Design for Manufacturing and Assembly (DfMA), and Modular Construction in Australia

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By 2050, Melbourne’s population will double to more than 8 million
Extra 700,000 homes will need to be built over the next 15 years
Challenges Facing the Construction Industry in Australia

Key problems

1. Project Delays & Cost Overrun
   - One in three projects experienced delay and cost overrun by up to 50%
   - Governments lost $28 billion over the last 15 years on cost overruns in infrastructure projects

2. Non-conforming Materials & Building Products
   - More than 50% of tall buildings in Melbourne use non compliant cladding materials

3. Quality Issue & Reduced Workplace Productivity
   - 40% projects reported having quality issues
   - Cost $2 billion a year for rework
   - Productivity hasn’t changed over the last 20 years

4. Safety on Site & Skilled Labour Shortages
   - Over 5 years 2008-2013
     - 182 workers killed
     - 63230 serious injuries
     - 20% tradespeople above 55 yr
**Productivity challenge, how can we solve it?**

**Challenges:** How do we build faster, cheaper, high quality and more sustainable buildings & infrastructure?

The productivity opportunity in construction

**Construction matters for the world economy**

... but has a long record of poor productivity

- Construction-related spending accounts for 13% of the world’s GDP
- But the sector’s annual productivity growth has only increased 1% over the past 20 years
- $1.6 trillion of additional value added could be created through higher productivity, meeting half the world’s infrastructure need

McKinsey & Company, 2017, Reinventing construction through a productivity revolution

5–10x productivity boost possible for some parts of the industry by moving to a manufacturing-style production system

**Resilient, Affordable and Sustainable Buildings**
Markets for Modular Prefab Construction

**Residential**
- $40B (Aus)
- +$500B (Asia)

**Education**
- $150M (Vic), 100 schools
- $2B (NSW),
- $6B/pa on upgrade & ext.

**Healthcare**

**Hotels**

**Infrastructure**
- $15B market
- $70B next 5 years
VISION
To create a global research hub that enables rapid growth of the emerging prefab manufacturing industry to deliver affordable and high-quality housing through innovation and streamlining of the supply-chain.

$4 million Australian Research Council funding and matching funding from industry
**One-stop-shop:** Digital design, prototyping, materials & components, testing and certification, manufacturing/automation, process optimisation, monitoring

*Fire*

*Acoustic*

*Structural*

*Thermal*

*Durability*

*IAQ*

*Energy*

*Wind*

*Flood*

*Earthquakes*
Centre partners
Our main objectives

Transform the Australian construction industry through:

• New materials, systems, techniques, and processes
• New financing and supply-chain models
• Achieve a step-change in productivity
• Realise significant cost reduction
• Up-skill existing workforce
• Develop high-value manufacturing capabilities
From Panelised to Volumetric Systems
Enabling technologies - Our R&D projects
Key Programs

1. Digital Technologies for Design, Simulation, DfMA
2. Novel Material Development & Testing
3. Innovative Construction & Infrastructure Systems
4. Financing, Risk & Supply Chain Management

Industry Outcomes
- 60% faster construction
- 50% reduction in life cycle costs
- 90% reduction in waste
- 50% reduction in GHG emission
- 70% reduction in labour & transport
1. Innovation in Design for Manufacturing and Assembly

- Design for Manufacturing and Assembly (DfMA)
- BIM Platform for Modular Prefab
- Design for Transportation
2. High performance materials

- Lightweight
- Fire resistant
- Affordable
- High Strength
- Durable
- Environmentally friendly
3. Advanced building systems and assembly techniques

Lightweight Floor Systems
Framing Systems
Panelised Systems
Smart Pods
Connections
4. Supply chain and financing innovation

Challenges

• Australian banks risk averse in lending to modular
• Risk of traditional modular industry being disrupted by imported modular industry if finance isn't solved.
• Supply chain inefficiency
Program 4: Supply chain and financing innovation

- New risk profiling tools and procurement frameworks for prefab housing.
- Logistic optimisation
- Assist industry to develop a more efficient supply chain and new financing models.
Modular Panelised Systems
Design for Manufacturing and Assembly

- Engineered timber post-tensioned panelised system
- Experimental and numerical validation of structural performance
  - Lifting system
  - Panel system
  - Timber floor system
Non-compliant Building Products – A Global Issue

Lacrosse Tower
Melbourne, 2014

The Address Hotel
Dubai, 2015

Grenfell Tower,
London, 2017
Big issues in product compliance

Non-compliant Building Products – A Big Cost

HUGE COST TO OWNERS

“Since the fire, 312 apartment owners in the 23 storey Lacrosse Tower have been ordered to rip off and replace the non-compliant material within the next 12 months and will be forced to bear the estimated $40 million cost themselves.”

The Australian, 18 February 2016

That equates to a cost of approximately $128,000/per apartment

More than 50% of high-rise buildings in Melbourne use similar non-compliant cladding materials
• The main challenge of the traditional supply chain is the shortage of an open and trustworthy information resource across the supply chain. Every link in the supply chain is a bottleneck for information sharing and trust erosion.

• The Blockchain technology has the potential to tackle these challenges. Information on each product can be indelibly recorded in the product’s Blockchain. This capability can be extended to provide some supporting evidence of any claim made about products or services provided.

• All of these records are available to the supply chain participants and can enable any audits on quality issues faced in the downstream supply chain. Since the information input to the Blockchain system is authenticated, the reliability of the information is significantly higher than in traditional building projects.
Inclose Façade System

CRC-P on Advanced Manufacturing of High Performance Building Facade Systems
Project details:

- Production to commence in April 2018
- Installation to commence in May 2018
- Façade installation complete in August 2018
SOUTHMOOR PRIMARY SCHOOL

CLIENT:
DET/ Victorian School Building Authority (VSBA)

PROJECT TEAM:
Grove Aust Pty Ltd
K20 Architects
BHA Project Management

TIMELINE:
Award: 5 October 2017
Design: 12 November 2017
Delivery: 9 January 2018
Handover: 26 January 2018

BUDGET
Design= $120,000
Construction= $2,100,000
Civil works= $420,000
77 apartments.
6 levels.
Assembled on site in just 10 days.
La Trobe Tower - Australia's tallest prefabricated building
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Summary – Key to Success for Modular Construction
Thank you

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