

PtD

- ▶ Where good design is important to business success
- ▶ Where smart planning minimizes hazards and risks to workers

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Prevention through Design—Focus on Construction

Welcome to the second issue of *PtD in Motion*. The focus of this issue is the construction industry. Over 9 million construction workers build and maintain roads, houses, workplaces, and physical infrastructure. This work includes many inherently hazardous tasks and conditions such as work at height, excavations, noise, dust, power tools and equipment, confined spaces, and electricity. Construction has about 7% of U.S. workers, but 21% of the fatalities—the largest number of fatalities reported for any of the industry sectors. The articles in this newsletter illustrate how design can be used to reduce or eliminate some of these hazards.

We are pleased to announce the release of a core resource on the national Prevention through Design (PtD) initiative. A special edition of the *Journal of Safety Research*, April 2008, contains the proceedings from the 2007 PtD Workshop held in Washington, DC, including break-out session reports by industry sector and functional area, as well as technical papers authored by experts in PtD. More information about the proceedings can be found on page 6, including instructions for obtaining a copy of this special PtD edition of the Journal.

The proceedings from the PtD Workshop, summarizing the input from our PtD stakeholders, are essential components in the development of the Prevention through Design strategic plan. NIOSH is currently analyzing this input and working with the National Occupational Research Agenda (NORA) industry sectors to identify key goals and outcomes. Later this year, we expect to publish the draft Prevention through Design strategic plan for public review and comment.

Finally, we would like to announce that Donna Heidel, CIH, is the new NIOSH coordinator for the PtD National Initiative. Donna was instrumental in the publication of the workshop proceedings and will be working with our partner organizations and companies as well as individual PtD experts to draft the strategic plan.

We appreciate your interest in PtD and we look forward to your comments and future contributions to this newsletter. The next issue of *PtD in Motion* will focus on Agriculture, Forestry & Fishing.

By Paul Schulte, Director, Education and Information Division, NIOSH

Technological Interventions in Construction Reduce Hazards, Cost and Time

By Leonhard Bernold, Dept. of Civil & Environmental Engineering, Hanyang University, Korea

Housing construction relies heavily on manual labor to lift, nail, drill, and cut. A motion analysis of carpentry work on two residential sites identified tasks that involve continuous bending to operate power tools (e.g., nail guns) on ground level. The recoil effect of the nail guns adds to the potential for back injury. A prototype wheeled nail gun carrier was developed and tested on construction sites to address these issues.

The wheeled nail gun carrier has extensions for ease of control and was well received by plant laborers who previously needed frequent breaks and had complained of back pain. The wheeled device eliminates recoil effect (Figure 1). A more mobile version also improves worker posture, while not eliminating the recoil effect (Figure 2).

Removing lead paint from bridges requires extensive measures to protect the environment and workers. A robotic bridge paint remover (RBPR) was tested at a pre-fabrication plant (Figures 3-4). The RBPR design removes the laborer from exposure to lead, while



Figure 1. Reducing the risk of back injury and fatigue during nail gun operation using wheels and extensions.



Figure 2. Reducing the risk of back injury and fatigue using a simple extension for a light nail gun.

also drastically speeding up the operation. The RBPR operates a CO₂ (dry-ice) nozzle with a shrouded vacuum that catches lead paint coming off the steel. After the lead paint is removed, the robot grabs a sandblasting nozzle to remove rust. The image of the cleaned surface is wirelessly transmitted to the operator for real-time inspection before the first protective paint layer is applied.

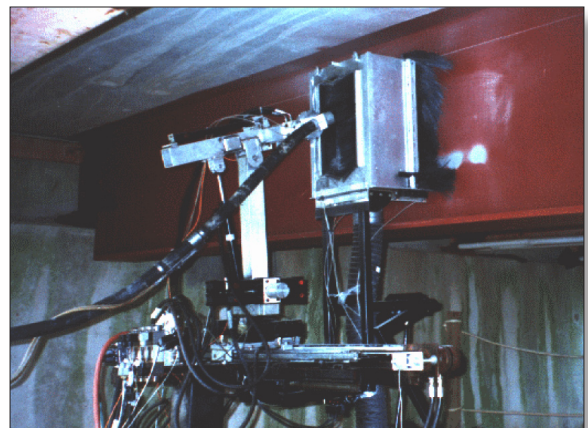


Figure 3. The RBPR being deployed for testing with a robot platform attached to a truck crane.

