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Chief Operating Officer,
Research and Commercialisation

Sydney Research Symposium

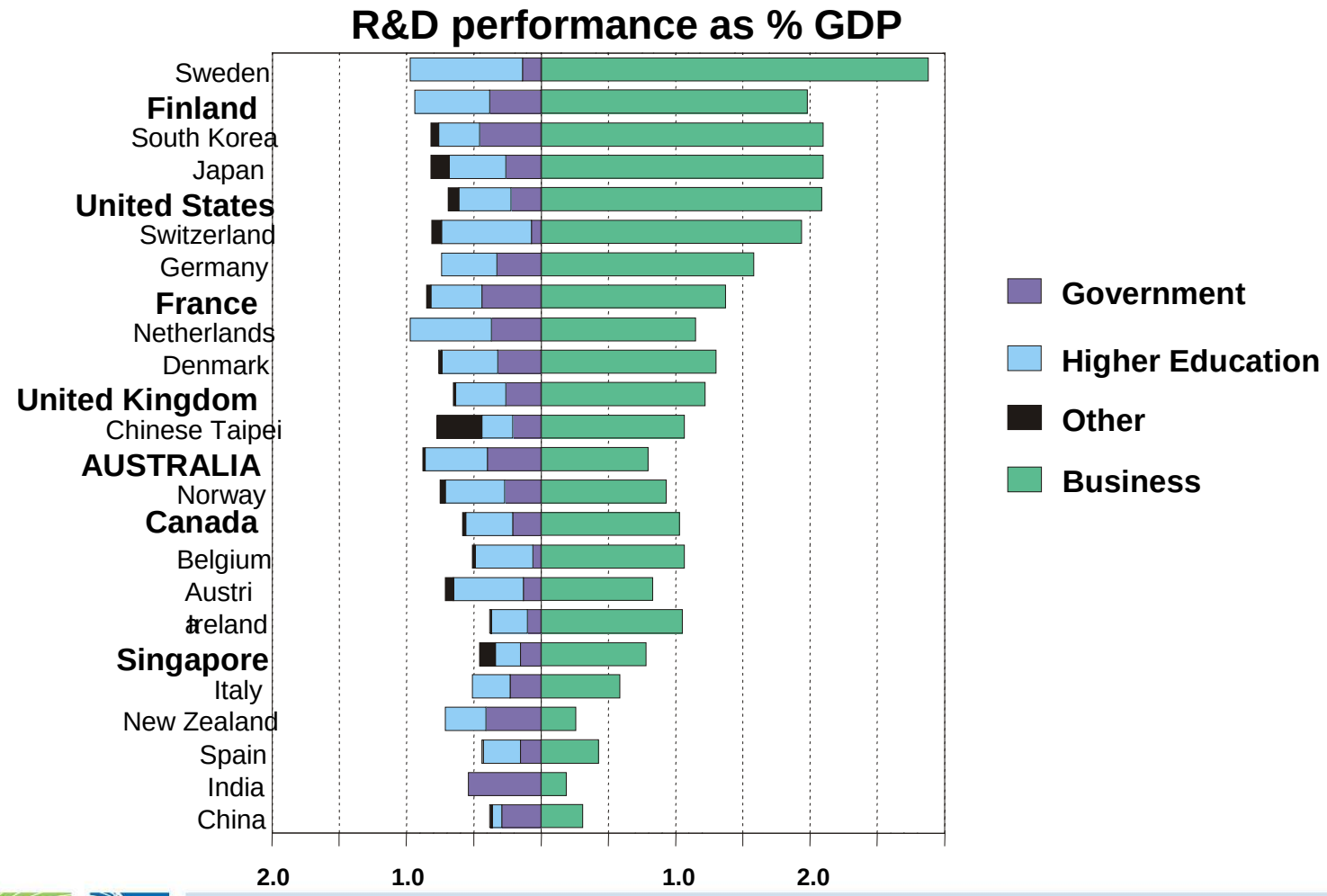
4 June 2007

Cooperative Research Centre (CRC) for *Construction Innovation*

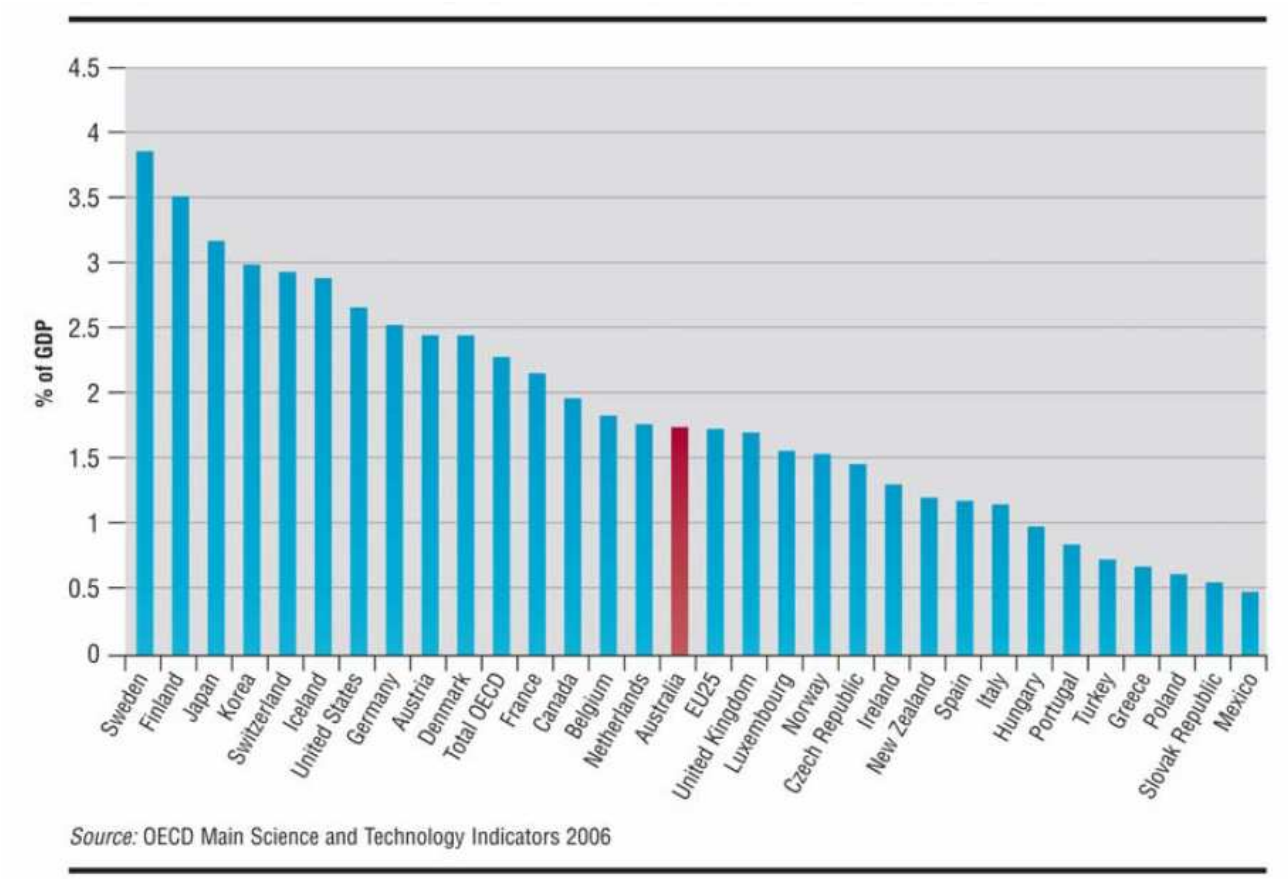
- International context of R&D
- Construction Innovation background
  - Current focus
  - Future focus
- Benefits of research in this industry

