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Cleanroom Construction

Modular Approaches

&

Sequence of Construction

Meeting Agenda

- Traditional vs Modular Decision
- Which Approach?
- Modular Systems Available
- Construction Approaches



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Traditional vs. Modern

- Traditional (Stud & Gyp):
 - Labor available & economical
 - Finish craftsmen quality known
 - Schedule not a driving force
 - Retrofit to match existing
 - “Material” cost vs. delivered cost
 - Epoxy paint most reliable
 - Capital vs. lease hold improvement



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Traditional vs Modular Concepts

- Widely held belief that a prefabricated
- approach to construction is more
- expensive
- Once was the case but gap is narrowing to favour modular pre-fabricated solutions:
 - Manufacturing economies of scale
 - Increased site Labour costs
 - Increasing Health & Safety demands



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Traditional Vs. Modular

- Modular (Walls and Ceilings):
 - Site labor reduced ~70%
 - Precise manufactured tolerances
 - Cleaner “clean build” construction
 - cGMP details & finishes available
 - Deliver system later in the program
 - Depreciation schedule vs. building
 - Future flexibility / expandability
 - Reduced commissioning/validation exposure
 - Robust systems



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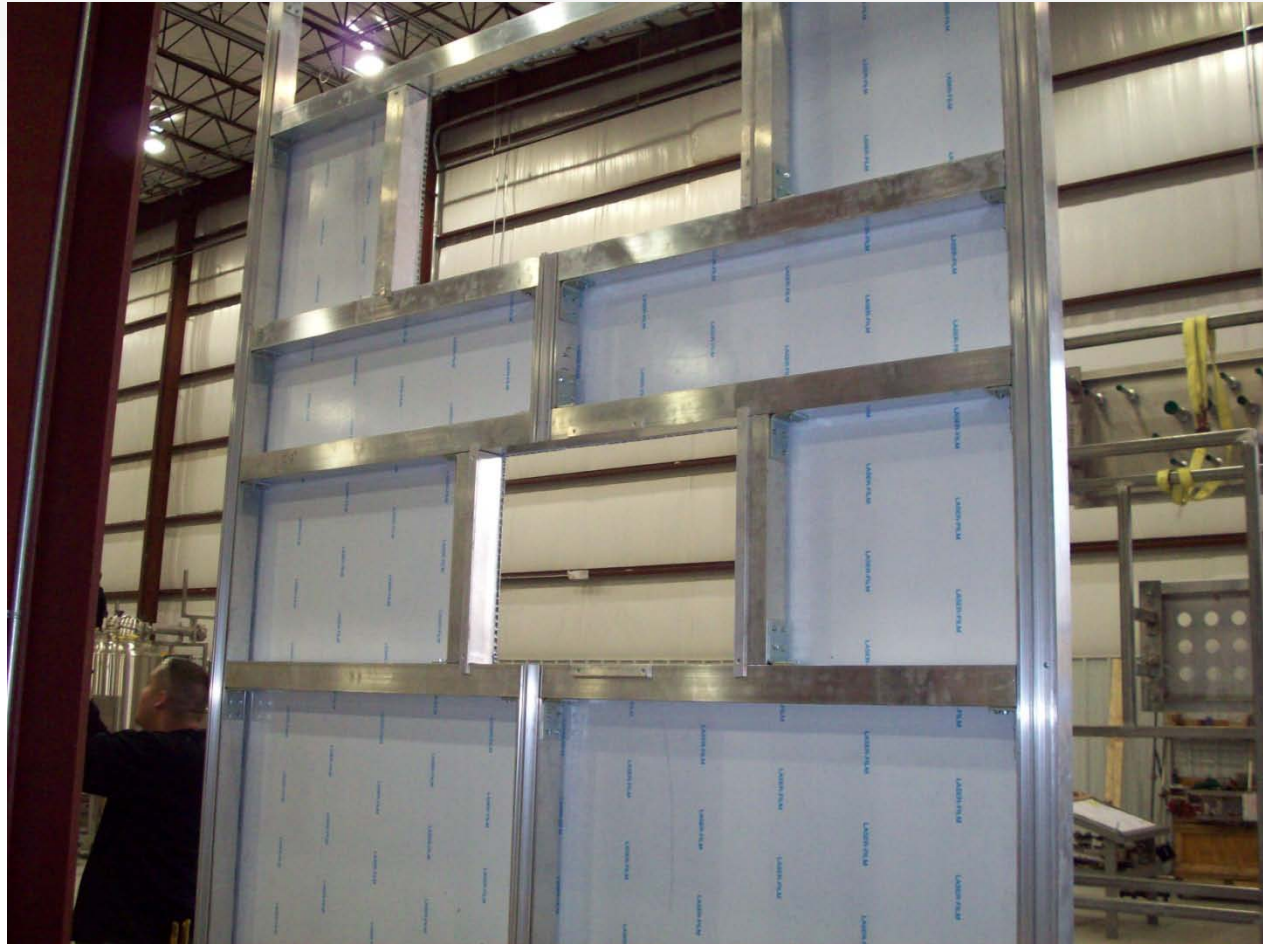
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Robust: Modular / Skid Integration



