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Sustainability – development or growth that provides for today’s needs without compromising the ability of future generations to provide for their own needs. What impact does it have on engineering and construction? How do we broaden our understanding of sustainability and increase the value of our projects and facilities?

These questions confronted us many months ago as we began planning for the 2004 Annual Conference. Our theme of “Building A Strong Sustainable Future” gives us an opportunity to answer these questions and provide you with in-depth knowledge about sustainability.

We believe that sustainability involves a triple bottom line: economic success, social well-being, and environmental protection. Our program addresses this triple bottom line head-on. In fact, you’ll find that our keynote and featured speakers get right to the point. They will explain the implications of sustainable development and describe the lessons from 9/11. A financial expert will provide a perspective on the economic recovery, and a distinguished military leader will explain the engineers’ role in rebuilding Iraq. We’ll discuss the leadership that sustainability will require of us in energy and environmental design. You’ll also see first-hand the importance of building medical infrastructure for AIDS/HIV patients in Uganda.

CII’s unique role in engineering and construction R&D will also be evident with reports on lean construction, attracting and retaining leaders of tomorrow, and radical reduction in project cycle time. Member companies will contribute as well with case studies on knowledge management, global construction, and project management excellence. Finally, a world-class panel of experts will outline how we can capture value from sustainable development.

To top it off, our host city of Vancouver — site of the 2010 Winter Olympics — offers many rich opportunities for us all. It is one of Canada’s premier locales, with the Pacific Ocean and the Coast Mountains providing backdrops that are to be treasured. Enjoy the conference, enjoy Vancouver, and celebrate with us at this twentieth annual gathering of engineering and construction’s best and brightest.
Sustainable Development: Status and Implications

Abstract

What is sustainable development? Where did it come from? Is it a new concept? Is it global? Who is pushing sustainable development as a new standard? Is it a generally accepted standard? Will sustainable development have significant impact on the construction industry in the future? What does sustainable development mean to me (a designer) and you (a constructor)? Should we be doing anything now? Is there a specific role or task which CII should be starting now?

Speaker

James L. Lammie – Director Emeritus, Parsons Brinckerhoff Inc.

For six years as CEO of Parsons Brinckerhoff, Jim Lammie had responsibility for corporate operations domestically and internationally. Previously he served for eight years as chief operating officer of the firm’s U.S. infrastructure design and project management company. Other experience includes director of the general engineering consultant for design and construction of the Metropolitan Atlanta Rapid Transit Authority (MARTA) transit system and 21 years in the U.S. Army Corps of Engineers. A member of the National Academy of Engineering, Lammie earned an engineering degree at West Point and post-graduate degrees at Purdue University, George Washington University, and the U.S. Army Command and General Staff College.

e-mail: lammie@pbworld.com
Abstract

This case study will demonstrate the improvement of the company project management program over the last ten years, focusing on implementation of lessons learned and other CII Best Practices. The audience will learn how to bypass false starts and non-productive steps on the journey. The benefits of an organized Best Practices Implementation Unit will be quantified, and strategic plans for future improvement will be shown.

The implementation session team will share the benefits of successful project management programs, and show how these tools can improve internal Project Management Programs.

Plenary Session Presenter

Ali A. Al-Ajmi – Vice President, Project Management, Aramco Services Company

With Saudi Aramco for more than 30 years, Ali Al-Ajmi began as an engineer in oil and gas operations. In the 1990s, Al-Ajmi managed numerous oil and gas facilities prior to becoming president and CEO of Petron Corporation, a Saudi Aramco investment. Later on he took assignments as vice president of employee relations and training and a similar position with Saudi Aramco Southern Area Gas Operations. Al-Ajmi earned a bachelor of science degree from the University of Arizona and a master’s in engineering management from the University of Missouri–Rolla.

e-mail: ajmiaa@aramco.com.sa
Implementation Session Moderator

Mohammed A. Hammad – Department Manager, Saudi Aramco

Mohammed Hammad’s current assignment is managing the planning and execution of the $2 billion Hawiyah Natural Gas Liquids (NGL) Recovery Program. Hammad has more than 20 years of experience, and has worked on major projects in Saudi Arabia, Europe, and North America. Major projects include the East/West Pipeline Expansion, the Shaybah Downstream Facilities, and the Hawiyah Gas Plant project. Hammad holds a bachelor’s degree in civil engineering from Cairo University.

e-mail: mohammed.hammad@aramcoservices.com
HammaOb@aramco.com.sa

Implementation Session Participants

Salah H. Al-Shehab – Business Manager, Saudi Aramco
e-mail: salah.shehab@aramcoservices.com

Saleh A. Al-Thunaian – Project Engineer, C.A. Project Design & Construction, Saudi Aramco
e-mail: saleh.thunaian@aramco.com

Eric J. Richter – Best Practices Specialist, Project Management Organization, Saudi Aramco
e-mail: eric.richter@aramco.com
Learning Objectives & Results

- Cost & schedule performance can be dramatically improved with an integrated approach
- CII best practices are one of the key performance enhancers available to all of us.

Agenda

- Capital Program Description
- Steps on the Journey
- What worked best?
- Results to date
- Embracing Change
Saudi Aramco Project Management

- Capital Program Size
  - $2.5 to $3 Billion per year expenditures
  - Project Size $2 million - $2 billion
  - 150 active projects – infrastructure to Refinery

- Contractor Information
  - Largest Projects Executed by Major EPC firms
  - Most engineered equipment purchase abroad
  - Smaller Projects - Local engineering & construction

- Corporate PM Functions
  - Quasi-governmental management
  - All funding authorized by Board of Directors

Steps on the Journey

What Worked & Didn't Work

- What did not work?
  - Management resistance to change
  - Voluntary participation by Project Teams
  - Lessons submitted without review
  - Internal Focus

- What did work? An Integrated Approach

Management Commitment

Set aggressive targets & measure results

External Benchmarking

Proven technologies for change
The Journey Toward Project Management Excellence

**Absolute Performance Improving**

**Project Cycle Time**

- **Schedule Performance Index**
  - Approved
  - Objective
  - Actual or in progress

**Best Practices Portfolio**

- Project Execution Planning Workshop (PEPW) – CII
- Project Definition Rating Index (PDRI) – CII
- Schedule Optimization – CII
- Scope Control & Change Management – CII
- Constructability – CII
- Planning for Startup – CII
- Lessons Learned – CII
- Value Engineering – SAVE
- Benchmarking – CII/IPA/Internal

**Quantifiable Evidence**

- **Schedule Growth**
- **Best Practices per megajoule**
- **Project Cycle Time**

**Notes**
The Journey Toward Project Management Excellence

Cost, Quality & Safety Improving

- Cost
  - Cost reliability improved
  - Absolute costs down 10% (per IPA)
- Quality
  - Quality measure established and improving
- Safety
  - Construction Lost Time Incidents down by 50% in 5 years

PM Efficiency Increasing

Embracing Change

- 2004 Strategic Initiatives
- Project Management Technical Competencies
- Capital Program Best in Class
Conclusion

Learning Objectives

- Cost & schedule performance can be dramatically improved with an integrated approach.
- CII best practices are one of the key performance enhancers available to all of us.

Implementation Session Topics

- Value of Best Practices
- Lessons Learned System

Saudi Aramco
Journey toward Project Management Excellence

CII Annual Conference
July 28, 2004
The Journey Toward Project Management Excellence

Notes
Learning Objectives & Results

- Cost & schedule performance can be dramatically improved with an integrated approach
- CII best practices are one of the key performance enhancers available to all of us.
- Results since 1999
  - Projects schedules - 23% better
  - Cost benchmarks - 10% better
  - Contractor Safety Performance – 50% better
Learning Objectives

- Understand how formalized implementation of CII Best Practices adds value
- Find out how to successfully build a Lessons Learned Program

Agenda

- Best Practices
  - Elements of a program
  - Implementation at the project level
  - Benchmarking results
- Lessons Learned
  - Description of process
  - Elements of a system
  - Demonstration of a website
Saudi Aramco Project Management

- Capital program size
  - 150 active projects – infrastructure to refinery
  - 1,000 people in projects and support activities
- Contractor information
  - Largest projects executed by major EPC firms
  - Most engineered equipment purchased abroad
  - Smaller projects – local engineering & construction
- Corporate Project Management functions
  - Quasi-governmental management
  - All funding authorized by Board of Directors

CII Implementation Model

- Celebrate Success
- Measure Results
- Product Implementation
- Products Training
- Product Champions/Review Boards
- Implementation Plan and Goals
- Self Audit
- Corporate Implementation Champion
- Corporate Commitment

CII Products CII Support Benefit/Cost Data

Implementation Approach

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>1993</td>
<td>Joined CII</td>
</tr>
<tr>
<td>1994</td>
<td>2nd System Benchmarking Study</td>
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<td>1995</td>
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<td>1996</td>
<td>1st Steering Committee</td>
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<td>1997</td>
<td>2nd Steering Committee</td>
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<tr>
<td>1998</td>
<td>Formed Best Practices Team</td>
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<td>1999</td>
<td>Updated training program</td>
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Notes
Best Practices Portfolio

- Project Execution Planning Workshop: CII
- Project Definition Rating Index: CII
- Schedule Optimization: CII
- Scope Control & Change Management: CII
- Constructability: CII
- Planning for Start-Up: CII
- Lessons Learned: CII
- Value Engineering: SAVE
- Benchmarking: CII - IPA - Internal

Implementation Methodology

- Subject Matter Experts (SMEs)
  - 23 SMEs
  - knowledgeable
  - recognized
  - dedicated full-time
- Hands-on facilitation with project teams
- Formalized workshops

Transferring Knowledge to Engineers

- Course: 2.5 days, 8-10 sessions annually
- Introduces, provides overview of Best Practices
- Taught by Best Practices SMEs
- Attended by projects, facilities operations, business planning, and design contractors
- Trained 1,500 to date
Implementation Planning

- Review capital program yearly to identify project starts
- Work with project teams to select applicable Best Practices and timing
- Monitor project progress and carry out Best Practices implementation sessions

Implementation Timing

Facilitated Best Practices Workshop

- Location: project site office
- Duration: two to four hours
- Participants: Appropriate stakeholders
- Benefits:
  - Best Practice primary benefit
  - Team building
  - Early identification of issues
  - Training
The Journey Toward Project Management Excellence

Best Practices Workshops

<table>
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<th>2001</th>
<th>2002</th>
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<td>Training for Personnel</td>
<td>457</td>
<td>637</td>
<td>407</td>
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Schedule Growth vs. Best Practice Use

1990-2003

Schedule Growth vs. Best Practice Use
by project size
1995-2003
Major Project Implementation – Project Description

Hawiyah
Natural Gas Liquids (NGL) Recovery Program

- Objective: Recover NGL and increase NGL supply to downstream industries
  - Construct grassroots NGL recovery facility
  - Expand existing Hawiyah Gas Plant facilities
  - Add fourth fractionation module at Ju‘aymah Gas Plant
  - De-bottleneck existing pipeline network
  - Install new upstream and downstream gas pipelines

Major Project Implementation – Best Practices Workshops

- Process facilities (North America)
  - Three SMEs visited during preliminary engineering phase
  - Conducted Best Practices training course onsite
  - Facilitated workshops:
    - Project Execution Planning
    - Lessons learned
- Pipeline facilities and site development (Saudi Arabia)
  - Facilitated full portfolio of Best Practices workshops

Major Project Implementation – Benefits

- Value Engineering savings
- Team alignment through Project Execution Planning Workshop
- Other intangible benefits
Recap

Formalized CII Best Practice Implementation

- Use internal and external benchmarking
- Customize CII Best Practices
- Use SMEs to facilitate Best Practices workshops
- Best Practices are foundation for future improvement

Lessons Learned
System Implementation

Definition

Lesson Learned:
Knowledge gained from experience
(successful or otherwise)
for the purpose of improving future performance
Lessons Learned Objective

- Improve project performance through:
  - repeating successful actions and decisions
  - avoiding repetition of mistakes
  - assisting project execution planning process
  - encouraging improvements in work processes
  - improving safety and quality performance

Lessons Learned Process

COLLECT → ANALYZE → IMPLEMENT

- Workshops
- Website
- Close-out reports
- Lessons Learned Review Committee ensures quality
- Facilitated review
- Independent review by project

Lessons Learned
Resources and Roles

- Lessons Learned System Management
  - System coordinator
  - Website designer/administrator
  - Review committee
- Project Stakeholders
  - Project management teams
  - Facility operations
  - Contractors
- Standards & Procedures Custodians
Lessons Learned Timing

Implement existing lessons from database

Funding

Prototype Design
Build/Procurement

MC

Construction

Collect and submit new lessons to database

Lessons Learned
Collection Workshop

- Session length: 3 to 4 hours
- Attendees: project team-operational-contractor-inspection
- One facilitator per six people
- Structure
  - Propose lessons learned ideas
  - Prioritize
  - Write detailed lessons for selected ideas:
    - Background
    - Root cause/benefit
    - Recommendation

Lessons Learned
Implementation Workshop

<table>
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</table>
Lessons Learned…
…about Lessons Learned

- Assign dedicated lessons learned system coordinator
- Implement website to collect and display lessons
- Ensure quality: Lessons Learned Review Committee
- Emphasize quality over quantity
- Use facilitated workshops

Thought for the Day

Knowledge that’s unused is like fuel that’s unburned:
It has potential — but no power.

— Mort Crim, radio personality

Thank you!
Lessons Learned
Website Demonstration

Best Practices – Lessons Learned
Implementation Session

• Agenda
  – Project phases & use of CII Best Practices
  – Project Management view of benefits of these practices
  – Audience question and answer session

Best Practices – Lessons Learned
Implementation Session

• Participants
  – Moderator
    • Mohammed Hammad
  – Participants
    • Salah Shehab
    • Eric Richter
    • Saleh Al-Thunaian
    • John Palmer
Abstract

Implementation strategy is crucial to the assimilation of CII research. The plenary session will highlight the progress in implementation over the last decade and the strategies and tools that have enabled member organizations to achieve their implementation goals. The Implementation Strategy Committee (ISC) will highlight validation of its Implementation Model as a roadmap to developing successful implementation strategies. Improvements in CII knowledge management and how CII is tapping technology to deploy products online will be discussed along with CII implementation programs and tools.

The implementation session is a must for members wanting to achieve their implementation goals. An experienced panel will discuss strategies, tools, and opportunities for implementation. Details on implementation metrics, the CKII, the Implementation Champion Program, and eRoom will be discussed. Also, three Implementation Resources will be reviewed: RS166-1, IR166-2, and IR166-3.

Plenary Session Presenter

Virgil L. Barton – Manager of Quality Services, Bechtel Power Corporation

Virgil Barton has had both domestic and international project assignments and has over 33 years of experience in power, petrochemical, industrial, shipbuilding, and telecommunication projects. Prior to his current assignment, he held various positions in quality and construction services. An advocate of the Six Sigma program, he is a certified Six Sigma Champion. Barton currently serves as co-chair of the CII Implementation Strategy Committee.

e-mail: vbarton@bechtel.com
Implementation Session Moderator

Donald G. Giles – Regional Engineering Manager, Eastern Facilities, U.S. Steel Corporation

Don Giles has over 25 years of experience in the steel industry, with a focus on project management — both new construction and revamps. With U.S. Steel the past 16 years, he has served in various engineering, technical services, and management positions. He currently manages the capital improvements programs in all facets of steel production. At CII, Giles has been involved with research on lessons learned and technology assisted learning. He co-chairs the Implementation Strategy Committee.

e-mail: dgiles@uss.com

Implementation Session Participants

William C. Beck – Vice President, Quality & Safety, Parsons E&C

William beck@parsonsec.com

Billy Miller, J r. – Construction Manager, Zurich North America

billy.miller@zurichna.com

Other Knowledgeable Points of Contact

W. Edward Back – Associate Professor, Clemson University

wmeback@clemson.edu

Cody Bryant – Project Manager, SW&B Construction

bryantc@swbconst.com

David M. Crawley III – Construction Services Manager Engineering & Construction Services, Southern Company Services, Inc.

dmcrawle@southernco.com

Manuel A. Garcia – Associate Director, Construction Industry Institute

manuel.garcia@engr.utexas.edu

Jay C. Hoover – Senior Project Manager, NASA Johnson Space Center

jay.c.hoover@nasa.gov
Implementation: Once a Dream...Now a Reality

Reza Jafari – Senior Electrical Engineer, U.S. Department of Health & Human Services
e-mail: jafarir@mail.nih.gov

Gregory A. Kanteres – Engineering Fellow, Performance Films Engineering, Solutia Inc.
e-mail: gakant@solutia.com

Richard F. King – Senior Vice President, Construction Support, Black & Veatch Corporation
e-mail: kingrf@bv.com

Sheryl L. Kolasinski – Director, Project Management, Smithsonian Institution
e-mail: kolas@opp.si.edu

William A. Ryan – Senior Vice President, Project Delivery, CSA Group, Inc.
e-mail: bryan@csagroup.com

David Witt – Construction Group Manager, General Motors
e-mail: david.witt@gm.com
Implementation: Once a Dream...Now a Reality

Implementation Strategy Committee

Once Upon a Time...

Implementation Was Only a Dream

CII Products

- Research Summaries
- Research Reports
- Implementation
- Education
Implementation: Once a Dream...Now a Reality

Implementation Resources

CII Implementation Model

CII Knowledge Structure

Overall Body of CII Knowledge
Arranged in Topological Form
Implementation Champion Program

- Two 1.5-day annual workshops designed to:
  - Inform about new CII products.
  - Provide tools/skills to improve performance.
  - Promote networking with peers.
- Facilitated Web-based e-room collaboration.

Implementation Tools

- Implementation Resource 166-2
  Implementation Model and Knowledge Structure Guide
- Implementation Resource 166-3
  CII Best Practices Guide
Implementation: Once a Dream...Now a Reality

Notes

Implementation Model & Knowledge Structure Guide

Implementation Resource 186-2

CII Best Practices Guide
Improving Project Performance

Implementation Resource 186-3

Value of Best Practices

Theoretical Relationship

Better

Performance

Practice Use

Low

High

4th Quartile
3rd Quartile
2nd Quartile
1st Quartile

-0.3

-0.1

0.1

0.3

0.4
Implementation: Once a Dream...Now a Reality
Implementation: Once a Dream...Now a Reality
Implementation: Once a Dream...Now a Reality

**CKII Distribution**

![CKII Distribution Chart](image)

**Hope is not a strategy...**

Implementation is never an accident. It is the result of high intention, sincere effort, intelligent direction, and skillful execution. It represents the wise choice of many alternatives.

**Technology and Culture**

- Technology touches the head; but the culture of an organization touches the heart.
- Culture is the shared beliefs, values, attitudes, institutions, and behavior patterns that characterize the members of an organization.

J. M. Juran
"Father of Quality"
(b. 1904)
Implementation Session

A panel of experts will explain these implementation tools and answer any questions about implementation.

– Don Cilea, U.S. Steel
– Billy Miller, Zurich North America
– Bill Beck, Parsons E & C

Come to the Implementation Session

Learn about:
– Implementation Champions Program
– Early Implementation Program
– Implementation Tools
– Implementation Champions e-Room
– Online Catalog
Implementation: Once a Dream...Now a Reality

Implementation Slides

Why did your organization join CII?

What is the most effective way for your organization to get a Return on Investment in CII?
Does your organization have an Implementation Champion?

Hope is not a strategy...
Implementation is never an accident. It is the result of high intention, sincere effort, intelligent direction, and skillful execution. It represents the wise choice of many alternatives.

Implementation Session
Billy Miller, Zurich North America
   Research Summary 166-1, “Measuring Organizational Implementation Status: CII Knowledge Implementation Index (CKII)”
Don Giles, U.S. Steel
   Implementation Resource 166-2, “Implementation Model + Knowledge Structure Guide”
Bill Beck, Parsons E & C
   The Implementation Champions’ Toolbox
Implementation Study

Research Summary RS 166-1

*Measuring Organizational Implementation Status:
CII Knowledge Implementation Index (CKII)*

Billy Miller
Zurich NA

What is CKII?

- CII Knowledge Implementation Index
- Evaluates organizational implementation process
- Use of CII Best Practices
- Examines the relationship between organizational implementation and project success
- Initial survey completed Fall 2001
Implementation: Once a Dream...Now a Reality

CII Knowledge Implementation Index (CKII)

- Quantifies degree of the organizational implementation status
- Calculated with data from Part I of the CII Implementation Survey
- Normalized score
  - Maximum: 200
  - Minimum: 0
  - Adjusted score by excluding "n/a" questions

CKII Distribution

Number of Best Practices Implemented by Participating Organizations

* Participants were implementing an average of 5.5 BPs out of 11
Implementation: Once a Dream...Now a Reality

**Summary of Findings**

- Wide range of implementation as organization
  - We are making progress
- Room for improvement
- Identify themes and steps to improve
Conclusions

- CKII is Benchmark Tool for Implementation
  - Plan to use survey tool every two years as an organization for CII (Implementation Strategy & Knowledge Committees)
- Room for improvement
  - Organizational implementation process
  - Best Practice implementation
- Best Practice usage information—good snapshot

Sources of Information

![Research Summary RS 166-1](image)

![Research Report RR 166-11](image)

Implementation Resources

Implementation Resource IR 166-2
“Implementation Model + Knowledge Structure Guide”

Implementation Resource IR 166-3
“CII Best Practices Guide: Improving Project Performance”

Don Giles, US Steel
Implementation: Once a Dream...Now a Reality

IR 166-2 Contents

Executive Summary
1. Introduction
2. CII Implementation Model
3. CII Knowledge Structure
4. Conclusions

Appendix 1: Knowledge Structure Terminology
Appendix 2: Knowledge Structure Development Process
Implementation Strategy Committee Members

IR 166-2 Background and Motivation

Improve implementation of CII products
- Many products with great potential have not been utilized by CII member organizations.
  - COMMUNICATE the implementation process.
  - Describe WHAT products are available and HOW to implement them.
  - Locate the RIGHT products for implementation.
  - Increase familiarity with CII best practices.
  - Decrease confusion over what is a CII Best Practice.

The Implementation Model

- Corporate Implementation Champion
- Corporate Commitment
- CII Products
- CII Support
- Benefit/Cost Data
Implementation: Once a Dream...Now a Reality
Implementation: Once a Dream...Now a Reality
Using IR 166-2
Implementation Model + Knowledge Structure

- Provides a “Jump Start Kit.”
- Use CII Implementation Model to drive your implementation program.
- Use the CII Knowledge Structure to identify CII Best Practices to adapt within your organization.

Implementation Resource 166-3
CII Best Practices Guide

Why use it?

- Extension of CKII
- Evaluation tool for CII Best Practices
- Keep it “user friendly”
- Update as new Best Practices are validated

IR 166-3
CII Best Practices Guide

- Description of CII Best Practice
- Essential Elements of Each Best Practice
- Benefits of Using Best Practice
- Checklist for Evaluating Implementation
CII Best Practices Guide Implementation Tool

- Introduce CII Best Practices.
- Determine which CII Best Practices to implement.
- Guide to Apply the Best Practice — project, corporate, or both.

CII Best Practices Guide Assessment Process

- Compare needs, processes, and procedures.
- Use checklists to assess level of implementation.
- Target areas needing improvement.
- Set priorities to achieve greatest benefit.

Users of the CII Best Practices Guide

- Continuous improvement managers to improve capital projects process.
- New project management employees in need of orientation and information.
- Experienced construction/project personnel familiar with CII Best Practices.
- Management/project personnel using checklists to evaluate active projects.
CII Best Practices Guide
Scoring Use

- Effectiveness of Implementation Rating (EIR)
- Indicates level of implementation
- Identify opportunities for improvement
- Compare EIR scores among similar projects

Implementation Resources
They are YOUR Tools

A tool is only worth something if it is used!

Implementation Champions’ Toolbox

Implementation Champions’
Toolbox Program

Bill Beck, Parsons E & C
Implementation Champions

- Implementation Champions
- Education
- Products Online
- Website Tool Box

Implementation Strategy Committee – Implementation Champion’s Tool Box Program

- Began in 1998
- Purpose
- Benefits
- 11 Workshops
- Implementation Champion Membership 64
  (CII Membership 95)

Topics Presented at Product Implementation Workshops

- Benchmarking
- Education Materials & Tools
- Facilitation Skills
- Front End Loading and the Project Definition Readiness Index
- Implementation Immunity
- International Risk Assessment
- Knowledge Management
- Plan for Implementation
- Pre-Project Planning
- Prefabrication, Preassembly, Modularization, Off Site Fabrication
- Process Industry Practices (PIP)
- Project Success
- Role of Implementation Champion
- RS 168-2 & 168-3
- Safety in the Workplace
- Tactical Implementation Plan
- Team Building
- US Embassy in the 21st Century
- Value Management
- Virtual Teams
- Work Process Simulation
- Zero Accidents Techniques
Education Tools

- Education Modules (20 available)
- CII Education Courses at:
  - Arizona State University
  - Clemson University
  - The University of Texas at Austin

TAL: Technology Assisted Learning Courses (Web Based Learning)

- Beginning late Summer- early Fall 2004
- Available "Online" on a 24/7 basis
- Complete Learning Management System
- CII succeeds EduNeering as course provider
- Free to CII members during designated access windows
- Access sold to outside organizations
- Full program rollout announcement coming soon
- Visit: http://construction-institute.org/tal.cfm

CII TAL Courses (Available Late Summer- Early Fall 2004)

- Constructability
- Development & Alignment of Project Objectives
- Pre-Project Planning (late 2004 or early 2005)
- Safety
- Scope Control & Change Management
CII TAL Topics to be Released in 2005-06

- Building the Project Team
- Design For Maintainability
- Developing, Implementing and Managing a Partnering Relationship
- Planning for Start-up
- Pre Fabrication, Preassembly, Modularization & Offsite Fabrication
- Pre-Project Planning
- Tools for Effective Materials Management

Products Online

288 Current CII Publications

- 87 Research Summaries
- 113 Research Reports
- 48 Implementation Resources
- 40 Other Publications

“Products Online”

As of 20 Feb 04
188 Additional Titles Archived

Products Online

- Publications Online Downloading Statistics
- November 2001 – March 2004
- Total Downloads
  ➢ (All members) 27,374
  ➢ (Current members only) 21,556
- Average per Member 244 Downloads
- Owners 37% Contractors 63%
Products Online

See complete presentation at Products Display

Future Tool Kit

- Web-based “Tool Kit” for all members
- Based on industry Knowledge Management Techniques
- Explicit Knowledge (written)
- Expert Locater (Subject Matter Experts)
- Tacit Knowledge (Non Written)
- Lessons Learned

Implementation Champions Program

- "Implementation Workshop" open to all members
- Excellent presentations at workshops
- Education tools and courses
- All CII products online
- Great collaboration and networking
- Why not participate?
- Next workshop: Sept 22-23, 2004 in Austin, TX
Hope is not a strategy...

Implementation is never an accident. It is the result of high intention, sincere effort, intelligent direction, and skillful execution. It represents the wise choice of many alternatives.
Abstract

The Project Definition Index (PDRI) for Industrial Projects was introduced by CII in 1996 and the PDRI for Building Projects in 1999 as tools to help project teams manage the pre-project planning process. Since that time, these two tools have been widely adopted by both CII members and others and are used around the globe for planning facility projects. This presentation will give a brief overview of the PDRI, the current status of usage among the CII membership, provide data linking its use to project performance improvement, and give guidance concerning successful implementation.

A panel of industry professionals will present their personal PDRI implementation experiences in the implementation session. The remainder of the session will be devoted to audience questions, shared experiences, and feedback on the implementation of the PDRI technique.

Plenary Session Presenter

G. Edward Gibson, Jr. – Professor, Department of Civil Engineering, The University of Texas at Austin

Edd Gibson’s research interests include organizational change, pre-project planning, risk management, construction productivity, electronic data management, and automation and robotics. He has been recognized by CII with both its Outstanding Researcher Award and its Outstanding Instructor Award. He is the author of CII’s Pre-Project Planning Handbook and Project Definition Rating Index (PDRI). He also was involved in developing CII’s International Project Risk Assessment (IPRA) tool. Dr. Gibson, a licensed professional engineer in Texas, received his Ph.D. in Civil Engineering from Auburn University and an MBA from the University of Dallas.

e-mail: egibson@mail.utexas.edu
**Implementation Session Moderator**

**G. Edward Gibson, Jr.** - Professor, Department of Civil Engineering, The University of Texas at Austin

**Implementation Session Participants**

Stephen P. Campbell – Chief, Project Management Office, Center Operations Directorate, NASA  
*e-mail: stephen.p.campbell@nasa.gov*

John R. Fish – Director, Procurement and Quality Assurance, Ford, Bacon & Davis, LLC  
*e-mail: jrfish@fbd.com*

Robert A. Herrington – Manager of Quality, Southern Region, Jacobs  
*e-mail: bob.herrington@jacobs.com*

David Kracht – Technology Manager, 3M Company  
*e-mail: djkracht1@mmm.com*

Javid H. Talib – Senior Project Manager – Gas, Oil & Chemicals Division, Black & Veatch  
*e-mail: talibjh@bv.com*
Executive Summary

The Project Definition Rating Index (PDRI) is a weighted checklist of project scope definition elements that facilitates project assessment during pre-project planning. Two versions of the tool exist—one for industrial (process) facilities and one for building facilities. This presentation will explore the current status of PDRI usage among CII members.

Background

PDRI is a risk management tool that can help the pre-project planning team assess and measure project scope definition risk elements and then develop mitigation plans. A risk management analysis is most effective when performed prior to “locking in” facility budgets and committing funds to detailed design and construction. Experience has shown that it provides numerous benefits, including use as a:

- Checklist that a project team can use to determine the necessary steps to follow in defining project scope.
- List of standardized project scope definition terminology throughout the construction industry.
- Standard for rating the completeness of the project scope definition to facilitate risk assessment, prediction of escalation, and evaluation of the potential for disputes.
- Means to monitor progress at various stages during the pre-project planning effort and to focus efforts on high risk areas that need definition.
- Tool that aids in communication between owners and design contractors by highlighting poorly defined areas in a scope definition package.
- Means for project team participants to reconcile differences by providing a common basis for project evaluation.
- An aid to small project scope development.
- Training tool for organizations and individuals throughout the industry.
- Benchmarking tool for organizations to use in evaluating the completion of project scope definition versus the probability of success on future projects.
The PDRI for Building Projects should be used when the primary designer of the new facility is an architect. It consists of 64 elements that are grouped into 11 categories and further grouped into three main sections. A list of the 64 elements is given in Table 1. The 64 elements are arranged in a score sheet format and are supported by 38 pages of detailed descriptions and checklists. An excerpt of the weighted score sheet from the Building PDRI is given in Table 2, along with an example of three PDRI element descriptions making up the equipment category.

The PDRI for Industrial Projects should be used when the primary facility designer is a process or mechanical engineer. The format of the score sheet and descriptions is similar to the buildings projects version of the PDRI. It consists of three sections, 14 categories, and 70 elements. A listing of the 70 elements is given in Table 3.
Table 1. PDRI for Buildings SECTION, Categories, and Elements

SECTION I. BASIS OF PROJECT DECISION

A. Business Strategy
   A1. Building Use Requirements
   A2. Business Justification
   A3. Business Plan
   A4. Economic Analysis
   A5. Facility Requirements
   A6. Future Expansion/Alteration
   A7. Site Selection Considerations
   A8. Project Objectives Statement

B. Owner Philosophies
   B1. Reliability Philosophy
   B2. Maintenance Philosophy
   B3. Operating Philosophy
   B4. Design Philosophy

C. Project Requirements
   C1. Value-Analysis Process
   C2. Project Design Criteria
   C3. Evaluation of Existing Facilities
   C4. Scope of Work Overview
   C5. Project Schedule
   C6. Project Cost Estimate

SECTION II. BASIS OF DESIGN

D. Site Information
   D1. Site Layout
   D2. Site Surveys
   D3. Civil/Geotechnical Information
   D4. Governing Regulatory Requirements
   D5. Environmental Assessment
   D6. Utility Sources with Supply Conditions
   D7. Site Life Safety Considerations
   D8. Special Water and Waste Treatment

E. Building Programming
   E1. Program Statement
   E2. Building Summary Space List
   E3. Overall Adjacency Diagrams
   E4. Stacking Diagrams
   E5. Growth and Phased Development
   E6. Circulation and Open Space Requirements
   E7. Functional Relationship Diagrams/Room by Room
   E8. Loading/Unloading/Storage Facilities

F. Building/Project Design Parameters
   F1. Civil/Site Design
   F2. Architectural Design
   F3. Structural Design
   F4. Mechanical Design
   F5. Electrical Design
   F6. Building Life Safety Requirements
   F7. Constructability Analysis
   F8. Technological Sophistication

G. Equipment
   G1. Equipment List
   G2. Equipment Location Drawings
   G3. Equipment Utility Requirements

SECTION III. EXECUTION APPROACH

H. Procurement Strategy
   H1. Identify Long Lead/Critical Equipment and Materials
   H2. Procurement Procedures and Plans

J. Deliverables
   J1. CADD/Model Requirements
   J2. Documentation/Deliverables

K. Project Control
   K1. Project Quality Assurance and Control
   K2. Project Cost Control
   K3. Project Schedule Control Requirements
   K4. Risk Management
   K5. Safety Procedures

L. Project Execution Plan
   L1. Project Organization
   L2. Owner Approval Requirements
   L3. Project Delivery Method
   L4. Design/Construction Plan & Approach
   L5. Substantial Completion Requirements
Figure 2. Excerpt from PDRI for Buildings Score Sheet, Category G, Equipment

Note: The score sheet excerpt and the three element descriptions given below comprise one PDRI for Building Projects category and are provided for illustrative purposes. The score sheet and descriptions for the 61 other elements are contained in CII Implementation Resource 155-2 (CII, 1999).

