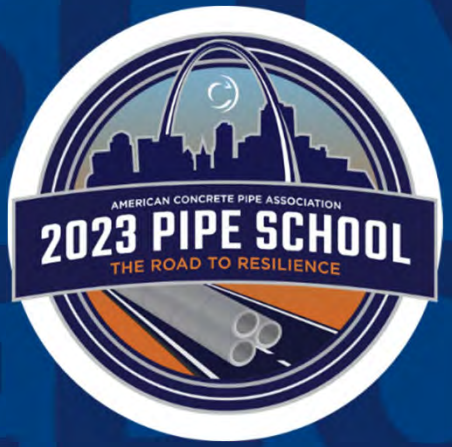
ETHICAL ISSUES IN PREVENTION THROUGH DESIGN



February 9, 2023

COLLEGE OF ENGINEERING
THE UNIVERSITY OF TOLEDO

Mike Toole, PhD, PE, F.ASCE
Dean, College of Engineering
Professor, Civil & Env. Engineering

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LEARNING OBJECTIVES

1. Summarize why engineering codes of ethics are needed.
2. Summarize the structure and content of the 2020 ASCE Code of Ethics.
3. Summarize the Prevention through Design concept and how it is applied.
4. Summarize the portions of the ASCE Code of Ethics that apply to PtD.

OVERVIEW

- ❑ Introduction to ASCE Code of Ethics
- ❑ Triple Bottom Line
- ❑ PtD Concept and Examples
- ❑ Applying ASCE Code of Ethics to PtD
- ❑ RCP Examples

Prevention through Design

= Design for Safety

= Safety by Design

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WHY PROFESSIONAL ETHICS ARE NEEDED

- ❑ We are self-interested creatures.
- ❑ We work for organizations competing in a capitalistic society.
- ❑ What could or should guide an engineer's actions?
  1. Local, state and federal laws
  2. Employer policies and procedures
  3. Employer values, culture
  4. Religious creeds
  5. Individual moral beliefs
- ❑ Professional codes of ethics fill the gaps with acceptable controversy

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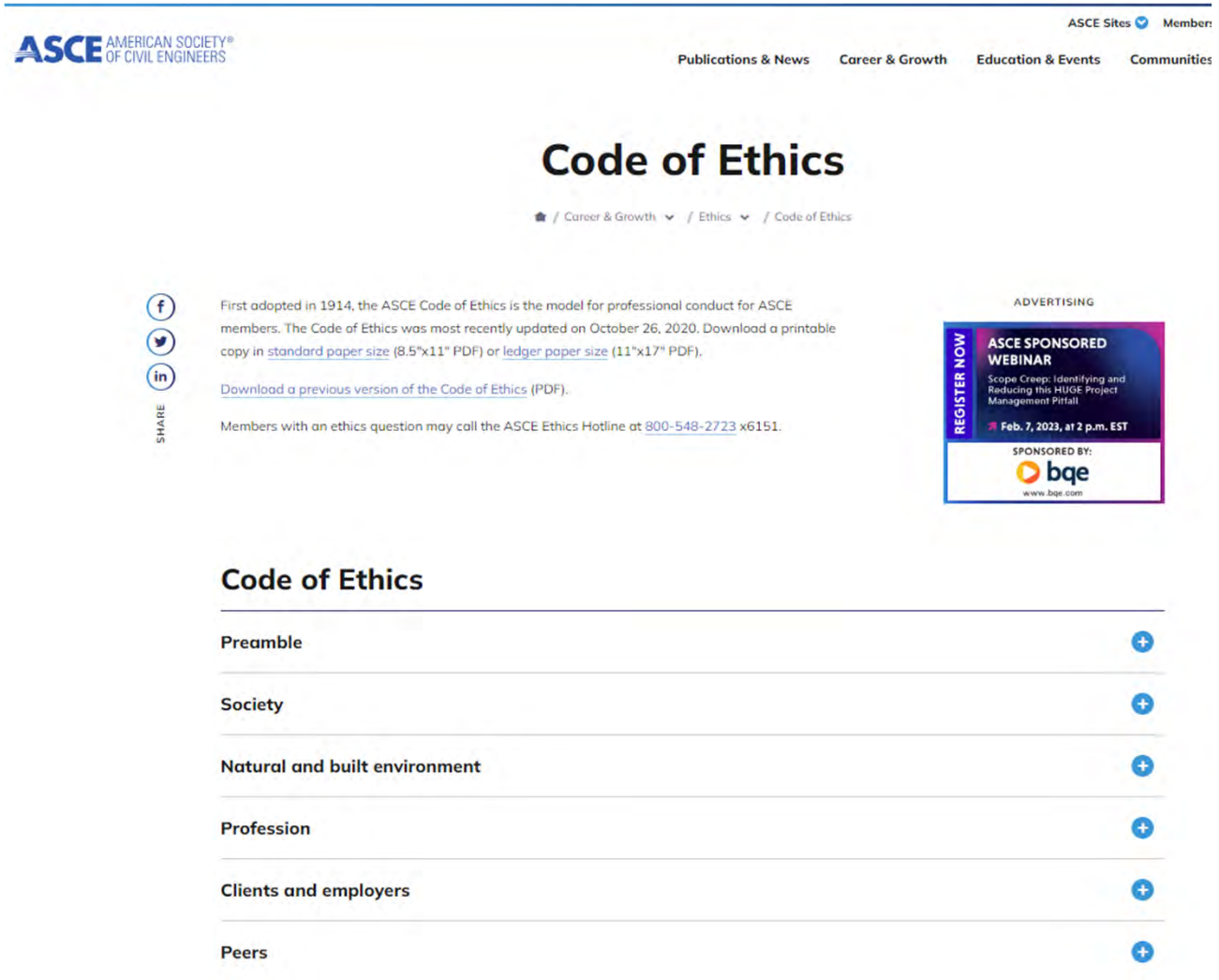
WWW.ASCE.ORG/CODE-OF-ETHICS/



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ASCE'S 2020 CODE OF ETHICS

- Preamble
- Expectations for 5 sets of stakeholders
  - Society
  - Natural and Built Environment
  - Profession
  - Clients and Employers
  - Peers
- "Engineers" + expected actions related to that stakeholder

Approved by the ASCE Board of Direction on October 26, 2020

CODE OF ETHICS
THE AMERICAN SOCIETY OF CIVIL ENGINEERS

PREAMBLE
Members of The American Society of Civil Engineers conduct themselves with integrity and professionalism, and above all else protect and advance the health, safety, and welfare of the public through the practice of Civil Engineering.