International context of R&D

International R&D Performance

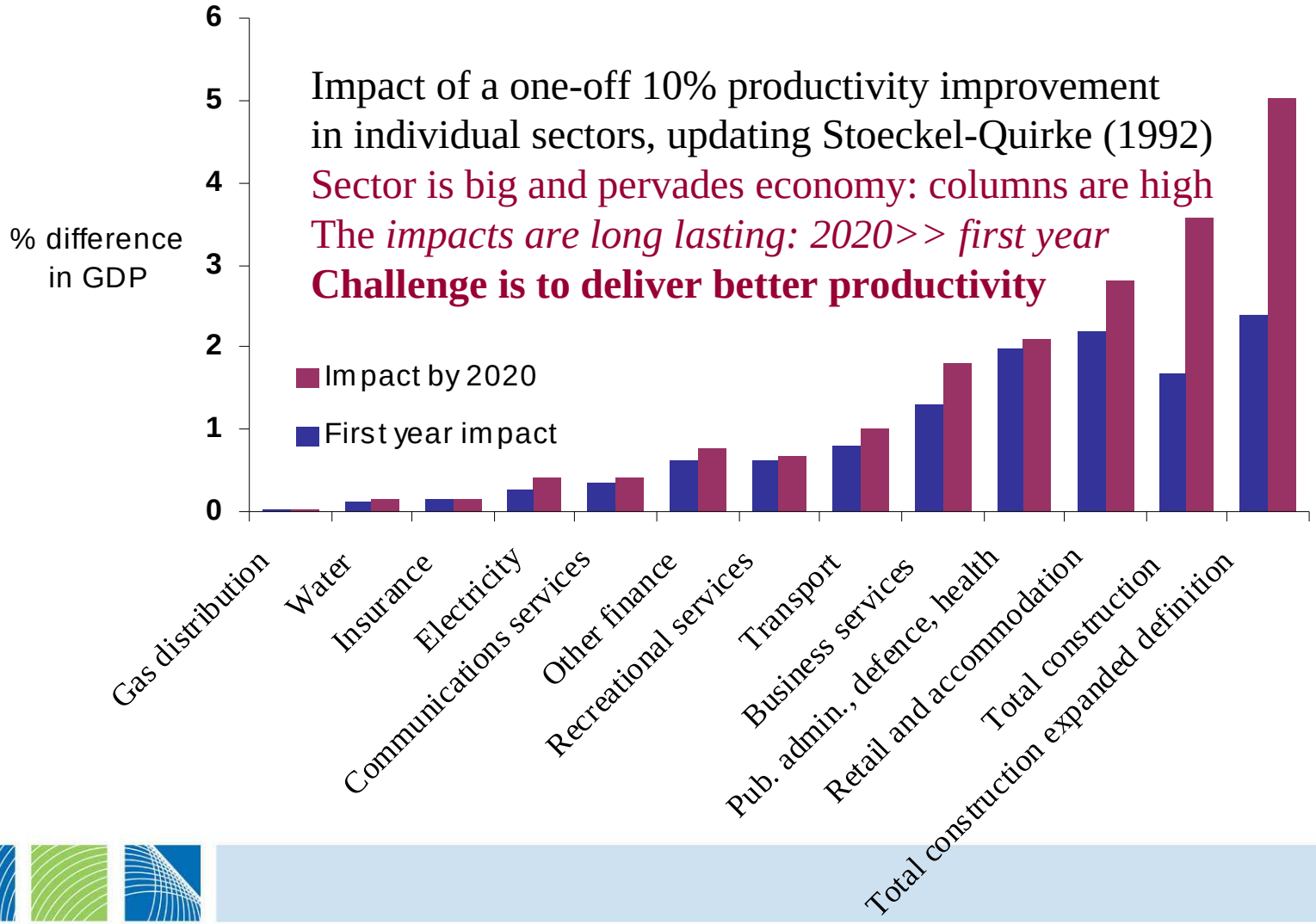


Gross domestic expenditure on R&D in OECD countries



Source: OECD Main Science and Technology Indicators 2006

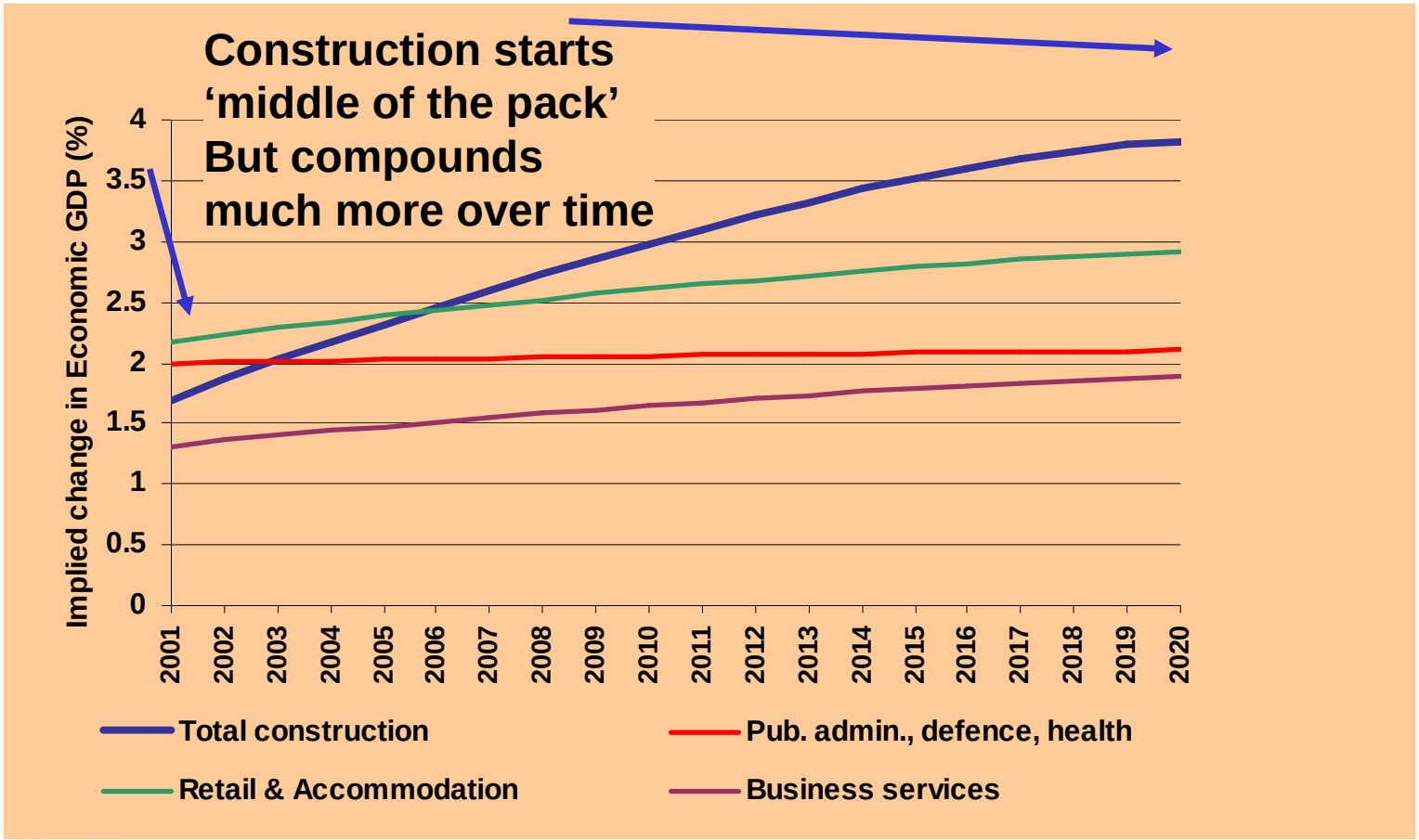
Construction Innovation Matters



Impact of Construction Productivity Gain

Growth impact of a one-off productivity improvement in selected sectors

(Source: ACIL Tasman, 2005)



Design, Construction, Property and FM Industry

- **Strong multiplier linkages – mining and transport**
- **Macro economic multipliers:**
  - **a one-off sustained 10% improvement in producivity is assumed in each service sector**
  - **the construction sector will have the biggest average annual impact on GDP, at 3% over 20 years (2000-2020)**
- **Construction Sector Contributes 20% of GDP (including FM)**
- 1 in 5 dollars generated in the Australian economy is generate by the AEC-FM industry.

Design, Construction, Property and FM Industry

- Growing at average rate of 2.6% pa
- Sector income A$130 billion
- Highly fragmented
  - 230,000 firms employing 730,000 people
  - 94% of businesses employ less than 5 people
- Federal Government Action Agenda clearly supported formation of CRC to service property and construction

