Bringing ideas to life

An expedition through the jungle

Delivering large scale commercial Passive House buildings Down Under – lessons learned.

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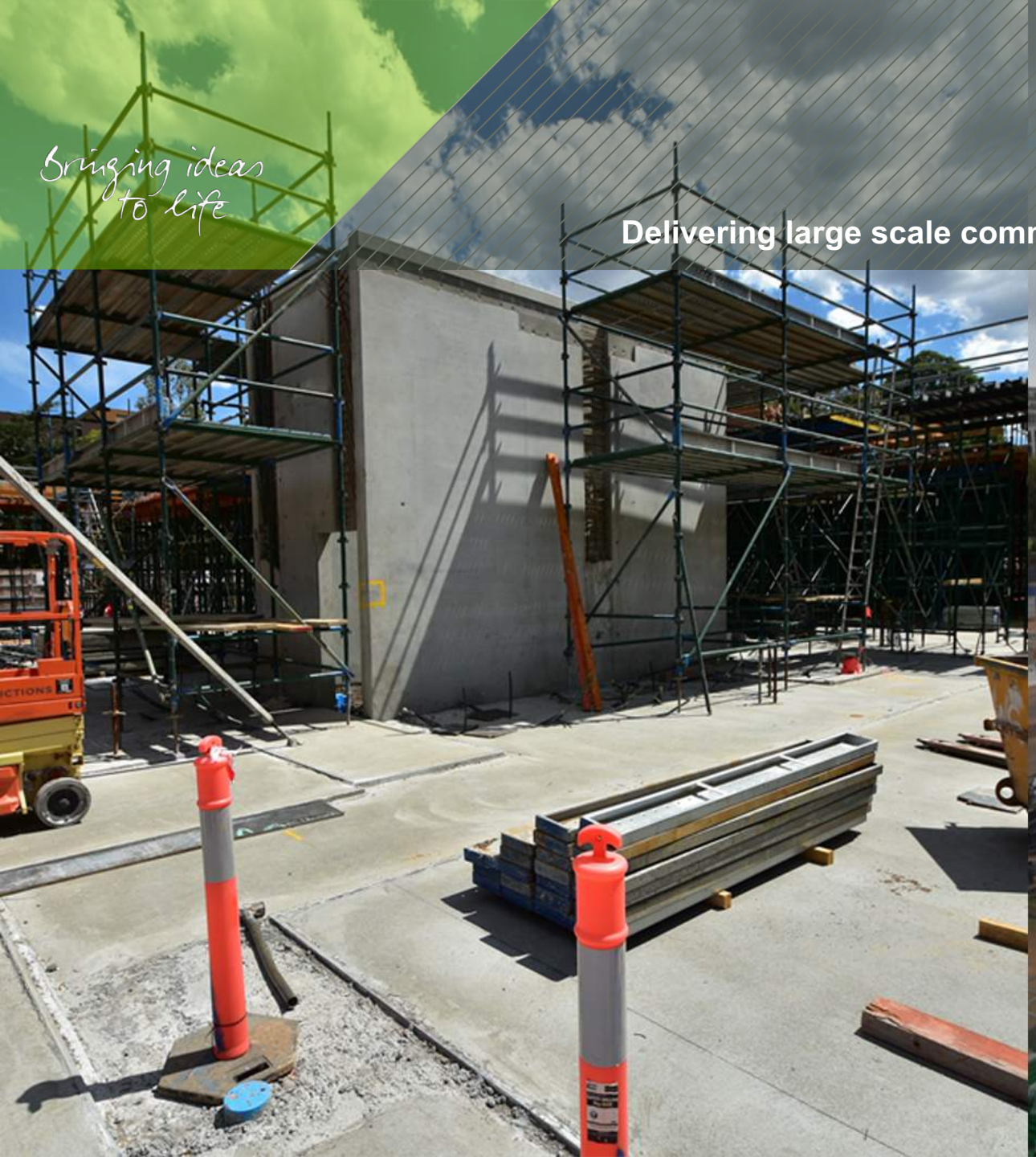

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Bringing ideas to life

Monash Chancellery

Clayton Campus, Melbourne

Client: Monash University
Builder: Kane Construction
Architect: ARM
Workplace Consultant: Geyer
Structure: Irwin Consult
Services::Aurecon
Passive House: Aurecon

