Coal Pensions – ARM Headquarters

Kier Construction Eastern, Exemplar BIM Project

Presentation Agenda

- Introduction to ARM and Project Overview
- Client BIM Objectives and Aspirations
- Project BIM Scope
- Project BIM Set Up
- Case Studies, Examples and Lessons Learnt
- Conclusion

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ARM

“ A Press release ”

In a loose collection of offices on an underwhelming business park outside of Cambridge sits Britain’s most successful technology company, ARM. You’ve probably never heard of it, but ARM’s designs are at the heart of the iPhone and nearly every other modern smartphone. It has fingers in almost every other area of technology, from fitness trackers to server farms. It records profit margins that analysts have described as “impossible” (in a good way), and goes a long way to helping justify the “Silicon Fen” label sometimes applied to Cambridge’s tech scene.

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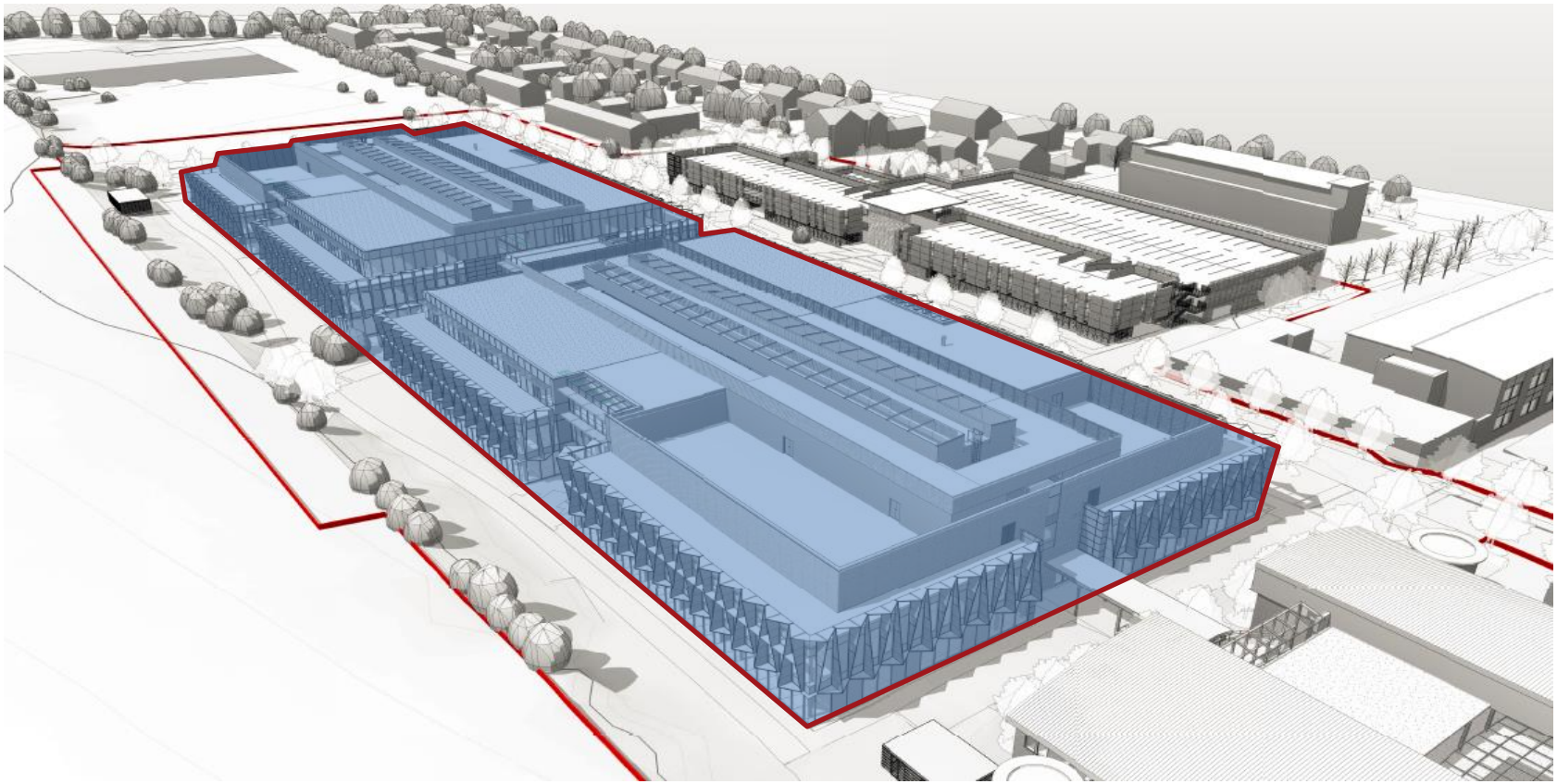
Project Overview

The ARM Peterhouse Technology Park Expansion Project involves the construction of a new 19,000 m/2 office facility and two multi storey car parks including associated earth works and infrastructure works.



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Overview of Construction Scope

North Deck Car Park
- 501 Spaces
- System superstructure solution with bespoke cladding system including Petrarch Panels and climbing plants. Will also incorporate public art scheme.
- Phased build and occupation
- Two new substations within

Externals
- Hard and soft landscaping
- Sustainable drainage infrastructure
- Various stats connections

East Deck Car Park
- 268 Spaces
- System superstructure solution with bespoke cladding system including Petrarch Panels and climbing plants
- Complex substructure of retaining walls and overbuild of existing sub station

ARM A and B Buildings – Structure & Envelope
- 2No 3 storey Office Blocks linked by double height reception block – Total NIA 17,500m2
- Steel Frame on pad foundations
- Insitu RC upper floors and ground bearing groundfloor
- Roofs – part RC and Part lightweight
- Flat roofs finish including Brown zones
- Curtain wall facades of varying designs including architectural fins which also provide solar shading

ARM A and B Buildings – Internal
- Central atrium with open plan floors for future fit out
- Structural glazed balustrades and feature staircases
- Feature timber walls and ceiling
- Fitted out toilet cores and finishes to central areas
- Primary services infrastructure including lifts, roof plant of chillers and AHUs, FCUs to condition air to reception and atrium

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Design – Key Capabilities & Designers

Our client team is :-

Coal Pensions Properties Limited
LaSalle Investment Management
Bidwells
Aecom

Consultants

- Architect – Scott Brownrigg
- Civil & Structure – Ramboll
- M&E - Hoare Lea
- Landscape – Liz Lake

Subcontractors with Design Input

- Façade – McMullen
- Steel Frame – Caunton
- M&E – Integral
- Upper Floors – SMD
- Decked Car Parks – Bourne/ Huber
- Feature Stairs – Taunton
- Flat and Brown Roofs - Avonside

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How was BIM utilised?

Client BIM Objectives and Goals

Pre Contract BIM Execution Plan

Primary Objectives	Description / Potential BIM Uses
3D Coordination	Design team to link respective models throughout the design and potentially the construction process.
Visualisation	Aid Design Team in showing the proposals in three dimensions.
Site Analysis	Using the Revit model to show the challenges of existing levels and the proposed building platforms.