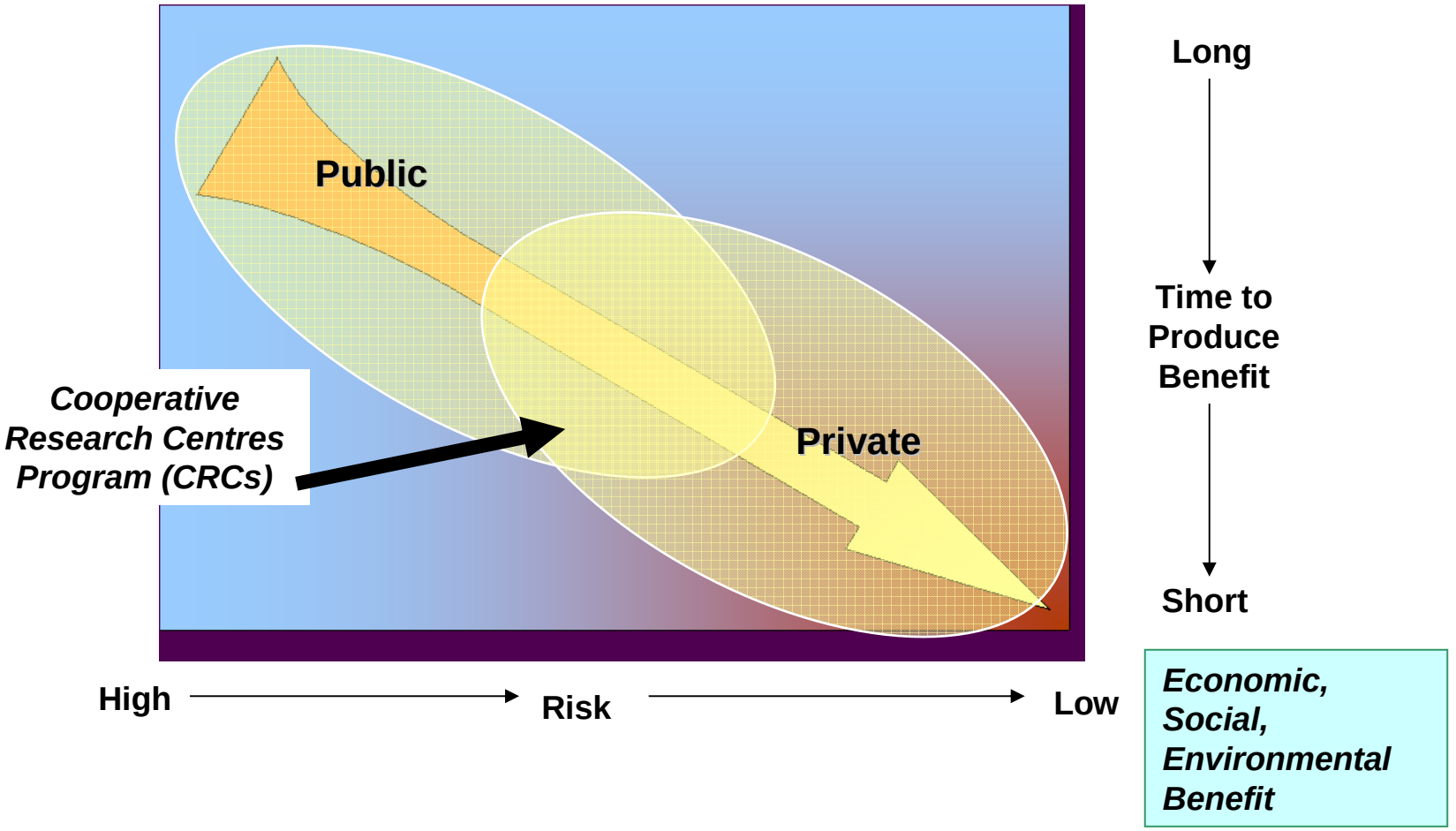
CRC for *Construction Innovation*

Our Vision

To lead the Australian property and construction industry in collaboration and innovation

Participants in the CRC for *Construction Innovation*

CRC Research Space



Public-Private Partnerships in R&D

- **Build innovative networks of industry, government and research**
- **Attract and mobilise resources**
- **Research skills training**
- **Respond to global challenges with national and international partnerships**
- **Implementation to make a difference**

CRC for *Construction Innovation*

- **A$64M in cash and in-kind over 7 years**
- **Government, industry and research partners**
  - 21 participants nationally
  - 400 people involved = 60 EFTS
- **Headquartered at QUT in Brisbane**
  - 6 centres nationally
- **Only one of its kind in construction in Australia**
  - Building, Infrastructure and FM

Creating…a better future through collaboration

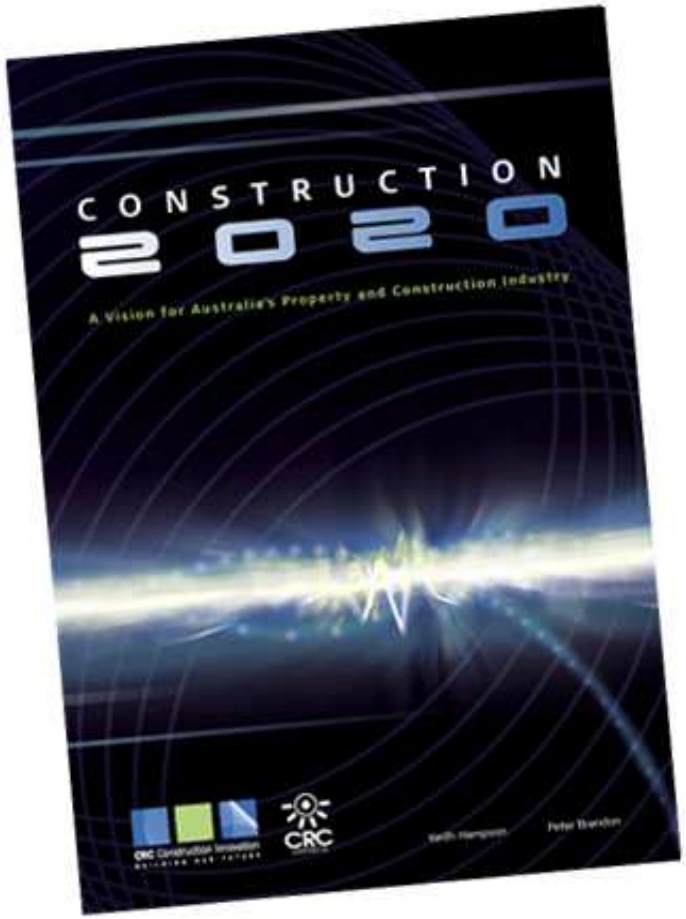
CRC for *Construction Innovation*

International Research Alliance (ICALL)

BuildingSmart IAI

CIB

National Vision



High Impact Benefits

Relationship Management Course

Relationship Management in Project Delivery – 2 day workshop
For those involved in project management and delivery – a practical and applicable approach

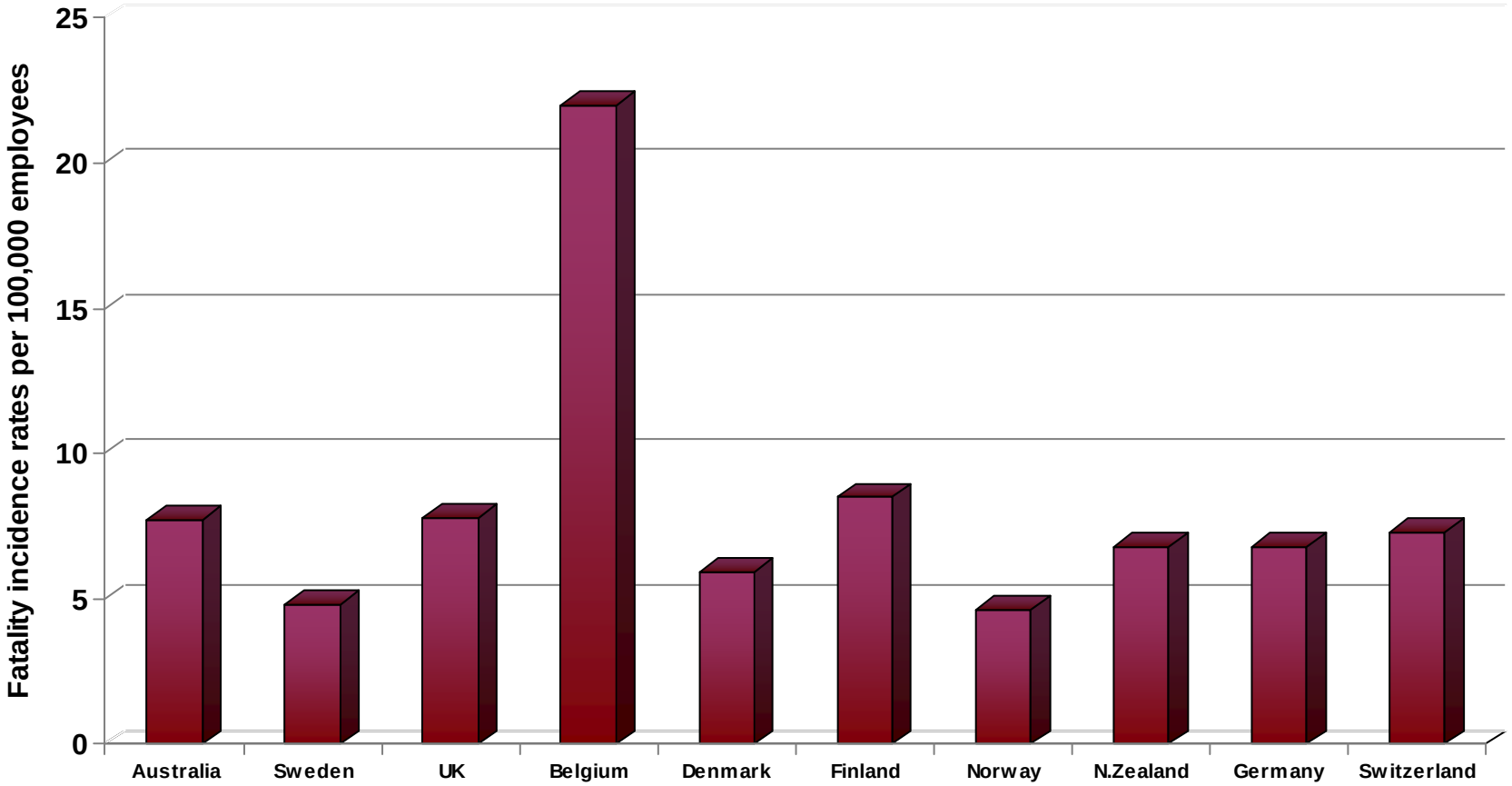
Courses rolled out :

