Construction Performance Committee Workshop CPC-5

PRODUCTIVITY CALCULATOR 101: Using & Advancing the Prototype

COAA BP Conference
Edmonton, CA
May 9, 2018
Introductions and Background

• COAA and CII have been engaged in construction productivity research for nearly a decade while collaborating on “Twice as Safe – Twice as Productive”
  – Developed a method to measure productivity through a single index number, similar to how the industry has adopted the safety incident rate metric
  – CURT and CIR engaged to launch an online prototype which makes the concept tangible

• Now looking for feedback as we promote the index for industry adoption
Basis of the Index

• Productivity data across 8 disciplines
  - Concrete
  - Structural Steel
  - Piping
  - Piping Insulation
  - Electrical Wire & Cable
  - Instrumentation
  - Equipment
  - Modules & Pre-Assembled Skids

• Use statistical treatment to eliminate units

• Prototype baselined against ~200 industrial projects in Canada/US

• Collect safety metrics, off-site fabrication, PM team size, and Engineering deliverable timeliness and accuracy
Methodology

Step 1: Collect data (*Productivity = direct hours / installed quantities*)

Step 2: Calculate productivity metric value of each discipline

Step 3: Transform productivity metric values by natural logarithm

Step 4: Standardize the transformed values (*Z-score*)

Step 5: Aggregate individual values weighted by workhours

Step 6: Plot the **Project Level Productivity Index** and discipline benchmarks
Prototype Demo
Use the Construction Labor Market Analyzer® login below to access the CLMA®, the Safety Benchmarking Portal and the Productivity Calculator.

High-Level Productivity Calculator

Log In as Guest

Construction Labor Market Analyzer®

Email

Password

Log In

Forgot your password?
Request an Account
**STEP #1: Input High-Level Project Info**

- **Project Name:** HLFI Demo Project
- **Country:** United States of America
- **Zip:** 70809
- **City:** Baton Rouge
- **State / Province:** Louisiana
- **Project Class:** New Construction

**Project Type**
- Project Type: Capital

**Industry Type**
- Industry Type: I - Chemical

**Total Installed Cost (TIC)**
- $15,000,000

**Construction Start Date**
- 12/01/2017
- 2017 December 1

**Construction End Date**
- 12/31/2017
- 2017 December 31

- Actual Project Data
- OR
- Test Project Data

Next
HLPI Introduction & Process

The High-level Productivity Index (HLPI) is a single project score that benchmarks your project's productivity versus other projects in North America. This index, developed by CII and COAA, is available through this free online prototype. Note that while you can benchmark any capital project, the system's baseline relies on industrial data to generate benchmarks.

The project HLPI is based on craft labor productivity data (hours & installed quantities) for 8 disciplines:

- Concrete
- Structural Steel
- Piping
- Piping Insulation
- Electrical Wire & Cable
- Instrumentation
- Equipment
- Modules & Pre-Assembled Skids

Since each discipline's productivity (measured in hours per unit installed quantity) is measured in different units, a statistical treatment is used to convert them into unitless numbers (more specifically, these are converted into...
STEP #2: Input Project Safety & Hours Info

Total Recordable Incident Rate (TRIR)
0.27

Total Construction Site Work-Hours
Direct Work-hours (including rework)
20,000
Indirect Work-hours
1,750

Units of Measure
US (Imperial)
### STEP #3: Input On-Site Quantity & Hours by Discipline

<table>
<thead>
<tr>
<th>Construction Discipline</th>
<th>Installed Quantity (count)</th>
<th>Actual Construction Direct Work-Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Concrete</td>
<td>Yd³ 344</td>
<td>25</td>
</tr>
<tr>
<td>Total Structural Steel</td>
<td>Tons 223</td>
<td>1,348</td>
</tr>
<tr>
<td>Electrical Wire &amp; Cable</td>
<td>LF 78,477</td>
<td>5,889</td>
</tr>
<tr>
<td>Total Piping</td>
<td>LF 1,600</td>
<td>578</td>
</tr>
<tr>
<td>Instrumentation Devices</td>
<td>EA 90</td>
<td>1,569</td>
</tr>
<tr>
<td>Piping Insulation</td>
<td>ELF 9,645</td>
<td>5,288</td>
</tr>
<tr>
<td>Total Equipment</td>
<td>EA 18</td>
<td>1,590</td>
</tr>
<tr>
<td>Modules &amp; Pre-Assembled Skids</td>
<td>EA 34</td>
<td>4,105</td>
</tr>
<tr>
<td>Total Scaffolding Work-hours</td>
<td></td>
<td>120</td>
</tr>
</tbody>
</table>
### STEP #4: Input Off-Site Quantity & Hours