### Definition Levels

- 0 = Not Applicable
- 2 = Minor Deficiencies
- 4 = Major Deficiencies
- 1 = Complete Definition
- 3 = Some Deficiencies
- 5 = Incomplete or Poor Definition

### G. EQUIPMENT

#### G1. Equipment List

Project-specific equipment should be defined and listed. (Note: Building systems equipment is addressed in element F4 - Mechanical Design and F5 - Electrical Design). In situations where owners are furnishing equipment, the equipment should be properly defined and purchased. The list should define items such as:

- Process
- Medical
- Food service/vending
- Trash disposal
- Distributed control systems
- Material handling
- Existing sources and characteristics of equipment
  - Relative sizes
  - Weights
  - Location
  - Capacities
  - Materials of construction
  - Insulation and painting requirements
  - Equipment related access
  - Vendor, model, and serial number once identified
  - Equipment delivery time, if known

**G2. Equipment Location Drawings**

Equipment location/arrangement drawings identify the specific location of each item of equipment in a project. These drawings should identify items such as:

- Plan and elevation views of equipment and platforms
- Location of equipment rooms
- Physical support requirement (e.g., installation bolt patterns)
- Coordinates or location of all major equipment

**G3. Equipment Utility Requirements**

This evaluation should consist of a tabulated list of utility requirements for all major equipment items such as:

- Power and/or all utility requirements
- Flow diagrams
- Design temperature and pressure
- Diversity of use
- Gas
- Water
Table 3. PDRI for Industrial Projects SECTIONS, Categories, and Elements

I. BASIS OF PROJECT DECISION
   A. Manufacturing Objectives Criteria
      A1. Reliability Philosophy
      A2. Maintenance Philosophy
      A3. Operating Philosophy
   B. Business Objectives
      B1. Products
      B3. Project Strategy
      B4. Affordability / Feasibility
      B5. Capacities
      B6. Future Expansion Considerations
      B7. Expected Project Life Cycle
      B8. Social Issues
   C. Basic Data Research & Development
      C1. Technology
      C2. Processes
   D. Project Scope
      D1. Project Objectives Statement
      D2. Project Design Criteria
      D3. Site Chars. Available vs. Required
      D4. Dismantling & Demolition Req’nts
      D5. Lead / Discipline Scope of Work
      D6. Project Schedule
   E. Value Engineering
      E1. Process Simplification
      E2. Design & Material Alternatives Considered / Rejected
      E3. Design for Constructability Analysis
   F. Site Information
      F1. Site Location
      F2. Surveys & Soil Tests
      F3. Environmental Assessment
      F4. Permit Requirements
      F5. Utility Sources with Supply Conds.
      F6. Fire Prot. & Safety Considerations
   G. Process / Mechanical
      G1. Process Flow Sheets
      G2. Heat & Material Balances
      G3. Piping & Instrmt. Diags. (P&ID’s)
      G4. Process Safety Mgmt. (PSM)
      G5. Utility Flow Diagrams
      G6. Specifications
      G7. Piping System Requirements
      G8. Plot Plan
      G9. Mechanical Equipment List
      G10. Line List
      G11. Tie-in List
      G12. Piping Specialty Items List
      G13. Instrument Index
   H. Equipment Scope
      H1. Equipment Status
      H2. Equipment Location Drawing
      H3. Equipment Utility Requirements
   I. Civil, Structural, & Architectural
      I1. Civil / Structural Requirements
      I2. Architectural Requirements
   J. Infrastructure
      J1. Water Treatment Requirements
      J2. Loading / Unloading / Storage Facilities Requirements
      J3. Transportation Requirements
   K. Instrument & Electrical
      K1. Control Philosophy
      K2. Logic Diagrams
      K3. Electrical Area Classifications
      K4. Substation Requirements / Power Sources Identified
      K5. Electric Single Line Diagrams

II. FRONT END DEFINITION
   F. Site Information
      F1. Site Location
      F2. Surveys & Soil Tests
      F3. Environmental Assessment
      F4. Permit Requirements
      F5. Utility Sources with Supply Conds.
      F6. Fire Prot. & Safety Considerations
   G. Process / Mechanical
      G1. Process Flow Sheets
      G2. Heat & Material Balances
      G3. Piping & Instrmt. Diags. (P&ID’s)
      G4. Process Safety Mgmt. (PSM)
      G5. Utility Flow Diagrams
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      J3. Transportation Requirements
   K. Instrument & Electrical
      K1. Control Philosophy
      K2. Logic Diagrams
      K3. Electrical Area Classifications
      K4. Substation Requirements / Power Sources Identified
      K5. Electric Single Line Diagrams

III. EXECUTION APPROACH
   L. Procurement Strategy
      L1. Identify Long Lead / Critical Equipment & Materials
      L2. Procurement Procedures & Plans
      L3. Procurement Resp. Matrix
   M. Deliverables
      M1. CADD / Model Requirements
      M2. Deliverables Defined
      M3. Distribution Matrix
   N. Project Control
      N1. Project Control Requirements
      N2. Project Accounting Req’nts
      N3. Risk Analysis
   P. Project Execution Plan
      P1. Owner Approval Requirements
      P2. Engr. / Constr. Plan & Approach
      P3. Shut Down/Turn-Around Req’nts
      P4. Pre-Commissioning Turnover Sequence Requirements
      P5. Startup Requirements
      P6. Training Requirements
Extent of Usage

CII conducted a survey in 2004 to determine the extent of PDRI usage, with 70 of 92 CII members responding (76%). Of the 70 respondents, 43 organizations are using the PDRI on capital projects, including 18 of 34 contractor and 25 of 36 owner respondents. The PDRI for industrial projects has been used for an average of 4.3 years, while the PDRI for building projects has been used for an average of 2.7 years. The breakdown of usage by type is given in Figure 4. Details of PDRI usage within these firms is given in Table 4.

Figure 4. PDRI Usage by Type (N=43)

Table 4. Frequency of Use Among Organizations Using PDRI (N=43)

<table>
<thead>
<tr>
<th>The PDRI is used:</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>As a checklist in early project development</td>
<td>81%</td>
</tr>
<tr>
<td>As a “gate” check before moving to the next project phase</td>
<td>72%</td>
</tr>
<tr>
<td>In conjunction with other front end planning measurement methods (i.e., IPA, internal measures)</td>
<td>72%</td>
</tr>
<tr>
<td>As a means of measuring or benchmarking front end planning process performance</td>
<td>70%</td>
</tr>
<tr>
<td>More than once on most projects</td>
<td>42%</td>
</tr>
<tr>
<td>As an audit tool</td>
<td>42%</td>
</tr>
<tr>
<td>In a modified form for small or unusual projects</td>
<td>33%</td>
</tr>
<tr>
<td>To help capture lessons-learned</td>
<td>28%</td>
</tr>
<tr>
<td>With the help of an outside facilitator</td>
<td>29%</td>
</tr>
</tbody>
</table>
Twenty-seven organizations indicated that they do not use the PDRI at this time. Among reasons given for not employing the PDRI were: that it is not applicable to the business model of their organization; that another measurement method or tool is used; or that the respondent had not heard of the PDRI or had time to implement it.

**Performance**

Table 5 compares project performance for a sample of 92 building projects worth $1.5 billion using a 200-point PDRI score cutoff. These data show the mean performance for the projects versus execution estimate for design and construction and the absolute value of changes as a percentage of total project cost. Projects with a PDRI score under 200 (a lower score is better) statistically outperformed projects with a PDRI score above 200. The PDRI score was determined just prior to the beginning of detailed design and the differences in performance parameters are statistically significant.

Table 5. Comparison of Projects with PDRI-Building Projects Scores Above and Below 200

<table>
<thead>
<tr>
<th>Performance</th>
<th>PDRI Score</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 200</td>
<td>&gt; 200</td>
</tr>
<tr>
<td>Cost</td>
<td>1% above budget</td>
<td>10% above budget</td>
</tr>
<tr>
<td>Schedule</td>
<td>3% behind schedule</td>
<td>20% behind schedule</td>
</tr>
<tr>
<td>Change Orders</td>
<td>7% of budget</td>
<td>11% of budget</td>
</tr>
<tr>
<td></td>
<td>(N=17)</td>
<td>(N=75)</td>
</tr>
</tbody>
</table>

A similar evaluation was performed on a sample of 104 industrial projects representing approximately $5.7 billion. Table 6 summarizes the project performance and PDRI score using the same 200-point PDRI score cutoff. Again, projects with better scope definition (lower PDRI score) significantly outperformed projects with poorly defined scope at the 95 percent confidence level.

The projects used in these samples were voluntarily submitted. The Building PDRI sample includes data from 20 organizations, including office, control building, recreation, institutional, and research facilities. Project sizes ranged from approximately $1.5 million to $200 million with an average cost of approximately $16 million. The Industrial PDRI sample included data from 39 organizations and represents heavy and light
Project Definition Rating Index (PDRI) Revisited

Table 6. Comparison of Projects with PDRI-Industrial Projects Scores Above and Below 200

<table>
<thead>
<tr>
<th>Performance</th>
<th>PDRI Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 200</td>
</tr>
<tr>
<td>Cost</td>
<td>3% below budget</td>
</tr>
<tr>
<td>Schedule</td>
<td>2% behind schedule</td>
</tr>
<tr>
<td>Change Orders</td>
<td>5% of budget</td>
</tr>
</tbody>
</table>

(N=57) (N=49)

Industrial projects including chemical, pharmaceutical, power, pulp and paper, refining, and metals facilities. Project size ranged from $100k to $635 million with an average of approximately $55 million.

It should be noted that the evaluations provided here are valid for the samples as given. These samples may or may not be indicative of projects in your organization and the samples may be biased because of the size and types of projects making up the sample. However, the results are convincing in terms of performance predictability.
Sources of Information

Website: http://construction-institute.org/pdri/


CII (1997). *Pre-Project Planning Tools: PDRI and Alignment*, Publication 113-1, Construction Industry Institute, The University of Texas at Austin, 33 pp., August.


Project Definition Rating Index (PDRI) Revisited

Plenary Slides

G. Edward Gibson, Jr., Ph.D., P.E.
Professor, Department of Civil Engineering
The University of Texas at Austin

Agenda

• What is PDRI?
• How broadly used by CII members?
• How organizations using PDRI?
• What is the value of using PDRI?
• How to use PDRI?
• Lessons learned since the tool’s introduction?

What Is PDRI?
PDRI – The Definition

• An Acronym
  – Project Definition Rating Index

• An Index
  – Score along a continuum representing the level of scope definition

• A Risk Management Tool
  – Identifies and measures risks related to project scope definition

PDRI – History

Born on date


PDRI – Composition

<table>
<thead>
<tr>
<th></th>
<th>Industrial</th>
<th>Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sections:</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Categories:</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Elements:</td>
<td>70</td>
<td>64</td>
</tr>
<tr>
<td>Score:</td>
<td>70-1000</td>
<td>70-1000</td>
</tr>
</tbody>
</table>
### PDRI Element Descriptions (Example)

**A1. Reliability Philosophy**

A list of the general design principles to be considered to achieve dependable operating performance from the unit. Evaluation criteria should include:

- Justification of spare equipment
- Control, alarm, and safety systems redundancy
- Extent of providing surge and intermediate storage capacity to permit independent shutdown of portions of the plant
- Mechanical / structural integrity of components (metallurgy, seals, types of couplings, bearing selection, etc.)
How Broadly Used?

PDRI Usage Among CII Members

- PDRI Usage:
  - Not Used (24)
  - Used (43)
  - Not Applicable (2)

- PDRI Type:
  - Both (15)
  - Industrial Only (22)
  - Building Only (5)

N = 72

How Being Used?
Usage

- As a checklist in early project development (81%)
- As a "gate" check before moving to the next project phase (72%)
- In conjunction with other front end planning measurement methods (72%)
- As a means of measuring or benchmarking front-end planning process performance (70%)
- More than once on most projects (42%)

Usage (continued)

- Others:
  - As an audit tool (42%)
  - In a modified form for small or unusual projects (33%)
  - To help capture lessons-learned (28%)
  - With the help of an outside facilitator (19%)

The Value

PDRI
Understanding PDRI Scores

1000 Points

Lower Is Better!

What does a score mean?

- A continuum
- Relative to timing
- Only as valid as effort/seriousness
- Accuracy (the real score) can be improved with facilitation
- Perhaps is not the most important output of the assessment

Comparison of Projects with PDRI Above and Below 200 — Industrial Projects

<table>
<thead>
<tr>
<th>Performance</th>
<th>PDRI Score</th>
<th>PDRI Score</th>
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<tbody>
<tr>
<td></td>
<td>&lt; 200</td>
<td>&gt; 200</td>
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<tr>
<td>Cost</td>
<td>3% below budget</td>
<td>4% over budget</td>
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<tr>
<td>Schedule</td>
<td>2% behind schedule</td>
<td>11% behind schedule</td>
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<td>Change Orders</td>
<td>5% of budget</td>
<td>8% of budget</td>
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<td></td>
<td>(N=57)</td>
<td>(N=48)</td>
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Project Definition Rating Index (PDRI) Revisited

PDRI – The Results

Example:
$55 Million Industrial Project, 24-Month Schedule

<table>
<thead>
<tr>
<th></th>
<th>&lt; 200</th>
<th>&gt; 200</th>
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<tr>
<td>Schedule</td>
<td>24 months</td>
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Comparison of Projects with PDRI
Above and Below 200 — Building Projects

<table>
<thead>
<tr>
<th>Performance</th>
<th>PDRI Score</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 200</td>
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<tr>
<td>Cost</td>
<td>1% over budget</td>
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<tr>
<td>Schedule</td>
<td>3% behind schedule</td>
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<tr>
<td>Change Orders</td>
<td>7% of budget</td>
</tr>
<tr>
<td></td>
<td>(N=17)</td>
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</tbody>
</table>

How to Use

PDRI
Assessing a Project

• What it SHOULDN’T be

Performed in a vacuum

Time Needed for Assessing a Project

• Two-and-a-half to four hours initially
• Less later

Observations

• Official sanctioning of activity
• Part of process
• Small cadre of facilitators
• Training
• Does not plan
• Risk mitigation process
Summary

Benefits of PDRI to Owners

- Well planned projects
- Better team alignment and communication
- Improved risk assessment
- Ability to make "tradeoff" decisions
- Can be used in developing a portfolio

Benefits of PDRI to Designers and Contractors

- Ability to measure scope
- Avenue to communicate
- Reconcile differences
- Standardized scope package
- Monitor progress
- Minimize design rework
Project Definition Rating Index (PDRI) Revisited

In Summary

- PDRI works!
- PDRI is not as easy as it appears
- “Score” is good, process of getting there is better

PDRI Publications

PDRI Industrial Projects
CII Implementation Resource 113-2

PDRI Building Projects
CII Implementation Resource 155-2

http://construction-institute.org/pdri/

Implementation Session Participants

Steve Campbell  NASA
John Fish  Ford, Bacon, and Davis
Edd Gibson  UT Austin
Bob Herrington  Jacobs
Dave Kracht  3M
Javid Talib  Black & Veatch
Project Definition Rating Index (PDRI) Revisited

Implementation Session
July 28, 2004

Implementation Session Participants

Edd Gibson, Moderator
Steve Campbell
John Fish
Bob Herrington
Dave Kracht
Javid Talib

PDRI Publications

PDRI Industrial Projects
CII Implementation Resource 113-2

PDRI Building Projects
CII Implementation Resource 155-2

http://construction-institute.org/pdri/)
Steve Campbell
Chief, Project Management Office
Johnson Space Center

How is the PDRI used at NASA JSC?

• Best Practice on All Capital Projects > $0.5M
• Three (3) years of use
• ~ 45 Capital Projects
• Planning Office Tool -- Pre-Project Planning
• Project Mgmt Tool – Design Phase
• PDRI Score is Requested for Project Approval and Funding

Results at NASA JSC

• ~ 15 Projects in P3 Now
• ~ 15 Project in Design Now
• ~ 15 Project in Construction Now or Done
• Very Good Results – Problem Avoidance
• A Few Project Surprises
  • Unknown Field Conditions, Steel Costs,
    Limited Competition
Lessons Learned at NASA JSC:

- We Could Have Used This 10 Years Ago
- Feel High Success Rate
- It’s Not a Guarantee
- Teams Can Work Well by Starting Well
- PDRI and P3 Need Updating for New Security and LEED Changes

John Fish

Director Procurement and Quality Assurance
Ford, Bacon & Davis, LLC
Also representing:
S&B Engineering & Construction, Ltd

Results at S&B/FB&D

- Pre-Project Planning Checklist - *CONSISTENCY!!!*
- Communication Tool
  - Help Communicate Business Drivers to Team.
  - Ensure Operations has buy-in
- Screen the WRONG project early.
- Provide Owner and Contractor a feedback tool across ALL projects.
- Emphasize the need for Best Practices IN FEL
- Importance of Business Drivers, contracting Strategy, Turnover and Commissioning Planning in FEL.
- Leads Explain WHAT and HOW to satisfaction of Project Manager and Owner Team.
How is the PDRI used at S&B/FB&D

- Trained NON-Project Facilitators
- Large Projects - 2 or 3 times
  - Guide to Prepare Team for IPA
  - Alignment
  - Focus on Heavy Hitters/At Risk Items
- Multiple Small Projects 1 to 2 times
  - Team Alignment
  - Identify At Risk Items
  - 200 Score Required for Funding by owners
  - Lump Sum EPC Bidding - Look for Risk/Weaknesses

Bob Herrington
Manager of Quality, Southern Region

JE JACOBS
How is PDRI used at Jacobs?

- Implemented in 1995 with draft CII document
- Recognized formally in Jacobs EPC work process as 'Value Enhancing Practice'
- Required use on all CPI capital projects > $2.0MM
- Employed formally at end of Phase 2 and 3 (Within FEL) to measure quality/completeness
- Used for tracking progress during FEL

How is PDRI used at Jacobs?

- Scoring and 'Gap List' reviewed in Pass Gate session, prior to proceeding into next project phase
- Utilized in addition to IPA FEL Assessment
- Used to evaluate 3rd party document quality & completeness

Jacobs Work Process Summary Map

PDRI USED AT PASS GATES

End of FEL

PHASE 1  PHASE 2  PHASE 3  PHASE 4  PHASE 5  PHASE 6  PHASE 7

Ongoing Activities: JIPs, Performance Measurements, Quality Audits, Client Satisfaction Surveys, Progress Reporting, Cost and Schedule Control, Total Value Added
Results at Jacobs

• PDRI use has ....
  • attributed to more complete/consistent FEL packages
  • led to more successful project outcomes by driving completion of FEL
  • prevented proceeding to next project phase prematurely (reduced rework)
• PDRI ‘Gap List’ used by Teams to
  • complete FEL deliverables within schedule
  • assess risks and establish mitigation plans

Lessons Learned at Jacobs

• PDRI sessions should be facilitated by internal 3rd party to obtain objective results
• Owner and multi-discipline participation improves results
• ‘Gap List’ is more valuable than “raw” score
• Interim use of PDRI provides excellent “Health Check” on project progress
• 3rd party packages improved through use of PDRI

Dave Kracht
Engineering Manager
Medical Markets Division Engineering

3M

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Project Definition Rating Index (PDRI) Revisited

**Capital Project Delivery Process at 3M**

Business Planning

- Project Screening
- PDRI
- Front-end Eng. Plan Sign Off

Business/Mfg 
& Eng. Mgr
(The Right Project)

Project Test
(The Right Scope)

Stakeholders & Project Team
(The Right Execution Plan)

- Define 
& Build

- Commissioning
- Startup

**Evolution of PPP and PDRI at 3M**

- 2000-2002: PPP, Alignment, and PDRI Training for Project Engineers (Edd Gibson)
- Requirement effective February 1, 2000, for Funding
- Integration of PDRI into our Project Management Process
  - Alignment of Phases 1-3 to the PDRI Elements (2004)
- Project Management Sub-Team (Engineering Council) – 2004

**PDRI Analyses**

Over 137 PDRI Analyses Completed to Date as Requirement for Funding.

- 2000 (52) PDRI (147) Average Score
- 2001 (27) PDRI (156) Average Score
- 2002 (12) PDRI (177) Average Score
- 2003 (29) PDRI (171) Average Score
- 2004YTD (18) PDRI (189) Average Score
Lessons Learned - Process

• Use Early in Project
  - Review PDRI & Element Descriptions with Key Project Personnel
  - Checklist
• Front-end Engineering Requires Time & Resource Availability
• Process Flow Diagrams & P&ID’s should be Prepared Prior to Funding
• Need Measurements to Demonstrate Value of PDRI

"The real benefit of the PDRI will not be realized until the engineering community and (business) management are fully supportive of front-end engineering……"

Lessons Learned - Team

• Core Team Participates in At Least One Evaluation Meeting
  - Alignment of Stakeholders
  - Balanced & Quantitative Assessment of Scope Definition.
  - Excellent Communication Tool
  - Teaching Tool for Non-Engineering Personnel.
“The PDRI is really comprehensive…. More so than any other single document we use and it is an eye opener for lab, process, even division manufacturing clients……….”

Lessons Learned- Facilitation

• Use a Facilitator from Outside the Project Team
• Challenge Project Team to have Element/Deliverable in Writing to Score Each Element as Completely Defined.
• Assemble Action List/Person Responsible

Javid Talib, P.E.
Senior Project Manager
Gas, Oil and Chemicals Division
BLACK & VEATCH
Using PDRI at Black & Veatch

- PDRI (Industrial) – Operations Directive
- Standard Execution Approach – Quality Gate
  - Front End Engineering Design (FEED)
  - EPC
- Benchmarking/Client Gates / IPA
- Lump Sum EPC Bidding

Results at Black & Veatch

- 20+ Projects
  - Achieved 220 or Less for All FEED
- Well Defined FEED
- Great Tool for Alignment
- Good Monitoring Tool
  - Chart to Target Scoring
- Good Correlation with Project Outcome

Charting Target PDRI Score Example
Implementation - How do we do it?

- Trained Facilitator
- Well Balanced Team/Participants
- Short Training Session for All Participants
- Automated Scoring Sheets
- Participant Come Prepared
- Encourage Open Discussions - Consensus
- Patience - Do Not Focus on Just Numbers
- Use Action List
- Maintain Same Participants
- Have Fun

Results at Black & Veatch

- Conformance to CII Expectation
- Checklist in Defining Project Scope
- Improved Execution Approaches,
  - Cost Control, Reduced Rework & Shorter Schedules
- Communication Tool to Avoid/Reconcile Differences – Buy-in
- Highlights Potentially "Poor" Projects Prior to Bidding/Authorization

Questions?
Recruit and Attract Future E&C Leaders

Attract, Recruit, and Retain Future Engineering & Construction Leaders

Project Team

Abstract

Data clearly show that the number of professionals and technical leaders that will be available in the future is diminishing. In addition, younger professionals are motivated by different factors than their counterparts from previous generations. This CII team has developed a company self-assessment tool to help recruit, attract, and retain industry professionals and technical leaders of tomorrow.

The plenary session features “The Construction Zone,” a short play on current aspects of attracting and retaining young leaders of tomorrow. The implementation session will include a panel of young professionals who participated in the interview process during the research. The audience will hear directly from the age group in question and will have an opportunity to talk with them.

Plenary Session Presenter

Harold L. Helland – Manager, Project Engineering, Abbott Laboratories

Harold Helland has over 17 years of experience in engineering and construction. In his current role, he is responsible for design, engineering, and construction of new facilities for all divisions of Abbott Laboratories. Prior to joining the firm, Helland was a project engineer for Davy McKee Corporation in the food and pharmaceutical division. He earned a bachelor’s degree in civil engineering from the University of Illinois–Urbana and a master’s in management from Northwestern University.

e-mail: harold.helland@abbott.com

Cast

Jodi X. Guerrero, Abbott Laboratories
Joe-da Thomas Roosa, Bechtel Group, Inc.
Joey Vernell McDonald, Jr., Southern Company Generation and Energy Marketing
Rod Serling character John R. Hewitt, Kværner Songer
Walkie-Talkie Charlie Kenneth E. Olmstead, Smithsonian Institution
Implementation Session Moderator

Tonya Beesley - Recruiting Coordinator, Baker Concrete Construction Inc.

Since joining Baker in 2000, Tonya Beesley has been working closely with high school and college students to promote opportunities in the construction industry. Beesley serves as an advisory committee member for several area high school construction technology programs, and also serves on the Construction Management Advisory Board at Southern Illinois University. She previously spent 17 years with Dresser Roots, a division of Halliburton. Beesley earned a bachelor’s degree in business administration from Indiana Wesleyan University.

e-mail: beesley@bakerconcrete.com

Implementation Session Participants

Xenia C. Guerrero – Pharma Equipment Engineer, Abbott Laboratories
  e-mail: xenia.guerrero@abbott.com

John R. Hewitt – President, Kværner Songer
  e-mail: john.hewitt@akerkvaerner.com

Saundra Lauerman – Divisional Director, Human Resources, The Shaw Group
  e-mail: saundra.lauerman@shawgrp.com

Vernell McDonald, Jr. – Project Engineer, Construction Management, Southern Company Generation and Energy Marketing
  e-mail: vmcdonal@southernco.com

Kenneth E. Olmstead – Director, Engineering, Design & Construction, Smithsonian Institution
  e-mail: olmstke@opp.si.edu

Thomas Roosa – Manager of Human Resources, Bechtel Group, Inc.
  e-mail: txroosa@bechtel.com
Other Knowledgeable Points of Contact

Samuel T. Ariaratnam – Associate Professor, Del E. Webb School of Construction, Arizona State University  
*e-mail: ariaratnam@asu.edu*

Heath S. Barger – Graduate Research Assistant, Del E. Webb School of Construction, Arizona State University  
*e-mail: heath_barger@hotmail.com*

David A. Brown – Projects Manager, Shell Exploration and Production  
*e-mail: dave.brown@shell.com*

Lynn Fister — Senior Vice President, Houston Operations, Parsons E&C  
*e-mail: lynn.fister@parsons.com*

John B. Frame – Scrubber Program Manager, Generation & Energy Marketing, Southern Company Services, Inc.  
*e-mail: jbframe@southernco.com*

Daniel R. Haag – Director of Human Resources, M. A. Mortenson Company  
*e-mail: dan.haag@mortenson.com*

Stephen A. Kappers — Senior Vice President & General Counsel, CSA Group, Inc.  
*e-mail: skappers@csagroup.com*

Edwin C. King — Human Resources Director, Foster Wheeler USA  
*e-mail: ed_king@fwc.com*

Ronald B. Rector — Vice President, Construction, BE&K Construction Co.  
*e-mail: rectorr@bek.com*

Kevin Sadowski – Graduate Research Assistant, Del E. Webb School of Construction, Arizona State University

Adnan A. Siddiqui — Construction Manager, The Dow Chemical Company  
*e-mail: AASiddiqui@dow.com*

John P. Trottier – Executive Vice President, AZCO Inc.  
*e-mail: jtrottier@azco-inc.com*
Executive Summary

As members of the “Baby Boomer” generation approach their retirement years, the engineering and construction industry faces a growing shortfall of new leaders to replace those that leave. Retaining talent in individual companies will likely prove to be more and more difficult, as well. CII chartered the Attract, Recruit, and Retain Engineering and Construction Leaders Project Team (PT 200) to explore this problem and provide solutions that can be implemented by companies throughout the industry. CII contends that such a program could result in significant gains for the industry by enhancing the real and perceived advantages of careers in engineering or construction management.

PT 200 concludes that solutions are indeed available. Through its literature search, questionnaires, and personal interviews with prospective, recent, and experienced industry professionals, the project team has identified specific benefits, programs, and other incentives that young people are looking for when choosing a career path and a prospective employer. To succeed in recruiting and retention, companies should consider improved compensation and benefits packages, career path and advancement opportunities, continued education and training, and a host of other ideas that the project team has identified through this in-depth CII study. PT 200 has prepared CII Implementation Resource 200-2 to serve as a checklist for organizations interested in a self-assessment of their recruiting and retaining efforts. This team’s report and presentation sessions describe the findings of the research and offer best practice recommendations.
Unravel the Mystery of Recruiting and Retaining Industry Leaders in...

The Construction Zone

When:  Plenary Session
        Wednesday Morning

        Implementation Sessions
        Wednesday, 10:45 a.m. and 1:00 p.m.

Where:  Plenary Session Theatre
Recruit and Attract Future E&C Leaders
Implementation Slides

Recruit and Retain Future E&C Leaders
Implementation Session
We're Building the Future in the
Construction Zone!

Tonya Beesley
Baker Concrete Construction

The Problem

- More retiring than graduating.
- Average age is 30 to early 40s.
- Graduates choose other industries.
- Decline of job loyalty.
Recruit and Attract Future E&C Leaders

Research Categories and Questions

Attract, Recruit, and Retain E&C Leaders Project Team (PT 200)
272 interviews—24 E&C firms

<table>
<thead>
<tr>
<th>Name of Firm</th>
<th># of People</th>
<th>Name of Firm</th>
<th># of People</th>
<th># of People interviewed</th>
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<td>IBM</td>
<td>5</td>
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<td>PG</td>
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<td>General Electric</td>
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<td>Alliionda</td>
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<td>Parsons</td>
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<tr>
<td>Baker (Australia)</td>
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<td>BE&amp;K (Japan)</td>
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<td>Southern Group</td>
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<td>Foster Wheeler</td>
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<tr>
<td>Smurfit</td>
<td>15</td>
<td>The Shaw Group</td>
<td>25</td>
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</table>

Notes:

Research Categories and Questions

Personal Information and Background

Research Categories and Questions

Current Career
Recruit and Attract Future E&C Leaders

Research Categories and Questions

Current Employer and/or Company

Research Categories and Questions

Benefits

Research Categories and Questions

Questions Regarding the Engineering and Construction Industry
Recruit and Attract Future E&C Leaders

Notes
Recruit and Attract Future E&C Leaders

Notes
Recruit and Attract Future E&C Leaders

Notes

I have worked in the Engineering and Construction Industry for:

- Less than 2 years: 30%
- 2-5 years: 32%
- 5-10 years: 18%
- 11-15 years: 16%
- More than 15 years: 16%

What originally attracted individuals to the E&C Industry:

- Closest to Nature
- Work Environment
- Work Location
- Interest in Construction
- Leadership Potential
- Career Progression

Paradigm Challenge

No Airplane Symbol
Recruit and Attract Future E&C Leaders
Recruit and Attract Future E&C Leaders

The Construction Zone

Panel

Harold Holland
Manager Project Engineering
Abbott Laboratories

Saundra Lauermer
Divisional Director, Human Resources
The Shriver Group

Vernell Mcdonald, Jr.
Project Engineer (Construction Management)
Southern Company Services

Xenia C. Guerrero
Pharma Equipment Engineer
Abbott Laboratories Global Pharmaceutical Operations

Dr. Samuel Amaranth
Associate Professor
Earl E. Bakke School of Construction
Arizona State University
PT-250 Research Laboratory

Notes

Top Factors That Influence the Success of Recruiting and Retention of Construction Leaders

# Technology

Harold Holland
Manager Project Engineering
Abbott Laboratories

Techno-Enablers

- Cell phones
- Palm pilots
- Project management software
- T1 lines
- GPS
- Bar coding
- Productivity, manpower, and equipment tracking
- Videogrammetry
Top Factors That Influence the Success of Recruiting and Retention of Construction Leaders

#7 Company Image
Saundra J. Lauerman
Divisional Director, Human Resources
The Shaw Group

#7 Company Image
Reasons to consider their employer a great place to work:
- Compensation and company benefits
- Career advancement opportunities
- Great working environment
- Co-workers
- Flexible work options
- Strong leadership
- Job stability

#6 Quality Leadership
Saundra J. Lauerman
#6 Quality Leadership

- Respect
- Trust
- Inspired to follow

Top Factors That Influence the Success of Recruiting and Retention of Construction Leaders

#5 Recognition

Vernell McDonald
Project Engineer (Construction Management) Southern Company Services

#5 Recognition

- Cash
- Gifts
- Travel
- Press
- Personalized thank-you
Top Factors That Influence the Success of Recruiting and Retention of Construction Leaders

#4 Mentoring
Xenia Guerra
Pharmaceutical Engineer
Abbott Laboratories

#4 Mentoring
30% of respondents are very satisfied with the overall leadership/supervision/career mentoring they receive.

#3 Training
Verneil McDonald
Top Factors That Influence the Success of Recruiting and Retention of Construction Leaders

#2 Career Path and Projects

Xenia Guererro
Career Path: Technical and Managerial
Fast Progression

#1 Pay: Compensation, Benefits, and Incentives

Harold Holland
“Show me the money…and fringe”
Recruit and Attract Future E&C Leaders

#1 Pay: Compensation, Benefits, and Incentives

Preferred Key Company Benefits

- Improvements Needed
  - Family-friendly benefits
  - Flex-time options
  - Continued education reimbursement
  - Company vehicle
  - Day-care assistance

Recruit and Retain Future E&C Leaders
Implementation Session
We're Building the Future in the Construction Zone!
Abstract

This session is designed for those who want to know more about CII and how its various efforts to improve the industry are generated and accomplished. A panel of members will provide insight on how CII provides unique research, networking, and professional development opportunities.

Implementation Session Moderator

Hans VanWinkle - Director, Construction Industry Institute

Prior to joining CII in 2003, VanWinkle was Deputy Commanding General of the U.S. Army Corps of Engineers. He oversaw the Corps’ military construction and real estate services and water resources program, and the design, construction management, and real estate services for other Defense and Federal agencies. He participated in Operation Desert Shield/Desert Storm in Iraq and Operation Joint Endeavor in Bosnia. VanWinkle is a Registered Professional Engineer (Virginia), a graduate of the U.S. Military Academy at West Point, and holds a Master of Science degree in public policy from the University of California-Berkeley.

  e-mail: h.vanwinkle@mail.utexas.edu

Implementation Session Participants

Emerson T. Johns – Chief Financial Officer and Operations Leader, Engineering, Facilities, and Safety, Health, and Environmental Services, DuPont Company
  e-mail: emerson.t.johns-1@usa.dupont.com

Susan M. Steele – Vice President, Industrial Services, BE&K Construction Company
  e-mail: steeles@bek.com
Abstract

The U.S. economy is speeding up two years into its recovery, and jobs are finally appearing. The Fed is confident enough in the expansion to begin raising interest rates. Growth is likely to slow, however, because the fiscal stimulus is all in the economy already, the consumer is spent out, and the higher interest rates will slow housing. Business investment is beginning to accelerate, which should carry the expansion, but at 3.5 percent, not the 5.5 percent of the last three quarters. Moreover, oil price spikes or weaker overseas growth threaten the recovery.

