

**Using BIM technologies to  
improve handover to FM**  
IAM Ireland  
**Presented by:**  
David Mullen – Oct. 2019

# Introduction

**David Mullen**

**Mechanical Engineering at NUI Galway**

**Post Grad Diploma in Energy Management at IT Sligo**

**Established Engineering Documentation 2006**

**Autodesk Certified Instructor**

**Co-Chair of CITA NW BIM Hub 2016-2018**



# **Our Services**



**Mechanical & Electrical O&M Manuals**

**Digital Safety Files**

**As Built Drawings**

**3D Modelling & MEP Co-Ordination**

**Point Cloud Scanning**

**Autodesk Authorised Training & Certification Centre**



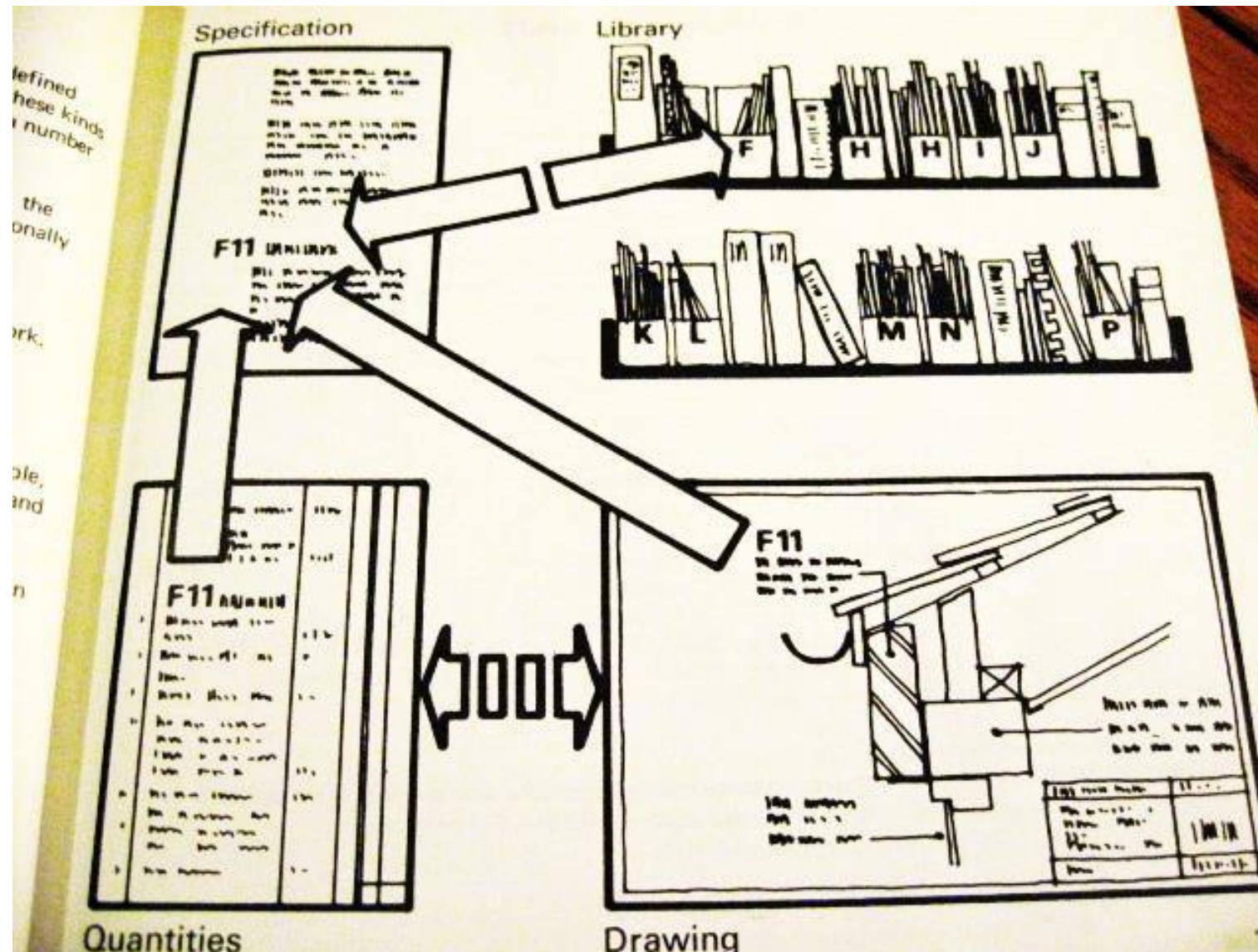
# Basis for the Safety File

## Technical Standards

➤ The digital safety file should comply with the following references

- Safety, Health & Welfare at Work (Construction Regulations) – 8, 13 & 21
- ‘Handover, O&M Manuals and Project Feedback, a toolkit for designers and contractors’  
A BSRIA Guide by Paddy Hastings, Kevin Pennycook and Roderic Bunn - BG 1/2007
- Industry best practice
- Project specific requirements – contractual obligations – PSDP input
- **Client specific requirements**

