

# NIOSH Construction (CON) Program:

Response to CON Expert Review Panel's Report

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## Introduction

The NIOSH Construction Program addresses a high hazard industry that comprises a wide range of activities involving construction, alteration, and/or repair under [North American Industry Classification System \(NAICS\) code 23](#). It includes not only residential and commercial building construction, but also heavy and civil engineering construction, such as water and sewer lines, highways, and bridges. Specialty trades like masonry, roofing, plumbing, electrical, drywall, and painting are also part of this sector.

Construction jobs are some of the most dangerous, with the highest fatality rate of all industries. In 2016, the United States (U.S.) construction sector employed 10.3 million workers, a number still rising after employment in the sector declined during the economic recession that began in 2007. Almost 40% of construction employees work for small businesses with fewer than 20 employees, and nearly 30% are of Hispanic origin [CPWR 2018a, b].

In 2018, NIOSH convened an expert panel to assess the relevance and impact of NIOSH research (conducted by NIOSH researchers or funded by NIOSH) in the construction sector from 2007 through 2017. Much of the research and related activities funded by NIOSH was done by CPWR-The Center for Construction Research and Training's research consortium. CPWR successfully competed to be the National Construction Center (NCC) and received NIOSH funding during this period. NIOSH provided the panel with a detailed [evidence package](#) describing inputs, activities, outputs, intermediate outcomes, and end outcomes for five topics: silica, musculoskeletal disorders, noise and hearing loss, highway work zones, and fall prevention. After the panel reviewed the package, NIOSH and NCC representatives briefed panel members during a face-to-face meeting. During the meeting, the panel was provided with additional supporting information and was able to ask questions and interact with the program representatives. Subsequently, the panel developed [a report](#), which included numeric Program scores for both relevance and impact as well as panel finding and recommendations.

The panel assigned the Construction Program a total score of 9.5 out of 10. Each panel member scored the program individually for relevance and impact on a scale of 1 to 5, and those scores were averaged and rounded to the nearest 0.5. The panel's score for relevance was 5 out of 5, which indicates that "the rationale for the activities completed by the Program is highly justified based on burden and need." The panel's score for impact was 4.5 out of 5. This score falls between the "Program made some contributions and/or demonstrates great potential to contribute to end outcomes or well-accepted intermediate outcomes" and "the Program has made major contribution(s) to worker health and safety on the basis of end outcomes or well-accepted intermediate outcomes."

The panel felt that NIOSH [research to practice](#) (r2p) efforts have improved the use of its research and communication products in the construction community and was impressed with NIOSH's increased use of technologies (e.g., tablets, cell phones) to accomplish r2p goals. In the panel's view, the most significant intermediate outcomes included adoption of engineering controls that are more effective than other types of hazard controls and changes to mandatory government standards, voluntary consensus standards, and other influential documents. NIOSH research projects also contributed to more effective personal protective equipment.

The panel also made recommendations to improve relevance and impact going forward. The Construction Program appreciates the panel's review and feedback and this *Response to the Construction Expert Review Panel's Report* addresses how the panel's recommendations will inform the future plans of the program.

## Construction Panel's Summary Recommendations for Future Considerations

### Recommendation 1: Continue to conduct basic and applied research

Consistent with its finding that the NIOSH Construction Program is highly relevant and impactful, the Panel recommends that NIOSH continue to conduct basic and applied research to improve construction worker health and safety. The effort should focus on prioritizing research in areas where improvement is most needed and maintaining a pipeline of research findings and developments for transfer and implementation. It is important to note that some topics require significant time to reach fruition.

NIOSH addressing at this time: Yes

#### Rationale:

We agree that it is important to maintain a pipeline of research findings and developments for transfer and implementation. NIOSH has and continues to place emphasis on transferring technologies. For example, we will continue to work with OSHA to update Table 1 of their silica standard for construction as additional silica control research is completed. Specific ongoing silica projects that involve transfer include work to incorporate silica controls into ISO standards for asphalt milling, research on controlling silica exposures from granite and engineered stone counter tops, and efforts to identify effective controls for tuckpointing.