Speaker

David Wyss – Chief Economist, Standard & Poor’s

David Wyss is responsible for S&P’s economic forecasts and publications, and co-authors the monthly Equity Insight and the weekly Financial Notes. Often quoted in the press, he also manages research projects, especially in financial risk. He formerly was a senior staff economist with the President’s Council of Economic Advisers, senior economist at the Federal Reserve Board, and economic advisor to the Bank of England. Wyss holds a bachelor’s degree from MIT and a Ph.D. in economics from Harvard University.

e-mail: david_wyss@standardandpoors.com
The U.S. Recovery: Gathering Speed

Plenary Slides

After the Recession: Gathering Speed

David Wyss
Chief Economist
212-438-4882
David_Wyss@standardandpoors.com

Oil
Vancouver
July 2004

The Recovery Is Finally Accelerating

- After two years of sluggish expansion
- Jobs are finally materializing
- Up to now, the recovery has run on two legs – consumer and government spending
- New capital spending is rising despite excess capacity
- Higher interest rates will slow housing and consumers
- Tax cuts are over, and the saving rate is already low
- Federal deficits will level off
- Higher oil prices could stall the expansion
- Especially if world economic stagnation still widens the trade gap

Energy Costs Have Dropped from Prewar Highs

(Service, refined acquisition price and reported by C.P.; consumer energy as percent of disposable income)
The U.S. Recovery: Gathering Speed

Notes
The U.S. Recovery: Gathering Speed

Notes

The Pork Barrel Polka

- In April 2001 OMB projected a $334 billion surplus for fiscal 2003.
- The deficit was $374 billion.
- OMB projects $521 billion this year.
- The estimate seems a low-ball; it will probably be near $460 billion.
- The deficits helped in the short run.
- But should be eliminated in the long run.
- Deficits should be kept in proportion.
- US will probably have lower deficit as share of GDP than Germany this year.
- But outlook worsens dramatically after baby boom retires.

Deficits Forever?

(Percent of GDP)

State Deficits

- States expanded spending when times were good.
- And cut tax rates.
- It’s tougher to contract when times get bad.
- Rainy day funds were never very big.
- Stock market was more important for revenue than states thought.
- Deficits have been brought under control, but with more difficulty than in the past.
- State bond yields are very high relative to Treasuries.
- As Treasury yields move up, so will state borrowing costs.
- But worst seems over.
The U.S. Recovery: Gathering Speed

State Budgets in Deficit

Outlook Has Improved

<table>
<thead>
<tr>
<th>Number of states</th>
<th>Feb 2003</th>
<th>Feb 2004</th>
<th>Apr 2004</th>
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<tbody>
<tr>
<td>Budget gaps</td>
<td>38</td>
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<td>20</td>
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<tr>
<td>Gap above 5%</td>
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<td>5</td>
<td>0</td>
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<tr>
<td>Mid-year gap</td>
<td>$25.7 bn</td>
<td>$2.5 bn</td>
<td>$0.7 bn</td>
</tr>
<tr>
<td>Budget overruns</td>
<td>37</td>
<td>23</td>
<td>20</td>
</tr>
<tr>
<td>Revenue above forecast</td>
<td>6</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>Revenue below forecast</td>
<td>30</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Concerned or pessimistic outlook</td>
<td>38</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

Source: NCSL Survey Apr 2004

State Bond Yields Remain High Relative to Treasuries
The U.S. Recovery: Gathering Speed

U.S. Income Properties -- Stores

- Compared to peak in 2000, const. in 2002 down 17%.
- Some negative news, yet ....
- On plus side, major retail chains still expanding.
  Expansion continues for Wal-Mart, Home Depot, Lowe's, IKEA.
- Move to smaller venues e.g. “lifestyle centers.”

U.S. Income Properties -- Hotels

- High-profile projects in 2003 include:
  Bellagio Hotel & Spa
  Le Reve hotel/casino
  Convention center-related hotels in Denver, Louisville
- Industry financials weak, though improving:
  Occupancies moving back above 66%.
- Efforts to "catch the upturn" will support new construction.

U.S. Income Properties -- Hotels

<table>
<thead>
<tr>
<th>Hotel Occupancy Rates</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Hotels</td>
<td>59.1</td>
<td>59.2</td>
</tr>
<tr>
<td>Luxury</td>
<td>66.9</td>
<td>66.8</td>
</tr>
<tr>
<td>Upscale</td>
<td>61.6</td>
<td>61.5</td>
</tr>
<tr>
<td>Midprice</td>
<td>57.2</td>
<td>57.5</td>
</tr>
<tr>
<td>Economy</td>
<td>54.2</td>
<td>54.3</td>
</tr>
<tr>
<td>Budget</td>
<td>56.3</td>
<td>56.1</td>
</tr>
</tbody>
</table>
The U.S. Recovery: Gathering Speed

U.S. Institutional Buildings

Healthcare facilities setting back from a robust 2002.

Healthcare Facilities
Millions of Square Feet

U.S. Manufacturing Buildings

Plant construction reached a new sq. ft. low in 2002 ...

U.S. Public Works

- Fiscal 2004 appropriations, passed in January 2004, were more supportive than expected.
  - Federal-aid highway program up 4% to $33.6 billion.
  - Mass transit up 1% to $7.3 billion. Airport grants flat.
  - EPA water infrastructure up 3%, Corps of Eng. down 3%.
  - Constraints - uncertainty over new transportation bill, steel price hikes
    state fiscal stress

- Bush Administration proposals for fiscal 2005.
  - Federal-aid highway program, mass transit unchanged.
  - Airport grants up 4% to $3.5 billion, plus $250 million for airport upgrades under Aviation Security Capital Fund.
  - EPA water infrastructure cut 18%, Corps of Eng. cut 17%.
The U.S. Recovery: Gathering Speed

Notes

U.S. Electric Utilities

New starts of electric utilities in sharp retrenchment

- Glut of power generation
  Projects started in 1999-2001
  now becoming operational
  Capacity utilization down
  from 95% (2003) to 90%

- Transmission line work
  recorded during initial
  phase of deregulation
  now needed.

Other Countries Are Catching Up

(Percentage of college graduates by age group)

The Trade Gap Yawns Wider

(Percent of GDP)
The U.S. Recovery: Gathering Speed

And The Dollar Remains Strong

(Real trade-weighted dollar)

<table>
<thead>
<tr>
<th>Year</th>
<th>Industrial</th>
<th>Developing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>1994</td>
<td>0.95</td>
<td>1.05</td>
</tr>
<tr>
<td>1995</td>
<td>0.98</td>
<td>1.08</td>
</tr>
<tr>
<td>1996</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>1997</td>
<td>1.05</td>
<td>1.15</td>
</tr>
<tr>
<td>1998</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>1999</td>
<td>1.15</td>
<td>1.25</td>
</tr>
<tr>
<td>2000</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>2001</td>
<td>1.25</td>
<td>1.35</td>
</tr>
<tr>
<td>2002</td>
<td>1.3</td>
<td>1.4</td>
</tr>
<tr>
<td>2003</td>
<td>1.35</td>
<td>1.45</td>
</tr>
<tr>
<td>2004</td>
<td>1.4</td>
<td>1.5</td>
</tr>
<tr>
<td>2005</td>
<td>1.45</td>
<td>1.55</td>
</tr>
</tbody>
</table>

Notes

World Growth Is Improving

(Real GDP, % change)

<table>
<thead>
<tr>
<th>Region</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>2</td>
<td>-0.1</td>
<td>1.2</td>
<td>2.5</td>
</tr>
<tr>
<td>Europe</td>
<td>1.5</td>
<td>2.5</td>
<td>3.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Japan</td>
<td>0.5</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>Other Asia</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Latin America</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

Can the Consumer Keep Spending?

- Spending has led the expansion
- The tax cuts are providing extra income
- Lower mortgage rates freed up funds
- Confidence is improving
  - But the saving rate is low
- Tax cuts are over
- And gasoline at a record high
- Net result will be a slowdown, not a retreat
- But the saving rate will remain low
The U.S. Recovery: Gathering Speed

Notes

Debt Service Now Above 1986 Record

(Household obligations as percent of after-tax income)

Saving Rate Remains Low

(A Percent)

Saving rate (left) — Net worth/income (right)

A Housing Bubble?

- Housing is the most affordable it has been since the early 1970s
- Thanks to low mortgage rates
- Home prices have outpaced incomes
  - But ratio of home price to income is only moderately high
- There are local bubbles
  - e.g., New York, Bay Area, Boston, DC
- And higher mortgage rates will cause weakness
- But housing looks less overvalued than other assets
More Affordable Housing Allows More Households To Own Their Home

Home Prices Are High Relative to Household Income

The Stock Market Will Recover, But Slowly

- Market rose over 20%/year from 1995 -99
- But dropped from March 2000 through June 2003
- First three consecutive down years since 1939-41
- Biggest drop since 1929-32
- Profits cannot continue to outpace GDP
- Share prices cannot continue to outpace earnings
- As interest rates rise
- Stocks will thus yield less in the future than in the recent past.
- But a near-term rally is being spurred by earnings recovery and dividend tax change
The U.S. Recovery: Gathering Speed

Notes

Long Bull Markets Are Followed by Periods of Weakness

(Percent return on S&P 500 and corrected by CPI)

Nominal  Real

High P/E's are Concentrated in Tech

(Based on 12-month forward operating earnings, Today vs. March 2000)

Bottom Line: The Economy Recovers, But Slowly

- Consumers are spending near max
- Businesses will not take over the lead yet
- But strong stimulus from fiscal policy
- Interest rates rise gradually next year
- Inflating prices and start to slow
- Weak recovery for stock market
- Risk of recession remains if:
  - Further terror attacks damage confidence
  - War disrupts oil supplies
  - World deflation sucks the US. into slower growth
The U.S. Recovery: Gathering Speed

Notes
A Case Study for Knowledge Management

Case Study: DuPont

Abstract

During the stages of developing and implementing a knowledge management (KM) process and culture, it will be clear that the business value in converting data to information and then transforming it into knowledge can increase the personal productivity of technical and project professionals by more than 25 percent. At the same time, a successful KM process enables renewal, innovation, and sustainable business growth. The development framework and implementation approaches will be outlined.

Plenary Session Presenter

Jim Porter – Vice President of Engineering and Operations, DuPont Engineering

Jim Porter served as CII Chairman in 2000 and has a lengthy association with CII in various executive capacities. Porter’s career with DuPont began in 1966 as a chemical engineer in Newark, Delaware. After a two-year tour of duty with the U.S. Army, he returned and took an assignment as a field engineer. He was promoted to field manager in 1979, followed by an assignment as Manager of Investment Engineering in 1981. With the restructuring of DuPont Engineering in 1990, Porter became Director of Engineering Operations. In 1992, he was named Director of Operations for the Fluoroproducts business. He has been in his current post since 1999. Porter holds a degree in chemical engineering from the University of Tennessee.

e-mail: james.b.porter-jr-1@usa.dupont.com
Implementation Session Moderator

Emerson T. Johns – Chief Financial Officer and Operations Leader, Engineering, Facilities, and Safety, Health, and Environmental Services, DuPont Company

Emerson Johns has been with DuPont since 1969, when he started his career as an internal auditor. Many of his assignments have involved interfacing with the Federal government, in particular DuPont’s activities at its Savannah River Plant. He also has been involved in DuPont operations in Puerto Rico, Germany, and the United Kingdom. Since 1986, Johns has been at the corporate headquarters in Wilmington, Delaware. Actively involved in CII for the past several years, Johns is former chairman of the Research Committee and chaired the CII Annual Conference in 2003.

e-mail: emerson.t.johns-1@usa.dupont.com

Implementation Session Participants

Carol P. Arnold – Knowledge Management Leader, DuPont Engineering

e-mail: carol.p.arnold@usa.dupont.com

Judith W. Passwaters – Engineering Director, E. I. duPont de Nemours & Co., Inc.

e-mail: judith.w.passwaters@usa.dupont.com

James B. Porter, DuPont Engineering

e-mail: james.b.porter-jr-1@usa.dupont.com
A Case Study for Knowledge Management

“Creating Sustainable Business Value”

Jim Porter
DuPont

“Knowledge Management”

The Right Information
at the Right Place
at the Right Time
at the Right Price
enables rapid, effective Decision Making
and Problem Solving delivering
Sustainable Business Results

The Goal is Zero

ZERO on-job injuries
ZERO off-job injuries
ZERO environmental incidents
ZERO ethics incidents
ZERO people-treatment incidents

100% Right Behaviors
A Case Study for Knowledge Management

### Knowledge As Value

<table>
<thead>
<tr>
<th>Product</th>
<th>Price Per Pound ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pentium processor</td>
<td>42,893.00</td>
</tr>
<tr>
<td>Viagra</td>
<td>11,766.00</td>
</tr>
<tr>
<td>Gold</td>
<td>4,827.20</td>
</tr>
<tr>
<td>Hermes scarf</td>
<td>1,964.29</td>
</tr>
<tr>
<td>Palm PDA</td>
<td>1,726.92</td>
</tr>
<tr>
<td>“Saving Private Ryan” DVD</td>
<td>874.75</td>
</tr>
<tr>
<td>Bicycle</td>
<td>100.00</td>
</tr>
<tr>
<td>Mercedes Benz E-Class sedan</td>
<td>18.98</td>
</tr>
<tr>
<td>Chevrolet Cavalier sedan</td>
<td>6.76</td>
</tr>
<tr>
<td>Hot-rolled steel</td>
<td>0.19</td>
</tr>
</tbody>
</table>

*Source: Fortune, March 20, 2000, p. 68*

### Compelling Drivers

**Improved Information Utilization**

- Improve productivity.
- Increase customer value.
- Renew and leverage needed competencies.
- “Smart” leverage of expertise:
  - “Safe” self-service
  - “Experts” in optimum role
  - New/unproven resources development
- Drive innovative solutions.

### Business Existing Examples:

**Effective Knowledge Management**

- Construction Industry Institute
- Process Industry Practices
- Center for Chemical Process Safety
- Independent Project Analysis
A Case Study for Knowledge Management

Knowledge Management Vision
Create a strategy and managing process for accelerating knowledge management that will introduce a culture change as well as effective tools and processes to further enable employees as “knowledge workers,” improve productivity, and use knowledge intensity to achieve sustainable growth.

Major Opportunity Areas

1. Capability to capture information

88% of DuPont’s top salespeople have over 30 years of experience.

40% of DuPont engineers will be pension-eligible in the next two to four years.

38% of a person’s time is wasted trying to manage information.

No central repository of intellectual capital.

Major Opportunity Areas

2. Capability to find right information and people

20% of a scientist’s time is spent searching and accessing information.

75% of the info people need to effectively work is not in “transaction backbone” data.

No capability to locate experts/expertise across company.
Major Opportunity Areas

3. Ability to collaborate and share info and expertise
   20% of a person’s time is spent repeating answers.
   25% of info that a company owns is used.
   65% of a company’s design work is duplicated.
   Success and business intelligence depend on readily available knowledge.

Knowledge Management Flowdown Process

Engineering Competency
Knowledge Management — Business Case Summary

- Benefit benchmarks
  - Increased productivity
  - Reduced problem-solving time
  - Best Practice sharing
  - Packaged solutions/offerings leverage
  - Decreased time to renewal

- Cost estimate
  - 5 to 6 million dollars over three years
A Case Study for Knowledge Management

Key Learnings

- Ease-of-access to knowledge assets is critical.
- Minimize time required to find/reuse knowledge.
- Management support is critical.
- Tacit knowledge capture is much more difficult than explicit.
- Knowledge management is a culture change — not just a toolbox.

At Our Implementation Session

Purpose

- Understand how knowledge management creates sustainable business value.
- Learn how to implement a knowledge management process and culture.
A Case Study for Knowledge Management
Implementation Slides

Knowledge Management (KM)
Implementation Session

Emerson Johns
Jim Porter
Carol Arnold
Judy Passwaters

Purpose

- Understand how KM creates sustainable business value
- Learn how to implement a KM process and culture

Agenda

Introduction Emerson Johns
Overview Jim Porter
KM Project Carol Arnold
Interoperability Judy Passwaters
Discussion All
“The only thing that gives an organization a competitive edge ... is what it knows, how it uses what it knows, and how fast it can know something new.”

Laurence Prusak
IBM Knowledge Institute

Key Benchmark Companies

1. Johnson & Johnson  Knowledge networking
2. Gateway  KM & IT client services
3. Sprint  Business market research
4. IBM  Institute for KM
5. PriceWaterhouseCoopers  KM
6. World Bank  Knowledge and learning
7. Intel  KM
8. Microsoft  Enterprise KM
9. Accenture  KM
10. Chevron  Information architecture
11. Ford  Best practices
12. Capital One  Knowledge champions
13. Skanska  KM
14. Cisco  KM
15. MIT Sloan School of Management  Academic program
16. British Petroleum  KM
17. Dow  KM
18. Texas Instruments  KM
19. Siemens  KM

Knowledge Management (KM)

Implementation Session

KM Overview

Jim Porter
Creating Sustainable Business Value from Data

Information = f(Data)
Knowledge = f(Information)
Sustainable Business Value = f(Knowledge)

Business Successes

- BP—attributed $260 million added value directly from KM
- Dow—saved $40 million over 10 years by divesting costly, unused patents
- Texas Instruments—saved $1 billion as a result of improved KM
- Chevron—employee productivity up 50 percent thru TQM and KM
- Siemens—its ShareNet tool added $122 million in sales since rollout

Of all the initiatives we’ve undertaken at Chevron during the 1990s, few have been as important or as rewarding as our efforts to build a learning organization by sharing and managing knowledge throughout our company. In fact, I believe this priority was one of the keys to reducing our operating costs by more than $2 billion per year.

Kenneth T. Derr
Chairman and CEO
Chevron
A Case Study for Knowledge Management

Leaping to Our Next Century

New DuPont Vision
To be the world’s most dynamic science company, creating sustainable solutions essential to a better, safer, healthier life for people everywhere.

Strategic Pathways

- Integrated Science
- Knowledge Intensity
- Productivity

Sustainable Growth
A Case Study for Knowledge Management

DuPont Business Goals

Top Line Growth
- World-class marketing capability
- World-class sales capability
- Enhanced innovation
- Knowledge in offer bundles

Productivity
- Employee productivity and effectiveness
- People renewal
- Global supply chain

Process View—Typical Enterprise (End-to-End View)

Other Key Stakeholders

Compelling Drivers
Improved Information Utilization

- Improve productivity
- Increase customer value
- Renew and leverage needed competencies
- “Smart” leverage of expertise
  - “Safe” self-service
  - “Experts” in optimum role
  - New/unproven resources development
- Drive innovative solutions
CII Knowledge Impact Areas

- Safety
- Business Decisions
- Capital Projects
- Plant Startups
- Competency Renewal
- Personnel Development
- Outside Influence

Knowledge Management (KM)

Implementation Session

KM Project

Carol Arnold
Three Major Opportunity Areas

1. Capability to capture information
   - 88% of DuPont’s top salespeople have over 30 years of experience.
   - 40% of DuPont engineers will be pension-eligible in the next two to four years.
   - 38% of a person’s time is wasted trying to manage information.

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2. Capability to find the right information and people
   - 20% of a scientist’s time is spent searching and accessing information.
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A Case Study for Knowledge Management

Major Opportunity Areas

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   20% of a person’s time is spent repeating answers.
   
   25% of info that a company owns is used.
   
   65% of a company’s design work is duplicated.

   Success and business intelligence depend on readily available knowledge.

Knowledge Management Continuum

Organizational Readiness & Productivity

DuPont Knowledge Management:
Phase 1

<table>
<thead>
<tr>
<th>Participants</th>
<th>Initial Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance—Internal Audit</td>
<td>100</td>
</tr>
<tr>
<td>CR&amp;D</td>
<td>4200</td>
</tr>
<tr>
<td>Engineering</td>
<td>500</td>
</tr>
<tr>
<td>Sourcing</td>
<td>1200</td>
</tr>
<tr>
<td>Crop Protection</td>
<td>15</td>
</tr>
<tr>
<td>Strategic Accounts</td>
<td>140</td>
</tr>
<tr>
<td>Imaging Technologies</td>
<td>20</td>
</tr>
<tr>
<td>Six Sigma</td>
<td>&gt;10,000</td>
</tr>
</tbody>
</table>
A Case Study for Knowledge Management

**Key Strategies and Initiatives**

**2003—Think Big, Start Smart, Scale Fast**

**KM Program Office**

...establish a dedicated team to lead the journey...

- Business/program lead
- Change management and education
- KM consulting
- Six Sigma/business analyst
- IT KM Lead
- Project-based resources
  - Project manager
  - Community facilitators
  - Knowledge capture resources
  - IT resources
### KM Roles and Responsibilities

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DuET Group Manager</td>
<td>Executive sponsor; actively supportive of the roll out.</td>
</tr>
<tr>
<td>Knowledge Stewards</td>
<td>Prime contacts for the KM team and early adopters of KM processes and tools. Champions of KM processes; work with subject matter experts to oversee group intellectual property.</td>
</tr>
<tr>
<td>Subject Matter Expert (SME)</td>
<td>Technology specialist, expert. Recognized, well-respected content/competency expert. Helps the Knowledge Steward manage intellectual assets for the rest of the group.</td>
</tr>
<tr>
<td>Knowledge Workers</td>
<td>All people in the workgroup (regardless of whether they may also be SMEs, Knowledge Stewards, or O&amp;Ps).</td>
</tr>
</tbody>
</table>

### Implement Common KM Processes

- Effective global collaboration
- Consistent knowledge sharing
- Build and grow strong teams
- Capture and organize knowledge assets
- Document and publish good/best practices
- Improve search/find and access to information
- Find the right person (or be found!)
- Better mentoring and training opportunities

### Example Value Areas to Explore

- Improve information/knowledge sharing
- Capability to capture information/knowledge
- Turning tacit knowledge into explicit knowledge
- Improved innovation process
- Ability to collaborate
- Efficiency and effectiveness of scientists
- Getting products to market faster
- Driving growth: Sales and marketing effectiveness and revenue growth
A Case Study for Knowledge Management

KM Roll Out Process

Manager's Meeting
Planning Meeting
Group Launch
Portal Set Ups
Tool Trainings
Learning Modules
Weeks 1-2 are planning, front-end loading, pre-work.
Weeks 3-4 are training, overviews, continued setup.
Weeks 5-6 are more training, some project work, feedback sessions, and a closing session.
Workshop
Close Out

Portal Overview
A brief tour of the portal environment and its concepts/terminology...

KEY FEATURES
- Collaboration
- Engineering Employees
- Engineering Search
- Engineering Page

KM Portal
A brief look of some tools available through the IPortal

- Sometimes
- QuickPages

- Taxonomy and Collections Search
Portal Overview

Sametime Instant Messenger and QuickPlace are located under the Collaboration tab.
Knowledge Management (KM)

Implementation Session

Engineering Interoperability

Judy Passwaters

2003—Think Big, Start Smart, Scale Fast

Knowledge Management Vision

Create a strategy and managing process for accelerating knowledge management that will introduce a culture change as well as effective tools and processes to further enable employees as “knowledge workers,” improve productivity, and use knowledge intensity to achieve sustainable growth.
A Case Study for Knowledge Management
A Case Study for Knowledge Management

Align KM and Interoperability/Facility Data Management

Issues and Challenges

- KM
  - Long-term storage/accessibility of electronic media
  - Enable the Data > Information > Knowledge progression

- Interoperability
  - Open systems
  - Applications integration
  - Legacy Data

DISCUSSION
A Case Study for Knowledge Management

**How Do You Knowledge-Enable the Business?**

- Sponsorship
- Support Knowledge Team
- Ability
- Orientation and Training Applications and Infrastructure Knowledge Services
- Processes
- Knowledge Management Processes Knowledge Asset Processes Innovation Programs
- Verification
- Management Review Delivery Assurance Review
- Measurement
- Balanced Score Card Reward and Recognition Performance Appraisals

**KM Processes**

- **Find**
  - Find the Right Person (or be found!)
  - Improve Search and Better Access to Information
- **Collaborate**
  - Effective Global Collaboration
  - Document and Publish Good/Best Practices
  - Build and Grow Strong Teams
  - Consistent Knowledge Sharing
  - Better Mentoring and Training Opportunities
- **Capture**
  - Capture and Organize Knowledge Assets

**Interoperability Issues and Challenges**

- Open systems—No active, coordinated U.S. body working on data standards.
- Applications integration—continues to be difficult achieving collaboration between software companies.
- The industry needs to reduce barriers to interoperability, enabling benefit realization.
Abstract
The primary drivers for lean adoption are reduced cost and improved schedule. This can be accomplished with no reduction in safety performance or quality. This CII project team will offer some early, but compelling, evidence that lean principles can be used to improve project performance. The team has thoroughly investigated available materials on the subject, analyzed work of early adopters of the principles, and researched the areas in which improvements can be made. Reasons to become lean will be detailed and a roadmap will be presented to lead interested parties in the right direction.

A panel of early lean adopters will talk about their experiences in the implementation session. Participants will be able to ask questions of the panel, the project team members, and the principal investigator.

Plenary Session Presenter
David Tweedie - Regional Manager, Fru-Con Construction Company

David Tweedie has full management responsibility for Fru-Con’s engineering and construction services out of its southeastern U.S. office in Tallahassee, Florida. He joined Fru-Con in 2003 after a long and successful career with Watkins Engineers & Constructors, where he had wide-ranging assignments and increasing responsibility. He began as a chief construction engineer and became a vice president and division manager. Involved with CII in various capacities since 1993, he currently chairs CII’s Lean Principles in Construction research study. Tweedie holds a bachelor’s degree in construction management from Louisiana State University.

e-mail: david.tweedie@frucon.com
Implementation Session Moderator

Louis F. Troendle – Director of Operations, Automotive, Washington Group International

Louis Troendle has 24 years of experience in the industry, including projects ranging from $6 million to over $2 billion in total installed cost. One recent assignment was at the tornado-damaged General Motors plant in Oklahoma City. This $100+ million reconstruction project, which involved a 24/7 schedule, was recognized for its low safety incident rate and excellent turnaround time to full production. Troendle holds a bachelor’s degree in civil engineering from the University of New Mexico.

e-mail: louis.troendle@wgint.com

Implementation Session Participants

Michael R. Haller – Executive Vice President, Walbridge Aldinger Company
  e-mail: mhaller@walbridge.com

John Hallman – Director, Manufacturing Construction Management Group, Worldwide Facilities Group – Capital Projects, General Motors Corporation
  e-mail: john.hallman@gm.com

Dan M. Kumm – Manager, Field Operations, Butler Manufacturing Company
  e-mail: dank@bucon.com

Paul Reiser – Vice President, Production & Process Innovation, The Boldt Company
  e-mail: paul.reiser@boldt.com
Other Knowledgeable Points of Contact

Joshua Balonick — Graduate Research Assistant, University of Colorado-Boulder
e-mail: joshua.balonick@colorado.edu

Brian W. Barker — Operations/Labor Relations Manager, Parsons G-UB-MK Constructors
e-mail: bwbarke5@tva.gov

Brian L. Becker — Senior Project Manager, General Motors Corporation
e-mail: brian.becker@gm.com

Anthony Buzzeo — Project Engineering & North America Construction Manager, Praxair, Inc.
e-mail: tony_buzzeo@praxair.com

Gregory D. Clum — Manager, BVCI Labor Relations, Black & Veatch Corporation
e-mail: clumgd@bv.com

Eric Delaney — Project Engineer, BMW Constructors, Inc.
e-mail: delaney@bmwc.biz

James E. Diekmann — K. Stanton Lewis Professor, University of Colorado-Boulder
e-mail: james.diekmann@colorado.edu

Sant Harit — Manufacturing Consulting Services Manager, Washington Group International Inc.
e-mail: sant.harit@wgint.com

James A. Hengel — Vice President, Project Management, Black & Veatch
e-mail: hengelja@bv.com

Eric Janovsky — Senior Project Manager, U.S. General Services Administration
e-mail: eric.janovsky@gsa.gov

Jeff Millikan — Project Manager, ALSTOM Power, Inc.
e-mail: jeff.millikan@power.alstom.com

Louis L. Prudhomme — Associate Director, Construction Industry Institute
e-mail: lprudhomme@mail.utexas.edu
Lean Manufacturing Tools for Construction

Mag A. Risk — Project Management Consultant, Johnson Controls, Inc.
   e-mail: mag.risk@jci.com

Brian Saller — Graduate Research Assistant, University of Colorado-Boulder
   e-mail: brian.saller@colorado.edu

Robert C. Schulz — Global Construction Technology Manager, The Dow Chemical Company
   e-mail: rschulz@dow.com

Craig Wright — Vice President Construction, Black & Veatch
   e-mail: wrightcg@bv.com
Lean Manufacturing Tools for Construction

Lean Principles in Construction Project Team

Change to Workplace Organization — How Walbridge Aldinger is effecting lean cultural change

Leader Involvement

• First and foremost — absolutely essential in setting pace and direction
• Leadership forums that emphasize the importance of lean performance
• Lean recognition program and accountability reinforced through employee performance appraisal

Education

• “Lean Fundamentals” instructor led eight-hour course required for all salaried positions
• Field training — Tradesmen and Foreman Training Program
• Trade apprentice schools
• Architects/Engineers
• Subcontractors
• Project specific (i.e., Corner House Lofts, Ann Arbor, Michigan)
• Development and implementation of Lean Toolbox Talks

Lean Construction Steering Team

Cross-functional members and executive sponsor whose mission includes:

• Define and achieve annual lean goals
• Articulate lean best practices
• Review lean savings ideas and lean achievement recognition
• Define implementation strategies and continuously evaluate

Full-Time Lean Manager

• Assist and advise teams in the field; provide project leaders with After Action Reviews
• Manage lean programs; lead the Lean Construction Steering Team
• Communicate (contributing editor for “Lean Focus” Newsletter and Lean Toolbox Talks)
• Subject matter expert who teaches

Process Improvement Work Groups — “Lean Teams”

Value-stream mapping to improve specific processes (Kaizen)
Lean Manufacturing Tools for Construction

Lean Olympics
Measures the implementation of lean best practices
Friendly competition, team recognition
  • Bronze
  • Silver
  • Gold
  • Extra Credit Laurels

1% Savings Drive
  • Motivates everyone to think of ways to eliminate waste and add value — lean is a state of mind
  • Pledged goals / reinforces fiscal responsibility
  • Tangible, measurable, and achievable (though not easy)
  • Aligned with other continual improvement tools — Walbridge Aldinger Quality Management & Value Management
  • Focus on capturing/sharing ideas (documented in value management database)
  • Linked to “Lean Achievement Recognition” (individual and team levels)

Detailed Logistics Planning
  • Site layout, staging areas, environmental impacts, security, field sanitation, 5S, traffic control, flow, etc.
  • Capitalizes on visual management

Pre-Task Planning for Lean (modeled on safety pre-task planning)

Consultants / Academic Liaison / Lean Construction Institute membership

Marketing & Communication
Website, “Lean Focus” newsletter, posters and slogans, Lean Toolbox Talks

Patience
  • Eat the elephant one bite at a time.
  • Improve 1000 things 1% instead of 1 thing 1000% (Toyota) — ref: 1% Savings Drive.
  • Takes years to realize — must become part of everything and everybody.
  • Reinforced through our core values.
Project Team 191:
Lean Principles in Construction

Lean Principles in Construction Project Team

Josh Balonick  University of Colorado
Brian Barker  GUB-MK Constructors / Parsons E&C
Brian Becker  General Motors
Tony Buzzao  Praxair
Jim Diekmann  University of Colorado
Eric DeLane
Sant Harit  Washington Group International
Mark Krewedl  University of Colorado
Dan Kumm  Butler Construction
Mag Risk  Johnson Controls
Bob Schulz  Dow Chemical
Lou Troendle  Washington Group International
David Tweedie  Fru-Con, Chair
Craig Wright  Black & Veatch

Project Team 191 Mission

To examine the potential for the use of Lean Principles that were developed in the manufacturing industry for adaptation and use in the engineer-procure-construct (EPC) industry.
Lean Manufacturing Tools for Construction

The Power of Lean

“Catch up with America in three years. Otherwise the automobile industry of Japan will not survive.”

Kiichiro Toyoda
Founder, Toyota Motor Co.
1894–1952

Lean in Manufacturing

Five Principles of Lean Manufacturing:

1. Precisely specify value by specific product.
2. Identify the value stream for each product.
3. Make value flow without interruptions.
4. Let the customer pull value from the producer.
5. Pursue perfection.

James P. Womack
Founder, Lean Enterprise Institute

Opportunity for Improvement in Construction Today

<table>
<thead>
<tr>
<th>Current Manufacturing</th>
<th>Current Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Added 84%</td>
<td>Value Added 16%</td>
</tr>
<tr>
<td>Waste 26%</td>
<td>Waste 57%</td>
</tr>
<tr>
<td>Support Activity 12%</td>
<td>Support Activity 33%</td>
</tr>
</tbody>
</table>
Lean Construction Defined

The continuous process of:

- eliminating waste.
- meeting or exceeding all customer requirements.
- focusing on entire value stream.
- pursuing perfection in execution of constructed project.

Drivers of Lean Manufacturing

- Mass production practices
- Limited space
- Reduced inventory
- Limited natural resources
- Lower demand
- Quality improvement

Drivers of Lean Construction

- Waste
- Non-standardized workplace
- Individual contract structure
- Fragmented relationships
- Supply chain integration
- Available work force
- Produce one-off projects
Lean Manufacturing Tools for Construction

Progress with Lean Manufacturing

Value Added Work Improvements

Use of lean manufacturing principles resulted in better optimization of resources.

Accomplishments of Lean Manufacturing

- Half the human effort in the factory
- Half the manufacturing space needed
- Half the investment in tools
- Half the engineering hours to develop a new product in half the time
- Less than half the needed inventory on site
- Fewer defects
- Produces greater and ever growing variety of products

Lean Construction Principles

- Eliminate waste
- Customer focus
- Workplace standardization
- Culture/people
- Continuous improvement, built-in quality
Waste in Construction Processes

• Excessive material handling
• Rework
• Design errors
• Conflicts between trades
• Conflicts between other contractors
• Ineffective supply chains

Rewards to “GO LEAN”

• Reduce waste / improve efficiency
• Improve safety
• Lower cost
• Better quality
• Fewer defects / less rework

You have the opportunity to be the construction industry leader.

