



CURT

THE CONSTRUCTION USERS ROUNDTABLE

"THE OWNERS VOICE TO THE CONSTRUCTION INDUSTRY"



Construction Measures: Key Performance Indicators

UP-101
September 2005

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Notice:

The purpose of this publication is to make available to industry the results of research and common owner practices. The information is provided solely for the individual consideration and education of CURT members and the industry. The publication does not necessarily represent the views of every CURT member company on this topic. The booklet is offered as an informational publication only. CURT intends only to synthesize current thought and trends concerning the topic. Neither CURT nor its committees make any warranty as to the completeness regarding the materials. Readers are encouraged to further research the topic before relying exclusively on these materials. Each CURT member and other readers of these materials are free, acting in its own discretion and its own perception of business self-interest, to reject or adopt the recommendations in whole or in part. Adoption and/or reliance upon these recommendations is strictly voluntary.

The Mission of The Construction Users Roundtable (CURT) is to promote cost effectiveness for owners doing business in the United States by providing aggressive leadership on issues that will significantly improve project engineering, maintenance and construction processes, thereby creating value for the owners.

1. Intent

CURT user practices are developed from individual member practices as presented and discussed at CURT workshops. They are intended for use by CURT member companies.

2. Objective

CURT owners strive for continuous improvement in their construction processes and results. Construction measures provide the means for monitoring and tracking critical in-process and results measures. The objective of this user practice is to define those measures and document measurements that CURT owners have identified as key performance indicators.

3. Principles

“What gets measured, gets improved.” Measures draw focus and attention to specific work processes and results. This focus and the resulting efforts to change cause these work processes to be improved and results to get better.

4. Scope

CURT owners rely on construction measures at both micro and macro levels to guide their decision making and managerial focus.

Micro-measures are measures at the individual project level that compare actual project results with expected results as defined in specific project goals and objectives.

Macro-measures, often referred to as benchmarking, compare and analyze results on a broader scale. Benchmarking can be used to compare results at project, site, regional, and global levels. Benchmarking can be both internal, within the corporate entity, and external, outside the corporation. Benchmarking is often expedited by industry associations such as the Construction Industry Institute (CII) or Construction Users Roundtable (CURT), or by for-profit benchmarking companies such as Independent Project Analysis (IPA).

Often, micro-measures are aggregated for site, region, and corporate entities and used for benchmarking at a higher level. For example, the OSHA Recordable Incident Rate (RIR) for individual projects at one manufacturing site can be aggregated and compared to the RIR at other U.S. sites. It could be further accumulated for a business area and compared to other U.S. business areas within the corporation, or totaled corporately and compared to other U.S. businesses and to U.S. averages kept by the federal government.

In addition, there are two general types of construction measures:

- ▲ **Results measures**, which track outcomes after the fact.
- ▲ **In-process measures**, which track leading indicators and anticipate potential problems before they happen.

For example: **Safety results measures** might include Lost-Time Incidents, Recordable incidents, Doctor Cases, First-Aid Cases, or Near-Miss Incidents. All of these measure outcomes, after the incident has occurred. **Safety in-process measures** might include behavior observation surveys, procedural audits, or accident prediction techniques. These measures track leading indicators of safety problems and anticipate potential safety incidents, before the incident occurs.

5. Corporate Approach (Policy)

CURT owners recognize the value of continuous improvement and use construction measures to focus their managerial attention on opportunities where improvement will pay the greatest dividend. Most CURT owner members have a corporate policy that requires individual projects to track and report selected construction measures. CURT owner members also aggregate and analyze these measures by site, region, and product area, as well as corporately.

6. Responsibilities

Project Level

The owner's Project Manager is accountable to ensure that project goals reflect both customer and corporate objectives, and that appropriate measures and procedures are established to track, monitor, and report construction results. The Project Manager is supported in this effort by other members of the Project Team, including:

- ▲ Project Engineer (Planner/Scheduler)
- ▲ Construction Manager

See the following table for a list of typical Project Team members and their construction measures responsibilities.