Engineers govern their professional careers on the following fundamental principles:

- create safe, resilient, and sustainable infrastructure;
- treat all persons with respect, dignity, and fairness in a manner that fosters equitable participation without regard to personal identity;
- consider the current and anticipated needs of society; and
- utilize their knowledge and skills to enhance the quality of life for humanity.

All members of The American Society of Civil Engineers, regardless of their membership grade or job description, commit to all of the following ethical responsibilities. In the case of a conflict between ethical responsibilities, the five stakeholders are listed in the order of priority. There is no priority of responsibilities within a given stakeholder group with the exception that 1a. takes precedence over all other responsibilities. [1]

CODE OF ETHICS

1. SOCIETY
Engineers:

a. first and foremost, protect the health, safety, and welfare of the public;
b. enhance the quality of life for humanity;
c. express professional opinions truthfully and only when founded on adequate knowledge and honest conviction;
d. have zero tolerance for bribery, fraud, and corruption in all forms, and report violations to the proper authorities;
e. endeavor to be of service in civic affairs;
f. treat all persons with respect, dignity, and fairness, and reject all forms of discrimination and harassment;
g. acknowledge the diverse historical, social, and cultural needs of the community, and incorporate these considerations in their work;
h. consider the capabilities, limitations, and implications of current and emerging technologies when part of their work; and
i. report misconduct to the appropriate authorities where necessary to protect the health, safety, and welfare of the public.

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[1]This Code does not establish a standard of care, nor should it be interpreted as such.

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2. NATURAL AND BUILT ENVIRONMENT

Engineers:

a. adhere to the principles of sustainable development;
b. consider and balance societal, environmental, and economic impacts, along with opportunities for improvement, in their work;
c. mitigate adverse societal, environmental, and economic effects; and
d. use resources wisely while minimizing resource depletion.

- ❑ What is Sustainable Development?
  - From 2017 ASCE Code of Ethics:

[3]In October 2009, the ASCE Board of Direction adopted the following definition of Sustainable Development: "Sustainable Development is the process of applying natural, human, and economic resources to enhance the safety, welfare, and quality of life for all of the society while maintaining the availability of the remaining natural resources."

OVERVIEW

- ❑ Introduction to ASCE Code of Ethics
- ❑ **Triple Bottom Line**
- ❑ PtD Concept and Examples
- ❑ Applying ASCE Code of Ethics to PtD
- ❑ RCP Examples

Prevention through Design

= Design for Safety

= Safety by Design

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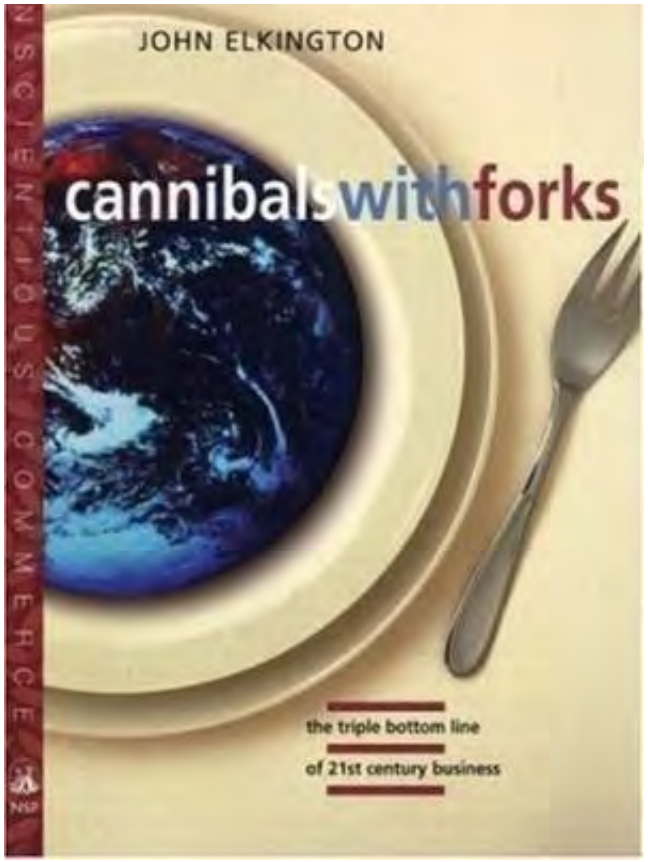
TRIPLE BOTTOM LINE

"All businesses can and must help society achieve three goals that are linked – **economic** prosperity, **environmental** protection and **social** equity."



http://blueandgreentomorrow.com/features/book-review-cannibals-with-forks-john-elkington-1999/