NBS Clause

Finishes

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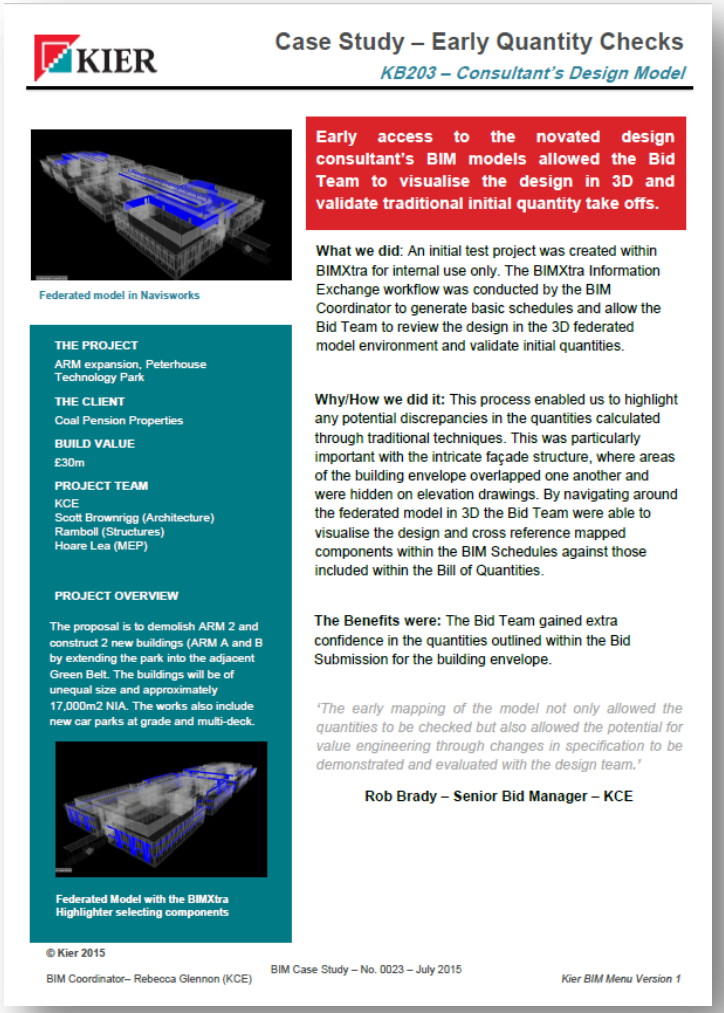
Early Quantity Checks

Consultant's Design Models

- An initial test project was created within BIMXtra for internal use only to generate schedules and review the design in the 3D environment for **validation of initial quantities**.
- **Highlighting Potential discrepancies** in the quantities calculated through traditional techniques for the intricate façade structure.
- The Bid Team **gained extra confidence in the quantities** outlined within the bid submission for the building envelope.



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Case Study – Early Quantity Checks

KB203 – Consultant's Design Model

Federated model in Navisworks

Early access to the novated design consultant's BIM models allowed the Bid Team to visualise the design in 3D and validate traditional initial quantity take offs.

What we did: An initial test project was created within BIMXtra for internal use only. The BIMXtra Information Exchange workflow was conducted by the BIM Coordinator to generate basic schedules and allow the Bid Team to review the design in the 3D federated model environment and validate initial quantities.

Why/How we did it: This process enabled us to highlight any potential discrepancies in the quantities calculated through traditional techniques. This was particularly important with the intricate façade structure, where areas of the building envelope overlapped one another and were hidden on elevation drawings. By navigating around the federated model in 3D the Bid Team were able to visualise the design and cross reference mapped components within the BIM Schedules against those included within the Bill of Quantities.

The Benefits were: The Bid Team gained extra confidence in the quantities outlined within the Bid Submission for the building envelope.

'The early mapping of the model not only allowed the quantities to be checked but also allowed the potential for value engineering through changes in specification to be demonstrated and evaluated with the design team.'

Rob Brady – Senior Bid Manager – KCE

THE PROJECT
ARM expansion, Peterhouse Technology Park

THE CLIENT
Coal Pension Properties

BUILD VALUE
£30m

PROJECT TEAM
KCE
Scott Brownrigg (Architecture)
Ramboll (Structures)
Hoare Lea (MEP)

PROJECT OVERVIEW

The proposal is to demolish ARM 2 and construct 2 new buildings (ARM A and B by extending the park into the adjacent Green Belt. The buildings will be of unequal size and approximately 17,000m2 NIA. The works also include new car parks at grade and multi-deck.

Federated Model with the BIMXtra Highlighter selecting components

BIM Coordinator– Rebecca Glennon (KCE)

BIM Case Study – No. 0023 – July 2015

Kier BIM Menu Version 1

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Common Data Environment Solution

BIMXtra

projects®

- **BIMXtra identified as the CDE** for the project to facilitate Level 2 BIM maturity
- The BIMXtra Document Management module has been used to **manage shared and published model information**.
- Viewpoint for Projects has been used in conjunction with BIMXtra to **manage all other published information**.

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Project BIM Scope

Modelling Tools
(Authoring Tools)

AUTODESK REVIT

Trimble Tekla

Geometry

Data

View

AUTODESK NAVISWORKS

Insight

BIMXtra Highlighter

Linked

CAFM COBie

Schedules

Role Based Access

Mapping

Change Management

AIM

Document Management

Project Communication

Secure

BIMXtra

Project Controls

Mobile Application

Data Validation

Work Packaging

Model Federation

Procurement

4D - Time

5D - Cost

Programme .csv

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Internet Connection Is Key

Poor Internet Connectivity

- Works on site commenced July 2016.
- Adequate internet connection was not available until January 2017.
- Extremely Poor download speeds

Lessons Learnt

Common issue across the Construction Industry. Further investigation and innovation required to speed up on site connection provisions.

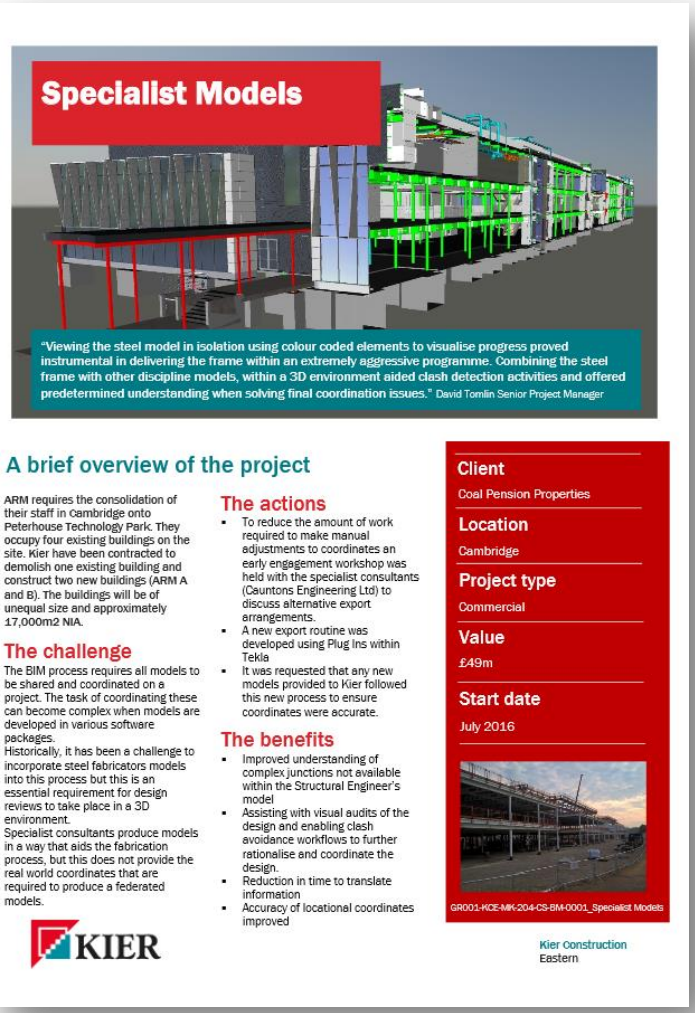
Specialist Modelling Tools

Tekla Structures Workflow

- Improved understanding of complex junctions not available within the Structural Engineer's model.
- Assisting with visual audits of design and enabling clash avoidance workflows to further rationalise and coordinate the design.
- Reduction in time to translate information.
- Accuracy of locational coordinates improved.

