COAA’s Initiatives Toward

**REWORK REDUCTION**

on Industrial Projects.

COAA Conference : Edmonton May 2006
Agenda

- Rework Reduction
- Project Rework Reduction Tool – PRRT™
  - The Tool:
    - Purpose, Features & Benefits,
    - Overview of Use: Screen Views
COAA – Committees & Initiatives

To document & facilitate the implementation of Best Practices

- Industrial Safety
- Labour Relations/ Workforce Development
- Contract Terms & Conditions
- Cost Reduction:
  - Workface Planning
  - Benchmarking Productivity
  - Rework Reduction
COAA Definition of *PROJECT REWORK*:

"Total direct cost of redoing work on the project regardless of initiating cause or source"

Project Rework is **NOT**: Scope Changes that affect previously installed work).
Rework Reduction Committee:

1. Engineering & Reviews
2. *Project Rework Reduction Tool - PRRT™*
3. Measurement & Classification
4. Construction Planning & Scheduling
Why all the fuss about Rework Reduction?

- Field Rework adds > 10% to Construction Phase Costs (Source: CII Research Summary 10-2 (1989))
- >>> 10% for PROJECTWIDE Rework during full project lifecycle.
- There are > $100B in Industrial Projects targeted for Alberta in next 10 years. (Source Alberta Economic Dev.)

*Do the math!!.*
COAA Rework Cause Survey - 2001

1. Engineering and Reviews
   - A. Late Design
   - B. Poor Document Control
   - C. Scope Definition & Design Changes
   - D. Errors & Omissions
   - 30%

2. Construction Planning and Scheduling
   - A. Late Owner Input
   - B. Constructability Problems
   - C. Unrealistic Schedules
   - D. Insufficient Turnover & Plant Startup Resources
   - 26%

3. Leadership and Communications
   - A. Ineffective Management of Project Team
   - B. Lack of Operations (End User) Buy-in
   - C. Lack of Safety and QA/QC Commitment
   - D. Poor Communications Between Inspectors
   - 18%

4. Material and Equipment Supply
   - A. Untimely Deliveries
   - B. Prefabrication and Construction not to Project Requirements
   - C. Non-compliance with Specifications
   - D. Materials not in Right Place When Needed
   - 13%

5. Human Resource Capacity
   - A. Unclear Worker Instructions
   - B. Inadequate Supervision and Job Planning
   - C. Excessive Overtime
   - D. Insufficient Skill Levels
   - 13%
Project Rework Reduction Tool - PRRT™
Objectives of PRRT – What can it do for YOU?

1. **Evaluation**: Facilitates periodic project ‘health checks’ to predict probability for Rework & Field Rework.

2. **Complement conventional project controls tools**.


...to eliminate REWORK & Cost Overruns!
Features & Benefits of PRRT

- Increases awareness in Rework, especially Field Rework, **WELL BEFORE** it impacts bottom line!

- Has been developed by COAA: an independent but integrated association of Owners, EPC’s and Contractors.
Applications of PRRT

- ‘Gate’ Check between phases of Project Execution
- Periodic Project Team Reviews
- Review meetings with client/ owner.
- Team & Client reports
- Benchmarking, or other comparisons between projects
- Projects Audits
- Training
From what does PRRT derive?

COAA Rework Cause Classification Chart....
PRRT Input – Rework Cause Classification

1. Engineering and Reviews
   - A. Late Design
   - B. Poor Document Control
   - C. Scope Definition & Design Changes
   - D. Errors & Omissions

2. Construction Planning and Scheduling
   - A. Late Owner Input
   - B. Constructability Problems
   - C. Unrealistic Schedules
   - D. Insufficient Turnover & Plant Startup Resources

3. Leadership and Communications
   - A. Ineffective Management of Project Team
   - B. Lack of Operations (End User) Buy-in
   - C. Lack of Safety and QA/QC Commitment
   - D. Poor Communications between Inspectors

4. Material and Equipment Supply
   - A. Untimely Deliveries
   - B. Prefabrication and Construction not to Project Requirements
   - C. Non-compliance with Specification
   - D. Materials not in Right Place When Needed

5. Human Resource Capacity
   - A. Unclear Worker Instructions
   - B. Inadequate Supervision and Job Planning
   - C. Excessive Overtime
   - D. Insufficient Skill Levels

Contribute to REWORK
What does PRRT consist - Input?