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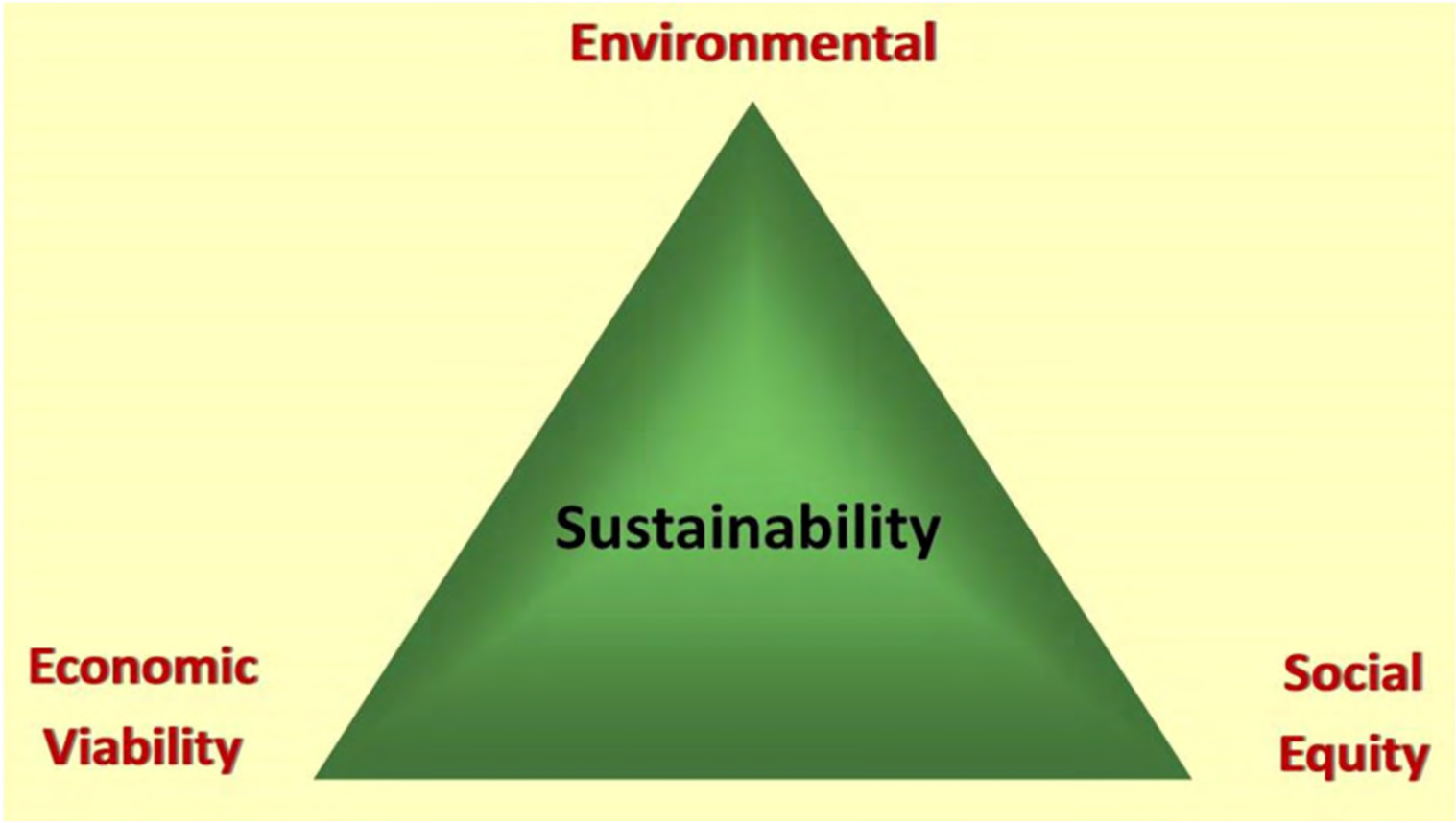
SUSTAINABILITY AND THE TRIPLE BOTTOM LINE



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SUSTAINABLE DEVELOPMENT

Capital projects that do not unfairly affect people who are not at the table during design and planning

Further reading:
Toole, T. M. and G. Carpenter (2013). "Prevention through Design as a Path Towards Social Sustainability." *ASCE Journal of Architectural Engineering* 19(3):169-173.

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SOCIAL SUSTAINABILITY ISSUES

- How will we convince all stakeholders that our project will not unfairly affect people who are not at the table during the concept development, design and construction planning?

  - Building occupants
  - Nearby residents
  - Local politicians and regulators
  - Our employees
  - Manufacturing workers
  - Construction workers
  - Maintenance workers

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ANNUAL CONSTRUCTION ACCIDENTS IN U.S.

- ❑ Nearly 200,000 serious injuries
- ❑ 1,000+ deaths

DESIGN-SAFETY LINKS

- **22%** of 226 injuries that occurred from 2000-2002 in Oregon, WA, and CA[1]
- **42%** of 224 fatalities in US between 1990-2003[1]
- **60%** of fatal accidents resulted in part from decisions made before site work began[2]
- **63%** of all fatalities and injuries could be attributed to design decisions or lack of planning[3]

[1] Behm, M., "Linking Construction Fatalities to the Design for Construction Safety Concept" (2005)
[2] European Foundation for the Improvement of Living and Working Conditions
[3] NSW WorkCover, *CHAIR Safety in Design Tool*, 2001

