PCI Overview
Comprehensive Quality Systems: A Smart Choice for Bridges

2011 Caltrans-PCMAC Precast Bridge Workshop
Sacramento, CA
November 17, 2011

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Managing Technical Director of Transportation
Precast/Prestressed Concrete Institute
Chicago, IL

FHWA 1990

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Washington, D.C. 20590

Subject: Certification Programs

Date: APR 19 1990

From: Chief, Bridge Division
Office of Engineering

Reply to Attn. of: HNG-32

To: Regional Federal Highway Administrators
Federal Lands Highway Program Administrator (HFL-1)

Industry established certification programs exist that are directed towards improvement and maintenance of the quality of the products in the particular industry, e.g., the Precast/Prestressed Concrete Institute (PCI) Plant Certification Program, the Steel Structures Painting Council (SSPC) Painting Contractor Certification Program, the American Institute of Steel Construction (AISC) Quality Certification Program and, in the near future, the Concrete Reinforcing Steel Institute (CRSI) Epoxy Coating Applicator Plant Certification Program.

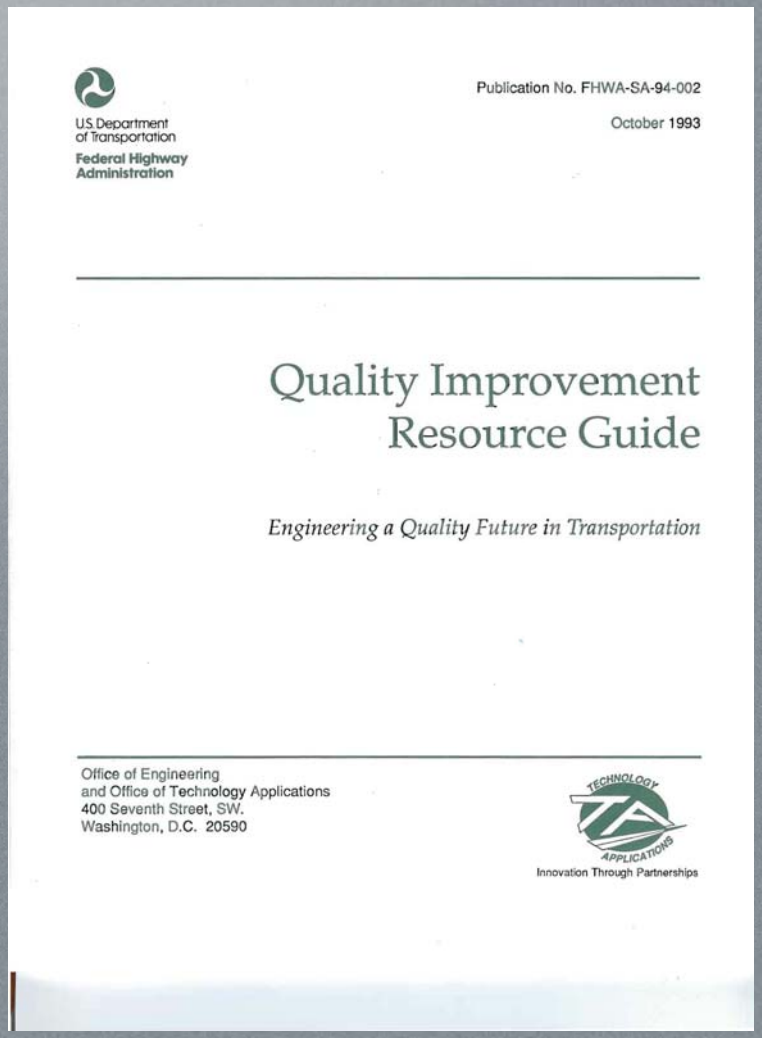
These programs establish a common requirement of quality for all member companies, enhance the integrity of the industries and help ensure that the product produced will best serve owner agencies. To this end, owner agencies should be encouraged to require the previously mentioned certification of producers involved in federally funded projects. The concept of certification is one mechanism by which the industry and the owners can work together in sustaining quality control and quality assurance programs for improved performance and economy in structures.

If you have any suggestions or comments concerning the use of certification programs as a tool for enhancing the quality, longevity and economy of bridges, please contact us. Some of the certifying industries will be sending some further information to you regarding these programs in the near future.

Stanley Gordon

The April 19, 1990 memorandum from Stanley Gordon served to encourage owners to work with industry to enhance quality, longevity and economy.

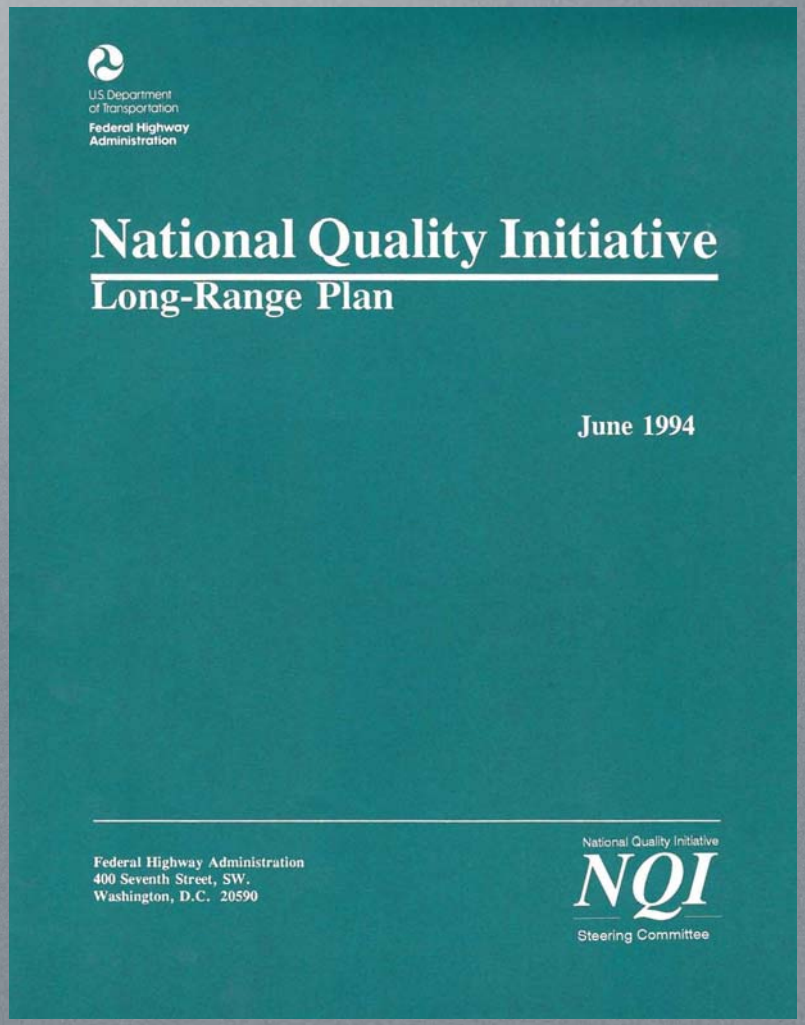
FHWA 1993



Focuses a whole chapter on Continuous Quality Improvement (QI)

Denotes QI as: A Concept for Change

NQI (1994 and updated 1997)



Scope " to achieve a higher quality consciousness"

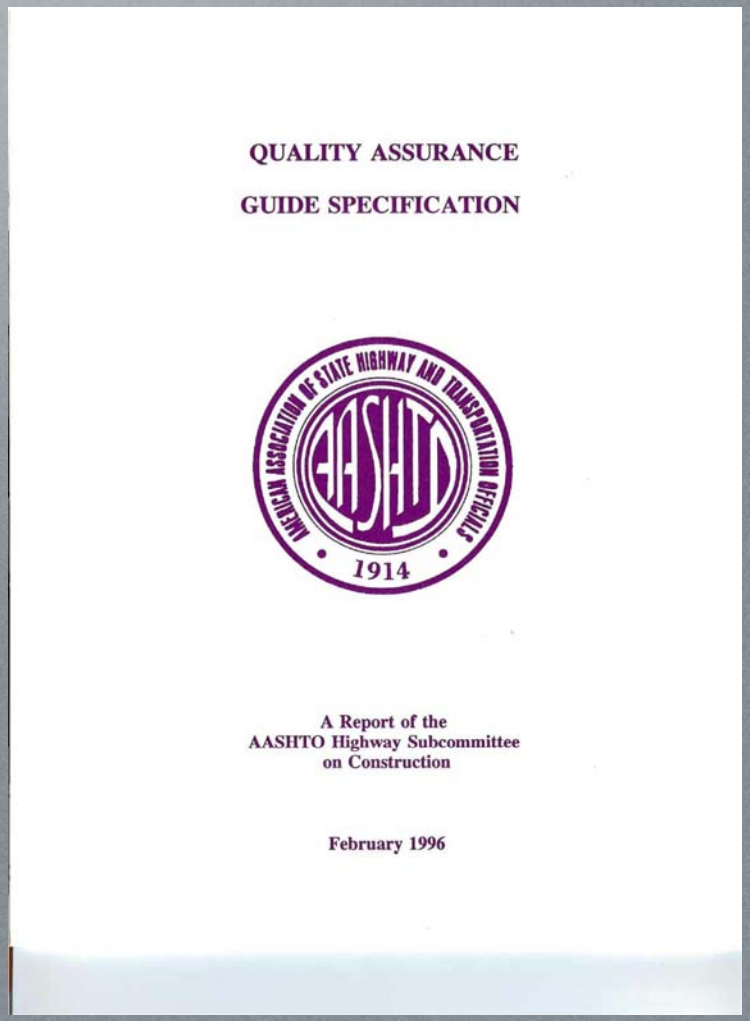
Objective 1: Promote and Disseminate Information on Quality Enhancement Practices...