- **Oct 06 – Qld Dept of Main Roads**
- **March 07 – John Holland Group**
- **April 07 – Qld Dept of Public works**

Courses being developed with tailored content

- **Lang O'Rouke**

Safety - Comparison of fatality incident rates per 100,000 construction industry employees 1998-99 to 2001-01



Safety Statistics - Australia

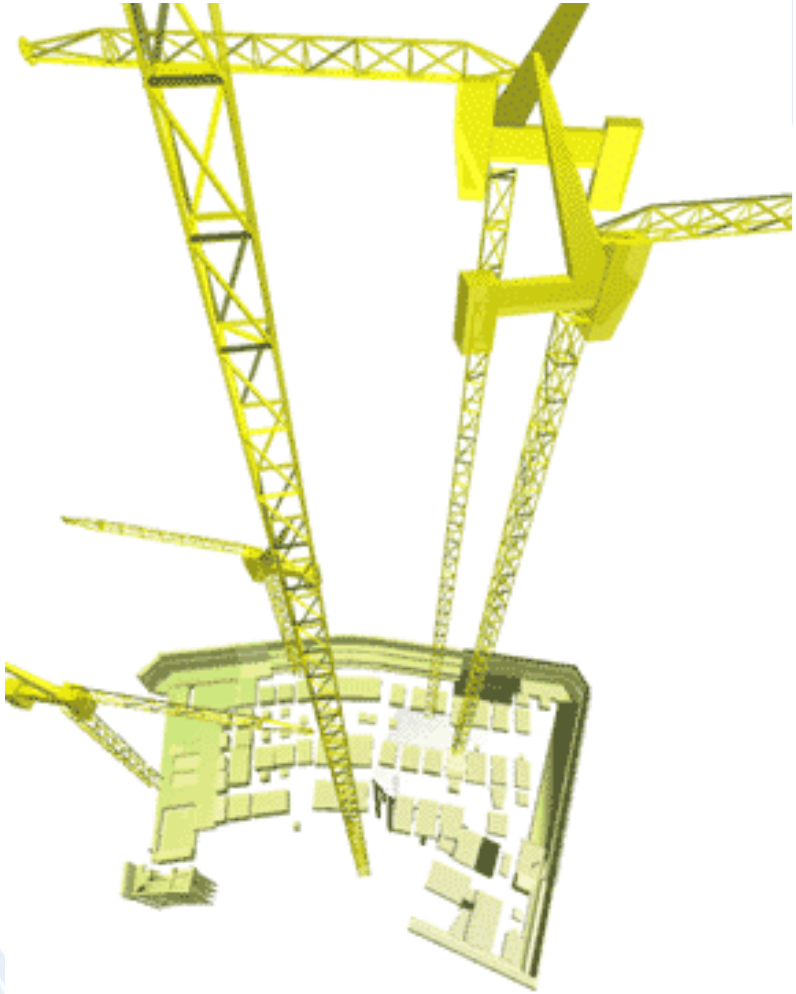
- Construction site labour makes up 8% of the Australian workforce but accounts for 15% of all fatalities in the workplace.
- On average one person is killed on a construction site each week in Australia.
- Responsibilities and Core Competencies
- Voluntary Code of Practice
- Training Toolkits
- Performance Assessment Indicators

BRITE Project

- **Improve the incidence and quality of innovation in the Australian building, construction and FM companies**
- **12 National Case Studies**
- **National Surveys**
- **Interviews with 20 of Australia's most innovative contractors**
- **Over 200 industry publication articles.**

Integrated Digital Modelling

(BIM, 3D CAD etc)



QUT

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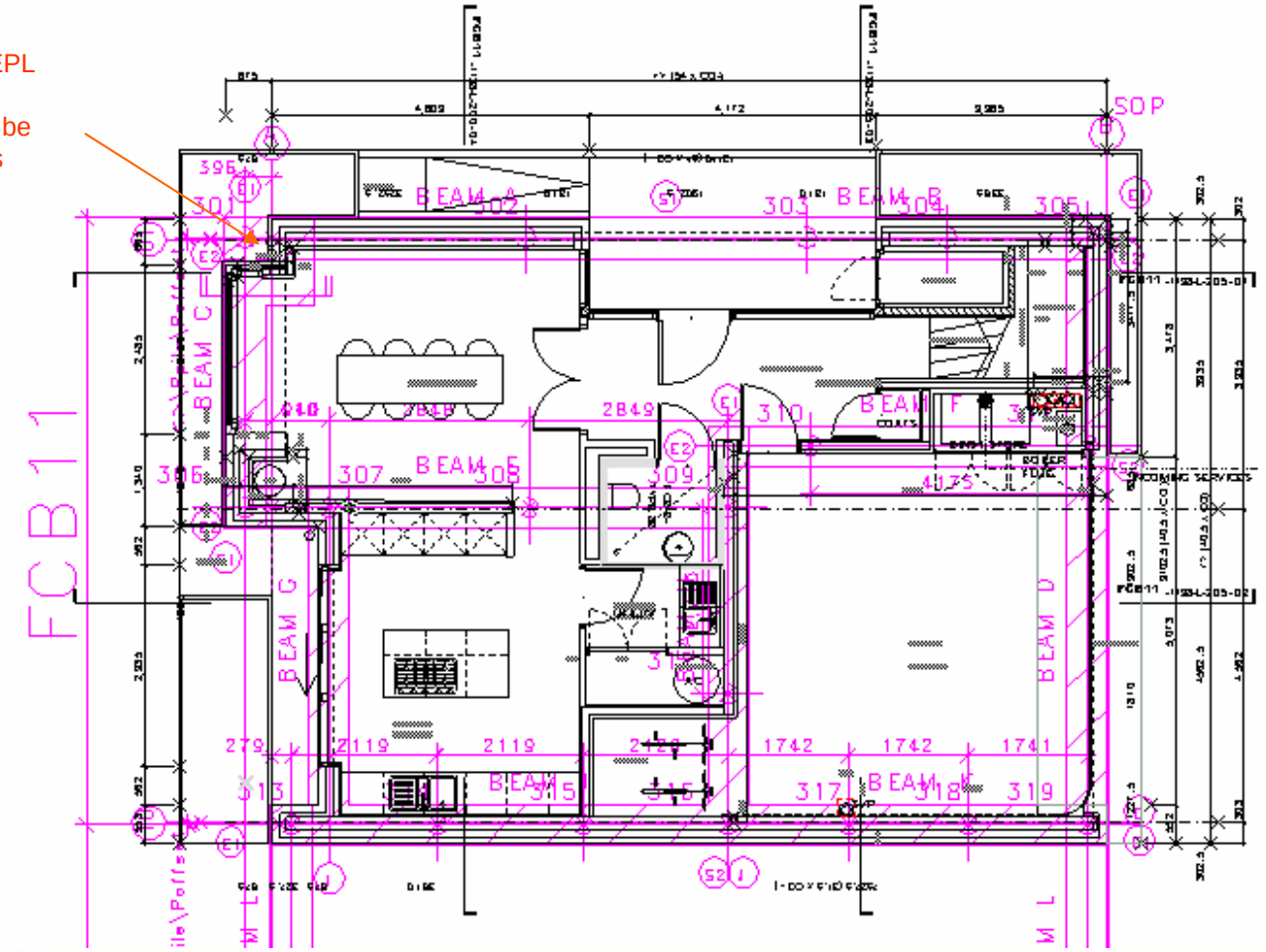
Limitations in Current Industry Practice

- **Little support for client requirements/performance or facility briefing**
- **Lack of integration of facility context for planning, sustainability, code checking compliance, etc**
- **What are most common design/construction errors?**
  - Design errors in construction - due to lack of/or poor coordination
- **Inadequate support for asset & facility management**
  - **Where is the asset information for FM?**