Responsibilities for Construction Measures (at the Project Level)	
Project Manager	<ul style="list-style-type: none"> ▲ Typically leads the Project Team to establish specific project goals ▲ Ensures that both customer and corporate objectives are incorporated in the project goals ▲ Defines measures to track progress against project goals ▲ Establishes work processes for gathering, analyzing, and reporting project measures ▲ Leads the Project Team to identify opportunities for improvement and to implement action plans for positive change based on project measures results ▲ Reports project results to both customer and corporate resources
Project Engineer (Planner/ Scheduler)	<ul style="list-style-type: none"> ▲ Integrates project measures work processes with the Project Controls system (see CURT UP-210, “Construction Project Controls: Cost, Schedule, and Change Management”) ▲ Collates and summarizes construction measures reports and forwards to the Project Manager
Construction Manager	<ul style="list-style-type: none"> ▲ Manages work processes to gather and analyze construction-specific measurement data ▲ Identifies construction-specific opportunities for improvement ▲ Establishes and implements construction-specific improvement plans ▲ Reports measures and improvement plan status to the Project Engineer

Corporate Level

A corporate-level resource is typically assigned to aggregate and summarize individual project reports at site, business-area, regional, and corporate levels. These summaries are available for analysis and for both internal and external benchmarking. Corporate-level opportunities for improvement are identified and corresponding action plans developed.

Responsibilities for Construction Measures (at the Corporate Level)	
Corporate Construction Resource	<ul style="list-style-type: none">▲ Establish the work process for reporting and summarizing measures data from multiple projects▲ Aggregate and summarize multiple project reports▲ Analyze summary data▲ Benchmark, both internally and externally▲ Identify opportunities for improvement at the corporate level▲ Establish action plans to improve results▲ Continuously improve corporate standards, work processes, and implementation

7. Timing

Project Level

Project construction measures and their associated work processes should be established in the early phases of project Planning, as soon as possible after project objectives and project scope have been defined.

Construction measures work processes are implemented during the Construction project phase. The defined construction measures work processes are used to gather measurement data for analysis, identification of improvement opportunities, development of improvement ideas, and implementation of construction-specific action plans.

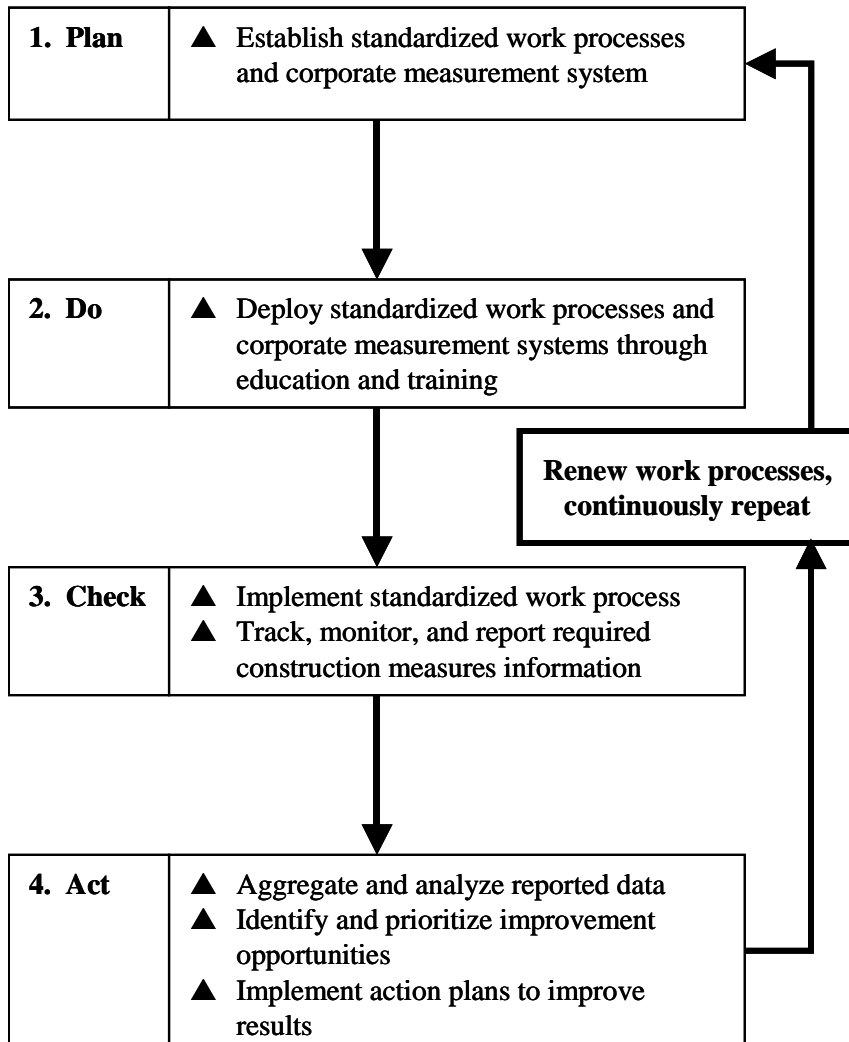
Corporate Level

Construction measures reports are aggregated, summarized, and analyzed periodically, typically monthly. Improvement ideas are developed and action plans implemented continually on a pace determined by investment cost, benefit received, and resource availability.

