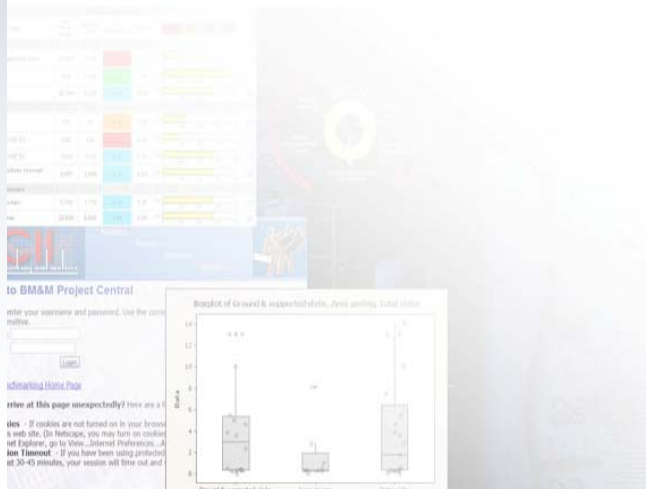


# Ten Years of Benchmarking American Engineering & Construction Firms

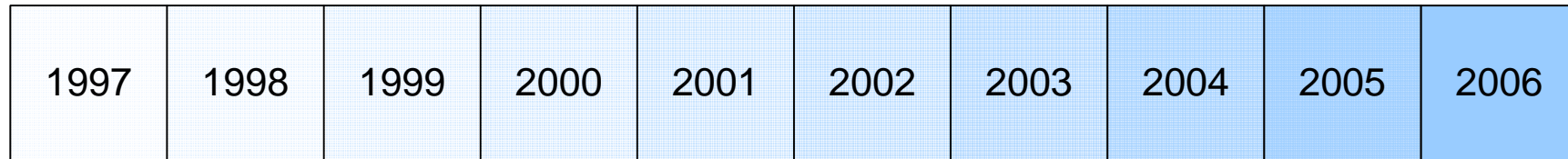
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*Revaluing Construction 2007*  
*Copenhagen*  
*October 10, 2007*

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# CII Benchmarking Journey



← Relative Performance & Practice Use Metrics (e.g. Cost Growth & Constructability) →

← Productivity Metrics →

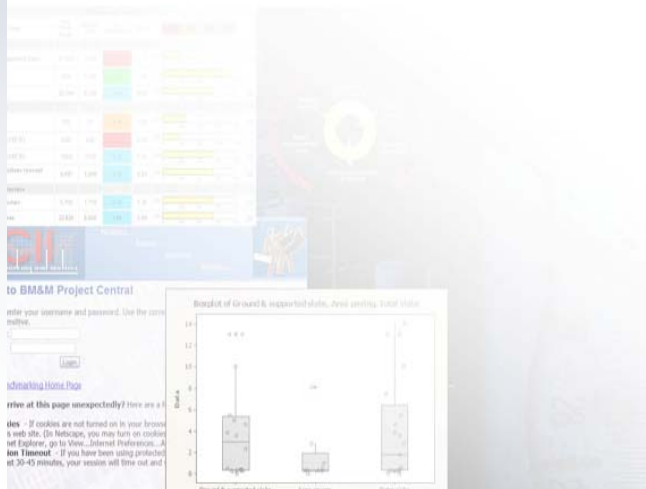
\* Construction

\* Engineering

← Industry Specific Metrics →

\* Pharma

\* Oil & Gas



# Construction Industry Institute®

## OWNERS

3M  
Abbott  
Air Products-Chemicals  
Alcoa  
Amgen  
Anheuser-Busch  
Aramco Services  
Biogen Idec  
BP America  
Cargill  
Chevron  
CITGO  
Codelco-Chile  
ConocoPhillips  
Dow Chemical  
DuPont  
Eastman Chemical  
Eli Lilly and Company  
ExxonMobil  
Genentech  
General Motors  
GlaxoSmithKline  
Intel  
International Paper  
Kraft Foods  
Marathon Oil  
Merck  
NASA  
Naval Facilities Engrg Cmd  
NOVA Chemicals  
Ontario Power Generation  
Petrobras  
Praxair  
Procter & Gamble  
Progress Energy  
Rohm and Haas  
Sasol Technology  
Shell Oil  
Smithsonian Institution  
Solutia  
Southern Company  
Sunoco  
TVA  
US Architect of the Capitol  
US Army Corps of Engineers  
US Bureau of Reclamation  
US Dept of Commerce/NIST  
US. Dept of Energy  
US Dept of Health/Human Svc  
US Dept of State  
US General Services Admin  
US Steel  
Weyerhaeuser Company