Objective 2: Advance Technology & Build Consensus on important Highway Quality Issues

Objective 3: Reward Exemplary QI efforts

Objective 4: Maintain National emphasis on the Continuous Quality Improvement

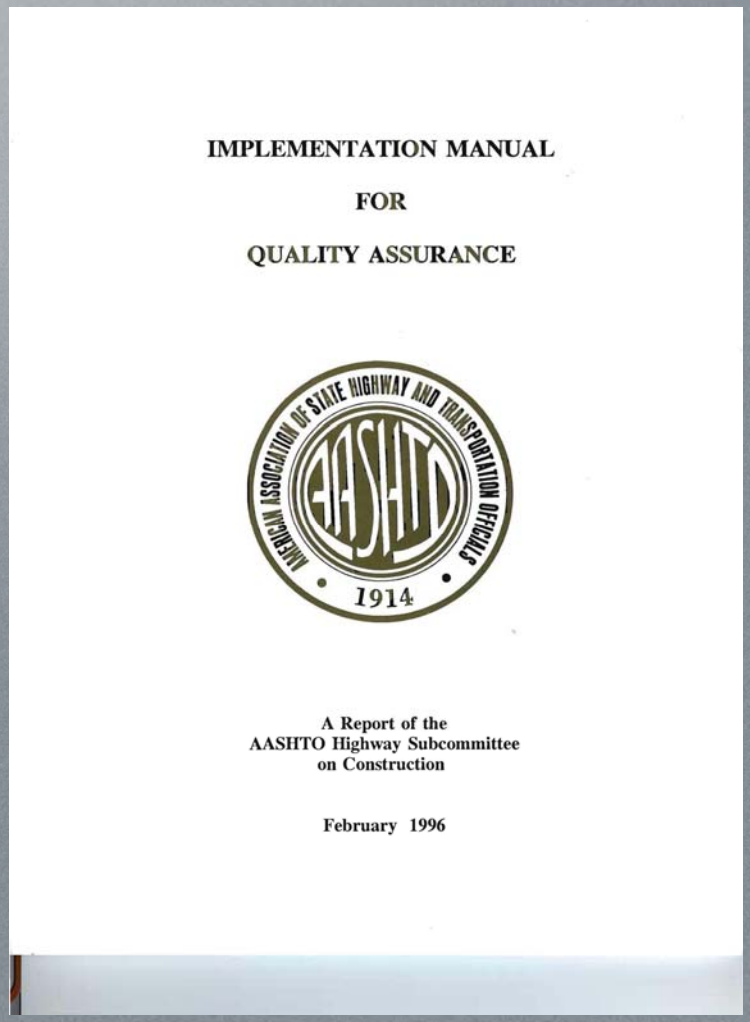
AASHTO Guide Specification (1996)



Adopts International (ISO9000) Quality Standards definitions for QC and QA

Promotes Industry involvement in developing standards

AASHTO Implementation (1996)



IMPLEMENTATION MANUAL

FOR

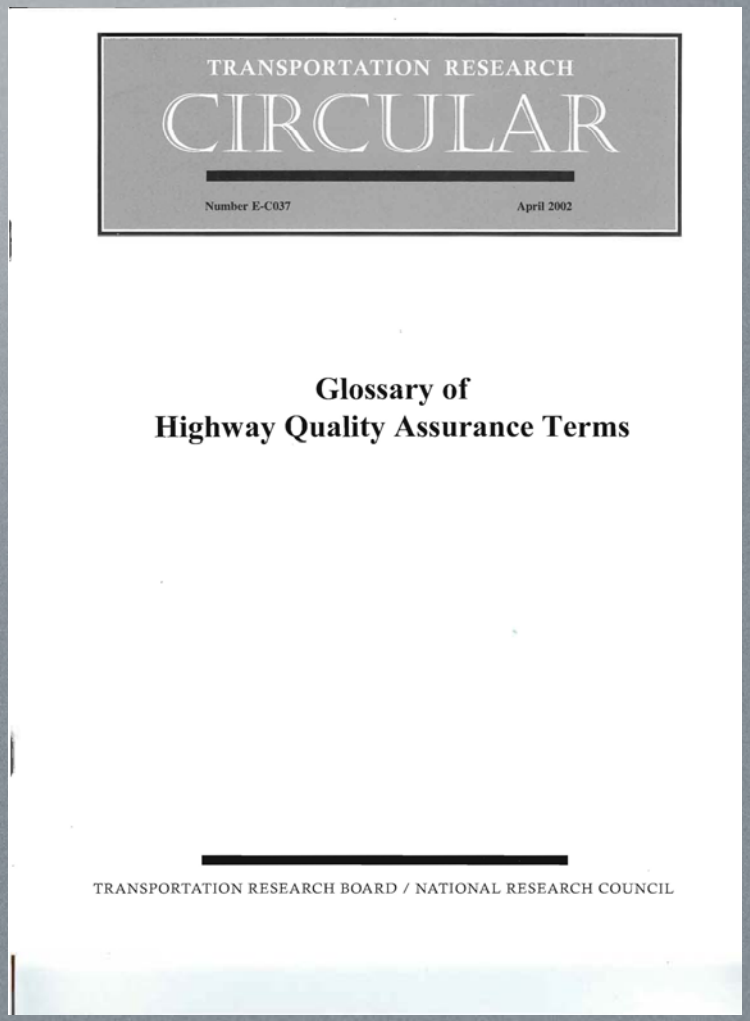
QUALITY ASSURANCE

A Report of the
AASHTO Highway Subcommittee
on Construction

February 1996

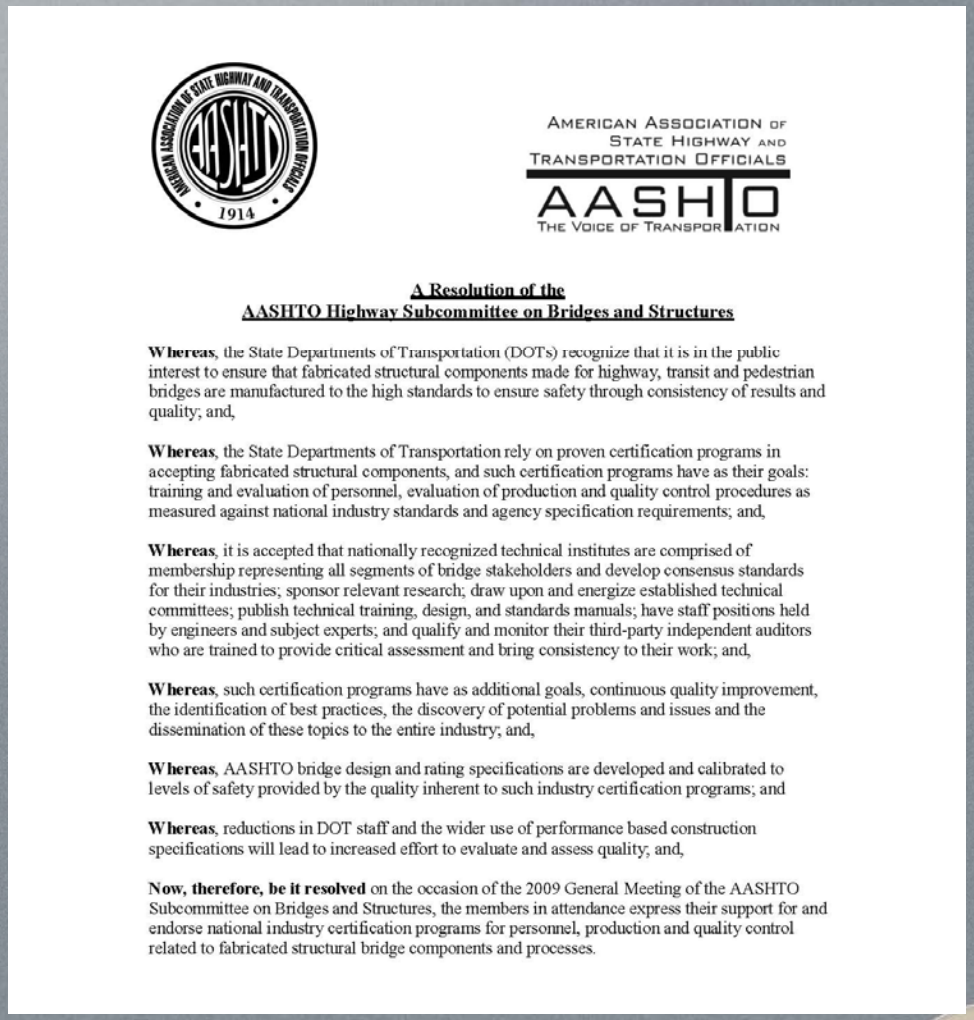
- *Defined parties roles with respect to QC and QA*
- *Laboratory Accreditation Program*
- *Personal certification for sampling and testing*
- *Detailed examples of dispute resolution and Independent verification testing*

