TEMC 2014 – Rainforest to Reef

Adapting to a changing environment

THE UNIVERSITY OF MELBOURNE

The Doherty Institute
Facility Design and Construction for the Transition from Project to Operation and Maintenance.

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The University of Melbourne

3 September 2014

Doherty Institute

A bit of information to start – what is

The Doherty Institute

And then

why would we want to consider

Operation and Maintenance during Facility Design and Construction.

Was Then - Is Now

Architect : Grimshaw Billard Leese

Builder: Brookfield Multiplex Constructions

Project Scope

The Peter Doherty Institute is a world-class institute combining;

RESEARCH into infectious diseases and immunity,
with,

- Teaching excellence,
- Reference laboratory diagnostic services,
- Epidemiology and
- Clinical services

AIM:

to significantly strengthen the national and global capacity to Detect, Verify and Respond to existing, emerging and re-emerging infectious diseases, like:

Severe Acute Respiratory Syndrome (SARS),

Influenza A Virus with pandemic potential,

drug resistant Malaria and Tuberculosis and other serious health threats.

Patron

The Institute has been named after the Immunologist Laureate Professor, Peter Doherty.

For over 50 years, Professor Doherty has dedicated his life to science with a vision to improve global health, well-being and prosperity. He is one of Australia's highly respected scientists.

In 1996, Professor Doherty and his Swiss colleague, Rolf Zinkernagel, were awarded the Nobel Price in Medicine for discovering how the immune system recognises virus-infected cells.

Professor Doherty is based at the Melbourne University's Department of Microbiology and Immunology.

Project Partners

Elements of the University of Melbourne and Melbourne Health

- University of Melbourne Department of Microbiology and Immunology
- Microbiological Diagnostic Unit Public Health Laboratory (UoM)
- Victorian Infectious Diseases Reference Laboratory
- World Health Organisation Collaborating Centre for Reference and Research on Influenza
- Victorian Infectious Diseases Service
- Victorian Nososcomial Infection Surveillance System

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Maximising Effort
through collaboration

The Building Location

WEHI

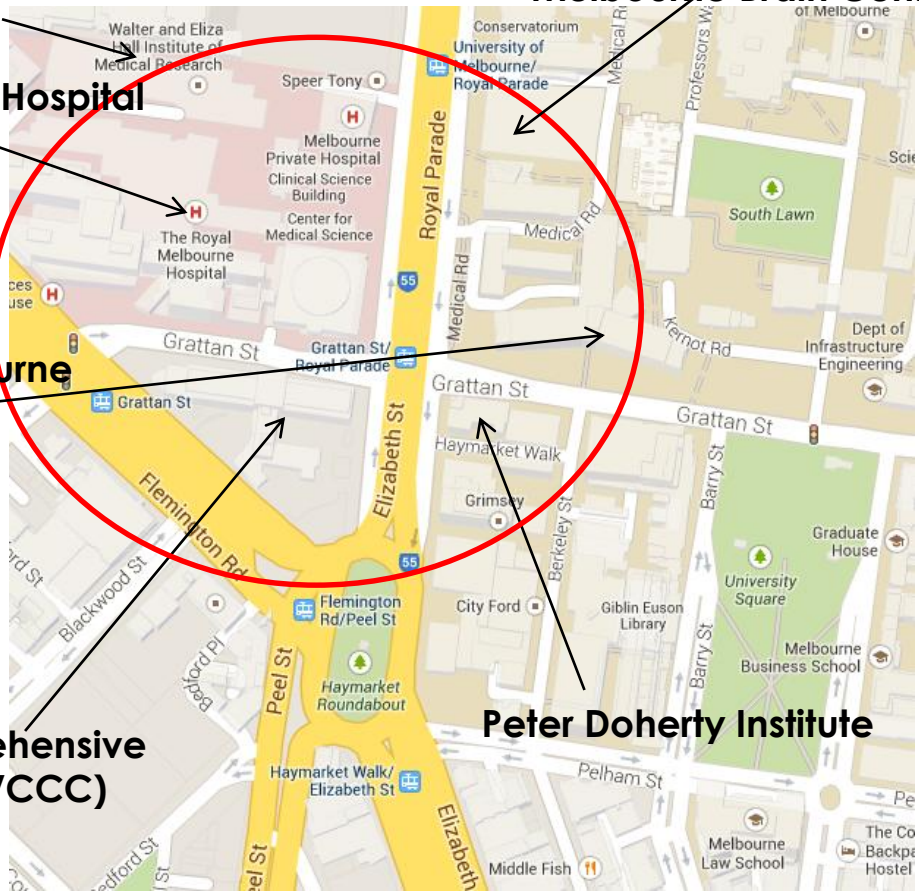
Melbourne Brain Centre

Royal Melbourne Hospital

University of Melbourne Medical School

Victorian Comprehensive Cancer Centre (VCCC)

