

# IRELAND - OFF SITE MANUFACTURING



## Architects' Perspective

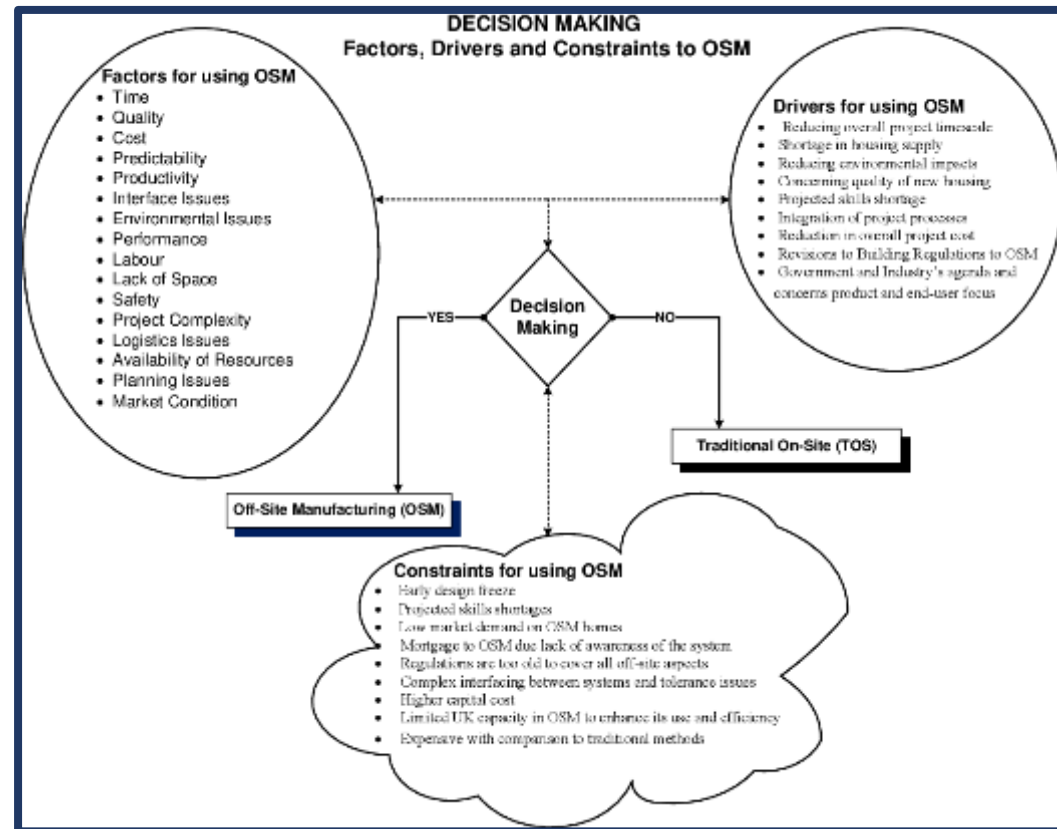
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David Browne, FRIAI, **RKD** Architects  
Joe Kennedy, FRIAI, **SMITH+KENNEDY** ARCHITECTS

# **OFF SITE MANUFACTURING OVERVIEW**

# INTRODUCTION

- Off-Site Manufacturing (OSM) now developing at scale in UK/US
- Increased use of BIM
- Speed of delivery, particularly for housing
- OSM re-emerging in recent years in RoI and NI, but still not at scale
- OSM in Ireland is typically component related with little modular at scale to date except for some M+E at construction stage
- Not without its problems and concerns



# FINANCE MODEL AND RISK

- Traditional construction payment made for completed work on site (or vested materials)
- OSM finance model is different
  - Upfront investment - manufacture, labour material
  - R+D to certify systems before manufacture
  - Earlier payment - before OSM units delivered
  - Higher pre-planning and design costs
  - Front loaded payment risks for Client.
- Module supplier now responsible for timely delivery of units - critical for schedule
- Mitigation of risk
  - Early supply chain involvement / procurement
  - Collaboration and proper risk apportionment