# Traditional approach

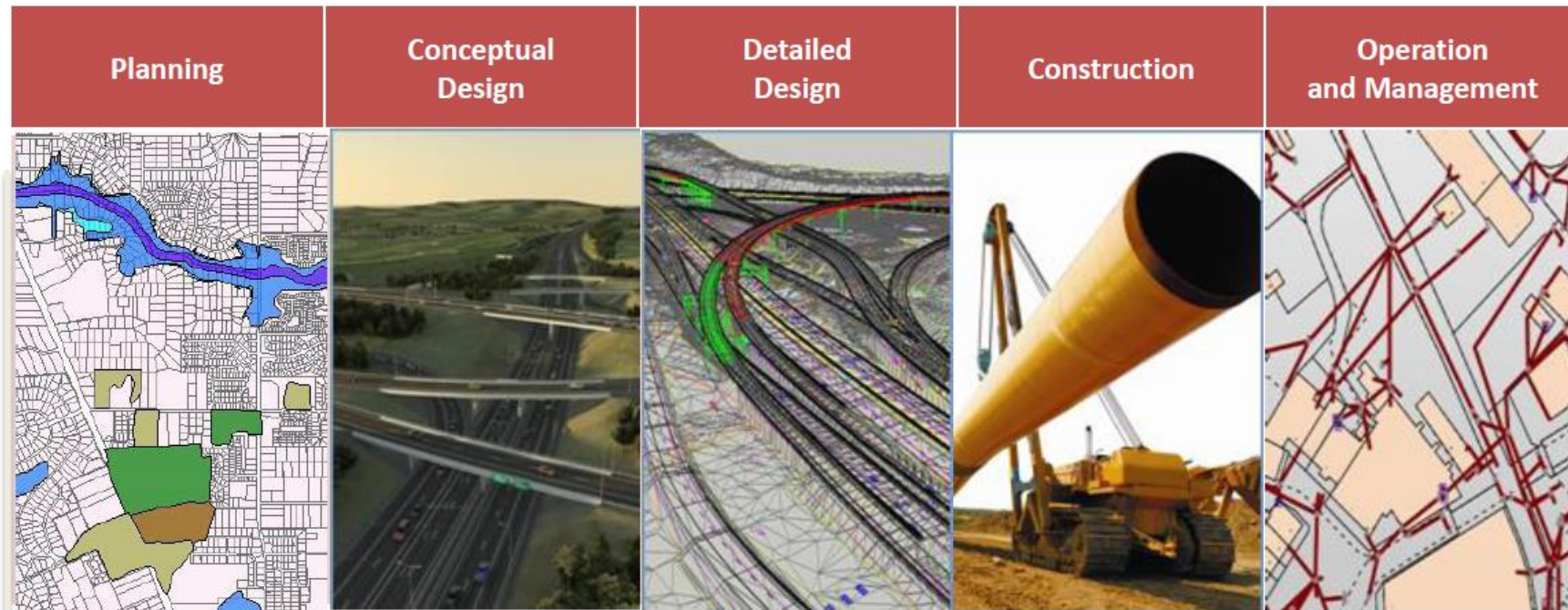








# Information lifecycle

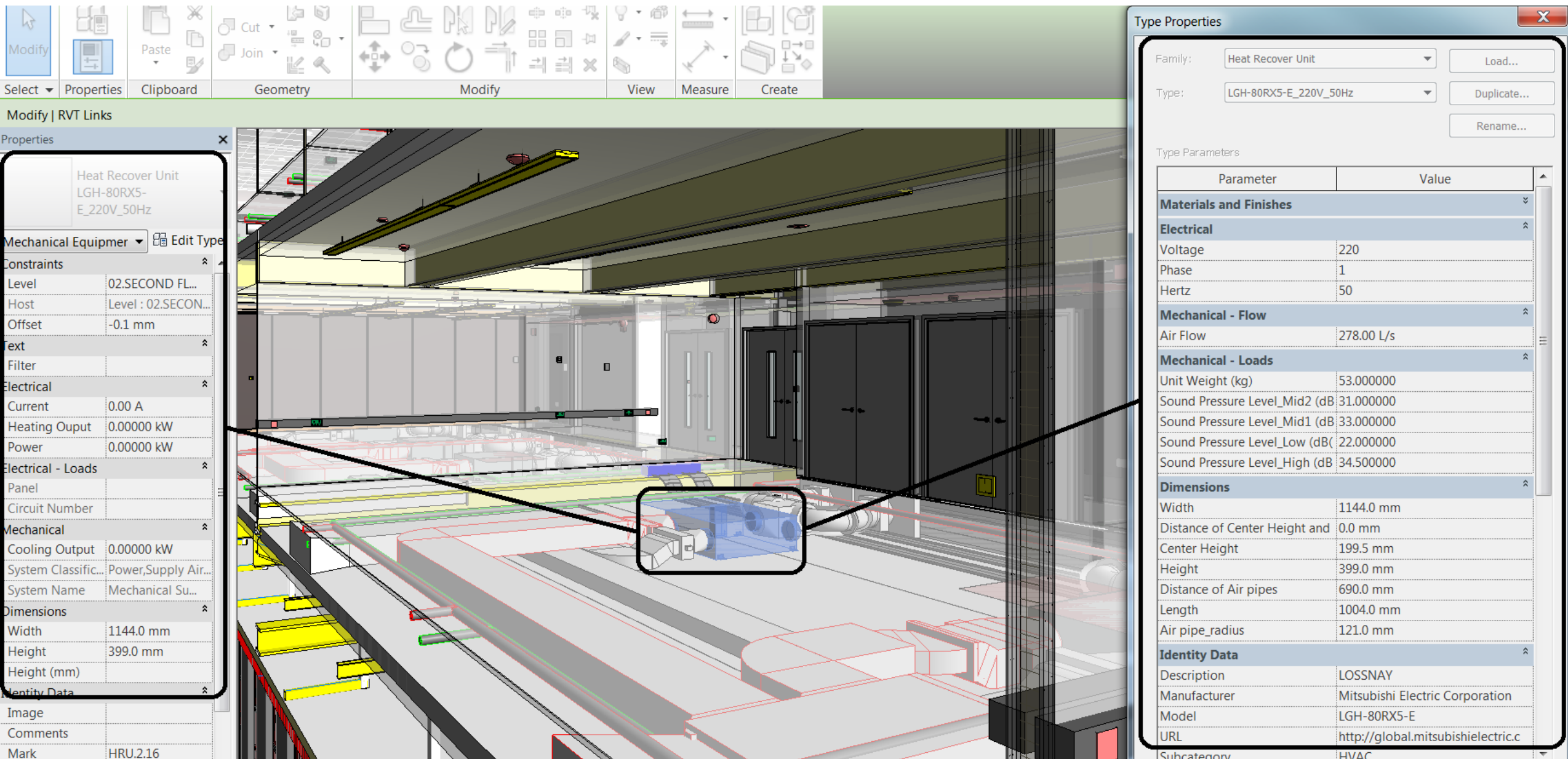


BIM process

Traditional Process



# Data Integration



**Modify | RVT Links**

**Properties**

Heat Recover Unit  
LGH-80RX5-E\_220V\_50Hz

Mechanical Equipmer Edit Type

**Constraints**

Level	02.SECOND FL...
Host	Level : 02.SECON...
Offset	-0.1 mm

**Text**

Filter

**Electrical**

Current	0.00 A
Heating Output	0.00000 kW
Power	0.00000 kW

**Electrical - Loads**

Panel	
Circuit Number	

**Mechanical**

Cooling Output	0.00000 kW
System Classific...	Power,Supply Air...
System Name	Mechanical Su...

**Dimensions**

Width	1144.0 mm
Height	399.0 mm
Height (mm)	

**Identity Data**

Image	
Comments	
Mark	HRU.2.16

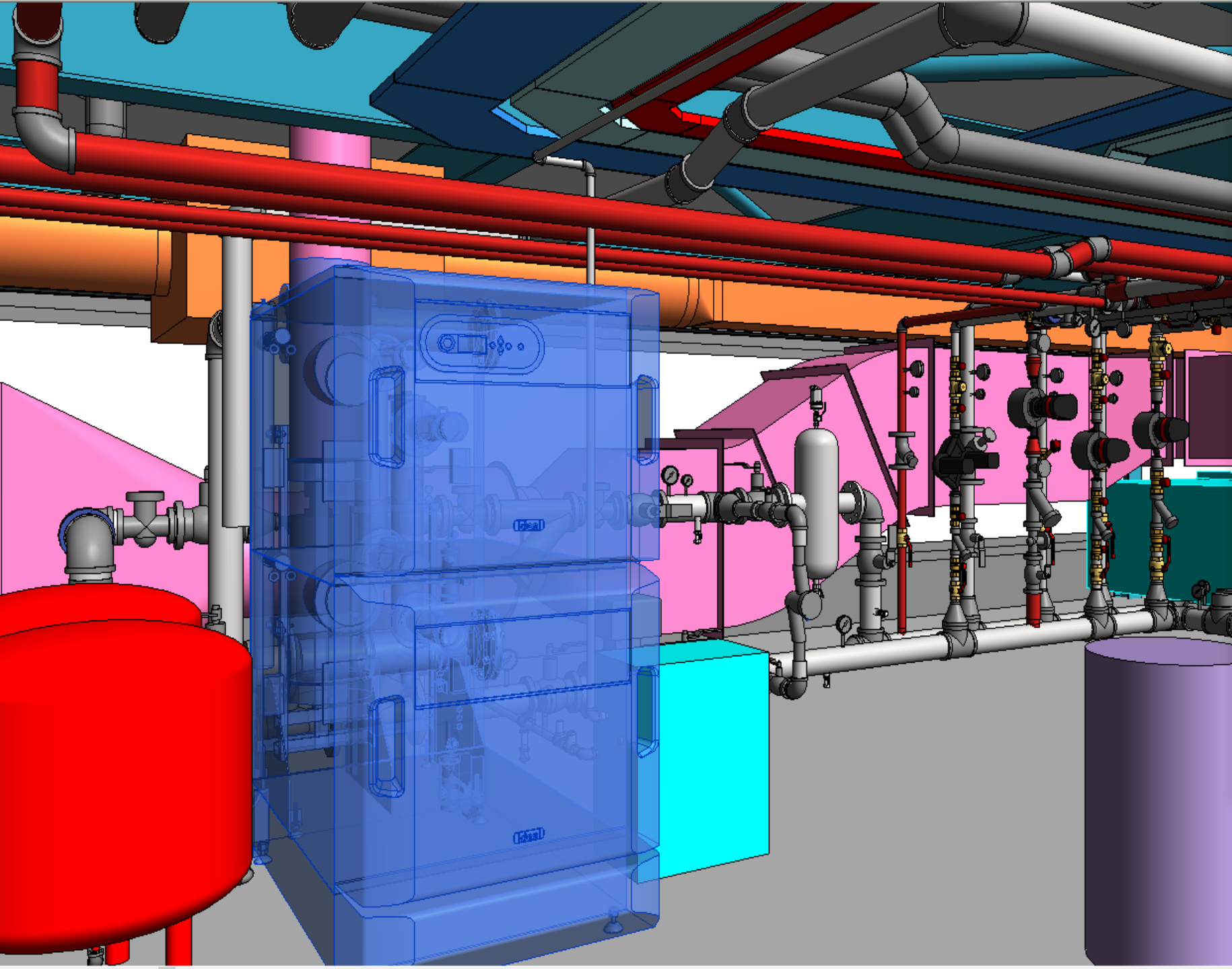
**Type Properties**

Family: Heat Recover Unit Load...

Type: LGH-80RX5-E\_220V\_50Hz Duplicate... Rename...

