Rising Stars of Safety Leadership Series

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Please join us at nsc.org/divisions
Speakers

• Dr. John Gambatese, Oregon State University
• Daniel Lavoie, Liberty Mutual
• Jason Timmerman, Allegheny County Airport Authority
• Brian Hanlon, Citizen's Bank
• Dr. Scott Earnest, NIOSH, moderator
To eliminate construction fatalities, injuries, and illnesses through a focused program of research and prevention
Number of Fatalities in Construction, 1992 - 2017 (All employment)

S1. Number and rate of fatal injuries, by selected major private industry, 2019

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of injuries</th>
<th>Rate (per 100,000 FTEs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>1,061</td>
<td>9.7</td>
</tr>
<tr>
<td>Transportation &amp; warehousing</td>
<td>913</td>
<td>13.9</td>
</tr>
<tr>
<td>Agriculture, forestry, fishing, &amp; hunting</td>
<td>573</td>
<td>23.1</td>
</tr>
<tr>
<td>Retail trade</td>
<td>291</td>
<td>2.0</td>
</tr>
<tr>
<td>Leisure &amp; hospitality</td>
<td>271</td>
<td>2.2</td>
</tr>
<tr>
<td>Educational &amp; health services</td>
<td>197</td>
<td>0.8</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>178</td>
<td>4.9</td>
</tr>
<tr>
<td>Mining, quarrying, &amp; extraction</td>
<td>127</td>
<td>14.6</td>
</tr>
</tbody>
</table>

6. Number of fatal injuries caused by Construction Focus Four, 2011-2019

Prevention through Design (PtD)

Mission: Design out hazards and minimize risks associated with:

- Facilities
- Work methods
- Processes
- Equipment
- Products & new technologies
Servicing rooftop HVAC equipment

Fall exposures

“Error trap” for workers

Design issues?

No access
No power
No equipment setback from edge
No fall protection

HVAC= Heating, Ventilation, and Air Conditioning

Why Prevention thru Design?

Photo: Matt Gillen
Dr. John Gambatese
A Focus on Design

Good design demands attention.

“Things alter for the wrong spontaneously, if they be not altered for the better designedly.”

Francis Bacon (1561–1626), British author, statesman, philosopher, and scientist
The Importance of Early Design and Planning

The ability to influence safety is greatest early in the project schedule during planning and design.

(Szymberski, 1997)

Design and Safety

Prevention through Design (PtD)

“PtD encompasses all of the efforts to anticipate and design out hazards to workers in facilities, work methods and operations, processes, equipment, tools, products, new technologies, and the organization of work.

“Safety Constructability”

Also referred to as: Safety in Design (SiD) Design for Safety (DfS) Life Cycle Safety (LCS)

Source: NIOSH Prevention through Design, https://www.cdc.gov/niosh/topics/ptd/default.html
Motivation for PtD

Hierarchy of Controls

- **Elimination**: Physically remove the hazard
- **Substitution**: Replace the hazard
- **Engineering Controls**: Isolate people from the hazard
- **Administrative Controls**: Change the way people work
- **PPE**: Protect the worker with Personal Protective Equipment

Graphic source: [https://www.cdc.gov/niosh/topics/ptd/default.html](https://www.cdc.gov/niosh/topics/ptd/default.html)
Support for PtD

22% of 226 injuries that occurred from 2000-2002 in Oregon, WA, and CA related to design\(^1\)

42% of 224 fatalities in US between 1990-2003 related to design\(^1\)

Changes in the design of the permanent structure could have reduced the likelihood of 47% of construction site incidents\(^2\)

60% of fatal accidents resulted in part from decisions made before site work began\(^3\)

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\(^3\) Lorent, P. (1987). European Foundation for the Improvement of Living and Working Conditions
Support for PtD

Sustainable development

USGBC – Prevention through Design LEED Pilot Credit, IPpc93

- Safety design review
- Safety constructability review

Graphic source: http://sustainablesafetyandhealth.org/scsh-overview/
Expected Benefits of PtD

