

Owners' Role in Facilitating Prevention through Design

Prevention through Design—
a new way of doing business

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Research Background

- Small grant provided by CPWR
- Proposal included 6 research questions regarding attitudes towards and roles played in PtD
- Research conducted 2007-2010
- Case studies and online survey (SurveyMonkey.com)
- Data analysis used Excel and SPSS
- Findings not just relevant to owners!

Exploratory Research Methodology

- 4 Case study organizations with varying PtD experiences
 - Computer chip manufacturer
 - Integrated energy conglomerate
 - Progressive health care organization
 - Regional power generator
 - 79 anonymous surveys
 - 65 face to face interviews
- 103 anonymous online surveys of national construction organizations

Finding 1:

Safety Leadership

- Culture drives Behavior; Leadership drives Culture
- Set a high expectation for worker safety and health
- Safety takes priority over other project criteria
- Everyone plays a role in site and user safety
- When multiple options are available to mitigate a hazard, designing out the hazard is chosen whenever practicable.

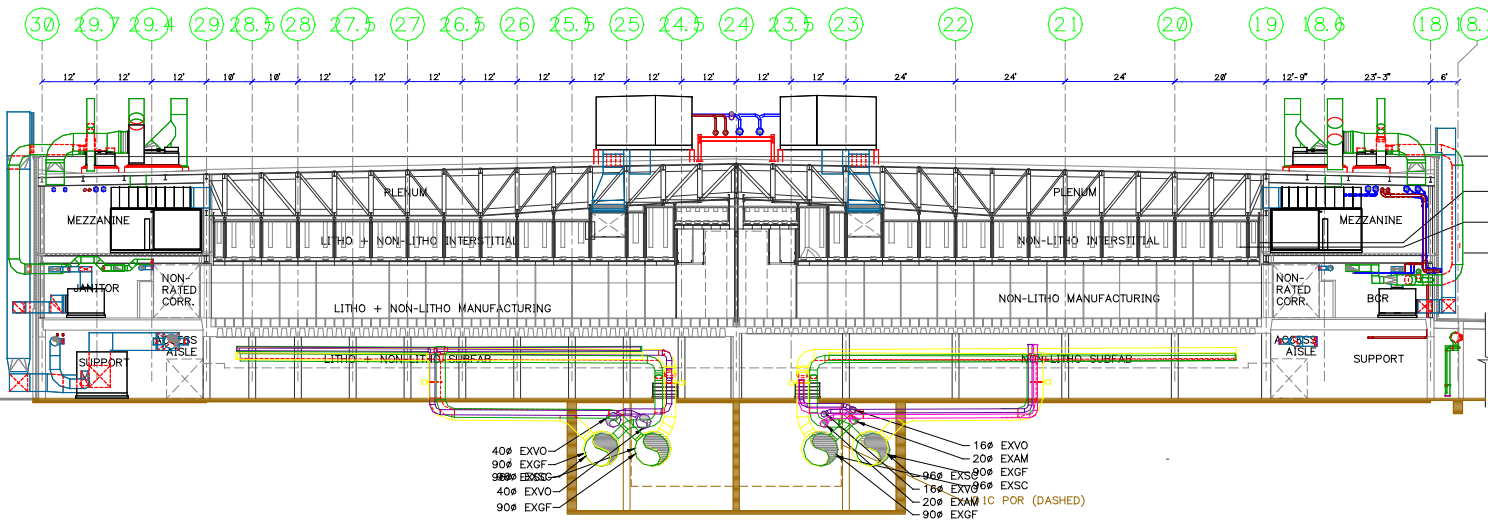
Finding 2:

PtD Business Value Recognized

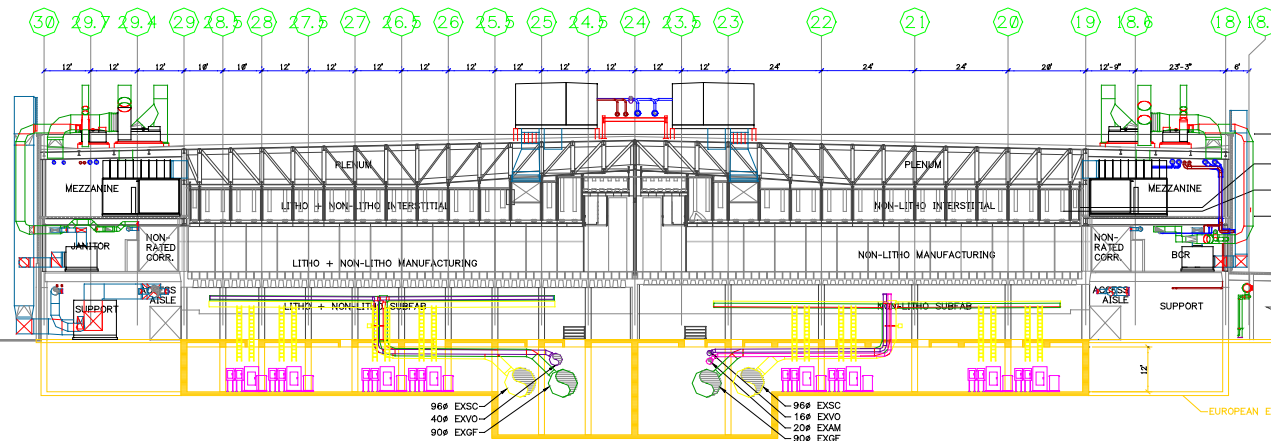
- Not just because it is the right thing to do
- Life Cycle Cost perspective
- PtD expected to:
 - reduce construction site injuries
 - reduce injury delays
 - improve construction quality
 - increase worker productivity
 - improve safety during maintenance and operations
 - Benefit owner, AE, contractor....

Life Cycle Analysis Example: Microchip Fabrication Plant

Plan of Record (POR):
Trench
below sub-fab level



New Fab: full
basement and
taller basement





Temporary
ladder,
platform and
safety line



Photos courtesy Bechtel Corp.

Finding 3:

Formal PtD Program Required

- Symbolic
- Awareness
- Structure and Accountability
- Process
- Integration and Coordination



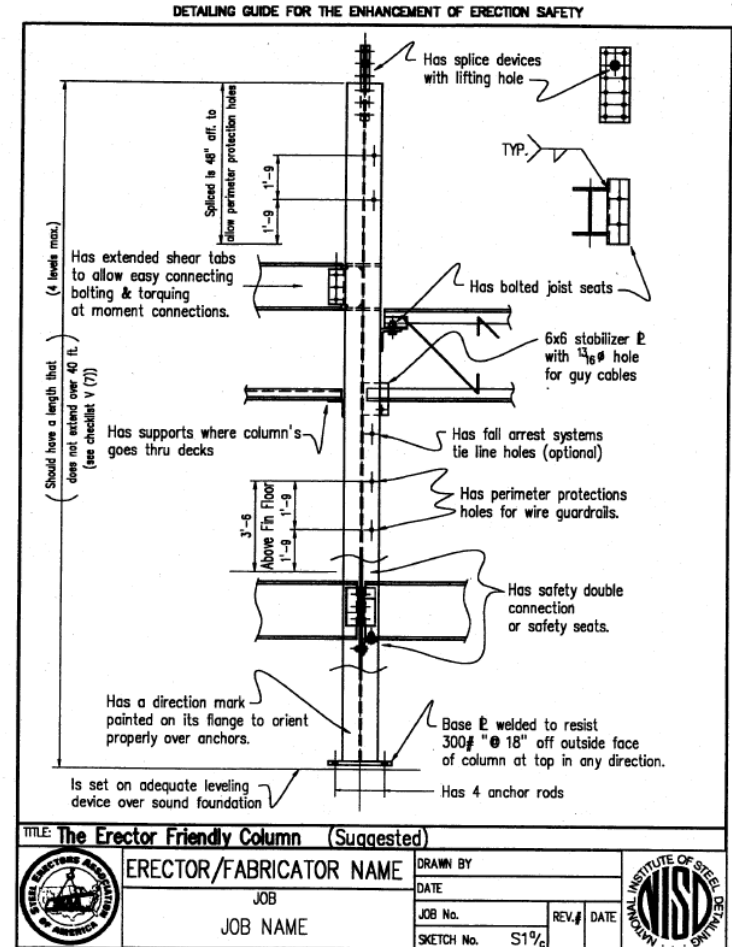
Finding 4:

Enabling Programs and Processes

- Strong project safety culture
- Effective set of risk management practices
- Constructability Reviews
- Project Delivery Method
 - Design-Build
 - Integrated Project Delivery

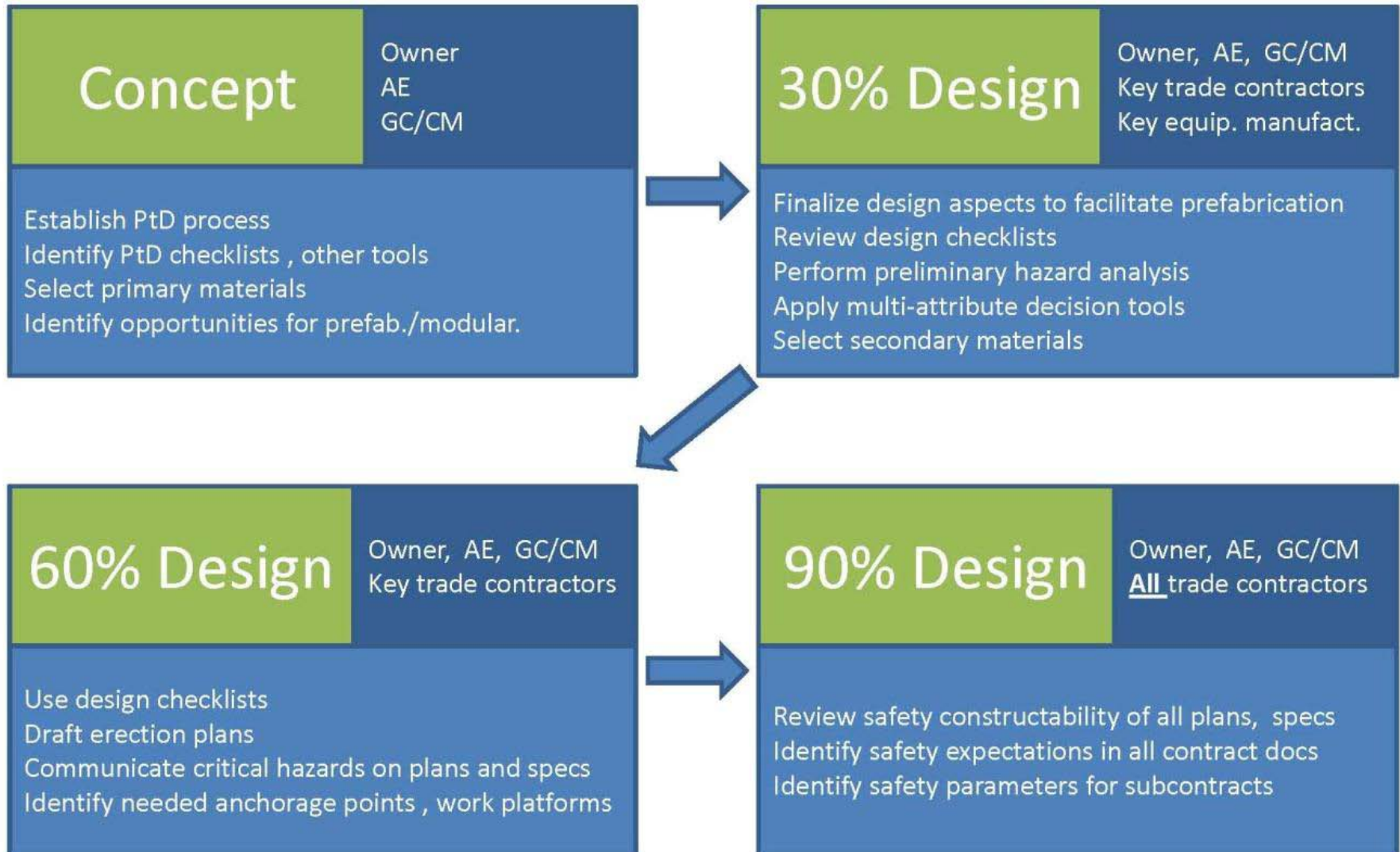
Constructability Review Personnel

- All engineering disciplines
- In-house construction safety
- External trades
- Operational safety
- Cost accounting