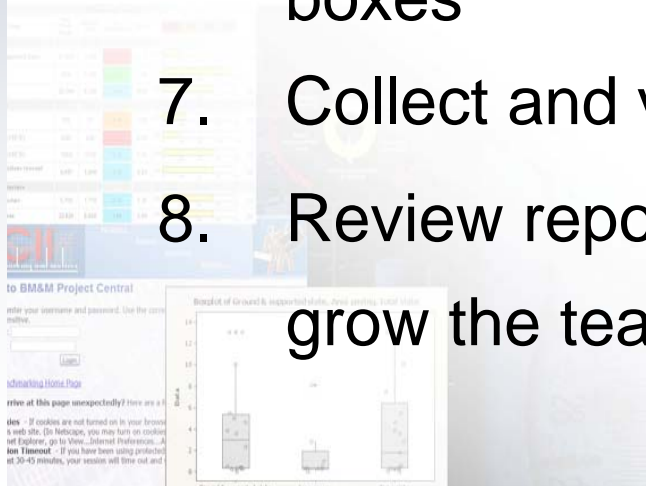
## CONTRACTORS- SUPPLIERS

ABB Lummus Global  
Aker Kværner  
ALSTOM Power  
AMEC  
Autodesk  
AZCO  
Baker Concrete  
BE&K  
Bechtel Group  
Black & Veatch  
Burns & McDonnell  
CB&I  
CCC Group  
CDI Engineering  
CH2M HILL  
CSA Group  
Day & Zimmermann  
Dick Corporation  
Dresser-Rand  
Emerson Process Mgmt  
Fluor  
Fru-Con  
Grinaker-LTA  
GS E&C  
Harper Industries  
Hatch

Hilti  
Hyundai E&C  
J. Ray McDermott  
Jacobs  
JMJ Associates  
KBR  
Kiewit Construction  
M. A. Mortenson  
Mustang Engineering  
Nielsen-Wurster Group  
Parsons  
Pathfinder  
Perot Systems  
Primavera Systems  
R. J. Mycka  
SNC-Lavalin  
S&B  
Shaw Group  
SNC-Lavalin  
Technip  
Victaulic  
Walbridge Aldinger  
Washington Group  
WorleyParsons  
Yates Construction  
Zachry Construction  
Zurich

# Developing a Benchmarking Program

1. Identify an interest group (participants)
2. Work with a 3<sup>rd</sup> party facilitator
3. Hold organizational & scoping meetings
4. Define the metrics
5. Develop the questionnaire – can be a deal breaker
6. Develop reports - keep it transparent, no black boxes
7. Collect and validate data
8. Review reports, assess value received, rescope, grow the team and continue