The nail gun carriers and the RBPR use innovative technological design to reduce hazards in the construction industry. For more information please visit our Web site (<http://www.ncsu.edu/CIL/CARL>).



Figure 4. The RBPR containment performing the robotic CO₂ blasting.

A Cultural and Linguistic Approach to Construction Safety Training and Education for Hispanic Workers

By Maria Brunette, Work Environment Department, University of Massachusetts Lowell

Today, Hispanics (or Latinos) are the fastest growing ethnic group and the largest minority group in the United States, accounting for 14% of the U.S. population. Hispanics work in some of the most dangerous industries in the U.S. They are *overrepresented* in both fatal and non-fatal occupational injuries compared to any other ethnic group, and are *underrepresented* in the ways that the scientific, research, and academic communities can reach them with appropriate safety and health research, education and information.

The construction sector, which accounts for 7% of U.S. workers but 21% of workplace fatalities, has a larger share of Hispanic workers than any industry except agriculture. The number of Hispanic workers in construction has tripled in the last decade to 2.6 million in 2005 (or 23% of all construction workers) with almost 75% of them being born outside the U.S. Rates of fatal and nonfatal injuries have been much higher for Hispanics than for the non-Hispanic construction working population.

The rapid change in workforce demographics is a critical factor in the allocation of safety educational and training resources. Appropriate health and safety training and education are widely recognized as crucial factors in reducing and preventing injuries. There is a need for linguistically and culturally appropriate occupational safety and health resources targeted to Spanish-speaking workers. Available resources are limited in quantity and quality, with most being mere translations, often inaccurate, of existing English materials. A culturally & linguistically-appropriate training program in construction safety targeted to Hispanic workers must take advantage of unique approaches such as a **worker participatory approach**, use of **non-traditional translation methods**, and **inclusion of cultural issues** into the design of training and educational materials.

Worker Participatory Approach—An OSHA 10-hr construction safety course was developed in English & Spanish by a partnership of Laborers Local 175 (Methuen, MA) and the Department of Work Environment at the University of Massachusetts-Lowell. Hispanic construction workers provided feedback via focus group sessions for the content, format, and length for each training module. By adopting a participatory approach, a relationship of trust and a sense of ownership were established among the Hispanic membership of Laborers Local 175.

Translation Method—A critical factor in developing linguistically and culturally appropriate safety training materials is selecting the translation method. Although back translation is the method

most widely accepted, it does not guarantee complete comprehension by the target audience since the goal of the method is a perfect match with the source language (English). The *decentering* method seems more appropriate when the aim is conceptual equivalence. It involves a continuous revision process where source language materials are translated into the target language (Spanish) and are revised until conceptual clarity and grammatical structures have been achieved. Decentering considers both languages equally important in the production of materials, while back translation considers the original language the standard against which the target version is to be compared.

Inclusion of Cultural Issues—It is very important to use workers' experiences, anecdotes, and images in educational materials. With this in mind, a project character and photos of Hispanic construction workers were prepared and incorporated throughout all written educational and training materials. Workers chose the name 'Cheo' for the construction worker character (Figure 1). Hispanic workers reviewed materials for visual appearance and suggested graphics and images with bright colors and cheerful faces for Cheo. Workers also decided that having a drawing of the construction workers and his family at the end of every module



Figure 1. Cheo.

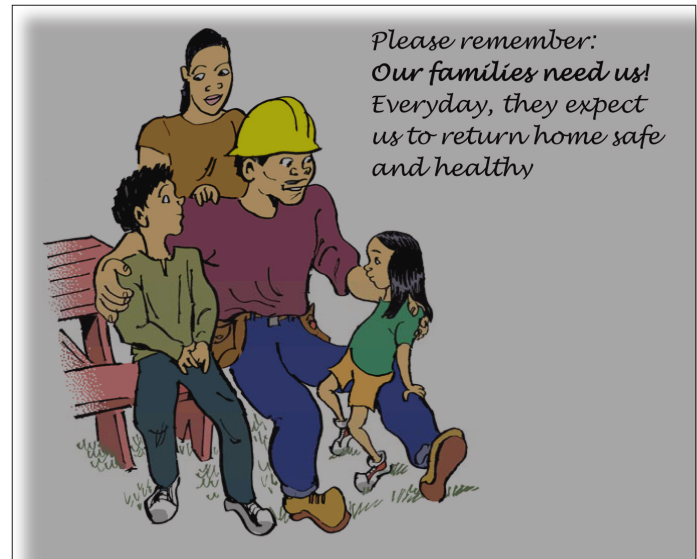


Figure 2. Cheo and family.