NIOSH will continue to address the need for maintaining a pipeline of research findings through our long-term strategic goals under the [Burden, Need, and Impact](#) (BNI) framework. Considering the burden and need when determining what research to conduct helps to ensure that high priority areas are addressed. Goals within the [NIOSH Strategic Plan](#) call for conducting basic, intervention, and translation research on various topics such as occupational hearing loss (Activity Goals 2.1.1–2.1.2) and the risk factors for back injuries (Activity Goals 4.2.1–4.2.3), particularly among vulnerable workers and those who work for small businesses.

The NIOSH Construction Program priorities include addressing struck-by and other traumatic injuries (Activity Goals 6.3.1–6.3.3). The NIOSH Strategic Plan also identifies a need for ongoing intervention research on fall prevention strategies (Activity Goals 6.2.1–6.2.2). NIOSH and the NCC will continue to support solutions-oriented, intervention research initiatives focused on these persistent hazards. We will also continue to identify and support research on emerging topics such as use of robotics, exoskeletons, and use of nano-enabled construction materials.

We also appreciate the panel's recognition that some safety and health topics require the commitment of significant time before improvements in outcomes may be measured. Rarely are occupational safety and health challenges in construction wholly understood or improved across the industry within a typical three to five year research study. Many of these challenges are difficult and complex, and numerous factors influence their rate of adoption. For example, the asphalt milling research partnership described in the evidence package took nearly a decade to reach fruition. Continuing to conduct applied and intervention research, in particular, is critical for addressing many of the persistent safety and health issues facing construction workers, as well as addressing emerging hazards such as new products, equipment, and work practices and their potential unintended consequences.

## Recommendation 2: Increase r2p efforts

The Panel recommends that NIOSH increase its efforts to improve r2p dissemination and outreach efforts to make the construction industry, construction workers, and construction safety and health personnel more aware of the NIOSH Construction Program and the NIOSH products that could help improve safety and health at construction sites.

NIOSH addressing at this time: Yes

### Rationale:

We plan to increase and improve r2p efforts in order to ensure that workers and contractors are aware of NIOSH research findings, as well as practical means to adopt new information, technologies, and evidence-based practices into their daily work. We will continue to strengthen the existing partnerships described in our evidence package, purposefully establish new partnerships with organizations and individuals who can help us understand the demands and constraints among workers and employers to adopting good practices, and ultimately ensure the findings from research are used. We will also engage these partners in helping us understand innovative dissemination methods, unique intermediaries who can reach more isolated segments of the industry, and novel ways to increase the impact of our program.

NIOSH will work with the NCC, which has staff with unique r2p experience and skills, to create strategic diffusion and social marketing plans. We will focus our r2p efforts on a range of construction related topics targeted at those with the highest burden, need, and potential for impact as well as those emerging issues where the burden is still unknown. We are currently focusing our r2p efforts on preventing falls in construction and stopping struck by incidents (including motor vehicle safety). Other active r2p areas include work organization, adoption of injury and illness prevention programs, and improving the industry safety culture and climate. The NCC has r2p plans in place to address occupational heat stress, hearing loss, musculoskeletal disorders, respiratory disease, and high fatality rates among small construction employers with fewer than 20 workers.

## Recommendation 3: Develop software products and use technology

The Panel recommends that NIOSH focus on developing software products (applications, interactive web pages, virtual reality learning, etc.) to provide the construction industry safety and health tools that use technology and algorithms, allowing large numbers of construction employers, employees, and safety professionals to get construction safety assistance when needed. Review of existing products may provide insight into best practices for software design; input from construction stakeholders may help identify products with greater potential for impact.