Limitations in Current Industry Practice

Common grid setting out needed for RJP/FCB/PCS/EPL

Currently, drawings have to be aligned by matching corners of building



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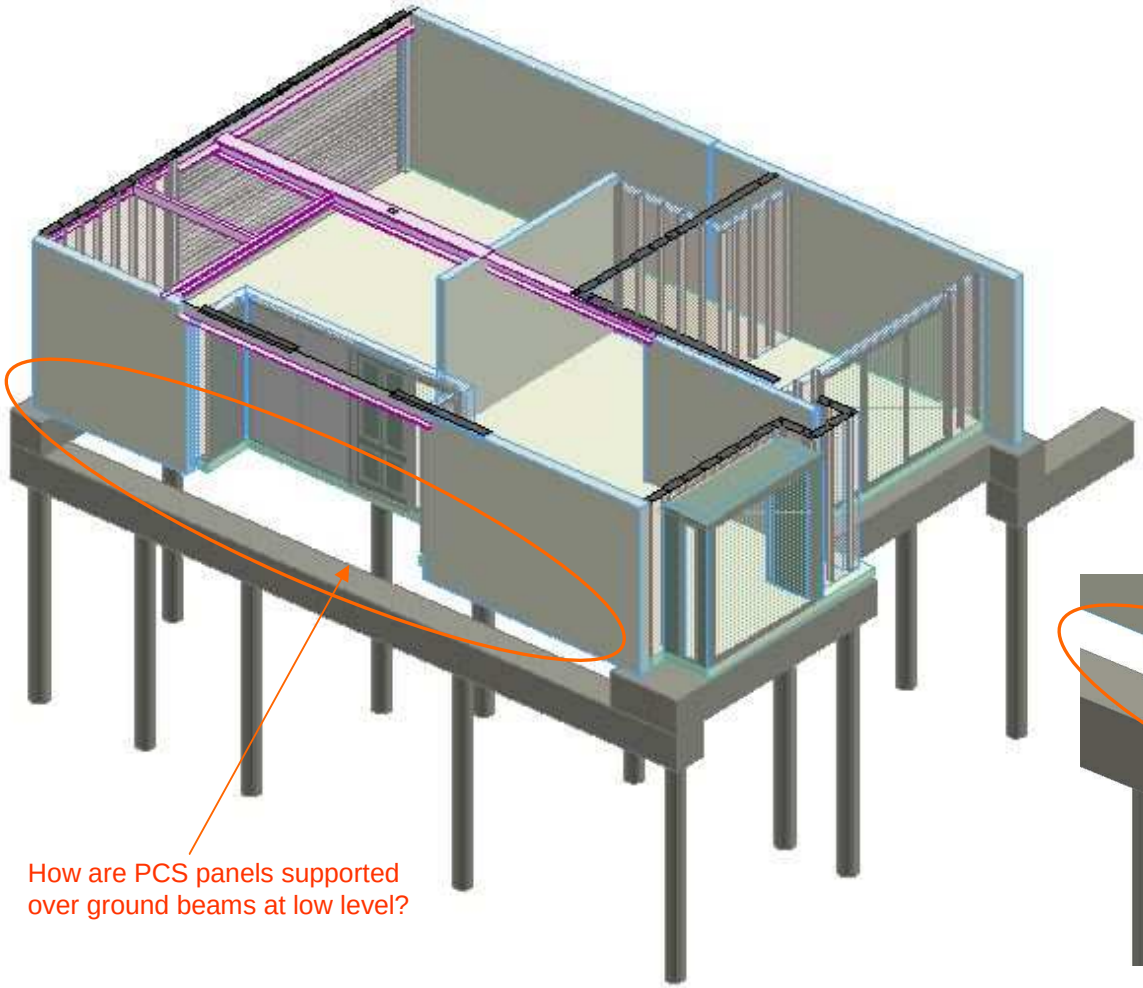
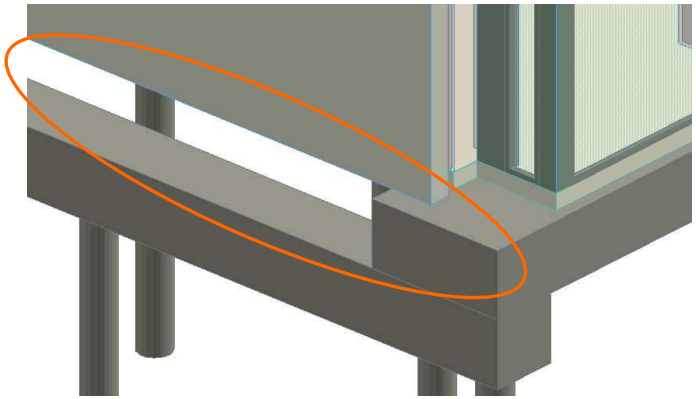
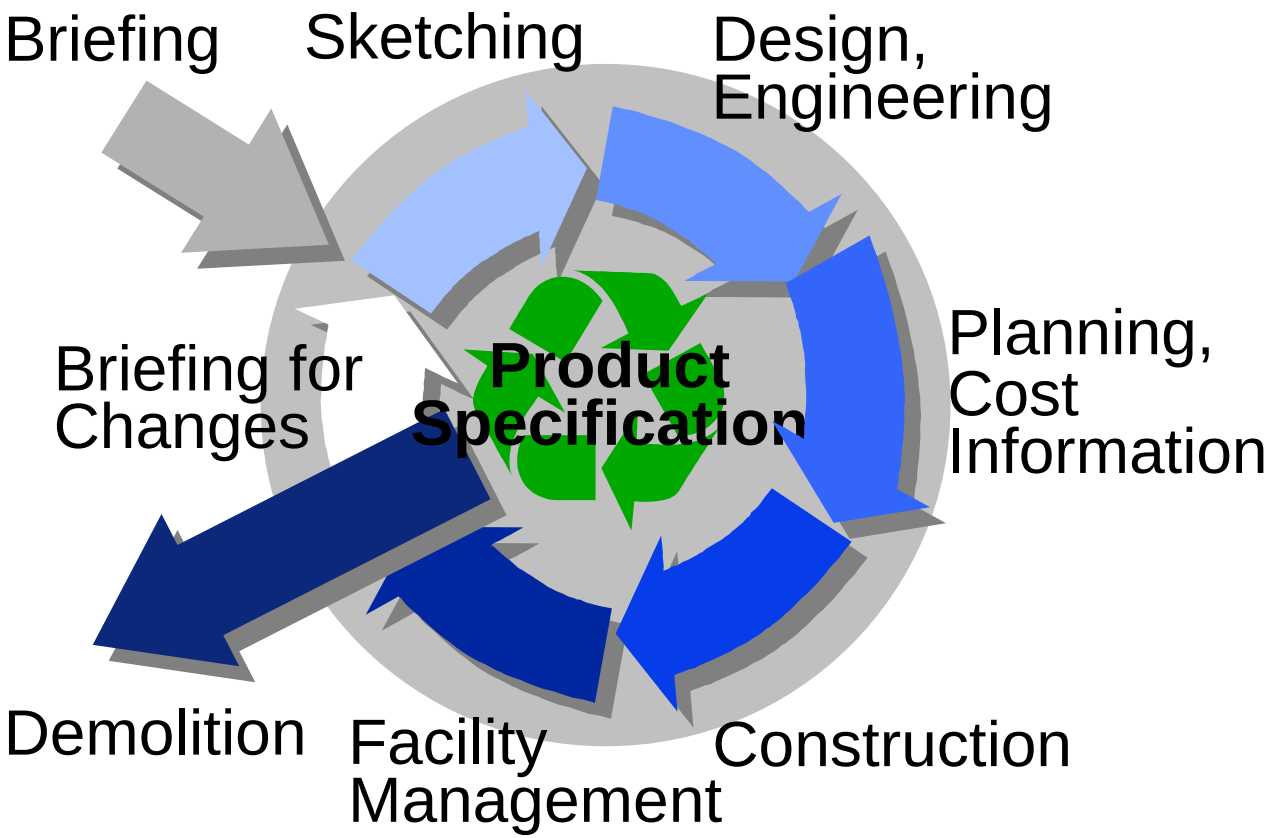
Limitations in Current Industry Practice