might have a positive impact on creating awareness among the working population of Hispanic origin. Hispanics place great emphasis on family and they consider it as the most important social unit. Workers discussed the impact of being injured at work on the family, which is reflected in the phrase next to the illustration of Cheo and family (Figure 2).

Using peer training in occupational safety and health has been reported to be more successful than using professional trainers for increasing self-efficacy among trained workers. It is also crucial to use native speakers with similar job experience when training Hispanic workers. A Hispanic construction worker member of Laborers Local 175 became an OSHA-certified trainer and later delivered all of the training sessions offered via this program.

A Spanish-English dictionary with more than 2,000 construction terms was developed and given to Hispanic Workers. It is a comprehensive resource for Spanish-speaking workers in the construction industry. A construction safety video was also produced, as well as a series of safety fact sheets and a Web site to make all materials publicly available. Please visit the Web site for more information:

<http://www.hispanicworksafe.org/>



Prevention through Partnerships

*By Margaret Blain Cervarich, National Asphalt Pavement Association/
Asphalt Pavement Alliance*

Industrial hygiene technology has advanced greatly over time, leading to many improvements in worker health and safety, but one tool for preventing worker exposure has nothing to do with technology—partnerships.

The Asphalt Partnership was launched in the mid-1990s due to questions about the hazards of asphalt fumes for paving-site workers. The National Asphalt Pavement Association (NAPA) pursued a partnership effort to remove fumes from the vicinity of workers via engineering controls. Within 18 months, all six U.S. manufacturers of highway-class paving machines designed, lab-tested, field-tested, and validated the efficacy of systems for their models. Then a voluntary agreement with OSHA was signed to incorporate these engineering controls into every U.S.-manufactured machine.

The royal road to this agreement was paved by a partnership which included NAPA member contractors, NIOSH, the Federal Highway Administration, paving machine manufacturers, and the Laborers and Operating Engineers unions. This partnership was recognized through the first NORA

(National Occupational Research Agenda) Award. The partnership stayed active for many years while the control systems were implemented, evaluated, and found to be effective.

In light of these successful relationships, NIOSH asked NAPA and its partners to help with a new silica exposure initiative. The result is today's Silica/Milling Machine Partnership, which includes industry, government, and labor representation. The goal is to evaluate exposures and use engineering controls or best practices to minimize silica-bearing dust at asphalt milling operations. Each milling machine manufacturer will have machines incorporating engineering controls readied for testing this spring.

Another area of focus for the Asphalt Partnership is work zone safety. The Asphalt Partnership, the Silica/Milling Machine Partnership, and the Work Zone Safety Partnership are models for achieving worker protection through involvement of key stakeholders. The approach has proven to be more expeditious, more thoughtful, and more effective than the usual regulatory channels. Most importantly, it can result in accelerating the delivery of highly effective worker protection through a win/win approach and cost-effective solutions. For more information:

<http://www.hotmix.org>

<http://www.asphaltalliance.com>

An Architect's Perspective on PtD in the Construction Industry

By Andrew Harte, BHDP Architecture

A great challenge for the PtD effort will be overcoming the resistance of an architectural community that has avoided construction means and methods for generations. While construction safety is a primary consideration for constructors and safety professionals, it is not a primary consideration for architects. The underlying reasons are numerous, ranging from liability exposure to basic creative freedom. I will not explore the causes of this

resistance; I prefer to discuss how safety professionals can engage architects to reduce injuries and deaths on construction sites.

From a PtD perspective, participation of building designers is crucial. Constructors have limited ability to influence building design, typically being contractually obligated to honor the designer's intent, no matter how dangerous or impractical the design may be. Given an inherently hazardous building design, they will do the best they can to build it safely, but key decisions have already been made. If predictable hazards are eliminated (or at least identified) during design, the constructor's job becomes safer, which is what PtD is all about.