Peter Doherty Institute

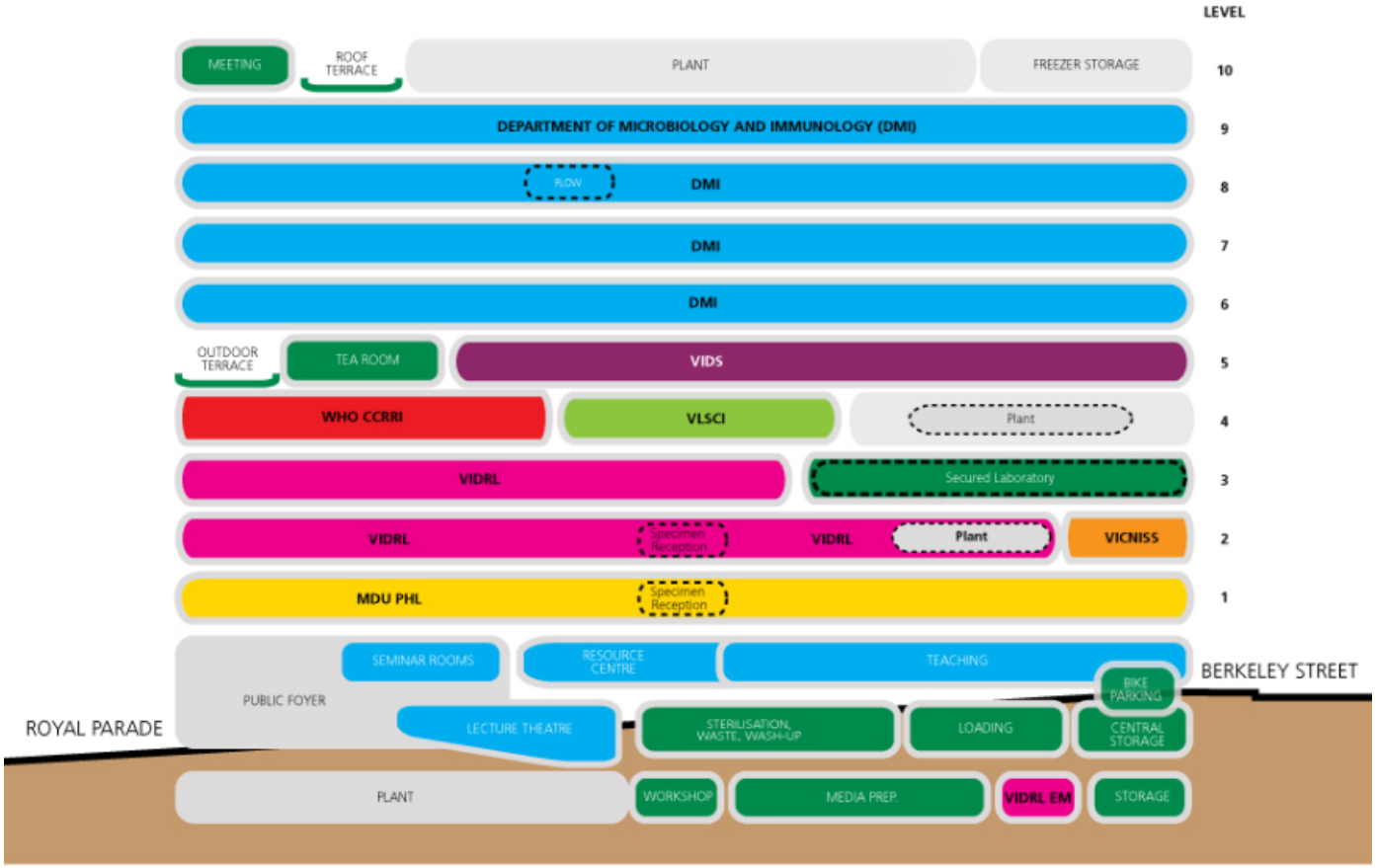


The Parkville Precinct Strategic Plan

Within close proximity of key institutions, such as, The Royal Melbourne Hospital, The University of Melbourne, Walter & Eliza Hall Institute of Medical Research, BIO 21 Research Institute and the Royal Women's Hospital.

A significant number of medical research centres and institutes form this extensive medical precinct

Block and Stack



Putting it all together – as it was at the start of the build

Key Attributes

- 14 Levels incl. 2 basements
- 2 major partners
- 6 separate departments

- 700+ users
- Low and High Containment
- Teaching

Maximising Effort
through collaboration

Key Design Features

- Purpose-designed and manufactured laboratory equipment, imported from 6 countries,
- An electron microscope room with Faraday Cage shielding and vibration isolation protection,
- 5-Star Green Star Rating,
- High physical and quarantine containment areas,
- A customised Building Management System, for the monitoring and management of essential machinery and equipment,
- Additional redundancy for all critical devices
- Façade, with 2,400 sq. meters (26,000 sq. feet) of Okalux glass,

Robust design with redundancy and flexibility

Building Sustainability

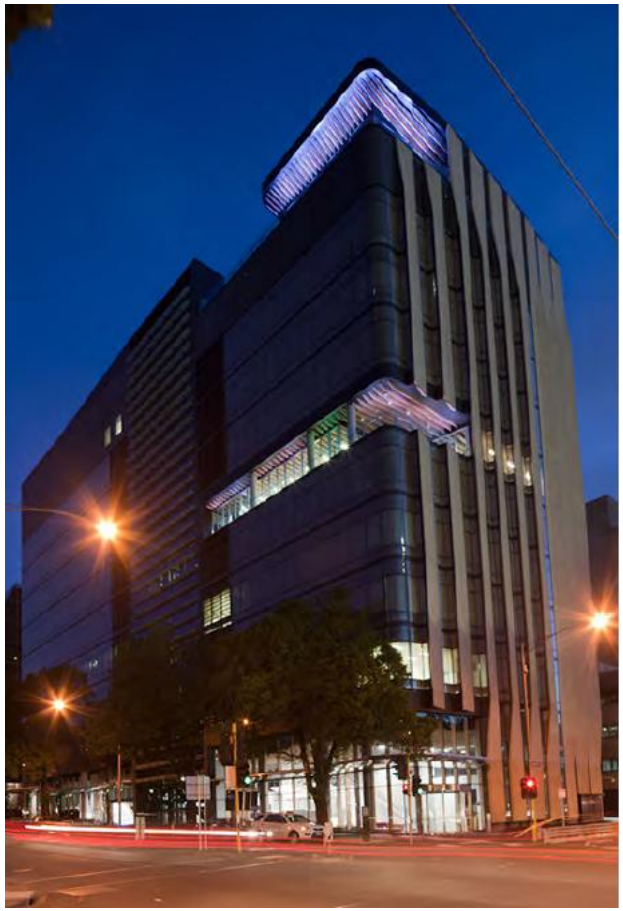
5-Star Green Star Rating

A 55 sq. meter (590 sq. feet) rooftop garden recycles storm water for use within toilets and saves 1.45 mega litres (383,050 gallons) of water a year.

- A co-generation system providing over 50% reduction in energy consumption.
- HVAC systems optimised to maintain efficiency of warm room, cool rooms and freezers.
- Building façade, designed to minimise the sun's intensity.