TRB (2002)



- *Glossary of QA elements*
- *Explains Pay adjustments*
- *Examination of Statistics*
- *Performance Modeling*
  - *Precision*
  - *Accuracy*

AASHTO SCOBS and SOM (2009)



AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO
THE VOICE OF TRANSPORTATION

A Resolution of the
AASHTO Highway Subcommittee on Bridges and Structures

Whereas, the State Departments of Transportation (DOTs) recognize that it is in the public interest to ensure that fabricated structural components made for highway, transit and pedestrian bridges are manufactured to the high standards to ensure safety through consistency of results and quality; and,

Whereas, the State Departments of Transportation rely on proven certification programs in accepting fabricated structural components, and such certification programs have as their goals: training and evaluation of personnel, evaluation of production and quality control procedures as measured against national industry standards and agency specification requirements; and,

Whereas, it is accepted that nationally recognized technical institutes are comprised of membership representing all segments of bridge stakeholders and develop consensus standards for their industries; sponsor relevant research; draw upon and energize established technical committees; publish technical training, design, and standards manuals; have staff positions held by engineers and subject experts; and qualify and monitor their third-party independent auditors who are trained to provide critical assessment and bring consistency to their work; and,

Whereas, such certification programs have as additional goals, continuous quality improvement, the identification of best practices, the discovery of potential problems and issues and the dissemination of these topics to the entire industry; and,

Whereas, AASHTO bridge design and rating specifications are developed and calibrated to levels of safety provided by the quality inherent to such industry certification programs; and

Whereas, reductions in DOT staff and the wider use of performance based construction specifications will lead to increased effort to evaluate and assess quality; and,

Now, therefore, be it resolved on the occasion of the 2009 General Meeting of the AASHTO Subcommittee on Bridges and Structures, the members in attendance express their support for and endorse national industry certification programs for personnel, production and quality control related to fabricated structural bridge components and processes.

Recognizes contributions of National Technical Institutes

Bridge Code calibrated based on quality standards set forth from the practices formulated by Nation Institutes

New Market Place Information (2009)

SPECIAL ADVERTISING SECTION

STEEL ON THE RISE

ARE ALL CERTIFICATION PROGRAMS CREATED EQUAL?

Close examination shows certain certification programs stand apart from the rest

By Brian Raff, P.E.

Specifiers rely on nationally recognized certification programs to ensure that a steel fabricator's procedures meet acceptable quality standards. In fact, the members attending the 2009 general meeting of the AASHTO Subcommittee on Bridges and Structures expressed support for and endorsed national industry certification programs for personnel, production and quality control related to fabricated structural bridge components and processes.

In 1976, the American Institute of Steel Construction (AISC), the not-for-profit technical institute established in 1921 to serve the U.S. structural steel design community and construction industry, started its certification program to establish an industry standard that would enable fabricators to demonstrate that they have a quality system in place. Today, AISC is the largest nationally recognized quality certification program for the steel industry and has over 325 AISC certified bridge fabricators and over 1,000 program participants worldwide.

In recent years, several new certification programs have surfaced. Barriers to entry are relatively low, and since the details of AISC's certified quality management system are freely available to the public, they have been used as the basis for programs developed by consultants and other independent entities. However, the requirements alone do not guarantee an effective quality certification program. It is important for specifiers and owners to recognize what sets AISC apart from competing certification efforts, and to require AISC certification as a means of ensuring quality on steel building and bridge projects.

Following is a list of 12 items that comprise a comprehensive quality certification program.

Industry standing. The AISC certification program relies on an extremely wide and diverse knowledge base focused on advancing quality. AISC is recognized within the steel design and construction industry as the preeminent forum and principal body of knowledge. As a national technical institute, AISC facilitates the exchange of knowledge across the full spectrum of industry stakeholders. With a well organized membership base and a focus on collaboration and dissemination of information, AISC provides a framework that other profit-oriented consultants cannot.

Welding a steel girder at AISC certified ASA member fabricator Industrial steel construction, corp. Inc.

Clearly stated purpose. A comprehensive quality certification program must serve as an effective engine for improvement, with a core purpose to advance quality within the steel industry. Its purpose must be stated transparently, with no hidden agenda. AISC is motivated to support the overall steel design and construction industry as a non-profit technical institute; it does not cater to corporate or individualistic agendas but forms strategic relationships for the greater good of the industry.

The raccoon creek steel bridge under construction in Pike county, KY.

Broad professional involvement. A comprehensive quality certification program must apply the best available professional qualifications, operational experience, and up-to-date knowledge to develop quality standards. AISC certification has committee participation that reflects a diverse and balanced mix of technical subject matter experts including fabricators, erectors, design engineers, code officials, DOT representatives and FHWA representatives.

Governance and consensus. A comprehensive certification program must apply its body of knowledge in a fair and balanced manner that reflects the true consensus of the construction industry. AISC has defined a governance structure with established procedures controlling the development of technical methods and quality standards.

Deliverables. A comprehensive quality management system must deliver a final "product" that adds value and helps fabricators improve. The product of the AISC certification program is an audited and certified quality management system; however, each certified fabricator receives a physical audit report summarizing a company's strengths and deficiencies. As a benefit to specifiers and project owners, any AISC certified company can provide their latest audit report upon request. This is where the AISC certification program may differ from other certification programs.

Validation. A comprehensive certification program must be able to validate key elements of knowledge, particularly new and/or complex technical methods and quality standards, prior to application. Technical institutes provide consensus-based program development, oversight committees, expert review panels, and public review procedures for this

continued on pages s9

INSTITUTE CERTIFICATION since 1967

CERTIFICATION RELIES ON A BODY OF KNOWLEDGE AND CONTINUOUS IMPROVEMENT

AASHTO resolution endorses certification programs by technical institutes to ensure that products meet specifications and remain on cutting edge of improvements

By William N. Nickas, P.E., and Dean A. Frank, P.E., Precast/Prestressed Concrete Institute

The American Association of State Highway and Transportation Officials (AASHTO) has released a resolution supporting the specification of components for bridge construction that have been fabricated using certified quality-control and production procedures. The resolution additionally recognizes that a national technical institute is uniquely qualified to develop and deliver certification programs for its specific industry.

The resolution, endorsed by the AASHTO Subcommittee on Bridges & Structures during its recent 2009 general meeting, calls for recognition of "national industry certification programs for personnel, production, and quality control related to fabricated structural bridge components and processes." It cites a number of reasons that technical institutes are the best option to ensure that standards and certification procedures fully engage current research results and state-of-the-art techniques. This body of knowledge, which is constantly evolving, is the foundation of the technical institute and the institute remains its guardian.

The resolution was crafted to address the recent proliferation of "certification" programs, which has caused confusion in the marketplace. Private commercial concerns and groups from other industries have developed inspection programs—often based on standards published by technical institutes—that are touted as certification programs. They have led some specifiers to believe that their certification programs offer procedures and results compatible with certification by the industry technical institute.

The Federal Office of Management and Budget has stated that government agencies are encouraged to reference nonprofit, consensus-based standards and participate with these institutes, rather than create their own requirements. Programs that lack the foundations of strong research, the organization of technical committees to gather consensus, or the ongoing commitment to a continuous improvement process, will fail to meet the standards-development requirements of the American National Standards Institute.

Also, adoption of certification programs outside an industry's nationally recognized technical institute effectively fragments the industry's quality-assurance machinery and isolates groups of fabricators from immediate access to the industry's official, continuously evolving body of knowledge. More than that, new certification programs may create confusion by establishing parallel but inconsistent procedures, references, and benchmarks. An industry must be attuned to one national standard.

As the AASHTO resolution makes clear, technical institutes offer significant benefits that other certifying entities cannot provide (to read the complete resolution, see the sidebar on the following page). Using a certification program is important, it notes, because state departments of transportation above all else must ensure the safety of the construction team and structure users. The resolution further states that the best way to provide such assurance is through "consistency of results and quality"

Certification
Much more than a checklist

Certification programs are much more than checklists used to conduct inspections. Effective, credible certification programs are based on an industry's body of knowledge, from which all related industry standards and state-of-the-art procedures are derived. This body of knowledge tells us what the industry can do with a particular material, product, or system and explains how it can be done reliably. The primary purpose of a certification program is to help ensure that products are manufactured in accordance with specifications and customer expectations. It is therefore critical that certification programs be continuously linked as closely as possible to the source of the industry's body of knowledge: the national technical institute.

Top Photo: Modern prestressed concrete manufacturing facilities require sophisticated industrial engineering capability. (Photo: Northeast Prestressed Products LLC, Cressona, Pa.)

New Market Place Information (2009)

In order for a quality certification program to perform efficiently, it must support **all of the points** addressed above. It is important to note that many of the points listed above originate from a pending joint white paper created by AISC and the Precast/Prestressed Concrete Institute (PCI) that will be available on each respective organization's website: www.aisc.org and www.pci.org , respectively.