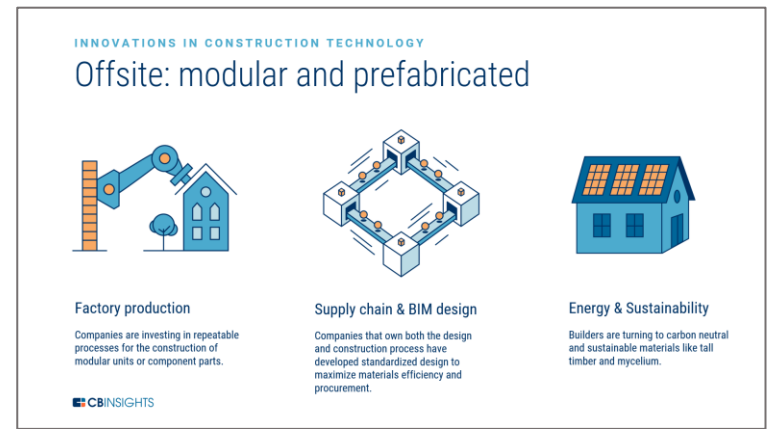
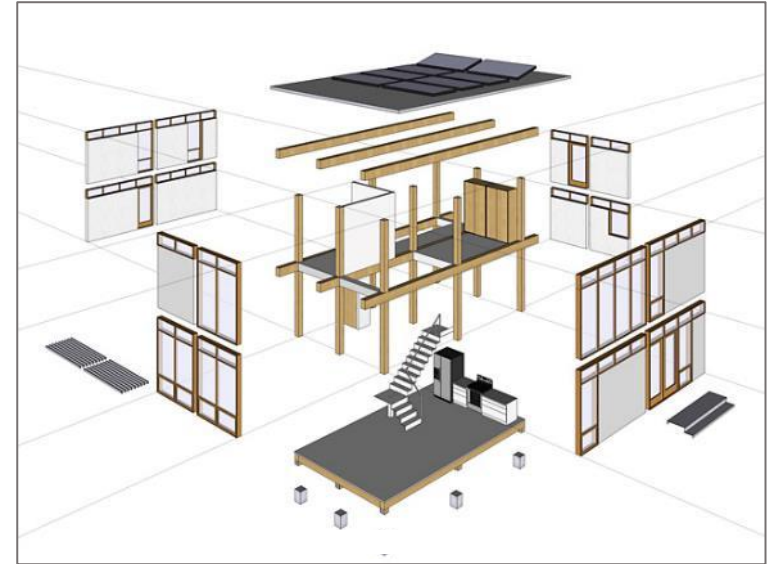
# QUALITY AND ASSURANCE

- Potential for higher finished construction quality
- Risks need to be understood by Insurers
  - Durability and maintenance assessments
  - Warranties
  - Build Offsite Property Assurance Scheme in UK
- Inspection by third party protocols needs to be more developed and effective.



# EARLY DESIGN DECISIONS CRITICAL

- Traditional value engineering at procurement or construction stage no longer effective
- VE opportunities need to be assessed at early design stage
- New design management protocols
- Change management cannot take place after commencement of manufacture
- Experienced project planners, designers and manufacturers key to success



# OSM ADVANTAGES

- Controlled manufacturing – improved quality, conditions, efficiency, H+S
- Speed
  - Modules completed in parallel with early construction
  - Fast on-site erection (up to 60% faster)
  - Less on-site work construction personnel
  - Efficient for city centre sites
  - Big construction waste reductions and better recycling
  - Reduced snagging – repetitive and less mistakes
  - Early decisions reduces potential on-site delays and cost overruns



# **POTENTIAL PROBLEMS, ISSUES AND CONCERNS**



● **Greater risk for client due to earlier payments.**

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- Insurance / pre-payment bonds.
- Risk sharing.
- Financial checks on suppliers.

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  - Reduced ability for change in evolving environment such as health care.
  - Scope of services agreements with Consultants need to reflect front loading.
  - Construction programme reduces but pre-construction programme may increase.
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- **Design approaches informed more by technology.**

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  - Innovation may suffer as efficiency becomes the imperative. Bespoke solutions less attractive.
  - Commoditisation of building requires adjusted responses in design.
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- **Local employment impact.**

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- Especially relevant in developing countries.
- May dilute instrument of Government in stimulating economic activity due to centralised manufacture.
- Potential positive impact if facility is in regions where employment can be boosted.

- **Specialised v general skill sets.**

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- May limit access to employment for lower skilled workers.
- Skills shortages may impact delivery.