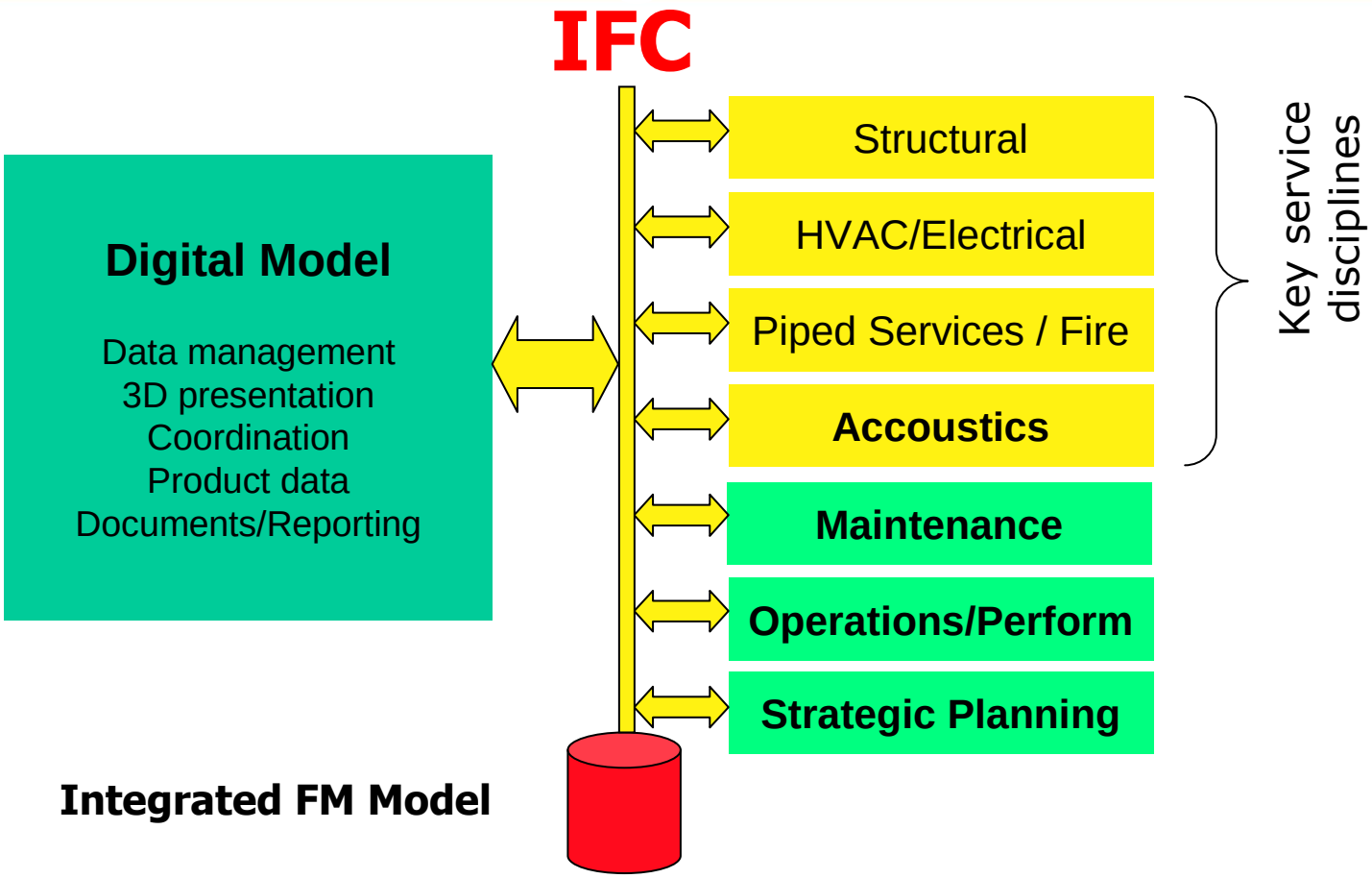
Information Lifecycle



Generic Attributes of BIM

- *robust geometry* - **objects are described by faithful and accurate geometry, that is measurable**
- *comprehensive and extensible object properties* **that expand the meaning of the object - Objects thus can be richly described e.g. a manufacturers' product code, or cost, or date of last service etc.**
- *semantic richness* **- the model provides for many types of relationships that can be accessed for analysis and simulation e.g. is-contained-in, is-related-to, is-part-of etc.**
- *integrated information* **- the model holds all information in a single repository ensuring consistency, accuracy and accessibility of data**
- *life cycle support* **- the model definition supports data over the complete facility life cycle from conception to demolition, extending our current over-emphasis on design and construction phase.**

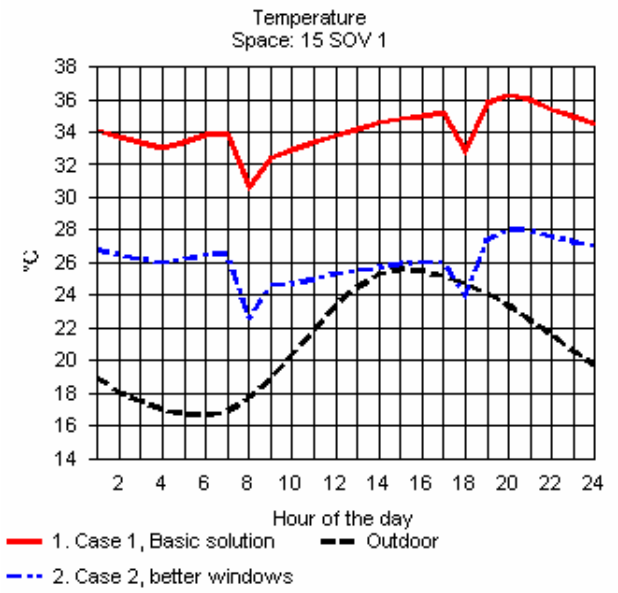
Strategy for information integration

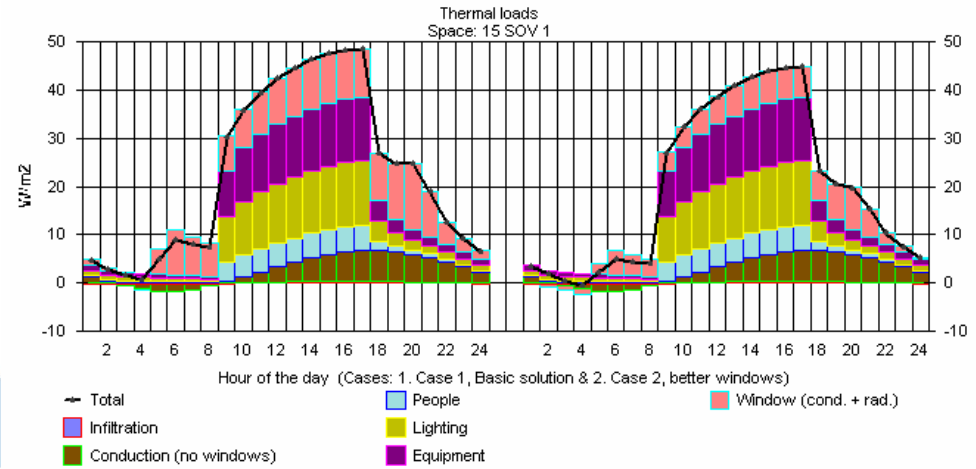


BIM Benefits

- *Faster and more effective processes* **– information is more easily shared, can be value-added and reused**
- *Better design* **– building proposals can be rigorously analysed, simulations can be performed quickly and performance benchmarked enabling improved and innovative solutions**
- *Controlled whole life costs and environmental data* **- environmental performance is predictable, life-cycle costs are understood**
- *Better production quality* **– documentation output is flexible and exploits automation**
- *Life-cycle data* **– requirements, design, construction and operational information can be utilised in facility management**
- *Integration of planning and implementation processes* **– government, industry and manufacturers have a common data protocol**