Detailing Guide for the Enhancement of Erection Safety published by the National Institute for Steel Detailing and the Steel Erectors Association of America

Constructability Reviews



Examples of Prefabrication



Steel Stairs

**Concrete
Wall Panels**



**Concrete Segmented
Bridge**

Why Early Constructability Reviews are Critical: Construction can drive Design

- Bechtel Solar Boiler
- URS/WGI USACE Dam
- URS/WGI Power Plant



Finding 4:

Enabling Programs and Processes

- Strong project safety culture
- Effective set of risk management practices
- Constructability Reviews
- Project Delivery Method
 - Design-Build
 - **Integrated Project Delivery**

Sutter Health IPD Process

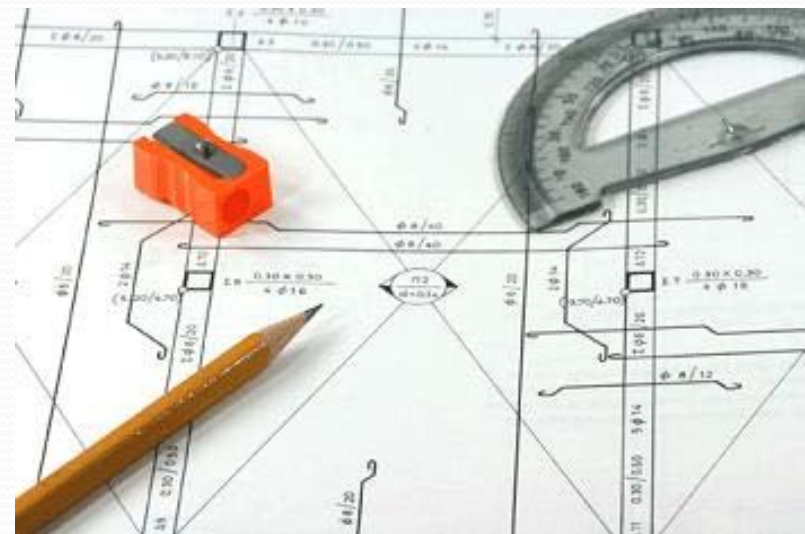
- Integrated Project Delivery (IPD) facilitates collaboration of design and construction professionals during design
 - Co-located
 - Processes and norms for candid feedback
 - Trust
 - Sufficient time
 - Life cycle costing criteria
 - Common success criteria



Finding 5:

AE Involvement Must be Encouraged

- Reality:
 - No regulatory requirement
 - No recognized duty
 - No immediate financial incentive
- Challenges:
 - Liability
 - Lack of knowledge
- Motivating mechanisms
 - Selection process
 - Contractual obligations
 - Financial incentives



Finding 6:

Ensure PtD Knowledge and Capability

- Knowledge of construction hazards and construction means and methods needed.
- Design-Build and IPD facilitate needed reviews
- AE knowledge gained through
 - Training
 - Constructability reviews
 - Design Checklists

BHP Billiton PtD Training

FORWOOD SAFETY

Leadership Inspiration Results Safety Excellence

- Home
- List of Courses
- Courses Completed
- My Training Records
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List of Courses

Michael, to launch a course or assessment click on the name in the first column. This will launch the applicable course or assessment and automatically track your progress and results.