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## ● Quality

- Errors made become imbedded in the project if not caught at pre-erection stage.
  - Repairs may be more problematic to address – e.g. pod from China develops fault after a number of years – how do you approach remedial work?
  - How should quality control / monitoring be addressed?
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- How is post completion liability dealt with – both Defects Liability Period and Latent Defects?

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## ● BCAR and Regulatory.

- The Code of Practice may need to be expanded to deal with inspection of off-site construction.
- Until the first post SI9 case involving OSM goes through the system, we will not understand the liability attaching to inspection and certification.
- Construction Products Regulations will apply – will that limit markets?

## ● Corona Virus.

- Does the pandemic permanently affect the way we think about construction activity – a reduction in close quarters work and social interaction on sites and in OSM factories?
- Combine 1.5m wide standard single module cassette glazing into 3m wide double units to achieve 2m separation.
- Design cladding panels greater than 2.5m width to achieve 2m separation.
- Maximise off-site prefabrication for all cladding and glazing components
- Maximise on-site areas remote from construction to prefabrication cladding and glazing prior to site installation
- Is risk transferred from site to manufacturing facility.



**HOW DOES BIM SUPPORT OSM?**

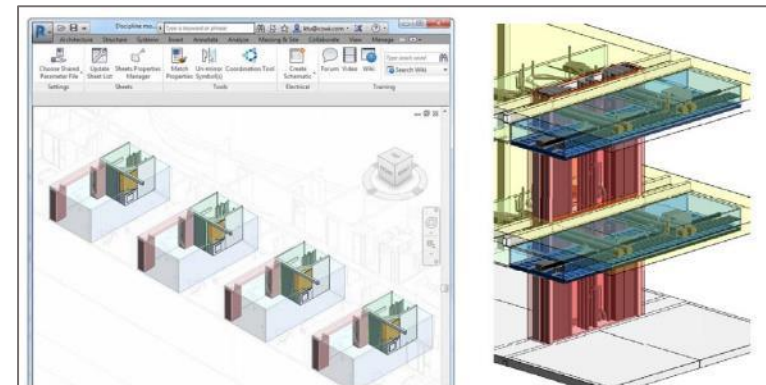
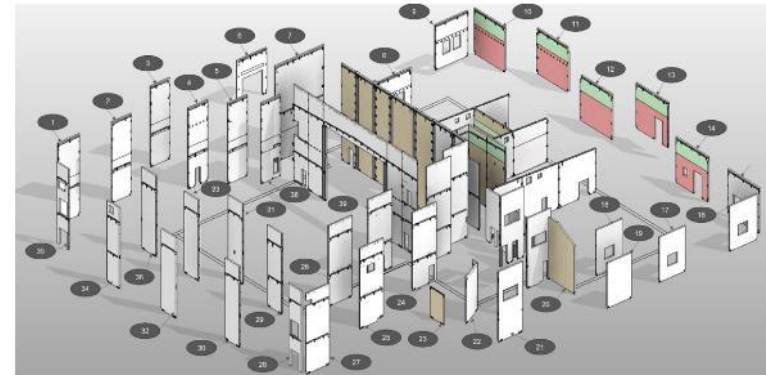


# HOW DOES BIM SUPPORT OSM?

Greater precision in specifying material requirements

- Reduces over-ordering
- Decreases construction site waste
- Assists fabricators and contractors with 3D model of element positions
- Can accurately represent geometry, behaviour and properties of individual building components
- Facilitates component incorporation into standardised building elements or volumes
- Allows direct interfacing between designers, suppliers, manufacturers and users
- Helps avoid longer lead-in times, high costs and modification problems

*BIM allows “construction data to be machine processable and components to be manufactured without human intervention”* Eastman and Sacks