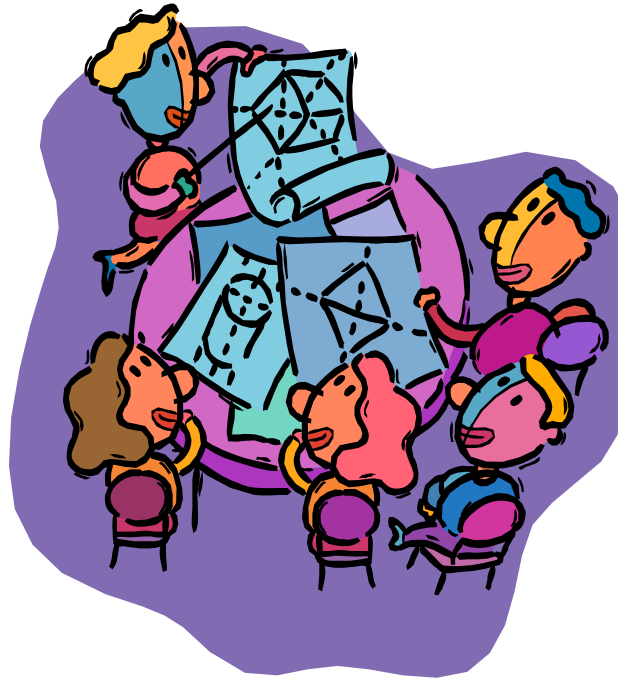


# The CII Model

## Team Approach

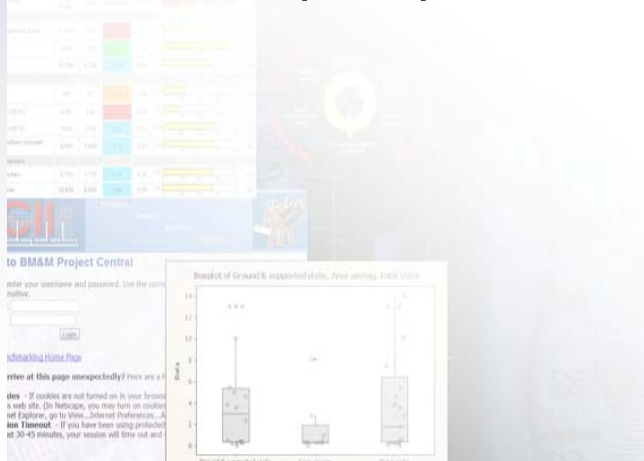
### CII

- Facilitates
- Provides benchmarking expertise
- Provides infrastructure
- Develops database
- Develops reports



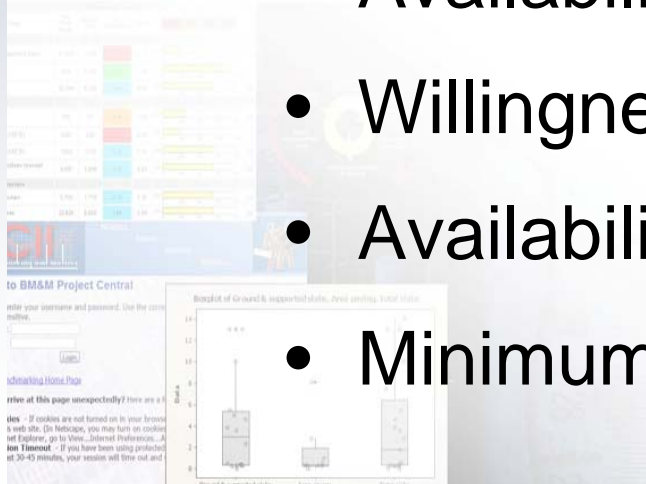
### Industry Participants

- Provide industry expertise
- Define specific requirements
- Provide benchmarking expertise
- Resource the initiative



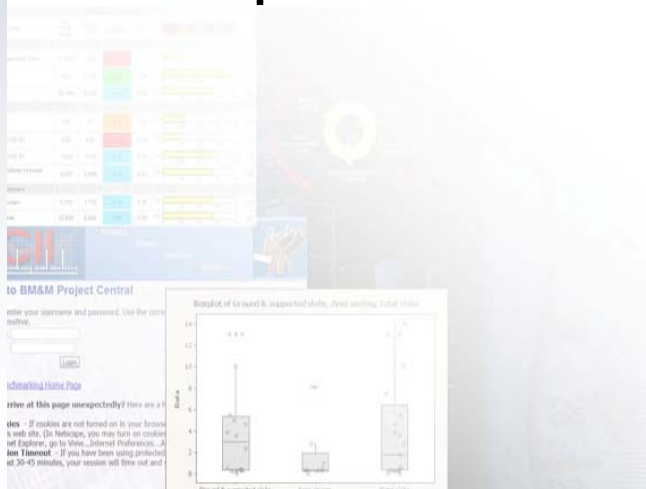
# The Benchmarking Group

- Common interests
- Similar issues
- Competitors
- Cultural fit
- Availability for participation
- Willingness to share data
- Availability of data
- Minimum numbers



# 3<sup>rd</sup> Party Facilitator

- Resources available (\$, time, personnel)
- Reputation
- Alignment of interests: facilitator & participants
- Experience



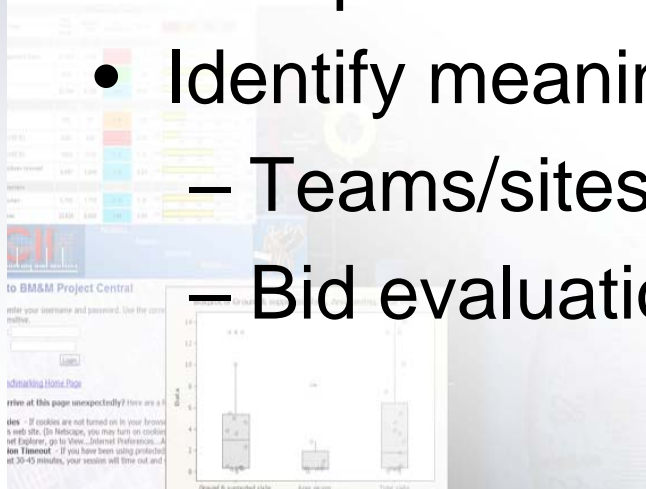
# Organizational & Scoping Meetings

- Who will participate
- Purpose of benchmarking effort
- Project types to benchmark
- Metrics desired
- Rules for participation (Governance Plan)
  - Cost
  - Expected number of projects
  - Incorporation of new members
  - Rights of departing members