- 30 to 90 weighted questions arranged in each of FIVE distinct project phase questionnaires.

Project Phases are:

1: End of DBM (Design Basis Memorandum)
2: End of EDS (Engineering Design Specification)
3: From ~20 % Detailed Engineering Complete
4: From ~20% Construction Complete
5: From ~50% Construction Complete
5. Human Resource Capacity

C. Excessive Overtime

5.5C1 How extensive is overtime being considered or applied in the Overtime Plan?

<table>
<thead>
<tr>
<th></th>
<th>No Overtime</th>
<th>Moderate OT &amp; Unplanned</th>
<th>Excessive OT Planned</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

5.5C2 Are the reasons for the Justified Overtime being fully evaluated and communicated within the entire team?

<table>
<thead>
<tr>
<th>Justified, Evaluated, and Communicated</th>
<th>Justified, Not Communicated</th>
<th>Seldom Justified</th>
<th>Not Justified</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
What does PRRT consist - Output?

1. **PRRI Rating INDEX**
   - ...ideal for project team & management reviews and project progress reporting.

2. Suggestions/ *BEST PRACTICE* ’Database from EXTENSIVE experience
What does PRRT consist - Output?

1. **PRRI Rating INDEX** derived from within 5 key PROJECT REWORK root cause Sections (& 20 Categories.)

   **High-impact**
   - ‘Tile’ Charts
   - Radar Charts (‘Dashboards’)
   - Scorecards and Trend Graphs.

   …ideal for project team & management reviews and project progress reporting.
### PRRT Output - Tile Chart

**Project Name:** Sample Project  
**Sub Project Name:** Sub-Project  
**Reference #:** SAMPLE PRRT 2.0  
**Location:** Sample Location  
**Project Manager:** Sample PM  
**Project Owner:** Sample Owner  
**Review Date:** Oct 15, 2002  
**Project Phase:** 3. > 20% Eng. Compl.

<table>
<thead>
<tr>
<th>No questions or all answered</th>
<th>Maximum Prob. For Rework</th>
<th>Moderate Prob. For Rework</th>
<th>Low Prob. For Rework</th>
<th>Minimal Prob. For Rework</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>(Review Index of 0 - 40%)</td>
<td>(Review Index of 40 - 55%)</td>
<td>(Review Index of 55 - 70%)</td>
<td>(Review Index of 70 - 100%)</td>
</tr>
</tbody>
</table>

**PRRI - Index:** 59%

1. **Engineering and Reviews**
   - A. Late Design
   - B. Poor Document Control
   - C. Scope Definition & Design Changes
   - D. Errors & Omissions

2. **Construction Planning and Scheduling**
   - A. Late Owner Input
   - B. Constructability Problems
   - C. Unrealistic Schedules
   - D. Insufficient Turnover & Plant Startup Resources

3. **Leadership and Communications**
   - A. Ineffective Management of Project Team
   - B. Lack of Operations (End User) Buy-in
   - C. Lack of Safety and QA/QC Commitment
   - D. Poor Communications between Inspectors

4. **Material and Equipment Supply**
   - A. Untimely Deliveries
   - B. Prefabrication and Construction not to Project Requirements
   - C. Non-compliance with Specification
   - D. Materials not in Right Place When Needed

5. **Human Resource Capacity**
   - A. Unclear Worker Instructions
   - B. Inadequate Supervision and Job Planning
   - C. Excessive Overtime
   - D. Insufficient Skill Levels
PRRT Output - Dashboard Chart

**PRRT - Project Rework Reduction Tool**

**PRRI - Index:** 49%

1. **Engineering and Reviews**
   - Late Design
   - Errors & Omissions
   - Scope Def. & Design Changes
   - Poor Document Control

2. **Construction Planning and Scheduling**
   - Late Owner Input
   - Insuff. Plant Startup Resources
   - Unrealistic Schedules
   - Constr. Problems

3. **Leadership and Communications**
   - Poor Team/Group Mgmt
   - Poor Inspector Communication
   - Insuff. Safety & QA/QC Commit.
   - Insuff. Ops. (Owner) Buy-in

4. **Material and Equipment Supply**
   - Untimely Deliveries
   - Mats. Not in Right Place
   - Non-Compliance to Specs
   - Incorrect Prefab. & Constr.