NIOSH addressing at this time: Yes

### Rationale:

We concur with the panel's recommendation, and we plan to continue exploring existing software products as we develop new applications to advance construction safety and health. We will work with the [NORA Construction Sector Council](#) and other partners to review draft/pilot software products. We will also reach out for input from our partners at the annual r2p Seminar/Workshop (A 1.5-day meeting planned and organized by the NCC focused on research to practice in the construction industry.) as well as throughout the year through the NORA Construction Sector Council meetings and Working Groups and other mechanisms. We will also continue to work with the NORA Construction Sector Council and other partners to identify knowledge and resource gaps in order to best target our research translation efforts to meet the greatest needs and maximize

the impact (consistent with BNI) on saving construction worker lives and preventing work-related illnesses and injuries. New information technologies (hardware and software) are constantly introduced, adopted, and rendered obsolete. This dynamic technological environment makes it challenging to evaluate and adapt emerging technologies to improve construction health and safety. Currently, the Construction Program is utilizing NIOSH's virtual reality laboratory to develop a simulator tool for boom lifts. NIOSH researchers are also working to develop a virtual safety consultant online program intended to help construction workers address basic construction safety and health issues.

As part of the NCC's r2p initiatives, new technologies to better reach and engage construction workers have been released and are being evaluated. We have begun NIOSH-NCC joint initiatives that allow us to bring different strengths to the process and ensure efficient use of resources. For example, NCC developed microgames, which are video games for use on a smartphone that reinforce learning and practicing real workplace skills. They are now being evaluated by NIOSH researchers. Targeted for the mobile phone video game generation, microgames show promise for raising awareness and use of safer practices.

One of the specific new technology applications that is in pilot phase by the NCC is [Best Built Plans](#), an online materials handling contractor planning tool designed to improve productivity and meet schedules. Best Built Plans is divided into two resources: a web-based site planning resource and a downloadable interactive toolkit including all of the planning resources as well as exercises available for Windows-based PCs. The downloadable program includes interactive training resources to help workers understand the need to plan lifts and introduces strategies and best practices to reduce the risk of injury. Throughout the training program, workers are prompted with reminders and tips for safe lifting. For example, workers will learn warm-up stretches via an interactive demo where they can click on the body part involved in an activity. The planning resources include materials contractors can use at each stage of a project to ensure that safe lifting practices are planned for and used. Starting each day, the program suggests reviewing that day's plan for materials movement and offers a suggested Toolbox Talk, including a QR code to two microgames that aim to encourage safe lifting practices. The microgames, Lift Coach: Plan Your Route and Lift Coach: Plan Your Lift, are free for iOS and Android devices.

#### [Recommendation 4: Research to effectively communicate and interact with small construction employers](#)

The Panel recommends that NIOSH perform research on the most effective methods to communicate and interact with small construction employers. The research would investigate methods for finding small employers, reaching them quickly, and motivating them to implement safety measures. This may be used to support awareness projects, marketing activities, and other r2p efforts. Research on the motivations of small employers who are successfully managing safety and health may be beneficial.

[NIOSH addressing at this time:](#) Yes

##### [Rationale:](#)

We agree with this recommendation and several goals within the NIOSH Strategic Plan emphasize identifying the best ways to reach and influence the safety practices of small construction firms and their employees. NIOSH and the NCC have several projects underway aimed at understanding the needs of small employers, identifying unique intermediaries who influence them, and determining which communications channels and products are most effective. For example, the NCC's Best Built Plans program to reduce sprain and strain injuries has already provided formative information on the barriers and motivators for contractors to engage in safe materials

handling practices – including those employers with fewer than 50 employees— and is now being pilot tested and translated into Spanish.

The NCC also developed a streamlined [Safety Climate Assessment Tool for Small Contractors](#) (S-CAT<sup>sc</sup>), piloted it with small employers through its Roofing r2p Partnership, and has recently translated it and tested this resources with small Latino contractors and their employees. The lessons learned from both of these initiatives will increase our understanding of the needs of contractors and how we can reach them. In addition, NIOSH is collaborating with the American Society of Safety Professionals (ASSP, formerly the American Society of Safety Engineers, ASSE) on a study to find the best way to promote fall safety practices among small residential roofing companies that employ Latino immigrants. This study is a follow-up to the [Overlapping Vulnerabilities report](#) that NIOSH and ASSE published in 2015 and a survey ASSP conducted in 2017 [Cunningham et al. 2018].