Type Parameters

Parameter	Value
<b>Materials and Finishes</b>	
<b>Electrical</b>	
Voltage	220
Phase	1
Hertz	50
<b>Mechanical - Flow</b>	
Air Flow	278.00 L/s
<b>Mechanical - Loads</b>	
Unit Weight (kg)	53.000000
Sound Pressure Level_Mid2 (dB)	31.000000
Sound Pressure Level_Mid1 (dB)	33.000000
Sound Pressure Level_Low (dB)	22.000000
Sound Pressure Level_High (dB)	34.500000
<b>Dimensions</b>	
Width	1144.0 mm
Distance of Center Height and	0.0 mm
Center Height	199.5 mm
Height	399.0 mm
Distance of Air pipes	690.0 mm
Length	1004.0 mm
Air pipe_radius	121.0 mm
<b>Identity Data</b>	
Description	LOSSNAY
Manufacturer	Mitsubishi Electric Corporation
Model	LGH-80RX5-E
URL	<a href="http://global.mitsubishielectric.c">http://global.mitsubishielectric.c</a>
Subcategory	HVAC



Type Properties

Family: MEP-Boiler-Ideal\_Heating-Evomod\_Floor\_Standing\_C Load...

Type: 500 Duplicate... Rename...

Type Parameters

Parameter	Value
<b>Data</b>	
Seasonal Boiler Efficiency (Bulding Regs L2) %	95.900000
NOx with O2 = 0% - ppm	22.500000
NOx with O2 = 0% - mg/kWh	39.700000
Max Flue Resistance - Pa	105.000000
Gas Rate - Max Rate m³/hr	50.400000
Gas Rate - Max Rate ft³/hr	1779.800000
Flue Gas CO² G20/LNG - Min Rate %	8.4 ± 0.2
Flue Gas CO² G20/LNG - Max Rate %	9.1 ± 0.2
Boiler Output (non-condensing) Mean 70 degree	46.700000
Boiler Output (non-condensing) Mean 70 degree	159325.000000
Boiler Output (non-condensing) Mean 70 degree	465.000000
Boiler Output (non-condensing) Mean 70 degree	1586774.000000
Boiler Output (condensing) Mean 40 degree C	51.400000
Boiler Output (condensing) Mean 40 degree C	175404.000000
Boiler Output (condensing) Mean 40 degree C	505.000000
Boiler Output (condensing) Mean 40 degree C	1723060.000000
Boiler Input Min Rate - Nett kW	47.600000
Boiler Input Min Rate - Nett Btu/hr	162411.000000
Boiler Input Min Rate - Gross kW	52.800000
Boiler Input Min Rate - Gross Btu/hr	180256.000000
Boiler Input Max Rate - Nett kW	476.000000
Boiler Input Max Rate - Nett Btu/hr	1624112.000000
Boiler Input Max Rate - Gross kW	523.200000
Boiler Input Max Rate - Gross Btu/hr	1802218.000000
Approx flue gas volume (@80 degree C) - Max	783.000000
Approx flue gas volume (@80 degree C) - Max	27615.000000

<< Preview OK Cancel Apply

# What is BIM?

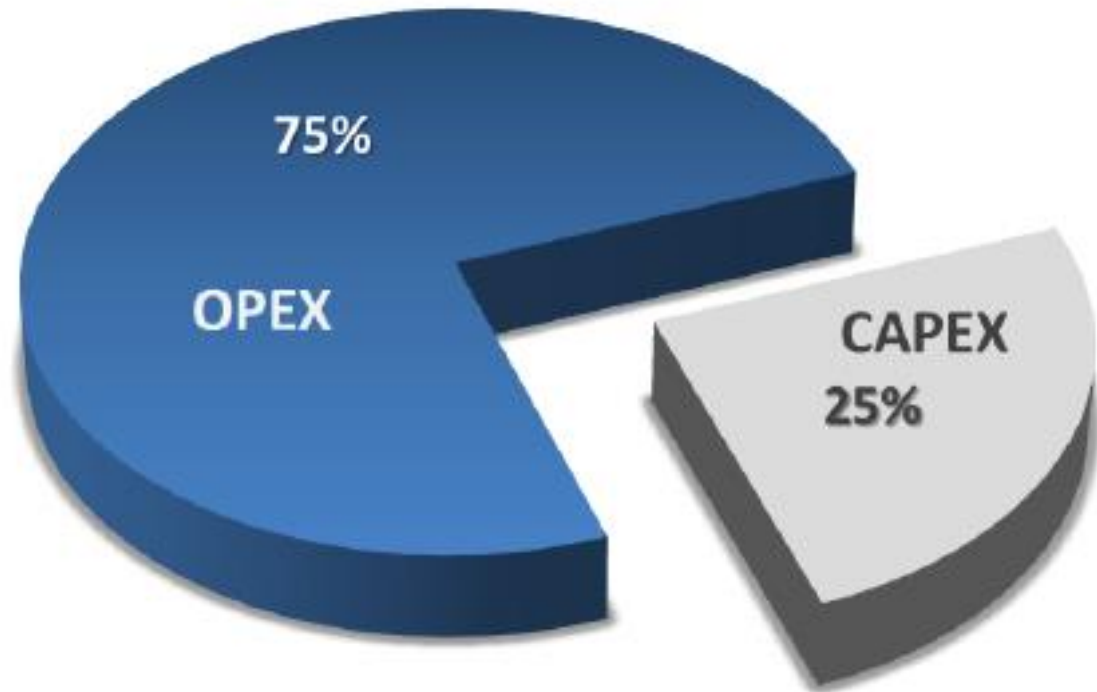
**“An integrated digital process providing co-ordinated, reliable, shareable data throughout all project phases, from design through construction and into operation”**



# What BIM is not...

- ☐ BIM is not 3D CAD
- ☐ BIM is not a single building model
- ☐ BIM is as much about the right data as it is about geometry
- ☐ BIM is not a single software tool
- ☐ BIM is not a replacement for good communication, team working, forward planning and due diligence