5. **Human Resource Capacity**
   - Unclear Work Specs & Instruct.
   - Insuff. Skill Levels
   - Inadequate Job Planning & Supv.
   - Excessive Overtime
## PRRT Output - Dashboard Element Chart

### 2. Construction Planning and Scheduling

<table>
<thead>
<tr>
<th>Project Name: Sample Project</th>
<th>Sub Project Name: Sub-Project</th>
<th>Reference #: SAMPLE PRRT 2.0</th>
<th>Location: Sample Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager: Sample PM</td>
<td>Project Owner: Sample Owner</td>
<td>Review Date: Oct 15, 2002</td>
<td>Project Phase: 3. &gt; 20% Engr. Compl.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No questions or all answered</th>
<th>Maximum Prob. For Rework</th>
<th>Moderate Prob. For Rework</th>
<th>Low Prob. For Rework</th>
<th>Minimal Prob. For Rework</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>(Review Index of 0 - 40%)</td>
<td>(Review Index of 40 - 65%)</td>
<td>(Review Index of 65 - 70%)</td>
<td>(Review Index of 70 - 100%)</td>
</tr>
</tbody>
</table>

**Section Score:** 34%

![Pie chart showing various planning and scheduling factors](chart.png)
### PRRT Output - Scorecard

**PRRT**

**PROJECT REWORK REDUCTION TOOL**

**PHASE REVIEW SCORE CARD**

<table>
<thead>
<tr>
<th>4. Material and Equipment Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Name:</strong> Sample Project</td>
</tr>
<tr>
<td><strong>Sub Project Name:</strong> Sub-Project</td>
</tr>
<tr>
<td><strong>Reference #:</strong> SAMPLE PRRT 2.0</td>
</tr>
<tr>
<td><strong>Location:</strong> Sample Location</td>
</tr>
<tr>
<td><strong>Project Manager:</strong> Sample PM</td>
</tr>
<tr>
<td><strong>Project Owner:</strong> Sample Owner</td>
</tr>
<tr>
<td><strong>Review Date:</strong> Oct 15, 2002</td>
</tr>
<tr>
<td><strong>Project Phase:</strong> 3. &gt; 20% Engr. Compl.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No questions or all answered</th>
<th>Maximum Prob. For Rework (Review Index of 0 - 40%)</th>
<th>Moderate Prob. For Rework (Review Index of 40 - 55%)</th>
<th>Low Prob. For Rework (Review Index of 55 - 70%)</th>
<th>Minimal Prob. For Rework (Review Index of 70 - 100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PRRI - Index:</strong></td>
<td></td>
<td></td>
<td></td>
<td>59%</td>
</tr>
</tbody>
</table>

| **Section Total:** 51% |

<table>
<thead>
<tr>
<th><strong>Question</strong></th>
<th><strong>Answer</strong></th>
<th><strong>Score</strong></th>
<th><strong>Weight</strong></th>
<th><strong>Question</strong></th>
<th><strong>Answer</strong></th>
<th><strong>Score</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Untimely Deliveries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late P.O's/ Contracts</td>
<td>Mostly Timely</td>
<td>67%</td>
<td>14%</td>
<td>Scope Change Impact</td>
<td>Screened and Managed Well</td>
<td>100%</td>
</tr>
<tr>
<td>Inspection &amp; Expediting</td>
<td>No Visits</td>
<td>0%</td>
<td>10%</td>
<td>Vendor Data Flow (Submission &amp; Approvals)</td>
<td>Significant Improvement Req’d</td>
<td>0%</td>
</tr>
<tr>
<td><strong>B. Prefabrication and Construction not to Project Requirements</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misunderstandings</td>
<td>Requirements Mainly Understood</td>
<td>67%</td>
<td>6%</td>
<td>Fab. &amp; Constr. Errors</td>
<td>Generally intolerable</td>
<td>33%</td>
</tr>
<tr>
<td>Vendor Alignment</td>
<td>Partially Aligned/Compliant</td>
<td>33%</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C. Non-compliance with Specification</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vendor ITP's &amp; Proced.</td>
<td>Many deficiencies</td>
<td>33%</td>
<td>9%</td>
<td>Site Receiving Inspect.</td>
<td>Developed and Implemented</td>
<td>100%</td>
</tr>
<tr>
<td>Inspection of Components</td>
<td>Mostly Evident</td>
<td>67%</td>
<td>3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>D. Materials not in Right Place When Needed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separated Components</td>
<td>Seldom Separated</td>
<td>67%</td>
<td>6%</td>
<td>Supplier Tier Plan</td>
<td>Solid Plans</td>
<td>100%</td>
</tr>
<tr>
<td>Shortages</td>
<td>Few Shortages</td>
<td>67%</td>
<td>3%</td>
<td>Site Material Management Plan</td>
<td>Only Adequate</td>
<td>33%</td>
</tr>
</tbody>
</table>