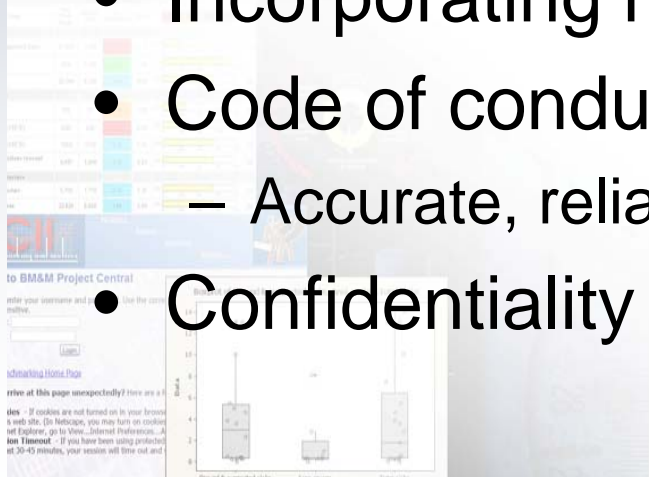
# Define the Purpose

- Evaluate competitiveness vs. peers on key performance outcomes
- Identify the drivers of outcomes (Continuous Improvement)
  - Practices
  - Impact factors
- Identify meaningful targets & norms
  - Teams/sites
  - Bid evaluation



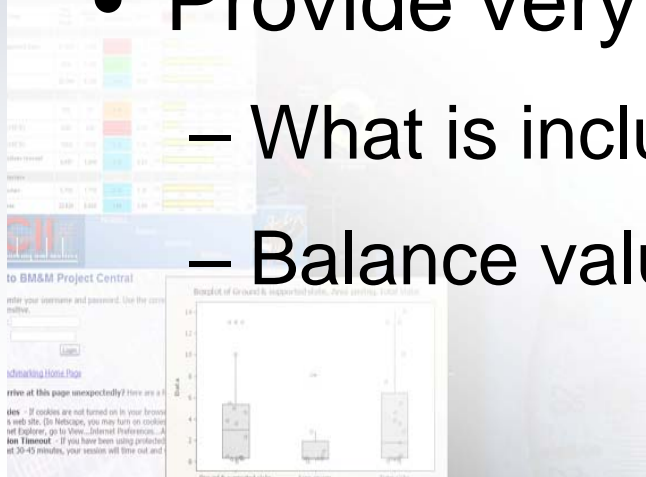
# Governance Plan

- Who can/will participate
- Participation expectations (data requirements)
- Cost of participation
- Use of data (& disposal)
- Schedule (milestones)
- Incorporating new members
- Code of conduct
  - Accurate, reliable and representative data
- Confidentiality policies



# Define the Metrics

- Establish the framework
  - What are the logical comparisons
  - Ability to rollup to higher levels
  - Flexible for future modifications
- Provide very specific metric definitions
  - What is included & excluded
  - Balance value of data vs. effort to collect



# Pharmaceutical Metrics Framework

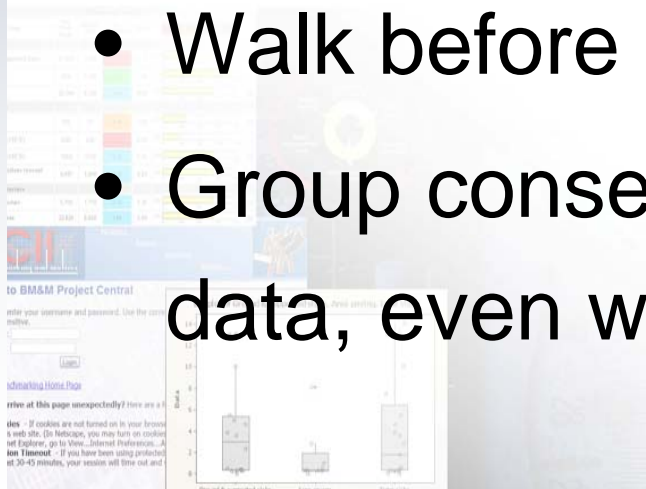
Pharmaceutical Bulk Manufacturing	Biological	Direct Derived	
		Fermentation	
		Cell Culture	Attachment Dependent
		Stirred Tank	
		Pilot Plant	
Pharmaceutical Secondary Manufacturing	Chemical	Manufacturing	
		Pilot Plant	
	Fill Finish	Parenteral	Syringe
			Delivery Device
			Vial
		Pilot Plant	
		Non-Parenteral	Inhalents
			Solid Dosage
	Cream / Ointment		
	Pilot Plant		
	Packaging		
	Pharmaceutical Warehouse		
	Pharmaceutical Laboratory	Research	Biological
			Chemical
		Quality Control / Quality Assurance	
Vivarium			
Process Development			