The white paper breaks down "material barriers" between the concrete and steel industry and demonstrates that while **some consultants and associations may offer certification programs, only the technical institute serving the corresponding industry has the established body of knowledge to serve as a singular, standardized and accredited certification organization.**

Characteristics of Technical Institutes

1. Industry
2. Clearly S
   Purpose
3. Broad Pr
   Involvem
4. Governa
   Consens
5. Researc
6. Validatio

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Audits
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AISC/PCI White Paper on
Quality Systems in the Construction Industry

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Chicago, IL 60601
www.aisc.org

Precast/Prestressed Concrete Institute
209 W. Jackson Blvd., Suite 500
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www.pci.org

Introduction

This white paper identifies 12 characteristics essential to any organization offering construction industry certification. Typically, these characteristics are found within the national not-for-profit *technical institutes* established to provide a consensus-driven forum for the development and continuous refinement of engineering, design, and quality standards and related certification programs. Owners and specifiers of both public and private facilities have depended on such organizations for conformity assessment and quality standards for more than 40 years.

Technical Institutes

Technical institutes are usually national or international in scope. Each is recognized as the preeminent forum for exchanging information and as the principal body of knowledge for the industry it serves. National technical institutes facilitate the exchange of knowledge between many different industry stakeholders, including subject matter experts, academics, designers, contractors, owners, code officials, fabricators, erectors, and manufacturers. With well organized membership bases and a focus on collaboration and dissemination of information, technical institutes provide a framework that independent industry organizations cannot. While any number of associations may serve an industry for a variety of professional and economic reasons, there is only one technical institute. When one industry overlaps with, or is a subset of, another, the technical institutes involved typically have well-established collaborative relationships with one another to effectively combine their bodies of knowledge. Technical institutes are not developed overnight; establishing expertise, standard-setting authority, and a reputation for reliability takes time, often decades.

Certification Programs

Because their properties may be difficult to verify at the construction site, prefabricated engineered components must be manufactured to meet contract requirements and to ensure quality and reliability. Direct independent observation and assessment of a fabricator's quality management system saves time and money, and provides assurance that a particular product has met a minimum level of acceptable quality standards. Specifiers need to rely on the nationally recognized *certification program* of an industry's technical institute to provide assurance that a fabricator has the personnel, organization, experience, procedures, knowledge, equipment, capability, and commitment to produce quality work.

In order to successfully and reliably perform this important function, a certification program cannot stand alone; it must be part of a comprehensive quality system *specific to the engineered components addressed*. The essential functional elements of a comprehensive quality system are listed in the attached discussion.

Certification Organization

Some public sector agencies establish certification programs in-house, often drawing upon the body of knowledge promulgated by the appropriate technical institutes (either directly or via public sector standards bodies) as the basis of their quality systems. Recognizing the resources and expertise necessary to establish the entire quality system for a given class of engineered components, owners may alternatively choose to specify institute-developed certification programs to provide prequalification of component fabricators.

Many commercial companies and industry associations also offer certification services. However, not all such offerings are supported by the necessary functional elements of comprehensive quality systems typically embodied in an industry's technical institute.

A certification program developed and run by an independent technical institute ensures transparency, allows for continued process improvement, and removes any fear of bias towards one or more companies.

In the construction industry, *only the technical institute serving the corresponding industry segment provides all of the necessary functional elements of a comprehensive quality system and therefore currently serves as a singular, standardized, and accredited certification organization.*

National Commission for Certifying Agencies

Standards for the
Accreditation of Certification Programs

Approved February 2002.
Revised September 2004
Revised November 2006 (editorial only)
Revised December 2007 (editorial only)

ISO IEC

GUIDE 65

General requirements for bodies operating product certification systems

NIST/NCCA/IAS/ISO

Certifying the certifiers.

NCCA extensive standards range from governance to competency testing

ISO 65 outlines the public's perception of what a creditable certification program entails

NIST and IAS accreditation recognized by some state Building officials as "validating Certification entities"

The framework set forth by white paper for fabrication facility certification follows these same rigorous tenants

NIST 1988

Notes that Certification Schemes range from the simple to the complex.

Certification has been around in various forms since the 4th Century

Fundamental to Deming's approach is "quality comes not from inspection, but from improvement of the production process"

Other Technical Institutes

- Examples of Technical Institutes

- American Iron and Steel Institute (AISI) plate standards;
- AISC for best practices and plant certification;
- American Segmental Bridge Institute (ASBI) for best practices and grouting-personnel certification;
- American Concrete Institute (ACI) for best practices and personnel certification;
- ASTM International for materials and test standards;
- American Welding Society (AWS) structural welding code, after-welding distortion tolerances, best practices, and personnel certification;
- Concrete Reinforcing Steel Institute (CRSI) reinforcement dimensions, bending and placement standards, and epoxy coating plant certification;
- PCI for best practices, plant certification, and personnel certification; and
- Post-Tensioning Institute (PTI) for best practices, hardware standards, and personnel certification.

Comprehensive Quality System

1. Industry Standing
   - Apply broad and diverse knowledge base
   - Maintain recognition in industry
   - Facilitate exchange of knowledge

FHWA Cooperative Agreement

- Federal and Industry agreement for shared funding of the advancement of Precast Prestressed Concrete Pavements
  - Developing Consensus based guidance documents

National Concrete Bridge Council

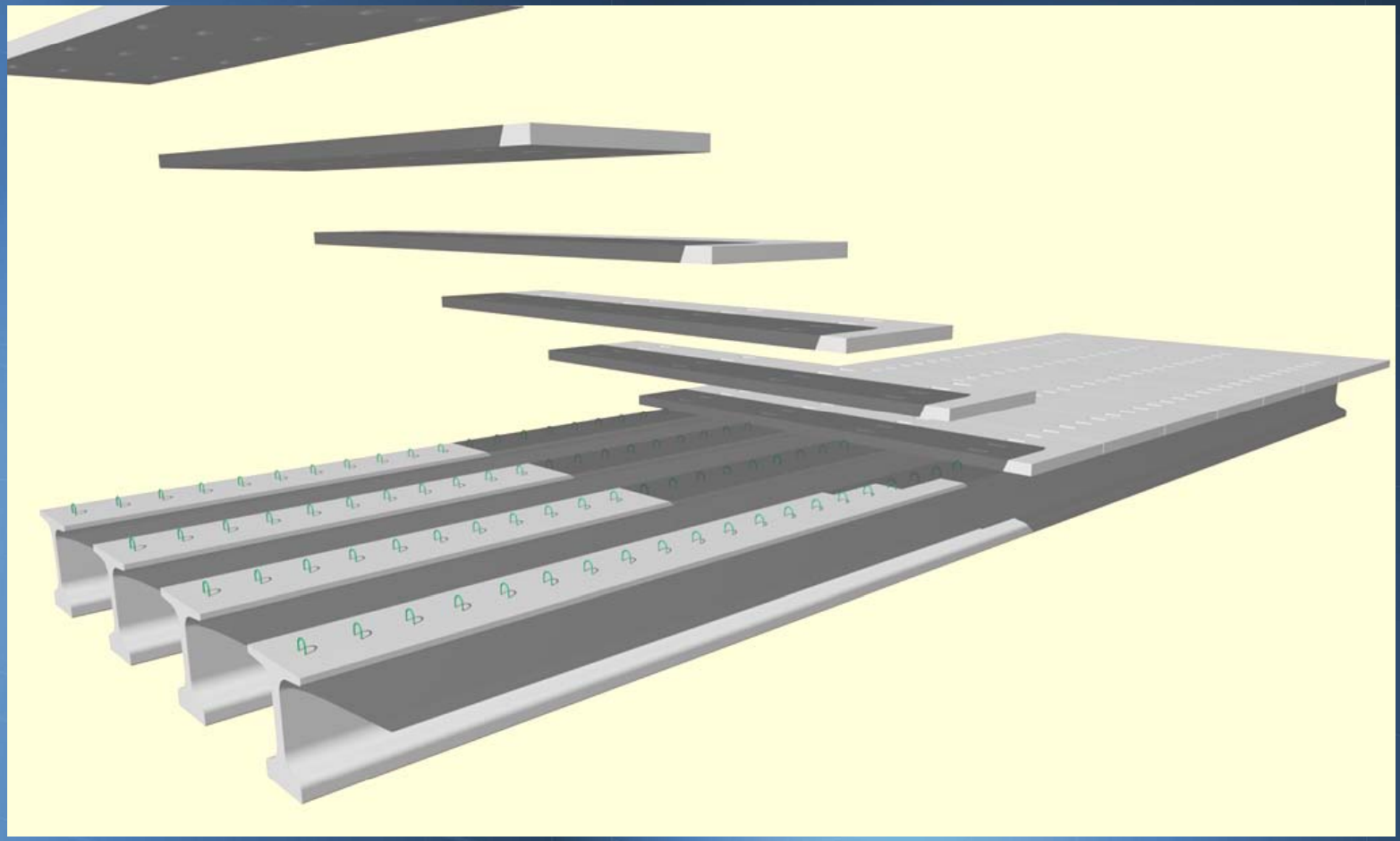
- American Coal Ash Association
- American Segmental Bridge Institute
- Concrete Reinforcing Steel Institute
- Expanded Shale, Clay, and Slate Institute
- National Ready Mixed Concrete Association
- Portland Cement Association
- Precast/Prestressed Concrete Institute
- Post-Tensioning Institute
- Slag Cement Association
- Silica Fume Association
- Wire Reinforcement Institute

Prefabricated Concrete Bridge Elements

What are Prefabricated Bridge Elements & Systems?