Lessons Learnt

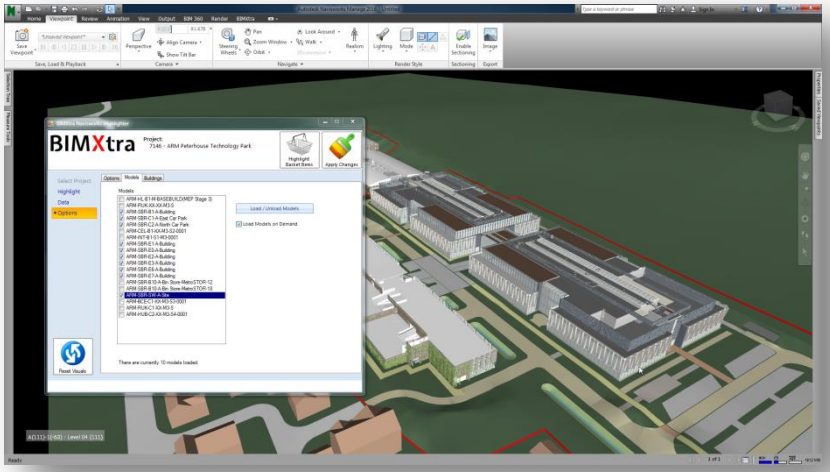
Early Subcontractor engagement required to incorporate into project BEP and undertake new workflow training and testing.



Model Viewing Tools

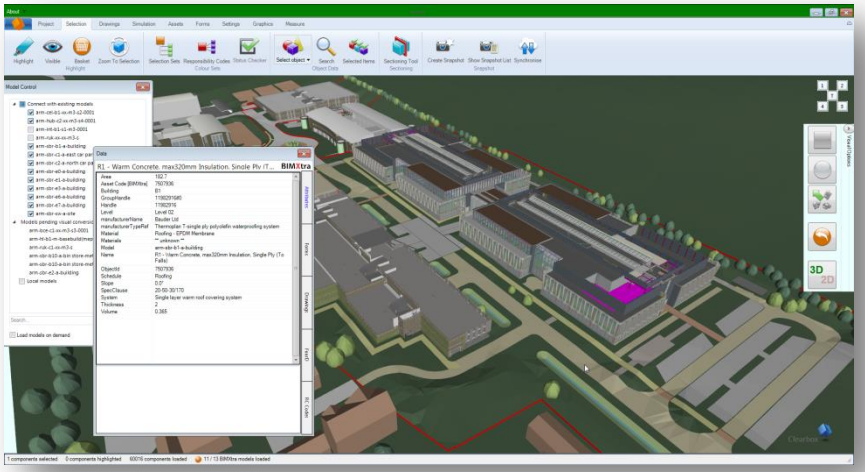
AUTODESK NAVISWORKS

BIMXtra Highlighter



- Highlight items by BIMXtra schedules or work packages in 3D only.
- Clash Detection/ Avoidance Workshops
- Design Coordination
- Quality Assurance

Insight



- Highlighting items by BIMXtra schedules or work packages in 3D and intelligent 2D Drawings.
- Field BIM Site Form Completion.
- Model & Site Audit
- Offline Mode

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Hardware Procurement

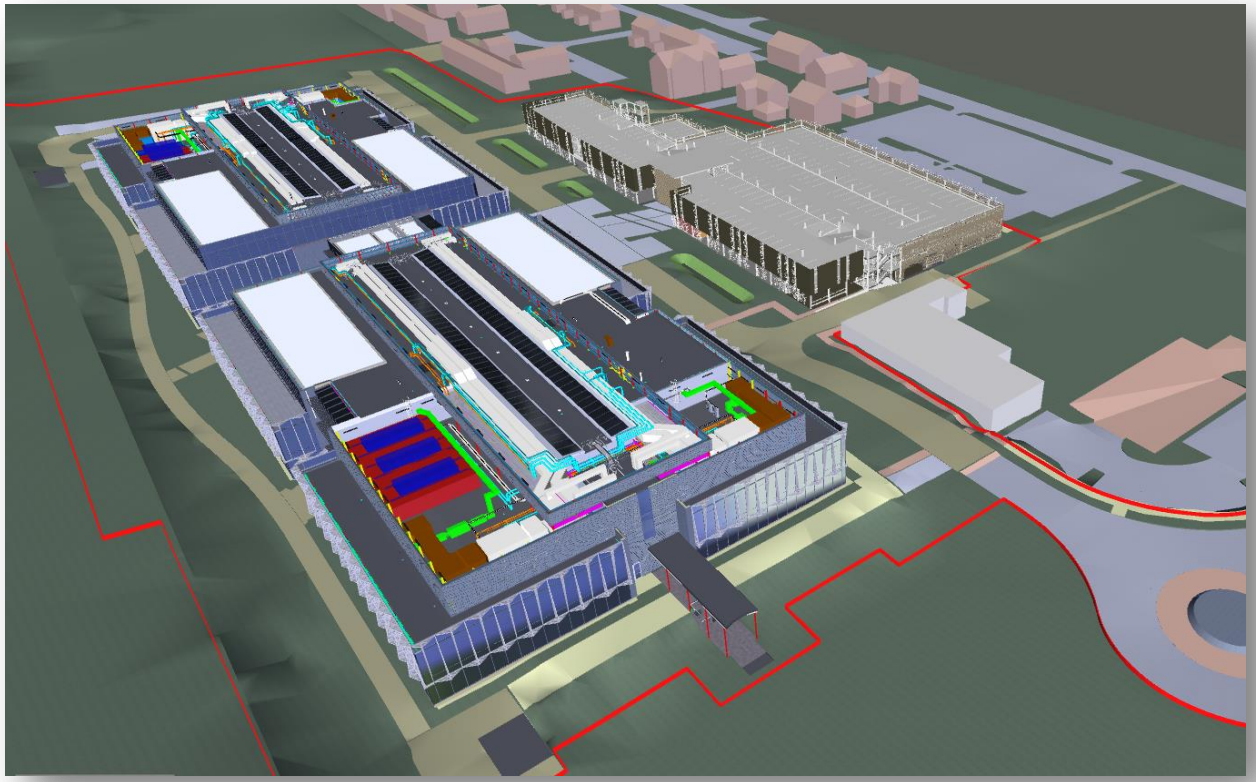
Clevertouch Plus Screen

- Viewing Drawings and annotating solutions
- Viewing models and annotating ideas
- Detailed Programme
- Method Statements
- Presenting progress reports in Client Meetings
- Convenience of writing minutes with attachments within the meetings.
- It is a very usable piece of equipment which is used by all on site daily.