# EXAMPLES

# SOME EXAMPLES - CONSTRUCTION

## BRICKWORK ON PRECAST CONCRETE PANELS

- Dublin Landings Commercial Offices
- Capital Dock (OMP) Residential





# SOME EXAMPLES - CONSTRUCTION

## UNITISED CLADDING AND GLAZING FACADES

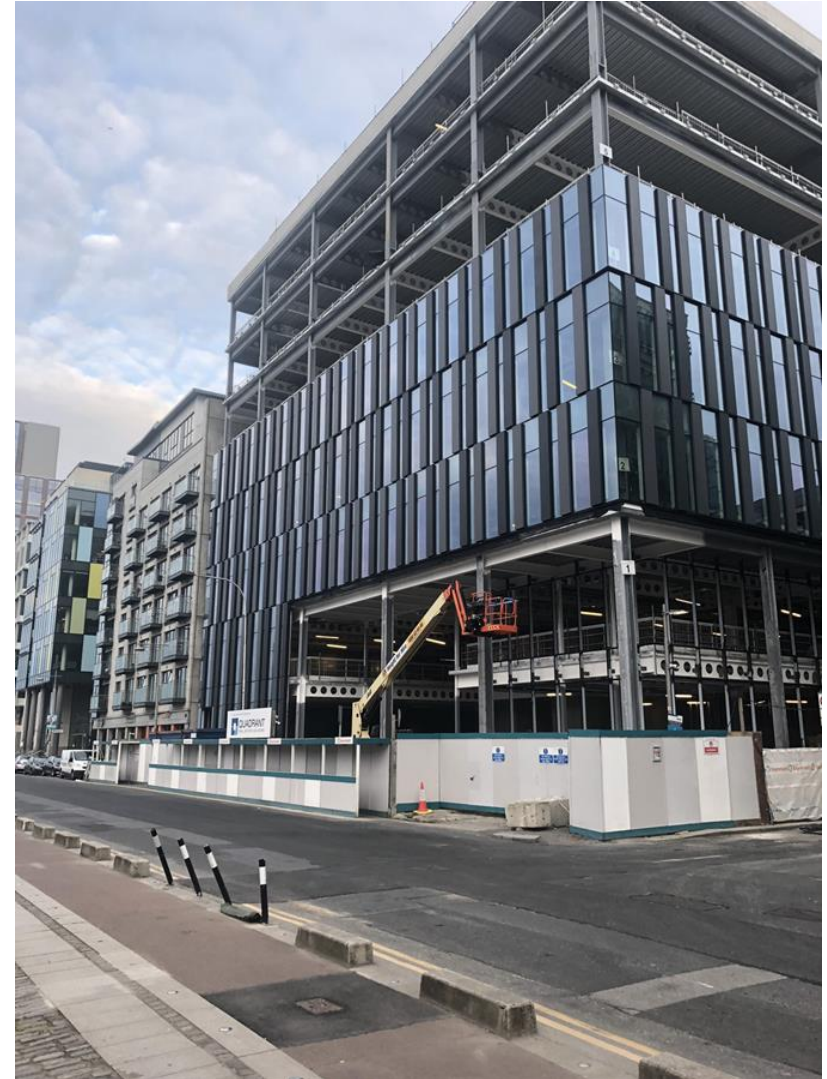
- 35 Shelbourne Road Office Development
- Assembled in Ireland



# SOME EXAMPLES - CONSTRUCTION

## UNITISED CLADDING AND GLAZING FACADES

- 76 Sir John Rogerson's Quay Office Development
- Assembled in Ireland





# SOME EXAMPLES - CONSTRUCTION

## PERMANENT INSULATED SHUTTERING

- Castle Park School, Dalkey
- Italian system allowed for on-site modifications



# SOME EXAMPLES - CONSTRUCTION

## VOLUMETRIC PREFABRICATION

- Holiday Inn Express in Trafford City
- Complete interior volumetric prefabrication
- Saved approximately £1 million in construction costs when compared to a traditional form of construction



*Courtesy Chapman Taylor*

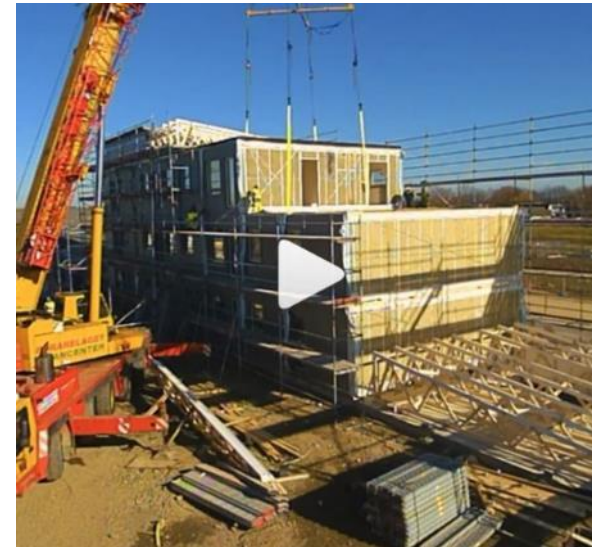




# SOME EXAMPLES - CONSTRUCTION

## IKEA, SKANSKA AND BOKLOK

- House as commodity – **product** rather than **project**
- BoKlok has previously built 11,000 homes across Sweden, Finland, Denmark and Norway. It has been trying to break into the British market for a decade, but this could be its first venture in the UK, scheduled for the year 2021.
- BoKlok sets property prices so that buyers have money left to live on after they have paid their housing costs.
- An unproven idea in this regulatory and climatic environment