# Thoughts on Defining the Metrics

- Remember attributes of good metrics
- Maintain alignment with purpose
- Definitions must be consistent with data collection system
- Walk before running
- Group consensus – If you can't get the data, even well defined metrics won't work



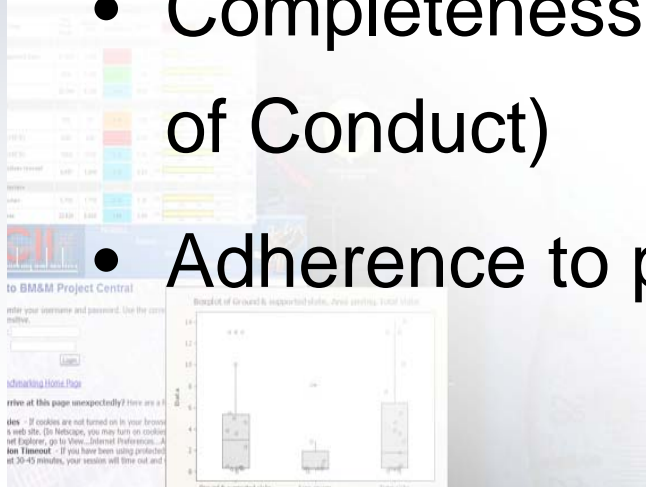
# Develop the Questionnaire

- What data are required beyond metrics defined?
- Who will complete the questionnaire; data access?
- How long will it take to complete the questionnaire?
- Web-based data collection systems:
  - Ease of access
  - Security
  - Cost
  - Training requirements



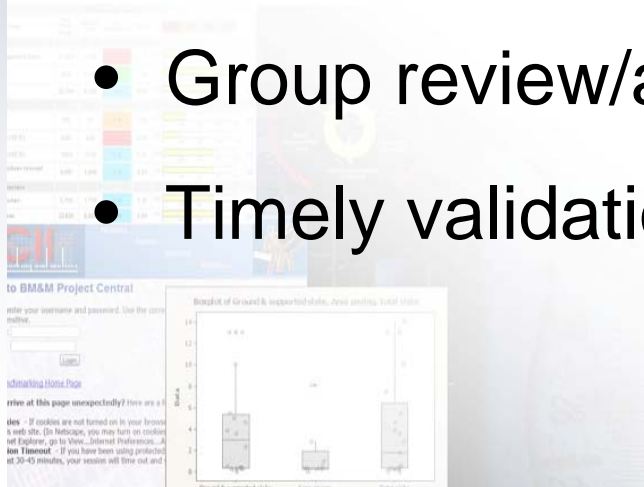
# Data Collection Issues

- Requirements for training
- Requirements for validation
- Establish data collection plan (numbers of projects and schedule)
- Completeness and accuracy are essential (Code of Conduct)
- Adherence to plan is critical



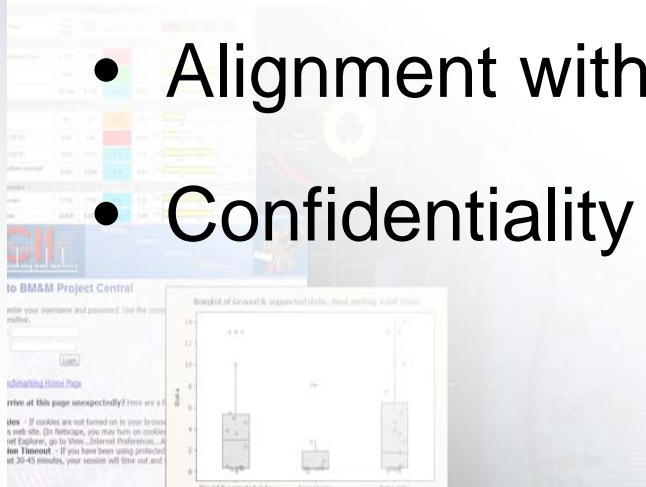
# Validation Process

- Part of the benchmarking agreement & Code of Conduct
- Separate levels for data entry and validation at company level
- Facilitator validation checks
- Group review/approval of aggregated data
- Timely validation is critical

