Integrated Project Delivery

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Integrated Project Delivery

a project delivery method that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.

AIACC (47 words)

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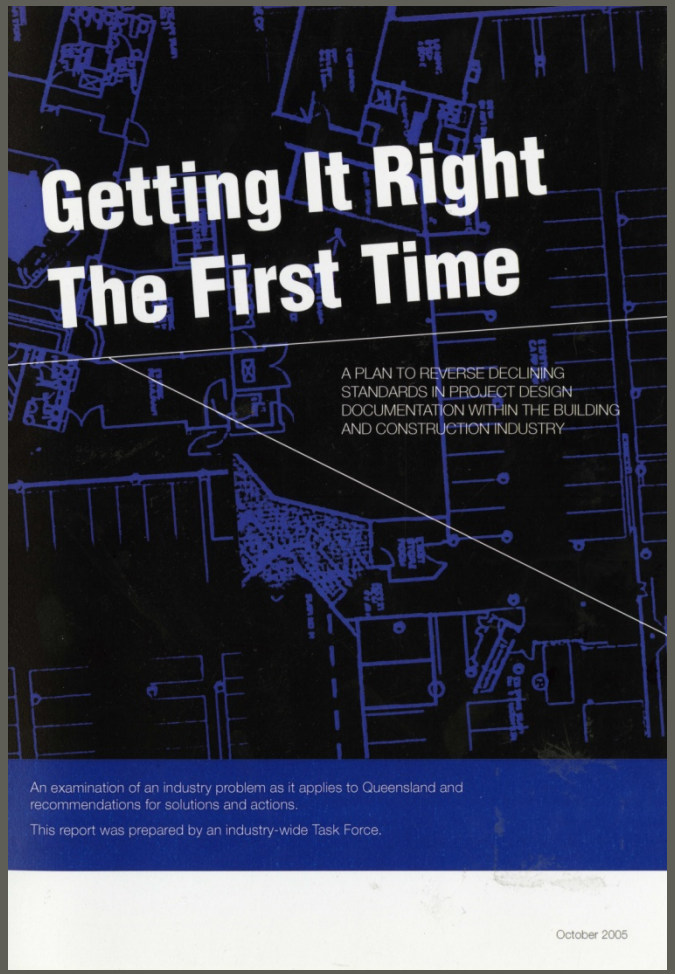
Quality of Documentation

Findings

- Declining standards of project documentation
- Causing 60-90% of variations
- Linked to reduction in fee level
- Led to an inefficient industry with adversarial behavior
- Cost overruns, rework extensions of time
- diminished reputation
- Adds 10-15% to the cost of construction in Australia which amounts to $12 Billion nationally in 2006 dollars



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Industry Productivity

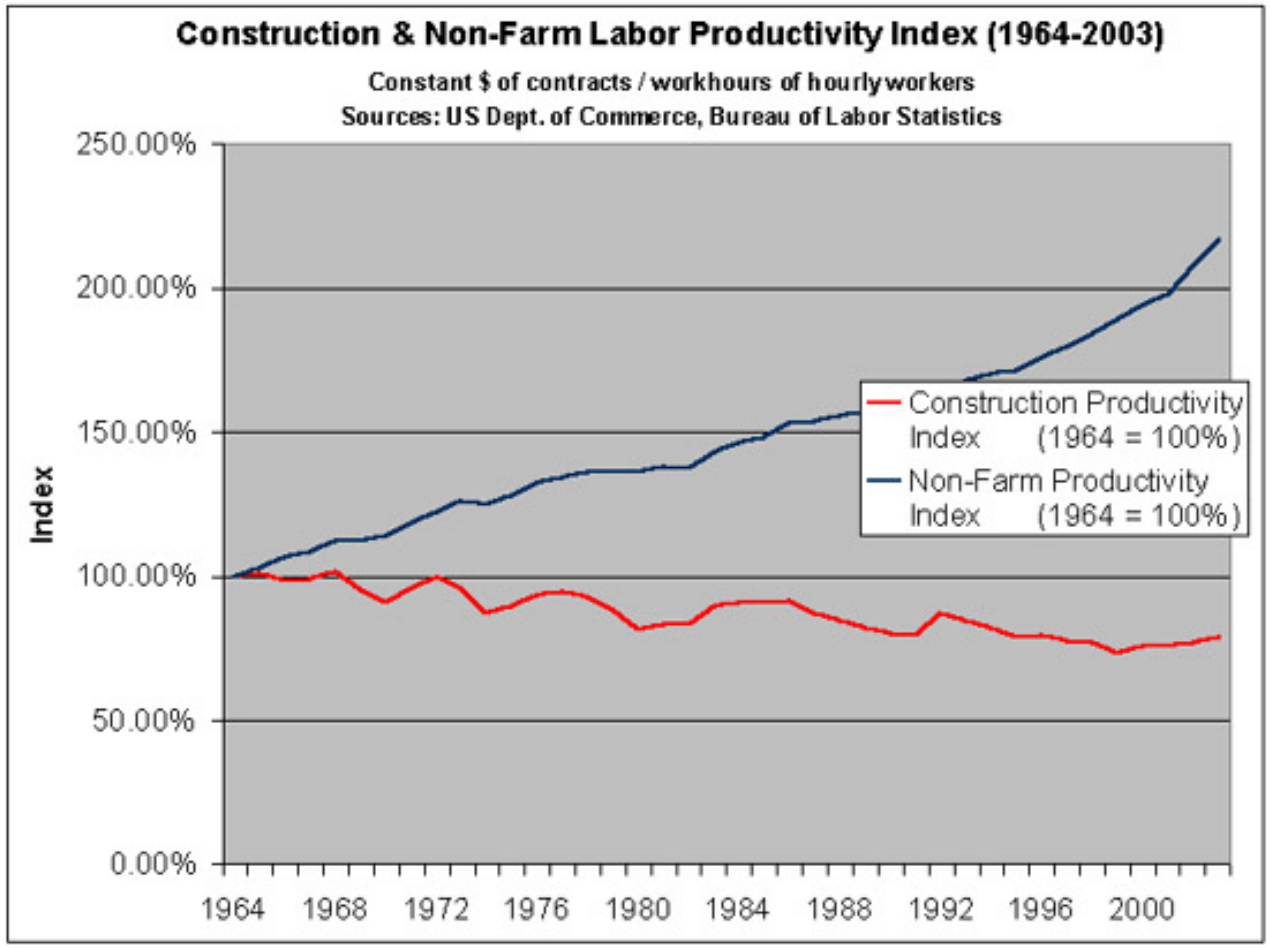

Figure 1. Labor productivity index for US Construction Industry and all non-farm industries from 1964 through 2003.

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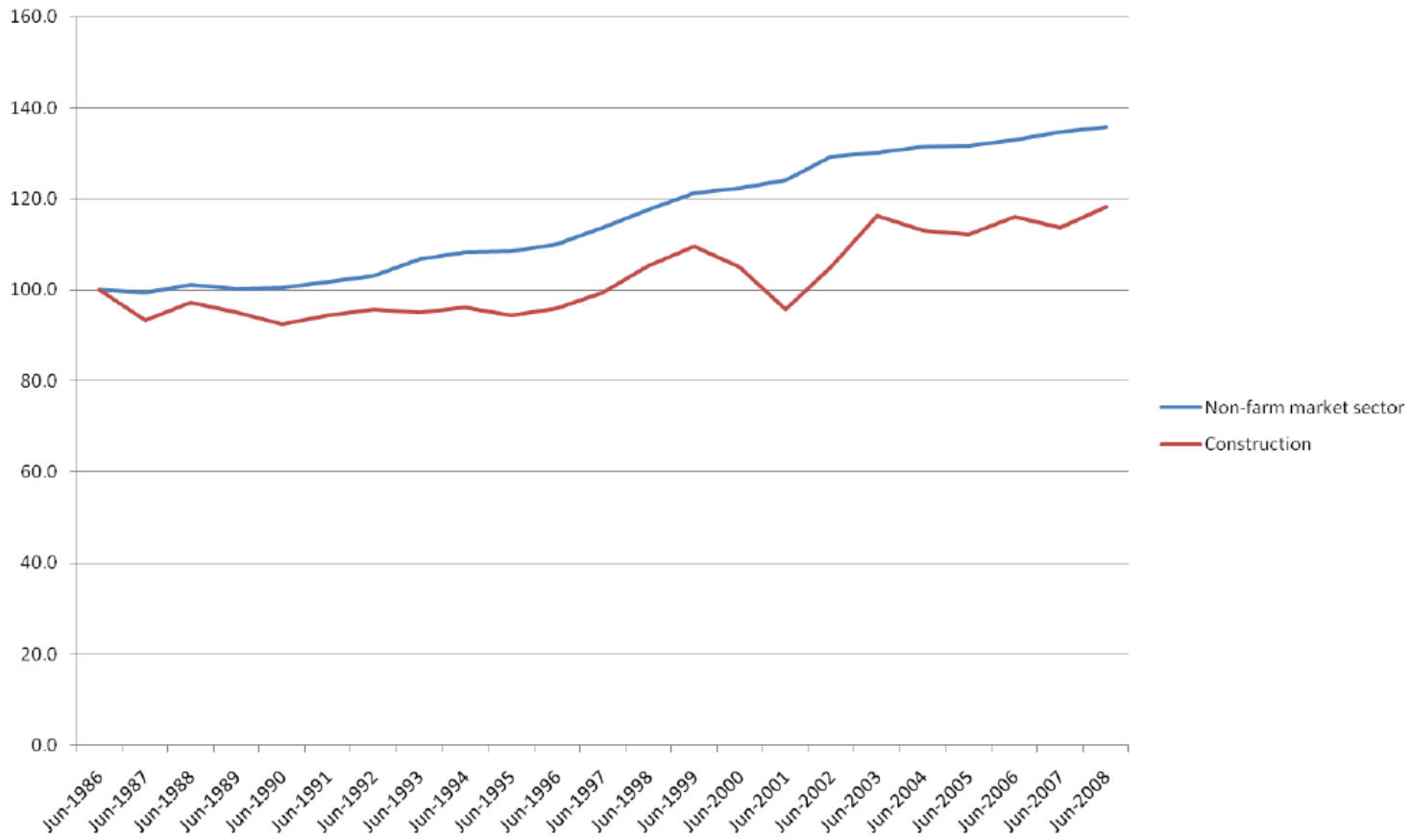
CONSTRUCTION AND NON-FARM LABOUR PRODUCTIVITY INDEX (GROSS VALUE ADDED PER HOUR WORKED) – reference year 1985-86



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Objectives

- Increase long term value for the owner
- Reduce time
- Eliminate waste
- Improve sustainability
- Improve profitability (with lower cost)
- Improved quality (whatever that means)
- Professional satisfaction and growth

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The current reality makes it necessary to find better ways

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Building Information Modelling

makes it possible to do so

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BIM Adoption 2009

- 2D only 24%
- 2D Mainly 26%
- Mix of 2D + 3D 44%
- 3D totally 6%

Autodesk survey

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Building Modelling

LEON ALBERTI 1404-1472

"*enables one to keep a clear notion of the distribution of the elements….the setting….the quantity of the building's parts and their arrangement….the formation of the walls….roofing etc….new solutions, even radically alter the original layout.*"

Three different categories of models

1. presentation models Florence Cathedral…competition purposes…choose from different models
2. simulate the structural features.
3. Working models built as accurately as possible to assists the mason

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- Illustrations of models exhibited around 1994 of thirty–one models of extant buildings realised in the 15th and 16th centuries
- RCS Films and TV S.p.A
  Milan, Italy 1994

Building Modelling

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Building Modelling

Building Modelling

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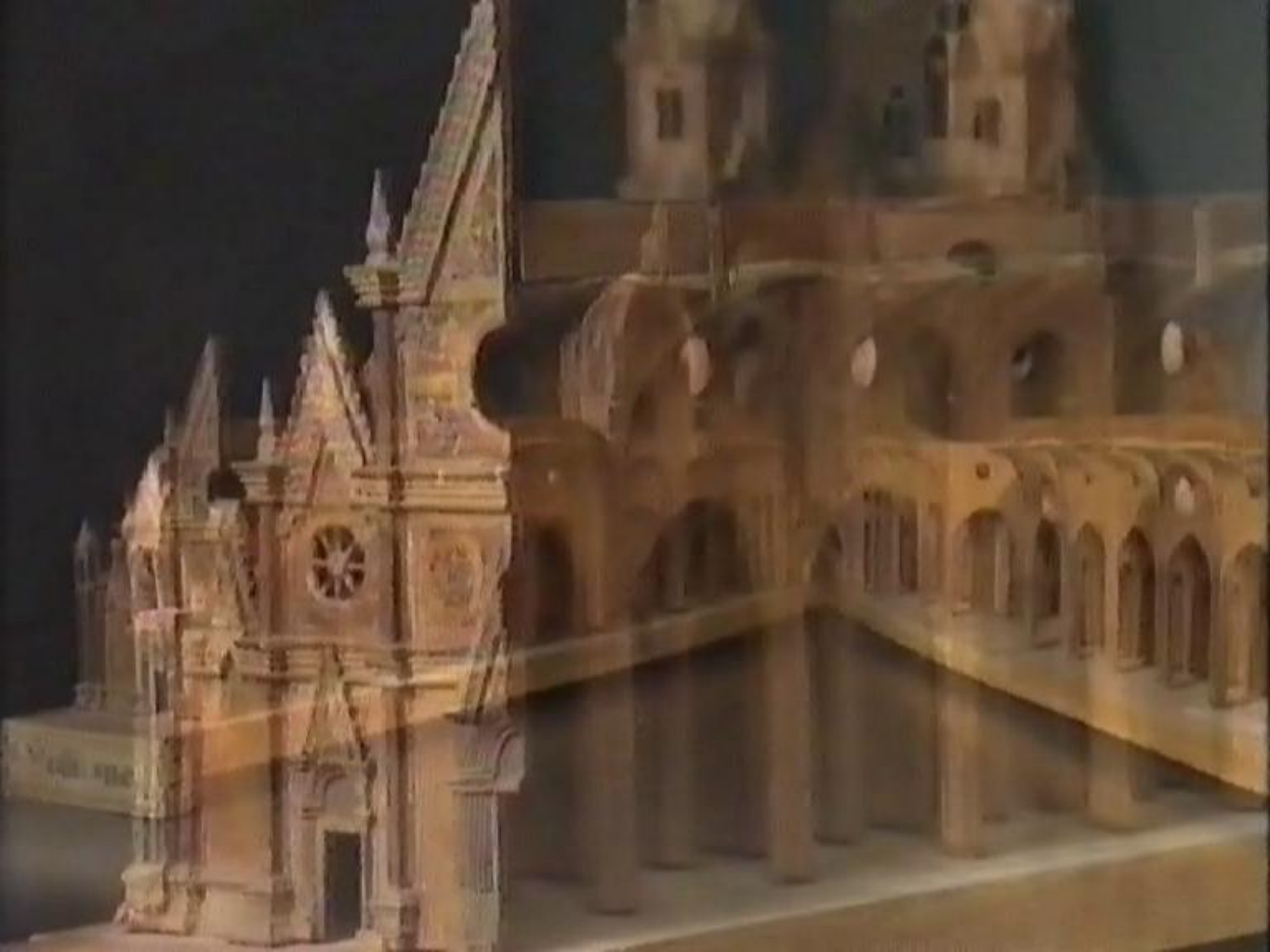