Projects HSE in Design Modules

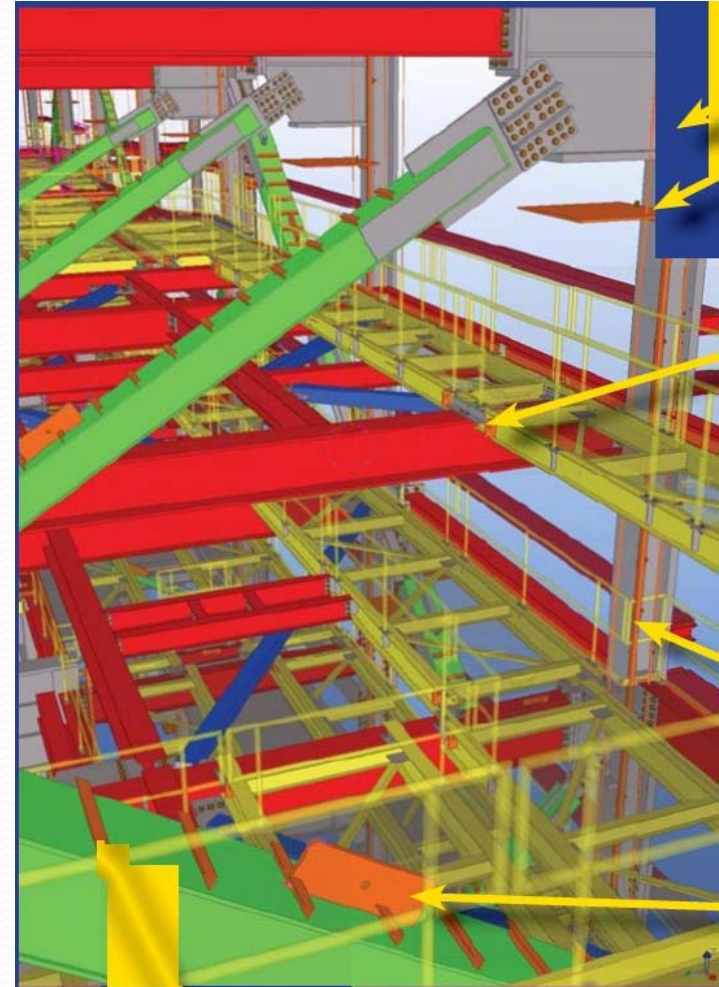
Name of Course	Status	Activity (no. of repeats)	Date Last Completed	Score (first attempt)	Duration
HSE in Design Module 1 (Version 1.0)	Complete	1	06:35 - 21/02/2011	4/5	19 mins 24 secs
HSE in Design Module 2 (Version 1.0)	Complete	1	06:55 - 21/02/2011	5/5	1 hour 15 mins
HSE in Design Module 3 - Engineering Assessments Introduction (Version 1.0)	Complete	1	08:12 - 21/02/2011		7 mins 10 secs
HSE in Design Module 3 - Discipline 2 (Civil) (Version 1.0)	Incomplete		08:20 - 21/02/2011		
HSE in Design Module 3 - Discipline 3 (Mechanical) (Version 1.0)	Not Attempted				
HSE in Design Module 3 - Discipline 4 (Electrical) (Version 1.0)	Not Attempted				
HSE in Design Module 3 - Discipline 5 (Instrumentation) (Version 1.0)	Not Attempted				
HSE in Design Module 3 - Discipline 6 (Structural) (Version 1.0)	Incomplete		08:21 - 21/02/2011		
HSE in Design Module 3 - Discipline 7 (Piping) (Version 1.0)	Not Attempted				



Finding 7:

PtD Tools Needed

- Design checklists
- 4-D CAD/BIM systems
- Risk identification and assessment documents



Courtesy Bechtel Corp.

DESIGN SAFETY CHECKLIST

CIVIL

THIS HAZARD OR CONCERN NEEDS TO BE ADDRESSED ON THIS PROJECT? Y=YES; N=NO

↓ THIS HAZARD OR CONCERN:
 ↓ HAS BEEN ADDRESSED IN OUR DESIGN
 ↓ WILL BE ADDRESSED IN OUR DESIGN
 ↓ OTHER
 ↓

Design Lead: _____
 Project No.: _____
 Plant: _____
 Date: _____

Double-click to add "x" to boxes. ↓			Item No.	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.	Project Engineer has communicated " HAZCOM " project information required for design engineering personnel making a site visit. (Each person that is sent to the job site must be informed of any potential hazards.)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.	Discipline Lead Engineer and civil team understand our safety goal: All engineering drawing and specifications will be prepared with a consideration for safety and constructability .
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.	Construction people working near fiberglass manufacturing need to understand the toxic air pollutants .
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.	Locations are identified where guard posts, walls, or barriers should be provided to prevent access to potentially unsafe areas.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.	Underground hazards and reference drawings locating any potential hazards are identified. (Examples: buried pipes, electrical cables, etc.)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.	Process engineer, construction project manager, customer, and vendor representatives have identified special loads that should be considered in our design.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.	Required quality records will be identified, collected, filed, and stored with proper disposition for structural specified materials . (Examples: high strength bolts, U-drain grates, concrete cylinder breaks.)

courtesy: The Southern Company

Non-Case Study Survey Data

- 103 anonymous surveys administered using SurveyMonkey.com
- National construction organizations with heavy owner membership:
 - CII
 - COAA
 - ASCE
 - GSA
 - ODOT
 - PennDOT
- 83% had never heard about PtD.
- 85% say they will consider trying or will implement PtD.
- 36% stated construction safety was part of the constructability review process.

