
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

Electrical Wire & Cable

Structural Steel

Instrumentation

Piping

Equipment

Piping Insulation

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



250

STEP #3: Input On-Site Quantity & Hours by Discipline

Construction Discipline	Installed Quantity (count)	Actual Construction Direct Work-Hours
Concrete	Yd ³ 344	1,348
Structural Steel	Tons 223	5,889
Electrical Wire & Cable	LF 78,477	576
Instrumentation Devices	ELF 9,645	1,590
Piping Insulation	EA 18	4,105

1,600 1,559

9%

+153%

Electrical Wire

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

Non-farm business labor productivity CAGR +1.9%

-19%


High-Level Productivity Calculator





Use the Construction Labor Market Analyzer® login below to access the CLMA®, the Safety Benchmarking Portal and the Productivity Calculator.


High-Level Productivity Calculator

 Email

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

HLPI Demo Project

Country

United States of America

Zip

70809

City

Baton Rouge

State / Province

Louisiana

Project Class

New Construction

Project Type

Capital

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





STEP #1: Input High-Level Project Info



Overview

Guide

Methodology

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 disciplines' 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)

Total Construction Site Work-Hours

Direct Work-hours (including rework)

Indirect Work-hours

Units of Measure

Previous

Next





STEP #3: Input On-Site Quantity & Hours by Discipline

Construction Discipline	Installed Quantity (count) ?	Actual Construction Direct Work-Hours ?
Total Concrete	Yd ³ 344 ?	25 ?
Total Structural Steel	Tons 223 ?	1,348 ?
Electrical Wire & Cable	LF 78,477 ?	5,889 ?
Total Piping	LF 1,600 ?	576 ?
Instrumentation Devices	EA 90 ?	1,559 ?
Piping Insulation	ELF 9,645 ?	5,288 ?
Total Equipment	EA 18 ?	1,590 ?
Modules & Pre-Assembled Skids	EA 34 ?	4,105 ?
Total Scaffolding Work-hours		120 ?

Previous

Next





STEP #4: Input Off-Site Quantity & Hours

Module Type	Installed Quantity (count)	Actual Fabrication Direct Work-Hours (including rework) [?]	Actual Fabrication Indirect Work-Hours [?]
Modules & Pre-Assembled Skids	EA <input type="text"/>	<input type="text"/>	<input type="text"/>

Owner's Project Management Team Size

Average Owner's PM Team Size (FTE's) in Construction Phase [?]

FTE

Previous

Next





STEP #5: Engineering Deliverables Survey

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

Seldom			Sometimes			Always	Don't Know
1	2	3	4	5	6	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

Seldom Complete & Accurate			Sometimes Complete & Accurate			Always Complete & Accurate	Don't Know
1	2	3	4	5	6	7	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Previous

Next





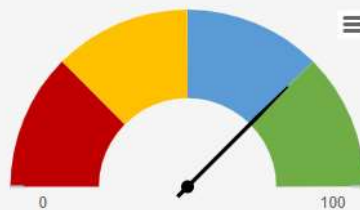
Benchmark New Project

Print

HLPI Demo Project

Industry Type:	I - Chemical
Project Class:	New Construction
Project Type:	Capital
Project TIC:	\$15,000,000
Project Dates:	2017 December 1 to 2017 December 31
Location:	Baton Rouge, Louisiana 70809 (US)