- **Superstructures**
  - Deck Panels: Partial & Full-Depth
  - Prefabricated Beams: Optimized for ABC, Optimized Shape, or Best Selected Section
  - Total Superstructure Systems:
  - Composite Units, Truss Spans
- **Substructures**
  - Pier Caps, Columns, & Footings
  - Abutment Walls, Wing Walls, & Footings
  - Total Substructure Systems
- **Totally Prefabricated Bridges**

Precast Deck on Precast Concrete Girders



Utah DOT MP200 Bridge

Photo Courtesy of Utah DOT

Utah DOT
Beaver Creek Bridge
GFRP Rebar in Deck Panels

Photo Courtesy of Utah DOT

Comprehensive Quality System

2. Clearly Stated Purpose
   - Serve as engine for quality improvement
   - State purpose transparently
   - Not-for-profit support overall industry
   - Form strategic relationships

Comprehensive Quality System

3. Broad Professional Involvement
   - Apply best professional qualifications and experience
   - Maintain diverse membership
   - Maintain balanced committee participation

PCI Membership

- 333 Producer Members
- 101 Supplier Associate Members
- 141 Erector Associate Members
- 1,953 Individual Members
  - 1,237 Professionals
  - 151 Associate Professionals
  - 237 Affiliates
  - 254 Students
  - 74 Life Members

Comprehensive Quality System

4. Governance and Consensus
   - Apply body of knowledge reflecting true consensus
   - Maintain defined governance structure
   - Follow ANSI standard development process

Comprehensive Quality System

5. Research
   - Address problems
   - Drive continuous improvement
   - Support/fund practical research
   - Publish internal research results
   - Disseminate external research results

PCI Strand Bond Research

The Effects of As-Cast Depth and Concrete Fluidity on Strand Bond

Robert J. Peterman, Ph.D., P.E.
Martin K. Eby Distinguished Professor in Engineering
Kansas State University
Manhattan, Kans.

This paper presents the results from strand end-slip measurements and load tests of members that were fabricated at six different precast concrete plants over the past 2½ years. All of the work reported herein is based on specimens that were produced using standard concrete mixtures and placement techniques. As such, the data presented are believed to be representative of current industry practice.

This study revealed that the occurrence of the so-called top-bar effect (top-strand effect) for pretensioned strands is primarily a function of the amount of concrete above the strand rather than the amount of concrete below it. Accordingly, the results of this investigation indicate that the current design assumptions for bond in pretensioned members are unconservative for members with strands near the top (as-cast) surface. This phenomenon can result in extremely large transfer lengths for strands located within a few inches of the top surface, including those in thin members. In addition, the top-bar effect typically becomes more pronounced in members as concrete fluidity increases.

However, these same findings also revealed that the current design assumptions for bond were generally accurate when strands were located deeper in the members. This was true for members made with either flowable concrete or self-consolidating concrete.

In recent years, the use of self-consolidating concrete (SCC) has been increasing steadily among prestressed concrete producers in the United States. SCC is defined as a highly workable concrete that can flow through densely reinforced or geometrically complex structural elements under its own weight. It adequately fills voids without segregation or excessive bleeding and without the need for vibration.[1]

In 2004, the Precast/Prestressed Concrete Institute (PCI) co-funded an extensive investigation to evaluate the bond between SCC and prestressing steel in pretensioned concrete members. The PCI study had the following three objectives:

- Determine the ability of six currently used SCCs made with admixtures from each of four major admixture suppliers in the United States to meet current ACI[2] and AASHTO[3] requirements for

A simple quality assurance test for strand bond

Robert J. Peterman

The transfer and development lengths of prestressing strands are critical parameters in the design of precast, pretensioned concrete members because they have a direct impact on both the flexural and shear design capacities of the members. However, because of the extreme difficulty and time required to experimentally determine these quantities, designers must currently assume values for the transfer and development lengths (usually the values recommended in the American Concrete Institute's [ACI's] *Building Code Requirements for Structural Concrete [ACI 318-08] and Commentary [ACI 318R-08]*[1] or the American Association of State Highway and Transportation Officials' *AASHTO LRFD Bridge Design Specifications*[2]).

Designers have historically assumed that the values provided in these two publications are applicable and conservative for pretensioned members. This is a different approach from that used for many other reinforced concrete design properties, such as concrete compressive strength, density, and air content. These properties are routinely measured, and their design assumptions verified, for the components used to construct prestressed concrete members.

In addition, the mixture proportions of concrete are continually increasing in complexity as new mineral and chemical admixtures are routinely being employed, often without consideration of their potential effect on strand bond capacity. Historically, it was believed that the ability of prestressing strands to bond to the surrounding concrete would be ensured by requiring a minimum concrete compressive strength at detensioning, which is an easily verified parameter. However, recent studies[3,4] have shown that some self-consolidating concretes (SCCs) and highly fluid mixtures can have significantly reduced bonding capabilities despite high compressive strengths at release. Thus, it is critical to verify the ability of strands to bond to the surrounding concrete and gain a better understanding of the mechanisms that are affecting this bond.

Editor's quick points

- This paper focuses on the development of a simple test that precasters can use to verify the bond of pretensioned steel reinforcement to concrete.
- Due to the continual increase in complexity of mixture proportions as new mineral and chemical admixtures are employed, it is critical to verify the ability of strands to bond to the surrounding concrete.
- A better understanding of the mechanisms that affect bond is needed.

PCI Blast Research

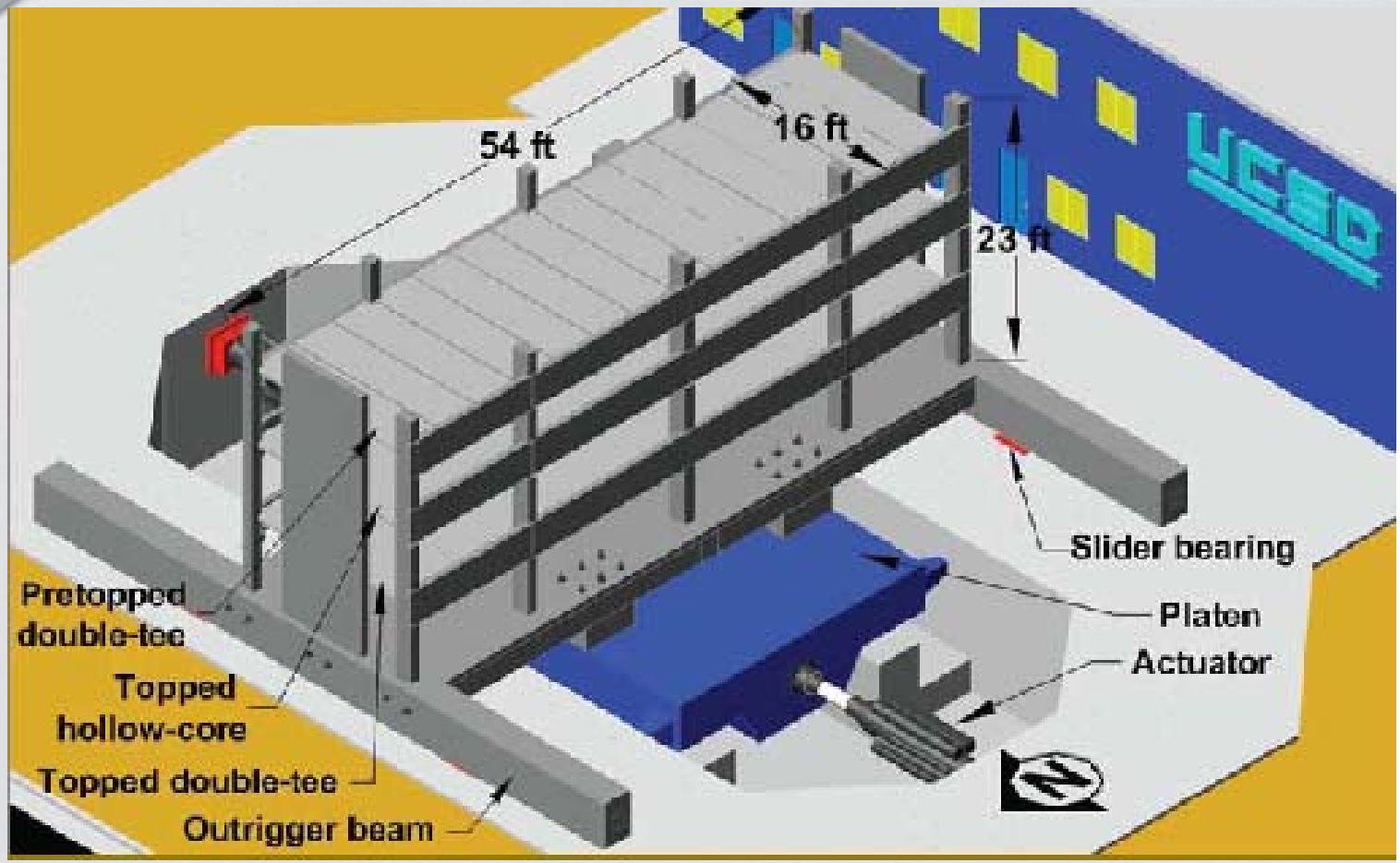
Air Force Research Lab

Tyndall Air Force Base, Panama City, FL

PCI Blast Research

- $1.6 million congressional appropriation
- Collaborative Research and Development Agreement (CRADA)
- Portland Cement Association (PCA) and Air Force Research Laboratory (AFRL)
  - PCI, TCA, NCMA, NCRMA, ICFA, CRSI
- Industry support with product donations and technical expertise

PCI Seismic Research



Diaphragm Seismic Design Methodology (DSDM)

PCI Seismic Research

- $2.5 million research program
  - National Science Foundation
  - George E. Brown Jr. Network for Earthquake Engineering Simulation
  - Charles Pankow Foundation
  - Precast/Prestressed Concrete Institute
  - Precast, prestressed concrete industry
    - Central Pre-Mix Prestress Co.