A number of sustainability measures were built into the design including co-generation, innovative façade and water recycling

A quick look

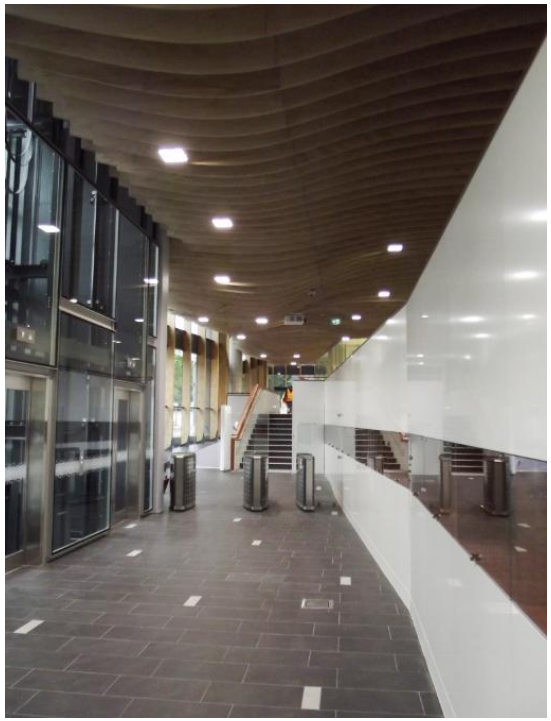


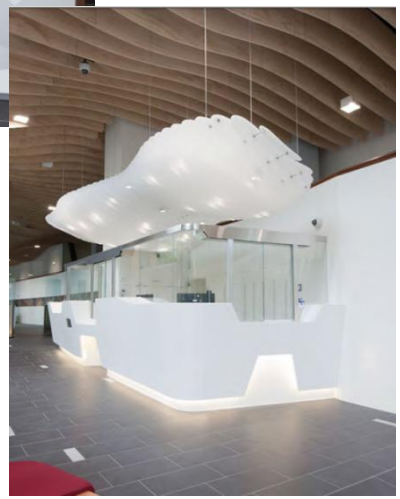
External Facade

A quick look

Geometrical Lines

A quick look



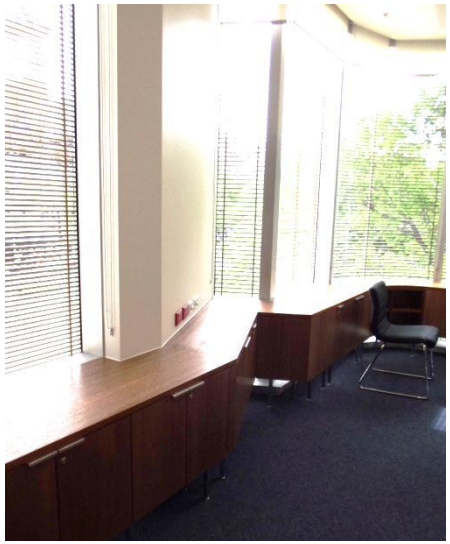


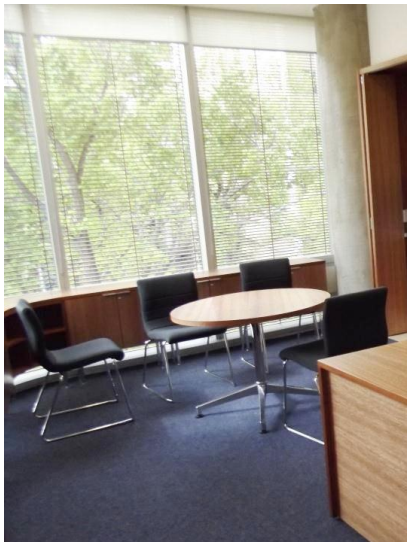
Foyer Interior

A quick look

Teaching Areas - Auditorium and Seminar Rooms

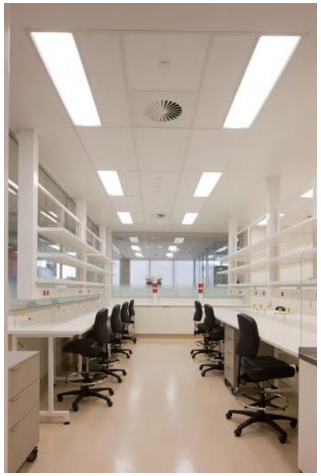
A quick look





Interior Offices

A quick look



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Laboratory Areas

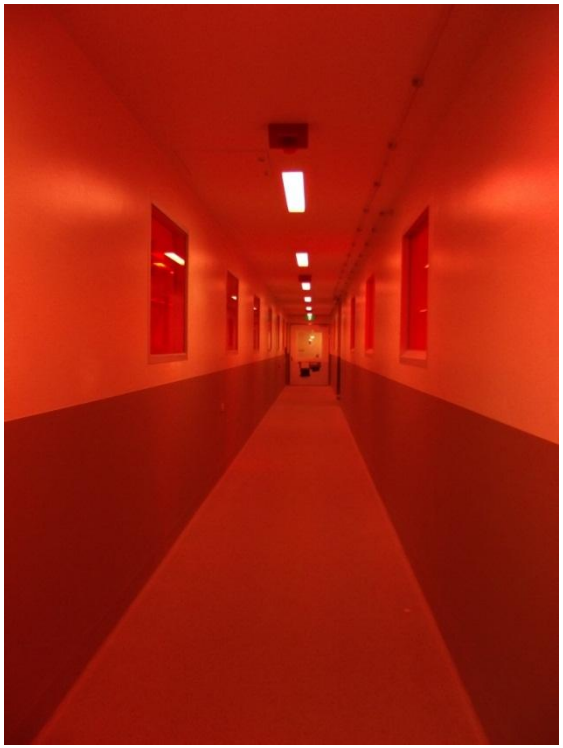
A quick look

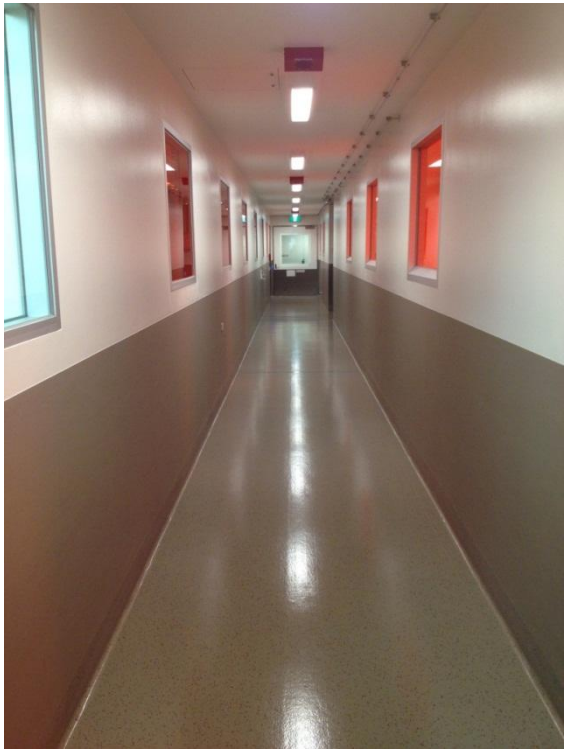
Tea Room – *a large collaboration space*