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Modular: Now Which Approach?

- Modular Building
- Modular Systems



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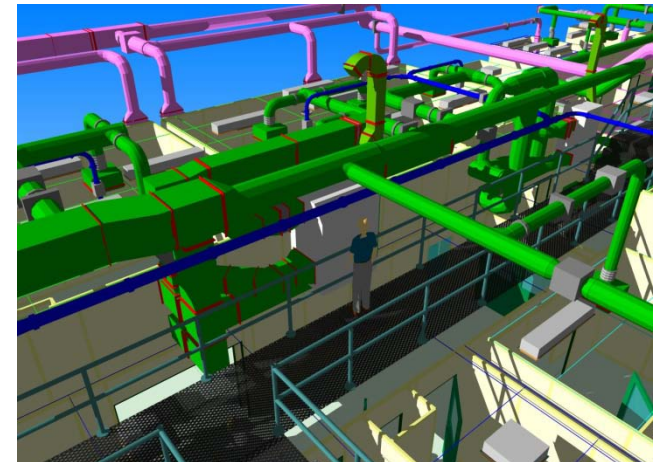
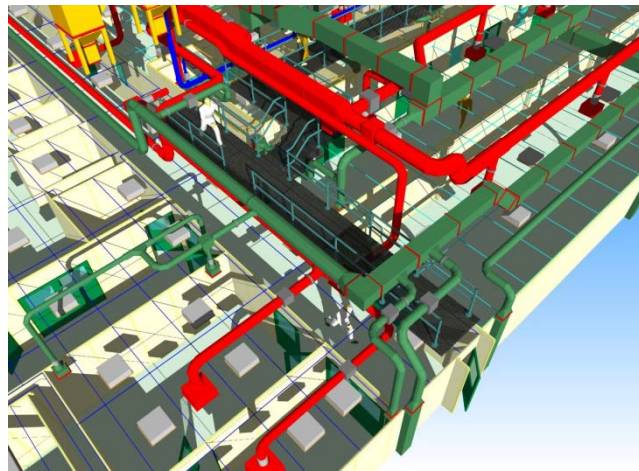
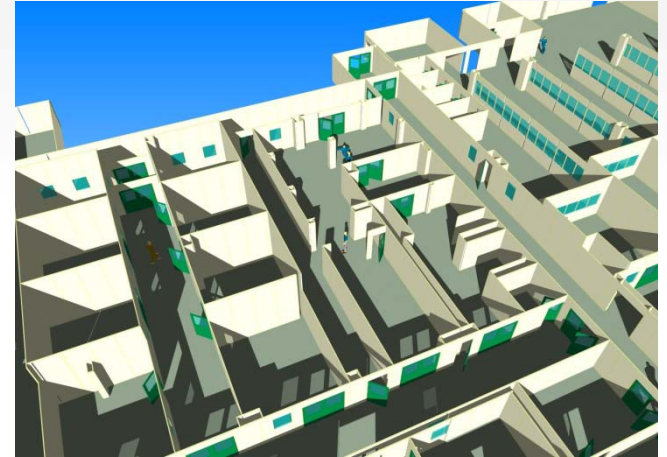
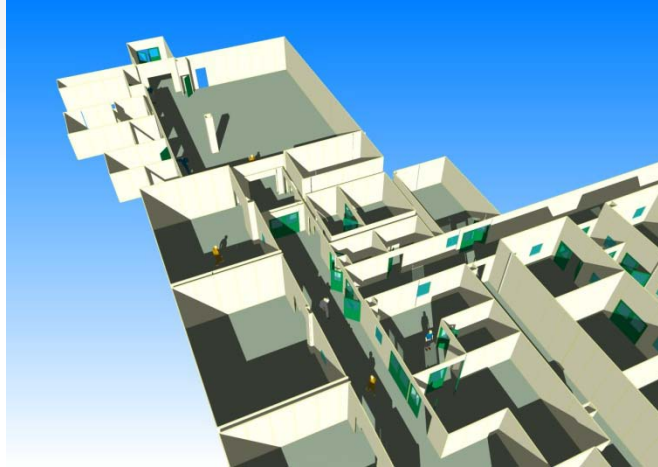
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Modular 3D Modeling



