated as an 'IT project'.

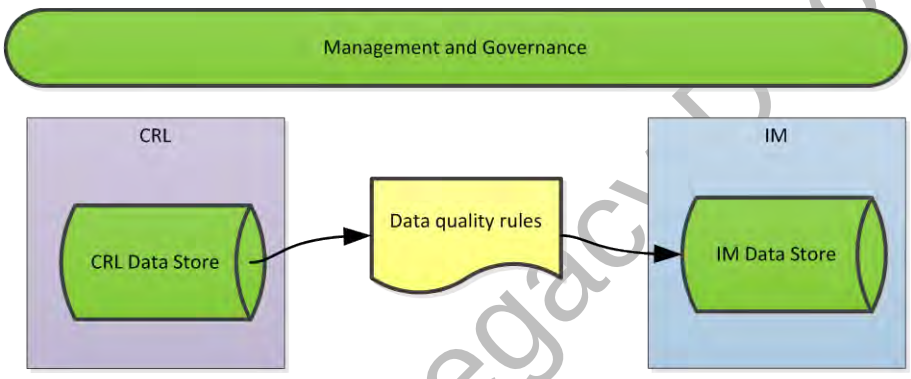

Figure 6 - Data migration solution

A key aspect of the PDM methodology is the agreement of data quality rules – business led definitions of how data should be assessed and migrated to destination systems. As these rules are developed they should be tested against the data to be migrated – any unexpected results or errors will indicate the need for new/changed data quality rules, which should then be tested.

11.7 Potential data transfer methodologies

A number of different potential approaches to the transfer of asset data are available and it is recognised that the different technologies and services available are developing rapidly; therefore the actual solution implemented may not exist at the time of writing this document. Additionally, since it does not appear likely that one option will be applicable to all types of asset information and all asset types, a range of options is likely to be utilised. Possible options include:

- ISO 16739 Industry Foundation Classes – Designed to transfer geometry data particularly for building structures and services
- COBie (Construction Operations Building Information Exchange) – UK Government specified approach that supports transfer of building related data, but does not natively

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separate asset duty from the equipment fulfilling that duty – a common rail/infrastructure required

- ISO 15926 – Engineering data exchange standard supported by a shared Reference Data Library. Different applications of the standard exist, however, in general these are not 'mission ready' and supported solutions for business application
- Data migration tools – A number of purpose built data migration tools are available that could be utilised as part of an overall, business led data migration methodology
- Direct integration approach – Utilisation of specific data integration tools that could either combine data from more than one Crossrail data source for use by an IM system or combine data from more than one TfL data source (which could include Crossrail data stores) and present to information users as a single integrated list of data. The developing TfL XIS System provides such a service

11.8 Information model

In order to support successful transfer of asset information to the Infrastructure Managers it is important that sufficient information modelling is undertaken in order to map the Crossrail information model to the IMs information models. This should support a number of activities, not least the data transfer and data migration approaches.

It should be recognised that the work to develop a suitable information model will take significant time and will involve a number of key people across each organisation. Input will be needed to clarify and define the business meaning of information, the rules that apply to it, the state of existing data etc. and then compare these to the same information in the receiving organisations. The process should be led by an experienced information modeller.

It is essential that suitable governance is in place to ensure that uncontrolled changes to the information models of one party do not result in abortive work or problems for another party. This will require individuals in certain roles in the IMs to operate in a more controlled manner than they have typically been using.

11.9 Contingency

There is a low risk that all the required activities to support Asset Information Handover will not be completed in time for handover of Crossrail. The activities detailed in the Sections above should help to mitigate this risk. However, if this situation were to arise, then the most pragmatic contingency approach would be to retain the systems and data stores used by Crossrail and provide access to the relevant IM staff.

This would allow information to be shared with the relevant Infrastructure Managers using the TfL Pathway/PMF, however, there are likely to be a number of disadvantages if such a contingency position had to be adopted:

- Multiple systems required to manage work activities, for example, work planning and scheduling would have to be undertaken in more than one system reducing efficiency and reducing opportunities to maximise staff utilisation;
- Data duplication – Some information on assets may appear in information for more than one IM leading to data duplication e.g. RfL Switchgear in an LUL Switchroom

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- Performance management – different systems and configurations would make it difficult to compare performance across asset areas and teams as differences in the granularity of data may affect performance measures;
- Difficulty finding information – searches for documents and data may need to be undertaken in more than one system leading to a risk that staff look in only one place and do not find the required information;
- Compatibility – data may be stored in different formats leading to increased effort to undertake analysis across business areas; and
- Different process and configuration – the configuration of key systems, such as CAD and Document Management will be different which would mean that existing IM revision/update/approval processes would need to be changed to allow for the different system configurations.