A quick look

High Containment

A quick look





Research and Specialist Support Facilities

A quick look

Board Room / Conference Room

The Forgotten Stakeholders

The most often forgotten stakeholders in a project are

Maintenance

Cleaning

Security

And last but certainly not least are the various corporate suppliers including utilities companies

Why consider operation and maintenance

Traditional Delivery

Construction often separated from operation and Maintenance by *normal practice, experience and budget*

Life Cycle Costing

Not always well done, well understood or funded as part of the *construction* budget

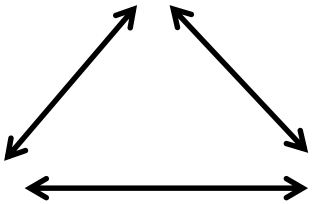
Construction Budget considerations often take the focus

Value Management often ***trades off*** Life Cycle improvements for required or additional functionality, space or even aesthetics

Why consider operation and maintenance

Tension

Construction



Operation ***Maintenance.***

Why consider operation and maintenance

Why consider ? Cost and Functionality

If you start early enough in the project and the concept is lead and fully supported by the Project Team, opportunities will emerge that provide improved functionality and operational readiness, often in additional to potential savings in at least one of the construction, operational and/or maintenance costs for the facility.

Knowledge

Knowledge and ability to understand and comment on operational and maintenance issues

embedded in the Project Team

Project Team ***mindset*** (attitude)

Operation and Maintenance are important

Design and Construction

Once you have the ***mindset*** you have a guide to assist with decisions

best overall solution to build, operate and maintain

easiest to build
no additional benefits

difficult to build
little or no additional benefit or high cost solution

Why start thinking about this at the beginning of the project ?

During the project –

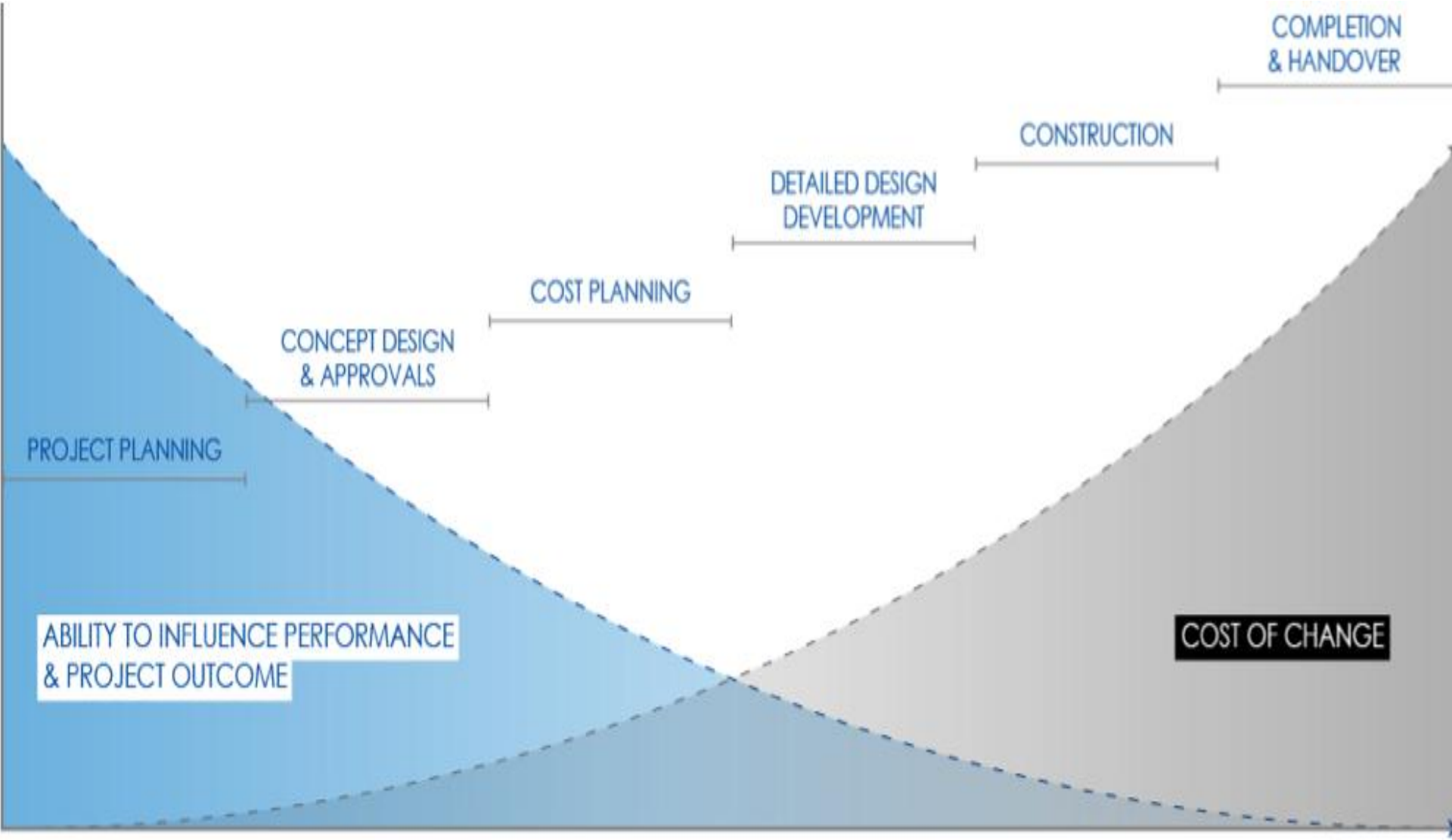
The effect of

CHANGe

on

cost

Mindset


COMPLETION & HANDOVER
CONSTRUCTION
DETAILED DESIGN DEVELOPMENT
COST PLANNING
CONCEPT DESIGN & APPROVALS
PROJECT PLANNING
ABILITY TO INFLUENCE PERFORMANCE & PROJECT OUTCOME
COST OF CHANGE