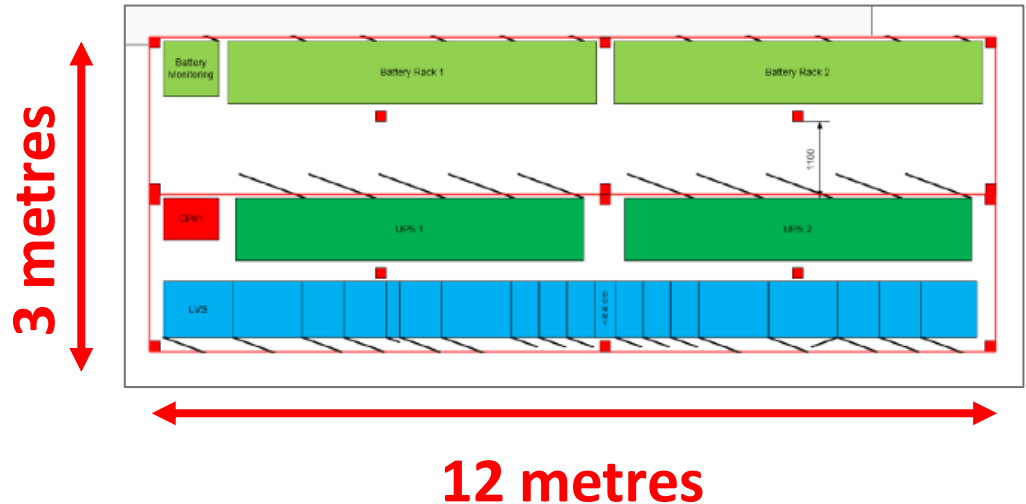


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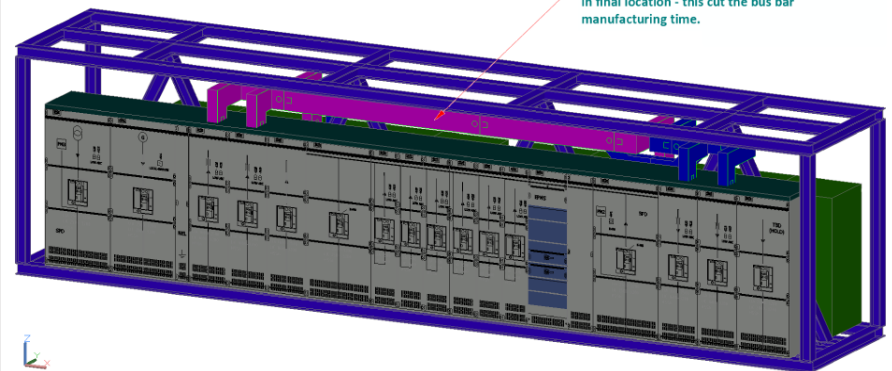
## INDUSTRIAL PROJECT, DUBLIN

- Modular M+E assembly
- Large industrial project
- Electrical installation
  - Battery racks
  - UPS
  - LV cabinets

