

14<sup>th</sup> Annual Workshop of the Australian Network of Structural Health Monitoring

# THE BENEFITS OF DIGITAL ENGINEERING AND PREFAB IN CONSTRUCTION

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Prefab in residential construction



# MIRVAC'S PREFAB JOURNEY



# YEARS OF PREFAB PROJECTS AND LEARNINGS

2013

2021



**ELIZABETH HILLS – NSW**

- 2 Home Trial
- Walls and floors
- 10 weeks program saving (42%)



**BRIGHTON LAKES – NSW**

- 110 homes
- Walls and floors
- Avg 27% reduced program



**DONCASTER – VIC**

- 36 Homes
- Walls, Floors & Lift Shafts
- 20-25% reduced program



**WAVERLY PARK – VIC**

- 11 Homes
- Walls & Floors
- 23% time saving in build duration



**WOODLEA – VIC**

- 26 homes
- First 52 bathroom pods used in Mirvac Homes
- 88% Reduction in On-Site labour hours for bathroom work

# COMPLETED HOMES USING PREFAB



# COMPLETED HOMES USING PREFAB



# Summary of benefits using 'prefab'

# BENEFITS FOR THE BUILDER

Construction Program	REDUCED BY 20-40%	↓
Site Prelims costs	REDUCED BY 20-40%	↓
Construction waste removal	REDUCED BY 40-50%	↓
Scaffolding hire period	REDUCED BY 30-50%	↓
On-site labour requirements	REDUCED	↓
Construction administration tasks	REDUCED	↓
Site safety administration tasks	REDUCED	↓
Manual Handling requirements	REDUCED	↓
Incidents and Injuries	REDUCED	↓
Work related stress and fatigue	REDUCED	↓
Inconsistent Quality	REDUCED	↓





## BENEFITS FOR THE CUSTOMER

- Certainty of Delivery
- Improved Performance
- Improved Durability
- Market leading product
- Improves consistency of quality and finish
- Reduce post completion issues



## BENEFITS FOR THE ARCHITECT

- Improves Design Efficiency
- Reduced documentation detailing
- Ability to develop a product catalogue
- Documentation Consistency
- Improve consistent workmanship outcomes



## BENEFITS FOR THE COMMUNITY

- Reduced waste generated on site
- Reduced carbon footprint of construction
- Higher Performing and energy efficient homes
- Reduce construction impact on community
- Reduced construction traffic



## BENEFITS FOR THE DEVELOPER

- Project metrics: Less time improves IRR and ROIC
- Responsible Developer Reputation
- Forward Thinking, Industry Leading
- Reduce Impact on existing development customers
- Reduces Project Delivery Risk






# The real challenges of prefab in residential construction

# CHALLENGES WITH PREFAB IN AUSTRALIA

CHALLENGES	SOLUTIONS
<p>PREFAB COSTS MORE</p> 	<ul style="list-style-type: none"> <li>• Adopt DfMLA principles</li> <li>• Demonstrate total project savings upfront</li> <li>• Unlock economies of scale</li> <li>• Utilise technology to reduce costs</li> </ul>
<p>CUSTOMER EXPECTATIONS (PERSONALISED DESIGNS)</p> 	<ul style="list-style-type: none"> <li>• Educate the customer on how to balance design excellence and DfMLA</li> <li>• Provide evidence on increased performance through prefab</li> <li>• Demonstrate the value of a better balance between aesthetics and performance</li> </ul>
<p>CHANGE MANAGEMENT</p> 	<ul style="list-style-type: none"> <li>• Educate all stakeholders on change management principles and techniques</li> <li>• Implement governance to assist in change management support</li> <li>• Demonstrate value and benefit to the various stakeholders</li> </ul>