**Category Total:** 41%

**Category Total:** 43%

**Category Total:** 59%

**Category Total:** 73%
PRRT Output – Element Trend Chart

Project Trend Graph

1. Engineering and Reviews
2. Construction Planning and Scheduling
3. Leadership and Communications
4. Material and Equipment Supply
5. Human Resource Capacity

Phases displayed on graph:
1. End of DBM
2. End of EDS/FEED
3. > 20% Engr. Compl.
4. > 20% Constr. Compl.
5. > 50% Constr. Compl.
Other PRRT Output

2. ‘Best Practices’ Database from EXTENSIVE experience:

- within the COAA membership.
- Extensive CII ‘Best Practice’ publications.
- other published material.
5A2 - Timely Spec. Inquiries

Timely Feedback to Queries on Specifications & Instructions.

When Timely Feedback to Queries on Specifications & Instructions is not occurring, workers will tend to make their own assumptions to complete the work. When the earlier incorrect assumptions are discovered much later, rework and FIELD REWORK results as the work needs to be remedied. Such errors may only be discovered out during final inspections or turnover and plant commissioning - and more costly and frustrating to fix at such a late stage.

Suggestions:

Request for Information system management: Establish a formal Request for Information (RFI) system that logs the queries as they arise. Assign an individual to regularly follow-up that responses are indeed being received in a timely manner.

Onsite Engineering Rep.: Assign and empower an engineering representative at the vendor's offices or the construction site who is competent and appropriate to address, and if possible resolve immediately, the queries as they arise. Alternatively, assign a construction liaison in the engineering office.
Developing a Worker Attraction and Retention Program

Adapted from CII Documents IR 135-11 “Attracting and Maintaining a Skilled Construction Workforce”

Overcoming the various barriers to attracting and retaining construction craftworkers begins with a commitment from management. The resources must be available to develop and implement a comprehensive company-wide employee program to attract and retain qualified craft workers. For some companies, this requires combining many existing benefit, incentive, and reward programs with additional components, while for other companies; an entirely new program must be developed.

Once management becomes committed to the development of an effective program and identifies the needed resources, the next step is to begin to change the culture of the company to one that promotes participatory management. For an industry that traditionally has embraced non-participatory management techniques, this is no easy task. Participatory management is nothing more than involving employees at all levels in an organization in the decisions that affect them, empowering them with the authority to perform their work in a quality manner, holding them accountable for their decisions, and providing meaningful incentives and rewards. The development and implementation of a Total Quality Management process can achieve this goal but all levels of management must be trained in participatory management techniques.

The next step in the process of attracting and retaining craft workers is to identify attributes of effective existing programs. It is recommended that the attraction and retention attributes contained in Appendix A be incorporated into the development and implementation of any program to attract and retain qualified craft workers.

Components of an Effective Program to Attract and Retain Workers
PRRT Overview

Key Features:

• **User Friendly Interface ("Keep it Simple philosophy")**

• **Single Project database file(s) are separate from software (Like MS Windows applications)**

• **PRRT User Stages are:**
  - Initiate project file (once only per project)
  - Establish Review Date & Current Project Phase
  - Complete Questionnaires
  - Observe & analyze PRRI Index Charts
  - Search for appropriate improvement Suggestions & proven ‘Best Practices.’
But that’s not all folks!

Additional Features of PRRT include:

- >100 Valuable **Resource Documents & Templates** in the Suggestions/ Best Practices Area (Library).
- Online **Bookshop**.
- ‘**Print & Run**’ Questionnaires - ideal for traveling.
- **Copy Chart** functions – ideal for inclusion in reports
Summary

➢ Rework Reduction

➢ Project Rework Reduction Tool – PRRT™

➢ The Tool:
  ➢ Purpose, Features & Benefits,
  ➢ Overview of Use: Screen Views
Where to obtain PRRT

**FREE** CD ROM or Download from:

www.coaa.ab.ca/costreduction/prrt