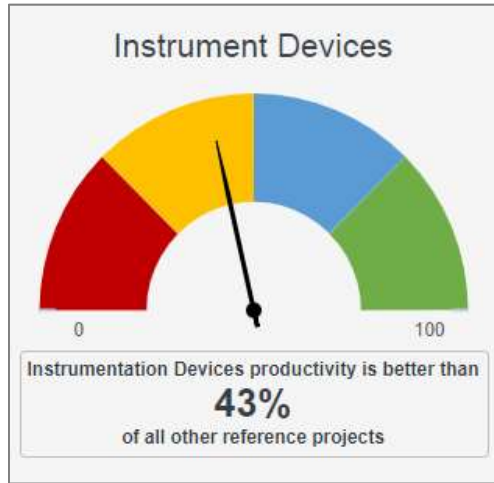
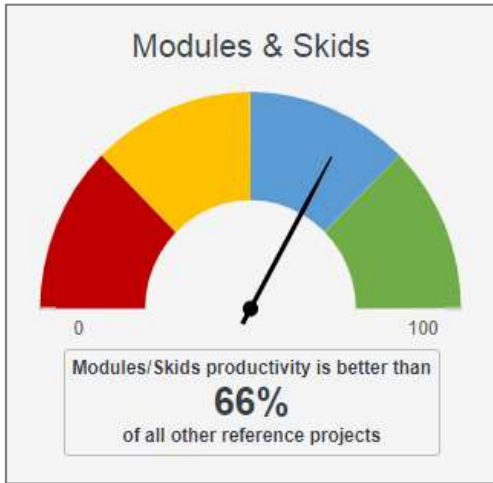
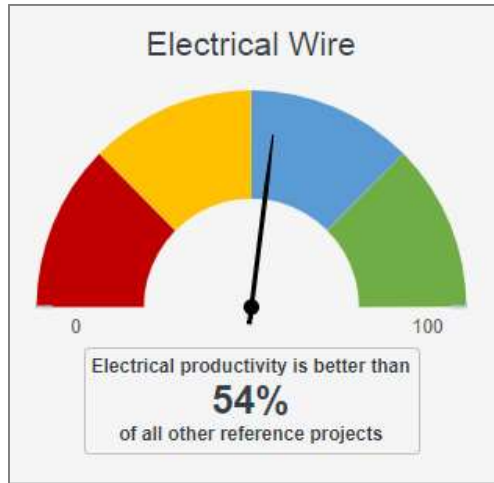
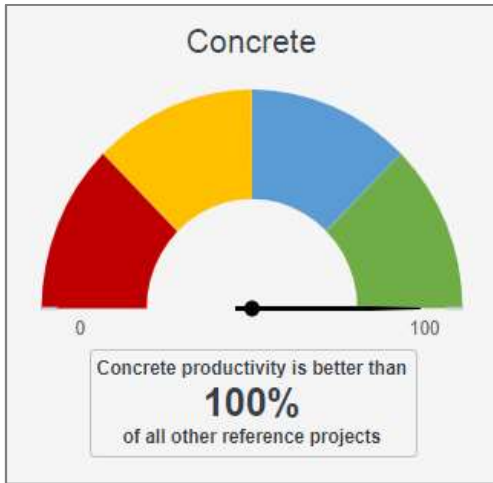
Productivity for Overall Project