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Modular Building



Modular Systems

- Modular walls / ceilings
- Traditional building services
 - Process systems
 - Mechanical equipment decks
 - Sequence of construction



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Modular Systems

- “Butler” steel buildings
- Process skids
- Prefabricated mezzanines
- Pipe racks
- Prefabricated support rooms (switch gear, teledata)
- cGMP Envelopes



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US Case Study

- Unistrut from building steel or intermediate steel
- Panelized walkable ceiling
- Simultaneous construction
 - High level work (duct, fire etc)
 - Epoxy floors
- Walls/Super Skids Integration



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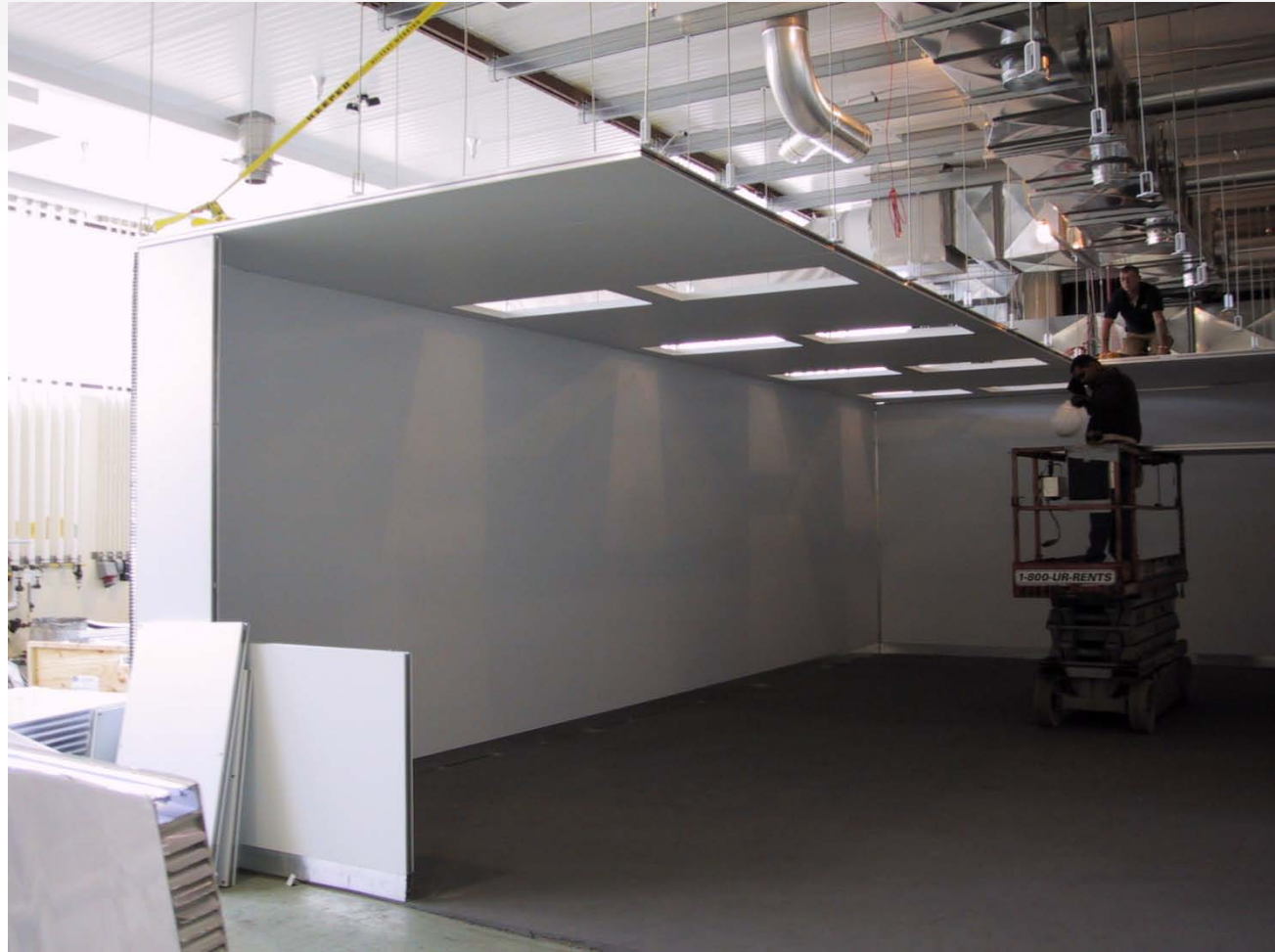
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US Case Study