# Why use BIM for FM?

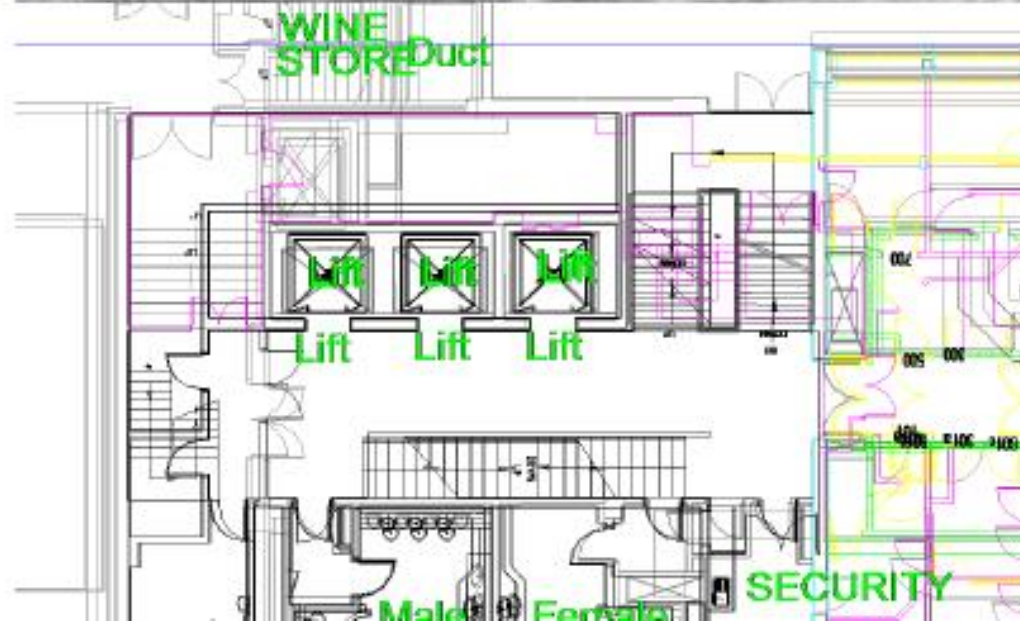
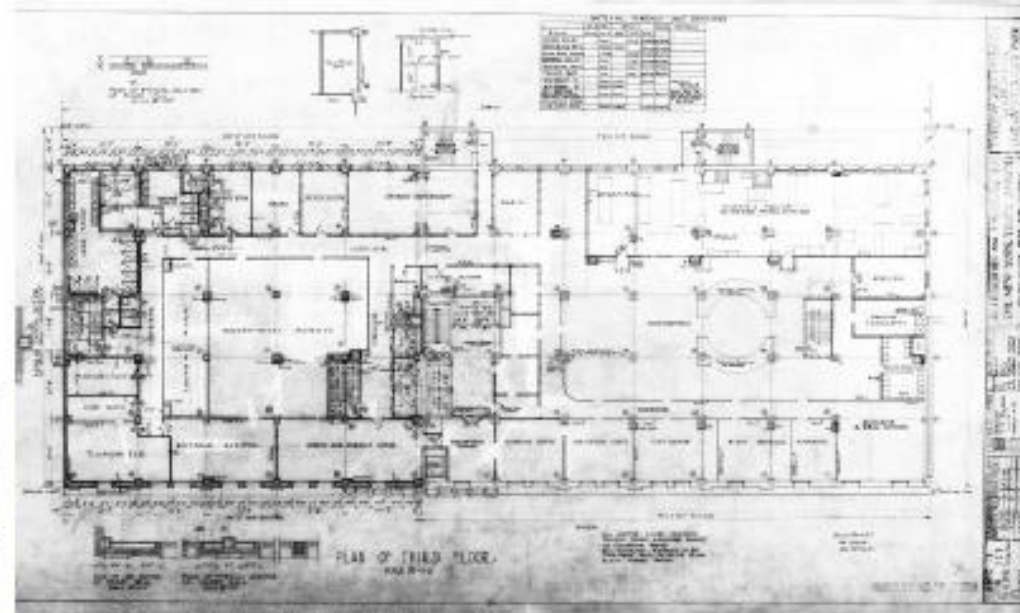
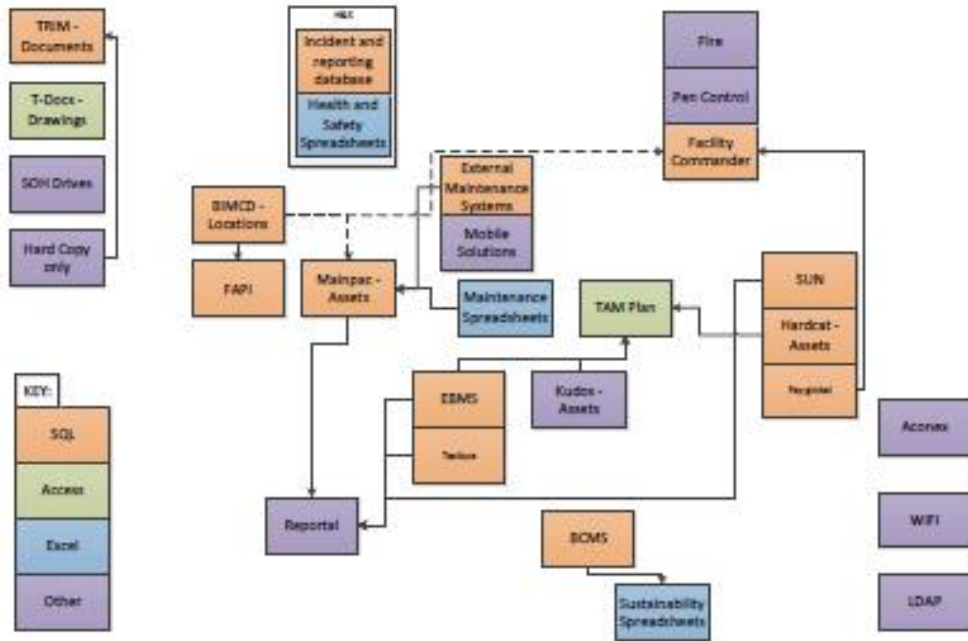


# Why use BIM for FM?

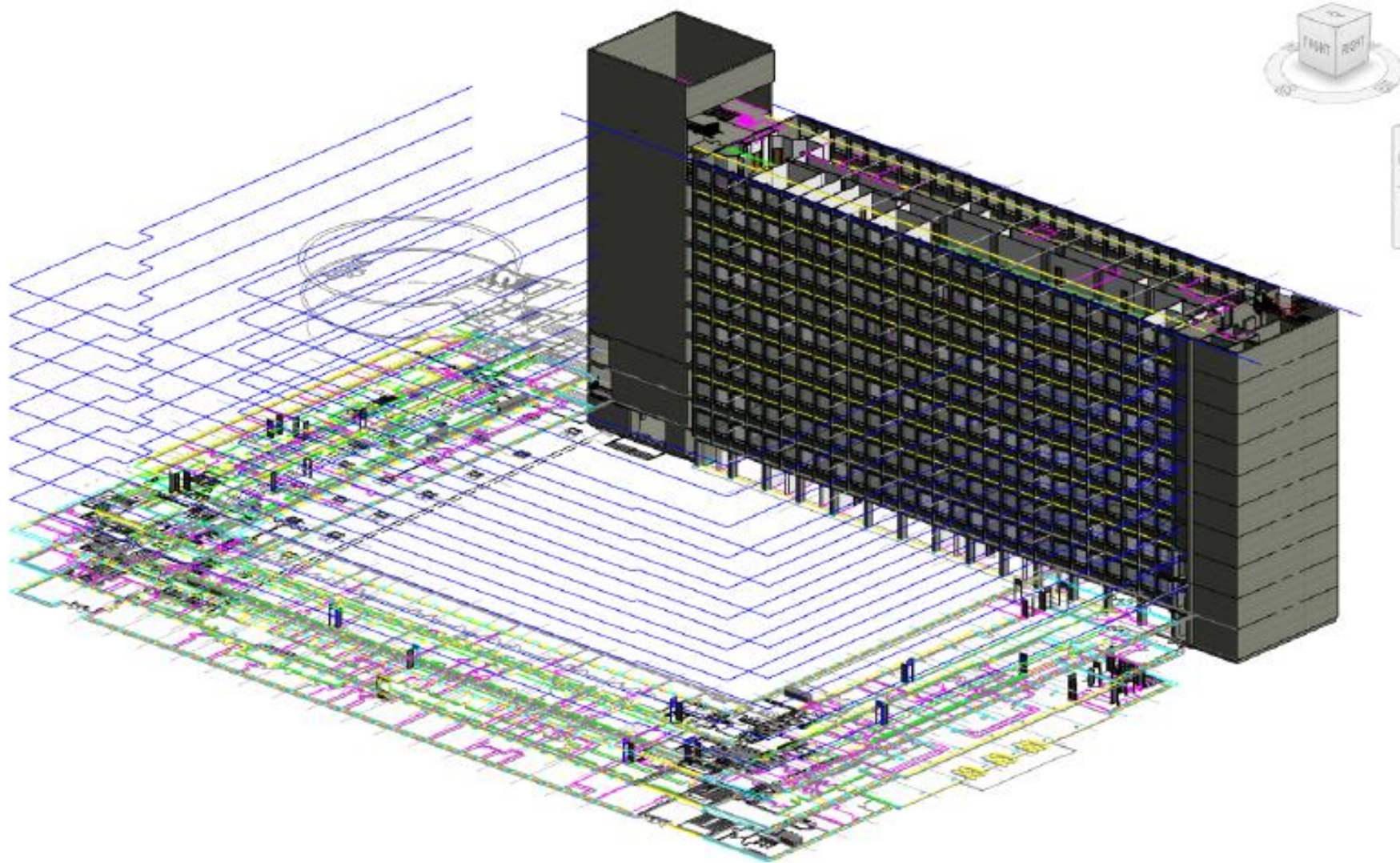




# Difficulties with Existing Estates

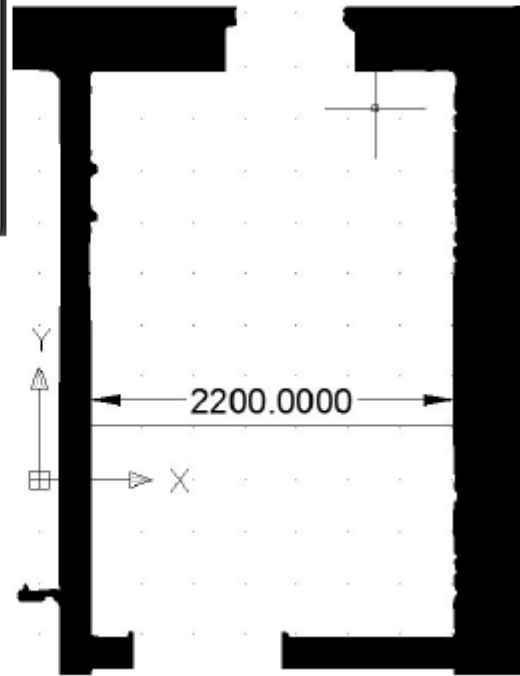
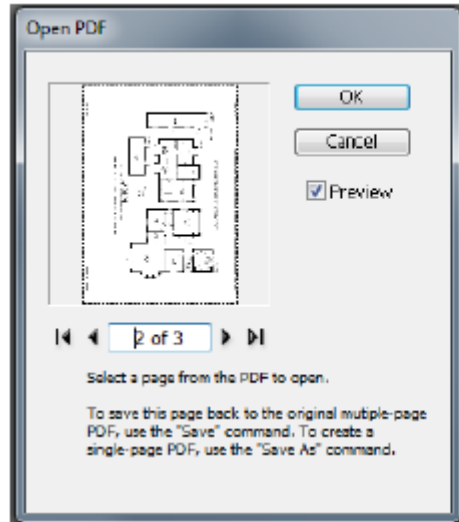