8. Procedure

CURT owners typically use the quality improvement cycle to drive improvements in work processes and results at both the project and corporate levels. This is established as a traditional Total Quality Plan-Do-Check-Act (PDCA) cycle. The following flow chart illustrates the PDCA cycle applied to continuous improvement of construction results.

Total Quality Improvement Cycle
Applied to Continuous Improvement of Construction Results



This improvement cycle is continuously repeated to drive improvements in construction work processes and ultimately construction results.

1. Plan: Establish standardized work processes and corporate measures system.

CURT owners establish standardized work processes through two separate approaches:

▲ In-house, proprietary development

The owner may designate staff resources to collate and summarize corporate experience to form a standardized work process. This approach is often used when the owner believes they have special experience or proprietary knowledge that might provide special insight. For example, an owner with a very successful employee safety program might follow a similar approach when developing a standardized program for construction safety.

▲ Search and reapply

A number of industry associations have established a series of best practices developed from research and member experience:

- The Construction Industry Institute has identified a series of “Best Practices” which they have made available to the industry.
- Independent Project Analysis has developed a group of “Value Improving Practices” that are available to customers of their benchmarking services.
- The Construction Users Roundtable has published a series of “User Practices” that summarize CURT member approaches to specific construction work processes.

Typically, owners use a combination of in-house development and search-and-reapply to establish their own body of standardized work processes.

Owners must establish a corresponding set of construction measures that will track progress and predict ultimate outcomes of the work processes adopted for their construction program. These measures support construction goals and objectives at the corporate, regional, site, and project levels. Each measure typically provides a mechanism to determine results-to-date and predict future outcomes. These predictive tools provide a means to focus managerial attention on problem areas and compare actual results with expected results.

CURT owners typically establish measures in the critical areas of construction management listed below.

▲ **Cost**

The cost management system tracks current spending and commitments and predicts ultimate cost outcome.

▲ **Schedule**

The schedule management system tracks construction progress to date and predicts ultimate schedule outcome.

▲ **Change Management**

The change management system tracks construction change and monitors cost, schedule, and quality implications.

See **CURT User Practice UP-201, “Construction Project Controls: Cost, Schedule, and Change Management,”** for more information about these management systems.

▲ Safety

The safety management system tracks and categorizes safety incidents that occur. Typical measures include:

- Fatalities
- Lost-Time Incidents
- Recordable Incidents
- Doctor Cases
- First-Aid Cases
- Near-Miss Incidents

The safety management system will also typically include predictive, in-process measures, such as:

- Behavior observation surveys
- Procedural audits
- Accident prediction techniques

See the following CURT User Practices for more information on safety measures and continuing improvement of safety management systems:

- **UP-805, “Construction Safety: Monitoring Performance and CURT User Practice”**
- **UP-806, “Construction Safety: Improving Safety Programs”**

▲ Quality

The quality management system monitors and analyzes quality of the constructed product and predicts quality problems and issues. Typical quality measures include:

- Quality control (QC) tests
 - Number performed
 - Frequency
 - Percentage passed/failed
- Number of non-conformance issues
- Number of change requests and root causes
- Cost of Rework
- Number of exceptions at turnover
- Cost of Quality
 - Quality Assurance (QA) Cost (cost of QA resources)
 - QA Cost as a percentage of construction cost
 - Cost of Quality (QA Cost + Cost of Rework)
 - Cost of Quality as percentage of construction cost

See **CURT User Practice UP-701, “Construction Quality: Achieving Quality on Capital Projects,”** for more information on Quality Measures.

▲ **Productivity**

Performance Factor (PF) systems are sometimes used by owners to measure labor productivity, predict the impact on project cost and schedule, and identify opportunities for productivity improvement. PF systems are most often used where reimbursable contracts place the owner at risk for lower-than-expected productivity.

▲ **Reliability**

Many owners measure the performance of the constructed product to understand how well their project delivery systems have satisfied the customer's requirements. These are measures that are critical to the financial success of the venture, such as rate, volume, efficiency, reliability, or operating and maintenance costs.

▲ **Customer Satisfaction**

Owner's often track the satisfaction of their internal corporate customer through use of customer feedback surveys and logs of customer feedback and concerns.