### Recommendation 5: Research on training and education

The Panel recommends that NIOSH perform research on the best approaches to train and educate construction employers, workers, and safety professionals. These efforts should focus on methods that are effective with adult learners, non-English speaking learners, and low-literacy audiences. Micro-learning, online training, and the use of augmented, virtual, and immersive reality should also be topics of research.

[NIOSH addressing at this time:](#) Yes

#### Rationale:

We concur that identifying effective mechanisms to educate construction workers is a critical task. In fact, NIOSH and the NCC will soon published a series of co-branded toolbox talks that NCC developed based on NIOSH research that explored ways to make this intervention tool maximally effective [Eggerth et al. 2018]. The NCC has translated them into Spanish in partnership with ASSP and created a version that industry stakeholders can co-brand and distribute directly to their clients/employees. NIOSH will also investigate the effectiveness of toolbox talks and corresponding microgames with Spanish-speaking construction workers. This work is intended to investigate effective methods for communicating basic construction occupational safety and health (OSH) knowledge can be replicated to non-English speaking populations, as well as the effectiveness of microgames for enhanced learning.

As NIOSH and the NCC researchers use software and develop technologies to encourage the use of safer practices, we will also be exploring how they can be used to train and educate target audiences. We intend to use [TRU-Net](#), established by the NCC to tap into the building trades' national training network, to help us find promising approaches and the best methods for using these technologies with specific populations including non-English-speaking learners and low-literacy audiences. We will also use TRU-Net to explore the practicality of using new technologies with these audiences.

The NCC will soon conduct a detailed and comprehensive evaluation of the OSHA-10 training program, in partnership with a consortium researcher and multiple university-based OSHA Training Institute Education Centers across the nation. The project will develop model effective approaches to improve this training program, and has the support from OSHA to share the adoption of those practices across the OSHA training national infrastructure, potentially improving the training of over 500,000 workers each year in the construction industry.

## Recommendation 6: Research about safety and health programs

The Panel recommends that NIOSH perform research to investigate effective methods that help employers develop safety and health programs. NIOSH should investigate effective methods to help move them from a point of low safety and health performance to a point of compliance with government regulations, and then to adoption of best practices.

NIOSH addressing at this time: Yes

### Rationale:

NIOSH and the NCC are actively involved in supporting contractors moving from low to high levels of safety and health performance. In 2018, both organizations partnered with OSHA on its [Safe+Sound Campaign](#), which focused on improving safety management and providing the tools and resources to develop safety management programs. Since joining the campaign as a national organizer, the NCC has continued to promote the Campaign's message and resources through social media and other communications platforms and has seen over a 200% increase in construction industry participation in the effort. The NCC plans to continue this effort.

NIOSH and the NCC leaders currently co-chair the NORA Construction Sector Council. We recently established Sector Council workgroups that are actively addressing various aspects of how to improve safety and health performance. For example, during our last meeting in November 2018, the workgroup reported that they are investigating approaches to improve job safety analysis, improve safety for temporary workers, and more effectively engage with key industry stakeholders. These promising efforts will continue for some time.

As part of continuing work that began with a multi-stakeholder meeting in 2013, the NCC explored how the industry views issues around safety culture and climate and developed eight leading indicators of safety culture and climate that are essentially identical to widely accepted core elements of safety and health programs. These leading indicators were operationalized over time, and are currently [available online](#) to industry employers as two versions of the Safety Climate Assessment Tool, one for all employers and one specifically focused on small employers. Tools to improve performance among these leading metrics have also been developed in recent years, including the [Foundations for Safety Leadership \(FSL\) training](#), aimed at construction foremen and in use in OSHA 30-hour training programs nationally. To date, 20,000+ workers have received FSL training as part of the OSHA 30-hour training. Many companies and unions have used/ continue to use the 2.5-hour training module with their workers and members. The NCC has plans to develop an online Safety Climate Safety Management Information System that provides a framework where the results of the Safety Climate Assessment could be used to help employers implement programs and tools that address their weaker rubrics or scores, in order to assist them with incrementally improving their safety program adoption.