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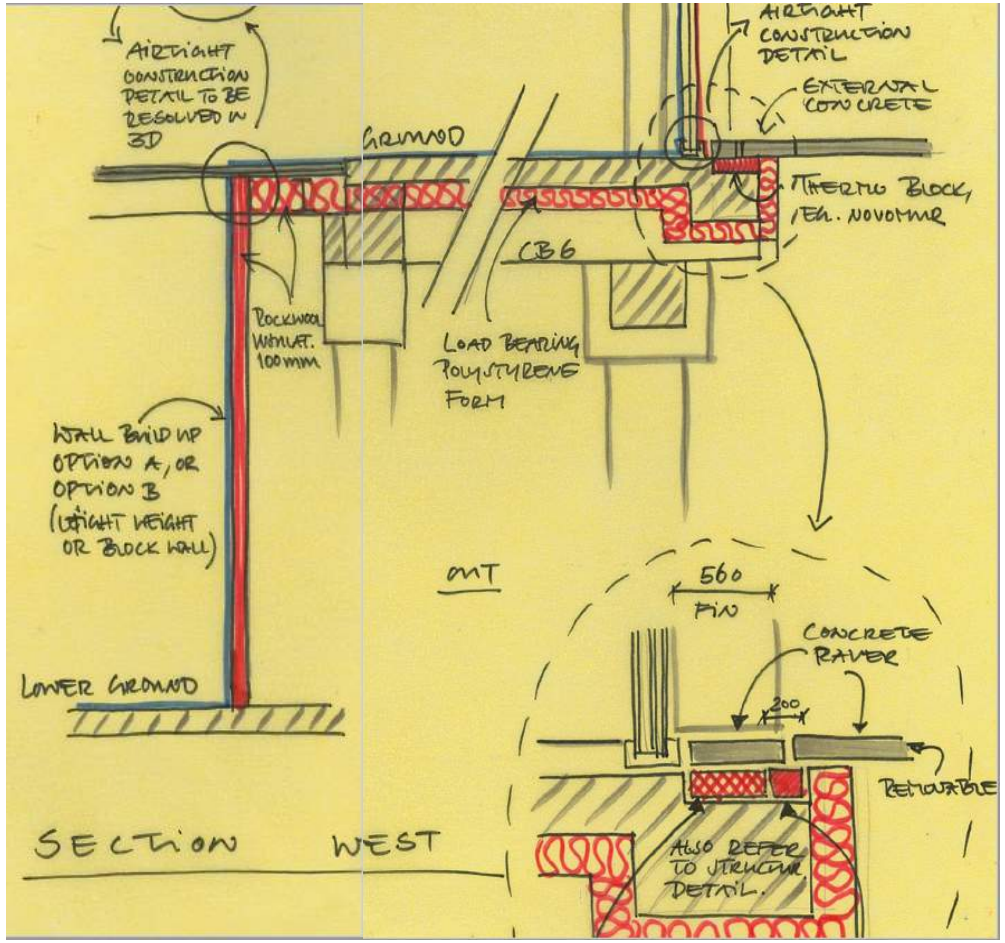
Technical Learnings