## CHALLENGES WITH PREFAB IN AUSTRALIA

CHALLENGES	SOLUTIONS
<p><b>MANUFACTURING SUPPLY CHAIN</b></p> 	<ul style="list-style-type: none"> <li>• Increased adoption of prefab will increase manufacturing supply chain</li> <li>• Early Engagement and Builder/Manufacturer risk sharing balance</li> <li>• Developing industry partnerships</li> </ul>
<p><b>INTENSE PLANNING REQUIREMENTS</b></p> 	<ul style="list-style-type: none"> <li>• Implement structured governance to assist in planning requirements</li> <li>• Utilise Technology (BIM and DE)</li> <li>• Establish appreciation for the benefits of better planning</li> </ul>
<p><b>ADOPTING DIGITAL ENGINEERING</b></p> 	<ul style="list-style-type: none"> <li>• Invest in Software to unlock efficiency</li> <li>• Education and Training on 3D, 4D and 5D benefits</li> <li>• Understand the value of model sharing between builder/designer/manufacturer</li> </ul>

# Mirvac case studies

CAPTURING DATA TO PROVE THE BENEFITS AND OFFSET CHALLENGES

## Case Study #1

# WOODLEA, VIC, 2021

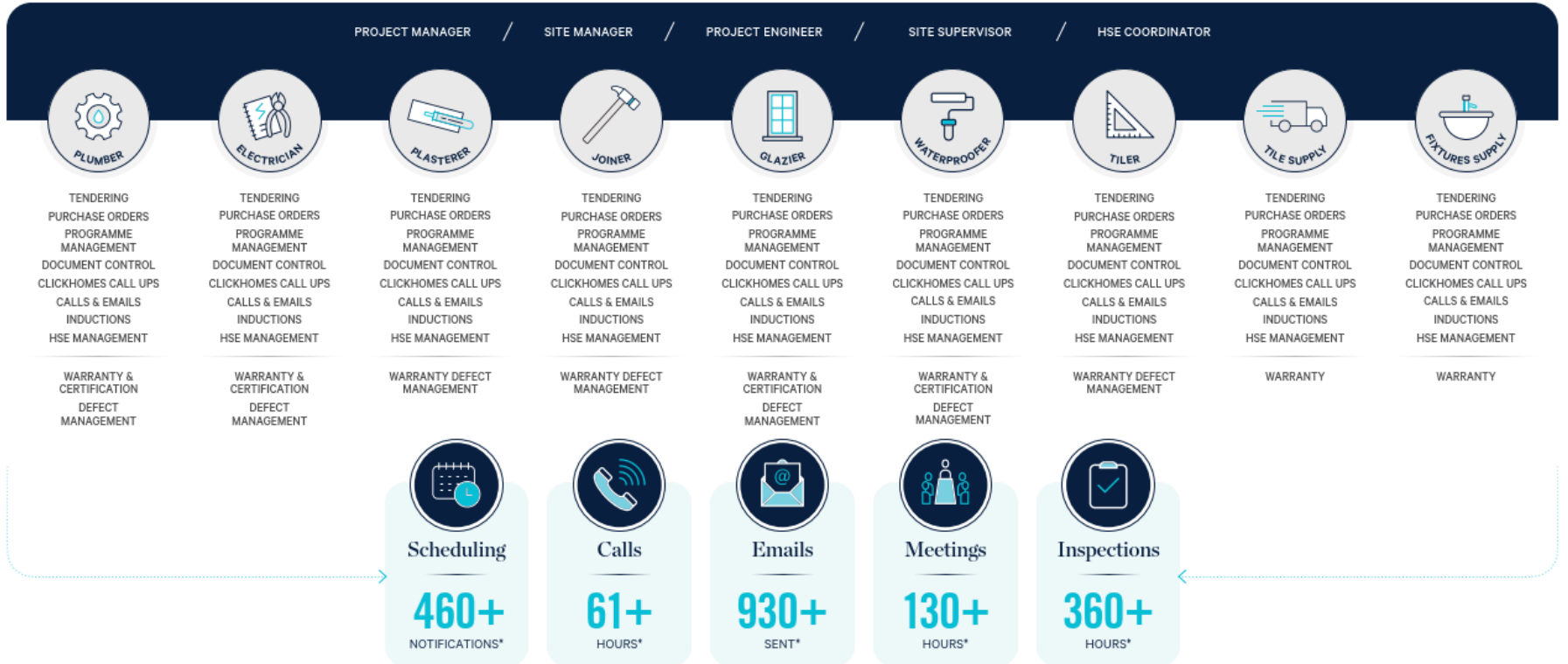