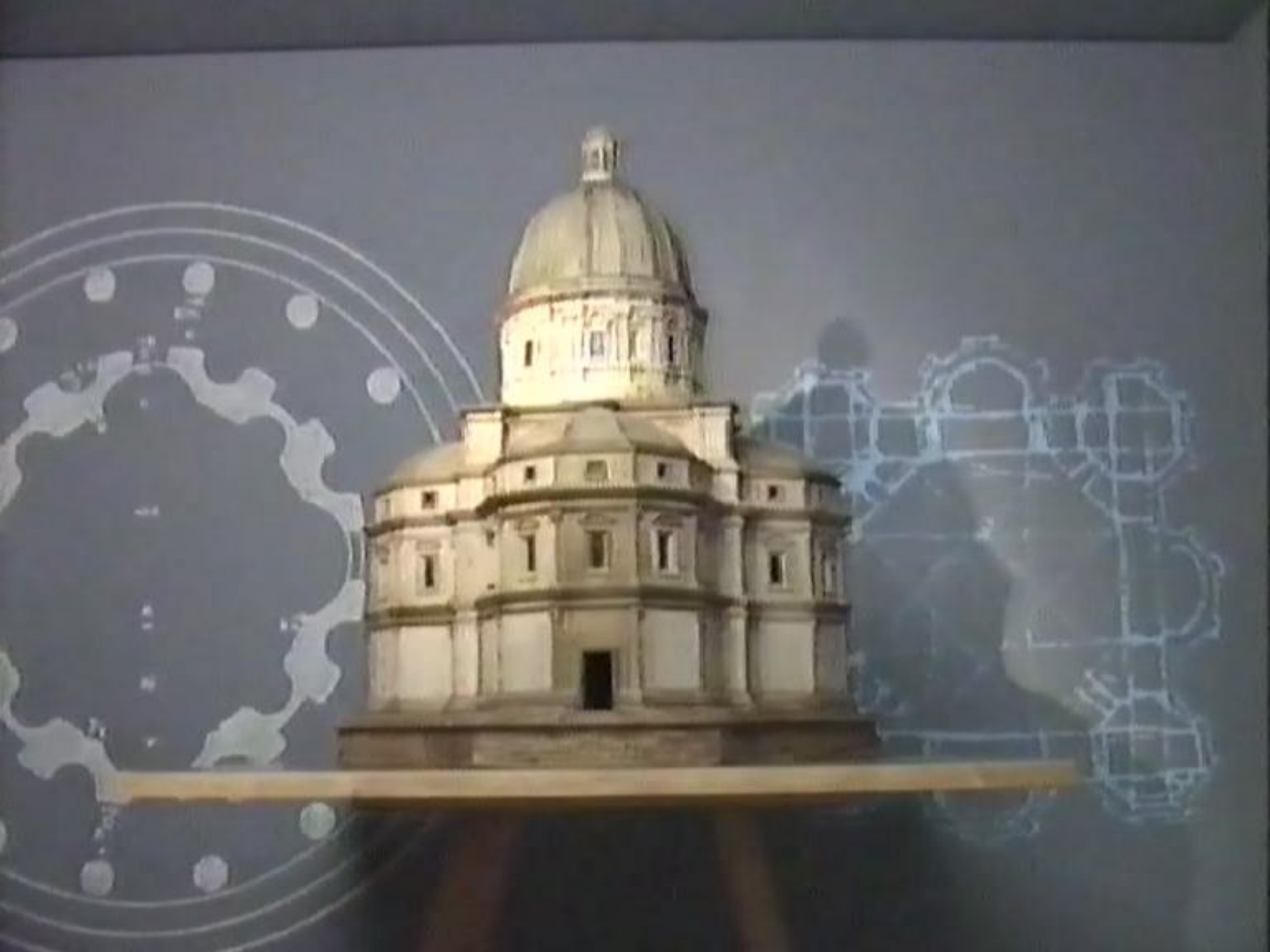

Building Modelling

Building Modelling

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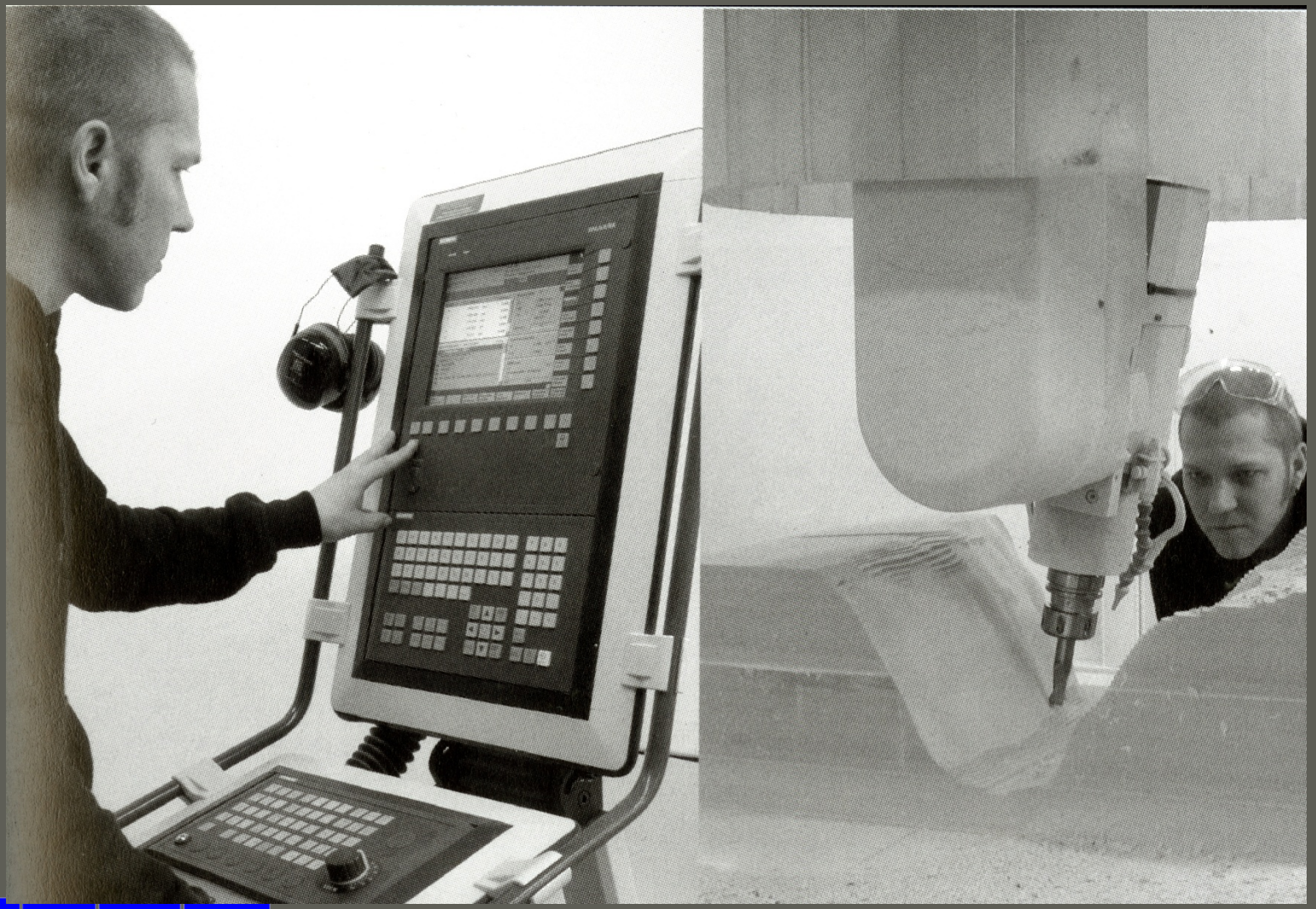
Building Modelling



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Building **Information** Modelling

The creation, communication and utilization of meaningful, accurate, complete and timely information

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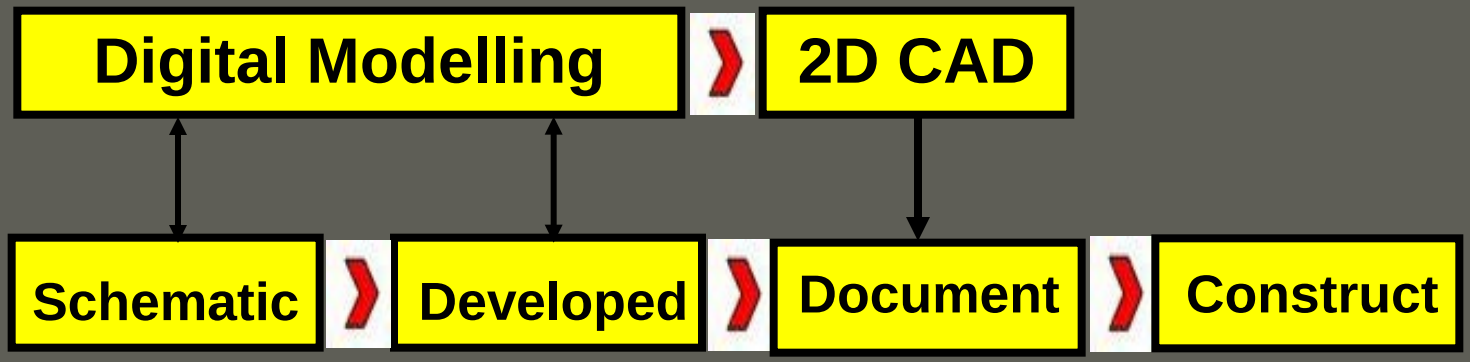
Traditional Methods + 3D



Design

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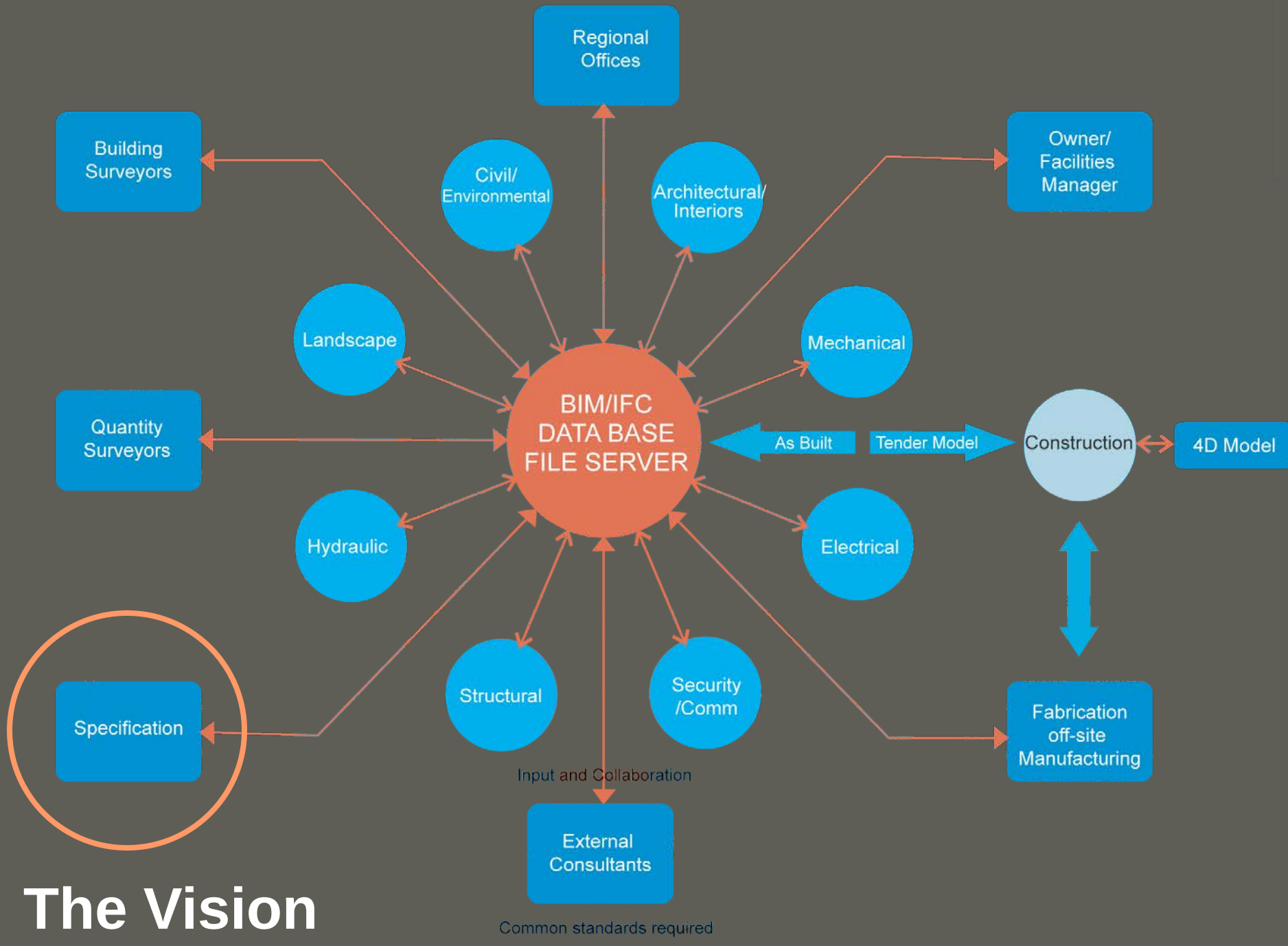
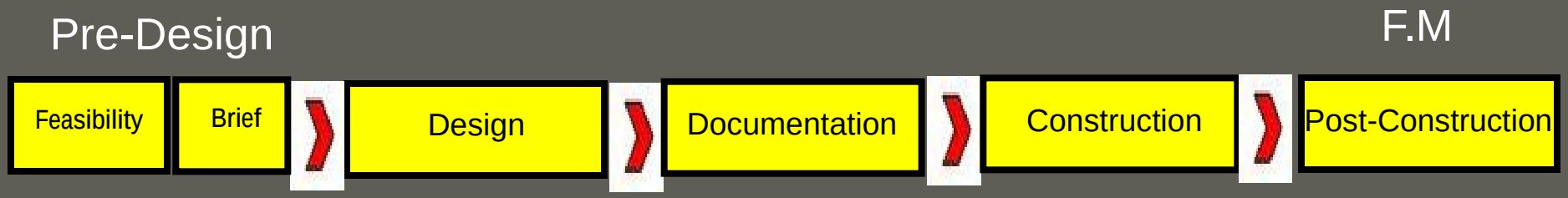