Waste Reduction = Sustainability
The Journey to Lean

- Literature research
- Global interviews with early adopters
- Meetings with prominent lean researchers
- Activity case studies
- Questionnaires

Lean Works!!

Implementation Session

Introduction – Lou Troendle, Washington Group Int.
- Change of culture
- Path forward
- Self-assessment tool

Panelists
- Jack Hallman, GM: Owner’s Perspective
- Mike Haller, Walbridge Aldinger: Visual Management
- Paul Reiser, Boldt: Production Planning/Culture Change
- Dan Kumm, Butler: Eliminate Waste
- Jim Diekmann, CU Boulder: Principal Investigator

Q&A
Lean Manufacturing Tools for Construction
Implementation Slides

Lean Construction from an Owner’s Perspective

Jack Hallman
Director, Manufacturing Construction Management
Worldwide Facilities Group, Capital Projects
General Motors Corporation

Products

- Safety
- Cost
- Quality
- Responsiveness

Manufacturing Operations
(suppliers to the product community)

- Safety
- Cost
- Quality
- Responsiveness
Lean Manufacturing Tools for Construction

Notes

Capital Projects
(suppliers to the manufacturing operations)

- Safety
- Cost
- Quality
- Responsiveness

Construction Industry
(suppliers to WPG Capital Projects)

- Safety
- Cost
- Quality
- Responsiveness

Standardized Work in General Motors Construction Work

- Construction General Conditions
- Project Management Process
- Construction Safety Process
- Supplier Pre-Qualification
- Comprehensive Engagement Agreement
- Customer Satisfaction Surveys
- Post Occupancy Evaluations
- Project Definition Rating Index (PDRI)
- Project Delivery & Contract Strategy (PDCS)
- Peer Reviews
- Value Stream Mapping
- GoFast!!
Implementing Lean Project Delivery at Boldt

- Lean/Lean, Lean Office, Target Costing & Lean Design, Material Management, Supply Chain Development
- Lean/Lean, Lean Office, Target Costing & Lean Design, Material Management, Supply Chain Development
- Lean/Lean, Lean Office, Target Costing & Lean Design, Material Management, Supply Chain Development

Pull Scheduling

Working from a target completion date backward, tasks are defined and sequenced so that their completion releases work.
Lean Manufacturing Tools for Construction

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Pull Scheduling Overview

- Work tasks, information flow, and material deliveries are planned based on the request (or “pull”) of downstream customers.
- Traditional concepts of how work, information, and material are processed need to change.
- Pull scheduling will often expose the need for smaller batches, just-in-time delivery, improved leveling of resources, and reduced lead times.
- Workflow becomes more reliable and efficient as the waste of waiting, redundancy, and over-processing are eliminated.

---

Pull Planning & Scheduling

Strategic  
Tactical

Planning

Master CPM Schedule  
Phase Pull CPM Schedule  
Lean Work Stream Pull Planning

Measurement

Float  
Percent Planned Complete

(Pull Intensity)  
(Planning Reliability)

---

Lean Production Mgt.

Master, Phase & Look Ahead Schedule

Make-Ready Process

Work Plan & Execution

Learning & Improvement

---
LeanStream
Managing work streams

- Decentralized planning and control at the crew level
- Start with a work stream milestone from the Master or Phase schedule
- Do a back-and-forth “pull” plan based on the release of work
- Plan and control the “hand off” of work
- Review daily
  - Did we do what we said we would
  - What did we learn
  - Will we accomplish tomorrow’s plan
  - What do we need to make tomorrow’s plan succeed

The Four Rules of a Lean Production System

- All work shall be explicit as to content, sequence, timing and outcome.
- Every connection (hand off of work) in the work stream must be direct, and there must be a clear way to request action and receive a response.
- The pathway for production must be simple and direct.
- Improvements are made according to a method, under guidance, and at the lowest possible level in the organization.

Lean Design Process

- Co-located, Multidisciplinary Target Cost Teams
  - Designers, Facility Users, Estimators, Specialty Contractors and Suppliers, Project Manager, Superintendent
- Shrink small batches of incomplete information
  - Evaluating design and budget more often
- Value Tools
  - Value Stream Mapping during Project Definition, Value Engineering Function and Worth
- Set Based Design
  - Advancing sets of solutions to the last responsible moment
- Simultaneous design of Product and Process
  - Digital prototyping and operations design
- Detailed design by specialty contractors and vendors
  - Calculating the waste of redundant detail design
The difference between “We already do this” and making the Lean transformation.

The industry is trying to work better within an existing environment and set of rules.

It isn’t until we change the underlying operating system, the environment, and the set of rules, that we can significantly change behavior and how work happens.

Lean gives us the opportunity to significantly change how work happens.

Leading an intense implementation of Lean principles and techniques

Business not as usual.
Moving from activity centered contract management to collaborative work stream management.

Implementation / K&O
• Advance Work Flow Management/Last Planner
• Material Management
• Operations Design & Standard Work Processes
• Digital Prototyping
• Lean Design
• Target Costing
• Supply Chain Development
Abstract

This presentation will answer the questions: “What is sustainability?” and “What is the triple bottom line impact on early engagement in the design phase?” You will learn what it means to be a company or organization that takes full advantage of triple bottom line benefits offered by a commitment to sustainability:

- Environmental quality
- Social equity
- Economic success

Case studies of Leadership in Energy and Environmental Design (LEED) certified facilities will be reviewed in the implementation session. Hear how green design can lower your construction costs, reduce operating costs, make a more productive environment, produce a higher valuation of building and visibility/marketability, and reduce insurance and risk of liability. A panel of experts will be available for questions and discussion.

Plenary Session Presenter

Paul von Paumgartten - Director of Energy and Environmental Affairs, Johnson Controls

Paul von Paumgartten manages Johnson Controls’ high performance green buildings business. Von Paumgartten, a well-known expert on energy and the environment, also is on the Board of Directors of the U.S. Green Building Council and serves on the council’s LEED steering committee. Before joining Johnson Controls, he ran his own consulting firm, Productive Environments. An invited speaker at numerous conferences, he also has taught lighting design courses and has conducted seminars for a variety of professional societies. Von Paumgartten earned a degree in finance and marketing from the University of Wisconsin–Milwaukee.

e-mail: paul.vonpaumgartten@jci.com
Implementation Session Moderator

Paul von Paumgartten - Director of Energy and Environmental Affairs, Johnson Controls

Implementation Session Participant

Michael Arny - President, Leonardo Academy
e-mail: michaelarny@leonardoacademy.org
Buildings for a Livable Future

Plenary Slides

Buildings for a Sustainable Future

Paul von Paumgarten
Director
Energy & Environmental Affairs
Johnson Controls, Inc.

Classic Definition of Sustainability

New Organizational Metric

Economy

Equity

Ecology

Triple Bottom Line

Sustainable Business Practices

Why Sustainability is Here to Stay

Transparency in Corporate Governance

Government Environmental Mandates

Top and Bottom Line Impact
Environmental Impact of Buildings
Americans spend as much as 90% of time indoors.

Buildings:
• Consume almost 40% of all energy.
• Add 40% to atmospheric emissions.
• Use 68% of all electricity.
• Use 12% freshwater, 88% potable water.
• Take up to 40% municipal solid waste stream.
• Exploit significant amounts of land.
Energy Savings Actions

1990-2000
- Energy Cost Savings – $16.7 billion
- Electric Energy Savings – 166 million MWh
- Electric Demand Reductions – 2,500 MW
- Carbon Dioxide Emissions Reduction 217 Million Tons

Total Energy Savings Actions

1990-2010
- $95 billion in energy savings
- 981 MWh in electric energy savings
- 6,000 MW in electric demand reduction (15 new 400 MW power plants)
- 5.3 billion MMBTU reduction in direct fuel use
- Total savings power all California households for 13 years, and 4% of Kyoto Goals

Characteristics of Green Buildings

- Optimal environmental and economic performance
- Increased efficiencies, saving energy and resources
- Satisfying, productive, quality indoor spaces
- Whole-building design, construction, and operation over entire life cycle
- Fully integrated approach – teams, processes, systems
Economic Benefits of Green Design

Lower Construction Costs
- Reduced site preparation and landscaping
- Lower waste disposal costs by 50 to 98 percent

Reduced Operating Costs
- Lower utility costs by 20 to 50 percent
- Reduced maintenance costs

Higher Valuation of Building
- Rule of Thumb: divide reduction in annual operating costs by 10 percent to get increased value of building.
- Up to $4 increased valuation for every $1 spent.

More Productive Environment
- Better tenant and worker attraction/retention
- Less absenteeism by 45 percent
- Higher productivity up to 16 percent

Reduced Insurance and Risk of Liability
- Healthy occupants, greater occupant satisfaction
- Lower environmental impacts
- Streamlined regulatory approvals

Higher Visibility and Marketability
U.S. Green Building Council

- National coalition representing all sectors of the building industry.
- Promotes design, construction, operation of environmentally responsible, profitable, healthy places to live and work.
  - Rating system to guide sustainable project development

LEED Point Categories

- Sustainable Sites
- Materials & Resources
- Water Efficiency
- Energy & Atmosphere
- Indoor Environmental Quality
- Innovation

LEED Programs

- Building Certification
  - Green, Silver, Gold, Platinum
- Professional accreditation
- Training workshops
- Educational resources
- Website – www.usgbc.org
LEED Family of Products

LEED Vertical Markets

U.S. Green Building Council Growth

- 4500+ member companies, firms, or organizations
- 1500+ building projects in LEED 2.0 certification process
- 30 chapters with dozens more in motion
Buildings for a Livable Future

LEED EB Pilot Participants

- National Geographic Society
- Pentagon
- U.S. GSA
- State of Maryland
- City of Chicago
- Furman University
- Duke University
- JohnsonDiversay
- Microsoft
- Johnson & Johnson
- Liberty Property Trust
- Russellville School District
- Buffalo Public Schools
- Cambridge Memorial Hospital
- Hewlett Packard
- Milliken Carpets

Case Studies

Buildings for a Sustainable Future

Paul von Paumgarten
Director
Energy & Environmental Affairs
Johnson Controls, Inc.
Sustainable Development Can Create a Competitive Advantage

- Paul von Paumgartten – Johnson Controls
- Michael Arny – National Geographic Society
- Greg Bell – JohnsonDiversey, Inc.

Overview

- Green Buildings
- Brengel Center Description
  - Sustainable Aspects
  - Results

U.S. Green Building Council

- National coalition representing all sectors of the building industry.
  - Rating system to guide sustainable project development
LEED Point Categories

- Sustainable Sites
- Materials & Resources
- Water Efficiency
- Energy & Atmosphere
- Indoor Environmental Quality
- Innovation

LEED Family of Products

- LEED for New Construction (NC)
- LEED for Existing Buildings (EB)
- LEED for Commercial Interiors (CI)

Brengle Technology Center

LEED-Certified Building
Milwaukee, Wisconsin
Brengel Technology Center

- Built in 2000
- $16 million technology & customer center
- 130,000 square feet on 7 floors
- Complements 100-year-old building next door
- Minimized footprint by building on existing site in city's center

Brengel Sustainable Features

- Open green-area courtyard in city center
- Personal environments for desktop control by employees
- Abundant use of natural daylight with advanced lighting technology

Brengel Sustainable Features

- Accommodates busing and bike to work
- Roof-mounted weather system for accurate energy applications
Building Automation System

- Optimal energy efficiency and performance with Metasys® Building Automation System
- Remote Access
  - Easy to identify energy savings opportunities
    - Energy sub-metering
    - Load profiling
    - Cost report generation

LEED Silver to Gold

- Modified housekeeping specifications
- Improved exterior landscaping and snow removal procedures
- Replaced compact fluorescent with low-mercury
- Reduced water consumption on existing fixtures
- Upgraded copying machines for better indoor environmental quality
- Additional parking for environmental preferecy transportation

- More points
  - Expanded measurement & verification
  - Ongoing recycling
  - Daylighting strategies

Brengel Benefits

- Integrated control system saved $225,000 during construction
- Lighting system consumes only .86 watts per sq. ft.
- 130,000 sq. ft. added -- with no additional maintenance personnel
- 35% reduction in operating costs
- $76,000 in annual energy savings

$4.2 Million Savings Over the Next 10 Years!
Sustainable Development Can Create a Competitive Advantage

- Paul von Paumgartten – Johnson Controls
- Michael Arny – National Geographic Society
- Greg Bell – JohnsonDiversey, Inc.

National Geographic Society
LEED Certification Case Study

Michael Arny
President
Leonardo Academy

Case Study Overview

- Introduction to National Geographic
- Vision for Creating Green Buildings
- LEED Certification Program
- NGS’s Performance Contract
- Cost/Benefit Analysis
Buildings for a Livable Future

Notes

National Geographic

- One of the world’s largest scientific and educational non-profit organizations
- Existing headquarter complex has four buildings

Green Buildings Vision

- Engineering Department challenge
- NGS vision for the new millennium
- 2000 Corporate Service goal
- Introduction to pilot program for LEED EB
- Johnson Controls selected as business partner

NGS Campus Green Building Adopted Operating Policies

- Site
  - Erosion control during site improvements
  - Hybrid vehicle parking and telecommuting
  - Green landscaping, storm and pest management
- Energy
  - Measurement & Verification plan
- Materials & Resources
  - Construction waste management
  - Resource reuse and recycled content policy
  - Certified wood
  - Wastewater treatment management
  - Contractor materials management and recycling policies
- Indoor Environmental Quality
  - Construction IAO management plan
NGS Performance Contract

- Modified RFP based on LEED requirements
- Partnered with Johnson Controls
- Performance Contract Highlights
  - Core processes - energy & water consumption
  - Established metrics for specific savings performance
  - Guarantees become responsibility of NGS in future
- Quarterly Review with Business Partner

Cost/Benefit Analysis

- Results align with NGS mission
- Tremendous savings
  - 10% savings in energy costs
  - $300,000 annual savings in operational costs
  - Lower water consumption
  - Lower waste disposal expenses
- Increased Market Value
  - $7 million investment increased real estate value by $24 million
  - Improved equity, credit rating, debt borrowing capacity

Steelcase Wood Products Plant
Grand Rapids, Michigan

- World’s First LEED-Certified Manufacturing Plant
- 800,000-square-foot facility, 700 workers
- 1.5 M gallons in annual water savings
- 70% reduction in VOC emissions
The Pentagon
Arlington, Virginia

- 6.5 million sq ft, 34 acre government facility
- Major renovation to integrate sustainable and secure operations
- Four projects registered with USGBC for LEED Certification

Boulder Community Hospital
Boulder, Colorado

- 265-bed acute care facility
- First LEED-Certified hospital
- Use of recycled materials in all possible areas
- Alternative vehicle transportation encouraged and supported

Key Bank
Cleveland, Ohio

- One of the nation’s largest bank based financial services company
- Locations throughout the country
- Organizational sustainable upgrades and operations
Bren School, UC  
Santa Barbara, California

- School of Environmental Science and Management
- Agreement provides training for environmental problem solving
- LEED Platinum Certified Building
- Greenest laboratory in America
- Variety of excellence in sustainability awards

City of Chicago  
Chicago, Illinois

- Industrial sustainability citywide rebuild program
- Green rooftop garden on top of City Hall
- DOE – Engine Company 46 and GSA – Area 1 are part of the LEED EB Pilot Program

Earning LEED for Existing Buildings Certification

JohnsonDiversey Global Headquarters

[LEED Certification Logo]
Why go for LEED Certification?

- Why a sustainable building?
  - Drives down operational costs
  - Increases occupant satisfaction
  - Increases asset values of facilities
- LEED provides the roadmap and the recognition

LEED’s Significance for JohnsonDiversey

- Environmental Leadership is 1 of 5 corporate business drivers.
- Regardless of design and construction, LEED-EB is the platform for operating buildings, sustainably.
- LEED-EB includes standards for green-housekeeping practices, chemical use and IAQ that can provide up to 25% of the certification points.
- Because of LEED’s wide recognition, customers call on us to help them understand and facilitate LEED certification.
- JohnsonDiversey has pioneered Healthy, High-Performance Cleaning, which includes LEED-EB criteria.

Company’s Sustainability Heritage

- The SC Johnson family of companies has a long history of commitment to sustainability.
- Practices embodied in company values called ‘This We Believe’:
  - Concern for environment
  - Concern for the community
  - Concern for employees
Environmental Leadership

- Mid-1970s, SCJ voluntarily eliminated use of all CFCs in aerosol products.
- Developed new technology and shifted market that led to Congressional ban of CFCs in the late 70s.

JohnsonDiversey
Global HQ

- Integrated design and construction process
- Commissioned to high environmental standards
- Contributed to development of national standards for environmentally responsible construction
- Completed before LEED-NC standards were launched
- Mandated to be built at or below market costs for a similar building with traditional construction

LEED-EB Gold Certification

- Indoor Environmental Quality
  - Healthy, High-Performance
  - Cleaning processes
  - Personal environmental controls at all workstations
  - CO2 monitoring
  - Use of natural daylight in more than 90% of occupied spaces
  - Line of site to outdoors from more than 80% of workspace
  - Innovative glare control
**LEED-EB Gold Certification**

- **Sustainable site**
  - 12 acres of restored wetlands and stormwater detention on 57-acre site
  - 30 acres of native prairie plants
  - Ongoing environmental site management

**LEED-EB Gold Certification**

- **Energy use**
  - Efficiency measures save $50,000 annually
  - Integrated building-automation, measurement & controls
  - Mixed-use facility (office and R&D labs) first to use ENERGY STAR® modeling

**LEED-EB Gold Certification**

- **Materials and Resources**
  - Rapidly renewable materials such as bamboo
  - More than 50% of site-generated waste is recycled
  - Use of very low VOCs
LEED-EB Gold Certification

- Water Use
  - Stormwater collected in detention ponds used for irrigation, saving 2 to 4 million gallons
  - Low-use fixtures throughout building

Commitment to Sustainability

- Live out heritage and corporate strategy for Environmental Leadership
  - Engaged with the USGBC and other environmental organizations
  - Contributions to developing standards
  - Continuous improvement

- Respond to customer needs and an emerging demand for safe, healthy high-performing buildings with products, services and solutions

- Offer our building as a ‘living laboratory’ and model for managing facilities in environmentally preferable ways

- Align with world-class suppliers and other partners in a constant delivery of environmental performance to the market

Notes
Abstract

In early 2004, Fluor Corporation implemented a chip and sensor based concrete maturity technology as a global standard practice in less than six months. Fluor’s corporate technology group learned about and piloted this technology in the FIATECH Smart Chips Project. The Smart Chips Project helps facility owners and EPCs leverage resources to implement commercial-ready or near-ready technology.

Since June 2003, the FIATECH Smart Chips Project has planned and conducted five realistic, in-field technology pilot studies and presented over a dozen online workshops with top academics, developers, and industry users. Smart Chips Project participants have used this collaborative learning and experience to accelerate implementation of valuable technologies.

In the implementation session, a panel of Smart Chips Project participants will share their experiences and discuss some promising new technology with construction industry application.

Plenary Session Presenter

Art Stout – Director, Capital Development Group, Intel Corporation

Art Stout joined Intel in 1979 and now manages both the design and construction process of Intel’s largest semiconductor wafer fab expansions in the U.S. and overseas. He also manages the strategies for design and delivery of new facility capital projects worldwide and examines best in class activity within both the research community and the marketplace. He is the author of the Project Triangle Principle, which explores the challenge of balancing continuous changes in scope, schedule, and budget. Stout, a registered engineer (California and Arizona), earned a degree in mechanical engineering from Arizona State University.

e-mail: art.a.stout@intel.com
Implementation Session Moderator

**Charles R. Wood** - Smart Chips Project Manager, FIATECH

Charles Wood has over 20 years of experience in capital project development planning and execution for both owner and contractor organizations, including more than 15 years in senior level management positions. Wood has led and supported professional teams in planning and executing large ($300 million) capital facility development projects. He earned a bachelor’s degree in construction technology from the University of Houston, an MBA and a master’s in accounting from Rice University, and a master’s in science and technology commercialization from UT Austin.

*e-mail: cwood@fiatech.org*

Implementation Session Participants

Ignatius Chan - Senior Scientist, ChevronTexaco Corporation
*e-mail: ichan@chevron.com*

Gary P. Chanko - Group Director, Fluor Corporation
*e-mail: gary.chanko@fluor.com*

Steven Glaser - Assistant Professor, University of California at Berkeley
*e-mail: glaser@ce.berkeley.edu*
The FIATECH Smart Chips Project, seed-funded by CII’s Breakthrough Strategy Committee in 2003, helps facility owners and EPCs leverage resources to learn about, plan for, adapt, and implement commercial ready or near-ready technology. In early 2004, Fluor Corporation implemented a chip and sensor based concrete maturity technology as a global standard practice. The corporate implementation, from beginning of pilot testing to global deployment, took less than six months. Fluor’s corporate technology group first learned about this technology and pilot tested it within the FIATECH Smart Chips Project.

Since its start in 2003, the FIATECH Smart Chips Project has planned and conducted five realistic in-field technology pilot studies of commercial ready technologies adapted to field construction and operations applications. Besides the concrete maturity technology, these pilots included: 1) commercial ready GPS technology to locate specific materials in laydown, 2) a RFID system to automate offshore materials and supply tracking, and 3) testing the capability of RFID technology to automate shipping and receiving of fabricated pipe and other highly metallic materials.

The FIATECH Smart Chips Project participants also collaborate on relevant construction technology developments through monthly online workshops with top academics, developers, and industry users. More than 50 Smart Chips workshop presentations have included: 1) extensive education in RFID technology and standards, 2) wireless networking technology and standards, 3) Global Positioning Systems (GPS) in civil construction application, 4) military logistics tracking systems, 5) concrete maturity monitoring systems, 6) micro-sensors in structural monitoring, 7) laser imaging, and much more.

By working as an industry group, the FIATECH Smart Chips Project participants have been able to leverage common resources, technology developer cooperation, and field experience to accelerate learning and implementation of valuable technologies.
The Smart Chips Project:
Collaborating for the Future

FIATECH Vision of an
Integrated and Automated Capital Projects Industry

Many companies are working or experimenting in this area.

This is the area where Smart Chips technology will take us.

The Intelligent Jobsite and Operating Facility

The Smart Chips Project
- Seed-funded by CII in 2002
- Technology pilots and education
What Are Smart Chips?

- **RFID** - Radio frequency identification
- **MEMS** - Micro electro-mechanical systems
- **Motes** - tiny networked sensor platforms

“Mote”

and more _ Global Positioning System (GPS), wireless networks, satellite communications

A way to radically improve productivity

FIATECH Smart Chips Sponsors

- Aramco Services
- Bechtel
- ChevronTexaco
- Fluor
- DuPont
- Jacobs
- Intel
- KBR
- Procter & Gamble
- Zachry

Collaborators:
- NIST
- Carnegie Mellon
- UT Austin
- University of Kentucky
- Tulane
- MIT Auto ID Center
- AIM Global

A Remarkable Success

In early 2004, Fluor implemented a chip and sensor based concrete maturity technology as a global standard practice.

The implementation took less than six months from beginning of pilot testing to global deployment.
Tracking Fabricated Pipe with RFID
• Error-free, real time pipe supply visibility.
• Automatically documents shipping/receipt.

Hosted by Fluor and Shaw Fabricators
Observation and report by UT Austin and Carnegie Mellon

Locating Tagged Material with GPS
• Rapid positive location of items in laydown.
• Increase craft productivity, prevent critical item loss.

Handheld gives location, bearing, distance.
Hosted by KBR on a BP project site.

Offshore Material Logistics with RFID
• Reduce lost crew time, critical item loss.
• Real-time visibility of a remote and complex chain.

Hosted by ChevronTexaco
Sponsor Value: 
Collaboration Costs Less

- Address high value construction industry problems together.
  - Good supplier cooperation
  - Low cost pilot technology
- Present large common market for technology developers.
  - Lower cost technology
  - Better support (standards)

Smart chips project membership costs less than one independent in-house pilot.

Sponsor Value: 
Collaboration Produces More

Smart Chips Online Workshops
Industry focus audience attracts:
  • Technologists
  • Construction academicians
  • User and pilot case studies

Relevant current topics:
  • RFID-construction issues
  • Industry-sponsored research
  • In-depth pilot updates

Smart chips project costs less than sending two people to one conference.

What’s Next?

Valuable opportunities are out there...

...What will you do with them?
Mote (ADXL202) Accelerometer

Why should you care...

...about successful collaboration in construction technology with FIATECH?

Intel Benchmark Study
Global Cost Comparison

If we can’t compete in the U.S. on labor costs, then we need to find another way!
The Smart Chips Project:
Collaborating for the Future

Implementation Session
Gary Chanko     Fluor
Ignatius Chan   ChevronTexaco
Steven Glaser   UC Berkeley
Charles Wood    FIATECH

The Smart Chips Project:
Collaborating for the Future

Visit the Conference Display
for a hands-on demonstration
of smart chip applications.
The FIATECH Smart Chips Project: Collaborating for the Future
Implementation Session:
Gary Chanko, Fluor
Ignatius Chan, ChevronTexaco
Steven Glaser, UC Berkeley
Charles Wood, FIATECH

Intel Benchmark Study
Global Cost Comparison

If we can’t compete in the U.S. on labor costs, then we need to find another way!

Productivity Growth
Growth in Real Output per Worker 1960-95

<table>
<thead>
<tr>
<th>Country</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>340%</td>
</tr>
<tr>
<td>Spain</td>
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<td>Canada</td>
<td>64%</td>
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<tr>
<td>United States</td>
<td>67%</td>
</tr>
<tr>
<td>New Zealand</td>
<td>39%</td>
</tr>
</tbody>
</table>
Waves of Technological Change

We need to invest in technology, innovation, and commercialization...and we need to invest wisely.

FIATECH Smart Chips
Sponsors

- Aramco Services
- ChevronTexaco
- DuPont
- Intel
- Procter & Gamble
- Bechtel
- Fluor
- Jacobs
- KBR
- Zachry

The FIATECH Smart Chips Project:
Collaborating for the Future

Implementation Session:
Gary Chanko, Fluor
Ignatius Chan, ChevronTexaco
Steven Glaser, UC Berkeley
Charles Wood, FIATECH
Field Implementation Studies of Smart Chip Applications: Two Success Stories

- Real Time Concrete Strength and Quality System
- RFID Technology for Tracking Fabricated Pipe

Use of the Concrete Maturity Method Construction of Industrial Facilities

- Advanced data loggers to accurately predict real time strength of concrete using the concrete maturity method
- Conducted under active project conditions by Fluor field personnel for the Amgen Opioid Program Project, Sunnyvale, CA
- Multiple concrete design mixes and pour types
- Pilot testing in parallel with traditional QC methods for comparison
What is Concrete Maturity?

- A proven, non-destructive, strength estimation technique
- Uses time and temperature measurements to determine the strength gain of in-place concrete
- Originally developed in the late 1940’s & early 50’s
- Accidents in the 1960’s resulted in further maturity research
- Interest increased in the 1980’s as companies looked for ways to accelerate construction
- Wide spread adoption in the U.S. over the last 10 years

Why Use Maturity Method?

- Accelerate Construction Schedules
- Reduce Field Hours
- Allow Earlier Form Removal
- Improve Quality Control
- Reduce Cylinder Break Costs
- Document Time/Temperature History

Great Results

- FIATECH Report: The Use of the Concrete Maturity Method in the Construction of Industrial Facilities: A Case Study, January 2004
  www.fluor.com
- Rapid results: Pilot to Global Deployment in less than Six Months
- Simple, Accurate, Reliable, Cost Effective, High Value
- Created Corporate Supplier Agreement with Technology Supplier
RFID Technology for Tracking Fabricated Pipe

- Two Phase Field Trials
- Phase One: test RFID read capability in static controlled field environment
- Phase Two: conduct trials of RFID technology in realistic dynamic application

Phase One Results

- Current active RFID technology works very effectively in a congested, metal intense construction field environment
- One reader sufficient to read all tags, when placed in a central location
- Proved RFID tags work around metal pipe for identification of spool pieces

Phase Two: Testing Through A Portal

- Is it possible to record tags on spool pieces loaded on a truck as the truck is driven through a portal?
- Technology and equipment furnished from Phase IV Engineering

FLUOR
**Tagging the Spool Pieces**

- Truck and trailer loaded with spool pieces
- Spool pieces with tags attached to the flange ends

**FLUOR.**

**Trailer Passing Through the Portal**

- Antenna locations circled in red

**FLUOR.**

**Phase Two Results**

- Able to write and read data on a tag.
- One reader sufficient to read all tags when placed in a central location.
- Able to pass load of tagged spool pieces through a portal and read all tags.
- Able to vary the load structure and tag placement and still read all tags.
- Developed a repeatable procedure for 100% read.
For more Information

FIATECH Report
Field Trials of RFID Technology for Tracking Fabricated Pipe
www.fiatech.org

RFID Journal, Jan 2004
Case Studies for RFID in Construction
www.rfidjournal.com

Notes

ChevronTexaco

The Gulf of Mexico Off-shore Materials Tracking Project and Other ChevronTexaco RFID Efforts

Ignatius Chan (ChevronTexaco)

Off-shore Materials Tracking Project

ChevronTexaco
Notes

ChevronTexaco Gulf of Mexico
Offshore Material Tracking Using RFID Tags

Project Team:
- ChevronTexaco
- FIATECH
- Technology consortium
- Supplier contacts for technology
- Phase IV Engineering
  - Providing RFID hardware
  - Programming for ChevronTexaco specific process
- Tulane University
  - Reporting — academic rigor and objective view

PROJECT OBJECTIVE
Understand the factors and feasibilities of using RFID technology in tracking the movement of materials from the Venice shore base to the Main Pass 41 field.

Problems Identified:
- Items unaccounted for at the base
- Items not delivered to the platform
- Items not loaded on the boat
- Items misplaced in yard/warehouse
- Items disappeared on route
- Items unaccounted for (no confirmation of receipt offshore)
- Items delivered to the wrong platform

Scope:
- Tracking of material shipments to and from the Venice shore base terminal to the Main Pass 41 DLM facility using RFID technology.
- Hardware: 60 RFID tags, 2 handheld readers
- 1 month study; parallel to existing process
- Checkpoints in the process
- Observations at each location
Learnings about the RFID technology

The fundamental RFID technology performed well. Both the hardware and software were easy to use. They operated with no problem in the marine weather/environment.

The RFID technology appears to suit our needs better than bar codes if we want to automate the shipping and receiving process.

Most of the people involved were able to visualize the eventual benefits relating to their own specific jobs.

Learnings about the Work Process

Need to closely couple the work process and the technology in order to successfully realize benefits.

More initial training was required before starting the pilot.

The technology forced a more stringent process.

The work process design must include steps to resolve exceptions and determine whether there is an error in shipping or an instrumental failure.

Other Learnings

The best case is to have the vendor tags the items and send us the electronic manifests. The benefit is the greatest when the technology is incorporated furthest upstream in the supply chain.

RFID makes it easy to provide accountability (fast, accurate). Manual process of accountability is tedious and they skip it.
Future Applications of RFID and Related Technologies in ChevronTexaco

Inventory Management and Tracking
- Warehouse for internal operations
- Supply Chain operations for Marketing

Safety
- Tracking of hazardous materials
- Monitoring in hazardous environments

Maintenance / Reliability
- Monitor equipment performance and usage
- Manage service schedules and prevent incidents

Key Issues for ChevronTexaco Technology Implementation

Acceptance from business units: Operating units need to see clearly value drivers and benefits

Infrastructure Development: Information needs to be interfaced with legacy IT systems

Relevant Sensors: Applications depend on parallel sensor technology advances

Wireless networks: Future of industrial automation

New Sensor Technologies for Monitoring the Civil Systems

Application
Science

Prof. Steven Glaser (glaser@ce.berkeley.edu)
and a cost of thousands
Imagine an
- intelligent
- self-networking
- asynchronous
- wireless
- adaptive
- dynamically reprogrammable
- cheap
- small

Sensing P
- a "MOTE"

Dense arrays of Motes are clustered around key structural elements.
- damage occurs locally, affects globally

During the normal life of the building the structural response to ambient excitation is monitored by 1000's of Motes
- too much data to send back to traditional server
- we want information, not data

Imagine multiple Mote networks as part of a global adaptive feedback system
Imagine this same organic system applied to an infinite family of applications.

First Mote/TOS-Based Commercial Product!!

Contract with Toshiba for monitoring of nuclear power plant turbo-pump bearings.

Motes are a Platform for an "Infinite" Variety of Sensors:
- MEMS Infrared Gas Sensor (IRG)
- Digital relative humidity sensor (RH)
- 3-D 24-bit Accelerometer (3D2)
- 3-D Accelerometer (AE2015)
- 12-channel GPS Mote (DGPS)

Notes
What is MEMS?

- MEMS is Micro ElectroMechanical Systems
- Integrated circuit processing + micromachining
- Sensors, Motors, Structures, Electronics Systems, on a micron (μm?) to centimeter scale

e.g. Synthetic Insects
(Smart Dust with Legs)

Goal: Make silicon walk.

MEMS Inertial Sensor

- Micro Electro Mechanical Systems
- 3-D accelerometers
- 3-D Rate Gyros
- 13+ bit digitization

Self-Assembling, Redundant Networking

* Active Dynamic Route Determination
* Radio cell structure very unpredictable
* Builds and maintains good breadth-first forest
* Each node only records own state and parent(s)
Applications
- Structural monitoring
- Fire fighting
- Archaeological preservation
- Natural hazards
- Seismic site response
- New projects

"It appears to be some kind of wireless technology."

Dense Instrumentation of Full Scale Structure
- Performed through 12+ strong shockings
- 100+ channels of acceleration data per test

30 Metal on
Dense structural

Wiring for traditional structural instrumentation

Notes

Our wireless Mote

Electromatics
Seismograph
= $5k each

Traditional piece
Accelerometer
(Wisconsin)
Mote (ADXL202) vs. Traditional Piezo Accelerometer

Dense-Pak™ Sensing Allows Quantification of Damage

Current Application:

Instrument the Golden Gate Bridge!