Comfort and Energy simulation





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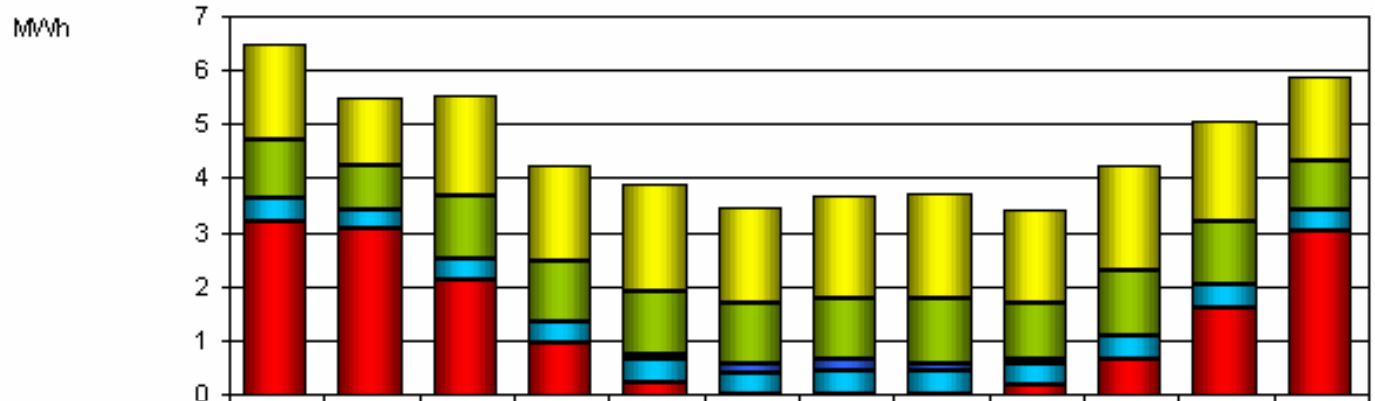
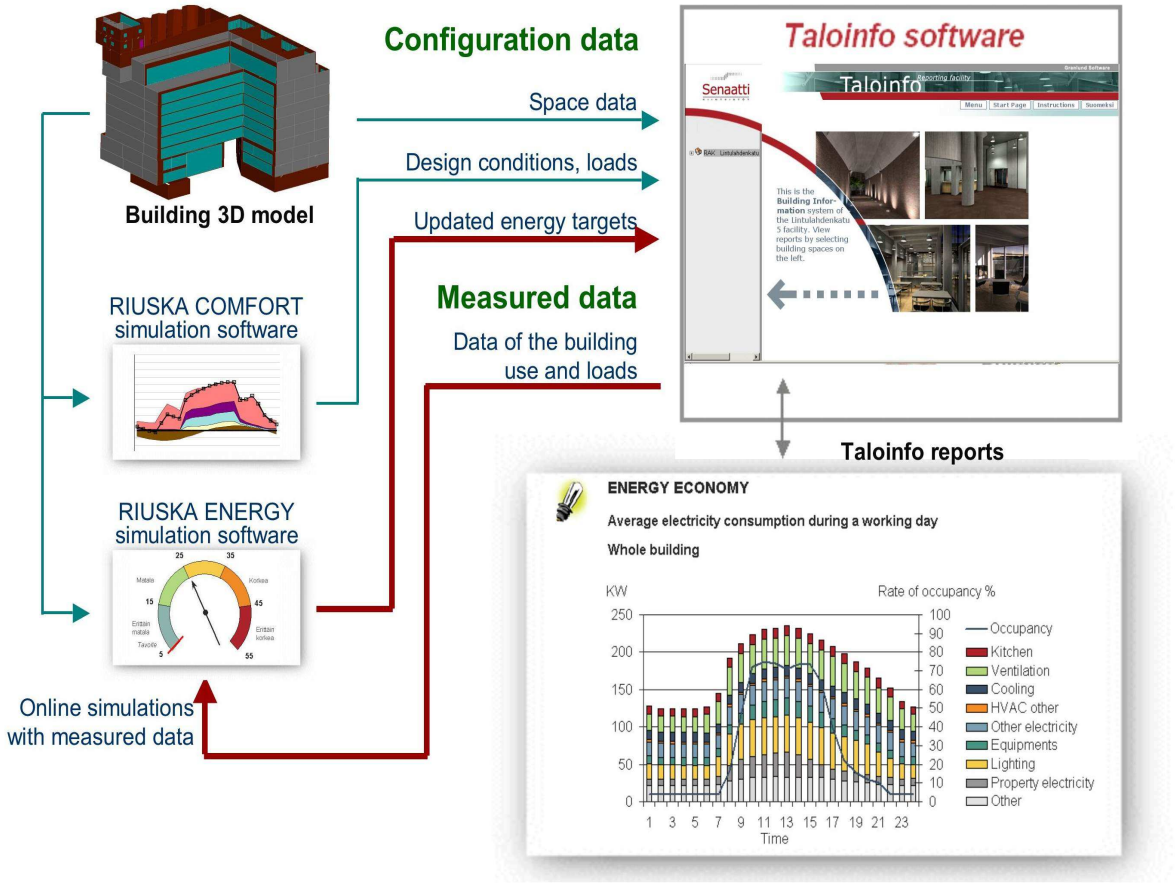
Comfort and Energy simulation

MONTHLY ENERGY CONSUMPTION



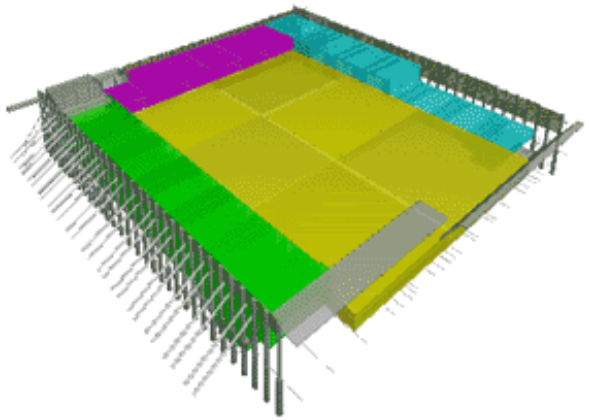
	1	2	3	4	5	6	7	8	9	10	11	12
Lighting electricity	2	1	2	2	2	2	2	2	2	2	2	2
Equipment electricity	1	1	1	1	1	1	1	1	1	1	1	1
HVAC, cooling electr.	0	0	0	0	0	0	0	0	0	0	0	0
HVAC, other electr.	0	0	0	0	0	0	0	0	0	0	0	0
Heating	3	3	2	1	0	0	0	0	0	1	2	3

FM Energy Monitoring

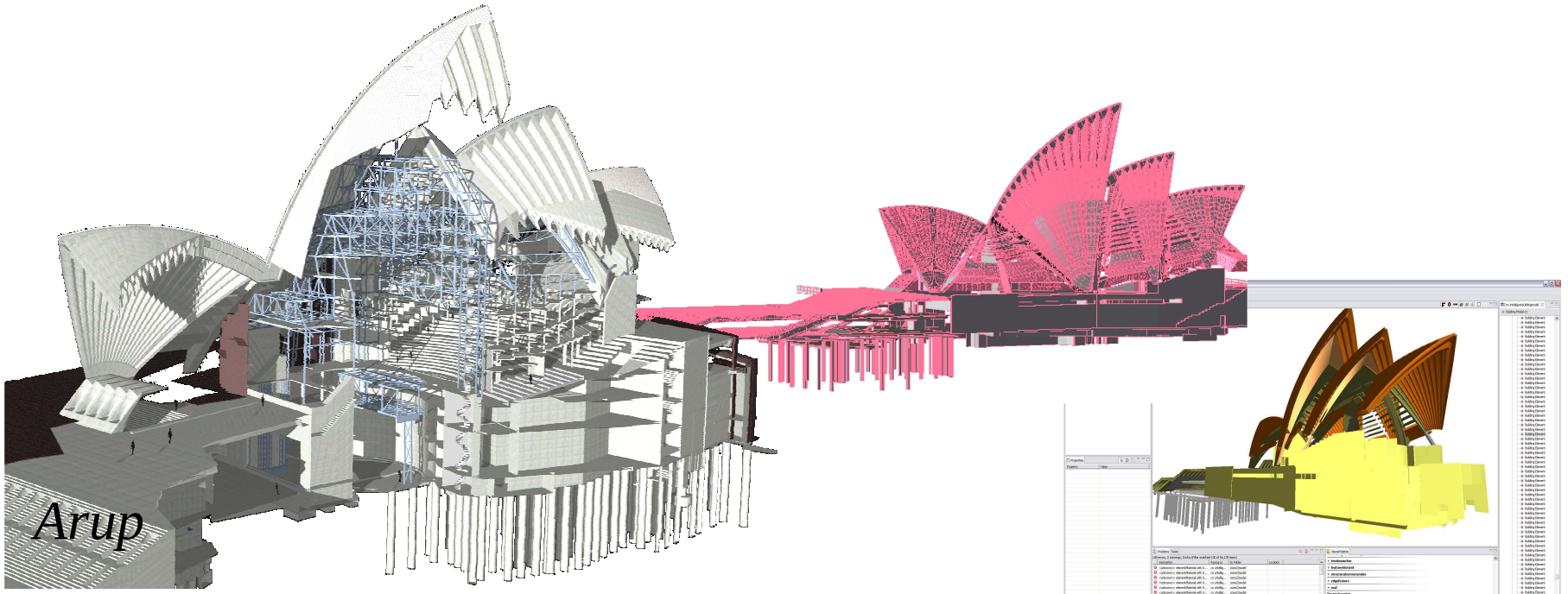


Construction Over time

- Progression of construction over time;
- Improves quality of:
  - Simulations
  - Construction Plans
  - Safety
  - Logistics
  - Costs
- Allows professionals to test the design for performance, construction sequences and identify design conflicts.