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US Case Study



Ireland Case Study

- Design Features
 - Platform ceiling
 - Hollow core walls
- Integrated
 - Lights/ Filters
 - M&E Services distribution
- Benefits
 - Parallel construction
 - Ease of maintenance access, (wide hangers)
 - No trip hazards
 - Interchangeability

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Ireland Case Study



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cGMP Envelope Manufacturers

- Plascore
- MSS (AES)
- Clestra
- Dagard
- Daldrop



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Plascore

- Based in USA
- Leader in Aluminum honeycomb core
- Pharma Product Line
 - Aluminum honeycomb core
 - uPVC finish
 - Wall/ceiling panels with internal frame
 - 5'x10' and 4'x10' Ceiling panels
 - Door/hardware solutions
 - 2", Liner, Cavity wall options
 - Framed wall option



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MSS (AES)

- Based in USA = AES
- Based in England = MSS
- First to market in US
- English MSS has installations in Ireland
- Product Line
 - Aluminum honeycomb core only
 - uPVC finish only
 - Panels not framed
 - Ceiling - panel/tray support system
 - Progressive wall system



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Dagard

- French, (cold rooms and cleanrooms)
- Significant presence in Pharma
- Product Line
 - Choice of panel cores
 - Choice of finishes (uPVC, epoxy)
 - Integrated ceilings (lights, filters etc)
 - Progressive wall system
- Significant installations in Ireland



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Clestra

- French - plants in France, India & Korea
- In Pharma since mid 70s
- Global capacity & capability
- Product Line - GMP variety & choice
 - Panel cores & finishes
 - Load bearing, interchangeable & platform ceilings
 - Fully non-progressive
- In Ireland since early 90s



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Daldrop

- German
- Specialist HVAC Engineering Company
- Turnkey provider
- Own product range, (Pharma & Micro)
- Product Line
 - Panel cores & finishes
 - Load bearing, interchangeable split panel ceiling system
 - Fully non-progressive
- Large projects in Ireland