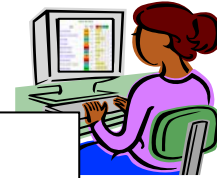


# Development of Reports

- Who is the target audience?
- Scorecard vs. narrative subjective analysis
- Data mining tools
- Access requirements: real time vs. post project
- Alignment with purpose
- Confidentiality & security issues



# The Scorecard



## Performance Metric NORMS

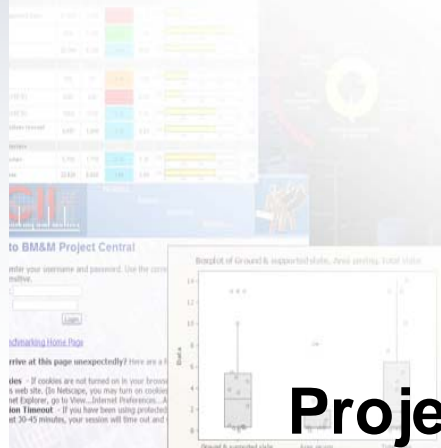
### Cost Performance

Metric	Project Score	Database Mean	4Q 3Q 2Q 1Q	n
Project Cost Growth	0.057	-0.050	4Q	22

Delta Cost Growth
Design Cost Growth
Procurement Cost Growth
Construction Cost Growth

### Practice USE Metrics

Metric	Project Score	Database Mean	4Q 3Q 2Q 1Q	n
<a href="#">Pre-project Planning</a>	8.372	8.036	3Q	24
<a href="#">Alignment for Pre-project Planning</a>	6.563	7.518	3Q	32
<a href="#">Team Building</a>	8.188	5.756	2Q	23
<a href="#">Constructability</a>	3.714	5.209	3Q	16*
<a href="#">Materials Management</a>	3.636	7.134	4Q	25
<a href="#">Safety (Zero Accidents)</a>	9.861	9.407	2Q	23
<a href="#">Project Change Management</a>	7.500	8.339	3Q	16*
<a href="#">Quality Management</a>	2.107	4.645	4Q	49
<a href="#">Technology Automation / Integration</a>	5.114	4.447	2Q	55
<a href="#">Planning for Startup</a>	9.615	6.573	1Q	26



## Project Level Performance & Practice Use



# The Scorecard

Pharma Cost				
Metric	Project Score	Database Mean	4Q 3Q 2Q 1Q	n
\$TIC / \$Process Equipment Cost <sup>1</sup>	6.525	11.309	1Q	11 <sup>†</sup>
\$Hard Cost / \$Process Equipment Cost <sup>1</sup>	4.273	6.998	2Q	11 <sup>†</sup>
\$Process Const. Cost / \$Process Equipment Cost <sup>1</sup>	1.752	5.603	1Q	11 <sup>†</sup>
\$Building Management System Cost / Building Mgmt System I/O Point Count <sup>1</sup>	\$ 7,957	\$ 3,968	4Q	20
\$Process Automation Cost / Total Process & Utility I/O Point Count <sup>1</sup>	\$ 4,495	\$ 4,389	3Q	8 <sup>†</sup>
\$Process Automation Cost / Validated Process & Utility I/O Point Count <sup>1</sup>	\$ 7,427	\$ 4,232	4Q	8 <sup>†</sup>
\$Facility Const. Cost / GSF	\$ 1,195	\$ 592	4Q	24
\$TIC / GSF	\$ 3,093	\$ 2,629	3Q	10 <sup>†</sup>
\$Soft Cost / \$TIC	0.345	0.354	2Q	11 <sup>†</sup>
\$Soft Cost / \$Hard Cost	0.527	0.588	2Q	11 <sup>†</sup>
(\$Design + \$Construction Mgmt.) / \$TIC	0.319	0.294	3Q	11 <sup>†</sup>

## Pharma Project Cost Performance

to BM&M Project Central

enter your username and password. Use the correct email.