## BATHROOM PODS



# COLLECTING BENCHMARK DATA FOR COMPARISON



# OUR PEOPLE – TRADITIONAL APPROACH



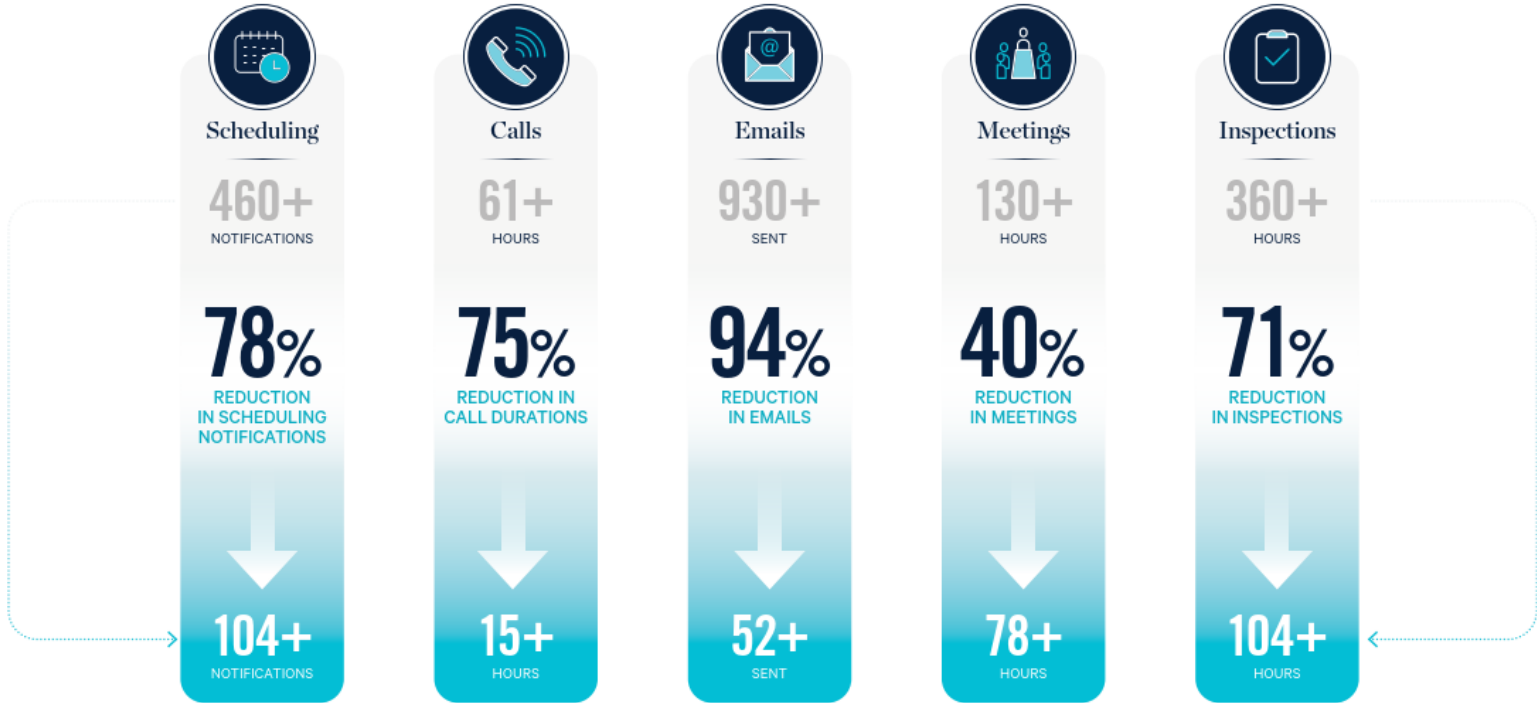
\*Based on 26 homes

# OUR PEOPLE – PREFAB APPROACH





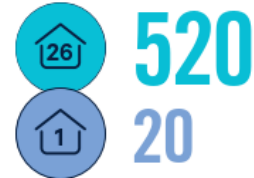
# SUMMARY



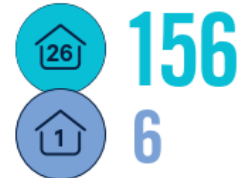
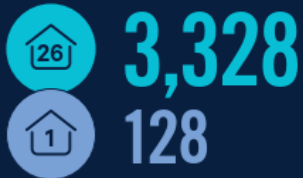
### Traditional



### Prefab Pod



98%  
REDUCTION IN  
ENTRIES AND EXITS  
IN A BATHROOM



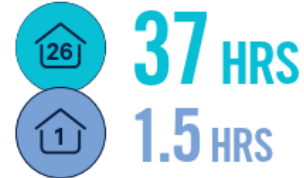
96%  
REDUCTION IN  
WORKERS FOR  
A BATHROOM

# OUR PROJECT

## Traditional



## Prefab Pod



## Case Study #2

# GEORGES COVE, MOOREBANK, SYDNEY



# COLLECTING BENCHMARK DATA FOR COMPARISON



# THE BENEFITS KEEP GETTING BETTER...

## PROGRAM BENEFITS

SUPERSTRUCTURE

**54%**

Reduction



EXTERNAL CLADDING

**67%**

Reduction



FLOORING

**91%**

Reduction



OVERALL DURATION

**30%**

Reduction



## OTHER BENEFITS

WASTE REDUCTION

**60%**

Reduction



SCAFFOLD HIRE

**53%**

Reduction



MANUAL HANDLING