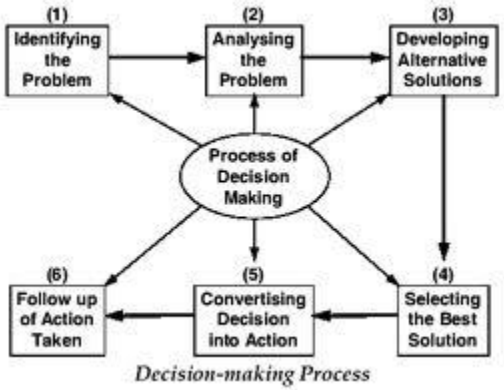
Additional Funds ?

Really ???

It is unlikely to find ‘uncommitted’ funding to add to your budget!

Authority to Decide

Authority, **ability** and **willingness to make decisions** on choices involving operational and maintenance related issues during construction *embedded in the Project Team*



Decision-making Process

Project Decisions

A number significant decisions were made early by the project that affected the operability and maintenance of the final facility

They were:

- **Peer review**
  check the design for issues with certification and operation
- **Appoint an independent specialist consultant**
  appointed to the project team to QA all containment areas – ensuring certification and operability
- **Require the builder to achieve facility certifications**
  builder responsible for all containment prior to Practical Completion

Project Decisions (cont)

- **Design Review opportunity prior to tender** for
  - ***Asset Services (maintenance) and***
  - ***Campus Services (cleaning and security)***
- **Creation of committees of decision makers and experts**
  to ensure project can be progressed
- **Integrate the person who would operate the building into the Project Team**
  early in the project - prior to the completion of the building structure.
- **Provide a Building Management Office**
  in an appropriate location within the facility

Sustainability and Energy Saving Measures.

A number of direct sustainability and energy saving measures were incorporated including

- Co-Generation (375 kW)
- Toilet flushing demand met by rainwater (40%) and grey water treated by the 55m^2 rooftop garden (60%)
- All domestic hot water produced as a by-product of co-generation
- Lighting control by sensors
- Night Purge and Heat Recovery assist HVAC Management
- Double glazed façade with interstitial louvers assists with heat gain/loss
- Low flow taps and fixtures throughout reduce water usage

Sustainability and Energy Saving Measures.

A number of *in-direct* sustainability and energy saving measures were incorporated including

- Provide cold and cool rooms rather than multiple separate equipment
- Positioning of most cold (freezer) rooms behind cool rooms
- Use of wire cages rather than hard walls for the L10 Freezer Farm
- Materials usage designed for longevity
- Incorporation of kick plates on doors and rails on walls to limit trolley damage
- Incorporation of vinyl walls in bin storage areas on each floor
- Sealing of vinyl for ease of cleaning and to reduce staining
- Use of carpet tiles and providing spare tiles to allow local replacement

Other Measures

A number of *other* measures were incorporated including

- **Building Maintenance Unit (BMU)** – specifically designed to lift the heaviest façade eliminating the requirement for street closure and crane setup to maintain the façade (note footpath closures below the lift will always be required)
- **Set downs** – by setting down the floors to match the corridor/access areas direct trolley access to and from the warm, cold and freezer rooms is achieved. This limits the risk of spills and drops of specimens – particularly in areas where inexperienced personnel (trainees, students and the like) will be moving biological materials
- **Travel paths**. By reviewing travel paths against number of trips improvements were made to reduce distance – reducing transit time and risk where samples are being transported

Other Measures (cont.)

- **Access Paths for equipment**. Ensuring that equipment access paths are sufficient to allow equipment to be moved to and from working areas with minimum dismantlement - allowing for easier future repair and replacement of the equipment
- **Standardisation and future proofing** were a consideration throughout the design and construction process with the development and prototyping the “kit of parts” for the laboratories and the various types of furniture including work stations, under bench units, tables etc.
- **Longevity, repair and replacement considerations** for all wearable components
- Incorporation of **load shedding emergency power** in the event of power failure to allow continued building operation and the ability to adjust power distribution as required depending on current workload and criticality

Other Measures (cont.)

- **Enhanced Building Management System with trending, alarm monitoring and notifications** including connection of high risk equipment including -80^{o} freezers and CO^{2} Incubators and the like
- Requirement for the builder to comply with the Project Verification Plan including **Installation and Operational Verifications** (IVs and OVs)for all containment areas
- ***Day One* Brochure** providing general information on the building and how it operates, who to contact for issues (including defects), how to arrange parking, information about University holidays and a multitude of other things that may be of interest to an occupant.
- Implementation of a **customisable IT software system** to manage issues, questions and requests.
- Moving the Building Operations Team in the facility first provides a high level of local support, including during relocation of staff into the facility

Asset/Building Manager

Benefits of having the Building Manager and Maintenance involved

- Commissioning management and control assistance
- Improved defecting and nuance resolution during commissioning
- Ability to fully operate the building from day 1
- Consideration of access for maintenance – not just installation
  - Input into Access paths for plant and equipment
  - Practical access around plant – not just statutory distances
  - Access hatch provision and placement - easier maintenance during building operation
- Practical input into finishes and material choices
- RPZ placement and maintenance
- Review of the design, construction and commissioning of the mechanical, electrical, hydraulic, vertical transport and other systems
- Integration with the development of the Building Management Systems including screens, navigation and requirements.

Benefits of having the Building Manager and Maintenance involved (cont.)

- Review and critique of the as constructed documentation for accuracy, understanding, and usability

The following comment is a direct quote from Geoff Campbell, the Building Operations Manager for the Doherty in a discussion on this presentation

"I was already comfortable at building handover which allowed me to concentrate on operating the facility and defect identification and management from day one!"

