



Summary of Standard Industry-wide Quality Metrics

Construction Industry Institute

Owner Organizations

Abbott
Adventist Health
Ameren Corporation
American Transmission Company LLC
Anadarko Petroleum Corporation
Andeavor
Anheuser-Busch InBev
Aramco Services Company
ArcelorMittal
Architect of the Capitol
Ascend Performance Materials
AstraZeneca
BP America, Inc.
Cargill, Inc.
Chevron
ConocoPhillips
Consolidated Edison Company of New York
Consumers Energy Company
Covestro LLC
DTE Energy
Eastman Chemical Company
Eli Lilly and Company
EnLink Midstream
ExxonMobil Corporation
General Electric Company
General Motors Company
GlaxoSmithKline
Global Infrastructure Partners
Honeywell International Inc.
Huntsman Corporation
Irving Oil Limited
Johnson & Johnson
Kaiser Permanente
Koch Industries, Inc.
LyondellBasell
Marathon Petroleum Corporation
National Aeronautics & Space Administration
NOVA Chemicals Corporation
Nutrien
Occidental Petroleum Corporation
ONEOK, Inc.
Ontario Power Generation
Petroleo Brasileiro S/A - Petrobras
Petronas
Phillips 66
Pioneer Natural Resources
Public Service Electric & Gas Company
Reliance Industries Limited (RIL)
SABIC - Saudi Basic Industries Corporation
Shell Global Solutions US Inc.
Smithsonian Institution
Southern Company
Tennessee Valley Authority
The Dow Chemical Company
The Procter & Gamble Company
TransCanada Corporation
U.S. Army Corps of Engineers
U.S. Department of Commerce/NIST/EL
U.S. Department of Defense/Tricare Management Activity
U.S. Department of Energy
U.S. Department of State
U.S. Department of Veterans Affairs
U.S. General Services Administration

Breakthrough Organizations

Blue Cats
Concord Project Technologies Inc.
Construct-X, LLC
Design + Construction Strategies
Group ASI
iConstruct
Index AR Solutions
Insight-AWP Inc.
O3 Solutions
OnTrack Engineering LTD

Service Providers

AECOM
APTIM
Atlas RFID Solutions
Autodesk, Inc.
AVEVA Solutions Ltd.
AZCO INC.
Baker Concrete Construction Inc.
Barton Malow Company
Bechtel Group, Inc.
Bentley Systems Inc.
Black & Veatch
Burns & McDonnell
CB&I
CCC Group
CDI Corporation
Consolidated Contractors Company
Construtora Norberto Odebrecht S.A.
Continuum Advisory Group
CRB
CSA Central, Inc.
Dassault Systèmes SE
Day & Zimmermann
Deloitte
DMS Corporation
Eichleay, Inc.
Emerson
Ensto, Inc.
ePM
Fluor Corporation
FMI Corporation
Hargrove Engineers + Constructors
Haskell
Hatch
Hexagon Process Power & Marine
Hilti Corporation
Hitachi Construction Machinery Co., Ltd.
I.M.P.A.C.T.
IHI E&C International Corporation
Jacobs
JMJ Associates LLC
KBR
Kiewit Corporation
Linde North America
M&H Enterprises (Energy Services)
Matrix Service Company
McCarthy Building Companies, Inc.
McKinsey & Company, Inc.
Midwest Steel, Inc.
NPCC
Pathfinder, LLC
PCL Constructors, Inc.
Pillsbury Winthrop Shaw Pittman LLP
PTAG, Inc.
Quality Execution, Inc.
Richard Industrial Group
S & B Engineers and Constructors, Ltd.
Samsung Engineering America
Saulsbury Industries
SBM Offshore
Siemens Energy, Inc.
Sinopec Engineering (Group) Co., Ltd. - SEG
Skanska USA
SNC-Lavalin Constructors Inc.
TechnipFMC plc.
The Beck Group
The Boldt Company
thyssenkrupp Industrial Solutions (USA), Inc.
Turner Industries Group LLC
Valency Inc.
Victaulic
Wanzek Construction, Inc.
Wilhelm Construction, Inc.
Wood
WorleyParsons
Zachry Group
Zurich



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**Prepared by
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for Industry-wide Quality Metrics**

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Executive Summary

The objective of the CII Quality Metrics project was to develop a set of quality metrics that are scalable and simple to capture, use currently available data, and are universal; in short, sustainable quality metrics for the capital project delivery process. These metrics are intended to provide aggregated data to enable CII member organizations to benchmark performance, in much the same way as they currently benchmark reported safety metrics.

Benchmarking quality performance enables comparative quantitative assessments of company quality performance, both internally and across the industry, in the areas of FEED, design engineering, procurement, construction, construction management, and the commissioning and startup of new or modified facilities. Quantitative assessment can, in turn, lead to improvements in work processes and project performance. The lessons learned will lower the cost of capital projects, enhance schedule performance, improve the performance of service providers and suppliers, and deliver more predictable project results.

To achieve this objective, CII established Research Team 313 (RT-313), Creating Standards for Industry-wide Quality Metrics, and tasked it with creating a set of standard quality metrics that can be used to effectively measure, categorize, and benchmark quality performance across the project delivery process. The capital facilities delivery industry recognizes the need to measure quality, but its organizations and projects utilize different execution models, which makes it difficult for them to standardize quality metrics. This lack of standardization leads to variability in performance assessment, which can negatively affect an organization's bottom line.