* Have a prototype structural health monitoring system up and running within a year

* Culler, Fenves, Glaser
Notes
Thanks!

Prof. Steven D. Glaser
Civil Engineering
University of California, Berkeley
glaser@ee.berkeley.edu
512/642-1264

The Boss

Tracking Fabricated Pipe w/RFID
Error free real time pipe supply visibility
Automatically documents shipping/receipt

Hosted by Fluor and Shaw Fabricators
Observation and report by U Texas, Carnegie Mellon

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Offshore Material Logistics w/ RFID

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Hosted by ChevronTexaco

FIATECH Smart Chips Project — Collaborating for the Future

FIATECH Smart Chips Project
Leverage Shared Experience

Address high value construction industry problems together
- Good supplier cooperation
- Low cost pilot technology

Present large common market for technology developers
- Lower cost technology
- Better support (standards)

SMART CHIPS PROJECT MEMBERSHIP COSTS
LESS THAN ONE INDEPENDENT IN-HOUSE PILOT

FIATECH Smart Chips Project
Leverage Shared Learning

Smart Chips Online Workshops
Industry focus audience attracts:
- Technologists
- Construction academics
- User and pilot case studies

Relevant Current Topics
- RFID construction issues
- Industry sponsored research
- In-depth pilot updates

THE SMART CHIPS PROJECT COSTS LESS THAN SENDING TWO PEOPLE TO ONE CONFERENCE
The FIATECH Smart Chips Project: Collaborating for the Future

Implementation Session:
Gary Chanko, Fluor
Ignatius Chan, ChevronTexaco
Steven Glaser, UC Berkeley
Charles Wood, FIATECH

Productivity Gap
Construction lags behind the economy

This is not just "the industry," this is you!
Abstract

Benchmarking has matured to CII Best Practice status – a documented and structured process with quantifiable benefits. Attendees will learn about the value member organizations are gaining through using the CII online Benchmarking Toolkit.

The Toolkit will be demonstrated online in the implementation session. Also, a panel will discuss both the challenges of implementation and the value obtained from the benchmarking process.

Plenary Session Presenter

Robert A. Herrington – Manager of Quality, Southern Region, Jacobs Engineering Group

Bob Herrington has more than 37 years of experience in the chemical and petroleum refining industries, with 30 years in managerial positions with Union Carbide and Jacobs. At Union Carbide, he managed numerous multi-site and multi-functional manufacturing and engineering programs. At Jacobs, he has made significant contributions in benchmarking as well as work process improvement, customer satisfaction, and “virtual office” implementation—all focused on client value. At CII, he has been active with the CII Benchmarking & Metrics program since 1996 and is co-chair of the committee for 2004. Herrington earned a mechanical engineering degree from the University of Arkansas.

e-mail: bob.herrington@jacobs.com
Implementation Session Moderator

Frank K. Suhan - Project Management Consultant and Manager of Project Controls, Johnson Controls, Inc.

Frank Suhan has 22 years of experience involving many aspects of engineering and construction management, estimating, quality assurance, code compliance, facility commissioning services, and government facilities operations and management. He also has extensive experience in strategic planning, program development, and conceptual estimating in all types of project delivery systems. A Six Sigma Black Belt, Suhan has led diverse teams on business improvement projects applying Six Sigma methodologies. He holds a bachelor's degree in civil engineering, construction management, and structural engineering from Michigan Technological University.

e-mail: frank.k.suhan@jci.com

Implementation Session Participants

Dean Ergenbright - Program Analyst, U.S. Department of State
e-mail: ergenbrightde@state.gov

Harold L. Helland - Manager, Project Engineering, Abbott Laboratories
e-mail: harold.helland@abbott.com

Robert A. Herrington - Manager of Quality, Southern Region, Jacobs
e-mail: bob.herrington@jacobs.com

James H. Jones - Project Manager, 3M
e-mail: jhjones@mmm.com

Grant G. Landry - Manager, Business Development, Jacobs
e-mail: grant.landry@jacobs.com

Stephen R. Thomas - Associate Director, CII
e-mail: sthomas@mail.sthomas@mail.utexas.edu
Other Knowledgeable Points of Contact

Ron Beechey  Scheduling Specialist, Dofasco, Inc.  
* e-mail: ron_beechey@dofasco.ca

Gertraud F. Breitkopf – Senior Program Manager, U.S. General Services, Administration  
* e-mail: gertraud.breitkopf@gsa.gov

Tom Butts – Manager, Southwest Operations, Lockwood Greene  
* e-mail: tbutts@lg.com

* e-mail: robert.chapman@nist.gov

Jean Childers – Accounts Operations Manager, AMEC, Inc.  
* e-mail: jean.childers@amec.com

Gregory D. Clum – Manager of Project Controls, Black & Veatch Corporation  
* e-mail: clumgd@bv.com

William G. Cooley, Sr. – Senior PMP Capital Effectiveness Engineer, U.S. Steel  
* e-mail: wgcooley@uss.com

Deborah L. DeGezelle - Systems Analyst, Construction Industry Institute  
* e-mail: debdeg@mail.utexas.edu

Dean Ergenbright – Program Analyst, U.S. Department of State  
* e-mail: ergenbrightde@state.gov

Donald A. Gaddy – Construction Safety & Health Manager, Engineering & Construction Services, Southern Company Generation & Energy Marketing  
* e-mail: dagaddy@southernco.com

James B. Gibson – Vice President, Projects, ALSTOM Power Inc.  
* e-mail: james.b.gibson@power.alstom.com

Kevin J. Gierc – Director, Project Controls, Dick Corporation  
* e-mail: kgierc@dickcorp.com
Benchmarking as a Best Practice

Charles M. Green - Engineering Specialist, Aramco Services Company
e-mail: charlie.green@aramcoservices.com

Carl G. Gretzinger - Facilities Project Planner, Project Planning Department, General Motors Corporation
e-mail: carl.gretzinger@gm.com

David G. Hile - Operations Manager, Fru-Con Construction Corporation
e-mail: david.hile@frucon.com

Howard Kass - Senior Facilities Engineer Program Manager, National Aeronautics & Space Administration
e-mail: howard.kass@nasa.gov

John E. Kurth - President, Aker Kvaerner Pharmaceuticals
e-mail: john.kurth@akerkvaerner.com

John M. Mellin - Manager, Business Planning & Performance, GlaxoSmithKline
e-mail: john.m.mellin@gsk.com

Michael S. Mitchell - Director, Project Management Office, Refining & Chemical Industry Center, Emerson Process Management
e-mail: mike.mitchell@emersonprocess.com

Wladimir Norko - Senior Engineer, Technical Policy Branch, U.S. Army Corps of Engineers
e-mail: walt.norko@usace.army.mil

Mark T. Owens - Director, Global Facilities Delivery, Eli Lilly and Company
e-mail: mto@lilly.com

David M. Perkins - Project Manager, Rohm and Haas Company
e-mail: david_m_perkins@rohmhaas.com

Derek C. Ross - Associate Director, Construction, Office of Facilities Engineering & Operations, Smithsonian Institution
e-mail: rossde@opp.si.edu

Michael J. Scholz - Engineer/Estimator, Kiewit Industrial Company
e-mail: michael.scholz@kic.kiewit.com

Danny Scott - Supervisor, Engineering Project Controls, BE&K, Inc.
e-mail: scottd@bek.com
James G. Slaughter – President, S&B Engineers and Constructors Ltd.
    e-mail: jgsjr@sbec.com

John H. Stuart – Leader, Enterprise Project Management Office, NOVA Chemicals Corporation
    e-mail: stuartj@novachem.com

John Tato II – Director, Project Evaluation & Analysis Division, U.S. Department of State
    e-mail: tato-iij@state.gov

    e-mail: steven.warnock@wgint.com
Benchmarking as a Best Practice

Plenary Slides

Benchmarking as a Best Practice

CII Annual Conference
Vancouver, British Columbia

My Objectives

• Discuss Value of Benchmarking
• Establish Ease of Use
• Gain Your Participation

Benchmarking Is...

• measuring yourself against the best relative to:
  - Performance Metrics
    • Cost
    • Schedule
    • Safety
    • Rework
    • Changes
  - Best Practice Use
  - Productivity
• planning and executing your improvement journey to “best in class.”
Benchmarking as a Best Practice

Part of a Continuous Improvement Journey

- Select Implementation Tools
- Conduct Training
- Implement Best Practices
- Measure Results
- Compare to Competition
- Identify Opportunities to Improve

The Value of Benchmarking

Project Cost Performance – Owners

Total 372 Projects & Total Project Cost $24.64 Billion

The Value of Benchmarking

- Comprehensive research has proven its value.

What gets measured... gets improved!
The Value of Benchmarking

- **Improves** project & company performance when used as an ongoing measure
- **Establishes** improvement goals based on external/competitive benchmarks
- **Enables** your company to understand & achieve “best in class” performance

Thought Break

Please ask yourself the following ........

- Have we planned an effective continuous improvement journey?
- Are we benchmarking?
- With CII?

CII Benchmarking Participation

- CII Benchmarking & Metrics participation
  - 1,200+ projects input in 8 years
  - Worth approximately $60 billion
  - Over 70 owners and contractors have participated

- New / re-energized companies benchmarking:
  - 3M
  - Amvil Corp.
  - BE&K
  - CDI Engineering Group
  - Eli Lilly & Co.
  - Foster Wheeler USA Corp.
  - General Motors Corp.
  - General Services Admin.
  - GlaxoSmithKline
  - Johnson Controls
  - Proctor & Gamble
  - Rohm & Haas
Benchmarking Is Easy at CII

Online

- Large Project questionnaire
- New Small Project questionnaire
- Implementation Toolkit

Implementation Toolkit

- Online http://cii-benchmarking.org/toolkit/main.cfm
- Assists in the implementation of Benchmarking
  - Training slides
  - Project selection criteria
  - Printable questionnaires
  - Executive level and project level presentations demonstrating the value of benchmarking

Presentations Show the Value of Benchmarking
Benchmarking as a Best Practice

Summary

- Benchmarking ......  
  _ best practice  
  _ value to your bottom line  
  _ guide to “best in class” performance  
  _ easy at CII  
  _ requires your participation  
- What gets Measured Gets Improved !!!!

Learn More

- Visit the Conference Display Area  
- Join our implementation sessions  
- Get involved!

Benchmarking  
Implementation Sessions

Benchmarking as a Best Practice
1. Learn how to incorporate benchmarking into your project processes  
2. See how member companies are gaining value through benchmarking  
3. Review CII’s Benchmarking Toolkit – the implementation resource for CII benchmarking  
4. Hear testimonials from companies using CII benchmarking  
5. Get an update on the status of CII benchmarking  

Notes
Benchmarking Implementation Sessions

Benchmarking Productivity

1. Report out on CII Productivity Metrics Retreat
2. Status on construction productivity data collection
3. Review CII engineering metrics definitions
4. Discuss issues of benchmarking productivity
5. Learn how to get started
Benchmarking as a Best Practice
Implementation Slides

Benchmarking As A Best Practice
CII Annual Conference Workshop
Vancouver, British Columbia

Objectives

• Define Benchmarking
• Benefits of Benchmarking
• Incorporating Benchmarking in Your Organization
• Tools & Training
• Closing Remarks
• Questions and Discussion

Panel Members

• Frank Suhan – Johnson Controls Inc.
• Grant Landry – Jacobs
• Dean Ergenbright – U.S. Dept. of State
• Harold Helland – Abbott Laboratories
• James Jones – 3M
What is Benchmarking

- Performance Metrics
- Best Practice Use
- Productivity Metrics
- Process Improvement

The Value of Benchmarking

Project Cost Performance - Owners

The Value of Benchmarking

Contractor Cost Performance
(Project Cost Growth)

By Age of Membership
Benefits

- System for Measuring Project Performance
- Enables Process and Performance Improvement
- Guide to Best in Class Performance

Incorporating Benchmarking

How do you incorporate Benchmarking into your corporate culture?

3M Journey
Johnson Controls Journey

BENCHMARKING AT JCI

Measure, Assess, & Improve
June 01, 2004
Johnson Controls Vision

- Measure and improve our performance and increase customer satisfaction on high profile projects
- Quantify performance across the project lifecycle
- Gain recognition as a company that delivers projects with world class performance as compared to our peer group

Value

- Benchmarking can prevent poor performance when used as an ongoing measure
- Allows our corporate culture to learn what is possible outside of our current belief system
- Enables JCI to achieve breakthroughs in performance

JCI Maturity Model
How Information is Compiled

- JCI input (Area and PMO participation)
- CII (Construction Industry Institute) member company input
- Analysis by CII in conjunction with the University of Texas

Sampling of CII Company Members (Owners)

- General Motors
- Eli Lilly
- Proctor & Gamble
- GlaxoSmithKline
- DuPont
- The Dow Chemical Company
- U.S. Army Corps. of Engineers

Sampling of CII Company Members (Contractors)

- Johnson Controls Inc.
- Honeywell International
- Walbridge Aldinger Company
- Fluor Daniels
- Washington Group International
- Black & Veatch
- M.A. Mortenson Company
- Turner Construction Company
The Process

- Area project teams possess all of the project information that is required to benchmark
- JCI Project Management Office (PMO) will input all data into the system through an interview process with Project Managers
- Projects teams receive reports on performance
- Summary of project and corporate performance will be published by CII
- All information gathered is confidential

Levels of Use

<table>
<thead>
<tr>
<th>Purpose for Using CII’s Benchmarking Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project System Improvement</td>
</tr>
<tr>
<td>Feedback on more than one project</td>
</tr>
<tr>
<td>Feedback on a single project</td>
</tr>
<tr>
<td>Productivity</td>
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<tr>
<td>Eng. Or Cost</td>
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</tbody>
</table>

Why Should a Project Manager Care?

- Understand your own performance across your portfolio
- Objective measurement of performance
- Identify areas for personal improvement
- Provide project performance information to management
- Gain management recognition on high profile projects
We need your HELP!!!!!

- The quality of the reports are directly related to the quality of the information input
- The more projects that we input with quality data will yield a statistically significant report

Benchmarking Will Allow JCI to...

- Accurately analyze, improve, and DOMINATE our business!

Status of JCI Benchmarking

- In testing phase
- Have selected a sampling of completed projects
- Six projects submitted to date
- Benchmarking is EASY, 2-1/2 hours per project
Path Forward

- Identify projects for benchmarking early in the sales phase
- Continue to input completed projects
- CII small projects database available to member companies October 2003

Toolkit


- Assists in the implementation of Benchmarking
  - Training slides
  - Project selection criteria
  - Printable questionnaires
  - Executive level and project level presentations demonstrating the value of benchmarking
Training

- Held 3 times per year around the U.S.
  - Online training in development
- Participants gain an understanding of the metrics and their definitions
- Assures data is collected consistently and accurately
- Instruction on use of the online system
- Review of the small and large project questionnaires
- Demonstrate project and industry reports and their use in the improvement process
- Discussion on how Benchmarking is part of the Continuous Improvement Process

Summary

- Benchmarking is a Best Practice
- Benchmarking adds value to your organization and your bottom line
- Benchmarking is a guide to best in class performance
- Benchmarking requires your participation
- What gets Measured Gets Improved !!!!

Questions & Discussion
Building HIV/AIDS Infrastructure in Uganda
Case Study: Pfizer

Abstract

A critical element of a large-scale HIV/AIDS program is creating infrastructure for program delivery in the developing world. The recently constructed Infectious Diseases Institute (IDI) in Kampala, Uganda, is an example.

The plenary presentation will demonstrate that a comprehensive pre-project planning process was critical. In the implementation session, CII’s Pre-Project Planning Handbook will be the focus. Key members of the IDI owner-contractor project team will share experiences, lessons learned, and data exchange.

Plenary Session Presenter

Donna J. Ryan-Rose – Senior Manager, Project Support Team, Pfizer Global Engineering

Donna Ryan-Rose helps develop, promote, and maintain project management tools that are consistent, efficient, and cost effective across the company. Her previous experience at Pfizer includes project management for commercial and pharmaceutical research capital facilities and facilities maintenance. She holds a bachelor’s degree in mechanical engineering from The Catholic University of America, an MBA from the University of Rhode Island, and a master’s in civil engineering from UT Austin.

e-mail: rose@pfizer.com
**Implementation Session Moderators**

**Barbara Lawson** – Project Director for Global Programs, Pangaea Global AIDS Foundation

Barbara Lawson joined Pangaea in 2001 and is currently responsible for the foundation’s role as fiscal administrator of the Infectious Diseases Institute at Makerere University, Uganda. She previously served in administration and finance posts at California State University-Monterey Bay and at Marin Community Foundation. She also is the former chief financial officer at the Pacific Stock Exchange, San Francisco. Lawson earned a bachelor’s degree in English from UC Santa Barbara and an MBA from UC Berkeley.

*e-mail: blawson@sfaf.org*

**Donna J. Ryan-Rose** – Senior Manager, Project Support Team, Pfizer Global Engineering

*e-mail: rose@pfizer.com*
Building HIV/AIDS Infrastructure in Uganda

Plenary Slides

Notes

Application of the Pre-Project Planning Process to the Construction of an HIV/AIDS Clinic in Kampala, Uganda

Pre-Project Planning Handbook
CII Implementation Resource 39-2
HIV/AIDS in Africa

- Worldwide, 40 million people live with HIV.
- Two-thirds live in Sub-Saharan Africa.
  - (20.6 million in 2003)
- In 2003, new HIV cases in Sub-Saharan Africa: 3 - 3.4 million
- Prevalence rates: 40 percent

Uganda

- About the size of Oregon
- 25.8 million people (2003 UN)
- 1890 - 1962: British Colony
- 1962 - 1986: unrest
- Avg. annual income: U.S. $260 (World Bank, 2001)
- 82%: agriculture, 13%: services, 5%: industry
- Adult prevalence rates: 1992: 30 percent, 2000: 8 percent
- Life expectancy: 42 years

“When planning for a year, plant corn. When planning for a decade, plant trees. When planning for life, train and educate people.”

Anonymous (Chinese Proverb)
Major Stakeholders

- Pfizer Foundation $11 million grant
- Pfizer Inc.
- San Francisco AIDS Foundation (SFAF) Pangaea Global AIDS Foundation
- Makerere University/Faculty of Medicine
- Academic Alliance for AIDS Care in Africa

Project Goals

- Increase access to medical care
  - Expand the existing clinic
  - Construct state-of-the-art clinical care facility
- Train healthcare professionals
- Support prevention counseling
- Capacity Building
  - Infrastructure
  - Administrative
  - Operational

Infectious Diseases Institute

- Clinic Area: 13,400 sf
- Lab Area: 5,600 sf
- Administrative/Training Area: 3,600 sf
- Gross Area: 28,900 sf
Building HIV/AIDS Infrastructure in Uganda

Project Challenges

Infrastructure
- Commercial
- Legal
- Technical
- Utilities

Project Challenges
- Economic risk
- Political stability
- Means & methods
Building HIV/AIDS Infrastructure in Uganda
Implementation Slides

Building HIV/AIDS Infrastructure in Uganda

- Donna Ryan-Rose, Pfizer Global Engineering, Pfizer Inc.
- Barbara Lawson, Pangaea Global AIDS Foundation

Application of the Pre-Project Planning Process to the Construction of an HIV/AIDS Clinic in Kampala, Uganda

Pre-Project Planning Handbook
CII Special Publication 39-2

Notes
Presentation Outline

1. Introductory Comments
2. Pre-Project Planning Process
   - Application
   - Challenges
   - Lessons Learned
3. Q & A

"Proper prior planning prevents poor performance"

Anonymous

THE PRE-PROJECT PLANNING PROCESS

Select Task

Define Scope

Project Pre-Project Planning Plan

Analyze Technology

Evaluate Alternatives

Develop a Project Definition Package

Determine Whether to Proceed with Project
Organize for Pre-Project Planning

Select Team

Draft Charter

Prepare Pre-Project Planning Plan

Organize for Pre-Project Planning

Organize for Pre-Project Planning

Select a Team

Membership on the team is fundamentally a function of organizational participation, and required attributes of individuals so that the team may accomplish its charter.

Strategic Team:
- Major Stakeholders
- Policy Foundation
- AIDS Initiative
- University of Mulago
- Makerere University Faculty of Medicine
- Academic Alliance for AIDS Care in Africa
- Training Team
- SPRING Uganda, Global AIDS Foundation
- Prizer Blood Engineering
Organize for Pre-Project Planning
Draft Charter

Defining team mission,
authority,
responsibilities and
accountability.

Organize for Pre-Project Planning
Project Goals

- Increase Access to Medical Care
  - Expand the existing clinic
  - Construct State-of-Art Clinical Care Facility
- Training of Healthcare Professionals
- Support Prevention Counseling
- Capacity Building
  - Infrastructure
  - Administrative
  - Operational

Organize for Pre-Project Planning
Prepare the $P^3$ Plan

The pre-project plan is a
formulation and documentation of
the methods and resources
available.
Organize for Pre-Project Planning
Challenges

- Simultaneous execution of:
  - Prepare the P³ Plan
  - Select the Project Alternatives
- Phased development of the project team
  - Stakeholder alignment
  - Managing team dynamics
  - Definition of roles & responsibilities

Organize for Pre-Project Planning
Lessons Learned

- Alignment of multiple stakeholders
- Managing organizational diversity
  - Defining roles and responsibilities
- Managing the geographic diversity
- Dedicate time and resources to communication

Select Project Alternatives

- Analyze Technology
- Evaluate Site(s)
- Prepare Conceptual Scopes and Estimates
- Evaluate Alternatives
Select Project Alternatives
Analyze Technology

Asses available technologies in relation to company needs and constraints.

Select Project Alternatives
Analyze Technology

- Lab Design
  - Functional Requirements
  - Equipment Requirements
  - Lab Layout
  - Building Infrastructure Requirements
- Information Technology
  - Hardware Requirements
  - Software Requirements
- Utilities/Building Infrastructure

Select Project Alternatives
Evaluate Sites

Assessment of relative strengths and weaknesses of alternative locations to meet the teams requirements.
Building HIV/AIDS Infrastructure in Uganda

Select Project Alternatives
Evaluate Sites

Select Project Alternatives
Evaluate Site
- Existing Technical Infrastructure
  - Land ownership
  - Geotechnical Conditions
  - Utilities Infrastructure
    - Availability
    - Reliability
  - Professional Services
    - Availability
    - Level of Development
  - Construction Means & Methods
    - Skill level
    - Level of Development

Select Project Alternative
Prepare Conceptual Scopes & Estimates

Provide a reasonable order-of-magnitude estimate of capital costs, using preliminary scope information and early estimating methods.

Evaluate Alternatives
Develop a complete picture (cost benefits, economics etc.) of each alternative so a valid comparison can be made.
Select Project Alternatives

Prepare Conceptual Scopes & Estimates
Evaluate Alternatives

➢ Identify Operational & Functional Program Requirements
➢ Comply with Local Codes
➢ Incorporated Industry Best Practices
➢ Balance Capital Cost with Life Cycle costs
➢ Positive impact on Local Economy
➢ Capacity building
➢ Culturally appropriate
➢ Develop project budget

Select Project Alternatives

Prepare Conceptual Scopes & Estimates
Evaluate Alternatives

➢ Facility Functional Summary
  ➢ Clinic: 15 Exam Rooms=200 outpatients per day.
  ➢ Training: 100 health care workers per year
  ➢ Lab: Lab testing support for 30% - 50% of outpatients (100 patients/day)
➢ Basis of Design
➢ Project Budget

Select Project Alternatives

Challenges

■ Managing Stakeholder Expectations
  • Cost
  • Schedule
■ Availability of reliable cost data
■ Local knowledge of means & methods
Building HIV/AIDS Infrastructure in Uganda

Select Project Alternatives
Lessons Learned
- Project Planning Due Diligence
- Managing Stakeholder Expectations
  - Process Education
  - Project Cost
  - Project Schedule
- Communication
- Local Representation

Develop a Project Definition Package
- Analyze Project Risks
- Document Project Scope and Design
- Define Project Execution Approach
- Establish Project Control Guidelines
- Compile Project Definition Package

Develop a Project Definition Package
Analyze Project Risks
- Technical Infrastructure
  - Professional Services
    - Availability
    - Level of Development
  - Construction Means & Methods
    - Skill level
    - Level of Development
  - Utilities Infrastructure
    - Availability
    - Reliability
    - Facility Sustainability
Develop a Project Definition Package
Analyze Project Risks

- Project Execution
  - Local experience, International systems
  - Multiple Stakeholder
  - Organizational Diversity
  - Geographic Diversity: 3 continents, 11 time zones
  - Procurement Logistics

Develop a Project Definition Package
Analyze Project Risks

- Commercial Infrastructure
  - Banking System
  - Manufacturing Base
  - Shipping/Storage/Warehousing

- Legal Infrastructure
  - Contract Law
  - Legislative Environment

Develop a Project Definition Package
Analyze Project Risks

- Economic Risk
  - Exchange rate
  - Import/Customs/VAT
  - "Deep Pocket" Syndrome
  - Non-value Added Fees

- Political Risk
  - Individual vs. systemic
Building HIV/AIDS Infrastructure in Uganda

Infrastructure Development Challenges

- Sociological Issues
  - Economics of Scarcity
  - Explorer vs. Settler Syndrome
  - “Do Gooder” Syndrome
  - “Local” Connection
  - Now vs. “Now-Now” vs. “Now-Now-Now”
  - Regional Diversity

Develop a Project Definition Package

- Document Project Scope & Design
  - Clearly define and communicate the basic requirements and objectives of the project.

- Define Project Execution Approach
  - Clearly define the key elements of “how” a project will be executed along with the procedures, methods, and resources required by the project execution.

- Establish Project Control Guidelines
  - Clearly define the processes for monitoring, evaluating, and adjusting the project execution as the project performance is compared to the project plan.

- Compile Project Definition Package
  - Summary of the project information

Develop a Project Definition Package

- Document Project Scope & Design
  - Revised Basis of Design & O&M Budget

- Define Project Execution Approach
  - “GMP Design-Build” process executed in 2 phases
  - Steering Committee: contract T&C, strategic planning
  - Project Committee: tactical project management
  - Pangaea Site Presence with Technical Consultants

- Establish Project Control Guidelines
  - International Federation of Consulting Engineers (FIDIC) Contract template

- Compile Project Definition Package
  - Library of documents
Develop a Project Definition Package
Challenges

- Identifying "next phase" resources
- Managing Stakeholder Expectations
- Communications

Develop a Project Definition Package
Lessons Learned
- Local input critical
- Capacity and sustainability planning need to begin early
- Continuity in project staff is critical
- Project Goals & Scope Definition
- Communication

The Pre-Project Planning Process

- Organize for Pre-Project Planning
- Select Project Alternatives
- Develop a Project Definition Package
- Decide Whether to Proceed with Project
Project Goals

- Increase Access to Medical Care
  - Expand the existing clinic
  - Construct State-of-Art Clinical Care Facility
- Training of Healthcare Professionals
- Support Prevention Counseling
- Capacity Building
  - Infrastructure
  - Administrative
  - Operational

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Project Goals

- Increase Access to Medical Care
  - Expand the existing clinic

- Training of Healthcare Professionals

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Project Goals

- Increase Access to Medical Care
  - Expand the existing clinic

- Training of Healthcare Professionals

- 3,800 patients registered by 12/03
- 1,700 patient visits per month
- 300 new patients per month
- 48 physicians trained
Project Results

- Completed within budget
- Minimal schedule delay
- High levels of stakeholder satisfaction
- Safety Performance: 250,000 without a Lost Time Accident, 5 first aid incidents

Sustainability Issues

Project Lessons Learned

- Implementation of the Vision of the End User
- Flexible Funding
- Dedicate time & resources to communication
- Create & follow detailed business plan
- Commitment to build local capacity & sustainability

Project Lessons Learned

- Build a transparent financial & management plan
- Project controls process
- Project resourcing
- Rigorous pre-project planning & project management plan
- Clarification of roles & responsibilities
- Adjust timeframes & expectations to fit resource limited environment
Infectious Diseases Institute
Faculty of Medicine
Makerere University
Kampala, Uganda
Abstract

How quickly companies can get back to “business as usual” after a flood, a fire, a tornado, or a terrorist attack depends on an investment in planning today. Planned business continuity, including training and exercises, reassures the staff, customers, and suppliers that the firm will be open for business after a major disaster. In so doing, companies will be planning effectively for sustainable development, which supports the community, the employees, and the nation.

Speaker

Joe M. Allbaugh – President & CEO, The Allbaugh Company

Joe Allbaugh formulates corporate strategies to expand competitive advantage for private sector clients. As the former Director of the Federal Emergency Management Agency (FEMA) during 2001-2003, he managed 2,500 employees and an annual budget of $3 billion. After the September 11, 2001, terrorist attacks, Allbaugh coordinated the Federal government’s $8.8 billion response and recovery effort. He was also a founding member of the Homeland Security Advisory Council. Prior to his presidential appointment at FEMA, he was the national campaign manager for Bush-Cheney. Before that, he served as chief of staff to then-Governor Bush. Allbaugh holds a bachelor’s degree in political science from Oklahoma State University.

e-mail: joe.allbaugh@theallbaughcompany.com
The Corps of Engineers’ Role in Rebuilding Iraq
Keynote Speaker: Gen. Robert L. Davis, U.S. Army

Abstract
General Davis will discuss the role of the Corps of Engineers in supporting the Coalition Provisional Authority and the new government of Iraq. Having spent six months in Iraq from June through December 2003, he assisted in setting up the Project Management Office. Today the Corps of Engineers continues to oversee military construction for multi-national forces in Iraq as well as providing construction services to the Project Management Office for restoring essential services and facilities as part of international efforts to rebuild Iraq.

Speaker
Brigadier General Robert L. Davis - Commander and Division Engineer of the Pacific Ocean Division, U.S. Army Corps of Engineers

Brigadier General Robert L. Davis is responsible for engineering design, construction, and real estate management for the Army and Air Force in Hawaii and Alaska and for all Department of Defense agencies in Japan, Korea, and Kwajalein Atoll, Marshall Islands. His division administers the Corps’ federal water resource development and regulatory programs in Alaska, Hawaii, American Samoa, Guam, and the Northern Mariana Islands. He deployed to Iraq for six months during Operation Iraqi Freedom and served as Commander, Iraq Provisional Command, Baghdad. He has been with the Corps of Engineers since 1974, and has been awarded the Legion of Merit (five times), the Bronze Star Medal (twice), and the Parachutist and Air Assault badges. General Davis earned a degree in industrial engineering from Auburn University, a master’s in operations research from Georgia Tech, and also is a graduate of the Army Command and General Staff College and the Air War College.

e-mail: larry.davis.bg@pod01.usace.army.mil
Abstract

This presentation will use a recently completed project near Mumbai, India, as a case study to show how any project in any location can be done safely. Tools, techniques, cultures, and management involvement will be discussed as the success factors.

The implementation session will describe what made this project successful and the steps that can be taken to have a successful safety program anywhere in the world. Informational and motivating, it will show what can be done with the correct focus and management support.

Plenary Session Presenter

Tom E. Will – Director of Capital, Engineering, and Process Development – Coatings, Rohm and Haas Company

With extensive and wide-ranging experience in the power, utility, and chemical business for Rohm and Haas, Tom Will now has responsibility worldwide for major capital projects at the company. At CII, he chaired the Owner/Contractor Work Structure Research Team in the late 1990s, and has been active on the Globalization Committee and other CII efforts for several years. Will addressed the CII Annual Conference in Minneapolis, Minnesota, in 1998. He holds a bachelor’s degree in mechanical engineering from the University of Virginia.

e-mail: twill@rohmhaas.com
Implementation Session Moderators

**Randy Arrington** - Alliance Manager, Jacobs Engineering

Randy Arrington has been involved in managing alliances at Jacobs for the last eight years. His focus is on alliances and creating value with long-term owner/contractor relationships.

e-mail: randy.arrington@jacobs.com

**Tom E. Will** - Director of Capital Deployment – Coatings, Rohm and Haas Company

Implementation Session Participants

Geoff Bell – Project Manager, Rohm and Haas Company

e-mail: gbell@rohmhaas.com

Lazar (Benny) Arimbrue – Construction Manager, Jacobs H&G

e-mail: mumbai.construction@jacobs.com
Working Safely in Global Construction

Case Study: Rohm and Haas and Jacobs

Executive Summary

It is possible to have a construction project with no recordable injuries. Furthermore, it is possible to achieve this goal anywhere in the world. Rohm and Haas in conjunction with Alliance Partner, Jacobs H&G (Jacobs), constructed a grassroots Adhesives & Sealants and Emulsions plant in Taloja, India (near Mumbai). The project was successful on many fronts: cost, schedule, quality, attainment of business goals, and safety.

The safety statistics for the project speak for themselves: 3.6 million work-hours, four recordable injuries, and an RIR of 0.2.

This project is an example of how the application of CII Best Practices can significantly improve the safety performance of any job site. In this case study we will discuss what the challenges were, how we addressed them, what the safety program consisted of, why we believe it worked, and how you can achieve similar results.

The mission of this project was to provide an operational grassroots chemical plant in Taloja, Navi Mumbai, India (operation began in July 2003). This facility produces both water-based emulsions and packaging/laminating adhesives.

This location was chosen due to its proximity to nearly 40-50 percent of the overall Indian market for both emulsions and adhesives, as well as to a major Indian port for handling raw materials. Mumbai is the hub of all industrial activity in India, thus offering best opportunities for hiring/retaining technical and management staff, and commercial support services, banks, hotels, and an international airport.

The project consists of five main areas: Bulk Raw Material Storage, Process Buildings, Product Storage, Utilities and Miscellaneous OBLs. The process equipment will be housed in a three- and four-level building of steel construction with concrete floors and metal siding. The primary process equipment is a single emulsion reactor along with polyester and polyurethane reactors. The utilities for the plant consists of: steam, cooling tower water, hot oil system, thermal oxidizer, scrubber, chiller, DI water, process/potable water, process/instrument air, firewater, electrical power, nitrogen and waste treatment. The OBL portion of the project will consist of a raw material warehouse, administrative offices, flammable warehouse for adhesives, QC lab, tech service lab for adhesives, bathrooms, showers, and canteen facilities. Other items included are guardhouse, perimeter fencing, paving, and landscaping.
Safety Challenges

Maintaining world-class safety programs in India has its own challenges.