# 2D to 3D development





# PDF to Revit conversion

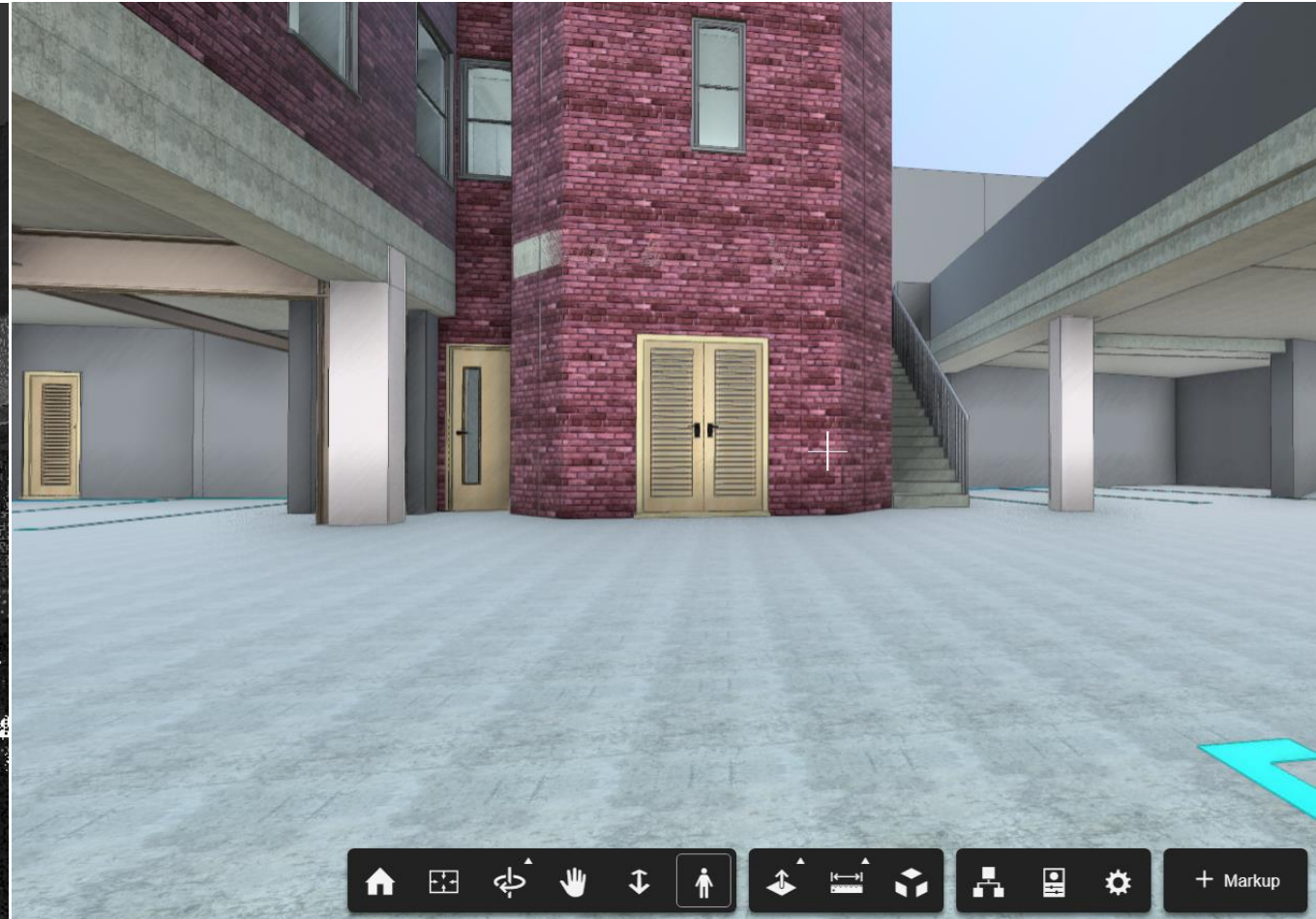


We recognise that often clients only have old PDF plans of the building they are operating.

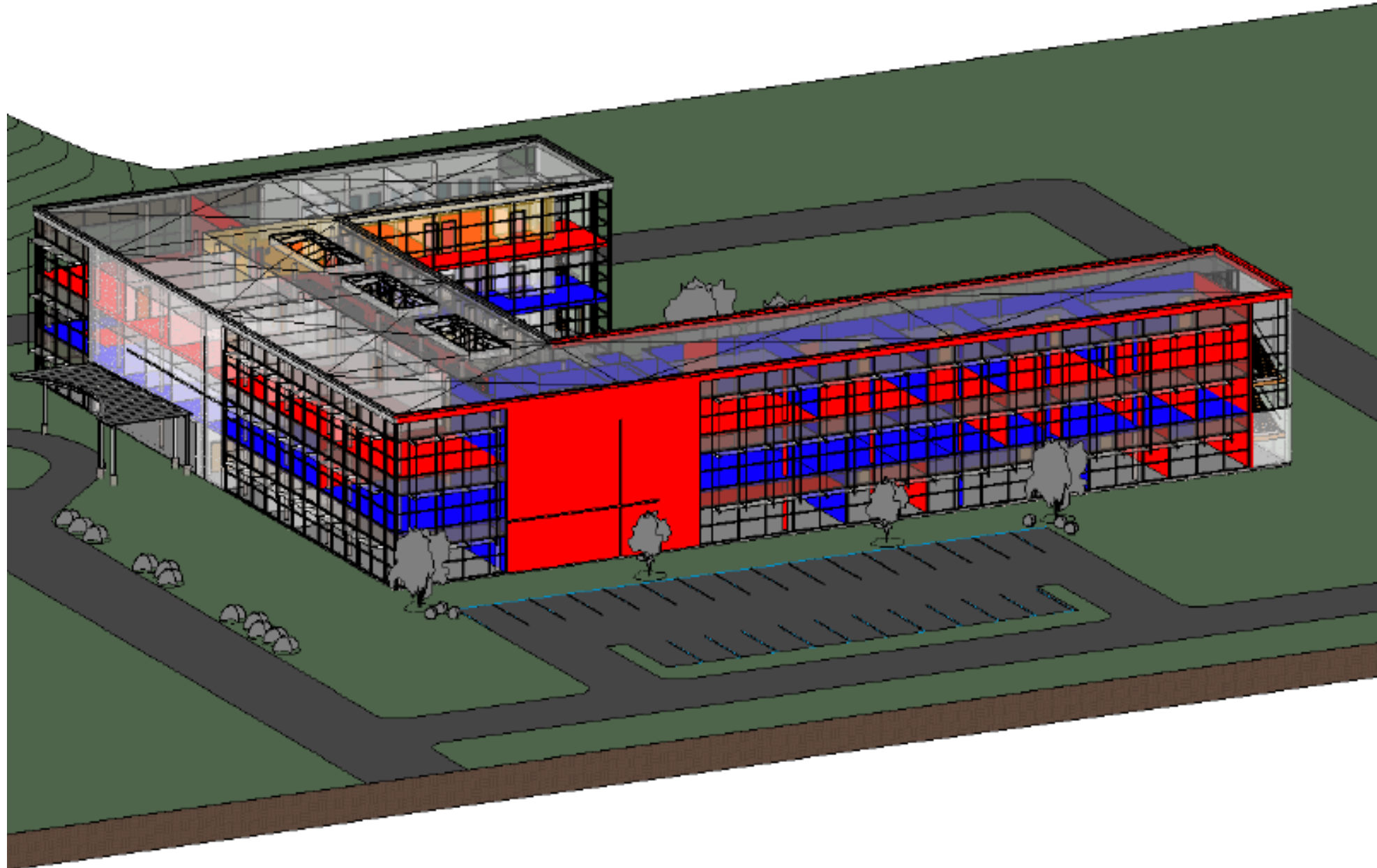
We have a process in place to convert these PDF's into dynamic Revit plans or models depending on the level of detail required.