NIOSH researchers conducted a case study that explored how a general contractor worked to create a strong safety culture among their subcontractors. They investigated the factors critical to the outstanding safety record achieved at a large commercial building project in Dallas, TX. This study provided multiple management- and subcontractor-level perspectives regarding the safety and health approach used, how this differed from other projects, and how the lessons learned could be integrated into the construction industry (Cunningham et al 2015). This study has informed the work of other NIOSH researchers who are studying safety climate and safety culture in construction, and research currently proposed will continue to test interventions based on these studies to identify and apply best practices in safety management systems.

Additionally, an NCC consortium project is currently studying how subcontractors working under general contractors with strong safety programs adopt elements of those programs. The research is exploring the



sustained improvement in performance of those subcontractors after the work under the strong general contractor has ended, as well.

Based on previous work by researchers in Europe and New Zealand, NIOSH researchers developed a model for occupational safety and health intervention in small businesses and has evaluated it with several intermediary organizations. The model offers some encouragement that initiator organizations can contribute to sustainable OSH assistance for small firms, but they must depend on intermediaries who have compatible interests in smaller businesses and they must work to understand the small business social system [Cunningham and Sinclair 2015]. NIOSH is currently conducting studies of various methods for disseminating health and safety guidance to small construction businesses through insurance companies, and plans to continue this line of research.

### Recommendation 7: Research towards construction equipment that protects workers from hazards

The Panel recommends that NIOSH continue to prioritize research that results in new and improved construction equipment that protects workers from hazards. NIOSH should work with consensus standards bodies to incorporate safer equipment designs into requirements that improve equipment used across the construction industry.

NIOSH addressing at this time: Yes

#### Rationale:

As noted in Recommendation 1, we agree that continued research on such interventions is critical and are an important piece of the NIOSH Strategic Plan. Research that leads to new or improved equipment, which has both practical and safety applications, is more likely to be accepted and used by contractors. The NIOSH Construction Program has a long history of conducting and promoting this type of research [Howard et al. 2010; Mead et al. 1999; Meeker et al. 2009]. We have found that when NIOSH construction research findings are included in voluntary or, more importantly, mandatory standards the likelihood that manufacturers will develop and commercialize the equipment on a broad scale increases significantly. As demonstrated by the OSHA silica standard and the ASTM consensus standard that preceded it (ASTM E2625-09, Standard Practice for Controlling Occupational Exposure to Respirable Crystalline Silica for Construction and Demolition Activities), such standards drive research, commercialization of interventions, and ultimately broad-based use of the safety equipment and work practices [ISO/AWI 2018].

In order to continue to translate research findings into consensus standards, both NIOSH and the NCC plan to continue to be actively involved with standard setting bodies, such as the American National Standards Institute (ANSI) and ASTM (formerly the American Society for Testing and Materials). NIOSH has representatives on several committees that relate to construction and related equipment, including the Society of Automotive Engineers (SAE) International committee for AS6228, Safety Requirements for Procurement, Maintenance and Use of Hand-held Powered Tools and the American Society of Agricultural and Biological Engineers, Environment within Agricultural Vehicle Enclosures Subcommittee. The work of the former standard committee is focused on tool design that will influence construction, whereas the work of the latter standard committee has direct application to enclosed cabs on construction equipment. Both NIOSH and the NCC have been very active on the ANSI-ASSP A10 committees for Construction Safety and Health. NIOSH researchers have periodically met with representatives of the Association of Equipment Manufacturers. That ongoing relationship will continue to be explored for ways to advance the utilization of new equipment and technologies as they are developed.

## Recommendation 8: Contribute to standards and influential documents

The Panel recommends that NIOSH continue to prioritize research and r2p efforts that result in safer mandatory government standards, voluntary consensus standards, and other influential documents, such as LEED and building codes, both in the US and internationally.