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Construction Approaches

- Interactive Conversation



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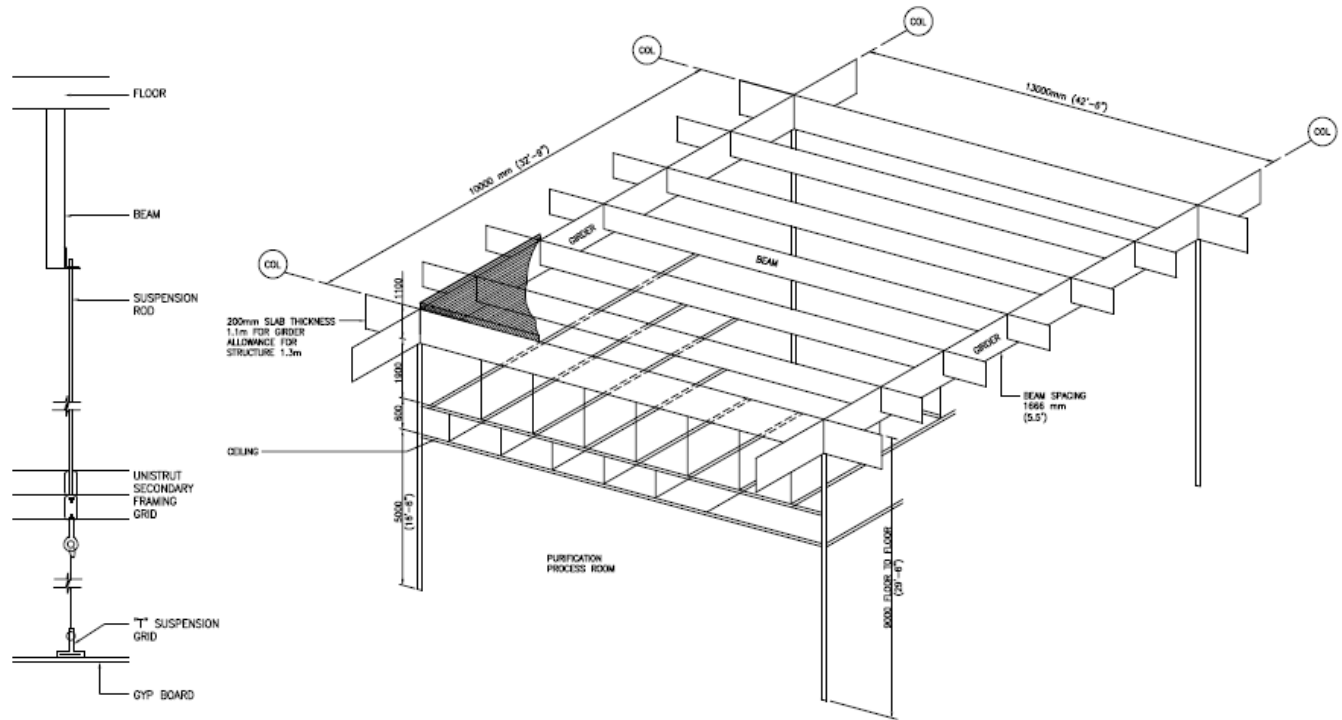


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Bay Framing Unistrut Secondary with GP or Panel Ceiling



OPTION A – BAY FRAMING WITH UNISTRUT SECONDARY
FRAMING SYSTEM & GYP BD OR PANEL CEILING

SCALE: NTS
10 MAY, 2008

JACOBS

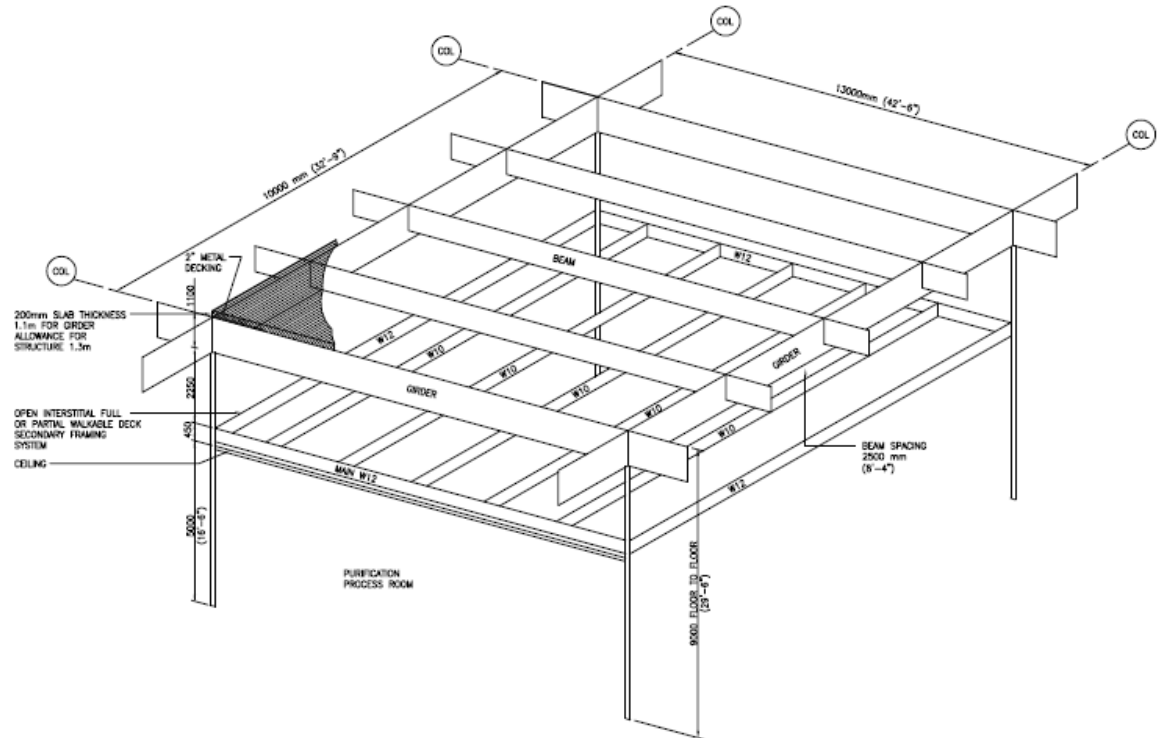
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Bay Frame with Beam Non-Integrated Ceiling