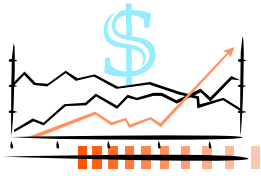
admin@home.com

login

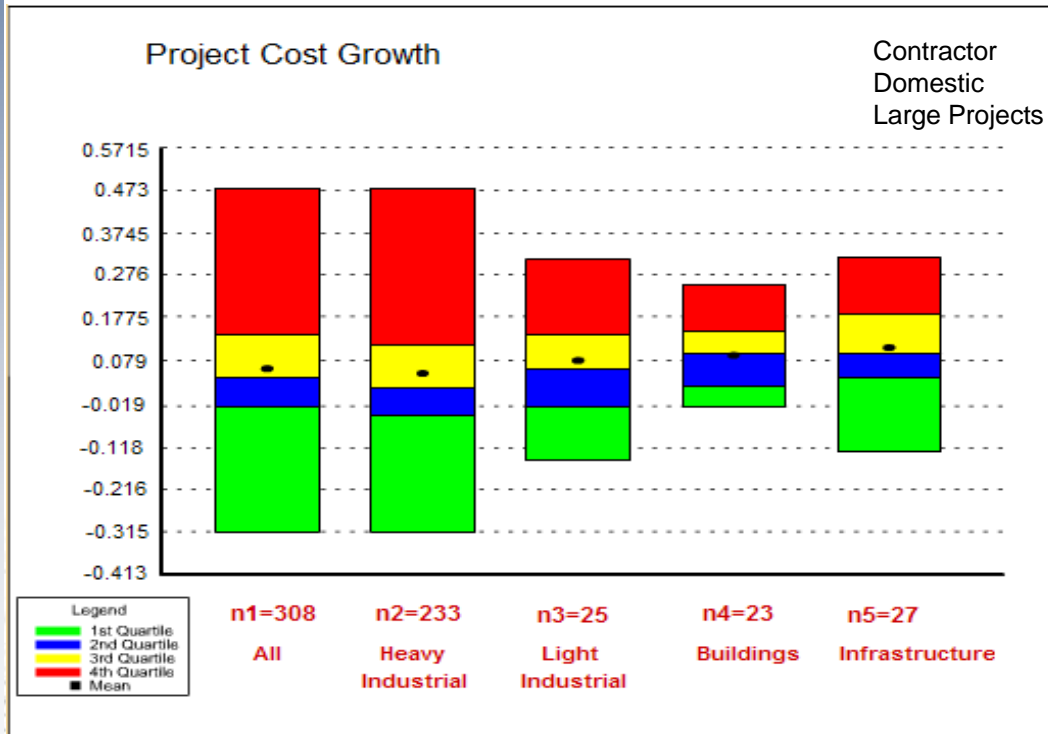
if you are not logged in, you will be redirected to the login page.

if you are not logged in, you will be redirected to the login page.

if you are not logged in, you will be redirected to the login page.



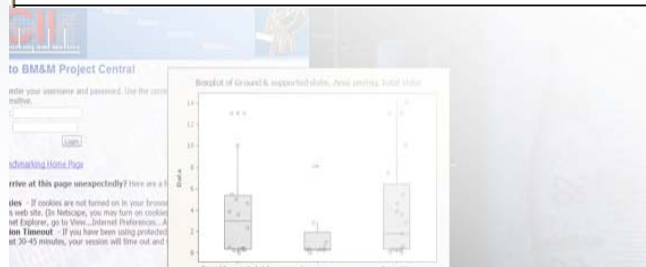
# Data Mining Tool



- **Online Reference Report for Industry Norms**

- **Metric Breakouts by:**

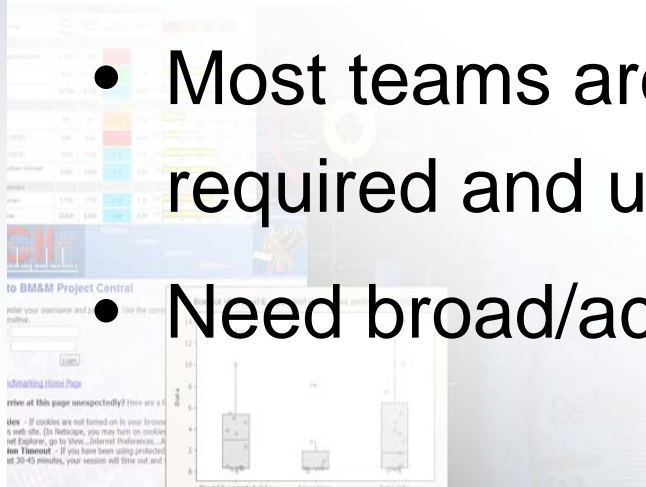
- Domestic & International
- Industry Groups
- Project Nature
- Cost Category
- Contractor Function (D, C, D&C)
- ...