**9550**

Less Manual Lifts



SAFETY RISKS

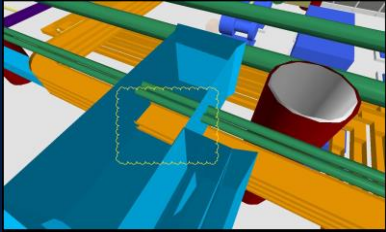
- Material Cutting
- Falling Objects
- Falls from Height



# What's next?

# DIGITAL ENGINEERING IN CONSTRUCTION

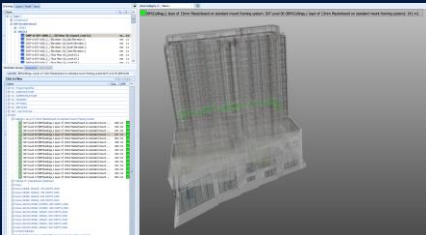
## 3D DESIGN COORDINATION



## 4D PLANNING

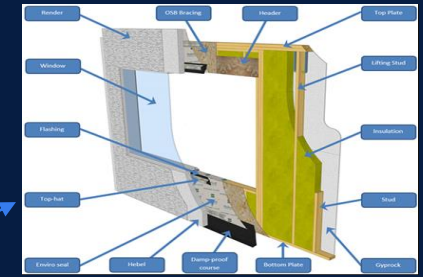


## 5D QUANTIFICATION & COSTING



## BUILDING INFORMATION MODELLING (BIM)

## OFF SITE MANUFACTURE



## CAPTURING AND LEARNING FROM DATA



## VISUALISATION AR/VR





# ALTONA NORTH – VIC

130 APARTMENTS – PREFAB WALLS, FLOORS AND BATHROOM PODS

## DFMLA PRINCIPLES ADOPTED AT CONCEPT DESIGN

- Transfer of Loads
- 6 Bathroom Types
- Floor plate Efficiency
- Lightweight Timber Structure

## EARLY CONTRACTOR ENGAGEMENT

- Compliance Consultant
- Structural Engineering
- Services
- Structure

## USE OF TECHNOLOGY (BIM)

- 3D Modelling
- 4D Planning
- 5D Estimating

## PREFAB ELEMENTS UNLOCKED

- External Walls
- Internal Walls and Parti Walls
- Structural Flooring
- Bathroom Pods