Regional Offices
Building Surveyors
Civil/ Environmental
Architectural/ Interiors
Owner/ Facilities Manager
Landscape
Mechanical
Quantity Surveyors
BIM/IFC DATA BASE FILE SERVER
As Built
Tender Model
Construction
4D Model
Hydraulic
Electrical
Specification
Structural
Security /Comm
Fabrication off-site Manufacturing
Input and Collaboration
External Consultants
Common standards required

The Vision

A Preferred Process



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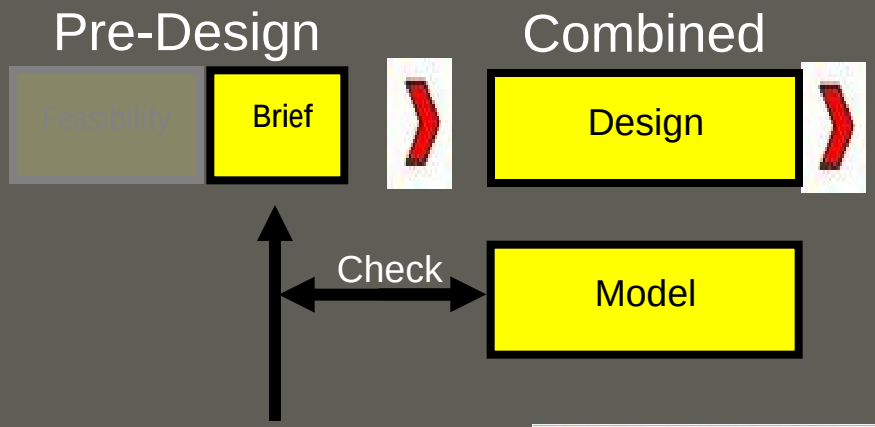
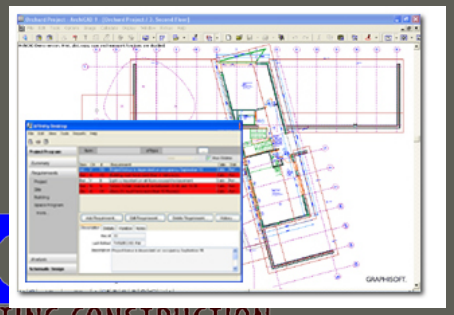
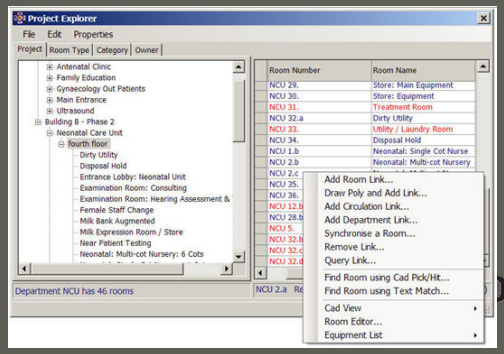
The Process – Pre-Design



Affinity / CodeBook





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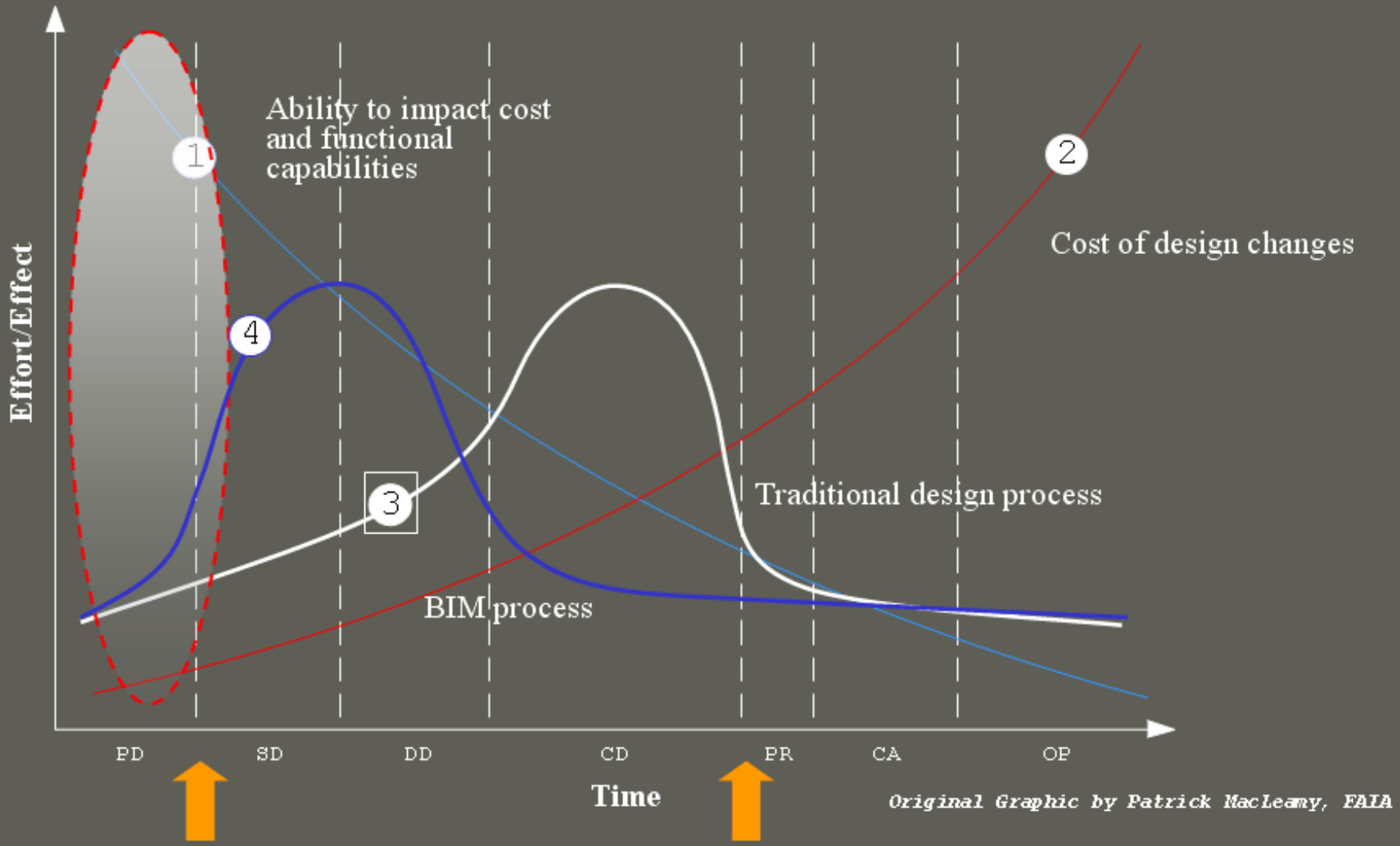
Documentation Flow



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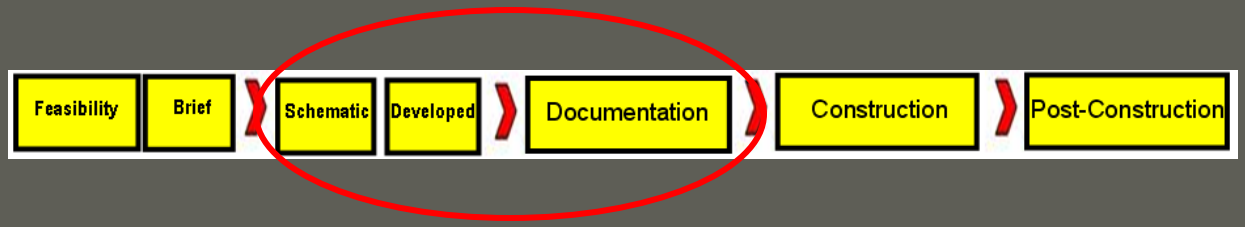
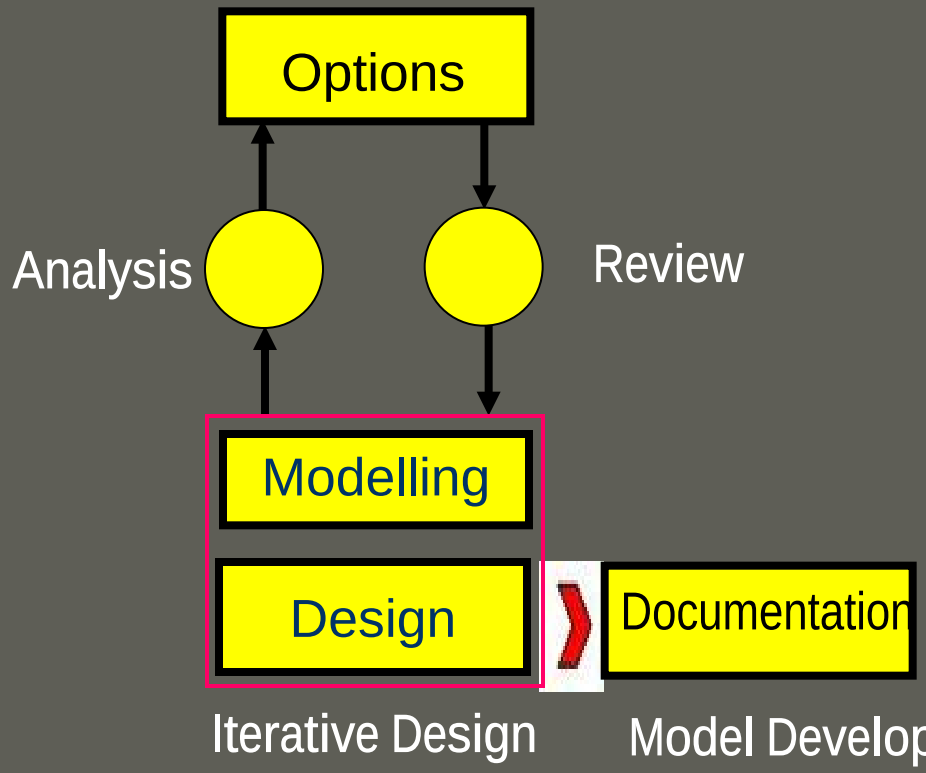
The Process –Design





STRUCTURE + SERVICES + SPECIALIST TRADE CONTRACTORS

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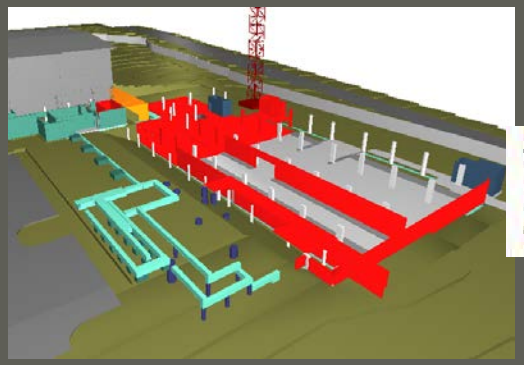
Construction-Facilities Management

Feasibility | Brief | Schematic | Developed | Documentation | Construction | Post-Construction