Geoff Robert Campbell
Building Operations Manager
Peter Doherty Institute

Where we went wrong

Not involving appropriate expert, operational and maintenance personnel early enough in the design.

Examples include :

- Rework to **equipment specifications** and in some cases equipment that meets the task but may not be the best choice
- *Solution* : *Employ appropriate experts to specify and layout the plant*
- **Liquid nitrogen** operating costs increase with the pipe run distances, even after significant additional construction cost is put into vacuum sealed sheathes and valves. *Solution: Put the storage as close as possible to the cryogen room.*

Getting the Balance *Right*

Not involving appropriate, expert, operational and maintenance personnel early enough in the design can cause issues but the involvement or ***early appointment*** of personnel (and hence cost) ***needs to be balanced against the benefits*** likely to be received.

Some Examples for consideration

Timing for appointment of

- Dean for a new medical school or the principal of a new type of P-12 early provides benefits in basic design and input into cutting edge educational techniques being considered
- Manager for a bio-resources facility early enough to critique and influence the design will save issues later.
- Researchers, Chief Investigators and/or Laboratory Managers at time of laboratory design.

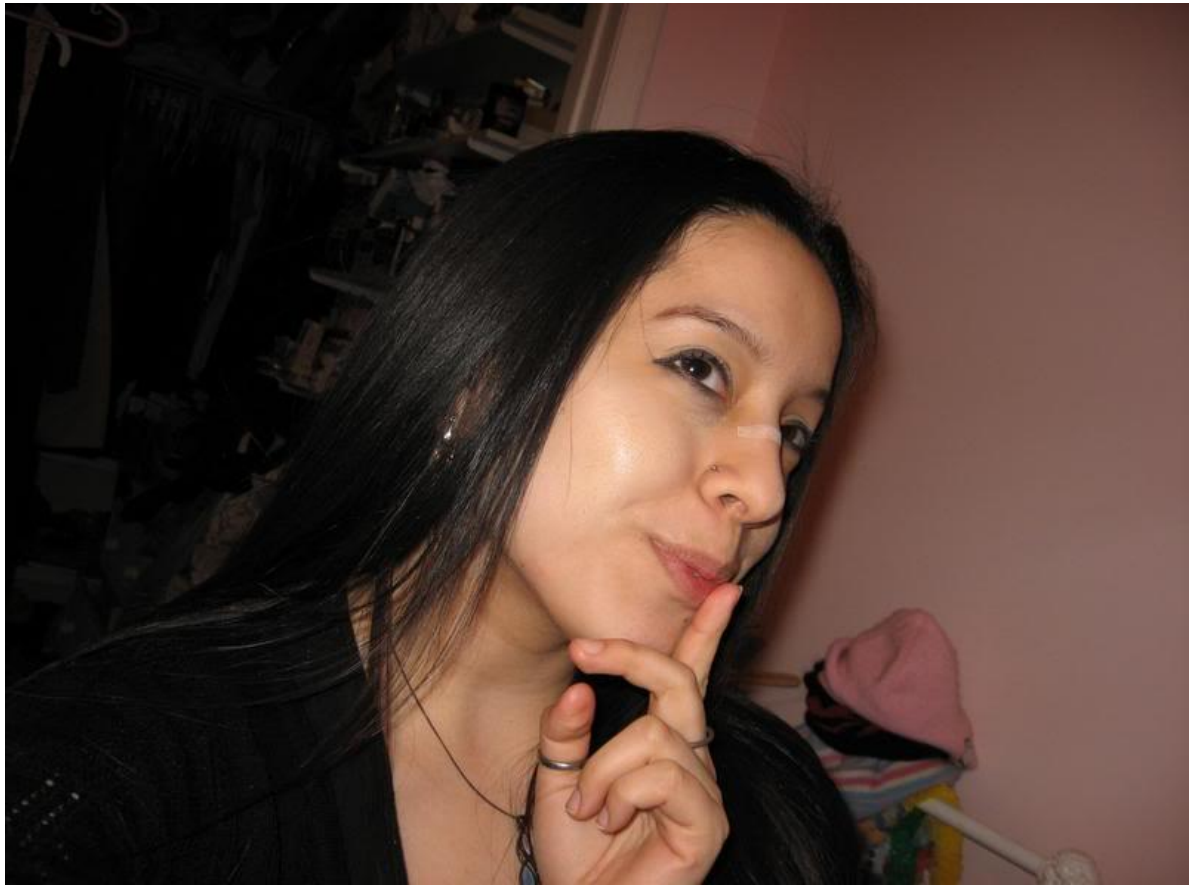
If available the best option would be for these personnel to brief the requirements and then review all aspects of the project through design and construction within the constraints of time cost etc. as part of the extended Project Team…….

Looking for that Balance

These examples illustrate the importance of involving the appropriate experts or operators at a stage where they can influence the outcome without significant cost to the project.

BUT part of that process needs to consider the likely ***BENEFITS*** for your project against the ***COST*** to the organisation (not necessarily just the project) of providing this expertise to the project a year or more before it is operationally required. Often these are "*secondary duties*" for existing staff and normal duties need to be considered by the core Project Team

Food for thought



Food for thought - PCR

Okay, that's all fine but what can we actually do to embed this in our culture ?

The first thing we can do is **document and learn**. We do that by arranging for a ***Post Construction Review***. This is conducted as soon as practicable after PC and occupation.

The aim is to identify from a project perspective **what was done well, what could be improved and how**. The emphasis is on lessons learned to inform the delivery of future projects.

The focus is on overall project outcome from inception to handover, including how decisions were made and their impact.

First impressions by the end users of the design and operational management are used to assist the review process.

Food for thought – User Site Walkthroughs

What else can we do to embed this in our culture ?

The second thing we can do for all projects is **Implement Regular User Inspections (*called site walkthroughs*)– NOT just for senior staff but for all prospective building users.**

This process provides a number of benefits including

- improved stakeholder "ownership"
- improved integration of the facility users into the Project Team
- automatic considerations of change management
  - i.e. users get to know the space and consciously *or subconsciously* resolve how it will be used
- additional personnel look, review and identify defects
- identification of design flaws during the build

HOWEVER

Food for thought - PCR

There is one

very large drawback

if this is not done properly.