LCA Research

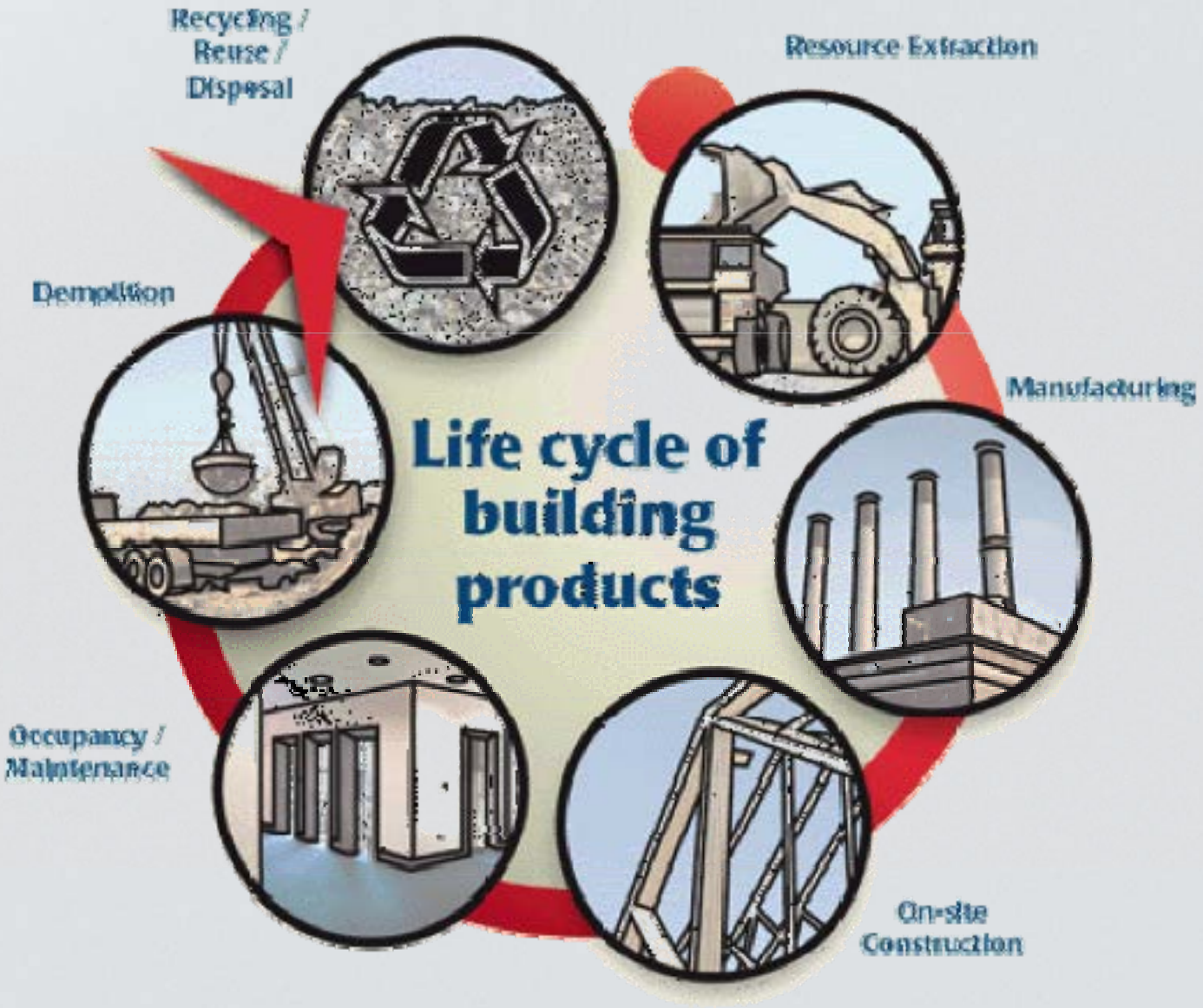
TOOLS OF THE TRADE

- **LCA: Life Cycle Assessment**
  - Energy impacts
  - Environmental impacts
  - Economic impacts
  - Cradle to grave (disposal)

- **LCCA: Life Cycle Cost Analysis**
  - Economic impacts only
  - Cradle to grave (disposal)

LCA Research

LCA Research



LCA Research

- **An LCA is:**
  - Evaluation of total environmental impact due to:
    - Extraction of materials and fuel used for energy
    - Manufacture of building components
    - Transportation of materials and components
    - Assembly and construction
    - Operation: energy consumption, maintenance, repair, renovation, etc.
    - Demolition, disposal, recycling, reuse
  - Complete assessment, not single criterion
  - Scientific, not subjective

Comprehensive Quality System

6. Validation
   - Validate knowledge and quality standards
   - Provide consensus-based program development
   - Provide oversight committees
   - Provide expert review panels
   - Provide public review

Comprehensive Quality System

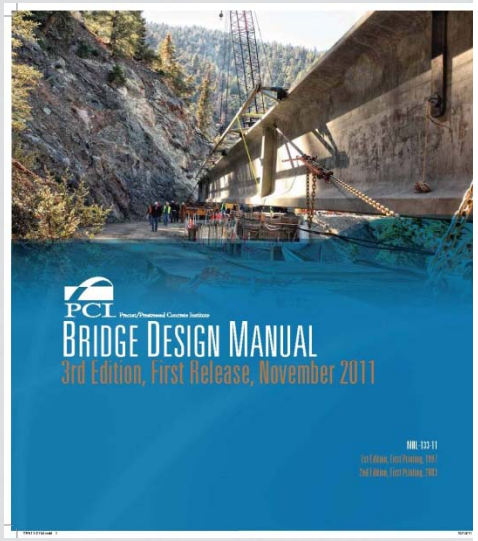
7. Dissemination
   - Educate industry personnel
   - Alert industry to technical and quality issues
   - Maintain journals, periodicals, manuals
   - Organize conferences

PCI's Transportation Trifecta

- Bridge Related Research Papers included and vetted in the ***Journal***

- ***Aspire*** showcases Projects and Concepts

- ***PCI Bridge Design Manual*** gives industry tested engineering solutions in its third edition



State-of-the-art Report On FULL-DEPTH PRECAST CONCRETE BRIDGE DECK PANELS

(SOA -01-1911)

Precast/Prestressed Concrete Institute

200 West Adams Street | Suite 2100 | Chicago, IL 60606-5230

Phone: 312-786-0300 | Fax: 312-621-1114 | www.pci.org

Report

PCI Precast/Prestressed Concrete Institute

State-of-the-Art Report on Full-Depth Precast Concrete Bridge Deck Panels

Prepared by the PCI Committee on Bridges and the PCI Bridge Producers Committee

Under the direction of the Sub-committee for the State-Of-The-Art Report on Full-Depth Precast Concrete Bridge Deck Panels

Co-sponsored by: U.S. Department of Transportation Federal Highway Administration

First Edition

Credit to

Vince Campbell
Former president of Bayshore Concrete Products Corporation, VA

STATE-OF-THE-ART REPORT ON FULL-DEPTH PRECAST CONCRETE BRIDGE DECK PANELS

With the sponsorship of
PCI Committee on Bridges and the PCI Bridge Producers Committee
(Technical Activities Council)

Under the direction of the sub-committee for the
State-Of-The-Art Report on Full-Depth Precast Concrete Bridge Deck Panels

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Several others that deserve special recognition for their contributions include: Vince Campbell for his vision to create a document on this topic; Nghi Nguyen, Parul Patel, and Sameh S. Badie who helped with the example in Appendix D and Kromel Hanna who assisted the technical editor to create the final publication.