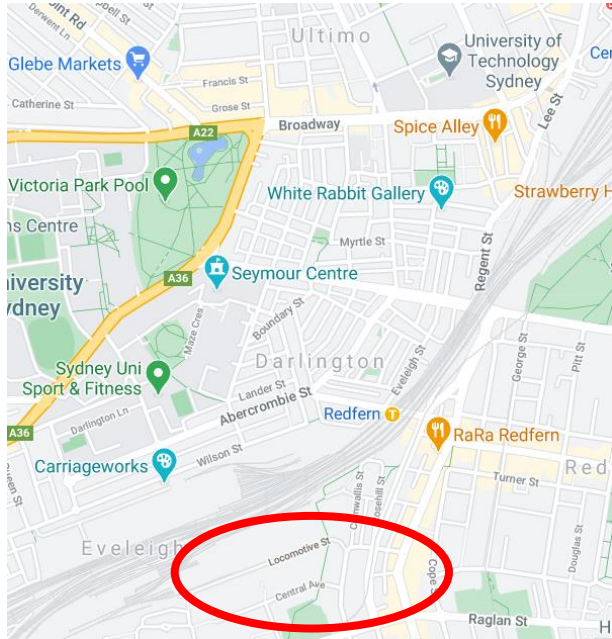
## CASE STUDY

# DIGITAL ENGINEERING & DFMA IN PRACTICE

# AUSTRALIAN TECHNOLOGY PARK (ATP) - SOUTH EVELEIGH

## Project Information

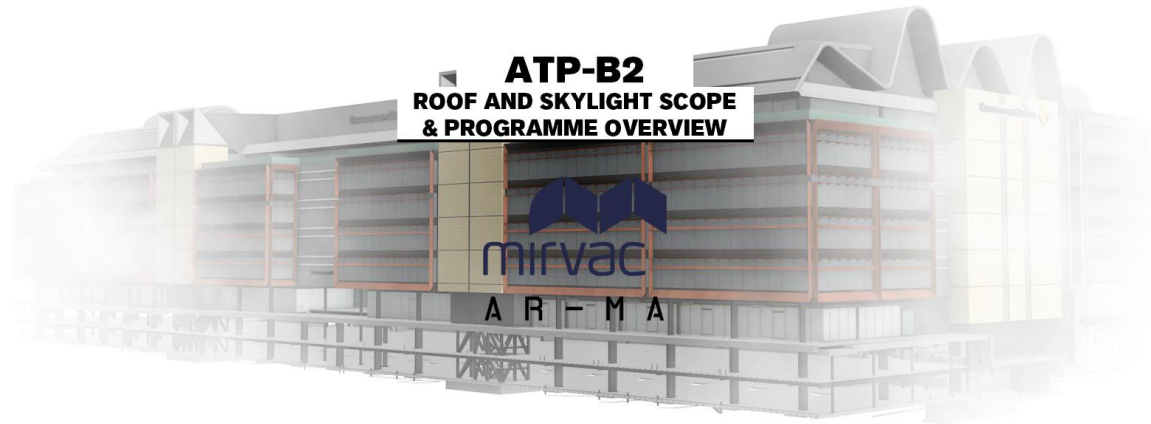
- » 125,000m2 NLA
- » \$925 million Construction Costs