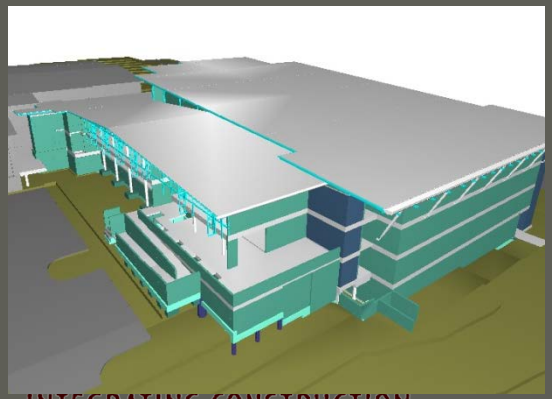
IFC CAD Model

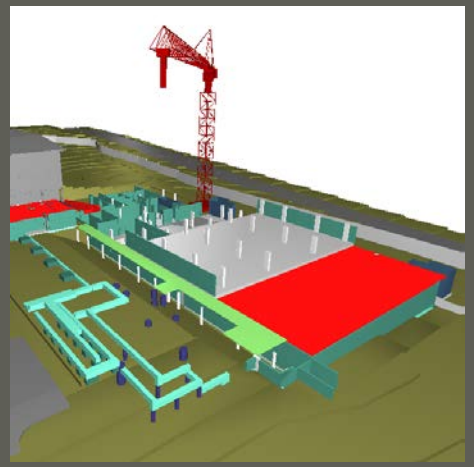
4D modelling

Site Installation



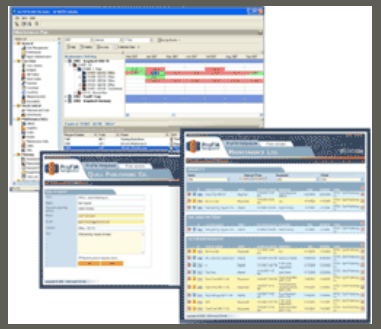
Construction → Post-Construction





ArtrA

ArchiFM



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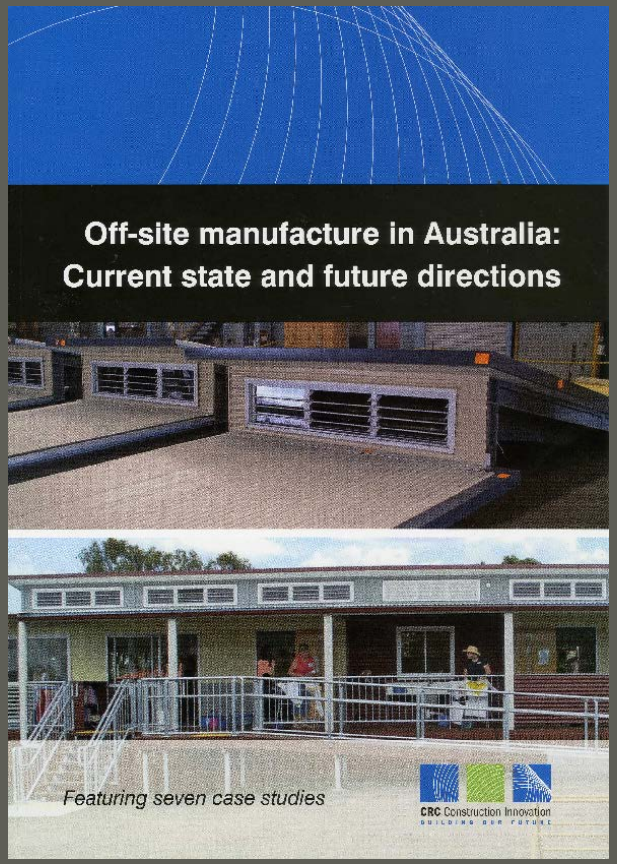
Off-site Manufacture



- A research project for the CRC-CI to document the state of play for OSM in Australia. (Nick Blismas from RMIT)
- Drivers and barriers
- Workshops in several States
- Action Plan
- Case Studies (Skilled Park)
- Links to BIM

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CRC-CI National Guidelines + Case Studies

- An initiative of the CRC-Construction Innovation to develop a document to promote a commitment to interoperability and a common direction in the Australian construction industry to the development of common strategies and standards for digital designs and construction

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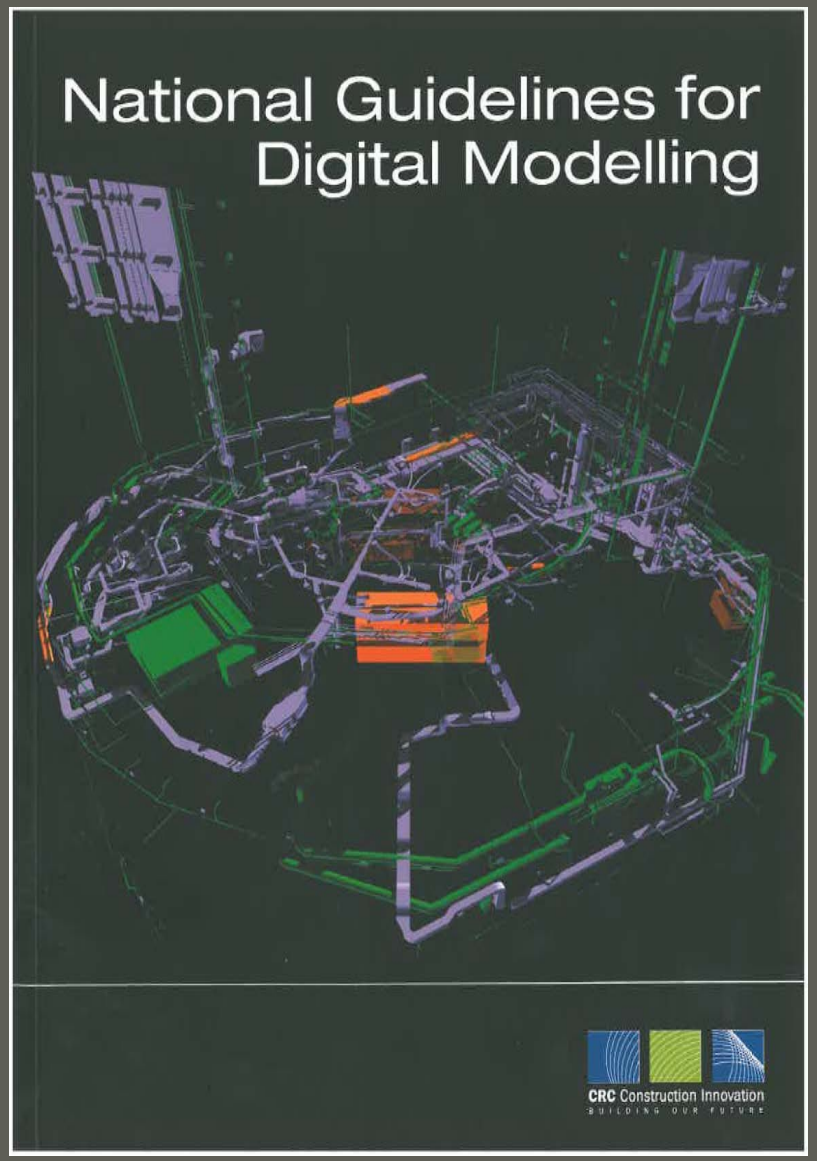

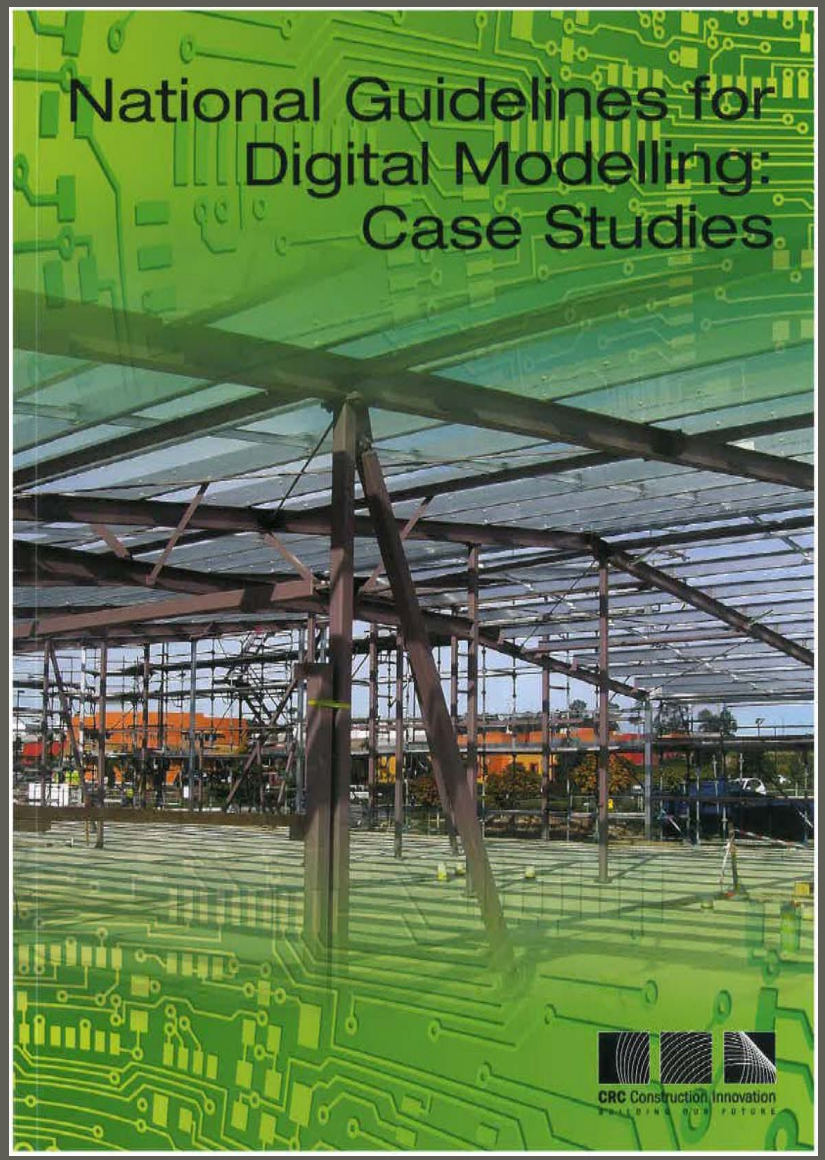

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- To avoid the uncertainty and disparate approaches that created inefficiencies with the implementation of 2D CAD for the past three decades.
- A “managers guide” rather than a standard
- Informed through lessons learned from case studies
- Collaboration with AIA Task Force

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TOWARDS INTEGRATION

Taking the Australian Construction Industry forward

TOWARDS INTEGRATION

WHERE WE WERE	WHERE WE ARE	NEXT STEP	WHERE WE ARE GOING

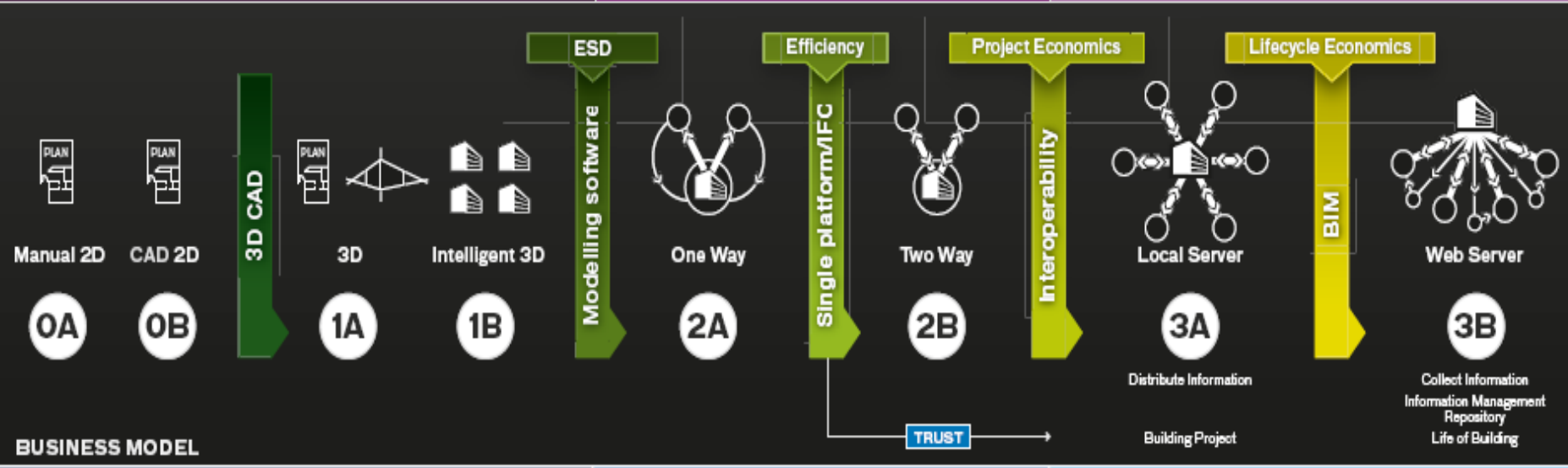
0 – 2D
Manual and CAD based (2D or 3D)

1 – MODELLING
Single-disciplinary use of object-based 3D modelling software within one discipline

2 – COLLABORATION
Sharing of object-based models between two or more disciplines

3 – INTEGRATION
Integration of several multi-disciplinary models using model servers of other network-based technologies

Representation	Prototype	Full Information Capture



ISOLATED	COLLABORATIVE	INTEGRATED

Legend

Communication type

traditional

digital

UPTAKE

Australian Institute of Architects

CRC Construction Innovation

Promotes the adoption of integrated multi-disciplinary models

- Pre-Design models
- Design models
- Construction models
- Fabrication models
- FM models

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The Future

- A National Research Centre for a sustainable built environment has succeeded the CRC.
- The Guidelines development will be continued by buildingSMART Australasia
- Object Libraries and expected to be a primary focus for the SBEnrc.