Thermal Bridging

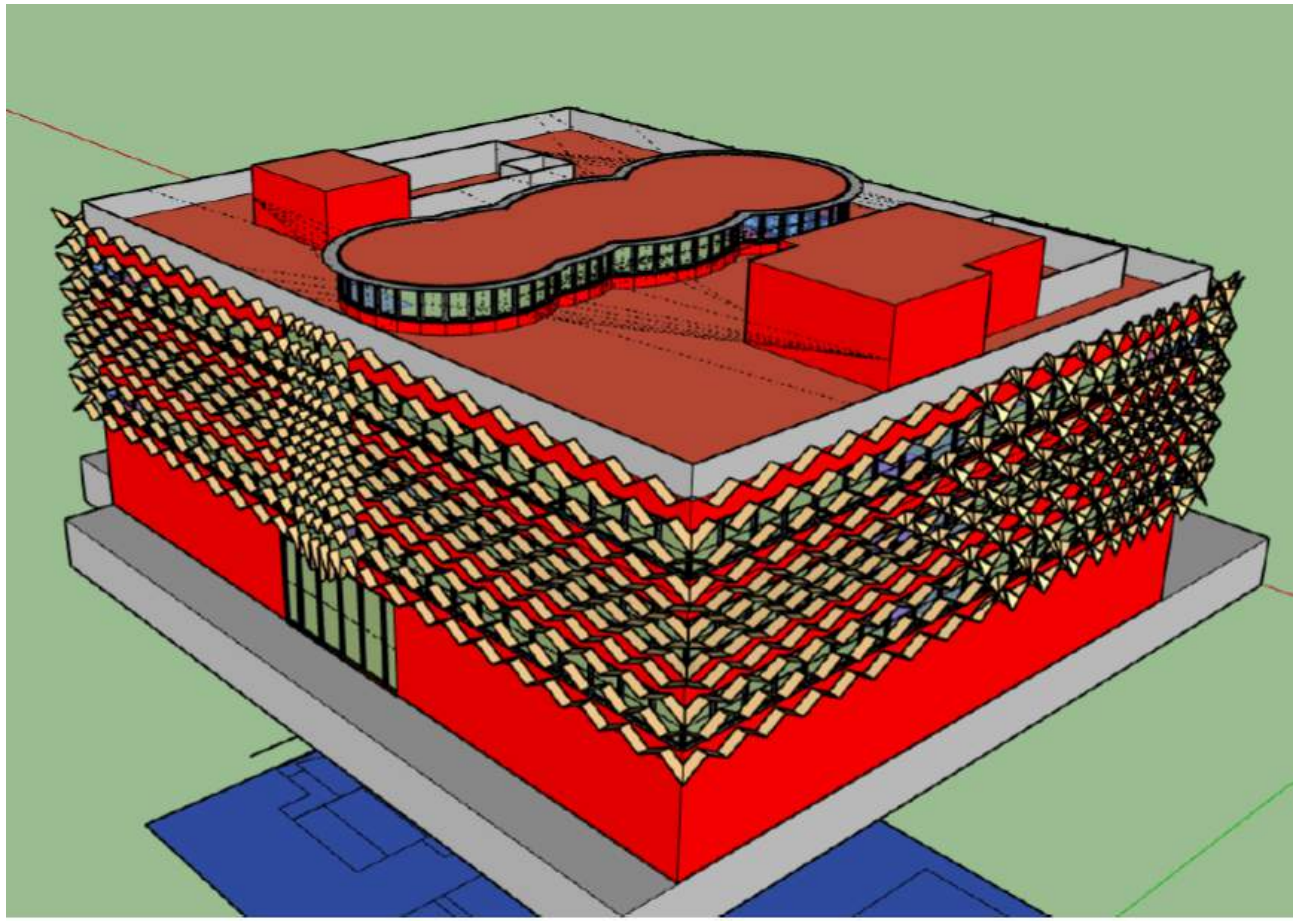
- In Melbourne (warm climate) the impact of Thermal Bridging for large buildings is not as significant as initially anticipated.

Structural Details



- On the primary structure avoiding thermal bridging can be very costly and complicated.
- Challenging to estimate impact without detailed modelling
- Pick your battles wisely

Shading Analysis



- PHPP has its limits for complex geometries
- Alternative tools must be used and results imported into PHPP

Combustibility of Airtightness Membrane

- Due to combustibility issue, airtightness membranes can be excluded from construction (depending on FER). Alternative solutions include wet plaster, airtight paints, corking/taping of joints of airtight panels.

Combustibility of Insulation

- Combustible insulation is typically excluded from the external building envelope. Sourcing non-combustible insulation for external applications remains a challenge.