# Laser Scanning to 3D Modelling

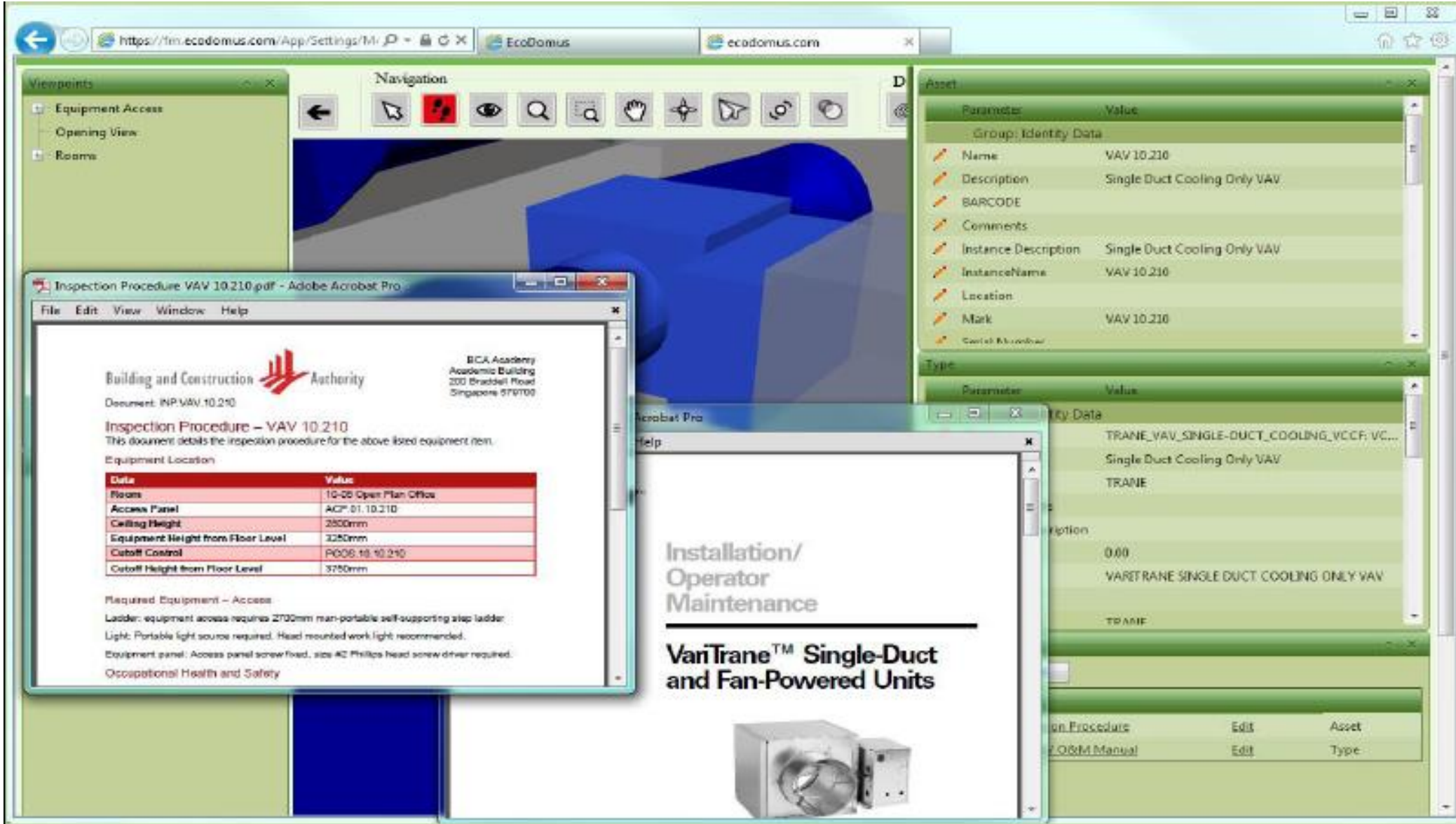


# Asbestos Management





# Linking to existing CAFM systems



The screenshot displays a web-based CAFM system interface. The main window shows a 3D model of a building. Overlaid on this are two windows:

**Inspection Procedure VAV 10.210.pdf - Adobe Acrobat Pro**

Building and Construction Authority  
Document: INP.VAV.10.210

**Inspection Procedure – VAV 10.210**  
This document details the inspection procedure for the above listed equipment item.


Equipment Location

Date	Value
Room	10-00 Open Plan Office
Access Panel	ACP 01.10.210
Ceiling Height	2500mm
Equipment Height from Floor Level	3250mm
Cutoff Control	P006.10.10.210
Cutoff Height from Floor Level	3750mm

Required Equipment – Access:  
Ladder: equipment access requires 2700mm non-portable self-supporting step ladder.  
Light: Portable light source required. Head mounted work light recommended.  
Equipment panel: Access panel screw fixed, size #2 Phillips head screw driver required.  
Occupational Health and Safety

**Installation/Operator Maintenance**

**VanTrane™ Single-Duct and Fan-Powered Units**



**Asset**

Parameter	Value
Group: Identity Data	
Name	VAV 10.210
Description	Single Duct Cooling Only VAV
BARCODE	
Comments	
Instance Description	Single Duct Cooling Only VAV
InstanceName	VAV 10.210
Location	
Mark	VAV 10.210
Control Room/Room	

**Type**

Parameter	Value
Identity Data	
TRANE_VAV_SINGLE-DUCT_COOLING_VCCF; VC...	
Single Duct Cooling Only VAV	
TRANE	
Description	0.00
VARETRANE SINGLE DUCT COOLING ONLY VAV	
TRANE	

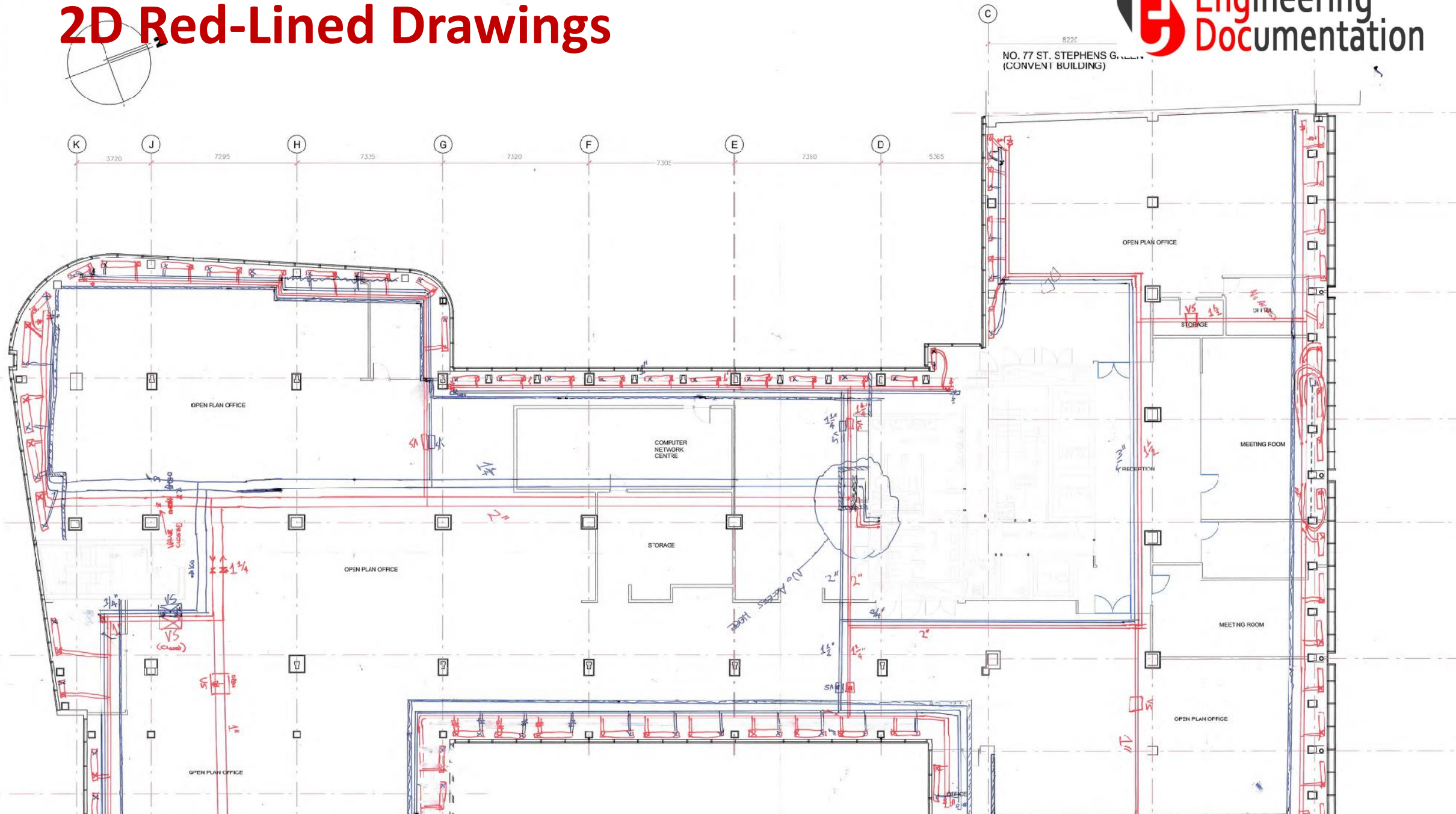
**Inspection Procedure** Edit Asset  
**VO&M Manual** Edit Type