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Joint Contact Centre (JCC) Project

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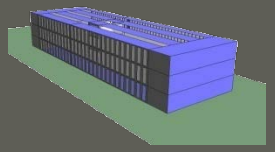
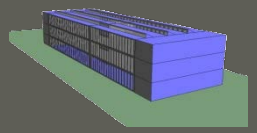
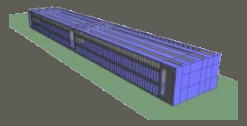
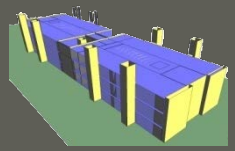
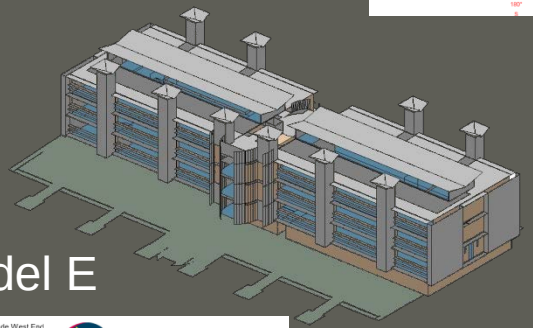
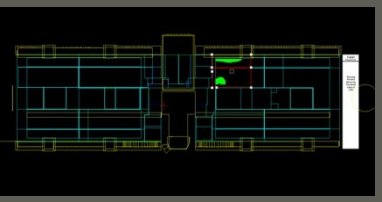
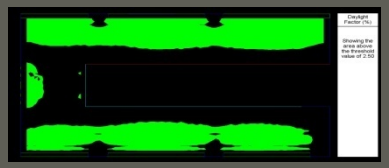
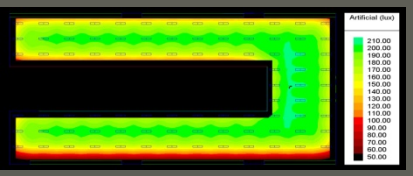
JCC Project IES: Energy Simulations

Analysing the Mass Model using IES: Energy Simulations.

Model A Model B Model C Model D Model E

Analysis calculation for room 0006200C (R006 SSQ Open Plan Area)

Summary results for working planes and floor

Surface	Quantity	Values Min.	Values Ave.	Values Max.	Uniformity (Min./Ave.)	Diversity (Min./Max.)
Working plane 1 Reflectance=0% Transmittance=100% Grid size=0.00 m Area=625.683m² Margin=0.50 m	Artificial illuminance	50.60 lux	173.93 lux	212.20 lux	0.29	0.24
	Daylight factor	0.0 %	0.0 %	0.0 %	0.00	0.00
	Daylight illuminance	0.00 lux	0.00 lux	0.00 lux	0.00	0.00
	Total illuminance	50.60 lux	173.93 lux	212.20 lux	0.29	0.24

Luminous efficacy for each working plane

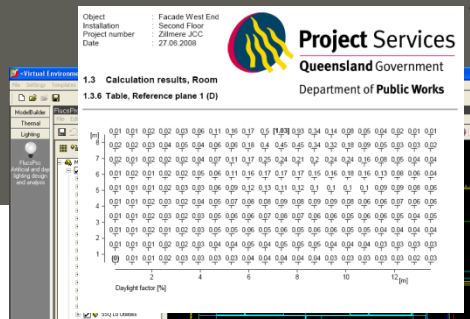
Name	Total base flux (lm)	Total luminaire power (W)	Power density (W/m²)	Power density (W/m²/100 lux))	Luminous efficacy (lm/W)
Working plane 1	236200.00	2784.00	3.87	2.22	81.25

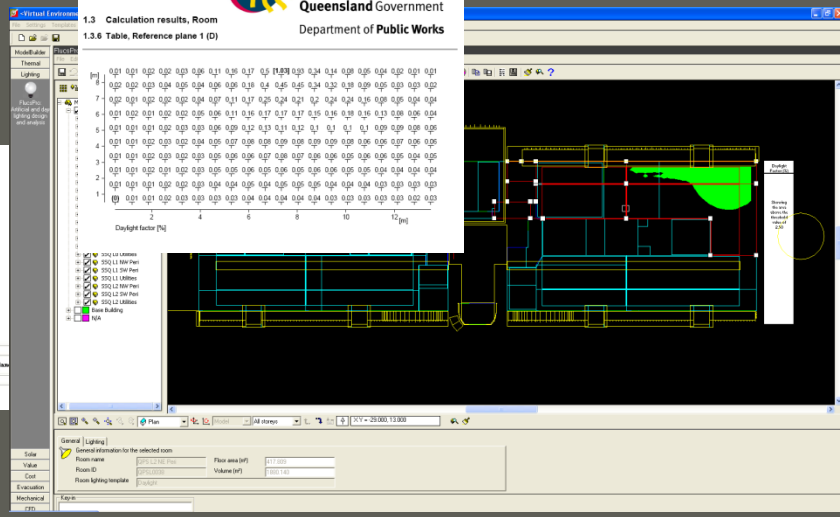
Input data and settings

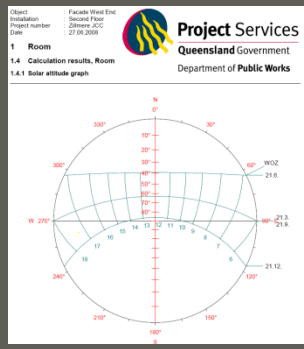
Numbers of surfaces used in the calculations

This room		Other visible rooms in the model		Visible rooms in the obstruction file		Ground plane
Internal surfaces	Surfaces of components	External surfaces	External openings	External surfaces	External openings	External surfaces	
53	0	32	0	0	0	0	1

ready in the building model) was added at the height set by the user (3.750 m above the floor), with reflectance 80.0%







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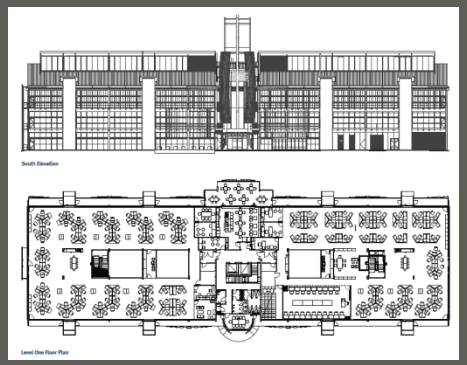
JCC Project



JCC Project

- $35 Million
- Undertaken by Project Services
- Internal consultants
- Trialling data transfer via IFC

Disciplines

- Architecture
- Structural
- Hydraulic
- Mechanical
- Electrical
- Civil
- Landscape
- Quantity Surveying

Software

- Affinity (design brief software)
- ArchiCAD 11 (Architectural Design Software)
- IES (Mechanical design software)
- Revit MEP (Mechanical, Hydraulics & Electrical Software)
- Revit Architecture (Architectural Documentation)
- ArchiCAD 11 (Office Interiors)
- ArchiCAD 11 (Landscaping Design)
- 12D

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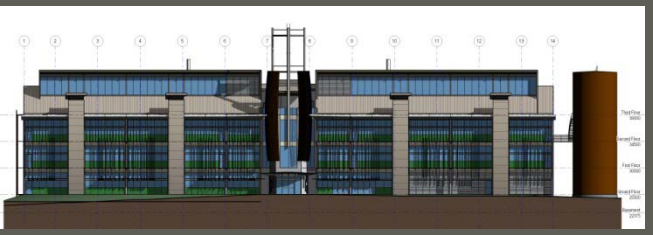
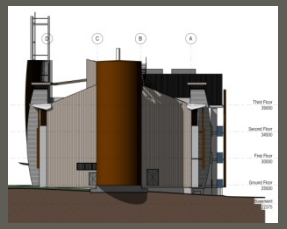
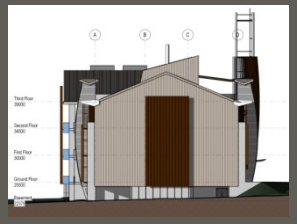
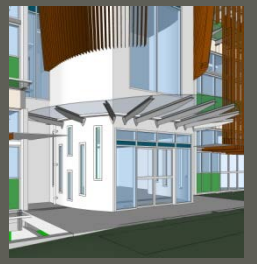
Architectural Discipline







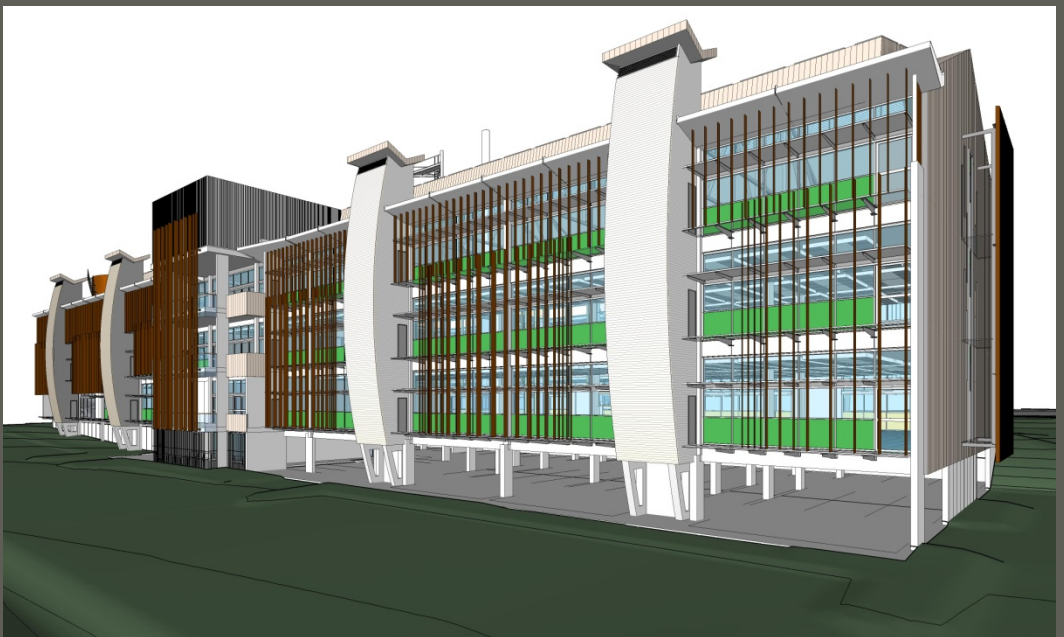


JCC Project

- Architecture used Revit for documentation.
- Transferring between disciplines using single stream application. Some IFC Transfer

Future Projects

- Architecture to use more of the IES analysis tools.
- Uniform Shared Co-ordinate system.
- Improve links to non Revit applications. Using IFC, GBXml or API translators.
- Development and enhancement of cost codes linking to CostX.
- Import 12D via new IFC exporter in 12D
- Implement stages of releasing areas of information rich objects.
- modelling for other disciplines.
- Develop and enhance more



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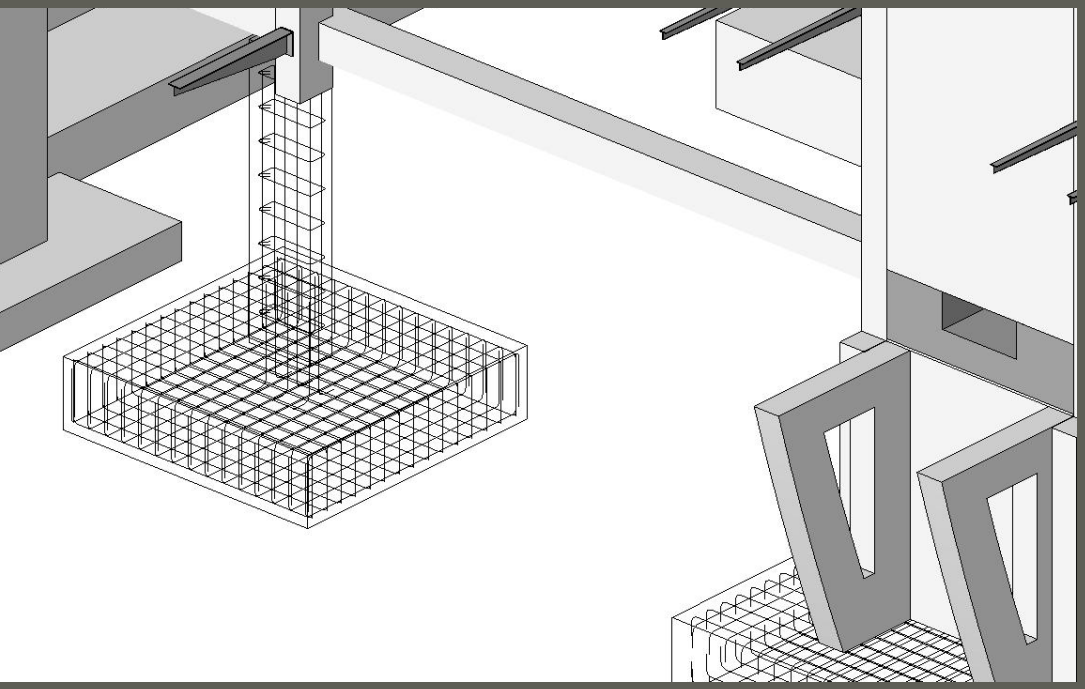
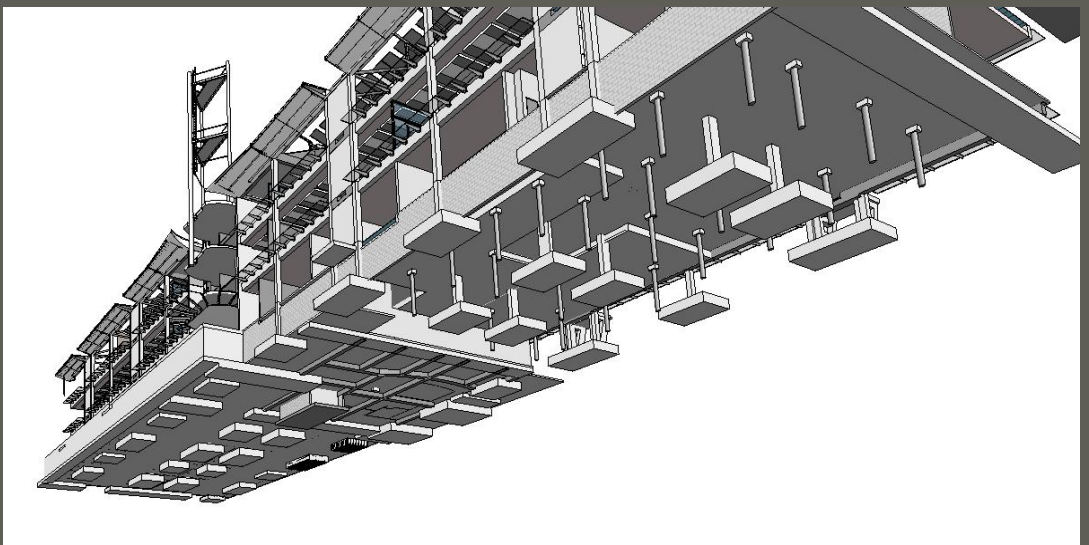
Structural Discipline