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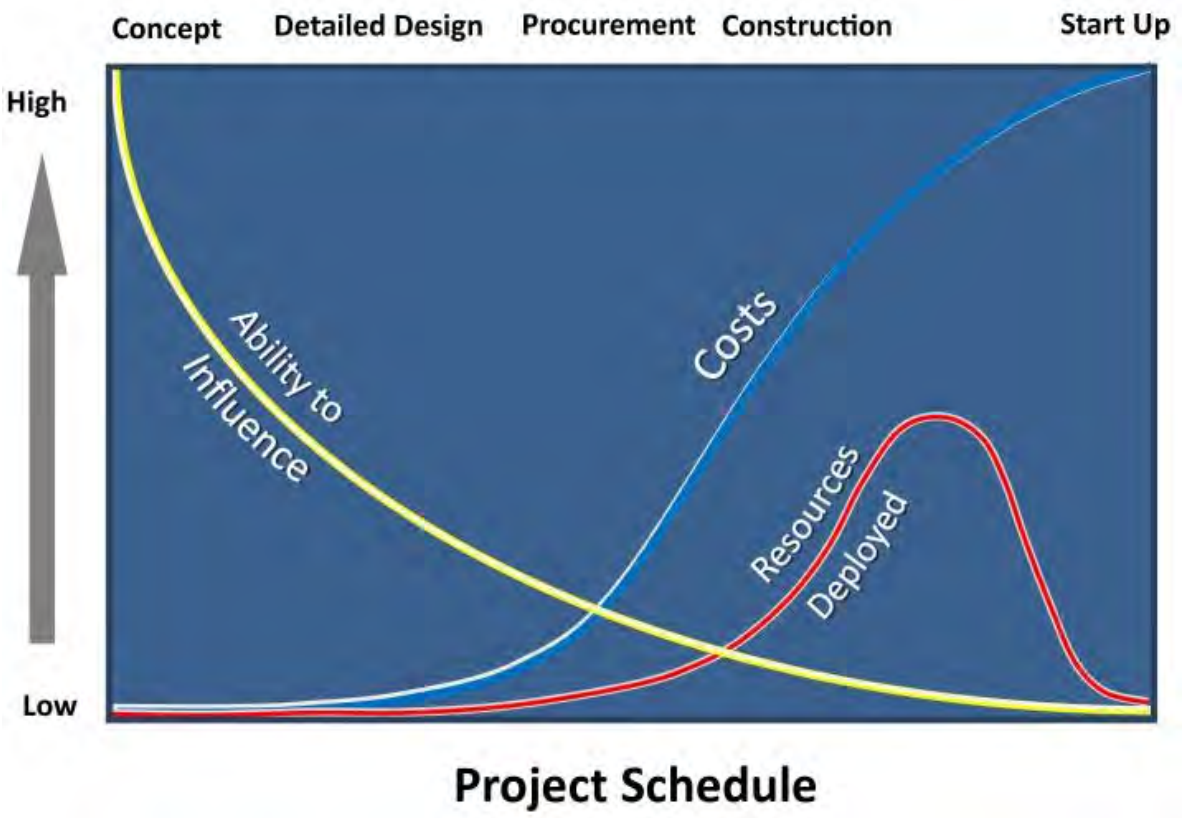
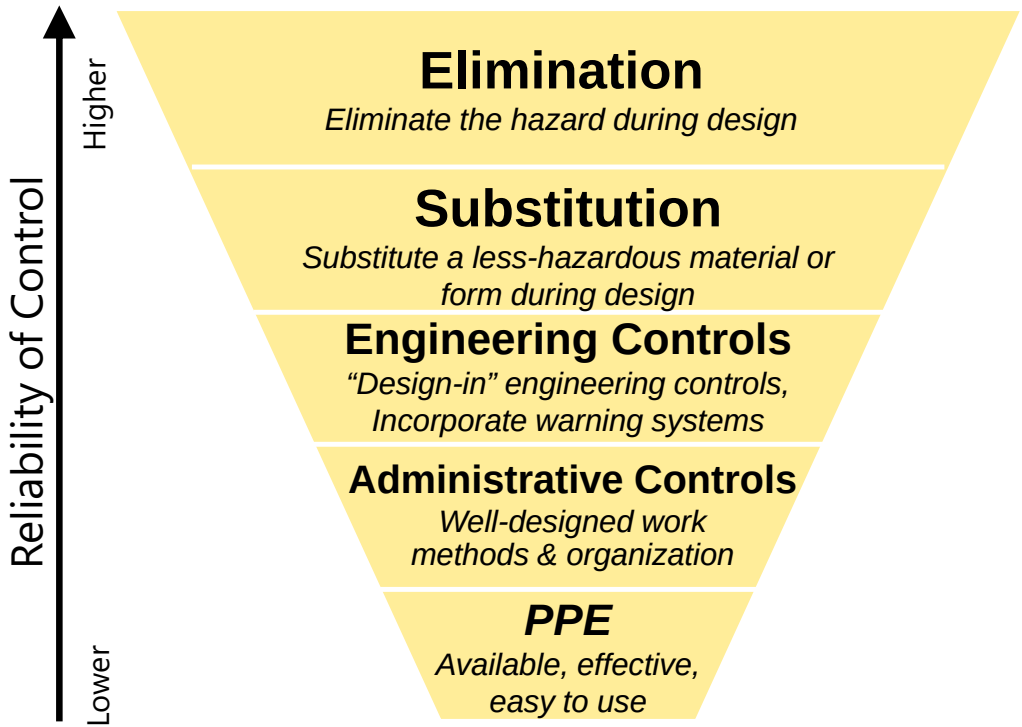
DESIGN HAS MAJOR LEVERAGE

- Ability to influence key project goals is greatest early in the project schedule during planning and design (Szymberski, 1997)



HIERARCHY OF CONTROLS



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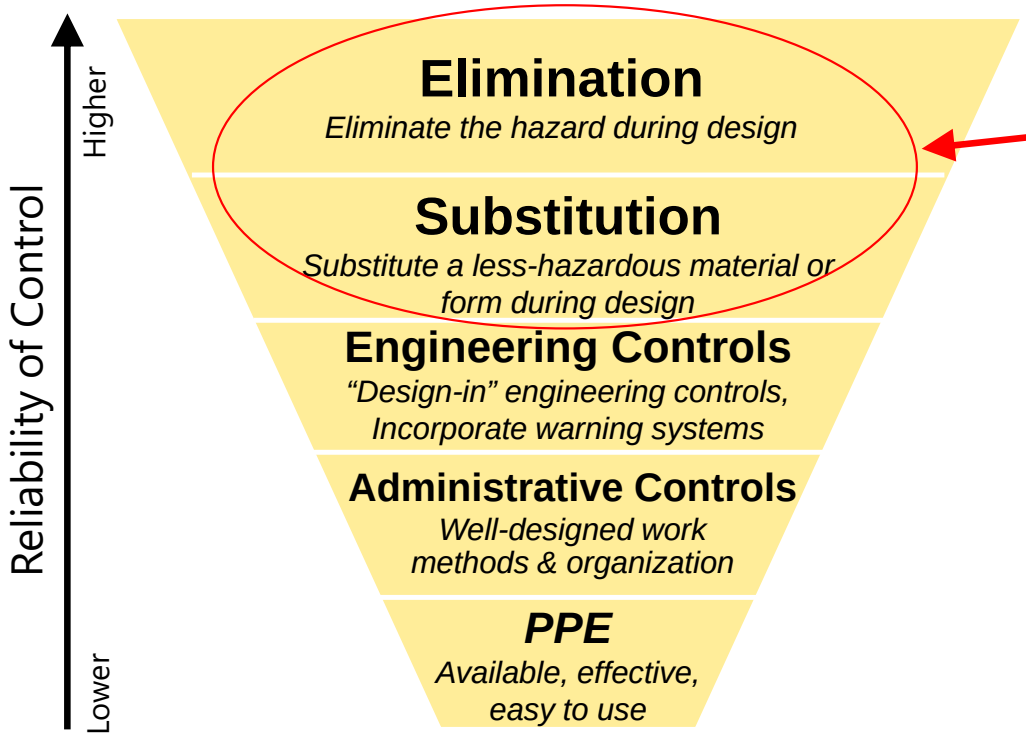

Prevention through Design

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PREVENTION THROUGH DESIGN (PTD)

"Addressing occupational safety and health needs in the design process to prevent or minimize the work-related hazards and risks associated with the construction, manufacture, use, maintenance, and disposal of facilities, materials, and equipment."