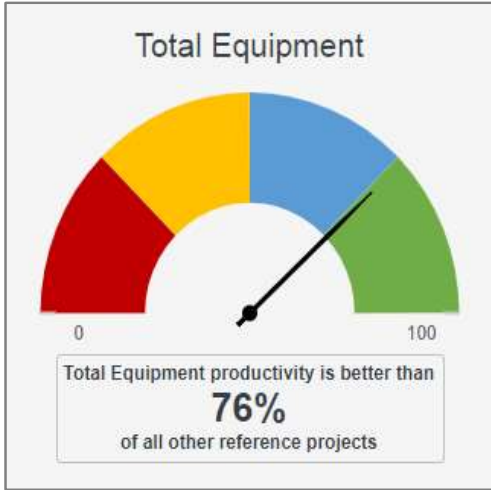
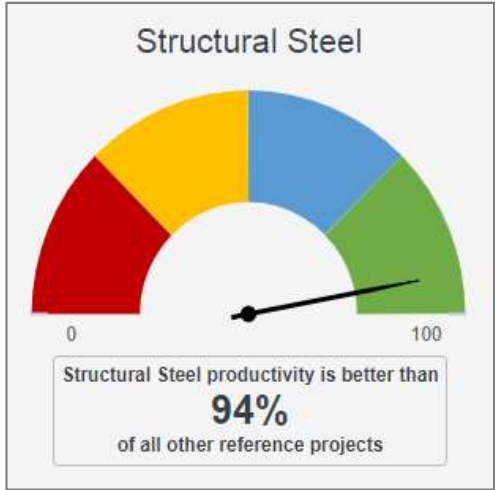
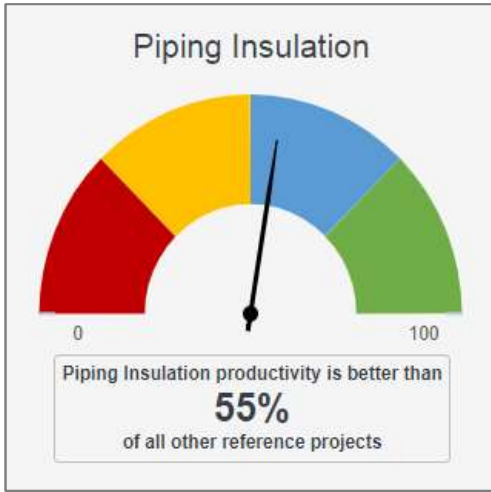
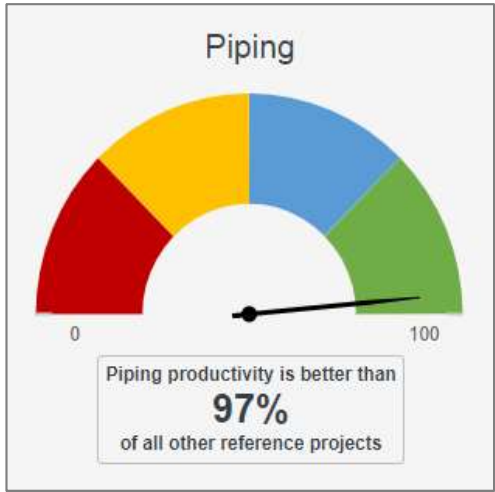


Overall productivity is better than
75%
of all other reference projects









Project Safety & Hours Info

Total Recordable Incident Rate (TRIR):	.27
Direct Work-hours (including rework):	20,000
Indirect Work-hours:	1,750

On-Site Quantity & Hours by Discipline

Construction Discipline	Installed Quantity	Actual Construction Direct Work-Hours
Total Concrete	344 Yd ³	25
Total Structural Steel	223 Tons	1,348
Electrical Wire & Cable	78,477 LF	5,889
Total Piping	1,600 LF	576
Instrumentation Devices	90 EA	1,559
Piping Insulation	9,645 ELF	5,288
Total Equipment	18 EA	1,590
Modules & Pre-Assembled Skids	34 EA	4,105

Total Scaffolding Work-hours	120
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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. These are also 0-100 scores. E.g. if your concrete discipline score is 30, your concrete labor productivity is better than 30% of the projects in the database.

The HLPI baseline is based on nearly 200 industrial projects in North America and is fixed 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:

- | <u>Project Type</u> | <u>Project Nature</u> |
|--------------------------------|-----------------------|
| • 22% – Chemical Manufacturing | • 35% – Grassroots |
| • 17% – Oil Refining | • 31% – Addition |
| • 13% – Electrical Generating | • 22% – Modernization |
| • 10% – Oil Sands SAGD | • 12% – Other |
| • 36% – Other | |

Average Year: 2005 (ranging from 1996 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.

CLMA CIR - Own Daniel Groves (Admin) Reports

Productivity Reports

Search

Action	Project Name	Overall PI	City	State	Country	Date Created
View	Demo	100%	Lexington	Kentucky	US	Jan 5, 2018 at 12:41 PM
Action	Project Name	Overall PI	City	State	Country	Date Created

Showing 1 to 1 of 1 records

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With CLMA® account, H LPC 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