2. Do: Deploy and implement standardized work processes and corporate measurement systems.

The project work processes and corresponding measures must be deployed to the Project Team. The Project Manager must:

▲ **Staff and mobilize the organization.**

Individuals responsible for project work processes and corresponding measures should be identified, assigned to the project, and mobilized for project implementation.

▲ **Outline project objectives, goals, and opportunities.**

The Project Team should understand the project objectives, goals, and opportunities.

▲ **Train the organization.**

The Project Manager should ensure that the project organization has the knowledge and understanding to implement the established work processes and corresponding measures.

▲ **Establish the required infrastructure.**

The infrastructure required for effective project management, including offices, computers, internet connections, printers, telephones, and fax capability, must be established to support effective project management.

3. Check: Standardized work processes are implemented, and construction measures are tracked, monitored, analyzed, and reported.

During project execution, the work processes and measures established during project planning are implemented. Responsible individuals track, monitor, and analyze measures and provide periodic reports to the Project Manager.

4. Act: Aggregate and analyze the reported data, identify and prioritize improvement opportunities, and implement action plans to improve results.

Recommendations for improvement are identified by responsible individuals and the project team. Action plans are developed to change work processes where improvement is needed. Continuing measures provide feedback on the effectiveness of the improvement plans. This cycle of Plan-Do-Check-Act is repeated over and over during project implementation:

-
- ▲ Plan: establish work processes and measures
 - ▲ Do: deploy work processes and measures to the team
 - ▲ Check: measure effectiveness of work processes
 - ▲ Act: improve work processes as needed

The PDCA cycle results in work processes that are continuously improved and project results that are more closely aligned with expectations.

This process can also be repeated at the corporate level with data aggregated from many projects. These measures can then be used in a corporate program of continuous improvement, effectively sharing learning among many project teams, and establishing a learning organization.

9. Summary

Owners who proactively establish a quality improvement cycle by standardizing work processes and corresponding measures of effectiveness, experience better project outcomes. Improved project results are driven by continuously improving systems and organizational knowledge and understanding. Measures are a critical tool used to drive this process.

10. Reference Documentation

CURT Documentation

- ▲ Notes from CURT User Practices Workshop, “How Owners Measure Project Success: Key Performance Indicators,” December 2004 and June 2005
- ▲ CURT User Practice UP 201, “Construction Project Controls: Cost, Schedule, and Change Management,” September 2004
- ▲ CURT User Practice UP-601, “Construction Purchasing: Capital Purchasing and Contracting,” June 2005
- ▲ CURT User Practice UP-701, “Construction Quality: Achieving Quality on Capital Projects,” September 2004
- ▲ CURT User Practice UP-805, “Construction Safety: Monitoring Performance,” August 2004
- ▲ CURT User Practice UP-806, “Construction Safety: Improving Safety Programs,” August 2004

Construction Industry Institute

- ▲ Benchmarking and Metrics Value of Best Practices Report, Feb 04 (BMM 2003-4)
- ▲ Benchmarking Implementation Toolkit, (IR BMM-2)

Construction User Roundtable Publications

The purpose of developing Construction User Roundtable (CURT) publications is to disseminate recommendations, guidelines, and reports developed by the Construction Users Roundtable. CURT is focused on improving the cost effectiveness of the U.S. construction industry. These publications have been developed from the point of view of owners or users of construction services. Efforts by all segments of the industry, however, are vital if major improvement is to be the result.

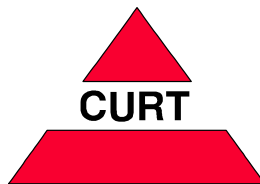
This publication is one of a series from committees or study teams addressing a problem area.

Findings and recommendations of The Construction Users Roundtable are included in publication series classified as White Papers (WP), Reports (R), or User Practices (UP). In addition to these classifications, CURT publications are numbered based on the category of the topic:

Category	Number Code
Constructability	001 to 099
Contractor Management	101 to 199
Cost	201 to 299
Interface Management	301 to 399
Workforce/Industrial Relations	401 to 499
Material Control	501 to 599
Purchasing	601 to 699
Quality	701 to 799
Safety	801 to 899
Security	901 to 999
Strategy	1001 to 1009
Work Planning and Scheduling	1101 to 1199
Technology/E-Sourcing	1201 to 1299
Special Projects	2001 to 2099

Examples:

- WP-1201: A CURT White Paper on Reverse Auction
- R-402: A CURT Report on Tripartite Initiatives
- UP -801: A CURT User Practice on Construction Safety in Contractor Prequalification



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