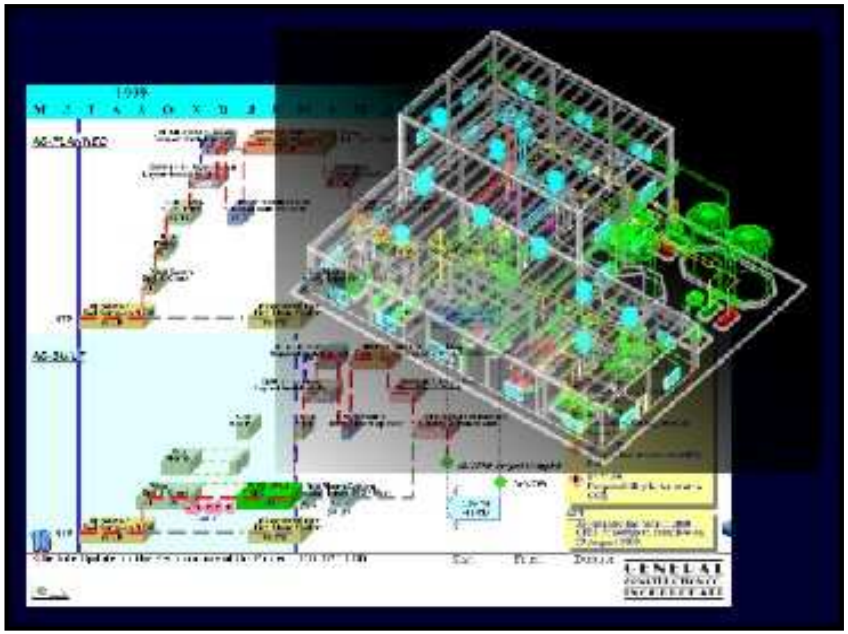
Reusing IFC data



Bentley Structural → *IFC* → ArchiCAD → *IFC* → IFC Viewer

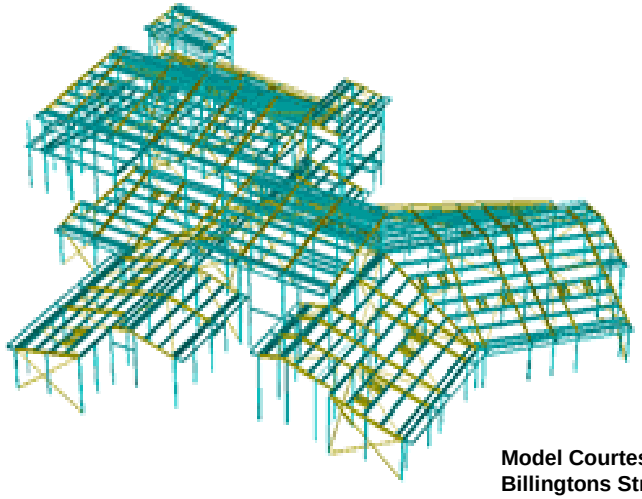
Business Case for Implementation

- Allow optimisation of design and construction alternatives
- Project teams are able to produce simulations of different design ideas and schedules quickly and easily
- Delays and changes can be minimised as design work is integrated with construction work
- Eliminates potential problems with constructability, design conflicts, assembly of building components and materials delivered to site.

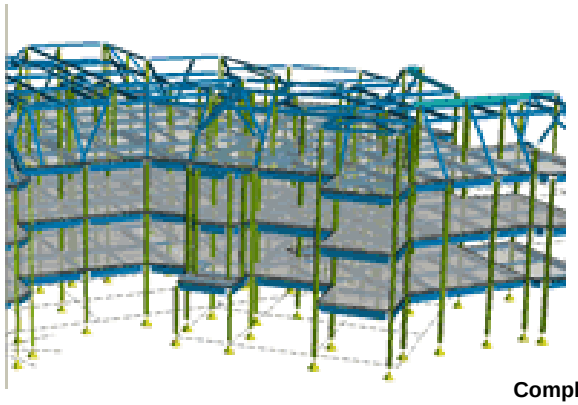


HOW TO IMPLEMENT

- A new work method/process is required in which more detailed information is supplied early on.
- Allow 3D models to be developed initially instead of having to try to convert 2D data.
- 3D models must allow changes to be made without having to completely reconstruct the model.



Model Courtesy of Billingtons Structures



Complete Building Design

Future *Construction Innovation*

Future *Construction Innovation*

- **Increase in number of participants**

Additional Focus of Research

- **Development of a National Standard for Digital Models**
- **Case Studies of brown field FM sites**
- **Reducing Disputes**
- **Safety Performance Indicators**
- **Collaborations with University of Salford (UK), Stanford University (USA) and Government property owners in Northern Europe and USA.**

Third International Conference

Clients Driving Innovation: Benefiting from Innovation

Demonstrating the benefits of applied research and innovation in the building, infrastructure and FM industry

12 – 14 March 2008

Surfers Paradise Marriott Resort & Spa
Gold Coast : Australia

In association with:

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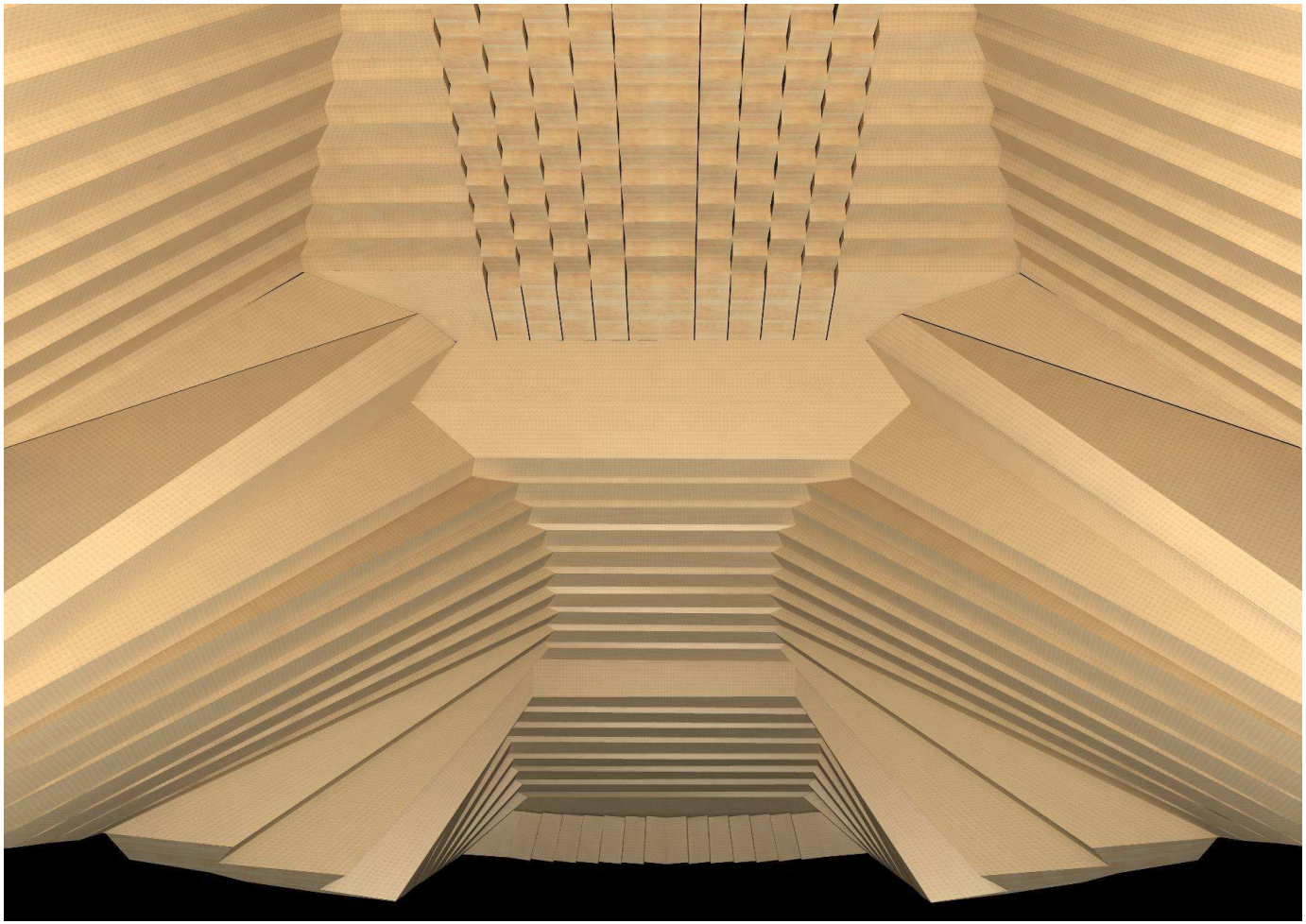
Thank You



Sydney Opera House - Final solid ceiling model used for coordination & documentation