JCC Project

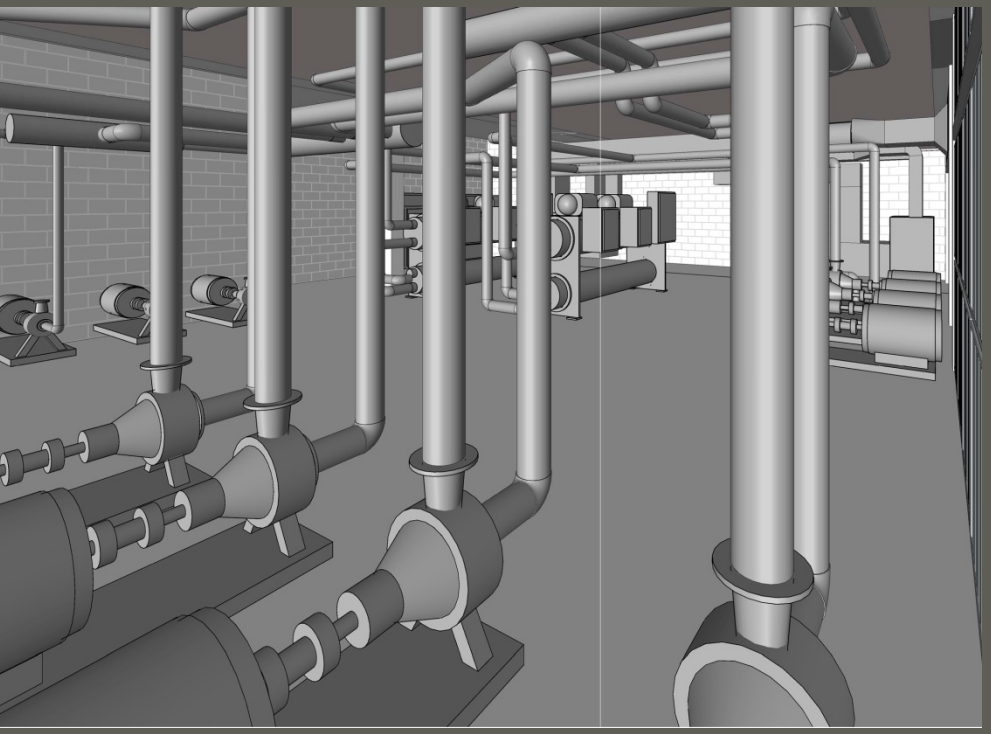
- Structural used Revit for documentation.
- Transferring between disciplines using single stream application. Some IFC Transfer
- Structural Model was incorporated in the Architectural.

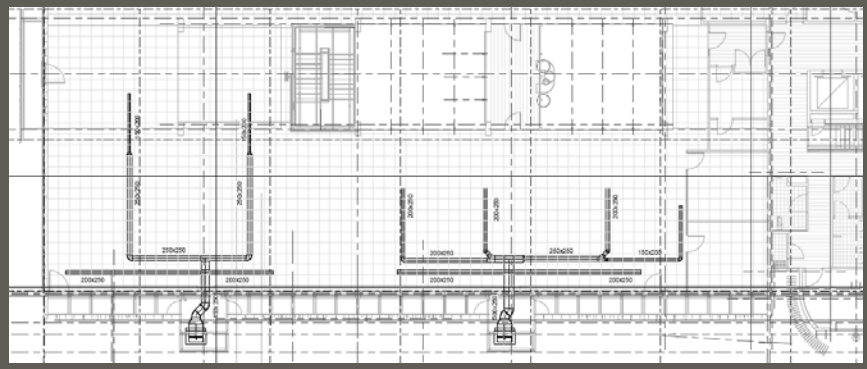
Future Projects

- Structural to use more analysis tools linking into the model.
- Uniform Shared Co-ordinate system.
- Improve links to non Revit applications. Using IFC, GBXml or API translators.
- Development and enhancement of cost codes linking to CostX.
- Implement stages of releasing areas of modelling for other disciplines.
- Develop and enhance more information rich objects.
- Separation of models allowing ease of work flow and reduction in file size.

Project Services

Mechanical Discipline



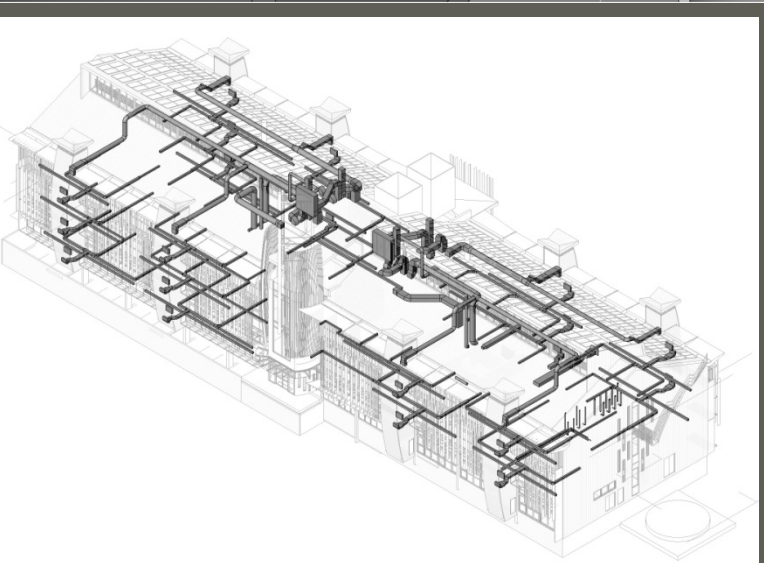


JCC Project

- Mechanical use Revit MEP
- Transferring between disciplines using single stream application.

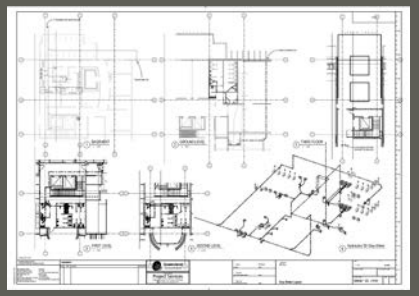
Future Projects

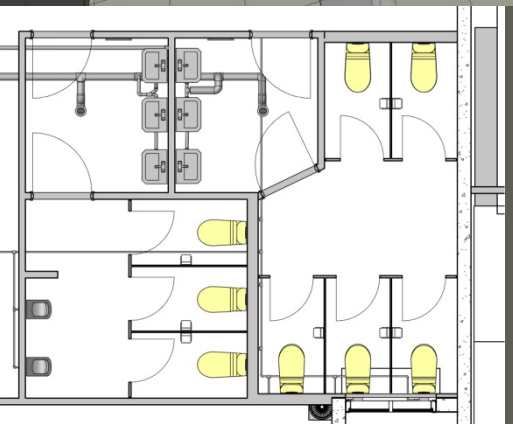
- Mechanical to use more of the IES analysis tools.
- Uniform Shared Co-ordinate system.
- Improve links to non Revit applications. Using IFC, GBXml or API translators.
- Develop and enhance more information rich objects.



Project Services

Hydraulics Discipline





JCC Project

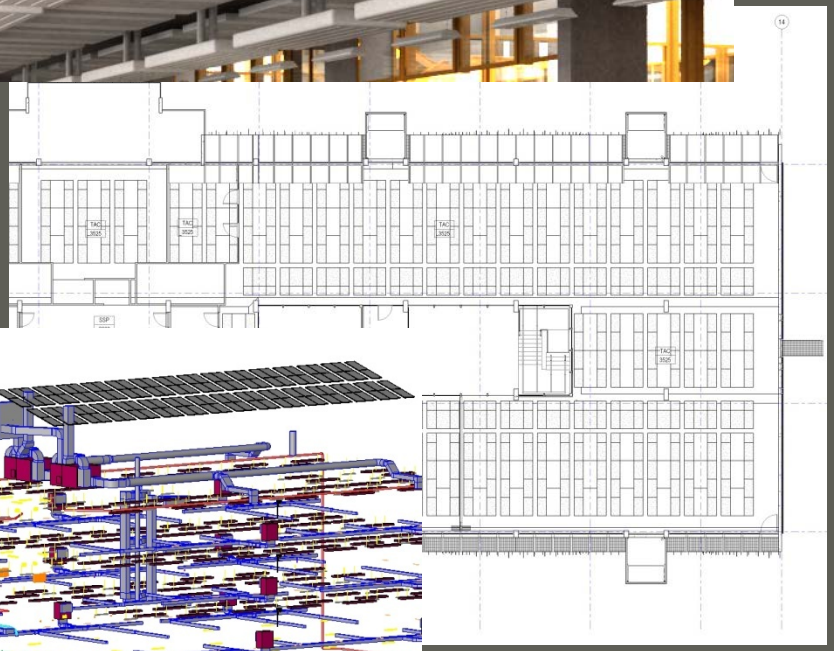
- Hydraulics used Revit MEP
- Transferring between disciplines using single stream application.

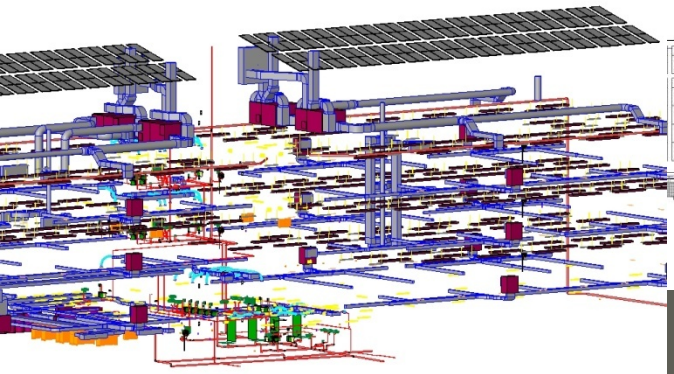
Future Projects

- Hydraulics to use more of the IES analysis tools.
- Uniform Shared Co-ordinate system.
- Improve links to non Revit applications. Using IFC, GBXml or API translators.
- Develop and enhance more information rich objects.

Project Services

Electrical Discipline





JCC Project

- Electrical used Revit MEP and IES.
- Transferring between disciplines using single stream application, GBXml and text inputs.

Future Projects

- Uniform Shared Co-ordinate system.
- Improve links to none Revit applications. Using , IFC , GBXml or API translators.
- Develop and enhance more information rich objects.
- Use IES at early design stage with Google Sketchup
- One room analysis via early design
- Experience, training and formal approach to ESD & design, mechanical, electrical, architect
- Building library elements to have built-in wiring rules from AS3000 inputted directly into both Revit & IES.

Project Services

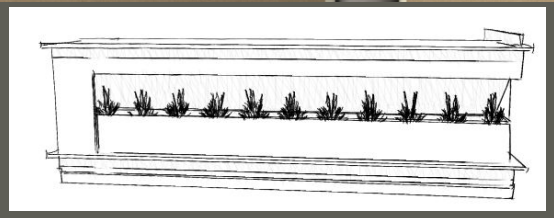
Office Interiors Discipline

JCC Project

- Office Interiors used ArchiCAD for documentation.
- Transferring between disciplines using IFC Transfer
- We also export a DWG file to allow 2D information in.
- We then export an IFC file with just the joinery elements as a link file into the Revit file.

Future Projects

- Improve links to Revit applications. Using , IFC , GBXml or API translators.
- Development and enhancement of cost codes linking to CostX.
- Develop and enhance more information rich objects.



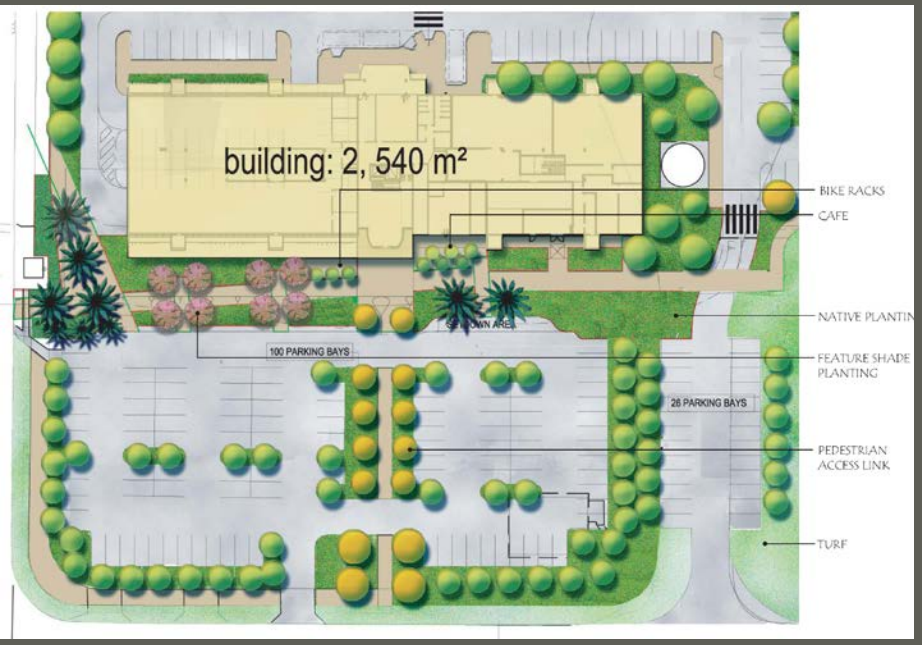
Security / Reception Counter

Personal Storage

Kitchen / Lunchrooms

Project Services

Landscaping Discipline

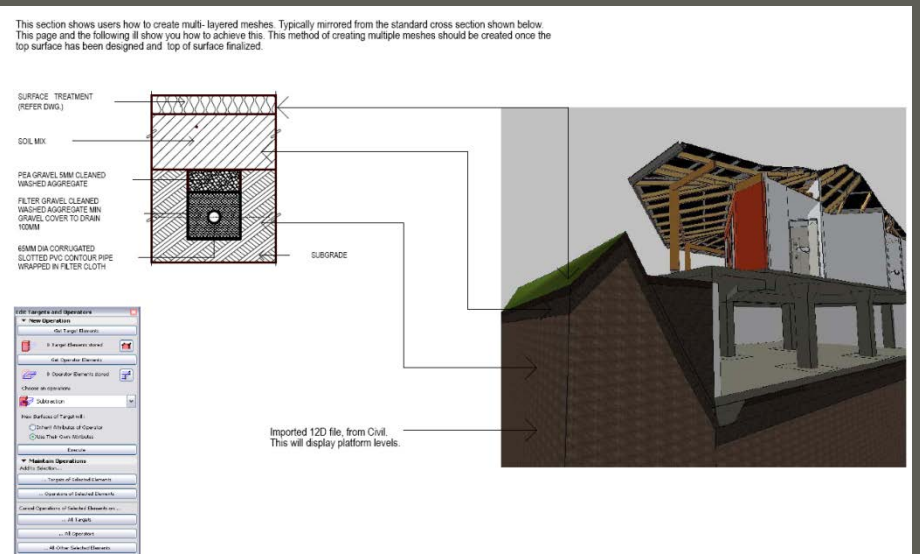


JCC Project

- Landscaping used AutoCAD for documentation.
- Transferring between disciplines using 2D CAD methods.