# STAGE 1 – CREATING THE DIGITAL MODEL



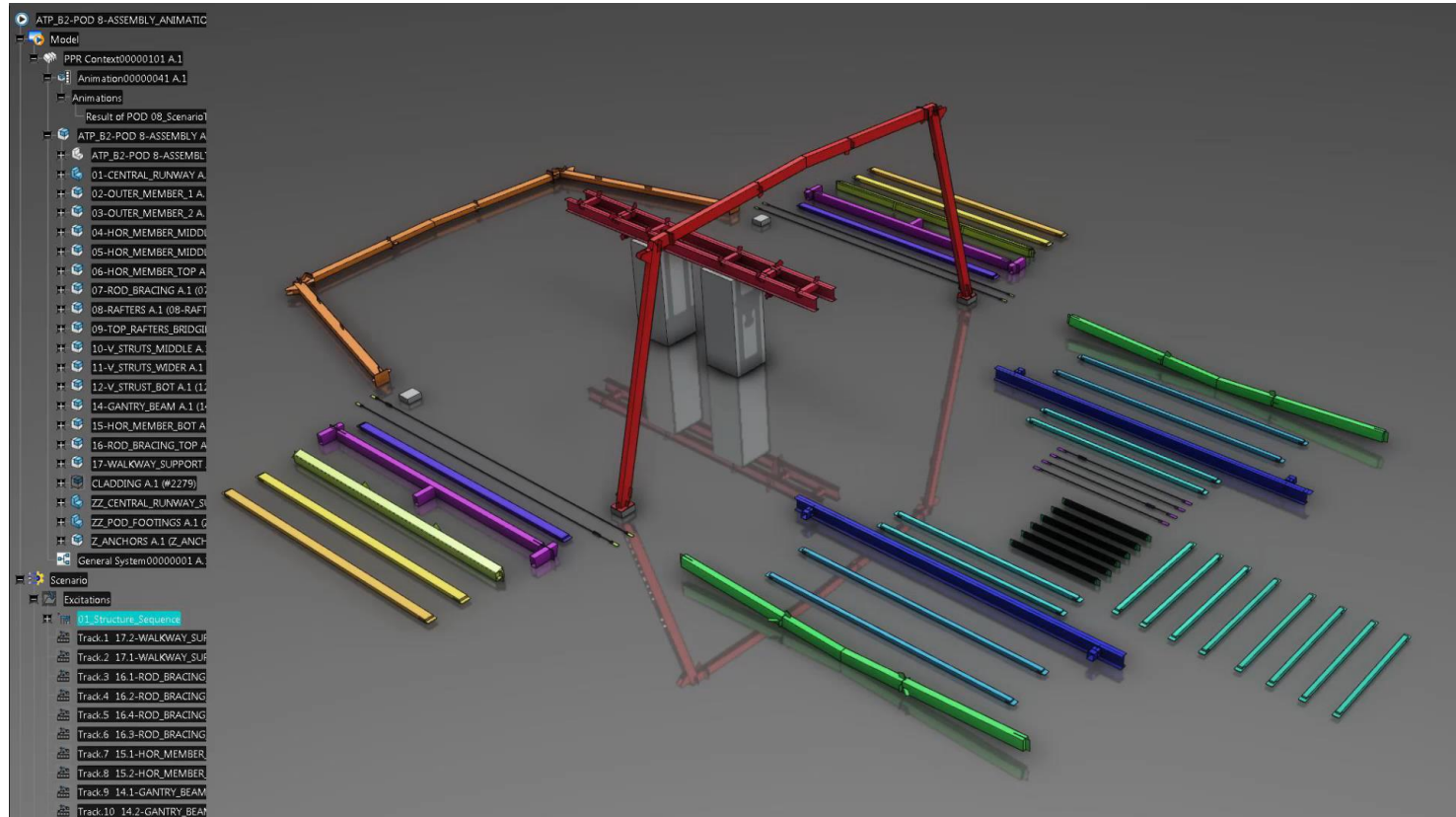
# STAGE 2 – IDENTIFYING COMPLEX ELEMENTS & DFMA PRINCIPLES