Design Coordination

Communication of Requirements

- To illustrate scale of project – federated models Scott Brownrigg, Caunton, Integral, & Huber



Design Coordination

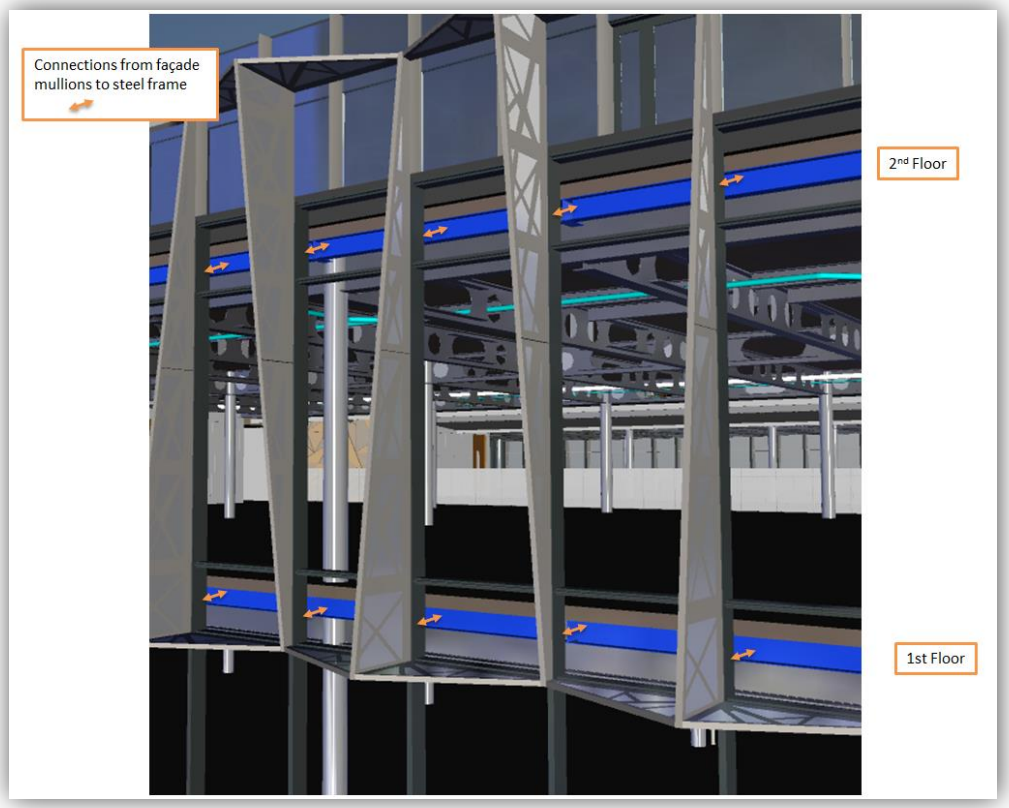
Communication of Requirements

- To illustrate façade fixing requirements to specialist fixings supplier

Message to specialist fixings supplier:

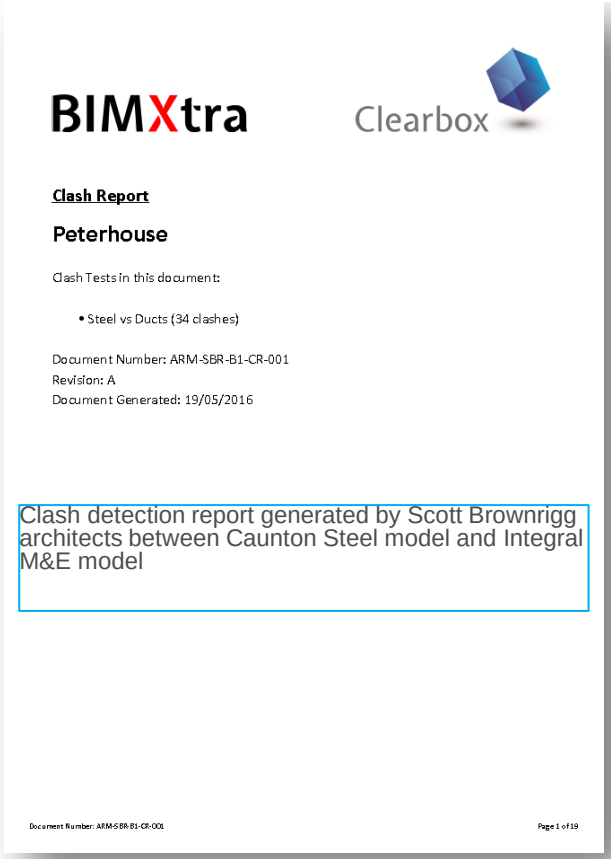
"The floor slab construction is as follows:

130mm thick RC floor on an R51 Structural Metal Deck
At 2nd floor level we need a slab edge fix solution.
At 1st floor we can do either a slab edge or top fix solution."



Design Coordination

Coordination of Services



BIMXtra Clearbox

Clash Report

Peterhouse

Clash Tests in this document:

- Steel vs Ducts (34 clashes)

Document Number: ARM-SBR-B1-CR-001
Revision: A
Document Generated: 19/05/2016

Clash detection report generated by Scott Brownrigg architects between Caunton Steel model and Integral M&E model

Document Number: ARM-SBR-B1-CR-001 Page 1 of 19

Peterhouse BIMXtra

Name	Clash1
Distance	-101.445mm
Status	New
Description	Hard
Point	549013262.54mm, 255955248.07mm, 29902.81mm

Item1

Layer	Undefined
Item Type	IcIFCRepresentationHolder
Item Name	Body

Item2

Handle	3148426
Layer	01-Level 1
Item Type	Solid
Item Name	Rectangular Duct

Name	Clash2
Distance	-94.114mm
Status	New
Description	Hard
Point	548871539.23mm, 255958570.65mm, 33726.60mm