- There is very minimal legislation in India on safety issues and the enforcement is even worse. Hence there is no real pressure on owners/contractors for maintaining high safety standards.

- Contractors are inclined to utilize work force labor instead of mechanical equipment as manual labor is the most cost-effective option.

- The majority of construction labor is poorly educated. Most of the work force wears no footwear. There was much reluctance by the workers to wear safety shoes.

- The work force is migratory. Some of the labor goes back for farming during certain times of the year. Contractors also tend to employ large numbers of subcontractors for specific portions of the job. This involves large numbers of labor turnover at the construction site. On this project about 5300 new workers were inducted at the site with total construction work-hours of about 3,600,000. The average labor strength was 800 at the site (a peak of 1,350).

- Civil construction activities commenced in April 2002. Monsoon in this area starts in June and it rains heavily in July/August. The site was partly open and undeveloped during this time. The heavy rain brings out poisonous snakes, which caused two lost-time incidents.

- The project schedule required compressing many construction activities in a short duration. This involved simultaneous operation of multidisciplinary work in a small area, which increased hazards and the possibility of accidents.

Elements of Program:

a) Management had shown commitment for the safety program from the beginning of the project. This uncompromising commitment for safety was first emphasized to Jacobs H&G with the specific requirement of “zero accidents” for the project site. In all subsequent project reviews with Jacobs H & G senior management, safety was always the first issue to be discussed.

Rohm and Haas senior management closely observed safety issues and safety performance on this project. The Rohm and Haas local
management was dedicated to implementation of the safety program. All safety issues were extensively reviewed and discussed during weekly teleconferences with Rohm and Haas senior management. A dedicated health, safety, and environment (HSE) manager was employed at an early stage of the project and the Rohm and Haas project manager was accountable for the safety program and reported to the highest corporate level as required.

b) Rohm and Haas required Jacobs H&G to set up a world-class HSE program covering planning, organizing, controlling, monitoring, and reviewing the job so that HSE aspects were taken into account from the beginning of the job through its completion.

In line with this requirement, a “Set of Site Rules” was prepared and was to be observed by all while on the project site. The Set of Site Rules explained the substance abuse policy as well.

c) Orientation for all new employees before they are allowed to work was made mandatory from the beginning. The program covered Rohm and Haas HSE Policy, Site Safety Organization, Security & Gate Pass requirement, Smoking & Drug Policy, Drinking Water & Sanitation facility, First Aid facility, Individual Responsibility, Vehicular Traffic, Housekeeping, Work in High Risk Areas, and Emergency procedures. For foremen and supervisors, special training sessions were conducted that detailed supervisor training.

d) Safety meetings with safety personnel and supervisors of all contractors were held on a weekly basis and typically addressed non-compliance issues, weekly inspections, training requirements, and likely challenges.

e) Disciplinary actions included Warning, Re-induction, and Temporary/Permanent Suspension from the job site for repeat violations by individuals, including foremen and supervisors.

f) Recognition for outstanding performance was achieved through instituting award ceremonies for achieving 250,000 safe work-hours. During the ceremonies, all workers were given small gifts and a few (5-10) were rewarded with special gifts for exemplifying “safe workers.” Foremen and supervisors were given certificates and contractors were given trophies for their contributions toward achieving safety at the site.
g) All work was strictly carried out under a “permit system.” Special permits were used for high-risk activities such as working at heights and confined spaces. Electrical work was carried out with proper permits covering a lockout / tagout system.

h) Standard format was developed with guidelines for investigation that helped in analyzing and identifying root causes of incidents. All investigation findings were shared with supervisors and management and actions were taken to avoid recurrence.

i) Monitoring of the safety program was achieved through safety observation reports and safety evaluations carried out during the construction phase. Corrective actions were taken to improve compliance on work activities that showed inconsistency in safety compliance.

j) Formal audits were conducted by the corporate safety manager to assess the effectiveness of the procedures and systems. This improved understanding of safety among all supervisors.

k) An emergency response plan was developed on the basis of guidelines prepared at the initial phase of the project.

l) All new workers were identified with a red band on hard hats and were accompanied by experienced co-workers for the first month. This “buddy system” helped new entrants to understand project safety culture.

m) The site prepared a list of “Top Ten” hazards associated with ongoing works. This list identified hazardous activities and risks associated with the work, was kept dynamic, and was revised at intervals depending on work situations at the site.

n) Power was supplied to a labor camp for electrical lighting. A health care program also was set up with local doctor visits to the village several times per week.

o) Historically in India, safety has not been a focal point, nor has recordkeeping. However, the safety performance of all contractors was a major selection criteria in awarding contracts, and safety bonuses were made part of contracts.
Industry “Best Practices” Utilized

1. Project Execution Planning
2. HSE Reporting & Metrics
3. Contractor Pre-Qualification
4. Site Orientation
5. Pre-Task Planning
6. Incident Reporting & Investigations
7. HSE Staffing
8. Training & Orientations
9. Audits & Inspections
10. Recognition & Rewards

Safety Statistics

Total installed cost  $50,000,000 (Gulf Coast Equivalent)
Total work-hours  3,600,000
Total lost work day cases  2
Total recordable incidents  4

Conclusions and Recommendation

With proper management involvement and commitment by all parties, it is possible to implement a world-class safety program in adverse conditions such as Taloja, India. To achieve this, a full understanding of the local culture and work practices is of extreme importance. Utilizing industry best practices and following through with the plan will deliver results.
Working Safely in Global Construction

Plenary Slides

No one person or single party can create a safe jobsite. It requires a collaborative effort with the owner and contractors working together from the top of their respective organizations down to, and most importantly with, the hourly workers.

Case Study: Taloja, India

- Adhesives, sealants, emulsions plant
- 3.6 million work-hours
- Two lost time incidents, two recordable injuries
- Construction Users
  Roundtable (CURT) Award
- President’s Health-Safety-Environmental Award (Jacobs)
- Joseph J. Jacobs Master Builder Award
- On time, on budget project that met business goals with outstanding safety results
Project Execution Strategy

Joint partnership by:
Owner:
  Rohm and Haas
EPCM Contractor/Alliance Partner:
  Jacobs H&G
Numerous subcontractors

Safety Goals

- Zero injuries
- Everyone goes home in the same condition they went to work
- World-class safety program
- Proactive safety tools
- Support worker needs (on and off the job)

Work Force

Taloja, India

Safe workers shown: 600
Project peak: 1,300
Total employees indoctrinated: 5,200
Safety Beliefs

- You can work safely anywhere _all of the time._
- Owner, contractor, and subcontractors working together make it happen.
- It all starts at the top.
- Safety management culture and systems drive results.
- Each and every individual must contribute.
- Injuries are produced by “at-risk behavior” that can be changed.
- Changing behaviors requires systems, resources, commitment, and hard work.

What Were the Keys to Safety Performance?

- Application of Industry (CII) Best Safety Practices
- “Owner’s Role in Safety” research (CII Project Team 190)
- Rohm and Haas/ Jacobs Alliance 18 Best Safety Practices

Details in Implementation Session

Tie-off / Fall Protection

_Do Not Worry If I Lose Balance, My Harness Would Save Me!_

Use Protective Equipment Properly. Safety Harness Lanyard To Be Hooked On Strong And Rigid Objects.
### Safety Statistics

<table>
<thead>
<tr>
<th>Category</th>
<th>U.S.</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction workers</td>
<td>9 Million</td>
<td>100 Million</td>
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<tr>
<td>Injuries per day</td>
<td>1,800</td>
<td>50,000</td>
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<tr>
<td>Construction deaths per day</td>
<td>5</td>
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<tr>
<td>Construction deaths per year</td>
<td>1,250</td>
<td>40,000</td>
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### Comparison to Similar Gulf Coast Project

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<tr>
<th>Category</th>
<th>Gulf Coast Typical CII Equivalent</th>
<th>Taloja, India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Installed Cost (TIC)</td>
<td>$50MM</td>
<td>$50MM</td>
</tr>
<tr>
<td>Work-Hours</td>
<td>600,000</td>
<td>3,600,000</td>
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<tr>
<td>Total Recordable Injuries</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Lost Time Incidents (LTI)</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Recordable Incident Rate (RIR)</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>CII Industrial RIR</td>
<td>1.0 – 1.1</td>
<td></td>
</tr>
<tr>
<td>U.S. Industrial RIR</td>
<td>5.0 – 7.0</td>
<td></td>
</tr>
</tbody>
</table>

### Challenges & Risks: Taloja, India

- No real safety culture or legislation.
- Many owners and contractors don’t support safety.
- High manual labor content and worker density.
- Work force: poor, unskilled, migrant.
- Civil work during monsoon season.
- Several distinct languages.
- Minimal use of construction equipment.
Key Program Elements

- Management commitment, involvement, accountability
- World-class health-safety-environmental program
- One common safety team
- New employee orientation and training
- Medical facilities — on and off site
- Pre-project planning
- Safety observations system and audits
- Recognition/reward and disciplinary system
- Incident investigation and feedback/learnings

Professional Safety Staffing

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<tbody>
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<td>Rohm and Haas</td>
<td>2</td>
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<tr>
<td>Jacobs</td>
<td>4</td>
</tr>
<tr>
<td>Safety specialty sub</td>
<td>5</td>
</tr>
<tr>
<td>Contractors</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
</tr>
</tbody>
</table>

Additional support and auditing from management at Rohm and Haas and Jacobs.

Why It Worked

- Management support and corporate alignment.
- The core project team and Jacobs’ local presence.
- Corporate alignment (Rohm and Haas/Jacobs).
  - “Walked the talk.”
- Organized, staffed project with safety as key success factor.
- Made local practices safe, didn’t impose the unfamiliar.
- Supervisors were key and we won their hearts and minds.
- Work force felt that management cared about safety.
Summary of Injuries

Three million, six hundred thousand work-hours:

- ONE industrial injury
- Four recordable injuries
  - Two lost time incidents
  - Two recordables
    - One was “slip and fall” resulting in laceration (only true industrial accident)
- Forty-four first-aid cases

Frequently Asked Questions

How did you deal with poor contractor safety culture?

Selection process, training, zero tolerance.

Frequently Asked Questions

Only one industrial injury?
Do people not report injuries at the site?

Not normal in India.
Site nurse improved reporting.
Site procedures mandated reporting.
Frequently Asked Questions

Why 660 percent turnover?
Migrant farm workers, contract agency workers, paid daily with no retention incentive, zero tolerance to at-risk safety behavior.

Safety Management Beliefs and Principles

- All safety incidents are preventable.
- All safety incidents are caused by at-risk behavior.
- All behavior can be changed.
- “If you’re not confronting at-risk behavior, you’re reinforcing it.”
- Leadership is required to institute change and improve safety.
- Attainment of zero injuries is possible.
Conclusions

Success Factors
• True and highly visible management commitment.
• Local jobsite commitment (walk the talk).
• Key contractor culture and commitment.
• Implementation of a solid, detailed safety plan utilizing CII Best Practices.
• Follow-through with elements of the plan.
• Winning hearts and minds of supervisors, making believers out of them.
• Above all, uncompromising intolerance to “at-risk behaviors.”

The Bottom Line

“You will achieve the level of safety that you demonstrate you want to achieve.”

Implementation Session

Working Safely in Global Construction

Moderator:
• Randy Arrington, Jacobs

Panelists:
• A. L. Benny, Construction Manager (Jacobs)
• Geoff Bell, Project Manager (Rohm and Haas)
• Tom Will, Capital Manager (Rohm and Haas)
Working Safely in Global Construction

Implementation Slides

Working Safely in Global Construction

Randy Arrington
Jacobs
Moderator

Implementation Session

Working Safely in Global Construction

Moderator:
Randy Arrington, Jacobs

Panelists:
A. L. Benny  Construction Manager, Jacobs
Geoff Bell    Project Manager, Rohm and Haas
Tom Will     Capital Manager, Rohm and Haas

Session Format

- Presentation, Case Study
- Words from the Project Manager & Construction Manager
- Open Discussion and Q&A Period
Alliance Mantra

We will never, ever, ever compromise safety for any reason.

Safety Statistics per Million Workers

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td># Injuries / day</td>
<td>200</td>
<td>500 *</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Estimated</td>
</tr>
<tr>
<td># Construction Deaths / day</td>
<td>.56</td>
<td>1.5</td>
</tr>
<tr>
<td># Construction Deaths / Year</td>
<td>139</td>
<td>400</td>
</tr>
</tbody>
</table>

The Ratio of Serious Injuries and Deaths per Capita for India as compared to the US is 3:1

Project Description

- Grassroots chemical plant
- Adhesives and emulsions:
  - Bulk raw material area
  - Process buildings
  - Product storage
  - Utilities
  - Administration building
  - Laboratory
  - Canteen
  - Misc. outside battery limits (OBL) and infrastructure
- 70,000 square meter site: 7 hectares (~ 16 acres)
- Gulf Coast equivalent ~ $ 50 million total installed cost
Summary of Injuries

- 3.6 Million Work Hours: ONE, Industrial Injury
- 4 Recordable Injuries
  - 2 LTI's
    - Snake Bites
  - 2 Recordables
    - 1 Slip and Fall
    - 1 Assault
- 44 First Aid Cases
  - 17 were blisters

An Average US Project

- If the Project had......
  - 3,600,000 Work Hours
  - RI of 1.0
- There would have been......
  - 18 Recordable Injuries
  - 2 Lost Time Injuries

Challenges/Risks

- No real safety culture or Legislation
- Indian Owners see safety as added cost
- Indian Contractors see safety as added cost
- High Manual Labor Content, minimal use of equipment/technology
- Workforce is poor, Unskilled, no belief in Personal Protective Equipment (PPE)
- Migrant Work Force (Travelers)
- Civil work during monsoon season
Challenges/Risks

- Tight schedule & manual labor = high worker density
- Living conditions are poor, labor camps
- Several distinct languages
- Low skill levels
- Only use construction equipment when manual labor cannot accomplish the task SAFELY

What Were Keys to Safety Performance?

- Application of CII Best Practices
- Owner’s Role in Safety - CII Project Team 190
- Rohm and Haas-Jacobs Alliance: 18 Best Safety Practices

CII Safety Best Practices

- Demonstrated management commitment
- Staffing for safety
- Planning: pre-project and pre-task
- Safety education: orientation/training
- Worker involvement
- Evaluation and recognition/reward
- Subcontract management
- Accident/incident investigations
- Drug and alcohol testing

Not Done
CII Study: Owners Role In Safety

- Contractor selection
- Contractor safety requirements
- Safety communication and involvement
- Monitor safety performance
- Participate in orientations
- Participate in incident investigations
- Conduct inspections and audits
- Owner Sponsored Recognition
- Near Miss Reporting

Alliance Best Health, Safety & Environmental (HSE) Practices

- Project HSE Plan
- Engineering Safe Plans of Action (SPA’s)
- Safety Observations (SOR’s)
- House Keeping
- Personal Protective Equipment (PPE) Requirements
- Permitting

Program Elements

- Management Commitment, Involvement and Accountability *
- Set Up world class EHS program
- New Employee Orientation *
- Disciplinary System
- Recognition/Reward System *
- Enforced Permit System

Notes
Program Elements

- Full-time medical staff on site
- Weekly doctor visit to worker’s camp to tend to family illnesses
- Arrangements made at local hospital
- Permanent availability of emergency transport vehicle at Site & Camp
- Safety Observations, Safety Evaluations, Surveys & Audits *

* Denotes CH Best Practice

Program Elements

- Emergency Response (drills conducted)
- One common safety team - all contractors
- Meaningful Safety Meetings
  - Buddy System
  - Incident Investigations *
  - Accurate Records & Reporting
  - Actions taken on learnings, Safety Observation Reports, etc. *

* Denotes CH Best Practice

Why It worked

- Management Support and Commitment.
- Core Project Team & Jacobs Local presence
- Corporate Alignment (Rohm and Haas/Jacobs)
- Walked the Talk.
- Proactive and truly caring about workforce safety and well being.
Why It worked

• Supervisors are the key
• Chose to work safely before schedule
• Spent more effort on Safety than typical U.S. Project
• Weekly doctor visit to worker’s camp
• The work force felt that Management cared about safety

Why It worked

• Brought attention to working safe
• Drove ownership to the masses.
• Management visibly and consistently reinforced Safety beliefs
• Organized and Staffed the project with Safety as a key Success Factor.
• Made the local construction practices safe, rather than impose unfamiliar practices.

Monthly Safety Summary Report

1. Summary       6. Risk Management Actions
2. Injury Report  7. Safety Meetings
3. Precautionary Measures  8. Safety Training
5. High Risk Conditions  10. Safety Observations
                       11. Inspection Log
### Safety Observation Summary Report

**Sample**

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Protection</td>
<td>971</td>
</tr>
<tr>
<td>House Keeping</td>
<td>664</td>
</tr>
<tr>
<td>PPE</td>
<td>461</td>
</tr>
<tr>
<td>Hot Work</td>
<td>317</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>242</td>
</tr>
<tr>
<td>Permits</td>
<td>225</td>
</tr>
<tr>
<td>Electrical</td>
<td>177</td>
</tr>
<tr>
<td>Lighting</td>
<td>104</td>
</tr>
<tr>
<td>Excavation</td>
<td>99</td>
</tr>
</tbody>
</table>

### Safety Observation Report (SOR)

**Summary**

<table>
<thead>
<tr>
<th>SOR Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td>77</td>
</tr>
<tr>
<td>Material Handling</td>
<td></td>
</tr>
<tr>
<td>Materials Storage</td>
<td>67</td>
</tr>
<tr>
<td>Manual Material</td>
<td>62</td>
</tr>
<tr>
<td>Handling</td>
<td></td>
</tr>
<tr>
<td>Hand &amp; Power Tools</td>
<td>50</td>
</tr>
<tr>
<td>Positive Observations</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>3,554</td>
</tr>
</tbody>
</table>

### Sample Safety Training Log

<table>
<thead>
<tr>
<th>Date</th>
<th>Safety Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
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<td>6</td>
<td></td>
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<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>
# Sample Inspection Log

<table>
<thead>
<tr>
<th>No.</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety Helmet</td>
<td>84</td>
</tr>
<tr>
<td>2</td>
<td>Safety Wear</td>
<td>205</td>
</tr>
<tr>
<td>3</td>
<td>Safety Shoes</td>
<td>246</td>
</tr>
<tr>
<td>4</td>
<td>Safety Vests</td>
<td>72</td>
</tr>
</tbody>
</table>

# Safety Posters from the Site

**Notes**
Working Safely in Global Construction
Notes
Site Management Team Recognition

Site-Wide Safety Awards

Tiffin boxes to all workers
Award Presentations

Safety Award Presentations

Dish and bowls distributed to all workers

Rohm & Haas Photographs

Project Manager presented award by Jacobs executive
Rohm and Haas India Pvt. Ltd
Certificate of Appreciation

is granted to:

V. Soundarajan

for outstanding contribution in achieving 2.0 Million Safe Workhours

Adhesives & Water-Based Polymers Plant

Granted: April 19, 2003

CURT: Construction Users Roundtable

Construction Industry Safety Excellence Award (CISE)

The CISE program seeks to:
- Encourage excellence in safety leadership
- Recognize world class construction safety programs
- Highlight achievements of companies who demonstrate success
- Owner Safety Award Presented for Best International Project category

Factors to Create a Safe Job Site

- Visible Management Commitment
- Walk the Talk
- Contractor Culture and Commitment
- Implement a safety plan utilizing CII Best Practices
- Follow through with the elements of the plan
- Win hearts and minds of supervisors, make believers out of them.
- ABOVE ALL, UNCOMPROMISING INTOLERANCE TO “AT RISK BEHAVIORS”
Management Involvement & Commitment

- Includes Senior and Middle Management
  - Owner and Contractors
- Direct and visible involvement
- Actively Participate in Events
  - Audits
  - Site Meetings, Job Walks
  - Awards Presentations
- Hold Project Team Accountable
- Celebrate Success

Management Involvement & Commitment

- Rohm and Haas
  - Plant Manager
  - Business EHS Director
  - Country / Business Manager
  - Capital Manager
  - COO
- Jacobs
  - Local Operations Manager
  - Regional EHS Manager
  - Regional Vice President
  - Executive Vice President
  - CEO
- Contractors = Owners Direct Involvement

Construction Manager’s Perspective

A. L. Benny
Jacobs H&G
Project Manager’s Perspective

Geoff Bell
Rohm and Haas

Wrap Up

• Questions for the Panel?
• Comments ?

Working Safely in Global Construction

Thank You…….
Abstract

The Globalization Challenge to EPCs Forum, co-sponsored by CII, the Globalization Committee, FIATECH, and CURT, was held on February 11 in Houston, Texas. Under the leadership of the facilitator, Wayne Burkan, the participants provided a list of ideas for the construction industry to pursue in making quantum changes. A white paper was published from the workshop, as well as a video and a CII news story.

The Globalization Committee will move forward with the work done during the Forum and solicit input from Annual Conference attendees to further pursue changes to be made to our industry. The implementation sessions will be roundtable discussions using the work product of the Forum as a starting point.

Plenary Session Presenter

Robert F. Pascuzzi - Vice President and General Manager - Pittsburgh, Kvaerner E&C

Rob Pascuzzi has over 33 years of experience in the performance of a wide variety of turnkey projects, both domestic and international, including environmental, manufacturing, metals, and power projects. His past assignments have included operations management, project management, construction management, and commissioning management. His international responsibilities have included Australia, Brazil, Canada, Guatemala, India, Indonesia, Mexico, and Saudi Arabia. A registered professional engineer (Pennsylvania), Pascuzzi holds a civil engineering degree from the University of Pittsburgh and a mathematics degree from Bethany College.

e-mail: rob.pascuzzi@akerkvaerner.com
Implementation Session Moderator

Freddie P. Wong - Senior Project Engineer, Project Liaison Unit, Aramco Services Company

Freddie Wong, born in Shanghai and raised in Hong Kong, is a Senior Project Engineer for Aramco Services Company in Houston, Texas. He currently is responsible for the training program for all Aramco technical services personnel. With Aramco since the mid-1970s, Wong has served as engineering specialist, project engineer, project design manager, and administrator. For the past several years, he has been active with the CII Education Committee. Wong holds a bachelor’s degree in electrical engineering from Texas A&M University as well as a law degree.

e-mail: fp.wong@aramcoservices.com
Other Knowledgeable Points of Contact

Abdulaziz M. Al-Omran — Manager, Technical Services Dept., Aramco Services Company
e-mail: aziz.omran@aramcoservices.com

Robert D. Couse — Principal Vice President & Manager of Operations, Fossil Power, Bechtel Power Corporation
 e-mail: rcouse@bechtel.com

John G. Gentile — Manager, International Project Support, General Motors Corporation
 e-mail: john.g.gentile@gm.com

Joseph P. Gionfriddo — Global Construction Manager, Corporate Engineering, The Procter & Gamble Company
 e-mail: gionfriddo.jp@pg.com

Edward S. Givens — Associate Director, Construction Industry Institute
 e-mail: ngivens@mail.utexas.edu

Makarand Hastak — Assistant Professor, Div. of Construction Engrg. & Mgmt., Purdue University
 e-mail: hastak@ecn.purdue.edu

George J. Mekulsia — Senior Risk Engineering Consultant, Zurich North America
 e-mail: george.mekulsia@zurichna.com

Robert A. Predmore — Manager of Projects, Corporate Services Construction, Intel Corporation
 e-mail: bob.predmore@intel.com

James A. Schmidt — Senior Vice President, Project Management, Fluor Daniel, Inc.
 e-mail: jim.schmidt@fluor.com

Tom E. Will — Director of Capital Deployment – Coatings, Rohm and Haas Company
 e-mail: twill@rohmhaas.com
The Globalization Challenge for EPCs

Globalization Committee

CII Member Companies:
Focus on Safety
Priceless

CII Member Companies:
Best Practices
Priceless
CII Member Companies:  
Breakthrough Strategies  
Priceless

CII Member Companies:  
Global EPC Value  
?????

Globalization Challenge to the EPC Industry

Owners/Contractors/Suppliers

- CII’s Strategic Plan identified Globalization as a major trend eight years ago.
- Does competing in the global marketplace appear as part of your “Strategic Plan?”
- What tactical plans are you implementing to win the competition?
Globalization Challenge to the EPC Industry

**Owners**

- How many of your facilities are being built/modified outside of your home country?
- How many of your facilities are being built/modified by CII contractors/suppliers outside of your home country?
- Are you satisfied with the value provided by your non-CII contractors/suppliers?

**Contractors/Suppliers**

- How much of your work is on facilities outside of your home country?
- What are owners telling you about the value you bring on facilities outside your home country (maybe in your home country as well)?
- What do you need to do to compete effectively and provide value in the global marketplace?

**Owners/Contractors/Suppliers**

Value = Benefit – Cost
Globalization Challenge to the EPC Industry

Contractors'/Suppliers' Perspectives of the Value to Owner

Value = Benefit – Cost

Is "cost" really a small influence in the owners' evaluation?

Globalization Challenge to the EPC Industry

Owners' Perspective of Contractors'/Suppliers' Value

Value = Benefit – Cost

Is "benefit" compromised in the owners' evaluation?

Globalization Challenge to the EPC Industry

Question:
What is the only commonality of these two diametrically opposed equations?

Value = Benefit – Cost

Value = Benefit – Cost
Globalization Challenge to the EPC Industry

**The Answer:**

In order to compete successfully, both must have the ability to provide

RELEVANT VALUE

in a global marketplace.

Globalization Challenge to the EPC Industry

- Workshop February 11, 2004, at Aramco’s Houston facilities sponsored by:
  - CII
  - FIATECH
  - CURT

- Approximately 75 attendees

Globalization Challenge to the EPC Industry

**Question Posed at Workshop:**

What step changes do we (Owners/Contractors/Suppliers) need to recognize or implement to remain or to become SUSTAINABLE?
Globalization Challenge to the EPC Industry

Typical Reactions to Change

• Incremental Change (GOOD!)
  - Readily accepted and constantly sought after

• Step Change (OUCH!)
  - Jettisons the old rules and renders the old investment worthless

Globalization Challenge to the EPC Industry

Incremental Change:

• How many of our organizations attempt to apply the same operational mentality globally?
• How many have “comfortable” and “conservative” risk and execution methodologies that are applied worldwide?
• Why do we think “one size fits all”?

THE COMPETITION HAS MOVED IN!

Globalization Challenge to the EPC Industry

Step Change:

• The standard or paradigm has shifted.
  • WE MUST HAVE THE GUTS TO GO BACK TO ZERO.
• When a standard shifts, everyone goes back to zero.
• Success in the old standard, without a step change, marks us for failure.
Globalization Challenge to the EPC Industry

**Critical Success Factors**

- Meet customers’ objectives relating to VALUE (cost, quality, schedule).
- Attain understanding of business cultures including reassessing human resources model, training, retention, skill levels and nationality mix.

Globalization Challenge to the EPC Industry

**Where we have made the least progress:**

- Recognition of value
- Security for employees and families
- Right employees & workforce issues
- Productivity gains due to technology quickly becomes the norm, but masks itself as step change
- Integration/compensation for business cultural differences

Globalization Challenge to the EPC Industry

**Where should we look for new solutions?**
Globalization Challenge to the EPC Industry

It is probable that someone is either working on or has already solved one of your “impossibilities.”

How do you find that person?

Globalization Challenge to the EPC Industry

Implementation Session

- Summary of Houston findings
- Additional “opportunities” will be identified.
- Methodology using “generic definition” will be employed.
- Specific “Path Forward” activities will be identified and actions assigned.

Globalization Challenge to the EPC Industry

Example of Solution Methodology to Be Discussed in Implementation Session:

- Identification of your “impossibilities.”
- Paraphrase using generic language.
- Determine who outside your field has already solved or would be interested in solving this kind of problem (in generic language)?
- Seek them out!
Globalization Challenge to the EPC Industry

*Example of Comparisons That Will Be Shared in Workshop:*

- An annual salary of $1,500 in China provides for an equivalent lifestyle in the U.S. of $30,000!
- An annual salary of $19,400 in India provides for an equivalent lifestyle in the U.S. of $115,400!

Taken from PMI Project Management Salary Survey – Third Edition
The Globalization Challenge for EPCs
Implementation Slides

Globalization Challenge to the EPC Industry

Houston 2004 EPC Workshop

- EPC is a commodity.
- Research is not rewarded.
- Creativity is not rewarded.
- EPC is not “patent-able.”
- Failure is not an option.
- Decisions are not timely.

Globalization Challenge to the EPC Industry

Paradigm Shifts

- “Best Buggy Whips Made.”
- Japan – “Get it right then, go fast.”
- World – Use all opportunities.
  - Better Ways?!
  - More than “CII Best Practices”
  - “Best Practices” from all sources
Globalization Challenge to the EPC Industry

Been there! – Done that!
- Automotive industry (Detroit vs. Japan)
- Assembly (U.S. vs. China, Mexico, others)
- U.S. – Service provider only
- U.S. – Knowledge provider?
- How to capitalize on U.S. strategic advantages

Globalization Challenge to the EPC Industry

EPC’s Biggest Problems/Opportunities
- Low-cost service providers
- “Good” quality of services
- Employees with low standard of living

Globalization Challenge to the EPC Industry

What are your greatest global challenges?
Globalization Challenge to the EPC Industry

- Meet owner's objectives.
- Deliver business benefits to owners.
- Understand how owner delivers value.
- Need significant 'total' cost reduction.
- Eliminate waste and defects (Lean six sigma).
- Evaluate human resource model:
  - Recruiting
  - Retention
  - Training
Abstract

Four key drivers must be present to radically reduce project cycle time: (1) a compelling business need; (2) owner commitment; (3) a high performing team; and (4) detailed project planning and execution. The key drivers will not be broadly applicable to a portfolio of projects at one time, but rather to projects that meet specific criteria. In addition, CII research identified five prioritized CII Best Practices that are key components of radical reduction. Research case studies delivered radical reductions in cycle time without sacrificing safety, quality or cost.

Learn about the Game Planner tool that will help determine which CII Best Practices and management techniques to use to achieve radical reduction in project cycle time. A secondary tool, the Playbook, covers project management fundamentals to support the Game Planner and will be discussed in the implementation session.

Plenary Session Presenter

David DeBruine – Associate Director, Health Care Engineering, The Procter & Gamble Company

David DeBruine has been with P&G for 27 years. At CII, he chairs the research effort on radical reduction in project cycle time. His experience at P&G covers engineering design, project management, construction management, technical operations management, and capital management, and he has worked at corporate as well as plant locations. Having been involved in many of the company’s global business units, his most recent assignments are in P&G’s growing health care business. DeBruine, a licensed professional engineer, holds a civil engineering degree from the University of Wisconsin–Platteville.

e-mail: debruine.dj@pg.com
Implementation Session Moderator

Clark W. (Skip) Stuart – Senior Manager, Materials Management, Black & Veatch

Skip Stuart is currently responsible for the deployment and implementation of material and supply chain management techniques and work processes on all domestic EPC projects. He also is responsible for directing corporate material management, logistics, transportation, and expediting functions and managing the construction equipment fleet services group. Prior to joining Black & Veatch, he was responsible for international material management activities for Stone & Webster Engineering. Stuart's previous CII research participation includes projects on radio frequency identification tagging and supply chain management.

e-mail: stuartcw@bv.com

Implementation Session Participants

Sanjiv Gokhale – Director of Construction Management, Department of Civil & Environmental Engineering, Vanderbilt University
e-mail: s.gokhale@vanderbilt.edu

Sam A. Scucci – Denver Construction Manager, Stone & Webster Power Division, The Shaw Group
e-mail: sam.scucci@shawgrp.com

Roy G. Sensenig – Director of Fossil & Hydro Services, Parsons E&C
e-mail: roy.g.sensenig@parsonsec.com

George R. Sullivan – Project Manager, Hydrocarbons & Energy Systems, Dow Chemical Company
e-mail: grsullivan@dow.com

Other Knowledgeable Points of Contact

David Campbell — Project Manager, Air Products and Chemicals, Inc.
e-mail: campbed@apci.com

Tina J. Carpenter — CE Engineer, Project Controls, U.S. Steel
e-mail: tcarpenter@uss.com
Radical Reduction in Project Cycle Time

  e-mail: cdotson@ppco.com

Sanjiv Gokhale — Professor, Vanderbilt University
  e-mail: s.gokhale@vanderbilt.edu

David R. Halvorson — Principal Project Manager, 3M
  e-mail: drhalvorson@mmm.com

Makarand Hastak — Assistant Professor, Div. of Construction Engrg. & Mgmt., Purdue University
  e-mail: hastak@ecn.purdue.edu

TaeHoon Hong — Graduate Research Assistant, Purdue University
  e-mail: hong7@purdue.edu

Christy U. Kollitz — Senior Cost/Schedule Engineer, Solutia Inc.
  e-mail: cukoll@solutia.com

John R. Offutt — Project Manager, ConocoPhillips
  e-mail: john.r.offutt@conocophillips.com

Tim Pike — Project Control Specialist, Conoco/Phillips
  e-mail: tlpike@ppco.com

Louis L. Prudhomme — Associate Director, Construction Industry Institute
  e-mail: lprudhomme@mail.utexas.edu

Brian E. Schmidt — Civil/Structural Chief Engineer Department Head, Black & Veatch Corporation
  e-mail: schmidtbe@bv.com

Donald Schreyer — Project Engineer, ALSTOM Power, Inc.
  e-mail: don.schreyer@power.alstom.com

Frank K. Suhan — Project Management Consultant, Johnson Controls, Inc.
  e-mail: frank.k.suhan@jci.com

Thomas W. Wilbor — Project Manager, Rust Constructors Inc.
  e-mail: thomas.wilbor@wgint.com
Radical Reduction in Project Cycle Time
Radical Reduction in Project Cycle Time Project Team

Executive Summary

Today’s businesses rely on just-in-time capacity enhancements and first-to-market product strategies to gain competitive advantage and increase profit margins. This has created an increased demand for a high performance project delivery system that can achieve a dramatic reduction in project delivery time.