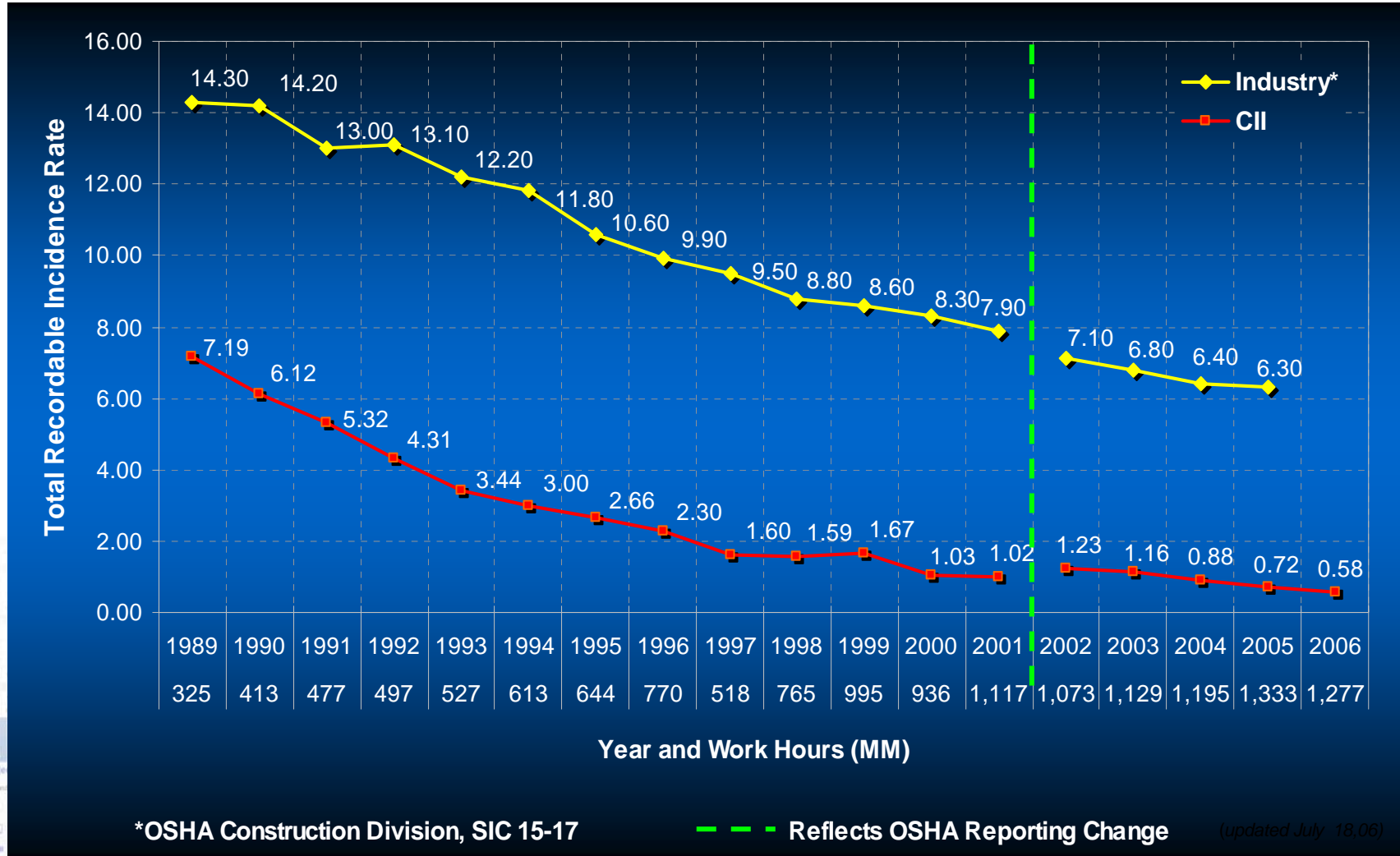
## Industry Analysis

# Benchmarking Considerations

- Set Realistic Expectations
  - Investment (time, \$)
  - Outputs (data value)
- You get out of it, what you put into it
- Focus on the critical metrics
- Most teams are too ambitious (over define data required and underestimate effort)
- Need broad/active participation



# Benchmarking Drives Improvement!



TRIR Trend