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- Thousands of attendees
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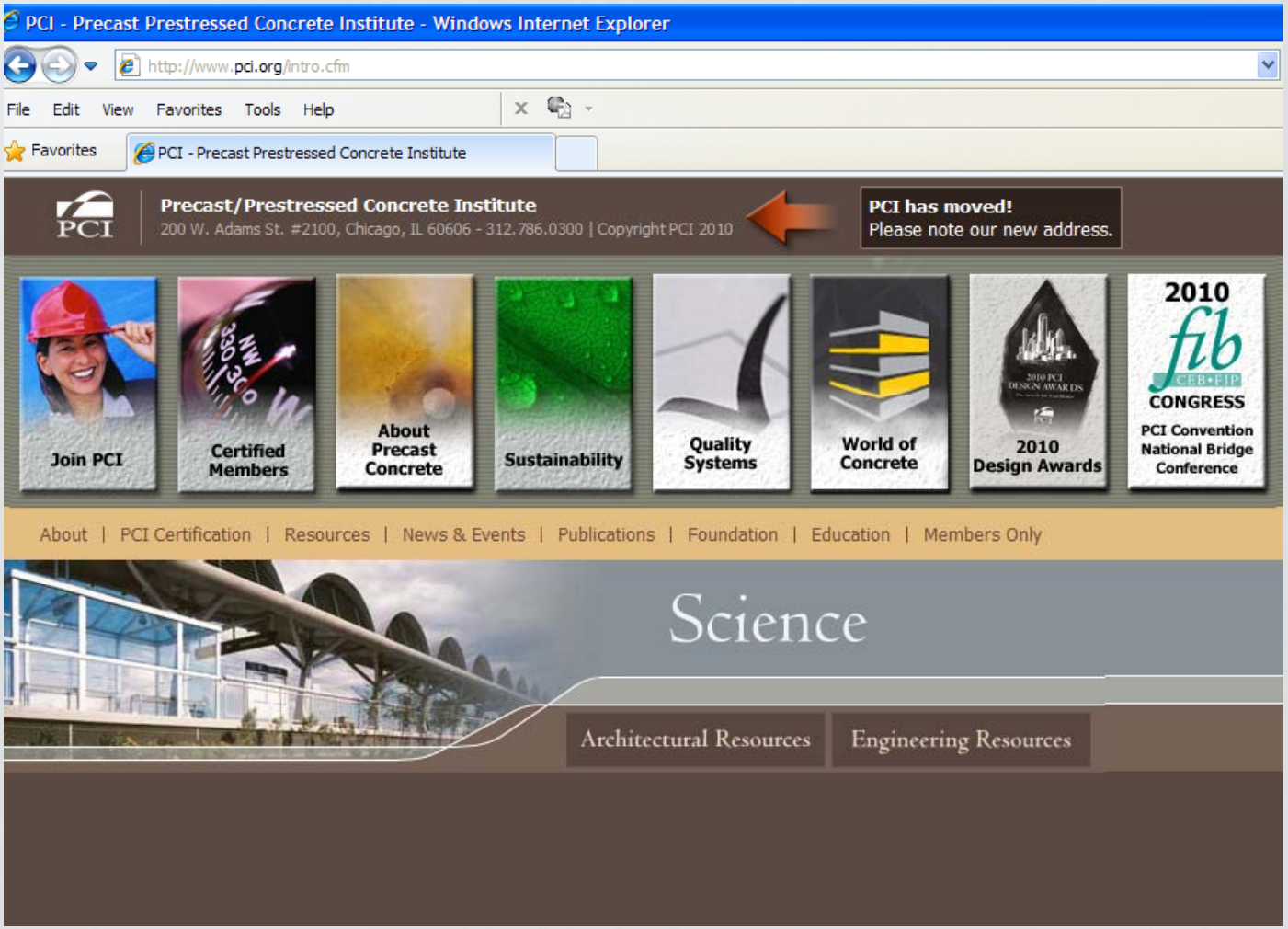
PCI Website



www.pci.org

Comprehensive Quality System

8. Certification of Personnel
   - Validate personnel competence
   - Scrutinize employees serving critical functions
   - Review company's quality management system
   - Confirm proper quality standards and procedures are in place

PCI Personnel Training & Certification

- **Plant Quality Personnel Certification**
  - Level I
  - Level II
  - Level III

- **Field Quality Personnel Certification**
  - Certified Field Auditor (CFA)
  - Certified Company Auditor (CCA)

Comprehensive Quality System

9. Certification of Fabrication Process
   - Ensure fabrication process is maintained at a consistent quality standards level
   - Promulgate quality standards
   - Establish certification procedures
   - Publish list of certified facilities
   - Provide means to resolve non-conformance and to appeal results
   - Maintain committees to set quality standards

PCI Plant and Field Certification

- **Plant Certification**
  - 268 Certified Plants
- **Field Certification**
  - 107 Qualified Erectors
  - 12 Certified Erectors

PCI Certified Plants

- For PCI certified plants visit:

http://www.pci.org/find/manufacturer/index.cfm

Comprehensive Quality System

10. Independent Audits
    - Ensure a facility meets quality standards
    - Conduct periodic verification through on-site audits
    - Conduct audits using third-party auditors
    - Employ auditor verification program

PCI Independent Auditor

International Accreditation Service

CERTIFICATE OF ACCREDITATION

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Vice President

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Page 1 of 2

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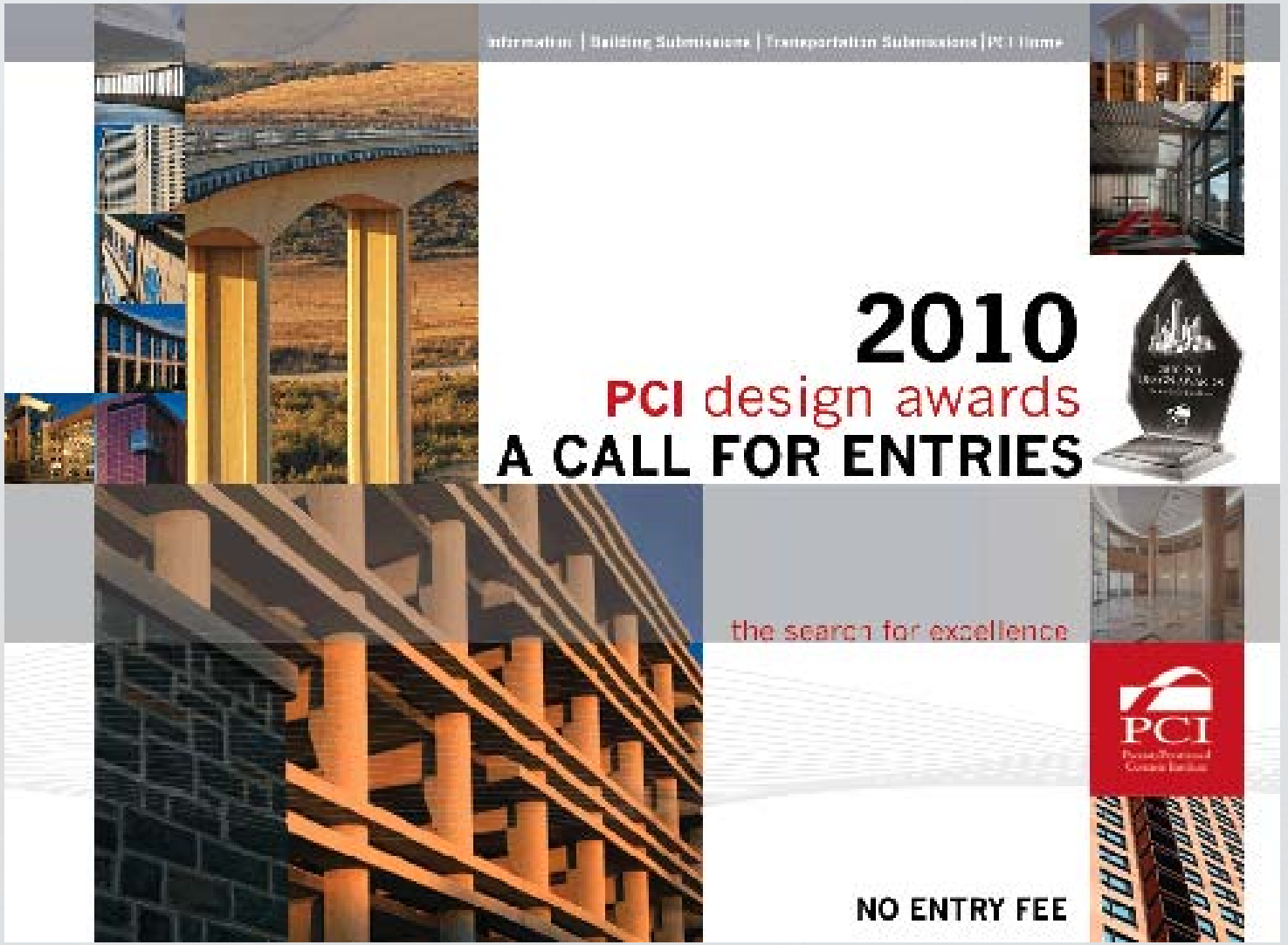
Comprehensive Quality System