Examples for unloading and transport on site



Module A  
View from LVS side

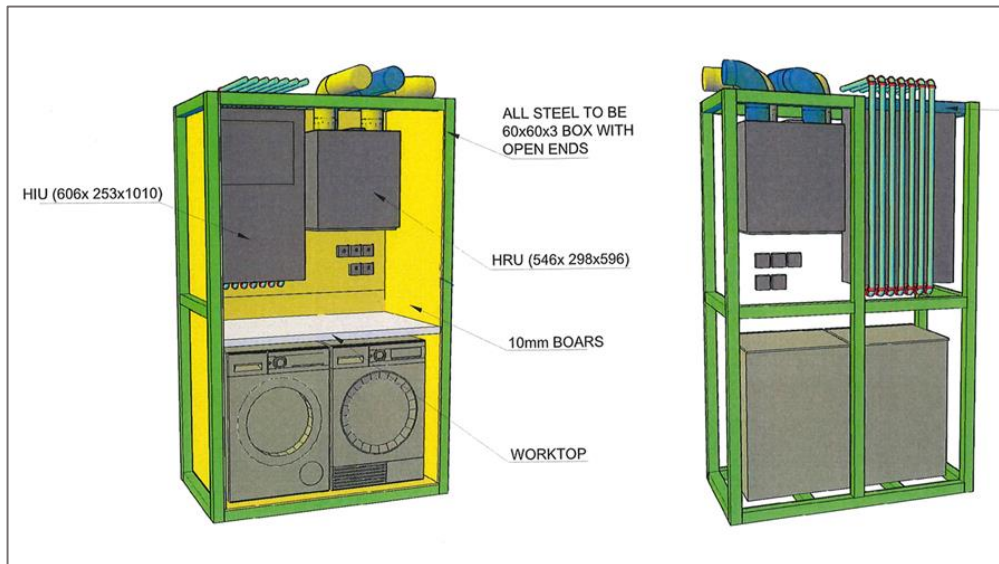


Bus Bar Connection made in the Factory and test fit done in factory to ensure correct connections - then disassembled and installed on site once the Skids placed in final location - this cut the bus bar manufacturing time.

# SOME EXAMPLES CONSTRUCTION

## MECHANICAL VENTILATION HEAT RECOVERY (MVHR) PODS

- 76 Sir John Rogerson's Quay residential apartments





# SOME EXAMPLES CONSTRUCTION

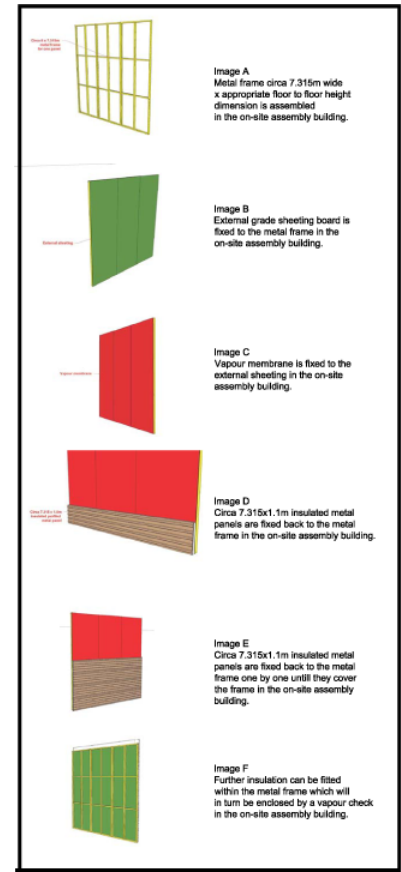
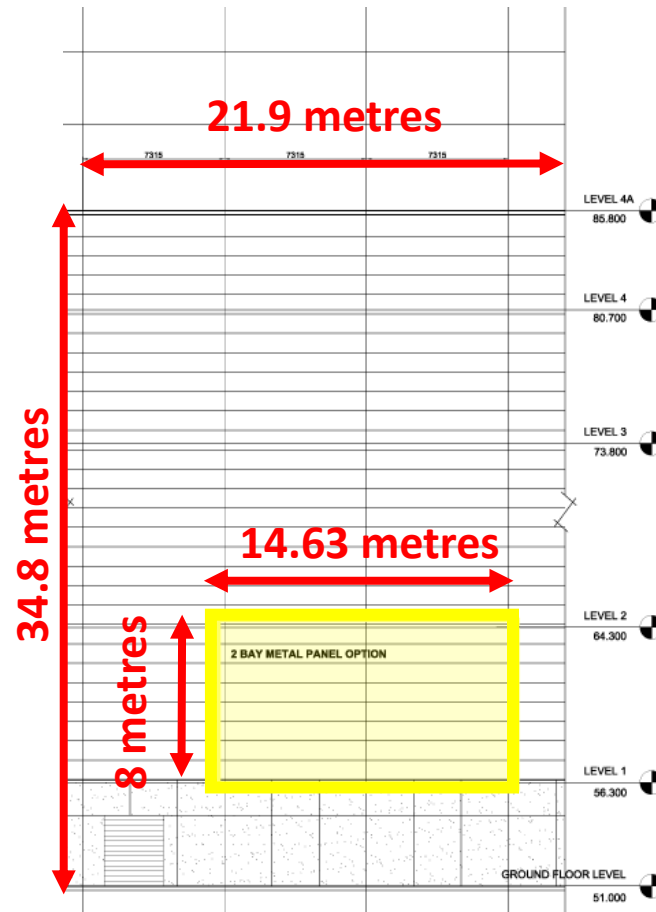
- Residential bathroom pods