It is **scope movement** *or* **scope creep**

*This is a very real risk if users are not managed prior to, during and subsequent to site walkthroughs. You **must** have prior agreement and support of the client executive that this process can only occur on the basis that it is **not** a time to rethink or change the requirements and **definitely not** the time to have a new bright idea that redefines the work required.*

The Keys to Success

- ***Expanding*** the ***Project Team*** to include the Building Operations Manager
- ***Selection*** and ***maintenance*** of the ***Project Team***
- Formation and management of ***appropriate interest groups***
- ***Robust governance*** with ***clear project authorities***
- Clear and regular ***communication***
- ***Management of*** all ***inputs and change***
- ***Strong leadership***

Understanding the issue and implementing measures that recognise of the importance of operation and maintenance during design and construction

What should you take away ?

And the one standout takeaway from today?

Integrate the person who will operate the building into the Project Team

Do this early in the project - prior to the completion of the building structure and certainly before any significant plant is even on site.

The cost on any large and/or complex project will be repaid many times over during the life of the building.

He (or she) will assist you to remain on track with operational and maintenance considerations

Questions

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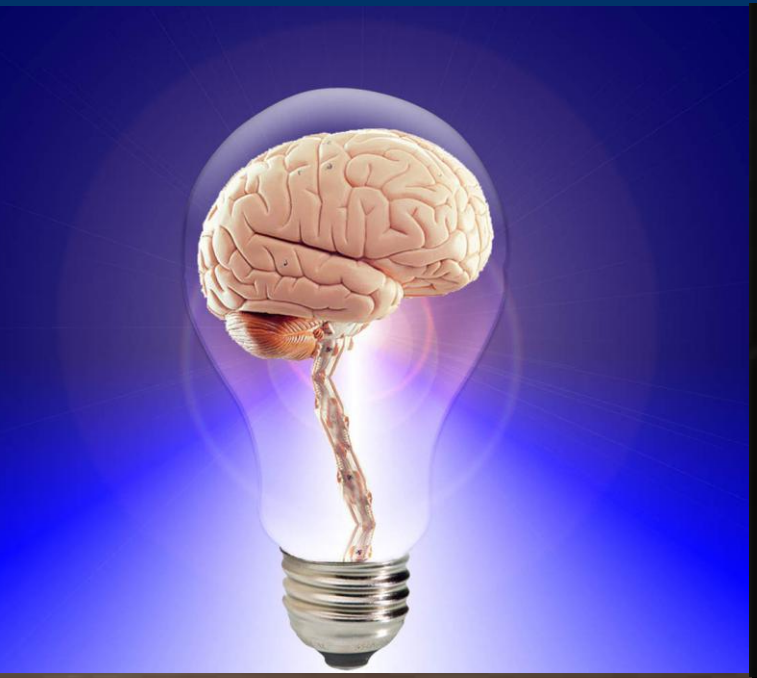
Some slides that might inspire an idea



Identify and Manage Risk

UOM FABP Risk Matrix

			Initial Risk Level (before mitigation)						Current Status (with mitigation)				
Nr	Category	Issues/Risk Description	Impact (Time, Cost, Quality)	Likelihood	Consequence	Risk level	Risk Management Strategy (accept, mitigate, transfer)		Action By	Likelihood	Consequence	Risk level	Status
41	Budget	Project budget allowances insufficient for this project.	Cost	4	4	E	Mitigate:	Tender has been let on budget and contingency set aside for construction period. Costs to be managed during CA phase.	PCG/PM/RLB	3	2	M	Open
42	Budget	Budget allowance inadequate for FF&E, AV & Information Technology and Communications	Cost	4	3	H	Mitigate	Cost for AV has been locked in via tender. FF&E to be scoped to meet available budget. ITS has reviewed and reconfirmed budget for active ICT.	Aurecon/Redback	3	2	M	Open
43	Estimating	Engineering service cost estimates incorrect	Cost	3	3	H	Mitigate	Services have been tendered and were returned on budget.	RLB / Aurecon	3	2	M	Open
50	Communications	Communication plan not prepared and stakeholders are not kept informed resulting in complaints, lost opportunities, poor acceptance of built outcome	Cost/Time/Quality	3	3	H	Mitigate:	Comms Plan has been prepared by PCS. Mar Comms has also been advised re Main Works tender outcome.	UOM	2	3	M	Open
52	Program	Program is delayed for reasons as identified above and decanting is delayed by a full semester	Time/Cost	2	4	H	Mitigate	Liquidated damages to take into acount additional leasing costs. Consultant team to adhere to program. PM to maintain current program and keep PCG and SC informed on program progress.	PM	2	3	M	Open
63	Signoffs	Signoffs from P&CS are not comprehensive.	Cost/Time/Quality	3	3	H	Mitigate:	Project Team to provide comprehensive briefing to UoM P&CS and all design changes to be signed off.	Project Team / PCS	3	2	M	Open
66	Contractural	Head contractor attempts to transfer their costs into trade contractors packages	Cost	2	3	M	Mitigate:	RLB to review scopes for all trade packages prior to tender issue. Tender returns to be vetted.	Aurecon/RLB	2	3	M	Open

Risk Matrix

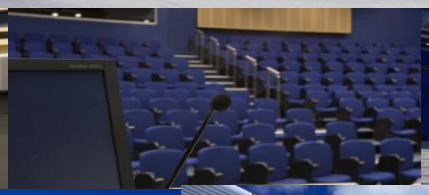
New Teaching Building - *University of Western Sydney*