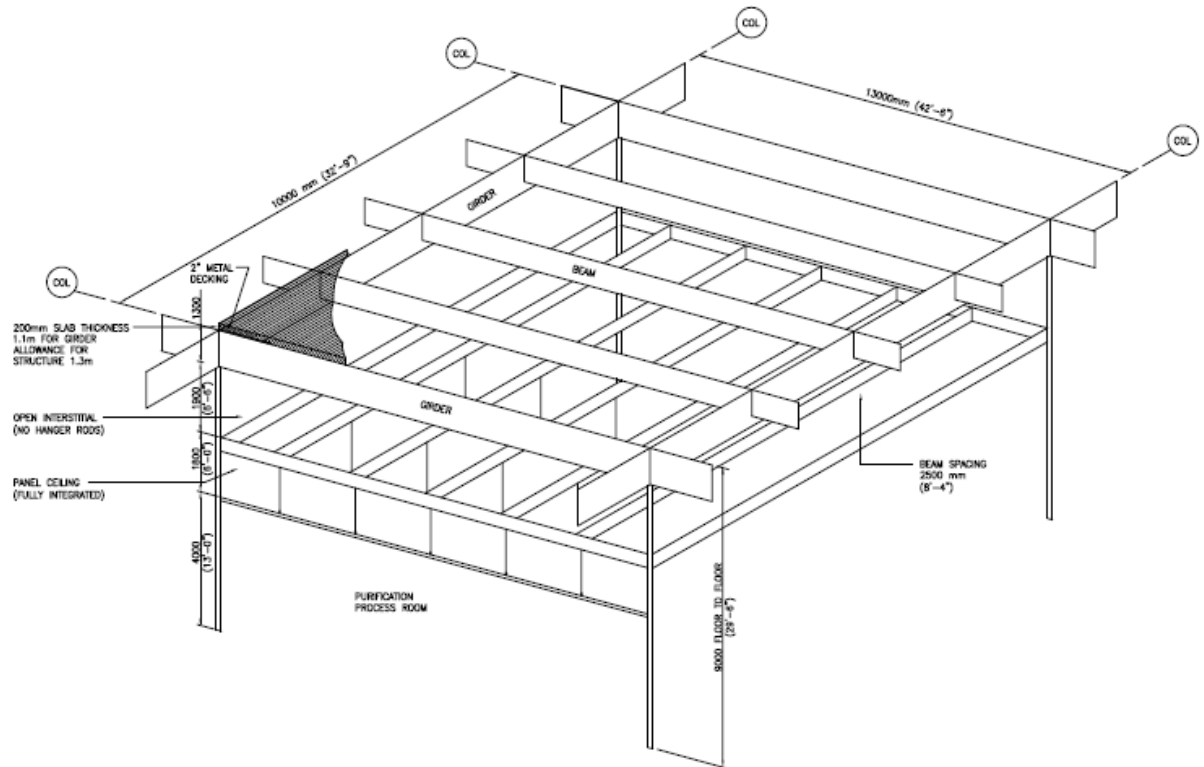


OPTION B – BAY FRAMING WITH BEAM SECONDARY FRAMING
WITH NON-INTEGRATED PANEL CEILING (PLASCORE)

SCALE: NTS
10 MAY, 2008

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Bay Framing with Tube Walkable Ceiling