Prevention through Design

= Design for Safety

= Safety by Design

(http://www.cdc.gov/niosh/topics/ptd/)

PtD Prevention through Design

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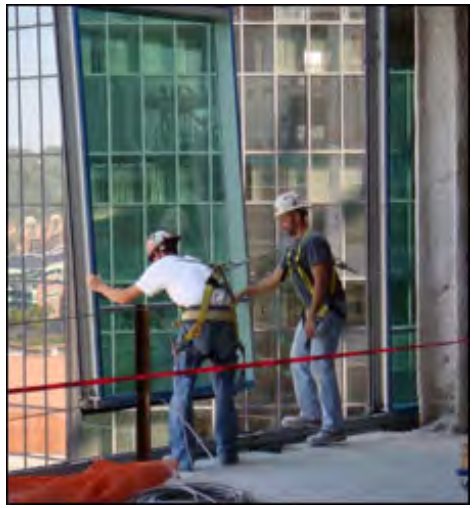
PTD IN CONSTRUCTION IS…



- ❑ Explicitly considering construction and maintenance safety in the design of a project.
- ❑ Being conscious of and valuing the safety of construction and maintenance workers when performing design tasks.
- ❑ Making design decisions based in part on a design element's inherent safety risk to construction and maintenance workers.

"Safety Constructability and Maintainability"

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TRUE STORY FROM NIOSH F.A.C.E REPORT

- Groundwater monitoring well plan called for a well to be installed under overhead power lines.
- Drill rig operator was electrocuted by arc flash from power line to rig
- Had design engineer known about proximity of power line and possibility of arc flash, the well location could have been shifted out of hazard zone

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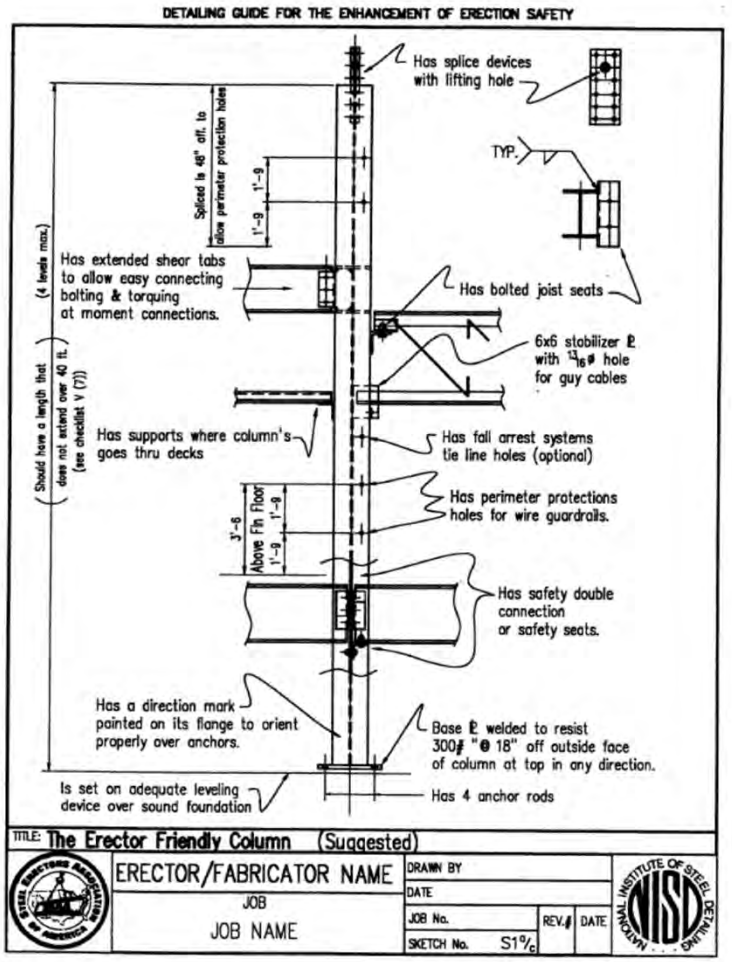
EXAMPLE: STRUCTURAL STEEL

The Erector Friendly Column

- Include holes in columns at 21" and 42" for guardrail cables and at higher locations for fall protection tie-offs
- Locate column splices and connections at reasonable heights above floor



Source: Detailing Guide for the Enhancement of Erection Safety. National Institute for Steel Detailing and the Steel Erectors Association of America.

The Erector Friendly Column

- Include holes in columns at 21” and 42” for guardrail cables and at higher locations for fall protection tie-offs
- Locate column splices and connections at reasonable heights above floor

Photo: AISC educator ppt

EXAMPLES: PREFABRICATION

www.ultimateengineering.com

Bridge Trusses

Concrete Wall Panels

test.jedinstvo.com

Pre-engineered buildings

Concrete Segmented Bridge

PREFABRICATION: THE LINK BETWEEN ENVIRONMENTAL SUSTAINABILITY AND SAFETY

- Prefabricated construction is inherently safer than “stick-built.”
- Work is shifted from dangerous work environments to engineered work environments and processes.
  - at height
  - in trenches
  - in confined spaces
  - exposed to weather (wind, water, ice, mud, lightning)
- Prefabricated construction has
  - lower construction waste
  - lower embodied energy
  - lower embodied greenhouse gases

ECONOMIC BENEFITS OF PTD

- Reduced site hazards
  - **Fewer worker injuries and fatalities**
- Reduced workers' compensation premiums
- Increased quality
- Increased productivity and fewer delays due to accidents so project deadlines are met

PTD DESIGN REVIEW

- ❑ Hazard identification
  - What construction safety hazards does the design create?
- ❑ Risk assessment
  - What is the level of safety and health risk associated with each hazard?
- ❑ Design option identification and selection
  - What can be done to eliminate or reduce the risk?
  - Remember the hierarchy of controls……