Non-Technical Findings

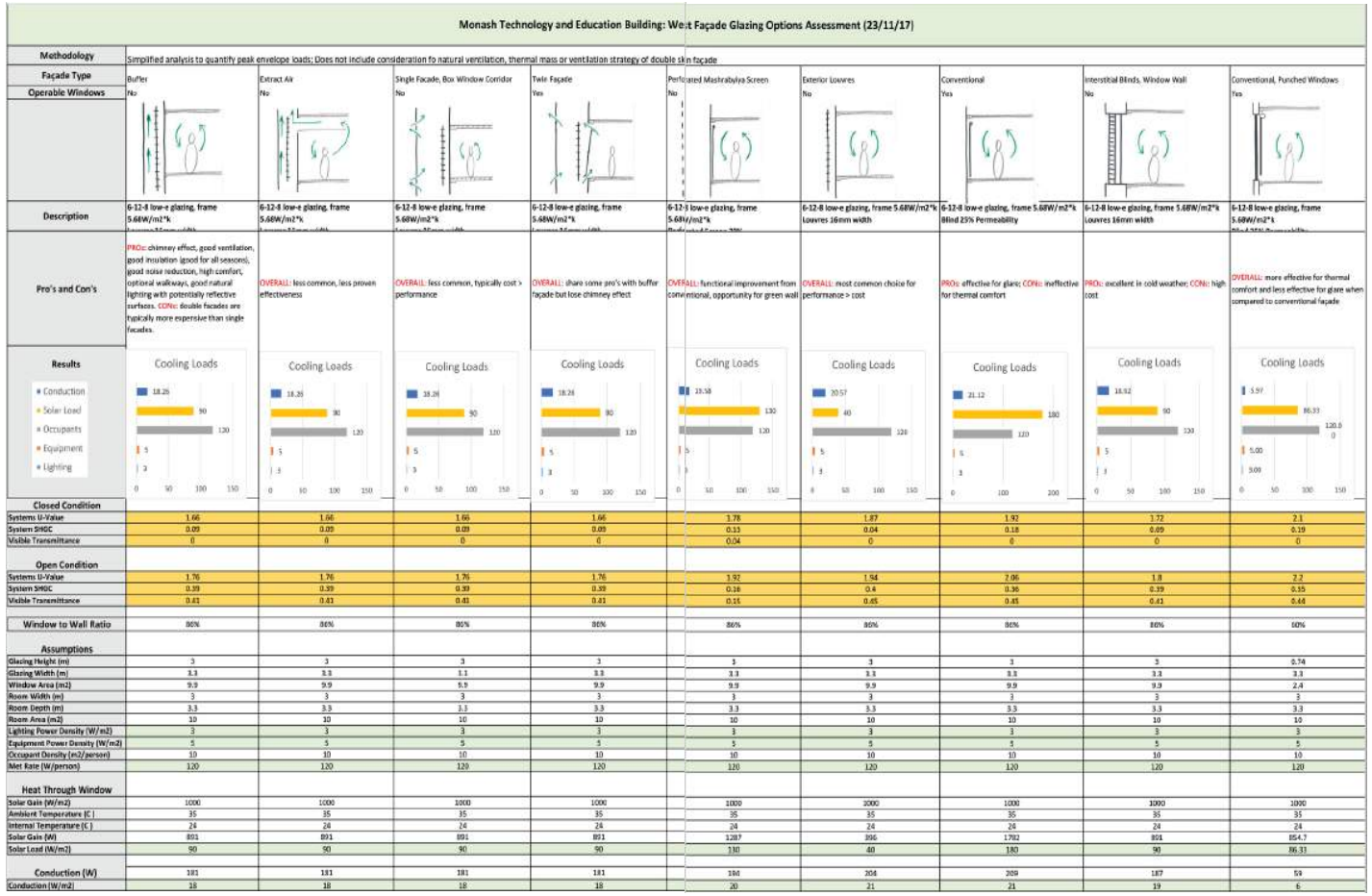
Project Team

- Procurement
- KPIs and personal agenda
- Accountability
- Project Target

Cost Planning

- Is there a separate ‘sustainability’ budget? What is included?
- Who evaluates trade offs and synergies?
- Who evaluates long term cost savings?
- How to value comfort, reputation, research opportunities, ….?