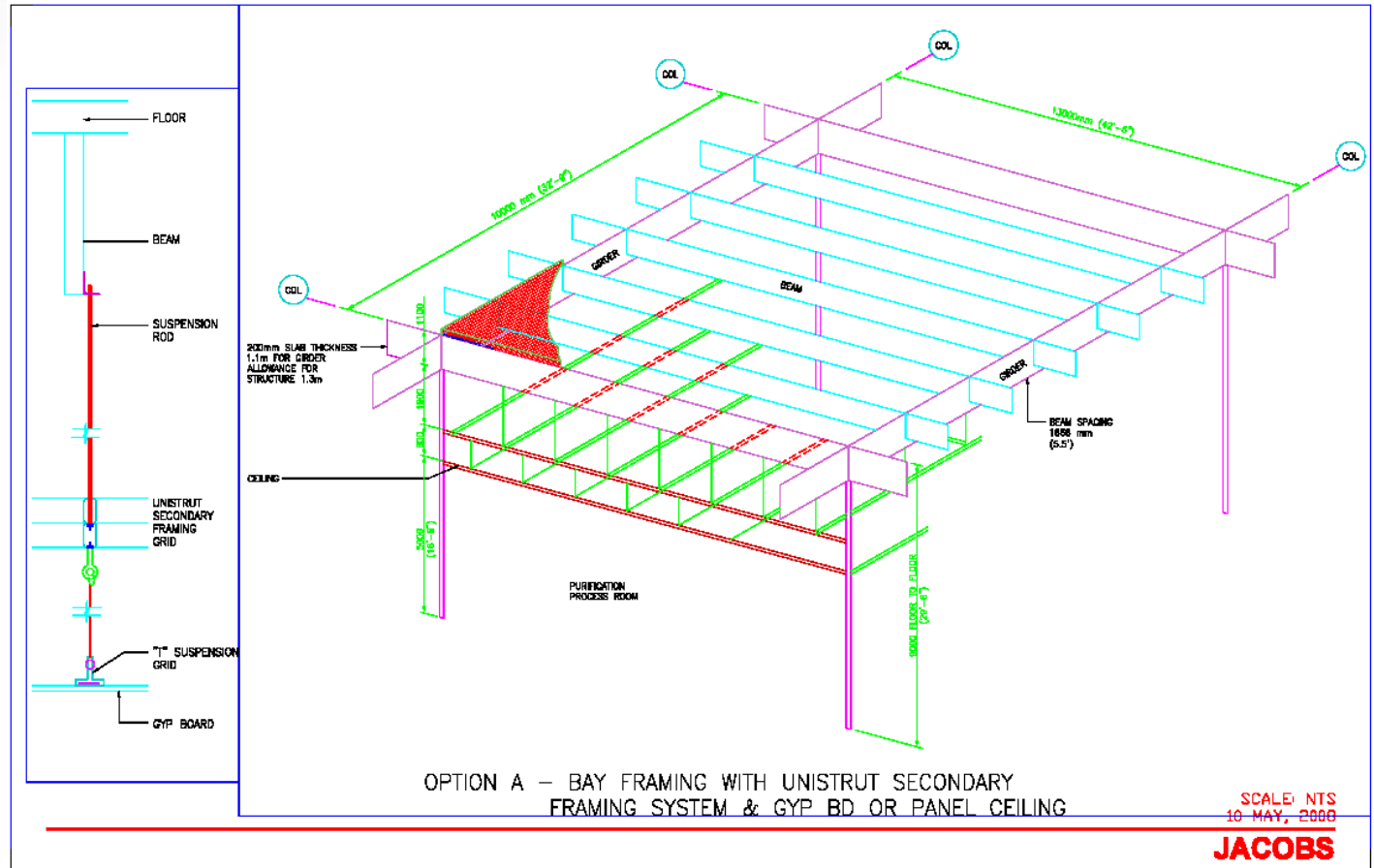


OPTION C – BAY FRAMING WITH TUBE SECONDARY FRAMING &
WALKABLE CEILING

SCALE: NTS
10 MAY, 2008

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Bay Framing with Unistrut



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Poor Interstitial Space Management



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Better Interstitial Space Management



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Optimal Interstitial Space Management



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Schedule Review

- Review schedule & discuss sequence of construction



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Whiteboard Discussions

- Construction
- Schedule



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