Construction Engineering:  
Reinvigorating the Discipline

Lean Construction Institute
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A brief history of project management

• An activity centered operating system develops based on Critical Path Method becomes an industry standard.
• Contracts and industry practice and structure evolve.
• Construction management becomes contract management.
• Productivity Improvement initiatives lead to discoveries.
  – Improving productivity of people and equipment can reduce project performance
  – CPM based planning does not produce predictable workflow

How do we manage projects now?

• Determine client requirements including quality, time and budget limits and design to meet them.
• Break project into activities, estimating duration and resource requirements for each activity and placing them in a logical order with CPM
• Assign or contract each activity, give start notice and monitor safety, quality, time and cost standards. Act on negative variance from standards
• Coordinate with master, some intermediate schedules and weekly meetings
  – reduce cost by productivity improvement
  – reduce duration by speeding each piece or changing logic.
  – improve quality and safety with inspection and enforcement
Research Findings from early 1990's

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor 1</td>
<td>33 %</td>
</tr>
<tr>
<td>Contractor 2</td>
<td>52 %</td>
</tr>
<tr>
<td>Contractor 3</td>
<td>61 %</td>
</tr>
<tr>
<td>Contractor 4</td>
<td>70 %</td>
</tr>
<tr>
<td>Contractor 5</td>
<td>64 %</td>
</tr>
<tr>
<td>Contractor 6</td>
<td>57 %</td>
</tr>
<tr>
<td>Contractor 7</td>
<td>45 %</td>
</tr>
<tr>
<td>Average</td>
<td>54 %</td>
</tr>
</tbody>
</table>

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Percent Plan Complete (PPC) Chart

Rasacaven: Electrical Power Distribution

Lean in the Construction Industry: Three Connected Opportunities

1. Impeccable Coordination

2. Designing, organizing and managing projects as Production Systems (why I am here – the opportunity for Construction Engineering, particularly in building construction)

3. The Project as a Collective Enterprise

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Planning Considerations

- Delay decisions to Last Responsible Moment
- Create Pull Schedules
- Only work to release downstream crews (important also in design)
- Reliability of work flow
SCHEDULE PERFORMANCE

- Contract Date: 12/30/03
- DD Complete: 1/26/04
- Demolition Complete: 1/7/04
- Time lost to DDB: 6 weeks
- Permit Issued: 4/14/04
- Work Begins on Site: 4/16/04
- Plant Ready to Go: 7/28/04
BUDGET PERFORMANCE

• GMP $6,000,000
• Final cost with normal markup $5,400,000
• IPD savings against GMP $600,000
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How is this different from current practice?
Optimize the project not the piece!

1. Project is a production system designed and managed for reliable and speedy workflow.


3. Collaborative cross-discipline design & problem solving improves value to client, profit for enterprise & capability of people.

4. Production control produces optimal solutions at the project level.

5. Contingencies to protect trade contractors are no longer needed.

6. Active continuous learning reduces need for production contingencies and improves productivity.
Reinvigorating….

• Construction Engineering
  – Begins when design starts
  – Embraces entire project
  – Applies the principles and practices of production system design
    • Reliable and speedy workflow
    • Determines contingencies required by system
  – Rapid learning within and between projects