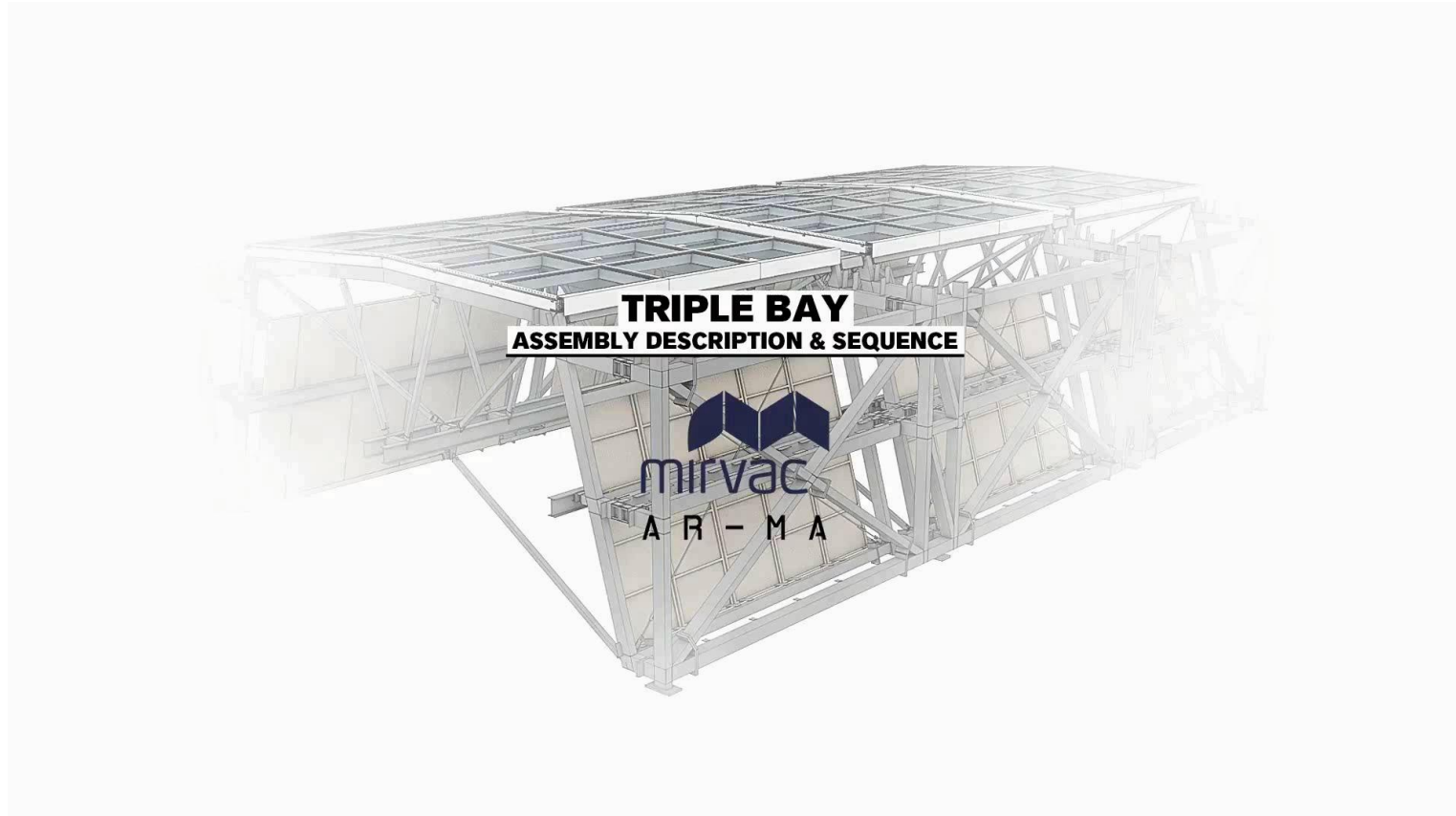
Identification of key DFMA opportunities in early planning phase of the project. These included:

- » Roof modules
- » Skylight / POD modules

# STAGE 3 – MODELLING COMPONENTS



# STAGE 4 – MODELLING ASSEMBLY OF COMPONENTS



# STAGE 5 – MODELLING SITE LOGISTICS



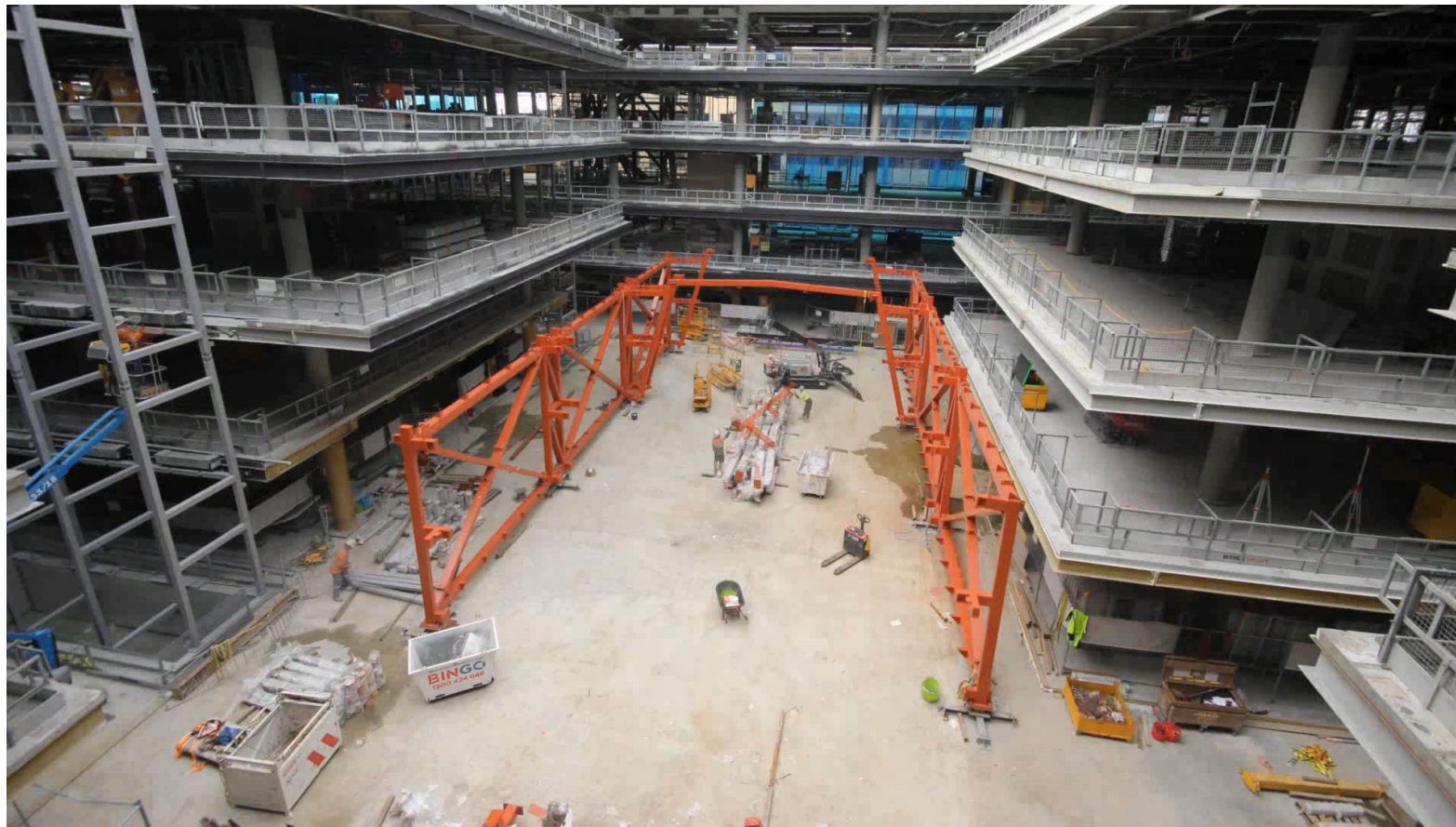


# STAGE 6 – CONSTRUCTION SEQUENCING (4D)



**ATP-B2**  
**ROOF AND SKYLIGHT SCOPE**  
**4D CONSTRUCTION SEQUENCE**

# STAGE 7 – ON SITE DELIVERY



# PHASE 6 – ROOF INSTALLATION PROGRESS PHOTOS



# Thank you