



## Assessing Safety Risks of Human-Robot Interaction

### Occupational Safety and Health Protocol for Assessing Human-Robot Interaction Safety Risks

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#### Overview

Robotics and automation (RA)—such as exoskeletons, drones, and single-task construction robots—offer new possibilities to combat challenges facing the construction trades, including unsafe and dangerous working conditions. Despite RA's potential positive impacts, human-robot interaction (HRI) can also introduce new hazards on the job site and elevate the potential impact of existing hazards. While some studies have assessed the effectiveness of RA technologies, none have evaluated the safety risks associated with implementing RA in the construction industry, and there is no HRI safety risk assessment protocol to assist practitioners conducting pre-task planning that involves RA. This study developed a practical process and tools for practitioners to identify and quantify HRI safety risks when using RA in construction operations.

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#### Read the report

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#### Key Findings

- The study identified 40 hazards associated with the use of robotics and automation (RA) for construction operations, classifying them into seven groups: Human; Control; Unauthorized Access or Operational Situation Awareness; Mechanical Concerns; Environmental Sources; Power Systems; and Improper Installation.
- It developed safety risk ratings for critical hazards in three categories of RA technologies (wearable robots, remote operated robots, and onsite automated robots) when used for three construction tasks (bricklaying, concrete grinding and polishing, and drywall installation).
- It identified 22 preventive strategies for mitigating human-robot interaction (HRI) safety risks during construction projects.
- It created a practical process for assessing and controlling HRI safety risk that comprises:
  - Safety Data Sheets on the use of wearable robots (exoskeletons), remote-operated robots (e.g., drones and unmanned ground vehicles [UGVs]), and onsite automated robots (e.g., bricklaying robots).
  - Job Hazard Analysis protocols for three tasks: drywall installation, bricklaying, and concrete grinding and polishing.
- It also developed practical assessment manual containing:
  - Descriptions of available RA technologies.
  - Applications of RA technologies.
  - Factors that influence the use of RA technologies.
  - Current standards and procedures for RA.



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