Item1

Layer	Undefined
Item Type	IcOaExGeometry
Item Name	#291144

Item2

Handle	6741561
Layer	02-Level 2
Item Type	Solid
Item Name	Toilet Extract

Document Number: ARM-SBR-B1-CR-001 Page 3 of 19

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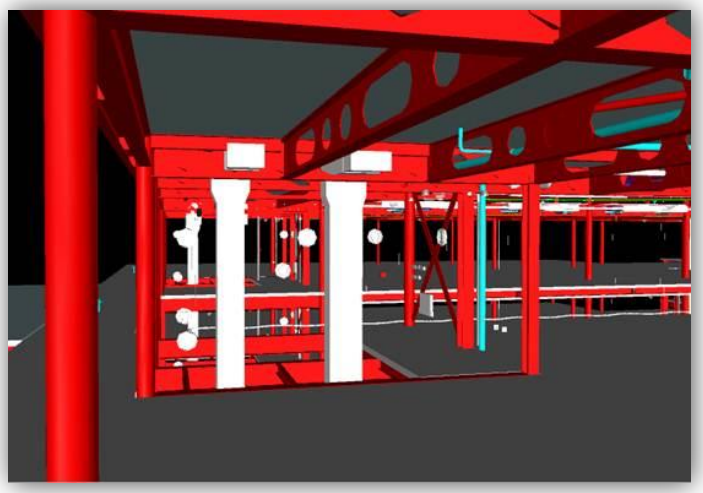
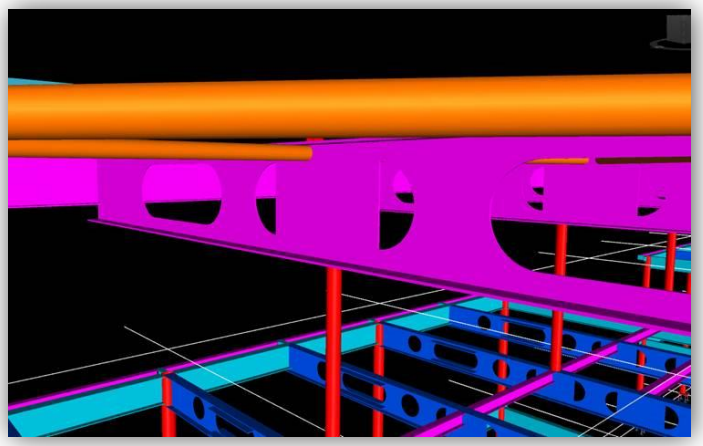
Design Coordination

Coordination of Services

- Model snapshot used in DTM to illustrate where a clash with steelwork and services had been picked up using clash detection to identify further service penetrations required
- Model snapshot used to confirm to ARM Fit Out Team that the bracing had been raised to provide full depth use of beam cut outs for the fit out services





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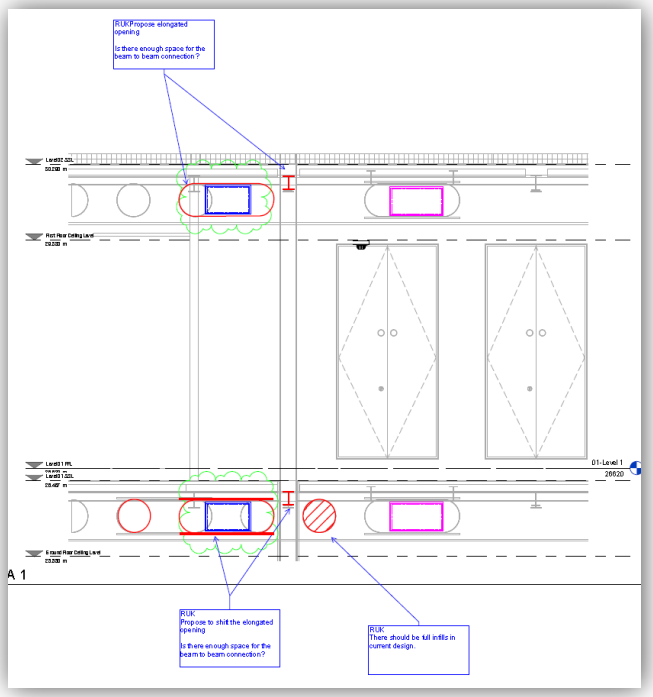
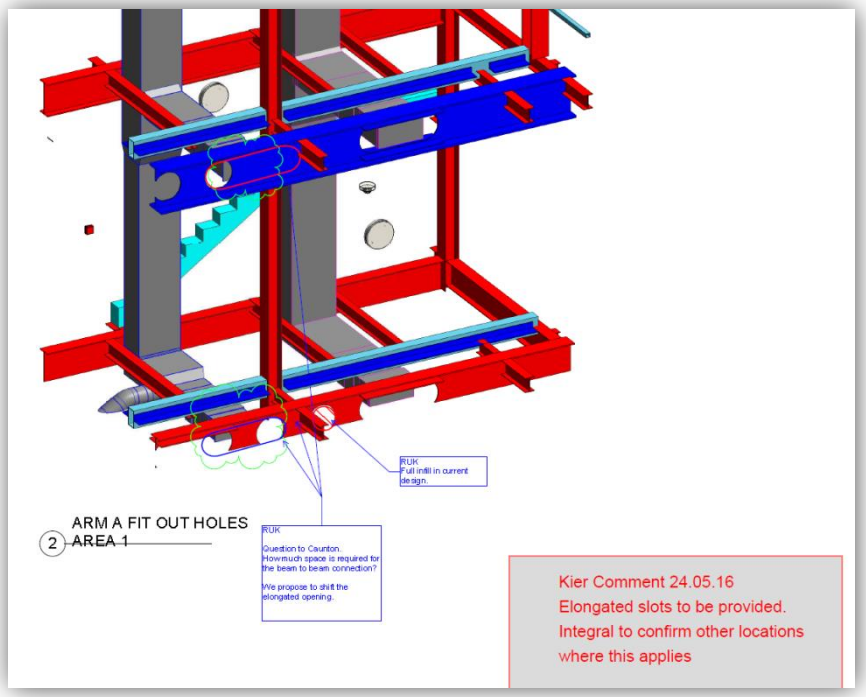
Design Coordination

Coordination of Services

- Model snapshot exchanged with multiple comments used to develop solutions for service penetrations through the steelwork.

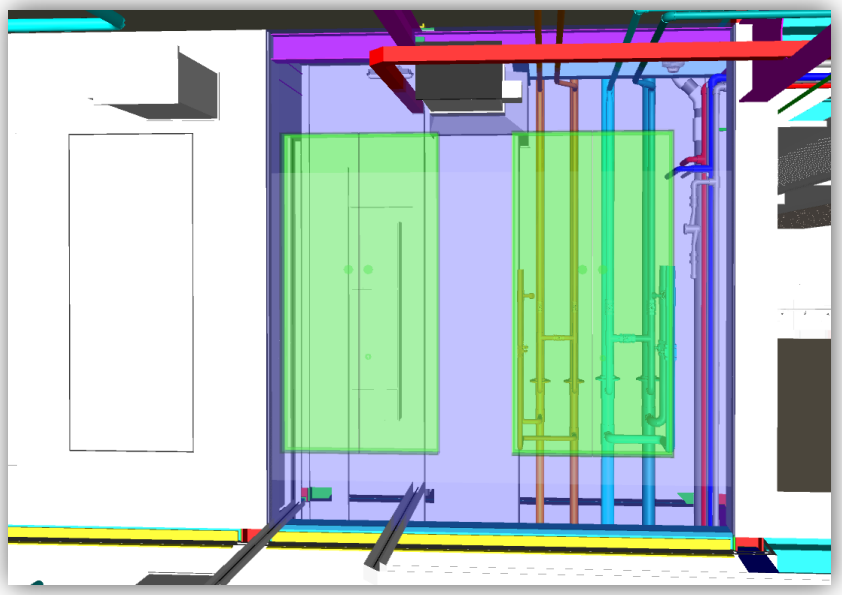




Design Coordination

Coordination of Services

- Model snapshot used in DTM to illustrate where there was clash with future tenant ductwork connection and base build cable trunking.
- Different elements can be colour coded and made transparent.
- Clash was not picked up by clash detection tool as no fit out ductwork in the federated model