# Site Mark-Up



# 2D Red-Lined Drawings





# Laser scanning & site validation





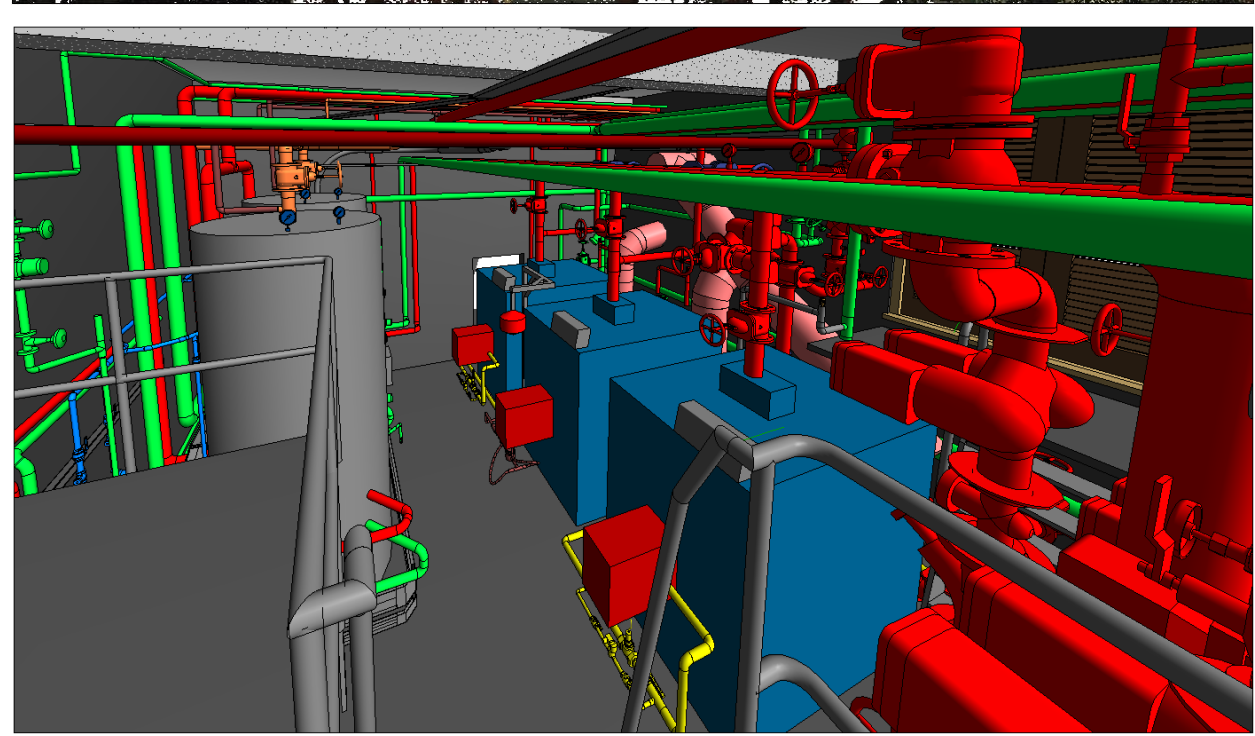
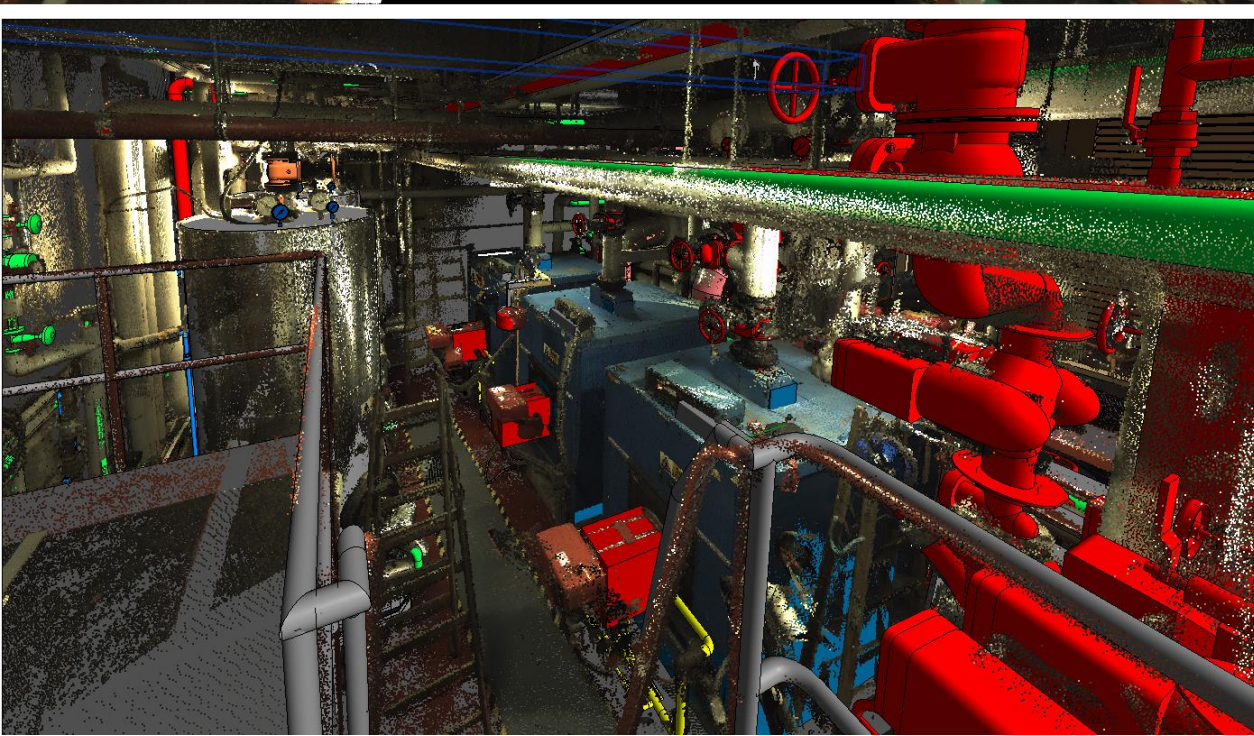
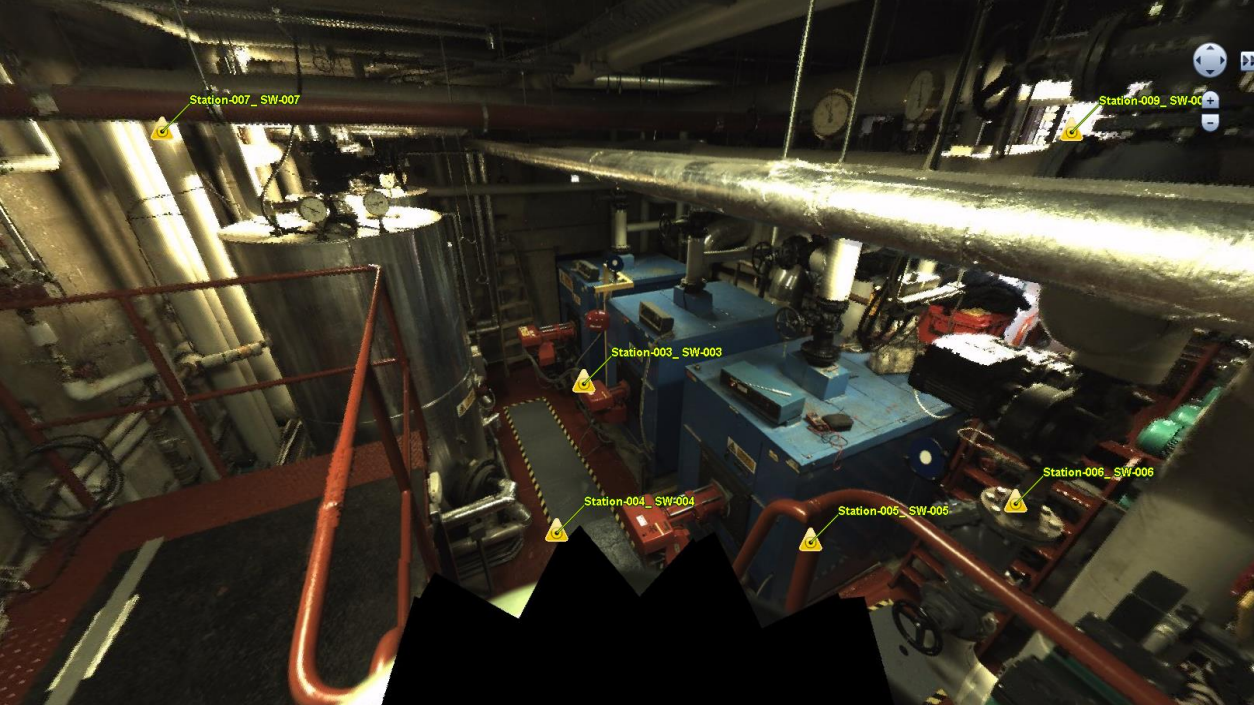