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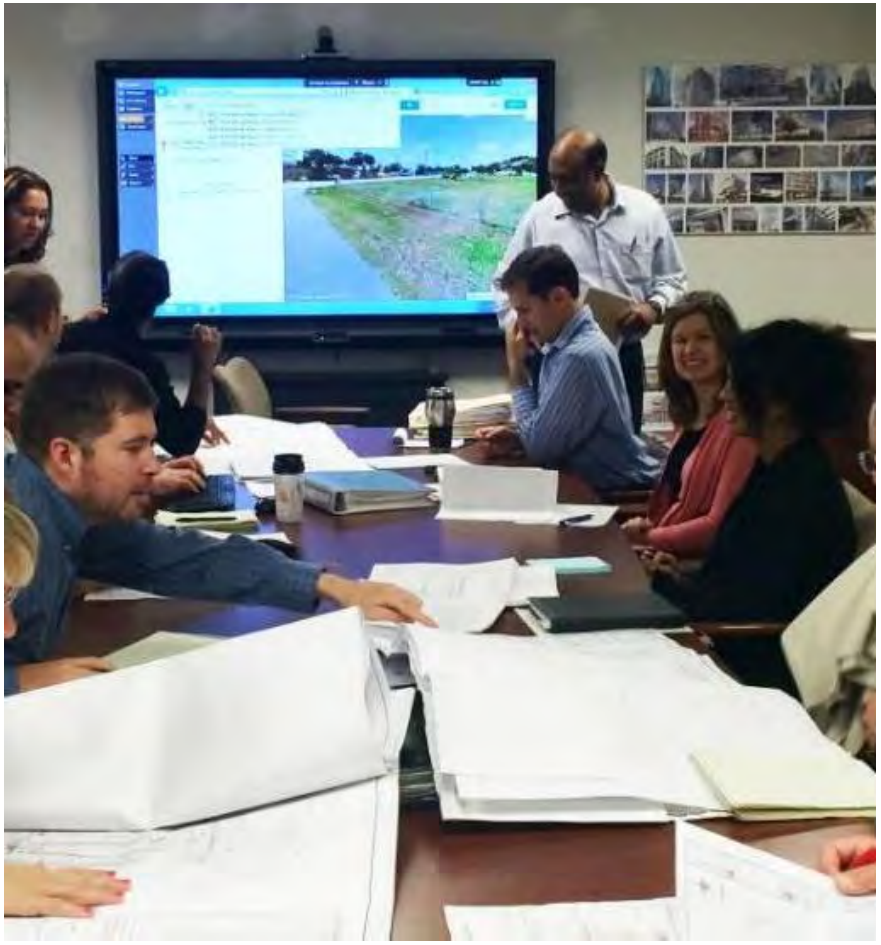
PTD DESIGN REVIEW



Get the right people
talking about the right things
at the right time!

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APPLYING CANON 1 TO PTD

Revisiting Canon 1:

"Engineers:

a. first and foremost, protect the health, safety, and welfare of the public;

…

f. treat all persons with respect, dignity, and fairness;"

- Do not our duties include minimizing all risks (especially to people) that we have control over?
- Do not we have the same duties for construction and maintenance workers as for the "public"?

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APPLYING CANON 4 TO PTD

4. CLIENTS AND EMPLOYERS

Engineers:

a. act as faithful agents of their clients and employers with integrity and professionalism;
b. make clear to clients and employers any real, potential, or perceived conflicts of interest;
c. communicate in a timely manner to clients and employers any risks and limitations related to their work;
d. present clearly and promptly the consequences to clients and employers if their engineering judgment is overruled where health, safety, and welfare of the public may be endangered;
e. keep clients' and employers' identified proprietary information confidential;
f. perform services only in areas of their competence; and
g. approve, sign, or seal only work products that have been prepared or reviewed by them or under their responsible charge.

- ❑ Do you have an obligation to let your client and employer know when you could design out a hazard?

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APPLYING CANON 5 TO PTD

5. PEERS

Engineers:

a. only take credit for professional work they have personally completed;
b. provide attribution for the work of others;
c. foster health and safety in the workplace;
d. promote and exhibit inclusive, equitable, and ethical behavior in all engagements with colleagues;
e. act with honesty and fairness on collaborative work efforts;
f. encourage and enable the education and development of other engineers and prospective members of the profession;
g. supervise equitably and respectfully;
h. comment only in a professional manner on the work, professional reputation, and personal character of other engineers; and
i. report violations of the Code of Ethics to the American Society of Civil Engineers.

- Which workplace?
  - Only your employer's facilities?
  - Project sites?

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APPLYING PTD TO ACPA PRODUCTS OVER THEIR LIFECYCLES

How can we design RCP and other ACPA products to make them safer to:

- ❑ Source raw materials
- ❑ Manufacture
- ❑ Store in the yard
- ❑ Transport
- ❑ Store on site
- ❑ Install
- ❑ Test the completed system
- ❑ Maintain the completed system
- ❑ Replace/Dispose of or Recycle/Reuse

TM4

TM2

Slide 36

TM0 source: https://theconstructor.org/concrete/design-concrete-pipes-sewers/17652/
Toole, Mike, 2023-01-23T13:35:25.056

TM1 https://theconstructor.org/concrete/design-concrete-pipes-sewers/17652/
Toole, Mike, 2023-01-23T13:40:54.823

TM2 https://www.countymaterials.com/en/news/item/reinforced-concrete-pipe-a-durable-choice-for-long-term-valu
Toole, Mike, 2023-01-23T13:43:06.725

TM3 https://www.constructioncost.co/reinforced-concrete-pipe.html
Toole, Mike, 2023-01-23T13:44:30.687

TM4 https://www.rinkerpipe.com/a-complete-guide-to-reinforced-concrete-pipe/
Toole, Mike, 2023-01-24T01:49:02.682

EXISTING RESOURCES DO NOT FOCUS ON DESIGN

- NIOSH 1983: “Comprehensive Safety Recommendations for the Precast Concrete Products Industry”
- OSHA website for Concrete Pipe Manufacturing
- WorkSafe New Zealand “Safe work with precast concrete”

WWW.OSHA.GOV/CONCRETE-PRODUCTS/CONTROLLING-HAZARDS#PIPE

Concrete and Concrete Products

- Standards
- Industry Segments and Controlling Hazards
- Safety and Health Programs
- Additional Resources
- **Workers' Rights**

Industry Segments and Controlling Hazards

This section identifies some of the major industry segments involved in the manufacturing of concrete and concrete products, and in construction work with concrete. It also lists some of the leading workplace hazards for these industries and links to safety and health resources for controlling these hazards.

- Manufacturing Sector
  - Concrete Block and Brick Manufacturing
  - Concrete Pipe Manufacturing
  - Ready-Mixed Concrete Manufacturing
- Construction Sector

Manufacturing Sector

Concrete Block and Brick Manufacturing (NAICS 327331)

- General Hazard Resources
- Amputations
- Confined Spaces
- Dermal (Skin) Hazards
- Electrical Hazards
- Fall Protection
- Respiratory Hazards
- Silica and Other Hazardous Substances
- Struck-By/Caught Between

Concrete Pipe Manufacturing (NAICS 327332)

- General Hazard Resources
- Amputations
- Confined Spaces
- Dermal (Skin) Hazards
- Fall Protection
- Respiratory Hazards
- Silica and Other Hazardous Substances
- Struck-By/Caught Between
- Truck Driving

Ready-Mixed Concrete Manufacturing (NAICS 327320)

- General Hazard Resources
- Amputations
- Confined Spaces
- Dermal (Skin) Hazards
- Fall Protection
- Respiratory Hazards
- Silica and Other Hazardous Substances
- Struck-By/Caught Between
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Construction Sector