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12 Responsibilities

To ensure that the overall processes for the provision and management of asset information operate effectively and efficiently and in particular to meet the objectives of this Management Plan, there are a number of key responsibilities for different stakeholders. These asset information related responsibilities are summarised as follows:

- CRL Head of Technical Information – Chair of Asset Information Governance Group, responsible for escalating significant issues to executive Sponsor;
- CRL Asset Information and Configuration Manager – Responsibility for the overall management, provision, specification and usage of asset information. Ensures effective use of configuration management by Crossrail;
- CRL CAD Manager – Responsible for the configuration, operation and effective utilisation of Crossrail CAD systems and design information;
- CRL Document and Data Manager – Responsible for the configuration, operation and effective utilisation of Crossrail Document Management System (eB) and document based information;
- CRL GIS Manager – Responsible for the configuration, operation and effective utilisation of geospatial based information provided to and utilised by Crossrail;
- Asset Information & Configuration Management Team – Led by the Asset Information & Configuration Manager and incorporating the Asset Information Provision Team (Managed by Asset Information Provision Manager), the Configuration Management Team (Managed by Asset Information Systems Analyst) and Technical Data Analysts;
- CRL Asset Information Provision Manager – The person within CRL who has responsibility for the provision of asset information. The CRL Asset Information Provision Manager role will include acting as the Secretary of Asset Information Governance Group, overall monitoring of asset information processes, technical approver of relevant changes;
- Asset Information Provision Team – Provision of information in to AIMS and eB, co-ordination of overall asset information provision processes, creation of AIMS Extracts for Contractors, import into AIMS of populated AIMS Extracts, overall coordination and standardisation role. This team includes the roles Asset Information Provision Manager who oversees the Asset Data Technician(s), Asset Information Modeller(s) and Asset Information Co-ordinator;
- Configuration Management Team – Control of information in to AIMS and eB, co-ordination of overall configuration management processes and day to day development and operations of AIMS to support the Asset Information Provision Team. This team includes the roles Asset Information Systems Analyst who oversees the Configuration Management Co-ordinator;
- CRL Delivery Central Team – Monitoring overall provision of asset information and addressing generic issues and approaches;
- CRL Site Team – Validation of asset information provided by Contractors, physical asset accuracy checking;

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- CRL IT – System enablers for asset information collection and transfer;
- Contractors – Responsible for receiving, storing and populating AIMS Extracts with accurate and timely asset information;
- Asset Information Governance Group (AIGG) – Group with overall responsibility for the provision and management of asset information; and
- Infrastructure Managers – The Infrastructure Managers are responsible for :
    - Facilitation of the 'receiving' activities in the handover process
    - Provide necessary resources to support the CRL process (if necessary, funding to provide these resources will be agreed with CRL)
    - Agree, through the AIGG, the asset information required at each lifecycle stage of the programme to achieve handover goals.
- Industry Partners – The Industry Partners have a communication and consultation role only and do not have specific responsibilities unless they are also an Infrastructure Manager.

The relationship between these roles is illustrated in Figure 7 below:

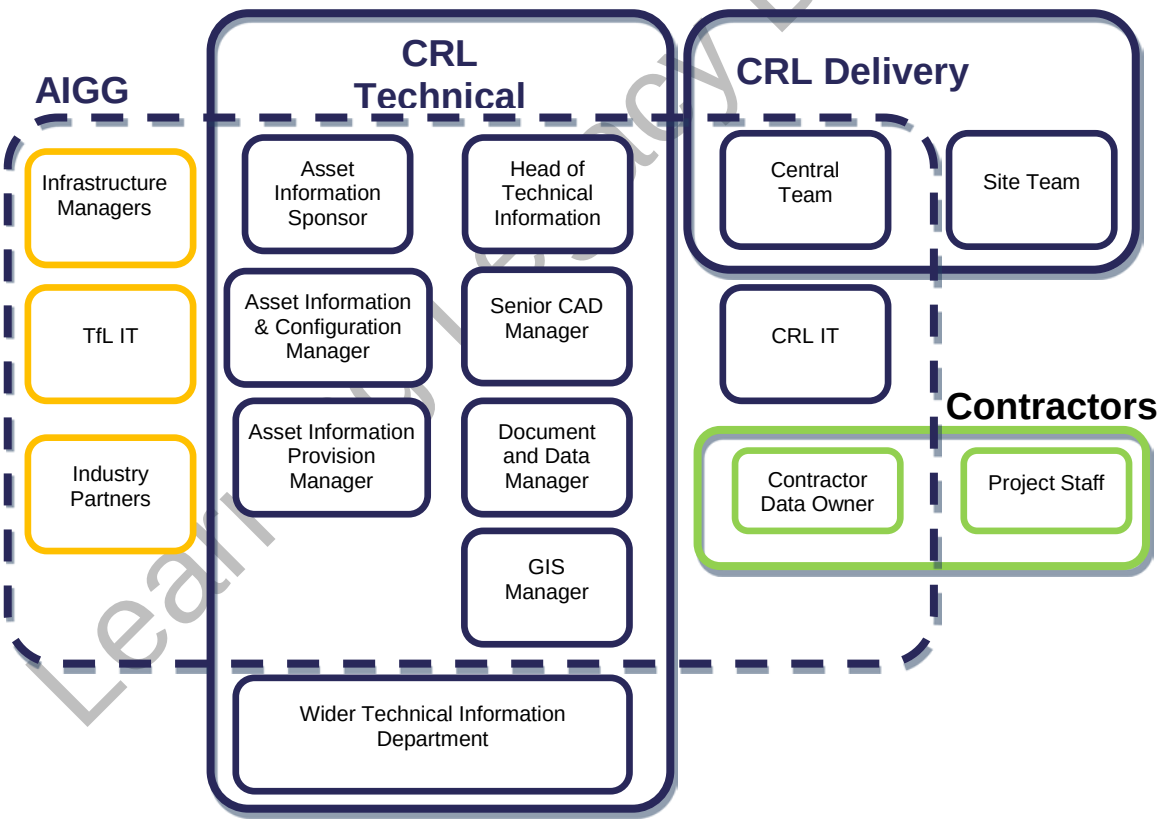

Figure 7 - Asset information responsibilities

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