Radical reduction is defined as a reduction of 25 percent or more in overall project cycle time when compared to the current industry standard for projects of similar size and scope. CII chartered the Radical Reduction in Project Cycle Time Project Team (PT 193) to investigate the reality, requirements, and barriers to such radical reduction in project cycle time.

The research findings emphasize that owner involvement is the key factor in determining the potential success of radical reduction. In order to achieve radical reduction in project cycle time, the four drivers were consistent and overriding. The first two define the need or the “why” and are completely under the control of the owner:

- A compelling business need
- Owner commitment

The second two define the execution or “how” and are the joint responsibility of the owner and contractor:

- High-performance team
- Detailed project planning and execution

The research also investigated the impact of radical reduction on certain key project objectives, specifically the following:

- Consistent schedule reduction of 25% to 50%
- Improved safety in over 85% of the cases
- Savings in cost up to 20% in all but one case study
- Equal or improved quality

Any project can utilize the findings from the PT 193 research to improve project performance, providing the key drivers are in place. Two CII Implementation Resources, The Project Manager’s Playbook and the Project Manager’s Game Planner, were developed to facilitate the choice, use, and optimal deployment of the techniques and CII Best Practices.
**Approach**

The hypothesis of this research was that a study of high performing projects would lead to the discovery of delivery practices or techniques, which, if applied broadly and routinely, would improve delivery time across the industry. The research methodology needed to define and test this hypothesis included the following:

- Literature review
- Questionnaire surveys targeting the CII membership and case study respondents
- Case studies of selected projects
- “Priority Matrix” based on the case study responses

The literature review helped in identifying the various schedule reduction techniques (SRTs), CII Best Practices currently used in the construction industry, and the reduction techniques applied in other industries (categorized as management techniques). Those most relevant to construction were studied in detail. The findings were distilled into a “Priority Matrix” for each of the commonly identified phases of a project (pre-project planning, design, materials management, construction, and start-up).

Twenty-nine domestic projects were identified that achieved radical reduction in project cycle time. Of these, seven were deemed useful for in-depth study for a better understanding of the decision-making process used by owners and the construction industry to radically reduce project cycle time. The major objective was to verify the known practices and techniques utilized as well as to identify additional reduction techniques.

The research covered a cross-section of the industry. Respondents included owners, architect/engineers, construction managers, contractors, and suppliers. The majority of the responses were from contractors. The size and variety of projects varied. Project types included general building, transportation, manufacturing, industrial process, petroleum, power, environmental, telecom, and others.

Generally, PT193 believes that almost all projects can benefit from cycle time reduction but, specifically, the following types of projects were identified as prime candidates for radical reduction techniques:

- Projects with strong business drivers.
- Projects that are complex.
Radical Reduction in Project Cycle Time

- Projects requiring a high degree of integration with outside stakeholders.
- Projects that have a high degree of upper management support.
- Large projects with a high level of purchasing activities/multiple packages.

The research also identified the most significant barriers to achieving radical reduction in project cycle time. Although generally within the responsibility of the owner, they may be influenced by the owner/contractor project team. These include:

- Scope changes
- Lack of decision making
- Lack of clear project objectives

Radical reduction is not for every project. It takes a huge commitment, a strong team, and outstanding execution, which are difficult to achieve and justify for every project in a routine fashion.
List of References


Radical Reduction in Project Cycle Time

PT 193 Team Members

David Campbell  Air Products & Chemicals
David DeBruine  Procter & Gamble, Chair
Sanjiv Gokhale   Vanderbilt
David Halvorson  3M
Mark Hastak      Purdue
John Oliff       CameronPhllips
Tim Pike         ConocoPhillips
Brian Schmidt    Black & Veatch
Don Schreyer     ALSTOM Power
Roy Sansenig    Parsons E&C
Sam Scucci      Shaw Group
Clark Stuart     Black & Veatch
George Sullivan  Dow
Tom Wilber       Rust

Past Members
Tino Carpoitor  U.S. Steel
Christy Kohrba  Soludia
Don Hurley      Buder Mfg

Grad Students
Kartik Gopali    Purdue
TaeHoon Hong    Purdue
Sharin Sert    Purdue

Definition
Radical Reduction in Project Cycle Time

Reduction greater than 25 percent as compared to industry average cycle time (target: 25-50 percent).

Project Cycle Time

Starts during planning phase, when owner’s engineering organization becomes involved, and continues through start-up.
Objectives

1. Identify approaches or practices that can radically reduce project cycle time.

2. Identify barriers to radical reduction in cycle time.

3. Prioritize the radical reduction techniques (RRTs) based on their potential for cycle time reduction.

Principal Beneficiaries

- Owners and contractors in:
  - Industrial
  - Building and
  - Infrastructure sectors

  including both private and public operations.

Methodology

[Diagram showing the methodology with the following steps:
- Literature Review
- Questionnaire 1
- Questionnaire 2
- Questionnaire 3
- Project Team
- Priority Matrix
- RR 193]
Radical Reduction in Project Cycle Time

Notes

Methodology

Literature Review

Questionnaire 1

Case Studies

Questionnaire 2

Priority Matrix

Questionnaire 3

Project Team

Priority Matrix

Research Report 193-11

Case Study Projects

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<thead>
<tr>
<th>Project</th>
<th>Capital Cost ($M)</th>
<th>Typical Duration (mo)</th>
<th>Actual Duration (mo)</th>
<th>Project Cycle Reduction (%)</th>
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</table>
Key Findings

- Key drivers WHY projects achieve radical schedule reduction:
  - Compelling business need
  - Owner commitment

Key Findings (cont.)

- Key drivers HOW projects achieve radical reduction:
  - High performance team
  - Detailed project planning and execution

Key Findings (cont.)

- These CII Best Practices are key components of radical schedule reduction over project phases:
  - Materials Management
  - Alignment
  - Pre-Project Planning
  - Constructability
  - Design Effectiveness
Radical Reduction in Project Cycle Time

Key Findings (cont.)

• In conjunction with CII Best Practices, management and schedule reduction techniques from other industries are required to achieve radical reduction.

Schedule Reduction and Management Techniques

• Start-up driven scheduling
• Use of electronic media
• Participative management
• Construction driven scheduling
• Employee involvement

Barriers to Radical Reduction

• Top three barriers:
  ➢ Scope changes
  ➢ Lack of decision making
  ➢ Lack of clear project objectives
Case Study Project Performance Metrics

- Technical objectives 7 of 7
- Safety 6 of 7 equal or better
- Quality 7 of 7 equal or better
- Rework 7 of 7 equal or less
- Cost 6 of 7 equal or better

Is Radical Reduction Possible?

YES!

- Four Key Drivers MUST be present
  - Compelling business need
  - Owner commitment
  - High performance team
  - Detailed planning and execution

Is Radical Reduction Possible with Every Project?

PROBABLY NOT!
The research did not discover any “silver bullets,” but there are tried and true approaches that, used together, can deliver results!

What if someone came to you and asked how to radically reduce their project cycle time?

Implementation Session

Moderator
Clark Stuart  Black & Veatch

Panelists
Sanjiv Gokhale  Vanderbilt
Sam Scucci  Shaw Group
Roy Sensenig  Parsons E&C
Radical Reduction in Project Cycle Time
Implementation Slides

Radical Reduction in Project Cycle Time
Implementation Session

Project Manager's
Game Planner and Playbook

Radical Reduction in Project Cycle Time Project Team

Agenda

- Welcome
- CIIL Project Team 193 Membership
- "Project Manager's Game Planner"
- "Project Manager's Playbook"
- Questions and Answers

PT 193 Team Members

David Campbell      Air Products & Chemicals
David DeBruine      Procter & Gamble, Chair
Sanjiv Gokhale      Vanderbilt
David Halverson     3M
Mark Hastak         Purdue
John Offutt          ConocoPhillips
Jim Pike             LCA
Brian Schmidt       Black & Veatch
Don Schuyver         ALSTOM Power
Roy Sensenig        Parsons E&C
Sam Scuoci          Shaw Group
Clark Stuart         Black & Veatch
George Sullivan      Dow
Tom Wilbor          Rust

Post Members
Tim Carpenter        U of G, Rural
Christy Kelliz       Soluis
Dan Humm             Butler Mfg

Grad Students
Kartik Goyari        Purdue
Tea Hoong Hong       Purdue
Shavik Safi          Purdue
Radical Reduction in Project Cycle Time

Panel Discussion

Moderator
Clark Stuart  Black & Veatch

Panelists
Sanjay Uppal  Vardarshik
Sam Scucci  Shaw Group
Roy Sensenig  Parsons E&C

Panel Discussion

Moderator
Clark Stuart  Black & Veatch

Panelist
George Sullivan  Dow
Radical Reduction in Project Cycle Time

Development of “The Game Planner”

- CII Project Phases

- Case Studies
  - CII Best Practices
  - Schedule Reduction Techniques
  - Management Techniques

Key Findings

- Key drivers WHY projects achieve radical schedule reduction:
  - Compelling business need
  - Owner commitment

- Key drivers HOW projects achieve radical reduction:
  - High performance team
  - Detailed project planning and execution

Organization of “The Game Planner”

- List of 25 Radical Reduction Techniques (RRTs)
  - page 2
- Top 10 RRTs by project phase
  - pages 6 and 7
- Relative impact of RRTs by project phase
  - pages 8 and 9
- Definitions for RRTs and their project applications
  - pages 10 through 13
- Radical Reduction Playcard
  - pages 14 and 15
The 25 Radical Reduction Techniques

Alignment
Constructability
Design effectiveness
Materials management
Pre-project planning
Zero accident techniques

The 25 Radical Reduction Techniques

Alignment
Constructability
Design effectiveness
Employee involvement
Materials management
Pre-project planning
Safety in workspace
Zero accident techniques

The 25 Radical Reduction Techniques

Alignment
Constructability
Construction driven schedule
Design effectiveness
Efficient packaging-transportation
Employee involvement
Freezing at project scope
Lump sum contract
Materials coordination
Materials ID on purchase documents
Materials management
Non-traditional drawing releases
Pareto’s Law

Participative management
Pre-project planning
Prioritize procurement of material
Realistic scheduling
Safety in workspace
Start-up driven schedule
Supper engineer early interaction
Supplier submittal control
Temporary start-up systems
Use of electronic media
Well-defined organization structure
Zero accident techniques
Radical Reduction in Project Cycle Time

Project Phases

- Pre-Project Planning
- Design
- Materials Management
- Construction
- Start-Up

Pre-Project Planning

- Start-up driven scheduling
- Participative management
- Pre-project planning
- Alignment
- Use of electronic media
- Well-defined organizational structure
- Pareto’s Law
- Employee involvement
- Realistic scheduling
- Construction driven scheduling

Design

- Constructability
- Use of electronic media
- Alignment
- Freezing project scope
- Design effectiveness
- Start-up driven scheduling
- Employee involvement
- Non-traditional drawing release
- Participative management
- Supplier/engineer early interaction
Radical Reduction in Project Cycle Time

**Notes**

**Materials Management**
- Materials management
- Start-up driven schedule
- Non-traditional drawing release
- Materials coordination
- Prioritize procurement of materials
- Efficient packaging for transportation
- Material ID on purchase documentation
- Supplier/engineer early interaction
- Supplier submittal control
- Employee involvement

**Construction**
- Start-up driven schedule
- Lump sum contract
- Constructability
- Participative management
- Realistic scheduling
- Construction driven schedule
- Zero accident techniques
- Alignment
- Safety in workspace
- Pre-project planning

**Start-Up**
- Start-up driven schedule
- Construction driven schedule
- Use of electronic media
- Alignment
- Temporary start-up systems
- Employee involvement
- Well-defined organizational structure
- Zero accidents techniques
- Participative management
- Realistic scheduling
Radical Reduction in Project Cycle Time

Top 10 Radical Reduction Techniques by Project Phase

Freezing Project Scope

Sum of Relative impacts by Phase = 100%

Notes
“Radical Reduction Playcard”

- A tool for developing strategies for a given project by assigning ranks (if necessary) and color-coding appropriate boxes
- A tool to track reduction during project phases when implementing different RRTs.
- Serves as a reference for future projects.
Radical Reduction in Project Cycle Time

Flow Chart

1. Identify your Project Phase
2. Choose WTHs from the list that can be applied (page 6-7)
3. Determine the relative impact of your chosen WTHs (page 8-9)
4. Identify highest impact techniques
5. Transfer information to Playcard (page 14-15) for your Game Plan

Notes

Project Playcard

[Diagram of a project playcard with a flowchart and steps]

[Image of a black and white diagram with a football play]
Radical Reduction in Project Cycle Time

“The Playbook”

• Fundamentals
• The Team
• The Plays
• The Game
• After the Game

Fundamentals

• Early Recognition
• Compelling Business Need
• Goals and Objectives
• Commitment

The Team

• The Draft
• Formations
• Team Spirit
• Team Effectiveness
Radical Reduction in Project Cycle Time

The Plays

- Pre-Project Planning
- Design
- Material Management
- Construction
- Start-Up

The Game

- Plan the Work/Work the Plan
- Project Work Processes
- Information Technology
- Project Controls
- Change Management
- Quality Management
- Risk Management
- Issue Resolution

After The Game

- Scores and Stats Metrics
- Post-Game Analysis
  Lessons Learned
Radical Reduction in Project Cycle Time

Questions & Answers

Notes
CII Chairman’s Perspective of Sustainability

Les Sturgeon, CII Chairman for 2004

Abstract

The pressure to perform in the area of sustainability requires a complex balancing act between creating shareholder value and increasing economic, social, and environmental value. The CII Chairman will provide a perspective on sustainability and the business approaches that are necessary to bring about sustainable successes. How well corporations perform in the area of sustainability requires competence in several areas: strategy, customer and product, stakeholder, finance, human resources, and knowledge management.

Speaker

Les Sturgeon – Division Vice-President of Global Facilities Engineering, Abbott Laboratories

Les Sturgeon is responsible for the planning, design, and implementation of major capital projects worldwide. With Abbott since 1973, he has held a series of positions in operations technical support and manufacturing management, and was previously manager of engineering. He has both domestic and international project experience and served as Abbott’s director of engineering for the diagnostics division from 1990-1995. Sturgeon earned a bachelor’s degree in chemical engineering from the University of Louisville. At CII, he is chairman for 2004.

e-mail: les.sturgeon@abbott.com
Abstract

The construction business moves fast and furious and needs to stay low cost, on time, on schedule and on budget. Do we have the time to handle another issue like “sustainable development?”

The answer is that we need to make the time if we want to stay in business for the long term. Sustainable businesses pay attention to the “triple bottom line” — economic results, long- and short-term; protecting the environment; and respecting the communities around us.

This panel will review the Suncor Energy oil sands mega project in Northern Alberta, where sustainability challenges were met head on and handled with excellence. We will also look at the Hatch approach to sustainable plant design and the relationship between sustainability and risk management. Finally we will look at what the Chief Architect thinks it takes to design a sustainable building from the ground up.

Moderator

J. Norman Lockington - Vice President, Technology, Dofasco, Inc.

Norm Lockington joined Dofasco in 1973 as an occupational hygienist. His roles expanded to include safety, environment, energy, and utilities. In 1993, he was appointed to his current assignment and has responsibility for 1,150 people and 15 departments. Lockington is chair of the International Iron and Steel Institute (IISI) Committee on Technology, past chair of the IISI Committee on Environment, and past president of the Association of Iron and Steel Engineers. He earned a bachelor’s degree in chemical engineering from the University of Waterloo and an MBA from McMaster University. Lockington is the CII Annual Conference Chairman for 2004.

e-mail: norm_lockington@dofasco.ca
Panelists

**Ed Feiner** – Chief Architect, U.S. General Services Administration

Ed Feiner provides national leadership for design and construction activities of the GSA and serves as senior advisor on design and construction policy and innovation. At GSA since 1981, Feiner previously managed master planning for the Naval Facilities Engineering Command. Besides teaching at Northern Virginia Community College, he lectures at Harvard University and to architectural program participants at numerous other colleges and universities. A Fellow of the American Institute of Architects, Feiner holds architectural degrees from The Cooper Union and the Catholic University of America.

*e-mail: edward.feiner@gsa.gov*

**Ron Genereux** – Vice President, Major Projects, Suncor Energy

Ron Genereux has been with Suncor Energy since 1988, and has participated at key engineering and managerial levels for a wide variety of projects, particularly ones involving oil sands and desulphurization. He recently was responsible for the construction of nearly $1 billion dollars worth of bitumen production facilities. As a senior member of Suncor’s Major Projects team, Genereux is also accountable for ensuring that all company growth projects are designed and constructed in a manner that supports the company’s vision of sustainability. He is co-chair of the Construction Owner’s of Alberta Association Productivity Measurement and Benchmarking Committee. Genereux earned a bachelor’s degree in mechanical engineering from the University of Saskatchewan.

*e-mail: rgenereux@suncor.com*
David Rodier – Leader, Sustainable Development Practice, Hatch

David Rodier leads the Sustainable Development Practice, which seeks to find innovative ways to help clients make breakthroughs in business and capital projects. Current areas of activity include integrating sustainable development into integrated risk management, initiation of a sustainable development community of practice for the company, establishment of a social risk network of consultants, and development of a sustainable plant design initiative. Rodier chairs the Executive Working Group of the International Council for Mining and Metals. Prior to joining Hatch, he was with Noranda Inc. for 36 years, holding a broad variety of operational and executive roles.
Abstract

This implementation session will report on the Engineering Productivity Metrics Retreat, which was held June 2–4, 2004, in Woodville, Texas. All CII member organizations active in developing engineering productivity metrics were invited to the retreat to review the alternative approaches of measuring engineering productivity that have been developed at CII in recent years. The retreat involved 28 representatives from 20 different organizations.

The goals of the retreat were simple:

1. To allow organizations to discuss the advantages and disadvantages of the alternatives.
2. To build a consensus on common metric definitions.
3. To develop a data collection strategy that will be supported by participating organizations.

The retreat was successful on all accounts. Now, with agreed-upon definitions, the path forward has been established. First, specific commitments have been made by participants for data submission in the fall. Second, a Benchmarking Committee report on this topic will be issued in March 2005.

During the implementation session, the metric definitions will be discussed and attendees will be extended the opportunity to participate in the data collection initiative. Those submitting data can expect to receive the March 2005 report.

Implementation Session Moderator

David G. Hile – Operations Manager, Fru-Con Construction Corporation

Dave Hile has over 20 years of experience in heavy industry, including assignments in the refining, pulp and paper, chemical, and power sectors. He has served as field engineer, project controls manager, and director of business development prior to his current assignment in operations. Hile is currently helping to guide a CII study on productivity and performance metrics for construction and engineering. He is a graduate of Indiana State University.

e-mail: dhile@watkins.dillingham.com
Implementation Session Participants

Charles M. Green - Engineering Specialist, Aramco Services Company
*e-mail: charlie.green@aramcoservices.com*

James G. Slaughter - President, S&B Engineers and Constructors Ltd.
*e-mail: jgsjr@sbec.com*

Stephen R. Thomas – Associate Director, Construction Industry Institute
*e-mail: sthomas@mail.utexas.edu*

Paul N. Woldy – Staff Engineer, ChevronTexaco Corporation
*e-mail: pwoldy@chevronexaco.com*

Other Knowledgeable Points of Contact

Ron Beechey - Scheduling Specialist, Dofasco, Inc.
*e-mail: ron_beechey@dofasco.ca*

Gertraud F. Breitkopf – Senior Program Manager, U.S. General Services, Administration
*e-mail: gertraud.breitkopf@gsa.gov*

Tom Butts – Manager, Southwest Operations, Lockwood Greene
*e-mail: tbutts@lg.com*

*e-mail: robert.chapman@nist.gov*

Jean Childers – Accounts Operations Manager, AMEC, Inc.
*e-mail: jean.childers@amec.com*

Gregory D. Clum – Manager of Project Controls, Black & Veatch Corporation
*e-mail: clumgd@bv.com*

William G. Cooley, Sr. – Senior PMP Capital Effectiveness Engineer, U.S. Steel
*e-mail: wgcsteen@uss.com*

Deborah L. DeGezelle – Systems Analyst, Construction Industry Institute
*e-mail: debdeg@mail.utexas.edu*
Productivity Metrics Breakthrough

Dean Ergenbright – Program Analyst, U.S. Department of State
e-mail: ergenbrightde@state.gov

Donald A. Gaddy – Construction Safety & Health Manager, Engineering & Construction Services, Southern Company Generation & Energy Marketing
e-mail: dagaddy@southernco.com

James B. Gibson – Vice President, Projects, ALSTOM Power Inc.
e-mail: james.b.gibson@power.alstom.com

Kevin J. Gierc – Director, Project Controls, Dick Corporation
e-mail: kjgierc@dickcorp.com

Carl Gretzinger – Facilities Project Planner, Project Planning Department, General Motors Corporation
e-mail: carl.gretzinger@gm.com

Harold L. Helland – Manager, Project Engineering, Abbott Laboratories
e-mail: harold.helland@abbott.com

Robert A. Herrington – Manager of Quality, Southern Region, Jacobs
e-mail: bob.herrington@jacobs.com

Howard Kass – Senior Facilities Engineer Program Manager, National Aeronautics & Space Administration
e-mail: howard.kass@nasa.gov

John E. Kurth – President, Aker Kværner Pharmaceuticals
e-mail: john.kurth@akerkvaerner.com

Grant G. Landry – Manager, Business Development, Jacobs
e-mail: grant.landry@jacobs.com

John M. Mellin – Manager, Business Planning & Performance, GlaxoSmithKline
e-mail: john.m.mellin@gsk.com

e-mail: mike.mitchell@emersonprocess.com

Wladimir Norko – Senior Engineer, Technical Policy Branch, U.S. Army Corps of Engineers
e-mail: walt.norko@usace.army.mil
Mark T. Owens – Director, Global Facilities Delivery, Eli Lilly and Company
e-mail: mto@lilly.com

David M. Perkins – Project Manager, Rohm and Haas Company
e-mail: david_m_perkins@rohmhaas.com

Derek C. Ross – Associate Director of Construction, Office of Facilities Engineering & Operations, Smithsonian Institution
e-mail: rossde@opp.si.edu

Michael J. Scholz – Engineer/Estimator, Kiewit Industrial Company
e-mail: michael.scholz@kic.kiewit.com

Danny Scott – Supervisor, Engineering Project Controls, BE&K, Inc.
e-mail: scottd@bek.com

John H. Stuart – Leader, Enterprise Project Management Office, NOVA Chemicals Corporation
e-mail: stuartj@novachem.com

Frank K. Suhan – Manager, Project Controls, Johnson Controls, Inc.
e-mail: frank.k.suhan@jci.com

John Tato II – Director, Project Evaluation & Analysis Division, U.S. Department of State
e-mail: tato-iij@state.gov

e-mail: steven.warnock@wgint.com
Productivity Metrics Breakthrough
Implementation Slides

Productivity Metrics Breakthrough
July 29th, 2004
Vancouver, BC

BMM Productivity Committee Members

Dave Hile, Chair  Fru-Con Construction Corporation
Danny Scott      BE&K Engineering
David Perkins    Rohm and Haas Company
Jim Gibson       ALSTOM Power Inc.
John Kurth       Aker Kvaerner Pharmaceuticals
Jimmy Slaughter  S&B Engineers and Constructors Ltd.
Steve Thomas     Construction Industry Institute
Inho Kim         CII / The University of Texas at Austin

Purpose of Implementation Session

- Review & discuss engineering productivity metric definitions agreed at Woodville Retreat.
- Extend to all CII member companies the opportunity to participate and receive reports.
Productivity Metrics Retreat

June 2-4, 2004
Woodville, TX

Summary of Retreat Participation

- 27 representatives from 20 companies

Productivity Metrics Retreat Participation

Owners
Jim Johns – 3M
John Jondle – BP North America
Paul Woldy – ChevronTexaco
David Teague – Dow
David Butler – GlaxoSmithKline
David Perkins – Honeywell and Haas Company
Richard Shunnarah – Southern Company Services, Inc.

Academia
Steve Thomas – CII (Facilitator)
Inho Kim – The University of Texas at Austin
Hana VanWinkle – CII, Director
Productivity Metrics Retreat Participation cont.

Contractors
Richard Hersley - ABB Lummus Global
Larry Stevens - ALSTOM Powers
Rick Osgena - ALSTOM Powers
John Ward - Stibb & Associates
Danny Scott - BESK, Inc.
Daryle Bierhart - CDI
Rick Campbell - Flint Energy
Peter Moore - Fluor Corporation
Dave Hile - Fru-Con (Facilitator)
Jack Yarbrough - Jacobs
Tony Smith - Mustang Engineering

Jimmy Slaughter - S&B (Host)
David Anders - S&B
Bob McKinney - S&B
Charles Reid - S&B
Marvin Black - S&B
Scott Bentivegna - Washington Group International, Inc.

Purpose of The Retreat

• Purpose:
  – Gain an understanding of engineering metric definitions (PT 192 & Benchmarking)
  – Develop a consensus on metrics definitions
  – Develop a data collection strategy
  – Have a relaxed setting to pull people together

Why Productivity Metrics?

• CII has provided leadership in project improvement for 20 years and member companies have vastly improved.

• CII research generally targets project processes and we have established many metrics that drive improvement at that level.

• Our continued success in the global environment however, requires improvement at the discipline level.

• Productivity metrics for both engineering & construction are essential to drive improvement at the discipline level.
Practice Use – Owners

Safety Performance Trend

Productivity Trend

Notes
Productivity Measurement History

Present Practices

Most companies:
- Track production of drawings and specifications versus budget
- Use % TIC as target engineering budget
- Use earned value concept in some form
- Have no uniform system of measurement

Source: RT 156 2001 Annual Conference Slide

Problems with Present Practices

- Lack of standard format and content
- Difficulty in tracking actual effort dedicated to each deliverable
- No correlation between number of deliverables and installed quantities or effectiveness
- Computer-based tools:
  - Schematics and specs from database
  - Physical drawings replaced by models

Source: RT 156 2001 Annual Conference Slide
PT-192

- Followed PT-156 approach for metrics based on installed quantities
- Concluded that companies can not report work-hours below discipline level
- Developed predictive models (basis hours) at the discipline level based on selected quantities.
- Developed Productivity Index:

  \[
  \text{Productivity Index} = \frac{\text{Actual Hours}}{\text{Productivity Basis Hours}}
  \]

PT-192 Issues/Concerns

- Relative vs. absolute measurement
- Based on predictive models:
  - Accuracy
  - Ability to update/reproduce
- Feasibility of Custom Tailored Approach
- Easier to collect data (Off-the-Shelf Approach)
- Use of tool

BM&M Approach

- Followed PT-156 approach for qty based metrics
- Developed common definitions for Direct/Indirect Accounts
- Developed Construction Prod. Metrics for 7 Categories (wk-hr/Installed Qty)
- Developed Engineering Prod. Metrics for 6 Categories (Wk-hrs/IFC Qty)

  \[
  \text{Raw Productivity} = \frac{\text{Actual Hours}}{\text{IFC Quantity}}
  \]
BM&M Issues/Concerns

- Absolute vs. Relative Measurement
- Based on direct measurement for IFC quantities
- Ability to feed data
- Use of metrics

Decision Point

- Are Productivity Metrics for CII?
  Unanimously – Yes!
- What Approach?
  - Direct Measurement
  - Predicted Model

Direct Measurement

\[
\text{Raw Productivity} = \frac{\text{Actual Hours}^*}{\text{IFC Quantity}}
\]

* Per Design Component
Highlights of the Retreat

- 27 attendees from 20 companies
- Reviewed current practice, Research, and Benchmarking approaches
- Discussed pros and cons of both approaches
- Built a consensus for CII productivity metrics
- Majority of attendees favored BM&M approach
- Modified the BM&M engineering productivity questionnaire
- Discussed a direct/indirect ratio for new metrics
- Developed data collection strategy
- Established path forward

Data Collection Strategy

- Goal:
  - Commitment for 50 projects by the end of 2004
  - PT-192: Obtain 118 projects by asking companies that participated
- How do we get more companies involved?
  - Owners contact “CII member” contractors
  - Contractors contact “CII member” owners
  - Annual Conference

What was Accomplished

- Developed a consensus that engineering productivity metrics are doable and will provide meaningful data to the industry
- Gained an understandings of engineering metric definitions (PT-192 & BM&M)
- Reviewed and modified engineering productivity metrics definitions
- Agreed on providing greater flexibility for data collection
- Agreed on measuring IFC quantity vs. Actual Installed quantity
- Added “Rework Hours” per each major category if data available
Path Forward

- Extend opportunity to participate to all CII member companies.
- New data collection through December 2004
- Meet at BOA in November to discuss progress in data collection
- Productivity Metrics report out by next March
- Meet in March or April 2005 to update and share each company’s experience

Special Training Available

- Benchmarking will hold a special productivity metrics training on
  August 24-25th – Austin, TX

Contact Frances DeCoux
fd.decoux@mail.utexas.edu
512-232-3000 to register

Productivity Metrics

<table>
<thead>
<tr>
<th>Construction Productivity</th>
<th>Engineering Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>Concrete</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>Structural Steel</td>
</tr>
<tr>
<td>Piping</td>
<td>Piping</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>Instrumentation</td>
</tr>
<tr>
<td>Equipment</td>
<td>Equipment</td>
</tr>
<tr>
<td>Electrical</td>
<td>Electrical</td>
</tr>
<tr>
<td>Insulation</td>
<td></td>
</tr>
</tbody>
</table>

Examples

- Work-hours / Qty Installed
- Design Hours / IFC Qty
Directs & Indirects - Engineering

<table>
<thead>
<tr>
<th>Account</th>
<th>Blends</th>
<th>Indirects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account</td>
<td>Discipline Engineer</td>
<td>Document Control</td>
</tr>
<tr>
<td></td>
<td>Designer</td>
<td>Reproduction Graphics</td>
</tr>
<tr>
<td></td>
<td>Technician</td>
<td>Project Management</td>
</tr>
<tr>
<td></td>
<td>Project Controls (cost/schedule/estimating)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Engineer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secretary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forecasting (scheduling)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction Support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Detail packages (scheduling, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality Assurance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accounting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Legal</td>
<td></td>
</tr>
</tbody>
</table>

Engineering Productivity Metrics

Concrete (Hi/CY)  Structural Steel (Hrs/Ton)

<table>
<thead>
<tr>
<th>Slabs</th>
<th>Structural Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground &amp; Supported Slabs</td>
<td>Pipe Racks &amp; Utility Bridges</td>
</tr>
<tr>
<td>Area Framing</td>
<td>Miscellaneous Steel</td>
</tr>
<tr>
<td>Foundations</td>
<td>Total Steel</td>
</tr>
<tr>
<td>Piling (each)</td>
<td></td>
</tr>
<tr>
<td>Foundations (&lt; 5CY)</td>
<td></td>
</tr>
<tr>
<td>Foundations (&gt; 5CY)</td>
<td></td>
</tr>
<tr>
<td>Total Foundations (CY) excluding piling</td>
<td></td>
</tr>
</tbody>
</table>

Concrete Structures
Total Concrete

Engineering Productivity Metrics Cont.

<table>
<thead>
<tr>
<th>Electrical</th>
<th>Piping (Hrs/LF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Electrical Equipment (Hrs/EA)</td>
<td>Small Bore (2-1/2&quot; &amp; smaller)</td>
</tr>
<tr>
<td>Electrical Equipment over 600V</td>
<td>Large Bore (3&quot; and Larger)</td>
</tr>
<tr>
<td>Conduit (Hrs/LF) (Hrs/No. of Runs)</td>
<td>Hangers and Supports (Hrs/EA)</td>
</tr>
<tr>
<td>Cable Tray (Hrs/LF)</td>
<td>Total Piping</td>
</tr>
<tr>
<td>Wire and Cable (Hrs/LF) (Hrs/No. of Terminations)</td>
<td></td>
</tr>
<tr>
<td>Other Electric Metrics</td>
<td></td>
</tr>
<tr>
<td>Lighting (Hrs/EA)</td>
<td></td>
</tr>
<tr>
<td>Total Electrical (Hrs/LF)</td>
<td></td>
</tr>
</tbody>
</table>
### Engineering Productivity Metrics Cont.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Hours/EA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Vessels</td>
<td>Pulp &amp; Paper Equipment</td>
</tr>
<tr>
<td>Atmospheric Tanks</td>
<td>Woodyard Equipment</td>
</tr>
<tr>
<td>Heat Transfer Equipment</td>
<td>Pulp Mill Equipment</td>
</tr>
<tr>
<td>Boiler &amp; Fire Heaters</td>
<td>Bleach Plant Equipment</td>
</tr>
<tr>
<td>Rotating Equipment</td>
<td>Stock Preparation Equipment</td>
</tr>
<tr>
<td>Material Handling Equipment</td>
<td>Wet End Equipment (through the Presses)</td>
</tr>
<tr>
<td>Power Generation Equipment</td>
<td>Dryer Sections</td>
</tr>
<tr>
<td></td>
<td>Other Process Equipment</td>
</tr>
<tr>
<td></td>
<td>Vendor-Designed Modules &amp; Pre-Assembled Skids</td>
</tr>
<tr>
<td></td>
<td>Total Equipment</td>
</tr>
</tbody>
</table>

### Engineering Productivity Metrics Cont.

<table>
<thead>
<tr>
<th>Instrumentation</th>
<th>Hours/Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loops (count)</td>
<td></td>
</tr>
<tr>
<td>Tagged Devices (count)</td>
<td></td>
</tr>
<tr>
<td>I/O (count)</td>
<td></td>
</tr>
<tr>
<td>DCS/PLC Configuration &amp; Programming (I/O count)</td>
<td></td>
</tr>
</tbody>
</table>

### Productivity Metrics Breakthrough

July 29th, 2004
Vancouver, BC
Abstract

Since the release of its Manual for Small (Special) Project Management in 1991, CII has had a leadership position in defining small project management practices. While many project management methods are the same for large and small projects, they are often not properly executed for small projects. Some techniques and practices, however, are beneficial to implement. Time will be provided to ask questions and discuss various approaches to small project execution.