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Management of Client Change

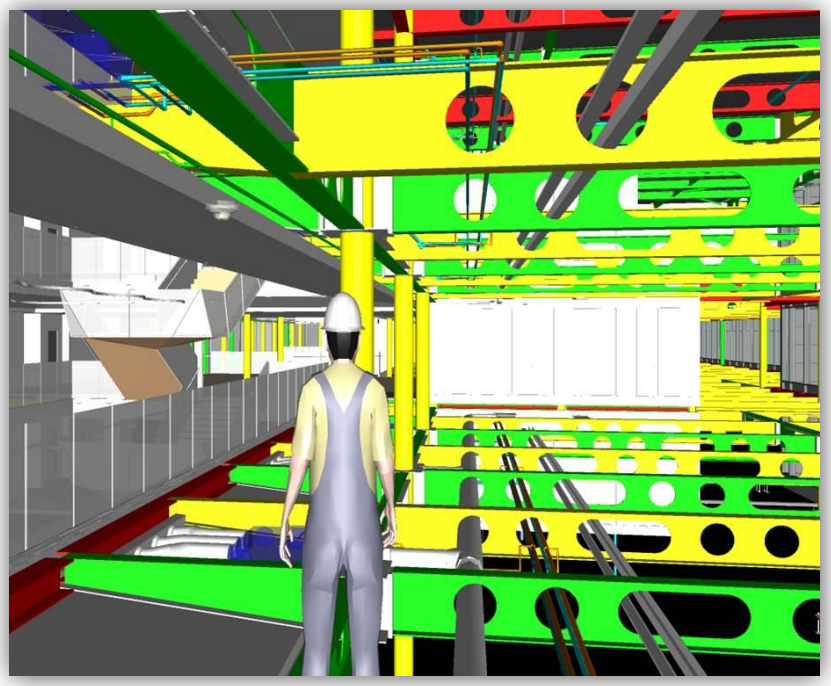
Question to Client

“Can you advise where you got to with COR 19

re-routing of services out of “tenant zone” for the atrium FCU’s.

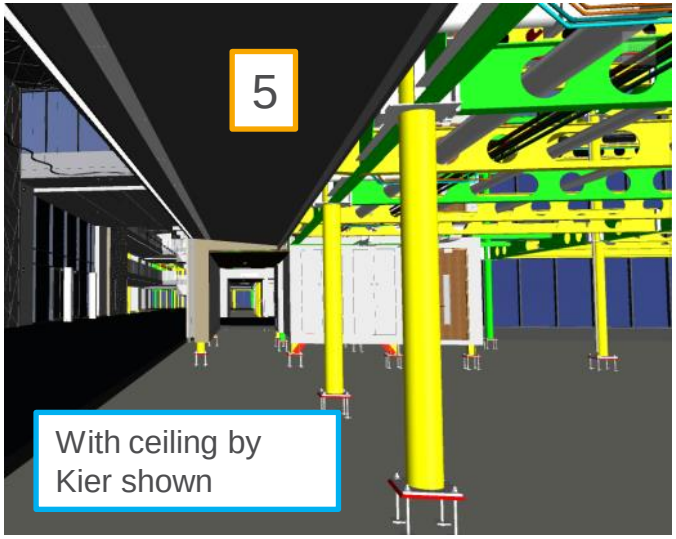
We have not received any information yet.

Currently our design is as screen shot below which follows the Hoare Lea Design Intent in the ERs”



Management of Client Change

COR 19 – Ground floor ceiling adjacent to atrium



Key Points

1 – supply outlets go to a ceiling mounted grill as shown
2 – fresh air supply ducts to each fan coil unit not required, alternative fresh air supply distribution proposed, need to verify this will work
3 – water services and condensate to be moved to ceiling void or in floor void above. Consider leak detection.
4 – trunking to be moved to ceiling void or floor void above
5 – consider making slope of ceiling shallower to allow fan coil unit to move closer to atrium and create more space for relocated services

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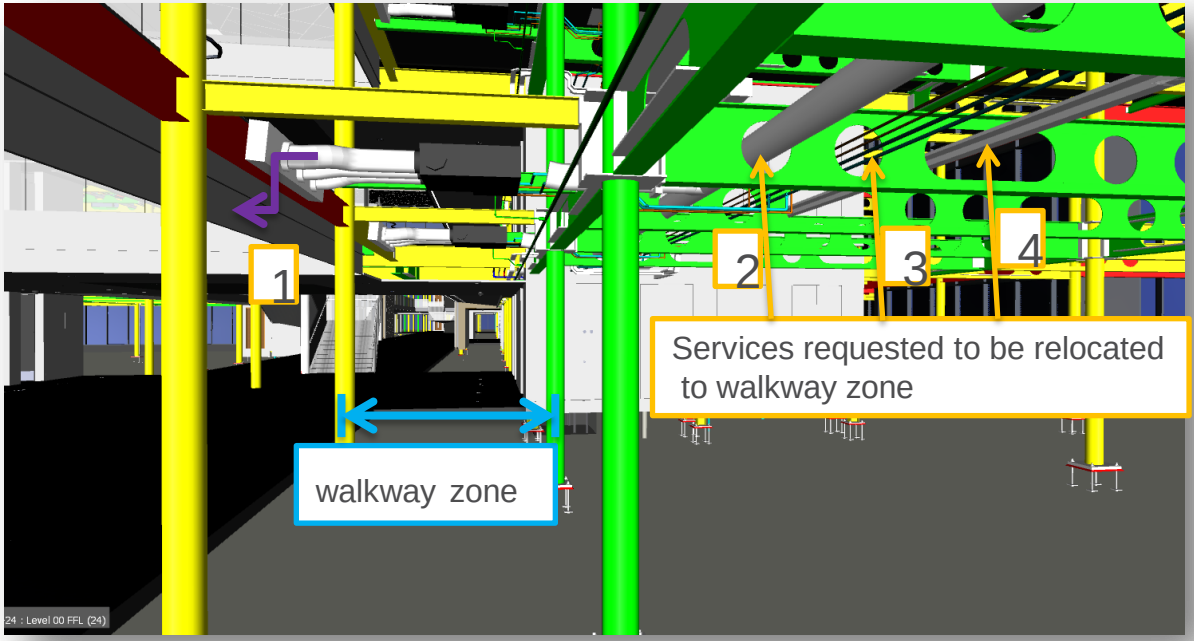
Management of Client Change

COR 19 – Ground floor ceiling adjacent to light well



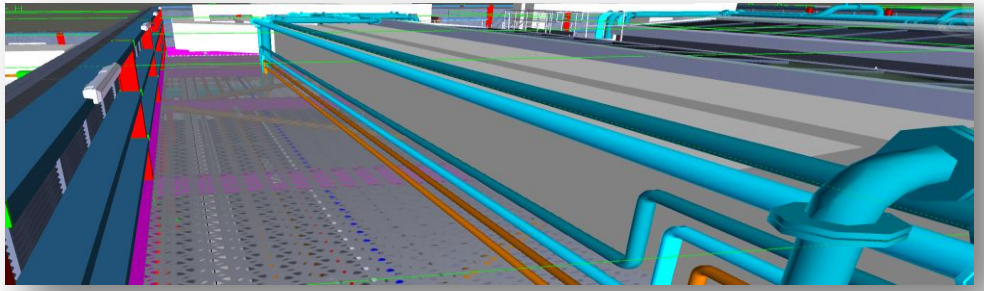
Key Points

1 – supply outlets need to set down and terminate in grill in bulkhead facia – there are tenant offices below, so cannot be in a ceiling grill
2 – fresh air supply ducts to each fan coil unit not required, alternative fresh air supply distribution proposed, need to verify this will work
3 – water services and condensate to be moved to ceiling void or in floor void above. Consider leak detection.
4 – trunking to be moved to ceiling void or floor void above

Quality Control

Quality Control of Installation

- M&E Sub-contractor Model reviewed against installation for on site audit.