Expensive Fixes



Monash Technology and Education Building: West Façade Glazing Options Assessment (23/11/17)

Methodology	Simplified analysis to quantify peak envelope loads; Does not include consideration fo natural ventilation, thermal mass or ventilation strategy of double skin façade								
Façade Type	Buffer	Extract Air	Single Facade, Box Window Corridor	Twin Façade	Perforated Mashrabiya Screen	Exterior Louvres	Conventional	Interstitial Blinds, Window Wall	Conventional, Punched Windows
Operable Windows	No	No	No	Yes	No	No	Yes	No	Yes
Description	6-12-8 low-e glazing, frame 5.68W/m2*k	6-12-8 low-e glazing, frame 5.68W/m2*k	6-12-8 low-e glazing, frame 5.68W/m2*k	6-12-8 low-e glazing, frame 5.68W/m2*k	6-12-8 low-e glazing, frame 5.68W/m2*k	6-12-8 low-e glazing, frame 5.68W/m2*k Louvres 16mm width	6-12-8 low-e glazing, frame 5.68W/m2*k Blind 25% Permeability	6-12-8 low-e glazing, frame 5.68W/m2*k Louvres 16mm width	6-12-8 low-e glazing, frame 5.68W/m2*k
Pro's and Con's	PROs: chimney effect, good ventilation, good insulation (good for all seasons), good noise reduction, high comfort, optional walkways, good natural lighting with potentially reflective surfaces. CONs: double facades are typically more expensive than single facades.	OVERALL: less common, less proven effectiveness	OVERALL: less common, typically cost > performance	OVERALL: share some pro's with buffer façade but lose chimney effect	OVERALL: functional improvement from conventional, opportunity for green wall	OVERALL: most common choice for performance > cost	PROs: effective for glare; CONs: ineffective for thermal comfort	PROs: excellent in cold weather; CONs: high cost	OVERALL: more effective for thermal comfort and less effective for glare when compared to conventional façade
Results	Cooling Loads (Conduction, Solar Load, Occupants, Equipment, Lighting)	Cooling Loads	Cooling Loads	Cooling Loads	Cooling Loads	Cooling Loads	Cooling Loads	Cooling Loads	Cooling Loads
Closed Condition									
Systems U-Value	1.66	1.66	1.66	1.66	1.78	1.87	1.92	1.72	2.1
System SHGC	0.09	0.09	0.09	0.09	0.13	0.04	0.18	0.09	0.19
Visible Transmittance	0	0	0	0	0.04	0	0	0	0
Open Condition									
Systems U-Value	1.76	1.76	1.76	1.76	1.92	1.94	2.06	1.8	2.2
System SHGC	0.39	0.39	0.39	0.39	0.28	0.4	0.36	0.39	0.55
Visible Transmittance	0.41	0.41	0.41	0.41	0.15	0.45	0.45	0.41	0.68
Window to Wall Ratio	86%	86%	86%	86%	86%	86%	86%	86%	60%
Assumptions									
Glazing Height (m)	3	3	3	3	3	3	3	3	0.74
Glazing Width (m)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Window Area (m2)	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	2.4
Room Width (m)	3	3	3	3	3	3	3	3	3
Room Depth (m)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Room Area (m2)	10	10	10	10	10	10	10	10	10
Lighting Power Density (W/m2)	3	3	3	3	3	3	3	3	3
Equipment Power Density (W/m2)	5	5	5	5	5	5	5	5	5
Occupant Density (m2/person)	10	10	10	10	10	10	10	10	10
Met Rate (W/person)	120	120	120	120	120	120	120	120	120
Heat Through Window									
Solar Gain (W/m2)	1000	1000	1000	1000	1000	1000	1000	1000	1000
Ambient Temperature (C)	35	35	35	35	35	35	35	35	35
Internal Temperature (C)	24	24	24	24	24	24	24	24	24
Solar Gain (W)	891	891	891	891	1287	396	1782	891	854.7
Solar Load (W/m2)	90	90	90	90	130	40	180	90	86.33
Conduction (W)	181	181	181	181	184	304	209	187	59
Conduction (W/m2)	18	18	18	18	20	21	21	19	6

- Anything is possible … but it typically comes with a price tag and an increased risk in not meeting PH benchmarks.

Strategic Plan

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Getting ready for the next expedition

- Project team responsibilities and qualifications
- Allow for training/education
- How to evaluate cost?
- Understand project added values
- High level design strategy and PHPP stress test Agree on risk strategy (safety margin)
- Understand availability of materials/products early, consider lead times and cost premiums
- Validate availability/constructability of thermal performance – e.g curtain walls
- D&C contract – clarity on performance specifications vs. architectural drawings

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