NIOSH addressing at this time: Yes

### Rationale:

NIOSH thanks the panel for this thoughtful recommendation. As noted in Recommendation 7, NIOSH and the NCC are well positioned to address this recommendation. Both organizations have developed and maintained an ongoing relationship with the OSHA Construction Directorate and the OSHA Directorate of Standards and Guidance, and our organizations are active participants on committees that establish consensus standards and codes. Probably the foremost of these consensus standards committees is the ANSI/ASSP A10 committee for Construction and Demolitions Operations. NIOSH staff and the NCC continue to maintain our presence at all of the ANSI/ASSP A10 committee meetings and provide substantial ongoing input into approximately 50 unique consensus standards addressing many different safety and health topics in the construction industry. This is just one example of many ongoing consensus standard activities.

In addition to our activities on the A10 committee we have numerous other ongoing activities to provide input into construction standards and influential documents that incorporate Prevention through Design (PtD) principles and engineering controls. For example, OSHA recently [announced an anticipated Request for Information](#) seeking information on construction tasks and silica exposures and controls to expand Table 1, *Specified Exposure Control Methods When Working With Materials Containing Crystalline Silica* in the silica standard for the construction industry. NIOSH plans to provide input to OSHA based on ongoing or planned engineering controls research discussed under Recommendation 1.

In another related area, in the future NIOSH will examine emerging hazards associated with nanomaterials in construction. This effort will provide input into consensus standards that address the materials' lifecycles. NIOSH engineers also serve on The Facility Guidelines Institute (the authoritative source for guidance on healthcare planning, design, and construction) committee on Guidelines for Design and Construction of Outpatient Facilities. This committee will develop guidelines that include PtD concepts and is expected to improve the health and safety of construction workers who build outpatient healthcare facilities. A NIOSH engineer is also currently working with the French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (French: Institut national de recherche et de sécurité, INRS) and other partners to generalize NIOSH research-based recommendations on controls for asphalt paving and milling machines to Europe. This effort will incorporate NIOSH recommendations into ISO/NP 20500-1 – Mobile road construction machinery – Safety.

## Recommendation 9: Develop and maintain partnerships

The Panel recommends that NIOSH build on recent successes with partnerships to develop powerful relationships that improve construction safety and health. Relationship development should be focused toward groups that will use their own resources, intellectual capital, ideas, and spheres of influence to improve safety and health. NIOSH and the National Construction Center should maintain the helpful existing relationships they have established, as well as seek out stronger relationships with other groups, such as trade associations,

professional associations, and owners. Partnerships with large construction companies and their trade associations may provide an opportunity to speed adoption of new products and technologies.

NIOSH addressing at this time: Yes

#### Rationale:

As noted in the panel's report and in Recommendation 2, partnerships are a critical component of NIOSH and the NCC's r2p initiative. To date, such partnerships have provided us with expertise, access, and information on specific tasks and construction populations critical for the successful completion of research projects. Early efforts related to partnerships focused on understanding what different organizations could contribute to the process and the best partnership structures to maintain long-term engagement.

In 2017, the NCC funded a study at the University of Colorado to conduct [social network analysis of the National Falls Campaign partners](#) to better understand partner roles, what portions of the construction sector they represent, and the reach and scope of the Campaign effort. This analysis of the partnering effort (and associated network) will be utilized to help making decisions about future partnering/relationship efforts to most effectively advance our goals.

Based on the lessons learned from previous efforts, we have begun to expand our partnership initiatives to the broader groups noted in the panel's recommendation. For example, a large national general contractor is working with the NCC on Best Built Plans, allowing the pilot testing to occur on multiple job sites across the country.

Work is also underway to better engage several national safety organizations and support their initiatives. One such initiative is a new partnership between the NCC and the ASSP to keep their members apprised of new safety and health resources and research through an ASSP sponsored webinar series.

We also continue to engage with large construction companies and associations on many of our ongoing research projects. For example, we have current research projects related to the redesign of hard hats that involves Turner Construction. We also continue to reach out to and engaging with Skanska, Builders Mutual, the Association of General Contractors (AGC), The Construction Users Roundtable (CURT) and the National Association of Home Builders (NAHB). This interaction is ongoing through various research projects and through interactions with the NORA Construction Sector Council or active participation at large construction safety and health conferences.