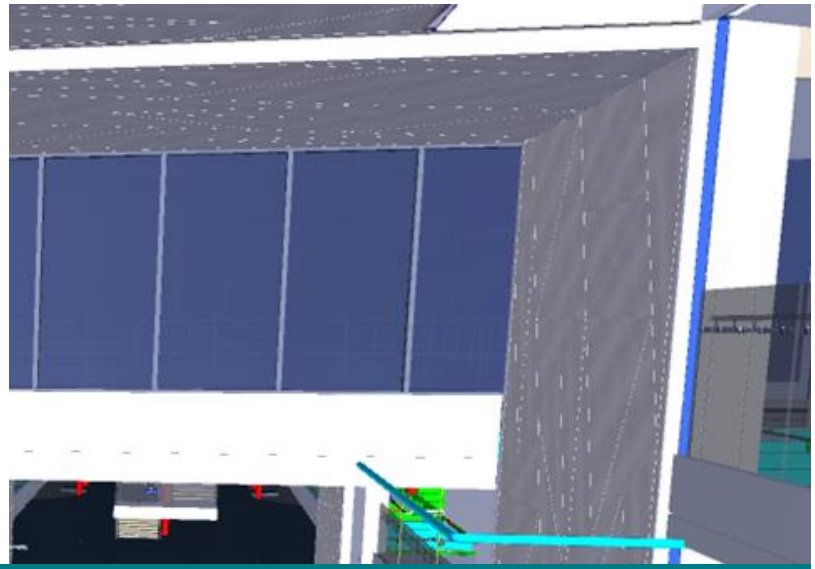


- As installed images used to convey non conformance

Design Coordination

Coordination of Services

- Failure to update models where info comes from 3rd party designers who are working in 2D
- M&E design is also subcontracted out by M&E subcontractor
- Syphonic drainage pipework clearly can't go here and the issue has been resolved in the specialist subcontractor's design, but not yet updated within the M&E model –further issues may not be realised.



Lessons Learnt

This could be tracked by using the BIMXtra/ Insight RFI and Commenting tool to capture design sketches/ minor changes to ensure they are actioned and updated within the 3d model. Responsibility lies with the subcontractor/ design consultant to complete the changes.

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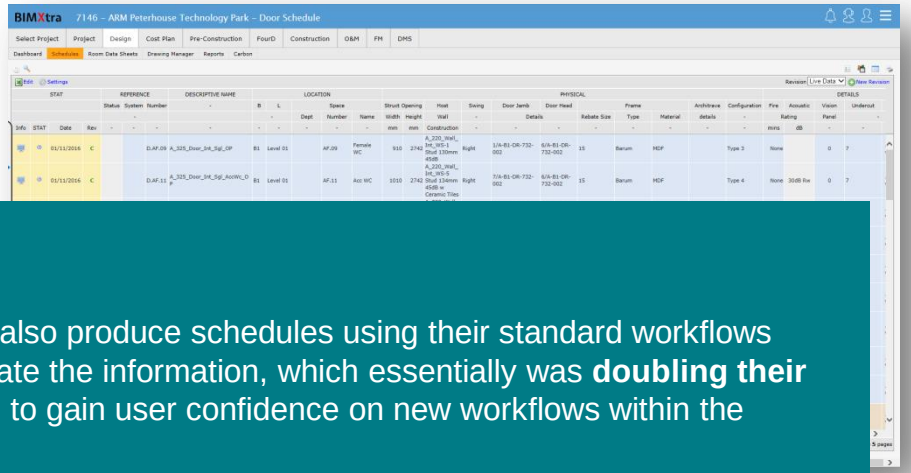
BIMXtra Design Schedules

High Quality Data

- All design consultants agreed to populate their BIMXtra schedules to a high

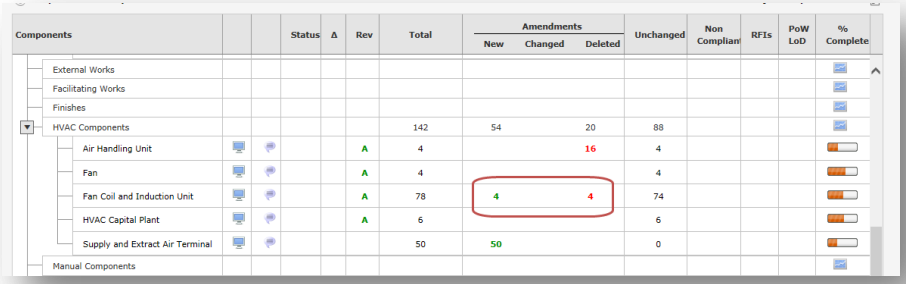


Lessons Learnt

- The Kier Team requested the Design Consultants to also produce schedules using their standard workflows alongside populating the BIMXtra Schedules to validate the information, which essentially was **doubling their efforts**. Only necessary through the transition period to gain user confidence on new workflows within the BIMXtra platform.

Information Exchanges took place on a fortnightly basis or upon sufficient change.

- **Design changes could be tracked** through the BIMXtra Schedule summary page.
- The data held within the **BIMXtra schedules is linked to the 3d and 2d information** through the mapping process.



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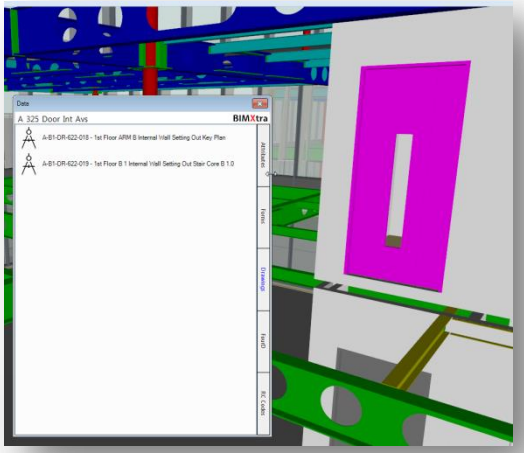
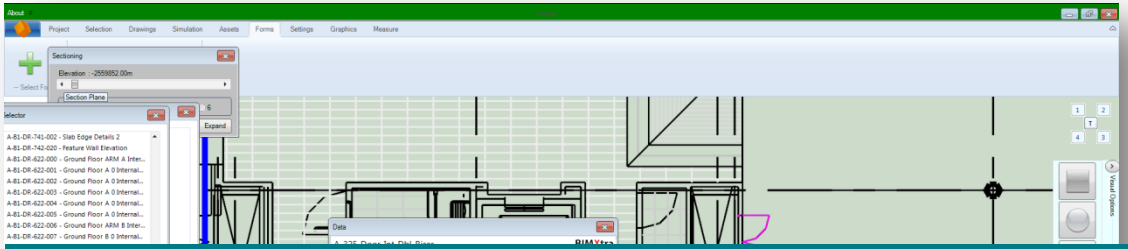
Single Source of Information

Insight

- Drawings manually downloaded from 4 Projects and uploaded onto BIMXtra to enable 3D to 2D functionality within Insight.
- Schedules grouped retrospectively into work packages by project Quantity Surveyor.