To satisfy its research objectives, RT-313 viewed project quality activities as a series of planned activities, unplanned outcomes of planned activities (unplanned outcomes), and unplanned events, arranged in an ascending order commensurate with the severity of their consequences.

The team structured these worsening potential outcomes into a Quality Pyramid, conceptually similar to the Safety Pyramid. The team then used the severity levels of unplanned events to define a metric that it called the Quality Performance Rate (QPR).

RT-313 developed a formula for establishing the QPR by measuring the effectiveness of a quality management system implemented on any project or within an organization. The QPR enables comparative assessments of project quality performance in the areas of front-end engineering, engineering and design, procurement, construction, construction management, and the commissioning and startup of new or modified facilities. The metric uses currently available data and is scalable, simple to capture, and sustainable.

This publication summarizes the research that enabled RT-313 to develop Implementation Resource (IR) 313-2, *Implementing Standard Industry-wide Quality Metrics*, which provides a step-by-step approach for calculating and implementing the quality metric (the QPR). IR313-2 also offers guidance for analyzing the data and setting targets aligned with internal business objectives, and uses an example to demonstrate how to advance the maturity of an organization's quality system by using the QPR.

Introduction

RT-313 Research Objectives

This research sought to develop a quality metric that replicates as much as possible the characteristics present in today's widely accepted safety metric. An industry-wide quality metric would allow both owners and contractors in the capital facilities delivery industry to accomplish the following:

- Establish a common understanding (common language) of quality by developing an approach similar to the common language now utilized for measuring safety performance.
- Benchmark current performance and identify trends both internally to an organization and across the industry.
- Identify areas for improvement.
- Become more proactive and initiate actions to maintain or improve quality, rather than habitually reacting to quality issues. Identify best practices and provide input to drive work process improvements that demonstrate value to the business by positively affecting the "bottom line" (supporting the commitment to quality and understanding the impacts of non-conformance).
- Demonstrate the organization's quality performance relative to both internal and external customers. Enable the organization to differentiate itself by sharing its performance as indicated by the common quality metric.

This research supports a culture change where quality issues will be identified, reported, and measured, similar to the changes that occurred in safety and resulted in a safety-conscious culture that encourages and rewards continuous improvement. RT-313 aims to change behaviors and institute a similar culture with respect to quality.

Team Focus

The team focused on developing a common quality metric that, as much as possible, replicates the characteristics present in today's widely accepted safety metric. This metric, the Quality Performance Rate (QPR), can be measured and analyzed (including by applying a severity model) to provide insights into quality performance and to allow benchmarking within the capital facilities delivery industry. The QPR framework can be applied throughout the entire capital project delivery life cycle. As the standard for performance comparisons, the QPR can be utilized by all parties involved in the capital facilities delivery industry: owners, engineers, constructors, EPC contractors, and suppliers.

Approach

The research began with a literature search into studies of quality in construction and other industries, which provided background information for this research project. RT-313 then collected data from early adopters, consisting of team members and representatives of other CII member organizations (both owners and contractors).

Literature Search

The team conducted a literature review to examine quality metrics within and outside the capital facilities delivery industry. RT-313 also consulted with the Parenteral Drug Association, Inc. (PDA), the American Productivity & Quality Center (APQC), and the Construction Quality Executive Council (CQEC), who supported and broadened RT-313's study of quality metrics outside the capital facilities delivery industry. Both the PDA and APQC are working on similar efforts to develop quality metrics – the PDA for the pharmaceutical industry (narrower than this study's focus), and APQC for industry in general (broader than this study's focus).

The literature search found no documented standard practices that currently measure quality events across the project life cycle, and the industry lacks a common language to categorize quality events. Most literature focused on the documentation aspects of quality. Given the limited amount of available literature that relates to quality metrics, RT-313 turned to the documented literature around the Safety Pyramid as a model and source of information as it constructed its quality metric.

By using concepts from the Safety Pyramid and data from CII member organizations (discussed in Chapter 3), RT-313 identified or developed the following tools:

- **Quality Pyramid** – A model that utilizes an approach correlated to the Safety Pyramid to create a common language that allows an organization to benchmark quality events. This approach provides a common understanding of the severity of unplanned events, and the relationships among planned quality activities, unplanned outcomes of planned activities, and unplanned quality events.
- **Quality Metric** – A standard for measuring quality. The quality metric developed by RT-313, designated as the Quality Performance Rate (QPR), is based on the number and severity of unplanned events, as defined by the Quality Pyramid.
- **Implementation Process Map** – A chart that defines an approach for an individual organization to establish a value case for adopting the QPR as a standard quality metric and to develop a work process for “mapping” its individual work processes to implement that metric.

The remaining sections of this chapter summarize these three tools.

Development of the Quality Pyramid (Common Language)

Predetermined, standardized common quality classifications establish a “common language” that enables the capital facilities delivery industry to assess quality and drive improvement. Standardized terms make it possible to measure quality consistently in the following ways:

- trending and benchmarking the quality performance of organizations or projects within organizations
- comparing quality performance across projects in a consistent manner
- capturing the consistent data required to improve the overall quality of the products and services provided.