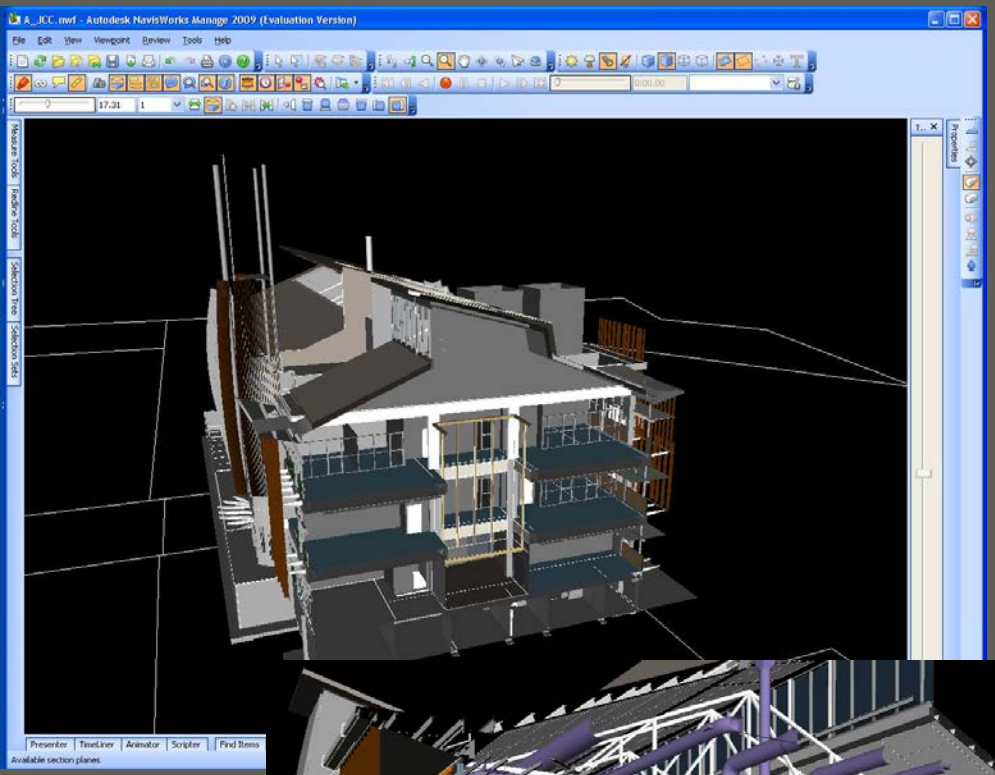
Future Projects

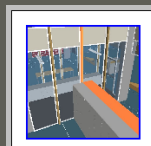
- ArchiCAD to be used by other users within the Landscaping area
- Links with 12D as platform levels and 3D Landscaping surface levels
- Utilising developed and enhance information rich objects.
- Implement stages of releasing areas of modelling for other disciplines.



Project Services

Clash Detection & Navisworks





Name	Clash61
Distance	-0.00000047m
Description	Hard
Status	Active
Clash Point	-16.75m, 1.91m, 26.60m
Date Created	2008/8/20 02:55:48
Approved By	

Item 1

Layer	Ground Floor
Item Name	175 x 75mm
Item Type	Solid

Item 2

Layer	Joinery (New)
Item Name	Whitewash
Item Type	Colour Body

JCC Project

- Clash Detection reports run with Navisworks.
- Navisworks Viewer allow other users to view the model.

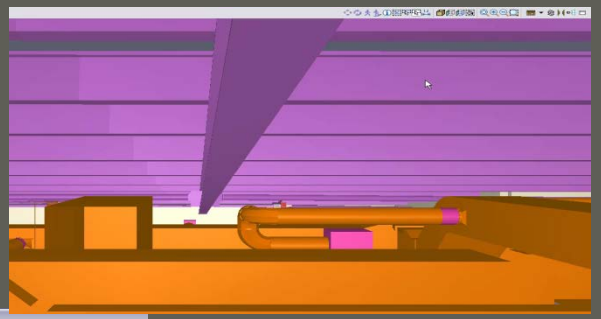
Future Projects

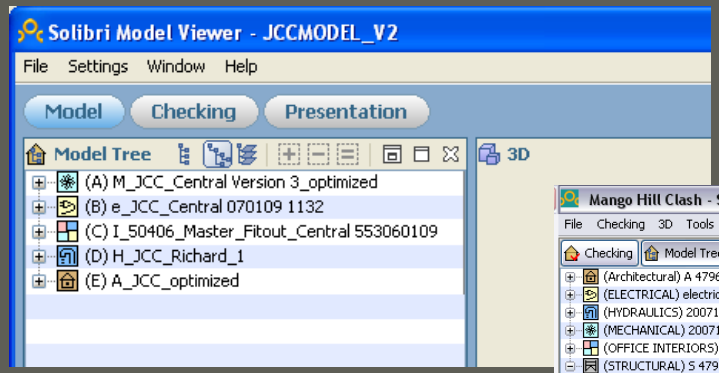
- Refine Clash reports
- Utilize 4D with in Navisworks with links back to CostX
- Link hyperlinks to elements for maintenance manuals to give to clients through viewers.

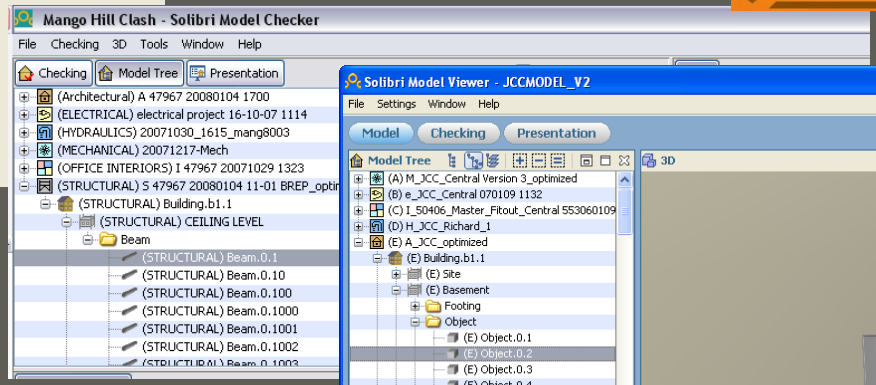
ICE INTEGRATING CO

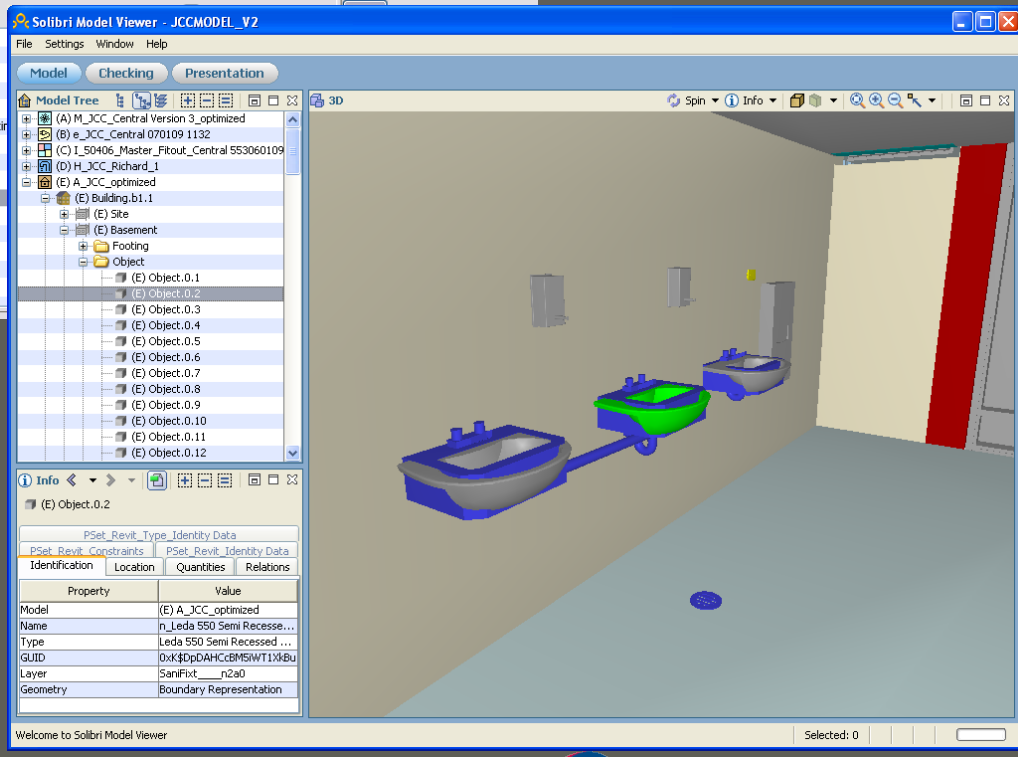
Project Services

Solibri Model Viewer









JCC Project

- Clash Detection reports run with Solibri.
- Solibri file were given to contractors for intergrading the model in tender stages.

Future Projects

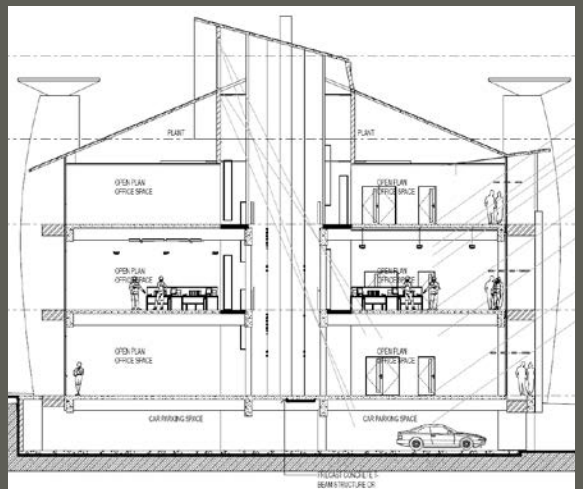
- Create set rules in solibri
- Training and rollout of viewers to all CAD users for checking.