Owner and AE Liability

- If PtD becomes common in U.S., will this increase potential liability to owners?
 - 42% stated owner liability would increase
 - 12% stated owner liability will decrease
- If PtD becomes common in U.S., will this increase potential liability to AEs?
 - 24% stated AE liability would increase
 - 30% stated AE liability will decrease

AE Resistance

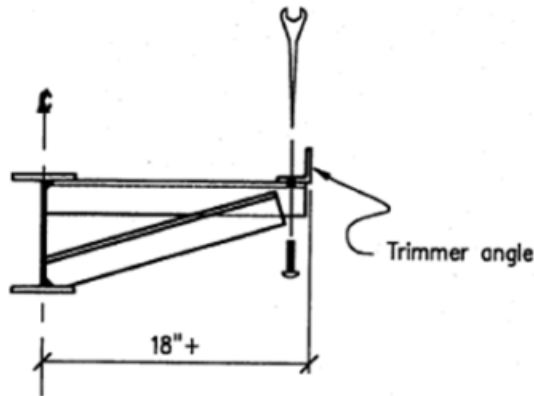
- 6% stated AEs will resist and cannot be forced to perform PtD
- 31% stated AEs will gladly perform PtD
- 94% stated their company's contracts with AEs could be changed to allow PtD.



AE Capability

- 5% stated AEs are already capable
- 91% stated AEs could become capable through training and/or assistance

DETAILING GUIDE FOR THE ENHANCEMENT OF ERECTION SAFETY



Problem: Bolting or welding at this location forces connector or welder to hang his body weight out of position.

Summary

- 4 Case study firms, 103 external online surveys
- Although most owners have not heard of PtD, many owners find PtD concept compelling.
- Some owners have implemented PtD successfully; others have enabled PtD through various processes.
- Formal PtD programs with design checklists, structured constructability reviews, and other processes are most effective.
- Safety leadership and collaborative contracts also important.

www.designforconstructionsafety.org

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Prevention through Design Design for Construction Safety



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News and Updates:

NIOSH is holding a [Prevention through Design Symposium](#) in Washington, DC, August 22-24, 2011. Over 150 participants are expected.

Alan Speegle at the Southern Company has compiled a list of over 1700 specific PtD items. This file can be downloaded [here](#) and from the Resources tab.

Researchers and practitioners have created [The Sustainable Construction Safety and Health \(SCSH\) rating system](#) to evaluate construction worker safety and health on construction projects.

Engineering News Record's lead [editorial](#) focused on a paper that chronicled resistance against PtD and mentioned the SCSH rating system.

A free American Institute of Architects (AIA) approved [course](#), "Overview of Construction Prevention through Design" is being offered by East Carolina University through a grant from the Virginia Tech Occupational Safety and Health Research Center. This course provides 1 Learning Unit/HSW credit (AIA approved). Participants in this course will be able to: 1) Define construction industry safety statistics; 2) Describe the role of design in construction safety; 3) Define safety and health terminologies; and 4) Recognize design influences in construction accidents. Email Mike Behm, behmm@ecu.edu, for course coupon code for free access. The first 20 participants will have free access.



Thank you for listening!

- mike.toole@bucknell.edu
- www.designforconstructionsafety.org
- John.Gambatese@oregonstate.edu
- <http://sustainableafetyandhealth.org>

AE Fees

- Will AEs need to increase their fees to perform PtD?
 - the average expected change would be +3.2%
 - only 11% stated higher AE fees will prevent PtD



Project Costs and Durations

- ▣ If PtD becomes common in U.S., will total project costs change?
 - 59% stated project costs would increase
 - 11% stated project costs will decrease

- ▣ If PtD becomes common in U.S., will total project durations change?
 - 59% stated project durations would increase
 - 6% stated project durations will decrease