### Recommendation 10: Evaluate and capitalize on the productivity effects of research and recommendations

The Panel recommends that NIOSH improve its efforts to evaluate and capitalize on the productivity effects of its research and recommendations. One example is found in the development of new or improved equipment, which may have positive effects on workplace productivity. Potential improvements to safety and health, combined with improved productivity, should be used in r2p efforts to motivate and encourage employers to adopt safer practices.

NIOSH addressing at this time: Yes

#### Rationale:

We too appreciate the importance of making the business case for safety as it is often an overlooked part of occupational safety and health research and r2p. NIOSH continues to emphasize the economic benefits of safety

and health research and associated interventions. NIOSH has been working with the RAND Corporation to develop a systematic approach and [illustrative case studies](#) to inform the occupational safety and health community about the economic benefits of safety and health [RAND 2017]. In addition, NIOSH staff have been working closely with the NCC to collect and present return on investment (ROI) examples on their [ROI Calculator](#). This ongoing ROI effort is intended to support selected safety solutions and encourage their use. These ROI examples include ones based on the drill rig research described in the Evidence Package, as well as, ones in support of the economic feasibility of the using silica dust controls.

In an effort to reduce manual material handling, the NCC's Best Built Plans program includes information on the potential productivity, financial and other benefits of engaging in safer materials handling practices – a message that resonates with construction financial management staff. The Construction Financial Management Association recently published an [article](#) on the Best Built Plans program in recognition that, in this instance, safety equals savings.

In addition, NIOSH efforts related to the safe use and implementation of automation and robotics are closely linked to improvements in productivity. Initial efforts have centered on the safe use of exoskeletons for certain tasks, and NIOSH researchers are currently helping to develop consensus standards for this new technology [Lowe et al. 2016; Zingman et al. 2017]. The NIOSH Strategic Plan contains several research goals related to these new technologies (Activity Goals 6.3.1-6.3.3). We plan to emphasize the link between safe use of automation and robotics and productivity in future construction program communications. Both NIOSH and the NCC intend to encourage construction researchers to collect information on productivity and other savings associated with safety interventions so that this information can be used in r2p efforts. We plan to incorporate language related to productivity and the business case into the NIOSH Strategic Plan to address this area through future research.

### [Recommendation 11: More frequent reviews of project within the Program](#)

The Panel recommends more frequent reviews of projects within the Program (especially for the most rapidly developing areas), including ongoing informal feedback from stakeholders. The precise mechanisms are less important than early, frequent, and diverse feedback by affected stakeholders, especially for topics that are rapidly evolving. With the ongoing development of online tools for collecting information and facilitating remote collaboration, future stakeholder input processes could be improved even further.

[NIOSH addressing at this time:](#) Yes

#### [Rationale:](#)

NIOSH appreciates this recommendation and recognizes the need for real-time feedback on research initiatives to ensure they reach their full potential and ultimately, help the Construction Program maximize its impact. The NIOSH Office of Construction Safety and Health routinely reviews construction related research projects across the Institute.

This feedback on NIOSH research projects occurs during Construction Steering Committee meetings, routine meetings with NIOSH divisions involved in construction research, and dedicated briefings. These opportunities allow us share insight that may help NIOSH researchers promote, align, or augment their research. In addition, NIOSH internal construction researchers and the NCC research consortium regularly share project updates during NORA Construction Sector Council meetings in order to receive stakeholder feedback.

NIOSH Office of Construction Safety and Health staff also work collaboratively with the NCC to review and offer feedback on both projects under development and in-progress. Moreover, the NCC has begun using online survey software (Qualtrics) to expedite the collections and analysis of stakeholder feedback. The NCC recently completed a literature review on the use of the Delphi method in construction research and is finalizing a report on how this method could be used to create an ongoing mechanism to engage stakeholders in measuring the impact of research.

As noted in Recommendation 9, strengthening and expanding use of partnerships is critical to addressing this recommendation, and NIOSH and NCC plan to build on our existing work to ensure that we are positioned to collect information and respond to the rapid changes taking place in the industry and the implications for safety and health research.

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