Lessons Learnt

- The whole project team need to be committed to the process. For example the work package process needs to be led by the commercial team in line with the procurement programme to ensure information is accessible by the Project Team.

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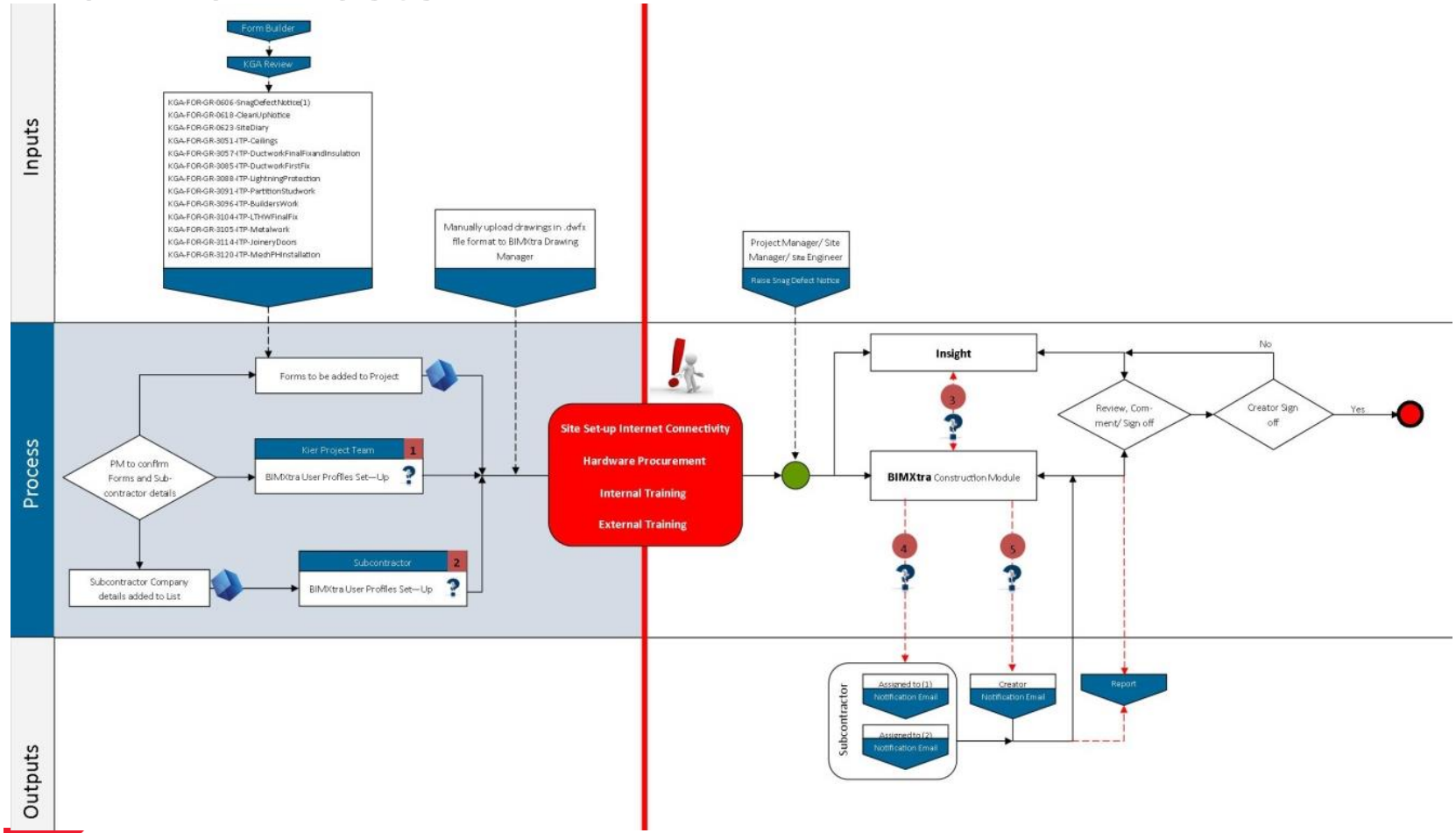
BIMXtra Insight Field BIM

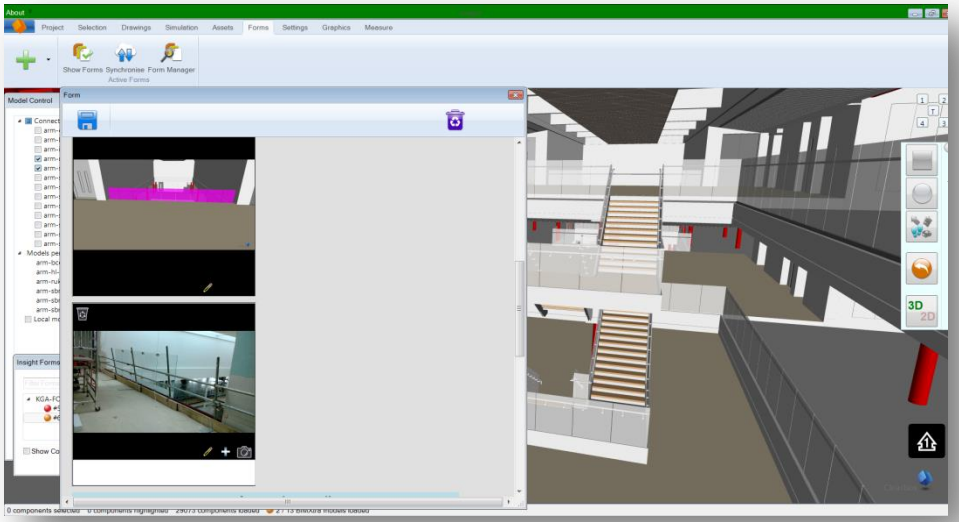
Workflow Tests



BIMXtra Insight Field BIM

Workflow Tests

- Currently in progress: 7 snags/ Non Conformances highlighted to be raised digitally via Insight alongside traditional methods.
- Surface Pro 4's and field BIM application enables immediate accurate recording and reporting to subcontractors of defects, saving site team time.



Lessons Learnt

Engaging with the supply chain is key to ensure they are capable and involved in using digital construction workflows and procedures.

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To conclude

Benefits

- Early Quantity Checks added confidence in measured bills.
- The ability to view all disciplines models including the steel fabricators model enabled us to view final steel connections in detail, improving design coordination with M&E and reduced clashes on site.
- Communication of construction information through marked up model view snapshots.
- Smart Screen facilitates improved problem solving through mark ups and as a presentation tool for reviewing detailed programmes, method statements and sequencing works (endless uses).
- Work packaging undertaken highlights scope of works for subcontractors and groups with 2D & 3D design information within Insight allowing project team with full access to project information on site.
- Field BIM workflow enables immediate accurate recording and reporting to subcontractors of defects, saving site team time.

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To conclude

Lessons Learnt & Ideas for the future

- Early engagement with Subcontractors to ensure BIM Capability is assessed prior to appointment.
- Internet Connection is Key.
- Small design changes are neglected and are not always recorded back into the models. Design Changes to be updated in models from initial sketches to ensure full coordination impacts are realised. (This could be managed through the RFI Commenting tool via Insight/ BIMXtra)
- The whole project team need to be committed to the process. For example the work package process needs to be led by the commercial team in line with the procurement programme.

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Thank you

Q&A Session