- General Hazard Resources
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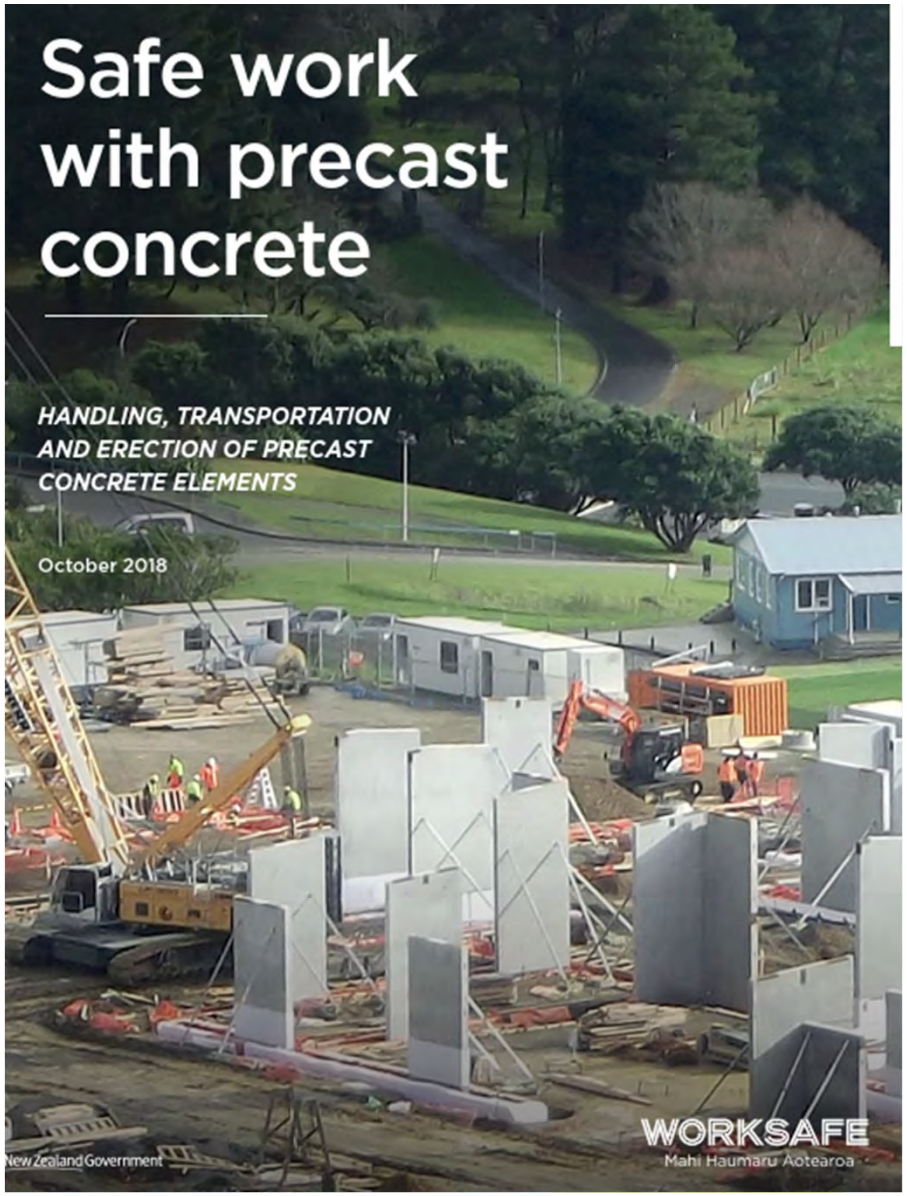
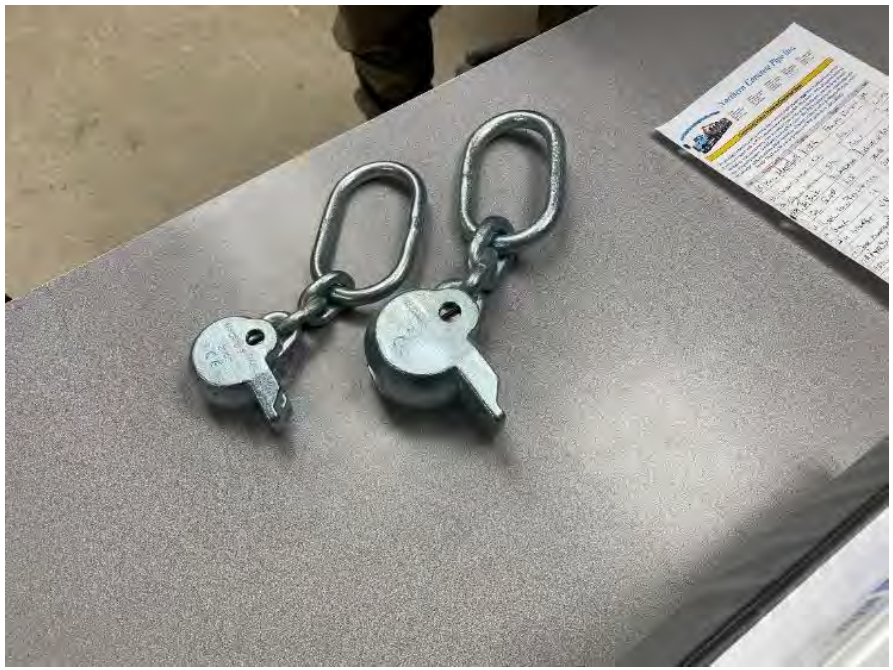
www.worksafe.govt.nz/topic-and-industry/concrete/safe-work-with-precast-concrete/



ENSURING PRODUCT IS NOT DROPPED 1



Photos courtesy of Northern Concrete Pipe, Inc.

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ENSURING PRODUCT IS NOT DROPPED 2

Photos courtesy of Northern Concrete Pipe, Inc.

GASKET QUALITY CAN AFFECT INSTALLATION SAFETY

Photos courtesy of Northern Concrete Pipe, Inc.