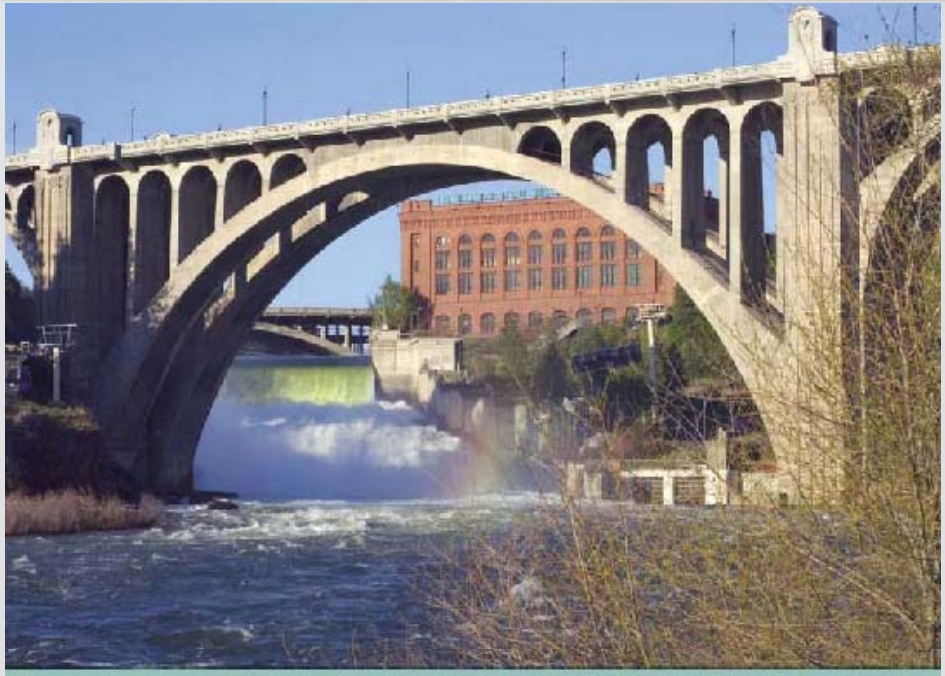
11. Feedback and Recourse
    - Ensure body of knowledge promulgated within industry
    - Ensure feedback is brought into body of knowledge
    - Gather/apply feedback during industry events
    - Include formal complaint procedures

2010 PCI Design Award Entries



http://www.pcidesignawards.org/2010/index.html

2006 PCI Design Award Winner



"The bridge's unique precast chain railing really set it apart from others. In our opinion, the only possible way to make such an aesthetic rail would be to use precast concrete."

■ **BEST REHABILITATED BRIDGE, COWINNER**

MONROE STREET BRIDGE REHABILITATION
Spokane, Wash.

Entrant Firm:
David Evans & Associates, Spokane, Wash.

Engineer:
David Evans & Associates, Spokane, Wash.

Owner:
City of Spokane, Wash.

General Contractor:
Wildish Standard Paving Co., Eugene, Ore.

Precaster:
Central Pre-Mix Prestress Co., Spokane, Wash.

JURY COMMENTS:

"An excellent example of how precast concrete can be included on a historic concrete rehabilitation project. Precast concrete deck panels were used in lieu of cast-in-place concrete. Using the sub-deck panels was unique and allowed for expediting construction. The bridge's unique precast chain railing really set it apart from others. In our opinion, the only possible way to make such an aesthetic rail would be to use precast concrete. Using current technology, the contractor was able to make an existing bridge look more modern and attractive to the community."

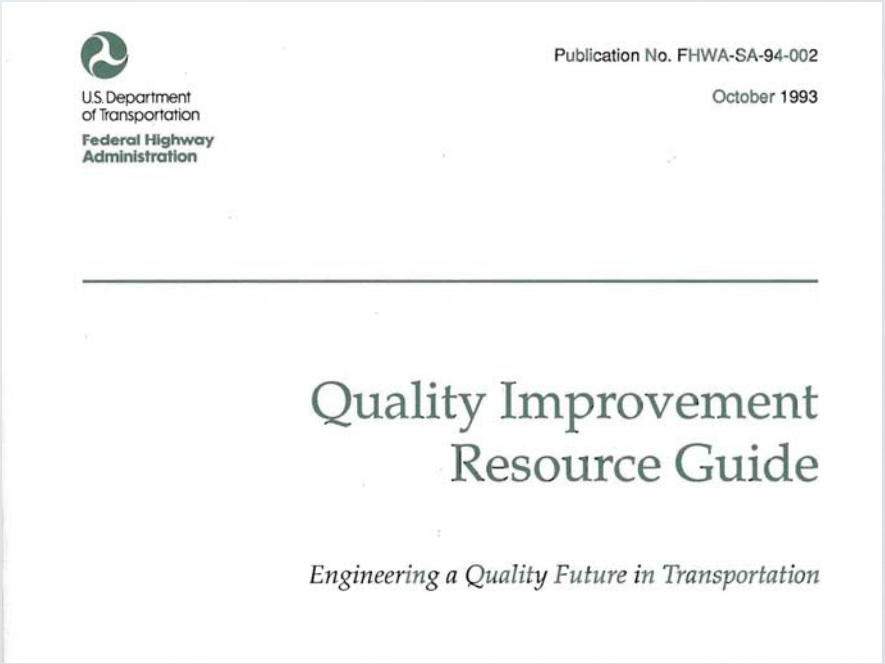
Comprehensive Quality System

12. Continuing Commitment
    - Maintain stability, reliability, and consistency
    - Allocate staff, volunteer time, and funding consistently
    - Support industry over the long term

PCI's Continuing Commitment

- PCI founded in 1954
- PCI certification established in 1967
- Over 50 on-going technical committees
- Full staff of technical, marketing, and administrative support
- Annual allocated budget

In Summary



Summary Quote
"... The information is intended to be an appetizer... to the Quality improvement process"

Quote from Page 24: A picture of a looped chain….

Vision+Skills+Incentives+Resources+Action Plan=Change

Change is the expected results and all the links are critical to the success. Missing even one link may be fatal to the success of Continuous Quality Improvement.

Comprehensive Quality Systems: A Smart Choice for Bridges

Our Collective involvement and participation advances the engineering practice and an auditor with a checklist is not a comprehensive program rooted in continuous quality improvement.

NHI Session Outcomes

Upon Completion of This Course, Participants Should be able to…

1. Describe the bridge superstructure design and construction process in accordance with the current *AASHTO LRFD* specifications.

2. Identify the application of appropriate current *AASHTO LRFD* specification articles dealing with:

- Selection of Bridge Type, Size, and Location
- Bridge Economics
- Bridge Materials
- Evolution of Bridge Design Codes
- Bridge Loads and Load Combinations

2. Identify the application of appropriate current *AASHTO LRFD* specification articles dealing with:
   - Structural Analysis
   - Deck Design
   - Concrete Bridge Superstructure Design
   - Steel Bridge Superstructure Design
   - Bearings Selection and Design

3. Demonstrate the use of the current *AASHTO LRFD* specification requirements for superstructure design through the completion of step-by-step procedures, student exercises and design examples.
4. Successfully complete applicable Learning Outcome Assessments with a combined score of 70% or higher.

Session 4

Preliminary Design Concepts for Prestressed Concrete Superstructures

Topic 4.2

Preliminary Design Considerations

Course No. 130081

LRFD for Highway Bridge Superstructures

Learning Outcomes

A. Identify basic structure types for a variety of span lengths

B. Describe preliminary bridge layout considerations

C. Describe the prefabrication process for pretensioned girders

Structure Types

- CIP and PC Flat Slabs
- Precast, Pretensioned Girders
- SBS Segmental Box Girders
- I-Girders and Box Girders CIP on Falsework

Structure Types

- Spliced I-Girders
- BC Precast Segmental Box Girders
- BC CIP Segmental Box Girders
- Cable Stayed Edge Girder or Box Girder

William's Observation

- Very Intense week
- Very Structured Curriculum
- As a National Class, strives to deliver total picture without jurisdiction preconceptions
- Instructors give background
- Directed Key References

- "My best and worst in the same Class"

Quality Systems make a difference

Body of Knowledge

IS YOUR CERTIFICATION PROGRAM PLUGGED-IN?

Specify PCI Certification – There is a Difference!

PCI Certification is built on, and integrated with the Body of Knowledge for the Precast Concrete Structures Industry. Certifying Precast/Prestressed Concrete Manufacturers for over 40 years.

Body of Knowledge – The Foundation of Certification

The Body of Knowledge (BOK) refers to the collective knowledge of an industry that is relied upon to design and build with a specific material or system. It is from the BOK that building codes, design guides, education programs, certification, and everything else relied upon is derived.

There are 12 essential elements that an organization must have to develop, maintain and disseminate an industry's Body of Knowledge. All of these elements are typically found in the industry's technical institute. Effective certification programs must be an integrated and ongoing part of an industry's BOK and therefore, be developed and managed by an industry's technical institute.

PCI is the technical institute for the precast/prestressed concrete structures industry and as such the PCI Certification program is an integrated and ongoing part of the precast concrete structures industry's body of knowledge. PCI Certification provides owners, designers and specifiers with the highest probability that precast concrete products and systems will be manufactured, and perform in accordance with specifications.

PCI

For more information visit www.pci.org/certification or contact Dave Frank, PE, PCI director of quality programs at dfrank@pci.org or 312-583-6770

Thank you!

PCI

Precast/Prestressed Concrete Institute

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www.pci.org