# IRELAND - OSM

## SOME EXAMPLES DESIGN

- Large scale industrial project
- Remote on-site construction
- 14.63 w x 8.0 h composite panels
- Minimum secondary steel
- Tracked roof mini crane and cherry picker for erection
- 5-man team – 400 sq m / day



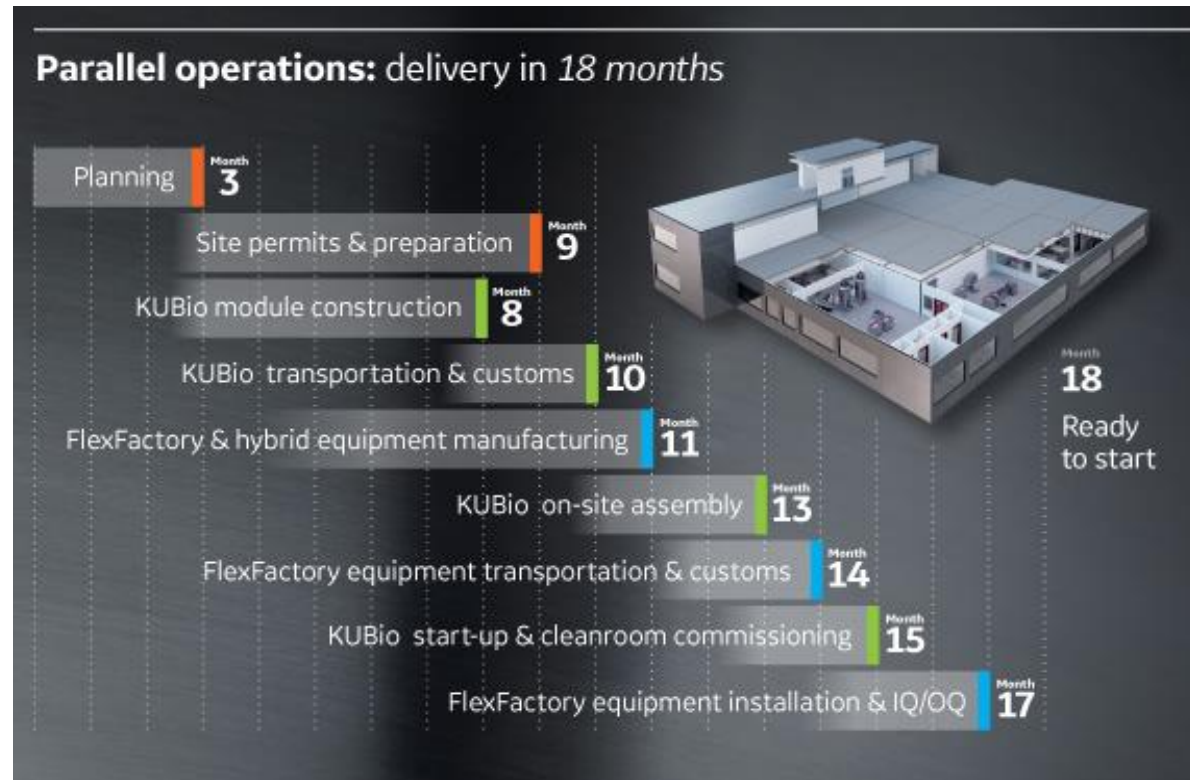
# **CASE STUDY**

**GE HEALTHCARE BIO PARK, CORK**



# GE HEALTHCARE BIO PARK

- Large prefabricated 1 and 2 storey 3,275 square metre pharmaceutical manufacturing modules within larger masterplan including traditionally constructed buildings including circulation administration, QC laboratories, warehousing and central utilities buildings