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BENDS/ANGLES CREATE NEW CHALLENGES

Photo courtesy of Northern Concrete Pipe, Inc.

www.archiexpo.com/prod/cpm-group-ltd/product-69767-2213822.html

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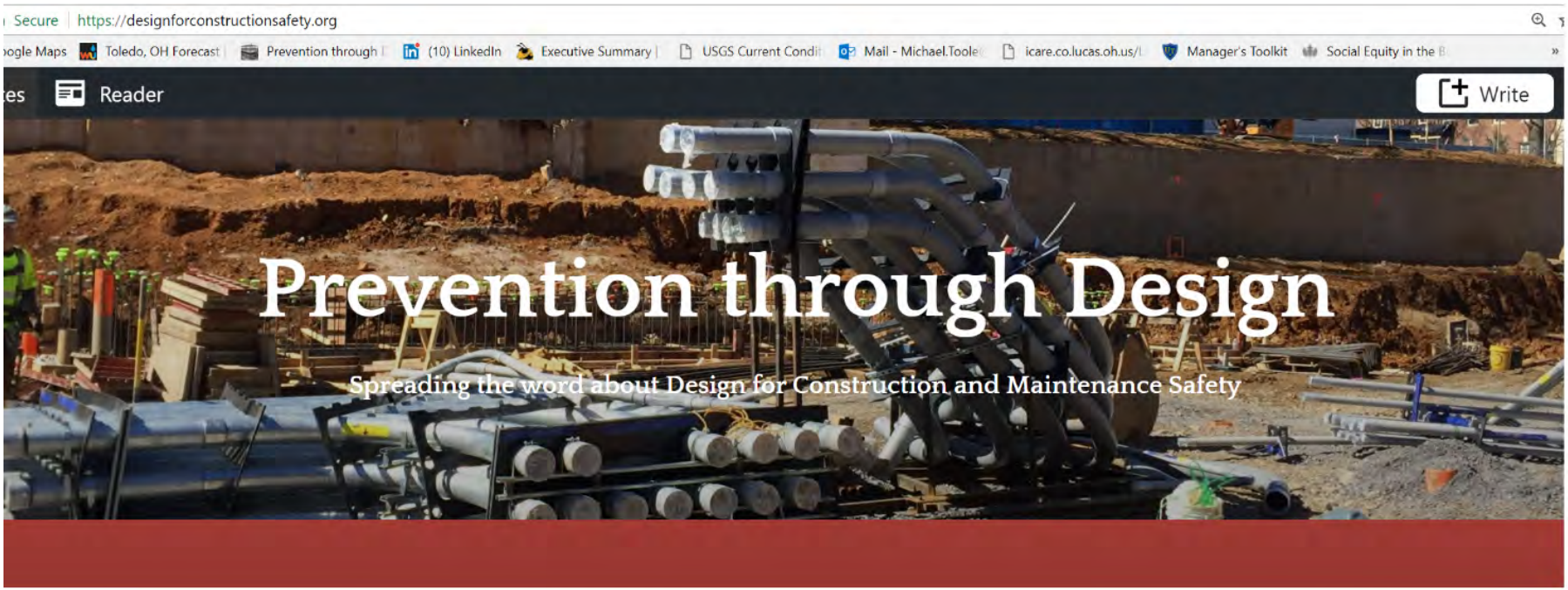
DESIGNFORCONSTRUCTIONSAFETY.ORG



SUMMARY

- The lifecycle of ACPA products—like the entire construction sector—includes many hazards that must be managed.
- The ASCE Code of Ethics requires designers to consider the safety of manufacturing, construction, and maintenance workers.
- Design for safety is an emerging process for reducing unnecessary occupational hazards.

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APPLYING PTD TO ACPA PRODUCTS OVER THEIR LIFECYCLES

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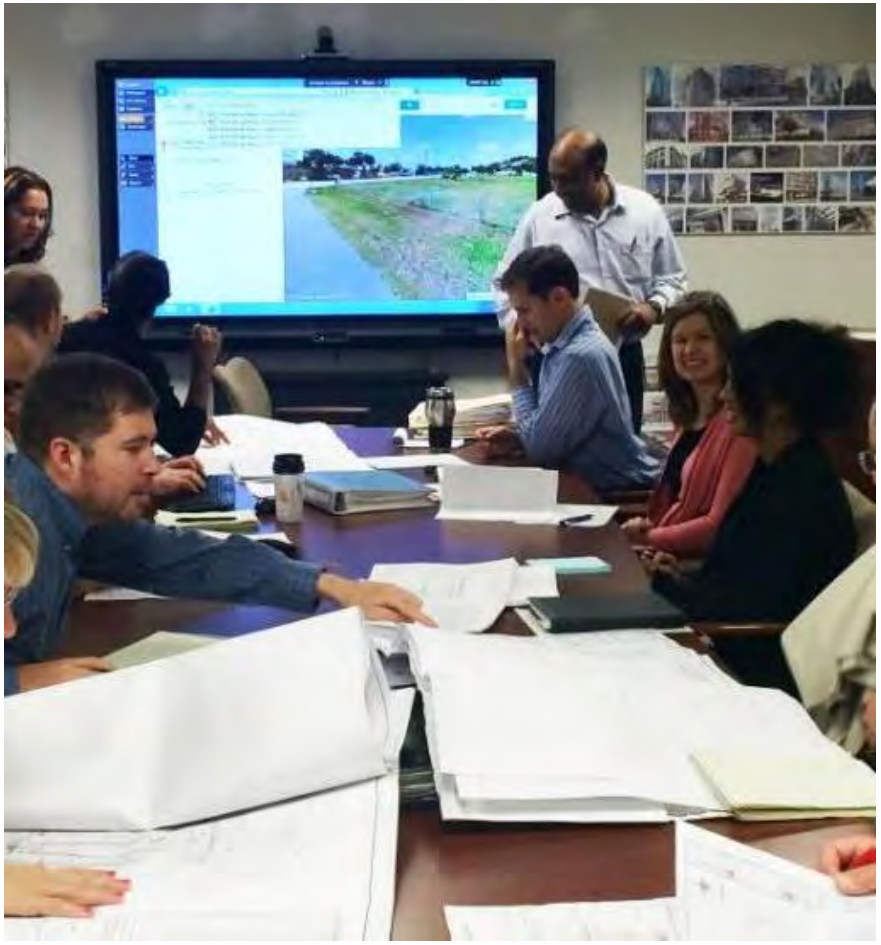
PTD DESIGN REVIEW



Get the right people
talking about the right things
at the right time!

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Thank you for listening!
Questions?

michael.toole@utoledo.edu
www.designforconstructionsafety.org

Thank you:
Don McNutt
Trygve Hoff
Bill Washabaugh
Brian Harman
Todd Marciniak
Rich Brewster
Scott Beacom