From an architect's perspective, the measures of project success are typically function, cost and aesthetics. Architects typically don't work for the contractors who build their buildings. What incentives are there for architects to design buildings that may be constructed more safely? Owners demand end-user safety, which architects are eager to address; if owners demand and compensate designers for construction PtD, architects will respond. Some sources suggest a relationship between building safely and building economically, which is a compelling business case if proven. Another consideration is that architects are ethically mandated to protect the health, safety, and welfare of the public. Aren't construction laborers part of that public?

As design professionals, architects are capable of innovating amazing solutions to functional, technical, and artistic challenges. Many construction safety challenges would be relatively simple to address. For example, a leading cause of construction deaths has been identified as "falls from height." Increasing roof parapets to a height of 42" has been recommended as an effective measure to improve jobsite safety. Can an architectural design accommodate a 42" parapet? Will owners pay the nominal added cost for a taller parapet? The answers may not always be "yes" but those questions seem reasonable to ask. Common sense suggests that a 42" parapet wall does not increase a designer's exposure to liability; rather, if it effectively reduces

the likelihood of jobsite accidents, the likelihood of a claim should also be reduced.

While PtD is eager to engage architects, architects may not be eager to embrace PtD in the absence of financial and/or ethical incentives. Regardless, the first step is to initiate dialogue. Inspired by the PtD Workshop last summer, BHDP Architecture has hosted a series of roundtable discussions with participation from NIOSH, Messer Construction, and SKS Insurance. The group has begun to develop a continuing education program designed to introduce designers and building owners to PtD concepts.

<http://www.bhdp.com>

PtD Workshop Proceedings— *Journal of Safety Research*

The first Prevention through Design Workshop was held in July 2007 in Washington, DC, to launch a National Initiative aimed at eliminating occupational hazards and controlling risks to workers by "designing out" hazards and risks when new equipment, processes, and business practices are developed.

The workshop, which attracted 225 participants from diverse industry sectors and disciplines, included plenary speakers highlighting the success of PtD in several industries; breakout sessions to identify opportunities, barriers, and next steps for each industry sector; and cross-industry breakout sessions to map out the top over-arching issues in PtD in the functional areas of Practice, Policy, Research, and Education. The output from the Workshop will be used to develop a strategic plan that highlights actions and milestones to institutionalize the concept throughout the United States.

The April issue of the *Journal of Safety Research* contains:

- Proceedings from the PtD Workshop
- Meeting break-out session reports from industry sectors

- Meeting break-out session reports from functional areas
- Technical papers authored by experts in Prevention through Design

For additional information please visit the *Journal of Safety Research* page on the National Safety Council Web site.

<http://www.nsc.org/lrs/res/jsr.aspx>

Spreading the Word about PtD

Recent conferences/meetings that included PtD on the agenda:

ORC Worldwide™ Occupational Health, Safety and Environmental Network Quarterly Meeting
February 7, 2008
Washington, DC

Applied Ergonomics Conference and Expo 2008 Post Conference Workshop
March 13, 2008
Orlando, FL

Association of Equipment Manufacturers (AEM) Safety Seminar
April 22, 2008
Dallas, TX

Upcoming conferences/meetings that include PtD on the agenda:

American Industrial Hygiene Conference and Exposition

May 31–June 5, 2008
Minneapolis, MN

Roundtables 215 & 225 (June 3, 2008)

NIOSH Emerging Issues/Current Trends Luncheon Discussions (June 3, 2008)

American Society of Safety Engineers Safety 2008
June 9–12, 2008
Las Vegas, NV

ORC Worldwide™ Western Occupational Safety and Health Group Meeting
June 19, 2008
Dana Point, CA

Prevention through Design Research Projects

Listed below are examples of current research projects that focus on the four PtD functional areas of Practice, Policy, Research, and Education. Future issues of this newsletter will include information about these research projects.

- Practice: Moving NIOSH Engineering Design Solutions into Practice
- Policy: Integrating PtD Concepts into Management Systems and Standards
- Research: Benchmarking Management Practices Related to PtD in the US and UK
- Education: Diffusing PtD Principles through Engineering Textbooks

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