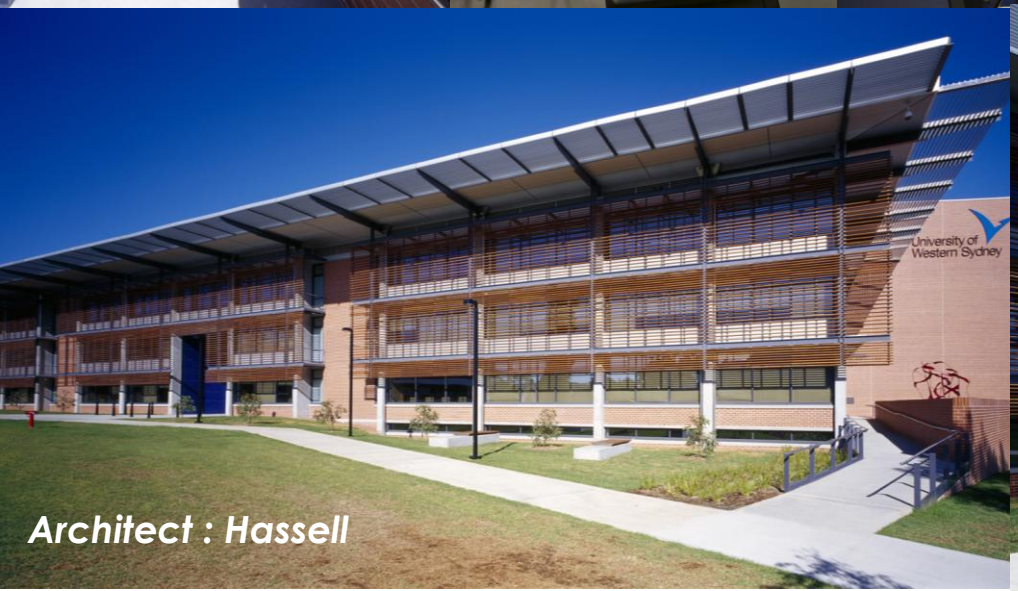
Architect : Hassell

Builder: Lipman

New Teaching Building

University of Western Sydney





Architect : Hassell

Builder: Lipman

School of Medicine

University of Western Syd

Architect : Lyons

Builder: Hindmar

Photograph by Dianna Snape

School of Medicine

University of Western Sydney

Architect : Lyons

Photographs by Dianna Snape

Builder: Hindmarsh

School of Medicine Stage 2 *University of Western Sydney*

Architect : Lyons

Photographs by Dianna Snape

Builder: Cockram

Multi-Purpose Building - *University of Western Sydney*

Architect : Hassell

Builder: Lipman

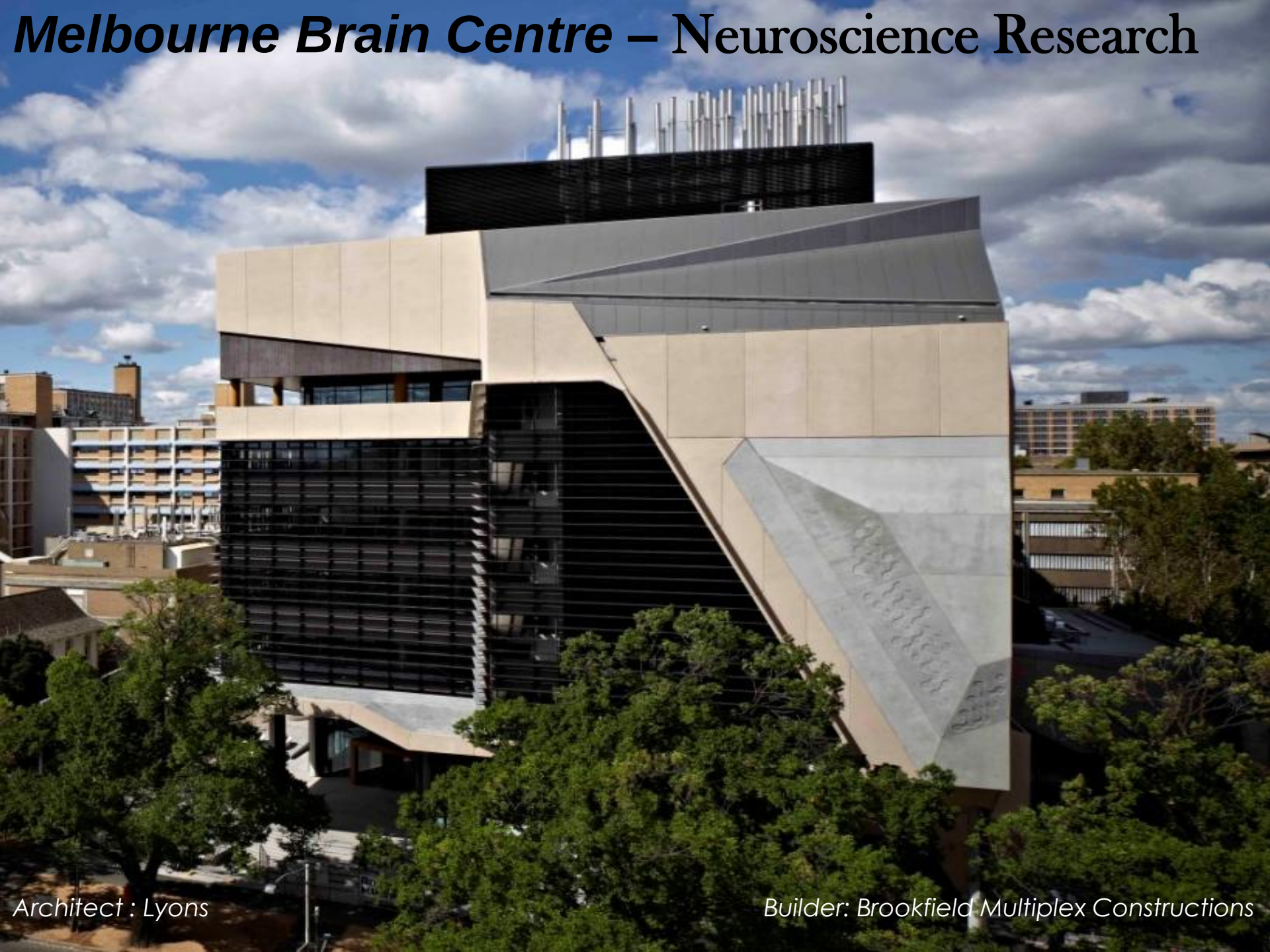
Multi-Purpose Building

University of Western Sydney

Architect : Hassell

Builder: Lipman

Melbourne Brain Centre – Neuroscience Research



Architect : Lyons

Builder: Brookfield Multiplex Constructions

Melbourne Brain Centre

Neuroscience Research

Architect : Lyons

Builder: Brookfield Multiplex Constructions

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