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Installed Quantity (count)</th>
<th>Actual Fabrication Direct Work-Hours (including rework)</th>
<th>Actual Fabrication Indirect Work-Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modules &amp; Pre-Assembled Skids</td>
<td>EA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Owner’s Project Management Team Size**

Average Owner’s PM Team Size (FTE's) in Construction Phase

FTE 5.5
### STEP #5: Engineering Deliverables Survey

**Engineering deliverables were released in a timely manner to support construction operations?**

<table>
<thead>
<tr>
<th>Seldom</th>
<th>Sometimes</th>
<th>Always</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

**Engineering deliverables were complete and accurate (minimal errors and omission)?**

<table>
<thead>
<tr>
<th>Seldom Complete &amp; Accurate</th>
<th>Sometimes Complete &amp; Accurate</th>
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HLPI Demo Project

<table>
<thead>
<tr>
<th>Industry Type:</th>
<th>I - Chemical</th>
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<tr>
<td>Project Class:</td>
<td>New Construction</td>
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<tr>
<td>Project Type:</td>
<td>Capital</td>
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<td>Project TIC:</td>
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<tr>
<td>Project Dates:</td>
<td>2017 December 1 to 2017 December 31</td>
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<td>Location:</td>
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Productivity for Overall Project

Overall productivity is better than 75% of all other reference projects
Productivity for Overall Project

Overall productivity is better than 75% of all other reference projects.
Concrete productivity is better than 100% of all other reference projects.

Electrical productivity is better than 54% of all other reference projects.

Modules & Skids productivity is better than 66% of all other reference projects.

Instrumentation Devices productivity is better than 43% of all other reference projects.
Piping productivity is better than 97% of all other reference projects.

Piping Insulation productivity is better than 55% of all other reference projects.

Structural Steel productivity is better than 94% of all other reference projects.

Total Equipment productivity is better than 76% of all other reference projects.
### Project Safety & Hours Info

<table>
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<tr>
<th>Description</th>
<th>Value</th>
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<td>Total Recordable Incident Rate (TRIR):</td>
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### On-Site Quantity & Hours by Discipline

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**Total Scaffolding Work-hours**: 120
Off-Site Quantity & Hours

Average Owner’s PM Team Size (FTE’s) in Construction Phase  5.5

HLPI Report Methodology

This report provides the High-level Productivity Index for your project, along with individual benchmarks for the reported disciplines. The HLPI assigns a number between 0 and 100 – the higher the better. E.g. if your HLPI is 88, your overall project productivity (based on a combination of disciplines’ productivity) is better than 88% of the projects included in the system’s baseline.

This report also provides productivity benchmarks for the individual disciplines. There are also 0-100 scores. E.g. if your concrete discipline score is 35, your concrete labor productivity is better than 35% of the projects in the database.

The HLPI baseline is based on nearly 200 industrial projects in North America and is revised in the system so progress can be tracked with respect to this baseline. The baseline will be updated in the future as more data is collected. The current project database is described as follows:

<table>
<thead>
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<th>Project Type</th>
<th>Project Nature</th>
</tr>
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<tbody>
<tr>
<td>22% – Chemical Manufacturing</td>
<td>35% – Grassroots</td>
</tr>
<tr>
<td>17% – Oil Refining</td>
<td>31% – Addition</td>
</tr>
<tr>
<td>13% – Electrical Generating</td>
<td>22% – Modernization</td>
</tr>
<tr>
<td>10% – Oil Sands SAGD</td>
<td>12% – Other</td>
</tr>
<tr>
<td>36% – Other</td>
<td></td>
</tr>
</tbody>
</table>

Average Year: 2005 (ranging from 1990 to 2015)
Average Workhours: 1.12 million workhours

NOTE: If you accessed the HLPI as a guest, your data and report will NOT be retained for future access. Be sure to print this report, save it as a PDF and/or make screenshots for your records. A full CLMA account enables retention and retrieval of your data and reports.
With CLMA® account, projects are set up and ready for labor risk analysis and more detailed productivity tracking.

With CLMA® account, HLPC reports are retained and available for future tracking and analysis (Phase 2).
Questions
&
Next Steps
Next Steps

• HLPC production release:
  • Company account
  • Portfolio management; historical projects
  • Data validation
  • Optional filtering by geography, project type
  • Dynamic productivity indices

• Research and further analytics on data
  • Peripheral correlation analytics (safety, PM size, modularization)
Questions to the Workgroup

• How difficult is it to get actual “as executed” data?
  – Convert dollars to hours by discipline?
• Each discipline has a number of sub-categories… too detailed or not detailed enough?
Call to Action

• Create your CLMA account

• Trial the calculator with actual projects
  – FEL3 quantity estimates
  – Calc actuals from cost if actual hrs not available

• Review and provide feedback:
  – Industry adoption
  – Value-add
  – Desired features