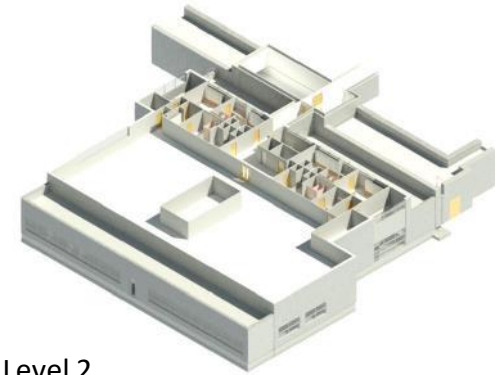
# GE HEALTHCARE BIO PARK

- KUBio is a prefabricated cGMP-compliant facility and process solution designed for the scalable and cost-efficient production of mAbs
- Prevalidated modular units and processing equipment are transported to selected site where they are assembled, and the resulting facility qualified, and can be ready-to-run within 14 to 18 months

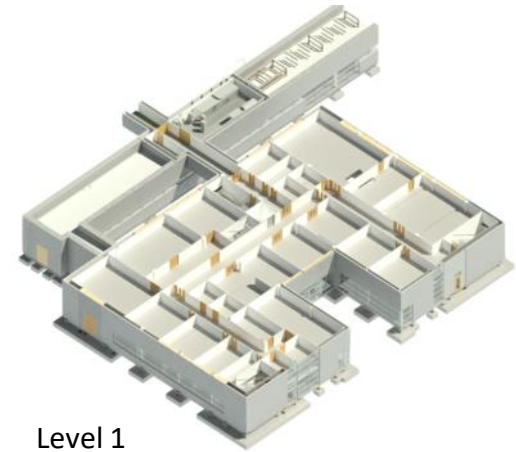


# GE HEALTHCARE BIO PARK

- 4 Production Facilities KUBio's with a total area of 13,100 sq m
- Prefabricated modular units 4.5m x 9.6m x 4m high, sized to suit ease of transportation
- Units supplied complete with all interior building finishes and service installations
- Prefabricated and pressure /integrity tested off-site at manufacturers premises
- Level 1- Process Laboratories with a footprint size 36m x 38.4m – Total 32 modules
- Level 2 – Laboratory Support Staff Facilities and Plant Rooms with a footprint size 27m x 38.4m Total 32 modules



Level 2



Level 1



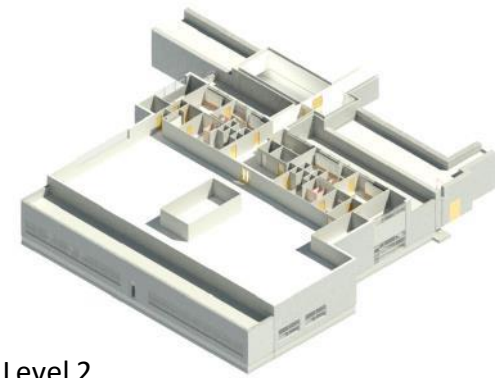


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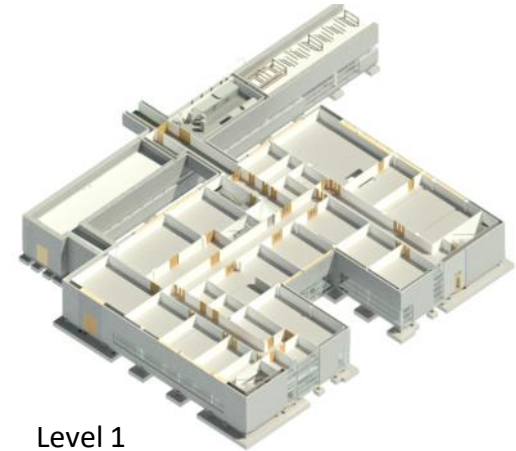
- Exterior finish – composite metal cladding secret fixed to prefabricated modules and single ply membrane roof finish
- Designed for connection to central spine to connect to support buildings - total development 42,500 sq m

## Programme (project currently on hold)

- Concept design commenced April 2016
- Planning lodged September 2016 and granted March 2017
- Tendered in packages over 7-month period from December 2016 – August 2017
- Construction programme
  - Enabling works 3 months
    - August – October 2017
  - Main Construction 22 months
    - November 2017 – September 2019



Level 2



Level 1



A photograph of a large, modern, multi-story building with a brown facade and many windows, some of which are illuminated. The building is set against a dark, cloudy night sky. In the foreground, there is a paved area with some orange traffic cones and a small blue structure. The overall scene is dimly lit, with the building's lights providing the primary illumination.

# KUBio™