# Laser scanning & site validation









# Property at North Frederick St.

## Laser Scan on Building

Leica Scan Station used

Multiple scans stitched using 'Cyclone'

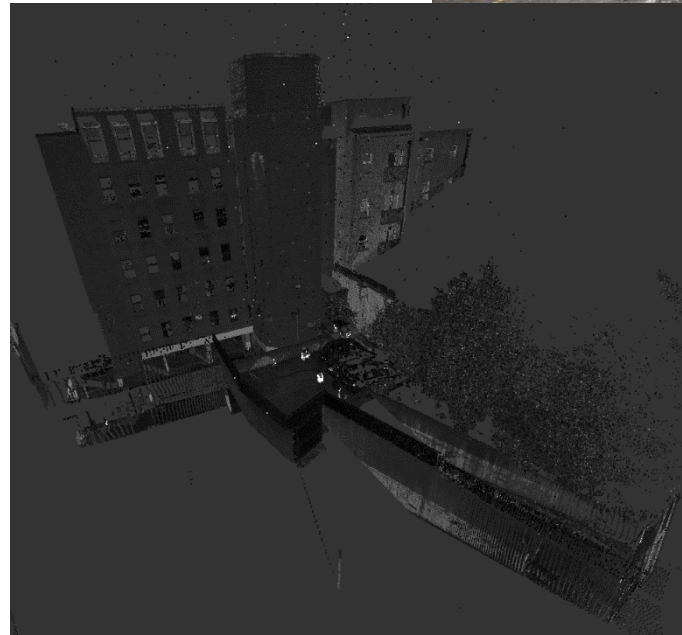
## Point Cloud Created

Edited & cleaned in point cloud viewer

## Model from Point Cloud

Model 'traced' from point cloud in Revit

Parameters tailored to client's needs



# Property at North Frederick St.

## Building Planning

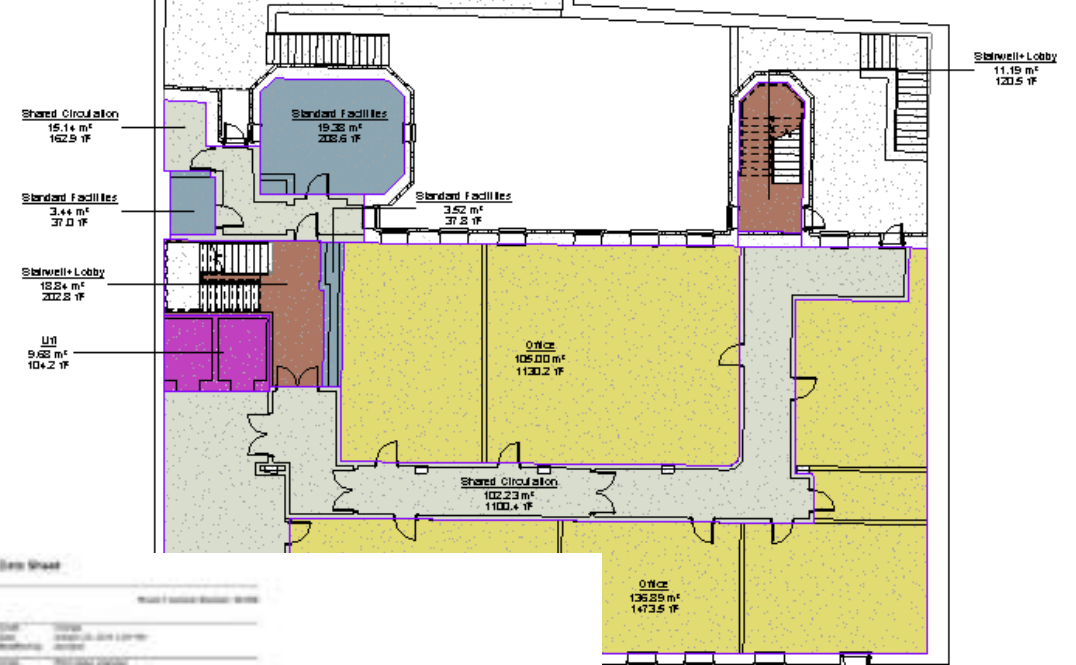
Rental areas calculated on a per-tenant basis  
Visualisation for potential clients

## Room Data Sheets

Asset information inputted into model  
Create detailed room data sheets  
Log of past issues and actions

## Facilities Management

Review data at point of use  
No loss of information  
Input once, use many times  
Responsibilities & issues assigned



Room Data Sheet

Room Name	Room Type	Room Area	Room Volume	Room Height	Room Length	Room Width	Room Depth	Room Orientation	Room Status
Room 1	Office	105.00 m²	1130.2 m³	10.7 m	10.7 m	10.7 m	10.7 m	North	Occupied
Room 2	Office	135.29 m²	1473.5 m³	10.9 m	10.9 m	10.9 m	10.9 m	North	Occupied
Room 3	Office	102.23 m²	1100.4 m³	10.7 m	10.7 m	10.7 m	10.7 m	North	Occupied
Room 4	Office	13.84 m²	232.2 m³	16.8 m	16.8 m	16.8 m	16.8 m	North	Occupied
Room 5	Office	11.19 m²	120.5 m³	10.7 m	10.7 m	10.7 m	10.7 m	North	Occupied
Room 6	Office	3.44 m²	37.1 m³	10.7 m	10.7 m	10.7 m	10.7 m	North	Occupied
Room 7	Office	3.62 m²	37.8 m³	10.7 m	10.7 m	10.7 m	10.7 m	North	Occupied
Room 8	Office	15.14 m²	162.9 m³	10.7 m	10.7 m	10.7 m	10.7 m	North	Occupied
Room 9	Office	19.38 m²	208.6 m³	10.7 m	10.7 m	10.7 m	10.7 m	North	Occupied
Room 10	Office	9.58 m²	104.2 m³	10.7 m	10.7 m	10.7 m	10.7 m	North	Occupied



# Benefits for FM

**Cost savings at both delivery and operational stages:** BIM can help organisations strip waste from their processes, as they can virtually build the facility as many times as necessary to create the perfect model. This also provides cost certainty.

**Improved efficiency and faster project delivery:** As all parties work together collaboratively, mistakes, discrepancies and duplicate work is avoided.

**Improved client satisfaction:** The client receives a building which matches their expectations and needs.

**Reduced safety risk:** BIM allows crowd behaviour to be analysed and fire modelling capability to be predicted to enable designs to be optimised for public safety.

**Greater project predictability and early modification:** Projects can be visualised at an early stage, giving owners and operators a clear idea of design intent and allowing them to modify the design to achieve the outcomes they want.



# Challenges

Need for understanding of the BIM process   Better forward planning  
Demands client leadership   **Not a panacea**   Initial investment in software  
Software needs to be carefully selected   Business case for BIM needs to be  
identified   Need to adapt traditional procurement for digital outputs   **Short  
term maintenance contracts**   Better understanding of information  
exchanges   Poor as-built handover records   Model ownership   Updating  
the model and data   **Supply chain needs to be aligned**   Interoperability  
with legacy systems   Standard classification of information   Clients don't  
currently always own all of their data   Poor feedback mechanisms   Clients  
have to specify what data outcomes they want at the outset   Can add risk if  
requirements aren't correctly articulated and supply chain tested.



SAFETY FILES | O&M MANUALS  
3D MODELLING | BIM | AUTOCAD

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