• Improved safety
  ◦ Construction, operations, and maintenance
• Increased productivity
• Increased quality
• Fewer delays due to accidents
• Enhanced designer-constructor collaboration
• Reduced workers’ compensation premiums
• Innovative designs
• Marketing/recognition
Potential Impediments to PtD

- No or minimal designer education and training in:
  - Site safety
  - Designing for safety
- Difficult to assess risks during design
- Contractual separation of design and construction
- Cost and time required to design for safety
- Fear of increased liability
- Competing priorities:
  - Safety vs. cost/schedule/aesthetics

(Source: http://www.btea.com/2016/11/28/comparing-project-delivery-methods/)
PtD Example

“Bring the work to the worker, not the worker to the work.”

Source: www.cte-ca.com/street-lights/

Source: www.swivelpole.com/au/
Dan Lavoie, CSP, ARM
Design Expectations

- Things you either want or do not want
  - Specific
  - Measurable
- Off-site pre-fabrication opportunities
- A guidance document to trigger questions with… (owner, architect, GC, Subs)

Who controls & manages design change process?
Constructability (Design) Review Opportunities

- A chance to review plans and drawings with a PtD eye (reduce/eliminate risk)
  - Any design expectations not met?
  - What tasks and/or design components could add risk to the work?
    - Are there options to design out hazards or risk?
  - Who has control over design decision making?
  - What perspective(s) is the design review taking into account?
    - Construction workers
    - End users
    - Public...
    - All?
Consider a Simple Example

- **Typical Light Fixture on a Stair Landing**
  - Installing & maintaining light fixtures may require a ladder or scaffold
  - What are risks for injury?
  - What are costs associated with this task?

- **Design Out Risk (new construction or renovation)**
  - Design light fixtures to allow same-level access (no elevating platform).
  - Use LED bulbs to reduce frequency of service
Construction Related Opportunities

- Site Access
  - Stairs vs. Ladders
PtD – During Construction
Example 1

Early PtD Example
Monticello – Home of Thomas Jefferson
Built 1782
Preconstruction Activities / Collaboration

Preconstruction Activities

- Prevention through Design
- Site Logistics and Planning
- Subcontractor Coordination
- EHS Preconstruction Planning

Site logistics and planning
PtD Life Cycle

2-3 years: Construction Operations

50+ years: Building Maintenance

Demolition of Structure

Prevention through Design (PtD)

Conceptual Design

Schematic Design

Design Development

Construction Final Documents
Concrete construction
• What is the safety issue and how can it be addressed?
WHAT ARE THE (02) KEY HURDLES WITH IMPLEMENTING PREVENTION THROUGH DESIGN?

1. Not dictating “Means and Methods”
2. Legal Liability
3. Contracts
EXAMPLE 5

Floor slab design live load

- Ability of floor slabs to support construction loading
- Need for shoring and reshoring

Graphic source: https://www.efcoforms.com/2015/03/what-is-shoring-what-is-reshoring/

Case Study – Citizens Bank

**Business goals:** Growth and New Look
- Branches (Renovations; Branch of the Future)
- Back offices; Johnston project

**HSE Goals**
- Eliminate hazards in Design
- PDCA

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- **2014**
  - Branches and small projects
  - Intro to PtD
  - Selection of Flooring
  - Facility Managers
  - Project Mgr.
  - Architects
  - Contractors
  - End Users

- **2018**
  - Johnston Campus Build
  - Education
  - Design Expectations
  - Project Practice
Case Study – Corporate Campus Build

- Program: construct a 420,000 square foot campus for 3,000 colleagues in 26 months
- Key participants:
  - Architect
  - Development Manager
  - Project Manager
  - Health and Safety Consultant
  - Engineers and consultants
  - Building Owner
PTD in Practice

Window Washing

MEP Layout

Slip Resistance
Review and Follow-up

- 153 design opportunities identified. 85% incorporated
- Monitor and track +/-\Delta during the entire project
- Re-introduced lessons learned into the over-all PtD process for future projects
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