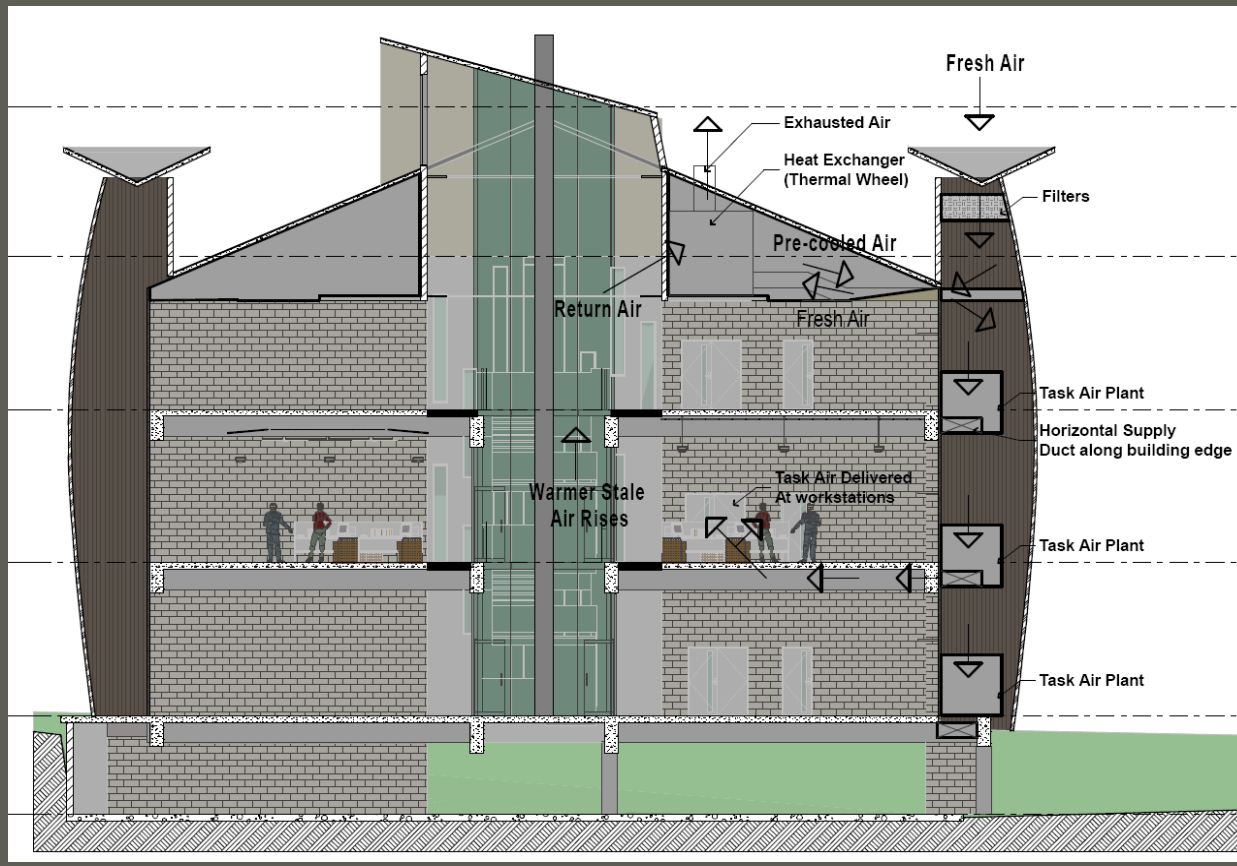
ICIS INTEGRATING CONSTRUCTION

Project Services

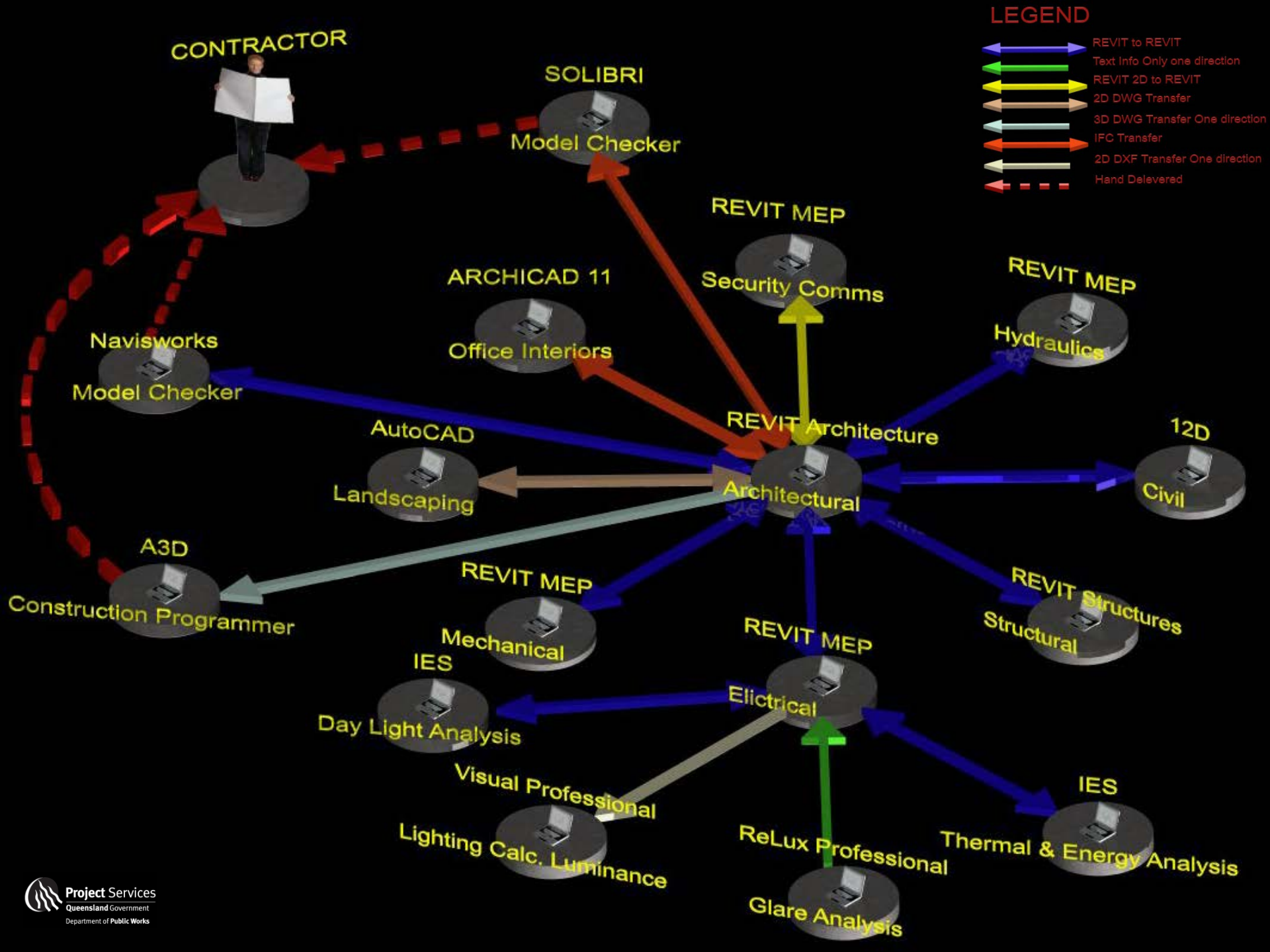
JCC Green Star

- Using Modelling and analysis to assist in Green design
- Lighting and Glare Analysis to maximise natural lighting





Project Services


LEGEND
REVIT to REVIT
Text Info Only one direction
REVIT 2D to REVIT
2D DWG Transfer
3D DWG Transfer One direction
IFC Transfer
2D DXF Transfer One direction
Hand Delevered
CONTRACTOR
SOLIBRI
Model Checker
REVIT MEP
Security Comms
ARCHICAD 11
Office Interiors
REVIT MEP
Hydraulics
Navisworks
Model Checker
REVIT Architecture
Architectural
AutoCAD
Landscaping
12D
Civil
A3D
Construction Programmer
REVIT MEP
Mechanical
REVIT Structures
Structural
IES
Day Light Analysis
REVIT MEP
Elictrical
Visual Professional
Lighting Calc. Luminance
ReLux Professional
Glare Analysis
IES
Thermal & Energy Analysis
Project Services
Queensland Government
Department of Public Works

Integrated Project Delivery

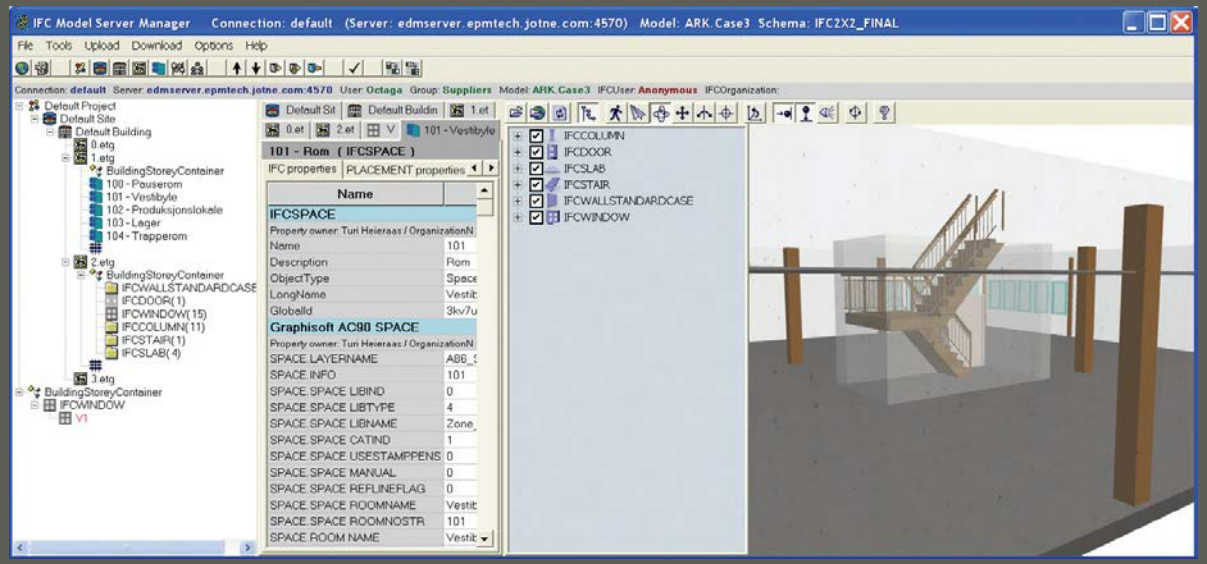
- Joint working party of the Australian Procurement and Construction Council (APCC) and the Australian Construction Industry forum (ACIF)
- A more collaborative and accountable delivery model that needs to engage with the whole team of consultants, contractor and specialist trade contractors during design stages and beyond
- Can engage with off-site manufacture better
- Alliancing delivery to client appointed team based on capacity to work together
- Issues of probity, value for money and establishment costs
- Complexity of the industry
- Very compatible with digital design and modelling

ICIS INTEGRATING CONSTRUCTION

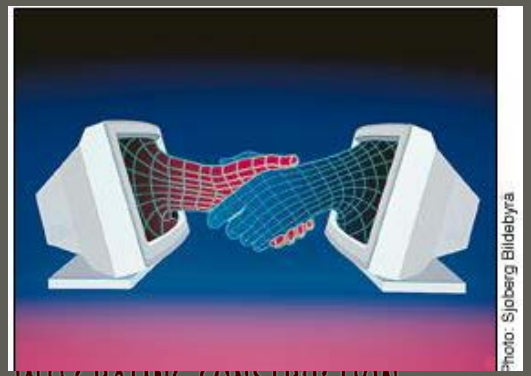
Project Services

Model server

Jotne EPM Technology



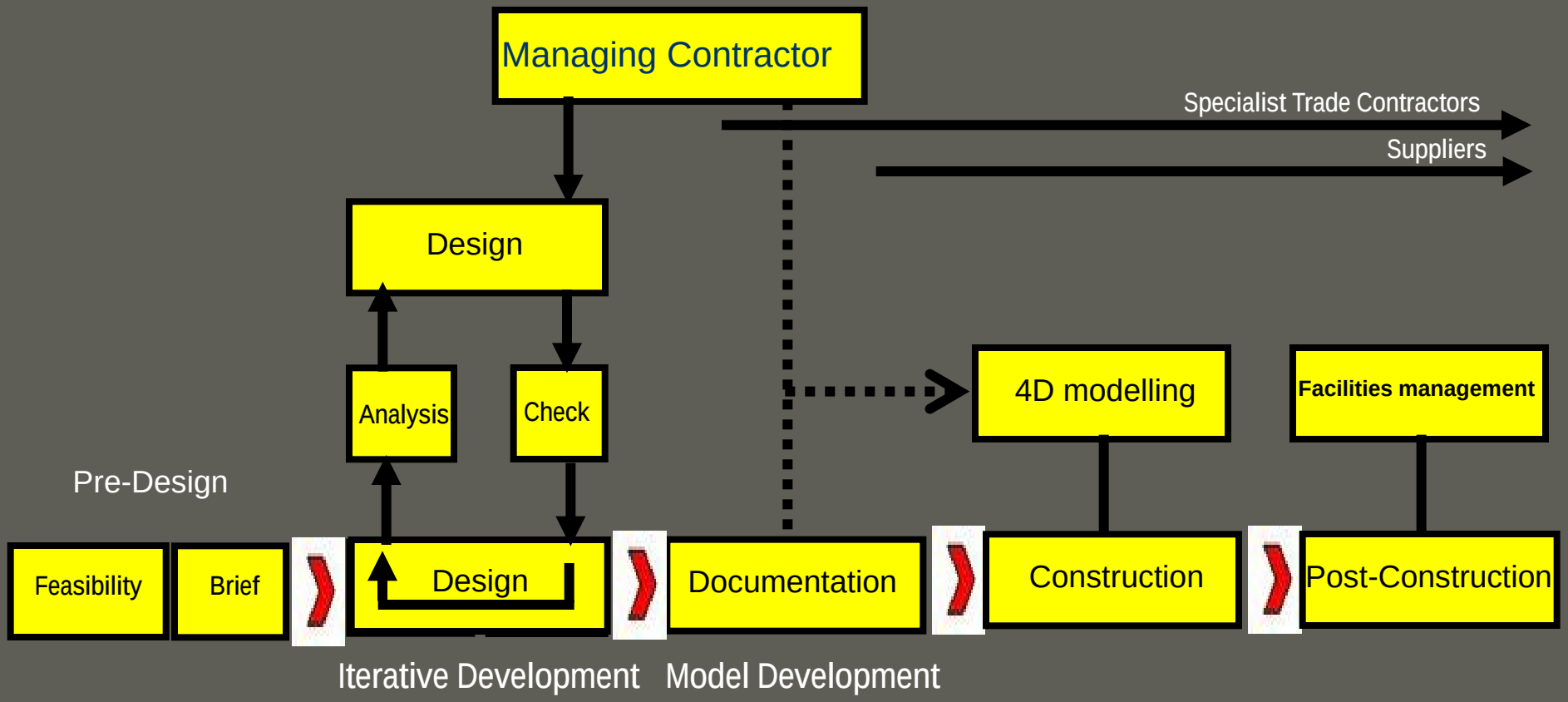
- minimize product life-cycle costs
- provide product life cycle support (PLCS)
- ensure data integrity
- collaborate in virtual or extended enterprises
- shorten product development cycles
- support concurrent product and process development
- respond with agility to changing customer needs



INTEGRATING CONSTRUCTION

Project Services

Integrated Project Delivery



STRUCTURAL SERVICES

COLLABORATION

ICIS INTEGRATING CONSTRUCTION

Project Services

Role Changes & Partnerships

Changes may include

- CAD Draftsperson Changing into Construction modellers
- Sub-Contractors ,Builders and Suppliers being consultants at design stages of projects.
- Emphases on Design Stages and minimizing Documentation Stages. Ownership and transfers of models with Design and Documentation Stages.
- Introduction of one person to co-ordinate these processes BIM Manger

ICIS INTEGRATING CONSTRUCTION

Project Services

Specification

- A quality control document
- Information complementary to the drawings
- What role will it play in the future?

ICIS INTEGRATING CONSTRUCTION

Project Services

Building Modelling

Questions

ICIS INTEGRATING CONSTRUCTION

Project Services