Implementation Session Moderator

Gary R. Smith – Professor, Department of Civil Engineering and Construction, North Dakota State University

Gary Smith is the Director of the NDSU Construction Management and Engineering division. His research interests include methods to improve management systems with an emphasis in quality and safety. His research includes projects in the highway, heavy, industrial, and manufacturing construction sectors. Smith has 17 years as an active researcher and teacher. He also has experience as a design engineer, project engineer, and estimator. A licensed professional engineer, he holds a doctorate in civil engineering from Purdue University.

e-mail: gary.smith@ndsu.nocak.edu
Abstract

This presentation will highlight key components and steps required to develop and implement an operations handbook. Although this endeavor is challenging, it is certainly not an insurmountable task. The paybacks are tremendous and far outweigh the contribution of company resources with significant benefits realized in all aspects of operations and business ventures.

Implementation Session Moderator

James Ross – General Manager, Quality Department, Kværner Songer

James Ross is responsible for QA/QC technical services and development, maintenance, and education of the company’s quality processes and systems. He also is the primary writer of Kværner Songer’s Operations Handbook. Previous assignments with the company include controller and vice president—administration. Ross has been active in CII for the past six years, and is currently involved in the Achieving Learning Organizations in the EPC Industry research effort. He holds degrees from Washington & Jefferson College (English) and Robert Morris University (accounting).

e-mail: jim.ross@akerkvaerner.com

Implementation Session Participants

John A. Friedrich – Process Manager, Kværner Songer
e-mail: john.friedrich@akerkvaerner.com

Richard P. Helper – Project Manager, Kværner Songer
e-mail: rick.helper@kvaerner.com

John R. Hewitt – President, Kværner Songer
e-mail: john.hewitt@akerkvaerner.com

Sam Steinmiller – Project Controls Manager, Quality Department, Kværner Songer
e-mail: sam.steinmiller@akerkvaerner.com
Our agenda for this implementation session is to:

- Provide you with some useful tools that may be of benefit to you in your operations or business
- Share with you our methodologies and strategies for developing and implementing an effective system toolkit
- Present some of the tools and techniques to enable you to integrate and align CII Best Practices into your processes and systems
A Toolkit for Construction Project Management

Notes
Notes
A Toolkit for Construction Project Management
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Notes
A Toolkit for Construction Project Management

Notes

A Toolkit for Construction Project Management

EMPLOYEE RESPONSIBILITY MATRIX
I. PRIMARY PROJECT DUTIES AND FUNCTIONS

B. CONSTRUCTIBILITY PRACTICES
6. Prepare Constructibility Applications and Solutions Report CP-1

EMPOYEE RESPONSIBILITY MATRIX
I. PRIMARY PROJECT DUTIES AND FUNCTIONS

C. CONSTRUCTION DESIGN SERVICES
7. Prepare Constructibility Applications and Solutions Report CP-1

Depicts integration and cross functional responsibility

Klaeser Vanger

A Toolkit for Construction Project Management

EMPLOYEE RESPONSIBILITY MATRIX
I. PRIMARY PROJECT DUTIES AND FUNCTIONS

B. CONSTRUCTIBILITY PRACTICES

Ref. No. | Description | Review Office Time Issue Requirements | Form Contents and Purpose | Responsible Employees
---|---|---|---|---
1 | Constructibility | | | Program Team

Prepared by the Project Team to document a constructibility issue during any project phase. Describes constructibility application — original and proposed alternate schemes and benefits to cost, schedule, safety, quality — solution agreed to and assigned responsibility — access issues.

Klaeser Vanger

A Toolkit for Construction Project Management

Don't Be Caught in This Guy's Shoes

Make Sure You Have The Right Tools in Your Toolkit

Klaeser Vanger
A Toolkit for Construction Project Management

History and Timeline of CI Best Practices

Launch Development and Initial Release Operations Handbook
Build CI Library – Conduct CI BP Research
Integration / Alignment Handbook w/CI BP
(1) CI Best Practice Assessment

Kraemer Wanger
“Think twice and sometimes not at all”

Notes
### A Toolkit for Construction Project Management

#### CI Best Practice Assessment

<table>
<thead>
<tr>
<th>Practices &amp; Initiatives</th>
<th>Impact</th>
<th>Design</th>
<th>Schedule</th>
<th>Budget</th>
<th>Execution</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan sustainability &amp; resilience</td>
<td>2.0</td>
<td>80</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Identify &amp; address project barriers</td>
<td>2.5</td>
<td>80</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Comply with sustainability standards &amp; ensure program life</td>
<td>2.5</td>
<td>80</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Implement sustainability throughout project lifecycle</td>
<td>2.0</td>
<td>80</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Develop sustainability ideals</td>
<td>3.1</td>
<td>80</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Monitor and evaluate project program effectiveness</td>
<td>2.6</td>
<td>80</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>80</td>
</tr>
</tbody>
</table>

**Notes**
A Toolkit for Construction Project Management
Banquet Presentation
Banquet Speaker: John Furlong

Speaker

John Furlong – Chief Executive Officer, Vancouver Organizing Committee, 2010 Olympic and Paralympic Winter Games

John Furlong, a longtime member of the Canadian Olympic Committee, Furlong served as co-chair of the British Columbia (BC) Summer Games, the BC Winter Games, and Sport BC. He founded the Northern BC Winter Games Society and served BC at seven Canada Games and two Western Canada Games. An international competitor in three sports and a coach as well, he is a former Canadian Squash Champion. He has been recognized with numerous community awards for his service to sport, including the Darrel Thompson Award and the Kaizan Award for services to sport in BC over a lifetime. Furlong was inducted into the BC Sports Hall of Fame this year.
Dr. G. Edward Gibson, Jr., has been selected as the recipient of the Outstanding Researcher Award for 2004. This marks the second time Gibson has been selected as the outstanding researcher, having been selected in 1996 as well. The two researcher awards coupled with his other recognition from CII as the outstanding instructor (1998) make him unique in the history of the Institute.

Gibson is a professor of civil engineering and the Austin Industries Endowed Faculty Fellow in the Construction Engineering and Project Management program at The University of Texas at Austin. He received his Ph.D. in civil engineering from Auburn University and an M.B.A. from the University of Dallas. He currently serves as a member of the Board of Governors for the Architectural Institute within the American Society of Civil Engineering.

He is an author or co-author of numerous articles and reports on pre-project planning. Among these documents are CII's Pre-Project Planning Handbook, Project Definition Rating Index (PDRI), Industrial Projects, and PDRI, Building Projects.

Most recently he has been involved in developing the CII International Project Risk Assessment tool and method. It is this research that has helped Gibson garner the outstanding researcher award for the second time. In a letter nominating him for the award, one CII member notes that, “In undertaking the research of this very complex subject, Dr. Gibson has shown leadership and provided direction which resulted in an easy-to-use work product. The research is founded on data that represents billions of dollars of capital investment. The work is unique to our industry and will become a standard for assessing risk for international projects.”

CII takes great pride in recognizing Dr. Gibson for his outstanding research contributions. He is a stellar researcher in one of the world’s largest industries. Congratulations to Dr. G. Edward Gibson, Jr., on his selection as the Outstanding Researcher for 2004.
Award Criteria

- The research significantly contributed to the improvement of the construction industry.
- The research is completed and products delivered.
- The researcher’s excellence is recognized by his or her CII team members, the staff, and the membership.
- The researcher’s report to CII is innovative, well written, and timely.

Previous Recipients of the Outstanding CII Researcher of the Year Award

1995 – Mike Vorster, Virginia Polytechnic University
1996 – Edd Gibson, The University of Texas at Austin
1997 – Stu Anderson, Texas A&M University
1998 – Gary Oberlender, Oklahoma State University
1999 – Ed Back, Texas A&M University
2000 – Jeff Russell, University of Wisconsin-Madison
2001 – Ed Jaselskis, Iowa State University
2002 – Carl Haas, The University of Texas at Austin
2003 – Jimmie Hinze, University of Florida

Outstanding Researcher Award Panel of Judges

W. Edward Back  Associate Professor, Clemson University
Melissa B. Herkt  Vice President, Global Project Management, GlaxoSmithKline
William L. Johnsmeyer  President, Butler Construction, Butler Manufacturing Company
Jerry R. Koogler  General Manager, Graycor Industrial Contractors
Louis L. Prudhomme  Associate Director for Research, Construction Industry Institute
Michael R. Peters has been selected as the recipient of the Outstanding Instructor Award for 2004. The award recognizes outstanding performance in using CII material to enhance the learning process.

Peters, corporate training manager for Washington Group International, helped to create and deploy the highly successful Project Team Training Program at his company. The Project Team Training Program covers 26 topics totaling 184 classroom hours. The training is done in two phases: first, a Web-based course or courses to be completed online as a prerequisite to a second phase of facilitated classroom training with case studies and team exercises. He and the Washington Group developmental team integrated all CII Best Practices and Proposed Best Practices into standard company work processes to improve project team performance. He also coordinated the efforts of Clemson University professors and subject matter experts in developing the program’s training modules.

During 2003, the Project Team Training Program involved 55,000 hours of training with 7,000 employee and client participants. Peters alone did 20,000 participant hours of training in team building, partnering, and owner/contractor work structure, all based on CII research and recommendations. This personal effort on his part totaled approximately 800 classroom hours — roughly 40 percent of his annual work time.

Peters has been involved in CII activities for several years. He moderated the Washington Group case study on the Project Team Training Program at the 2002 CII Annual Conference as well as the 2002 Construction Project Improvement (CPI) Conference, which is sponsored by CII. He is currently a member of the CII Education Committee.

Consistently rated as an exceptionally effective instructor by the written critiques submitted at the end of each training session, Peters has created high demand for his services among Washington Group offices and projects worldwide. By virtue of this involvement, he has contributed significantly to improved project performance, transferring knowledge about CII research findings and recommendations to project teams for implementation. CII salutes Mike Peters and is pleased to recognize him with its Outstanding Instructor Award for 2004.
**Award Criteria**

- The nominee is an exceptionally effective instructor whose contributions, talent, and efforts have been recognized for outstanding performance by the participants in learning activities involving CII education material.
- The nominee has presented CII material in ways that have significantly enhanced the learning process.
- Consideration will also be given to the degree to which the nominee has contributed to the development of CII education material.

**Previous Recipients of the Outstanding Instructor Award**

1995 - Jorge Vanegas, Georgia Institute of Technology
1996 - Stan Nethery, Dow Chemical
1997 - Steve Sanders, Clemson University
1998 - Edd Gibson, The University of Texas at Austin
1999 – Don Shaw, Ontario Hydro
2000 - Gary Aller, Arizona State University
2001 - Ed Back, Clemson University
2002 - Ed Ruane, J. A. Jones Construction Company
2003 – James M. Neil, Morrison Knudsen (deceased)
         Emmitt J. Nelson, Shell Oil Company (retired)

**Outstanding Instructor Award Panel of Judges**

Manuel A. Garcia  
Associate Director for Education, Implementation, Knowledge Management, Construction Industry Institute

Arnold M. Manaker  
Project Manager, Paradise SCR, Tennessee Valley Authority

Leo McKnight  
Director, Training & Development, Hilti Corporation

Gary R. Smith  
Professor, Department of Civil Engineering and Construction, North Dakota State University
Outstanding Implementer for 2004
Melissa Herkt

Melissa Herkt is the 2004 recipient of the Outstanding Implementer Award from the Construction Industry Institute. The award recognizes outstanding achievement in enhancing implementation of CII Best Practices within one or more CII member organizations.

Herkt is vice president of global project management at GlaxoSmithKline (GSK). She recently sponsored a team within the company to establish common and consistent ways of managing capital projects. She and the team developed a comprehensive project management standard with specific emphasis on the CII Knowledge Areas and corresponding Best Practices and Proposed Best Practices. The resulting GSK standard has more than 100 implementation tools, several of which come directly from CII research.

Herkt’s active role and participation has brought a significant amount of experience and credibility to the standard within her company. More than 350 people from over 60 company sites have been trained in the use of the project management standard in 25 different countries. This includes 50 global manufacturing and supply sites, seven R&D sites, consumer healthcare and nutritional sites, and the company’s biological group that supports its U.S. commercial operations. GSK personnel have consistently rated the training course as excellent. In addition, the standard has been used as a case study in a prestigious UK academic-industry research project. The company’s R&D organizations in Europe and North America will soon adopt the standard as well.

Herkt has been a leader in promoting the concepts of implementation, knowledge management, and in creating a global project management community for her company. Also active in other CII efforts, she has assigned several GSK representatives to a variety of CII projects. Her leadership, commitment, and innovative ideas make her a valuable asset to all. CII is proud to recognize Melissa Herkt as the Outstanding Implementer for 2004.
Award Criteria

- The nominee has made a significant contribution to enhancing the implementation of CII Best Practices and/or CII Proposed Best Practices within one or more member organizations.

- Objective and specific data are available from the nominating organization that demonstrates the improvements attained through the enhanced implementation of CII Best Practices or CII Proposed Best Practices. The categories of improvements should include: cost, schedule, safety, quality, and process improvement.

- The nominee has demonstrated a commitment to the implementation of CII Best Practices or Proposed Best Practices.

- The nominee has developed and/or employed creative and innovative means to enhance the implementation of CII Best Practices or CII Proposed Best Practices. The nominee has also willingly informed others of these means and has shared the details of their use with those interested in implementation.

Previous Recipient of the Outstanding Implementer Award

2001 - Richard J. Jessop, Ontario Power Generation

2002 - Mohammad S. Al-Subhi, Saudi Aramco

2003 - Bernard J. Fedak, United States Steel Corporation

Outstanding Implementer Award Panel of Judges

Manuel A. Garcia
Associate Director for Education, Implementation, Knowledge Management, Construction Industry Institute

Donald G. Giles
Manager, Engineering, Mon Valley/Clairton, U.S. Steel Corp.

Robert F. Jortberg
RADM U. S. Navy (Retired) and former Associate Director, Construction Industry Institute

Richard F. Kibben
President, Kibben Consulting

Jack E. Turner
Consultant, Construction Management Services
The Benchmarking User Awards, given to both an owner organization and a contractor organization, recognize exceptional use of and contributions to benchmarking.

**Owner: GlaxoSmithKline**

GlaxoSmithKline (GSK) actively demonstrates continued and outstanding support of the benchmarking program. GSK helped launch Benchmarking’s pharmaceutical study as well as the small projects initiative. The company supports the Benchmarking Committee, has submitted significant amounts of project information to the Benchmarking database, and has sent many GSK representatives to the benchmarking training workshops.

**Contractor: Aker Kværner**

Aker Kværner has steadfastly supported and been involved with CII Benchmarking since the program’s inception. A supporter of the recent productivity measures initiative, it also has representation on the Benchmarking Committee. Aker Kværner is the only CII member organization to have submitted data to all seven versions of the benchmarking questionnaire. The company shared its experiences in benchmarking at last year’s Benchmarking Users Forum.

**Award Criteria**

- Best application of benchmarking for project system improvement.
- Contributions to benchmarking through active participation (forum, training, project submittal, committee).
- Willingness to share ideas.

**Previous Recipients of the Benchmarking User Awards**

**2000** - Owner: Champion International  
Contractor: Jacobs Engineering

**2001** - Owner: General Motors Corporation  
Contractor: BE&K

**2002** - Owner: Aramco Services Company  
Contractor: Dillingham Construction Holdings  
S&B Engineers and Constructors Ltd.

**2003** - Owner: Rohm and Haas Company  
Contractor: CDI Engineering Group Inc.
Benchmarking User Awards Panel of Judges

The Benchmarking & Metrics Committee selects the recipients of the award each year. The committee includes the following individuals:

Ron Beechey  Scheduling Specialist, Dofasco, Inc.
Gertraud F. Breitkopf  Senior Program Manager, U.S. General Services Administration
Tom Butts  Manager, Southwest Operations, Lockwood Greene
Robert E. Chapman  Economist, Office of Applied Economics, National Institute of Standards & Technology
Jean Childers  Accounts Operations Manager, AMEC, Inc.
Gregory D. Clum  Manager of Project Controls, Black & Veatch Corporation
William G. Cooley, Sr.  Senior PMP Capital Effectiveness Engineer, U.S. Steel
Deborah L. DeGezelle  Systems Analyst, Construction Industry Institute
Dean Ergenbright  Program Analyst, U.S. Department of State
Donald A. Gaddy  Construction Safety & Health Manager, Engineering & Construction Services, Southern Company Generation & Energy Marketing
James B. Gibson  Vice President, Projects, ALSTOM Power Inc.
Kevin J. Gierc  Director, Project Controls, Dick Corporation
Charles M. Green  Engineering Specialist, Aramco Services Company
Carl Gretzinger  Facilities Project Planner, Project Planning Department, General Motors Corporation
Harold L. Helland  Manager, Project Engineering, Abbott Laboratories
Robert A. Herrington  Manager of Quality, Southern Region, Jacobs
David G. Hile  Operations Manager, Fru-Con Construction Corporation
Howard Kass  Senior Facilities Engineer Program Manager, National Aeronautics & Space Administration
John E. Kurth  President, Aker Kværner Pharmaceuticals
Grant G. Landry  Manager, Business Development, Jacobs
John M. Mellin  Manager, Business Planning & Performance, GlaxoSmithKline
Michael S. Mitchell  Director, Project Management Office, Refining & Chemical Industry Center, Emerson Process Management
Wladimir Norko  Senior Engineer, Technical Policy Branch, U.S. Army Corps of Engineers
Mark T. Owens  Director, Global Facilities Delivery, Eli Lilly and Company
David M. Perkins  Project Manager, Rohm and Haas Company
Derek C. Ross  Associate Director, Construction, Office of Facilities Engineering & Operations, Smithsonian Institution
Michael J. Scholz  Engineer/Estimator, Kiewit Industrial Company
Danny Scott  Supervisor, Engineering Project Controls, BE&K, Inc.
James G. Slaughter  President, S&B Engineers and Constructors Ltd.
John H. Stuart  Leader, Enterprise Project Management Office, NOVA Chemicals Corporation
Frank K. Suhan  Manager, Project Controls, Johnson Controls, Inc.
Benchmarking User Awards for 2004

John Tato II Director, Project Evaluation & Analysis Division, U.S. Department of State

Stephen R. Thomas Associate Director, Construction Industry Institute

Richard L. Tucker Leadership & Service Award

Kent Underwood

CII is pleased to announce the creation of a new award, the Richard L. Tucker Leadership and Service Award. The award recognizes an individual who has contributed significantly to the advancement of the CII mission and to the success of CII as an organization. It is named in honor of Dr. Richard L. Tucker, who personally led the effort to create the Construction Industry Institute in 1983 and who served as the first CII Director from its inception until his retirement as Director in 1998.

The CII Executive Committee selects the award recipient. The award may be presented to a CII volunteer participant in CII programs, to an individual not affiliated with a member organization who otherwise meets the criteria for the award, or to a CII staff member. The award is to be presented not more than once per year, and is to be presented only when a worthy candidate has been identified and selected.

The recipient must have been active in CII programs or have provided significant and exceptional service to further the accomplishment of the CII mission; demonstrated a strong and lasting commitment and support for the mission and the objectives of CII; and served as a role model for other CII participants. The recipient also must have been active in CII efforts for at least three years.

J.Kent Underwood

J. Kent Underwood is the first recipient of the Richard L. Tucker Leadership and Service Award. Because of his long association with CII and the extensive industry experience he has brought to bear in the pursuit of the CII mission, he makes an excellent choice as the initial recipient.

Kent Underwood retired in 2002, after more than 33 years of service to the engineering and construction industry. Prior to his retirement, he was manager of project management for Solutia Inc. in St. Louis, Missouri. He has over 33 years of experience in the engineering, construction, and facilities management industries, 25 with Monsanto and Solutia. He has been recognized twice with the Engineering News-Record Magazine Award of Excellence for his work with The Business Roundtable. He also has been active in civic and community affairs, serving as vice chairman of the St. Louis Regional Convention and Sports Complex Authority. He served in the U.S. Air Force, achieving the rank of captain.
He began his association with CII in 1986. In the ensuing 15 years, he served in numerous capacities. Among his efforts, he served on the Board of Advisors as both an alternate and an advisor. He also served on the original Implementation Committee as well as the Membership Committee and The Business Roundtable/AIChE Engineering and Construction Contracting (ECC) Advisory Council. He also was an influential member of the CII Executive Committee from 1999 to 2001. In addition, Underwood played an important role in the CII Annual Conferences through his participation as a CII Forum panelist in both 1997 in St. Louis and in 2002 at Keystone, Colorado.

Kent Underwood has steadfastly supported CII from its formative days and has provided leadership, service, and a seasoned point of view to help CII accomplish its mission to improve the engineering and construction industry. It seems only fitting that he should be selected as the initial recipient of this newly created award since his leadership, service, and support of CII and its initiatives are exemplary in every way. He will now serve as the prototype for the Richard L. Tucker Leadership and Service Award. CII is proud to honor Kent Underwood as the first recipient of this new and singular honor.
The Construction Industry Institute established the Carroll H. Dunn Award of Excellence in 1985 to honor an individual for significant achievements in improving the engineering and construction industry. The award is CII's highest honor and is recognized as one of the most prestigious awards of its kind in the construction industry. A recipient for 2004 has been selected by the CII Executive Committee and will be recognized at the CII Banquet.

Carroll H. Dunn

Carroll H. Dunn was the Project Director of the Construction Industry Cost Effectiveness (CICE) by The Business Roundtable that led to the creation of the Construction Industry Institute. He was instrumental in the establishment of CII. Dunn had a highly decorated career in the United States Army Corps of Engineers. He retired as a Lt. General. During his military career, Dunn served in World War II and later served as Director of the Titan II Missile Program and Division Engineer of the Corps’ Southwestern Division.

In 1980, Dunn began work as the full-time Project Director of the CICE Project. The CICE study led to the creation of CII. Dunn’s service to CII was considered so valuable that he was appointed an ex-officio member of all the original committees and research task forces.

Criteria of the Dunn Award

Criteria for the Dunn Award include the following:

- Significant contributions to the construction industry.
- Demonstration of the highest degree of personal dedication to improving costs, schedule, quality, and/or safety of the capital facilities delivery process.
- A level of knowledge and breadth of experience that distinguish the recipient as an eminent authority.
- A leadership position in the construction industry from which others can be influenced by example and direction.
- A record of accomplishment that brings added distinction to the recipient, the organizations with which he or she has been associated, and to the industry at large.
Recipients of the Dunn Award of Excellence

Carroll H. Dunn (1985) – inspiring leader and project manager of the CICE Project who guided the establishment of CII as a principal national forum for construction research

Charles D. Brown (1987) – early application of cost-effectiveness principles led to stellar engineering career; DuPont representative to CICE study; energetic advocate of CICE findings

Ted C. Kennedy (1988) – a founder of BE&K; influential member of original CII Board of Advisors; recognized industry leader in education, training, and employee development

Robert H. Miller (1989) – intense DuPont participant during CICE who later chaired CII, oversaw its first published research, and helped to establish its educational program

Louis Garbrecht, Jr. (1990) – pioneered “engineering” of the construction process and proved that constructability is cost-effective; early advocate of project management research; original chairman of CII

Clarkson H. Oglesby (1991) – research pioneer and author of classic construction engineering textbooks who established the first graduate studies in construction at Stanford University

James M. Braus (1992) – Shell Oil and CICE leader and diplomat who bridged diverse opinions within CII to keep the Institute unified and authored the original CII Strategic Plan

Gary D. Jones (1993) – hard-working, determined 1987 CII chairman whose “implementation challenge” that year led to a dramatic change in how CII viewed implementation

Jack E. Turner (1994) – originated idea that led to establishment of The Business Roundtable, and later suggested a study of owner-contractor issues that became the CICE Project
Daniel J. Bennet (1995) – aspiring association executive, CICE participant, and author of CII by-laws who led establishment of the National Center Construction Education and Research

John W. Morris II (1996) – led effort to unite Corps of Engineers, Federal government, and environmentalists in shaping national water resources policy during turbulent transition era

Richard L. Tucker (1997) – professor, productivity research pioneer, CICE participant, and renowned industry speaker who personally led efforts to establish CII at UT Austin; served as first Director from 1983-1998

Edward W. Merrow (1998) – researcher who developed the Project Evaluation System, an analytical tool to benchmark project data, and founded Independent Project Analysis (IPA)

Donald J. Gunther (1999) – hard-driving Bechtel executive whose leadership, dedication, and teamwork influenced others personally and professionally as well as changed Bechtel’s approach to worldwide business

Arthur J. Fox, Jr. (2000) – long-time editor of Engineering News-Record; traveled around the world to report on more than four decades of industry progress, created ENR's Engineer of the Year award

H. B. Zachry, Jr. (2001) – born constructor who led a road contracting firm founded by his father to a worldwide leadership role through dedication to his employees and principles of quality, safety, and client satisfaction

Joseph J. Jacobs (2002) – Jacobs Engineering founder who led his company to the top echelons of the engineering world and whose entrepreneurial spirit and ethical beliefs inspire those who work for him
Appendices
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ABC-SIM</td>
<td>Activity-Based Costing Simulation</td>
</tr>
<tr>
<td>ABT</td>
<td>Advanced Building Technology [Matrix]</td>
</tr>
<tr>
<td>AC</td>
<td>Annual Conference</td>
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<tr>
<td>ACTS</td>
<td>Advanced Construction Technology System</td>
</tr>
<tr>
<td>ADR</td>
<td>Alternative Dispute Resolution</td>
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<tr>
<td>AIA</td>
<td>American Institute of Architects</td>
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<tr>
<td>AIChE</td>
<td>American Institute of Chemical Engineers</td>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<tr>
<td>ASTD</td>
<td>American Society for Training and Development</td>
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<tr>
<td>BA</td>
<td>Benchmarking Associate</td>
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<tr>
<td>BOA</td>
<td>Board of Advisors</td>
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<tr>
<td>BP</td>
<td>Best Practice</td>
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<tr>
<td>BM&amp;M</td>
<td>Benchmarking and Metrics</td>
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<tr>
<td>BMC</td>
<td>Benchmarking and Metrics Committee</td>
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<tr>
<td>BRT</td>
<td>The Business Roundtable</td>
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<tr>
<td>BTSC</td>
<td>Breakthrough Strategy Committee</td>
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<tr>
<td>CCIS</td>
<td>Center for Construction Industry Studies</td>
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<tr>
<td>CEC</td>
<td>Continuing Education Course</td>
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<tr>
<td>CEN</td>
<td>European Committee for Standardization</td>
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<tr>
<td>CEPM</td>
<td>Civil Engineering Project Management</td>
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<tr>
<td>CEU</td>
<td>Continuing Education Unit</td>
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<tr>
<td>CI</td>
<td>Construction Institute [ASCE]</td>
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<tr>
<td>CIAG</td>
<td>Construction Industry Action Group</td>
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<tr>
<td>CIB</td>
<td>International Council for Research and Innovation in Building and Construction</td>
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<tr>
<td>CICE</td>
<td>Construction Industry Cost Effectiveness</td>
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<tr>
<td>CII</td>
<td>Construction Industry Institute</td>
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<tr>
<td>CIMIS</td>
<td>Common Industry Material Identification Standards [Organization]</td>
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<tr>
<td>CIP</td>
<td>Continuous Improvement Process</td>
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<tr>
<td>CKII</td>
<td>CII Knowledge Implementation Index</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>CPI</td>
<td>Construction Project Improvement [Conference]</td>
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<td>CPI</td>
<td>Consumer Price Index</td>
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<tr>
<td>Compass</td>
<td>Communications Project Assessment [Tool]</td>
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<td>CURT</td>
<td>Construction Users Roundtable</td>
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<tr>
<td>D/IT</td>
<td>Design/Information Technology</td>
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<tr>
<td>DART</td>
<td>Days Away, Restricted, or Transferred</td>
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<tr>
<td>DB</td>
<td>Design-Build</td>
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<tr>
<td>DBB</td>
<td>Design-Bid-Build</td>
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<tr>
<td>DL</td>
<td>Data Liaison</td>
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<tr>
<td>DPI</td>
<td>Disputes Potential Index</td>
</tr>
<tr>
<td>DRB</td>
<td>Dispute Review Board</td>
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<tr>
<td>E&amp;C or E/C</td>
<td>Engineering and Construction</td>
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<tr>
<td>EC</td>
<td>European Community</td>
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<tr>
<td>EC</td>
<td>Education Committee</td>
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<tr>
<td>ECC</td>
<td>Engineering Contracting &amp; Construction [Conference]</td>
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<tr>
<td>ECI</td>
<td>European Construction Institute</td>
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<tr>
<td>EEC</td>
<td>European Economic Community</td>
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<td>EIP</td>
<td>Employee Incentive Program</td>
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<tr>
<td>EIP</td>
<td>Employee Incentives Plan</td>
</tr>
<tr>
<td>EM</td>
<td>Education Module</td>
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<tr>
<td>EMR</td>
<td>Experience Modification Rate</td>
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<tr>
<td>ENR</td>
<td><em>Engineering News-Record</em></td>
</tr>
<tr>
<td>EPC</td>
<td>Engineer-Procure-Construct</td>
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<tr>
<td>ERC</td>
<td>Engineering Research Center</td>
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<td>ExCom</td>
<td>Executive Committee</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>FEL</td>
<td>Front-End Loading</td>
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<tr>
<td>FIAPP</td>
<td>Fully Integrated and Automated Project Processes</td>
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<tr>
<td>FIATECH</td>
<td>Fully Integrated and Automated Technologies</td>
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<tr>
<td>FRI</td>
<td>Field Rework Index</td>
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<td>GC</td>
<td>Globalization Committee</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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GPM General Performance Model
GPS Global Positioning System
HIV/AIDS Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IC Implementation Champion
IDS Industry Data & Statistics
IPA Independent Project Analysis, Inc.
IPRA Instructional Project Risk Assessment
IR Implementation Resource
ISC Implementation Strategy Committee
ISO International Organization for Standardization
JSA Job Safety Analysis
KA Knowledge Area
KM Knowledge Management
KMC Knowledge Management Committee
KPI Key Performance Indicators
KSFG Knowledge Structure Focus Group
LEED Leadership in Energy and Environmental Design
LL Lessons Learned
LWCIR Lost Workday Case Incidence Rate
MC Membership Committee
MEMS Micro Electro-Mechanical Systems
NGL Natural Gas Liquids
NIST National Institute of Standards and Technology
NSPE National Society of Professional Engineers
OCWS Owner Contractor Work Structure
OLA Online Administrator
OMB Office of Management and Budget
OSHA Occupational Safety and Health Administration
P&ID Piping and Instrumentation Diagram
PBP Proposed Best Practice
PDCS Project Delivery and Contract Strategies
 PDH | Professional Development Hour
PDRI | Product Definition Rating Index
PE | Professional Engineer
PEpC | Procurement, Engineering, procurement, Construction
PEPW | Project Executive Planning Workshop
PIP | Process Industry Practices
PM | Project Manager
PO | Purchase Order
POL | Products Online
PPMOF | Prefabrication, Preassembly, Modularization & Offsite Fabrication
PPP or P³ | Pre-Project Planning
PRB | Product Review Board
PT | Project Team
QEC | Quality Evolution Chart
QM | Quality Management
QPMS | Quality Performance Management System; archived
R&D | Research and Development
RC | Research Committee
RD&D | Research, Development, and Deployment
RFID | Radio Frequency Identification
RFP | Request for Proposal
RIR | Recordable Incidence Rate
RR | Research Report
RRT | Radical Reduction Technique
RS | Research Summary
RT | Research Team
SAME | Society of American Military Engineers
SAVE | [term]
SHE | Safety, Health, and Environmental
SME | Subject Matter Expert
SPC | Strategic Planning Committee
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>SRI</td>
<td>Security Rating Index</td>
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<tr>
<td>TAL</td>
<td>Technology Assisted Learning</td>
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<tr>
<td>TED</td>
<td>Training, Education, and Development</td>
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<tr>
<td>TISP</td>
<td>The Infrastructure Security Partnership</td>
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<tr>
<td>TQM</td>
<td>Total Quality Management</td>
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<tr>
<td>TRIR</td>
<td>Total Recordable Injury Rate</td>
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<td>USGBC</td>
<td>U.S. Green Building Council</td>
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<td>VE</td>
<td>Value Engineering</td>
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<td>VM</td>
<td>Value Management</td>
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<tr>
<td>XC</td>
<td>Executive Committee</td>
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</tbody>
</table>
CII Member Organizations

3M
Abbott Laboratories
Air Products and Chemicals
Amgen
Anheuser-Busch Companies
Aramco Services Company
BP America
CITGO Petroleum Corporation
Cargill
Celanese
ChevronTexaco Corporation
ConocoPhillips
Dofasco
The Dow Chemical Company
DuPont
Eastman Chemical Company
ExxonMobil Corporation
General Motors Corporation
GlaxoSmithKline
Intel Corporation
International Paper
Kraft Foods
Eli Lilly and Company
NASA
NOVA Chemicals Corporation
Ontario Power Generation
Petrobras
Praxair
The Procter & Gamble Company
Rohm and Haas Company
Shell Oil Company
Smithsonian Institution
Solutia
Southern Company Services
Tennessee Valley Authority
U.S. Army Corps of Engineers
U.S. Department of Commerce/NIST/Building and Fire Research Laboratory
U.S. Department of Energy
U.S. Department of Health and Human Services
U.S. Department of State
U.S. General Services Administration
U.S. Steel
Weyerhaeuser Company

ABB Lummus Global
ALSTOM Power
AMEC
AZCO
Aker Kværner
BE&K
BMW Constructors
Baker Concrete Construction
Bechtel Group
Black & Veatch
Bovis Lend Lease
Burns & McDonnell
CB&I
CDI Engineering Solutions
CH2M HILLS/IDC/Lockwood Greene
CSA Group
Day & Zimmermann International
Dick Corporation
Emerson Process Management
Fluor Corporation
Foster Wheeler USA Corporation
Fru-Con Construction Corporation
Gilbane Building Company
Grinaker-LTA
Hatch
Hilti Corporation
Honeywell International
Jacobs
Johnson Controls
Kellogg Brown & Root
Kier/CCC USA
Kiewit Construction Group
M. A. Mortenson Company
Mustang Engineering
Parsons E&C
Perot Systems Corporation
Primavera Systems
S&B Engineers and Constructors
The Shaw Group
Technip USA Corporation
Turner Construction Company
Victaulic Company of America
Walbridge Aldinger Company
Washington Group International
Williams Group International
Yates Construction
Zachry Construction Corporation
Zurich North America
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