Healthcare and Research Project Execution

Prefabciation and Module Construction

Novartis Institutes for Biomedical Research

Presented by:

Dean Poillucci, Skanska

Miami Valley Hospital Expansion
Session Overview

- Project Overview
  - Novartis Institutes for Biomedical Research
  - Miami Valley Hospital

- Construction labor productivity

- Innovative approach to meet project and industry challenges
  - Multi-Trade Prefabrication (MTP) Implementation
  - Challenges
  - Benefits

- Building Owner Value

- Video
NIBRI Project Overview

Design Team
Maya Lin Studio with Bialosky + Partners
Toshiko Mori Architect
Michael Van Valkenburgh Associates
Cannon Design

Project Overview
608 Lab Tower: 337,000 sf
613 Lab Tower: 310,000 sf
615 UG Parking: 148,000 sf
Total: 795,000 sf

Courtyard/Plaza – 1.99 acres
Total site – 3.76 acres
Miami Valley Hospital Overview

- Starting Point for Campus Transformation to High Acuity/High Technology
- 484,000 Square-Foot Expansion
- 12 Floors (7 Floors of Inpatient Beds)
- Heart Center Focus
- Conversion to All Private Rooms
- Architect: NBBJ
Typical Project Execution Expectations

Best in Class
- Safety
- Quality
- Cost
- Operational Efficiency and Flexibility
- Schedule
- Sustainability
In a 2011 study conducted among architects, engineers, contractors, and building owners, supports the arguments that speed to completion, quality, and safety can be increased with modular construction, while overall costs, material waste, and the impact on the environment can be reduced.

Unfortunately, innovation in the modular construction industry is slow to adapt.

Innovative Approach to Meet Function and Execution Expectations

- Multi-Trade Prefabrication (MTP)
- Off-Site Construction Facility (OSCF)
Construction Labor Productivity

- Non Farm Labor Productivity increased by an average of 1.59% each year over the last 50 years

WHILE...

- Construction Labor Productivity DECREASED by an average of 0.6% each year of the same time period

Industry That’s Slow to Adopt Innovation

- Many small subcontracting firms
  - < 10% of firms have more than 35 employees (1)
  - < 5% of firms have more than 75 employees (1)
- Cost of innovation is prohibitive for small firms
- Wide array of trade specific work and specialties
- Minimal sharing of methods and techniques
- Integration of various trades to optimize the whole is uncommon
- < 0.035% of contract value is invested in R&D for improved construction practice (1)

(1) Paul Teichotz, Ph. D., Center for Integrated Facility Engineering, Stanford University
Factors Affecting Labor Productivity

- Site Access and Logistics Constraints
- Poor Proximity of Work, Tools and Materials
- Stacking of Trades
- Working at Heights and Jobsite Hazards
- Learning Curve
- Absenteeism & Turnover
- Crew Size Inefficiency
- Weather

What if... We could modify methods of construction to reduce or eliminate the above issues?
Site Location and Access
OSCF Layout – 100,000 SF
HVAC Air Valve/Box Scenario

- Field Installation Requires
  - ~13 Visits to Each Control Device w/ Reheat
  - ~9 Visits to Each Control Device w/o Reheat

- For the NIBRI Project
  - +/- 1,200 HVAC Control Devices
  - 13,600 Visits
  - Across 647,000 SF
  - Spanning 2 buildings and 19 Floors
LEAN Approach for Best Value

- Pull Scheduling
- Leverage BIM Model from Design Team
- Multi-Trade Prefabrication (MTP)
- Off Site Construction Facility (OSCF)
- Design Assist MEP Subcontractors
- Just-in-Time Delivery
Multi-Trade Prefabrication (MTP)

- Execute critical path work of multiple trades
  - Plumbing
  - Sheet metal
  - Piping
  - Electrical
  - Insulation
  - Carpentry

- Off Site Construction Facility (OSCF)
MTP Scope

- MEP Risers
- MEP Above Ceiling Horizontal Distribution
- Penthouse and Basement MEP Distribution
- MEP Equipment
- AHU control valves stations
MEP Overhead Rack Layout
NavisWorks Model

Actual Installation
Facilitating Maintenance

“No Fly” Zones

Planned Access – Predictable/Repeatable Layout
MTP Racks to Accommodate Project Requirements
Patient Room Prefabrication Plan

- Bathroom Pods
- Casework Module
- Patient Head Walls
Module Savings Example

Key Differences:

- Material Changes
- Lower Construction Labor
- Installation Labor
  - Hoisting and Rigging
  - Actual Installation
- Logistics
  - Crane Rental
  - Trucking
  - Site Delivery Labor

Projected Savings: 4% to 8%
Healthcare Opportunities for Prefabrication

Patient Headwalls (178)  
Bathroom Pods (178)  
Exterior Skin

Corridor Racks (120)  
Elevated Walkways
MTP Implementation

- Early integration of owner, design and construction team
- Detailed pull scheduling
  - Provide maximum amount of time for owner decisions and design development
- Identify true project critical path
- Prefabrication and module plan development during schematic design
- Maximize trade diversity in the MTP
- Focus on high labor elements
MTP Challenges

- Planning and day to day management by CM required
- Introduction in geographical markets
  - PLA’s
- Critical path of project shifts
  - More pressure on the exterior envelope
- Coordination with exterior envelope
  - Schedule
  - Openings for rigging
**MTP Benefits**

- **Safety**
  - Work at heights and over shafts is greatly reduced

- **Schedule**
  - Completing critical path MEP rough-in activities concurrent with superstructure reduces overall timeframes

- **Cost**
  - Reduced schedule and productivity gains result in cost savings

- **Quality**
  - Work performed in a controlled environment produces higher quality

- **Commissioning and Punch List**
  - Installation verification and above ceiling punch list start in OSCF

- **Sustainability**
  - Reduced waste from the construction process
Multi-Trade Prefabrication℠

MTP Benefits 8 Projects

- Reduced schedule
  Average 8-16 weeks

- Waste elimination

- Punch list and Cx

- Improved safety
  Zero Prefabrication Accidents

- Enhanced quality

- Cost savings
  1-2% of Direct Costs
Modular Jet Ways
Foot Bridge Fully Commissioned within 30 Days
## Modular Foot Bridge – Performance Metrics

<table>
<thead>
<tr>
<th>Conventional Delivery</th>
<th>Prefabricated Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>• $2,100,000 to Construct</td>
<td>• $980,000 to Construct</td>
</tr>
<tr>
<td>• 4-6 Months of Disruption of Hospital Entry</td>
<td>• 3 days of Construction with No Disruption</td>
</tr>
<tr>
<td></td>
<td>• Overnight removal of bridge after completion of permanent connector</td>
</tr>
</tbody>
</table>
Miami Valley Hospital Video

Short video version
Tradeline 3

- MTP results in execution improvements across all elements of the project
- The more complex the project and challenging the logistics, the greater the benefit of MTP and OSCF
- Planning is essential to successful implementation