PRECAST CONCRETE BUILDING CONSTRUCTION PROCESS COMPARISON

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Agenda:

• Introduction
• Methodology
• Results
• Conclusions
Introduction

- Previous research applied Lean thinking to improve production to solve the common problems.

Long lead times

Jumbled flow

Process waste

- Seldom research focuses on comparing process status of PC construction between developing countries and developed countries.
Methodology
Case study analysis

“How” and “Why” process differences occur in selected cases

Case selection
- Multifamily PC projects
- Accessible information
- Local typical implementation methods

Cases analysis using VSM
- Current state map
- Comparison
- Future state map
- Ideal state map

Conclusion
CURRENT STATE MAPPING OF CASE 1.

Case 1

Location: Alberta, Canada
Project type: 6 story multifamily building
Precast concrete supplier (PS): Local large company
PS’s scope of work: design, produce, delivery, erection
Use 3D modeling in Design
**Current State Mapping of Case 1.**

Current problems:

- Extra shop drawing modification ranges from 5 minutes to 1.5 hours was needed to modify each drawing.
- The lead time between the production and delivery could be 1 to 2 weeks.
- The lead time before erection was one-month long, which was caused by the slow production rate and the fast erection rate.
Case 2

Location: Beijing, China
Project type: 12 story multifamily building
Precast concrete supplier (PS): Local large company
PS is subcontractor
PS’s scope of work: design (2D drawings), produce, delivery
Current state mapping of Case 2.

Current problems:

- Long lead times before the start of shop drawings caused by the subcontract agreement.
- Long shop drawing design duration caused by traditional 2D-drawings.
- 2-8 hrs. per drawing
- The complex connection method increased the erection duration.
## COMPARISON OF THE CURRENT STATE PROCESSES

### Table: Comparison of Current State Processes

<table>
<thead>
<tr>
<th>Case</th>
<th>Case 1 in Alberta, Canada</th>
<th>Case 2 in Beijing, China</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement time</td>
<td>✅ Early</td>
<td>late</td>
<td>Better synergies, less error and rework</td>
</tr>
<tr>
<td>Components design</td>
<td>✅ More standardized</td>
<td>Less standardized</td>
<td>Shorter lead time, lower cost</td>
</tr>
<tr>
<td>Project participation</td>
<td>✅ Whole project cycle</td>
<td>Limited project phases</td>
<td>Better synergies and productivity</td>
</tr>
<tr>
<td>Engineering design</td>
<td>Third party consultant</td>
<td>✅ In-house engineering</td>
<td>Better shop drawings</td>
</tr>
</tbody>
</table>
Future State Mapping of Case 1.

Kaizens (Improvement suggestions):
- Enhance the cooperation through an inhouse engineering department to improve quality of shop drawings
- Improve the shop drawing export function to reduce modification.
- Introduce a supermarket to
  - Reduce the lead time (duration)
  - Change the push system into a partial pull system
**FUTURE STATE MAPPING OF CASE 2.**

Kaizens (Improvement suggestions):

- Apply BIM to improve the design efficiency.
- The precast supplier should positively participate in the project from early project phase to drive the design.
- Standardize the components design to improve efficiency and reduce cost.
IDEAL STATE MAPPING FOR FUTURE PROJECTS

Industry 4.0
**IDEAL STATE MAPPING FOR FUTURE PROJECTS**

- **Kaizens** (Improvement suggestions):  
  - Combine BIM & Lean to improve production system.  
  - Use data driven simulating to inform project duration and cost.
**Ideal State Mapping for Future Projects**

- **Kaizens:**
  - Use RFID and other sensors to collect data in the value chain for product lifecycle management.
IDEAL STATE MAPPING FOR FUTURE PROJECTS

• Kaizens:
  • Use autonomous vehicles to improve logistics
  • An integrated system to utilize technologies in Industry 4.0 to improve the productivity
IDEAL STATE MAPPING FOR FUTURE PROJECTS

- Kaizens:
  - Use virtual reality (VR) or augmented reality (AR) to educate and assess the workers’ skills and improve safety
• Kaizens:
  • Educate students with lean construction concepts can reduce the knowledge barrier as lean experts are critical to the success of lean improvements for the precast supplier.
Conclusions

• Compared the current processes of the two selected precast construction projects in Canada and China, both have some places for future improvement.

• The project in Canada has less rework, shorter lead time and better productivity because of the earlier PS involvement, application of BIM and higher ratio of standardized precast design.

• The project in China has higher quality of shop drawings because of the in-house engineering capability.

• Enhanced cooperation and improved shop drawing export function are suggested to the Canadian PS to reduce the design duration and shorten the lead time, and applying BIM to design precast elements from the project early phase is the solution for the Chinese PS.

• A comprehensive future state map is proposed for future precast projects using a combination of new technologies in industry 4.0.