Construction Helmet Ratings

Why we did this study

Falls are the dominant cause of fatal and serious brain injuries in construction. Analyses show that about 57 percent of fatal and 54 percent of non-fatal construction brain injuries involve a fall, so head protection needs to be evaluated under fall-like impacts, not only top impacts from dropped objects. Many of these injuries can be prevented with appropriate helmets.
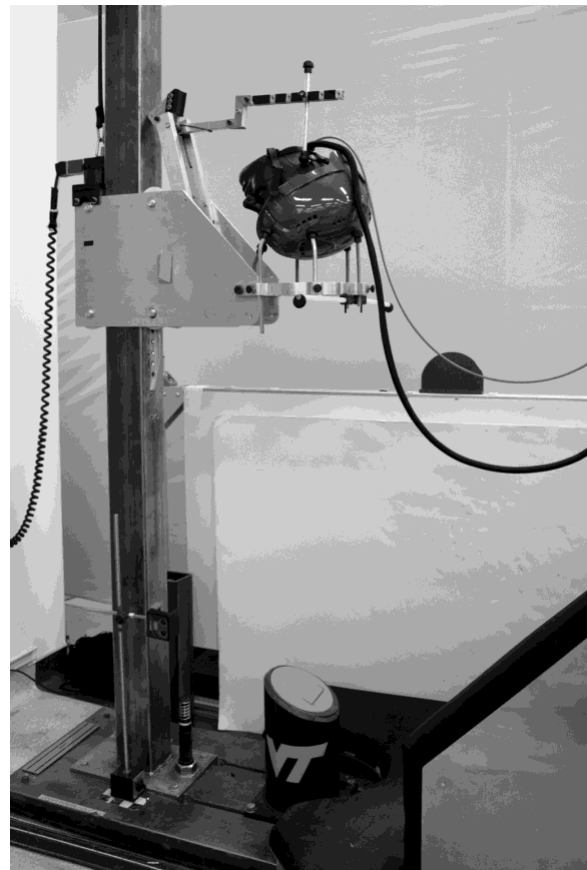
How we did the study

We developed a fall-specific rating system using the STAR framework. STAR (Summation of Tests for the Analysis of Risk) combines lab tests that mirror common real-world head impacts with injury risk models to produce an overall performance score for helmets. Lower STAR scores identify helmets that lower injuries on the jobsite.

Test methods

Helmet impact conditions: Each helmet model underwent 12 impacts representing severe but survivable fall scenarios, defined from OSHA accident patterns. A helmeted test dummy head was dropped onto a 25-degree anvil at speeds representing 14 ft and 25 ft falls across three locations on the helmets. Each impact condition was repeated twice, and each impact was done on a new helmet sample. We recorded linear and rotational head accelerations.

Injury risk and performance scoring: Skull fracture risk and concussion risk were computed for each impact using the linear and rotational head acceleration measurements. We weighted each condition by how often similar falls occur, then summed risks to yield an overall performance score (STAR value) representing the predicted number of injuries per 100 fall-like head impacts. A lower score indicates better protection.

Helmet types: Type I and II helmets were evaluated. Type I helmets consist of a shell and suspension system and are certified for top impacts. Type II helmets consist of a shell, suspension system, energy-absorbing material,

and a chinstrap. They are certified for top and side impacts. Electrical classes (C, E, G) address electrical exposure and are independent of impact protection measured here.

What we found

Across the fall-representative impacts in this protocol, Type II helmets showed markedly better performance than Type I. Type II models lowered predicted concussion risk by about 34 percent and reduced predicted skull-fracture risk by about 65 percent. Interpreted in practical terms, if a group of workers experienced 100 skull-fracture injuries while wearing no helmet or a Type I helmet, only 35 of those injuries would have occurred with Type II helmets under the same impact conditions. These differences arise because Type II helmets include energy-absorbing material and chinstrap systems that keep the helmet secured to the head during the impact.

What the helmet scores mean: The STAR value estimates the combined number of concussions and skull fractures expected out of the 100 fall-like head impacts we model with our tests. Because one fall can cause both a brain injury and a skull fracture, the maximum score is 200. Lower is better.

How to use the ratings

- For crews exposed to fall hazards, select 4- or 5-star Type II helmets.
- Consider fit and retention systems, since the helmet can only do its job if it stays on the head during a fall.
- The construction helmet ratings are continually updated. Monitor the website (https://helmet.beam.vt.edu/construction-helmet-ratings.html) for the latest models and results.
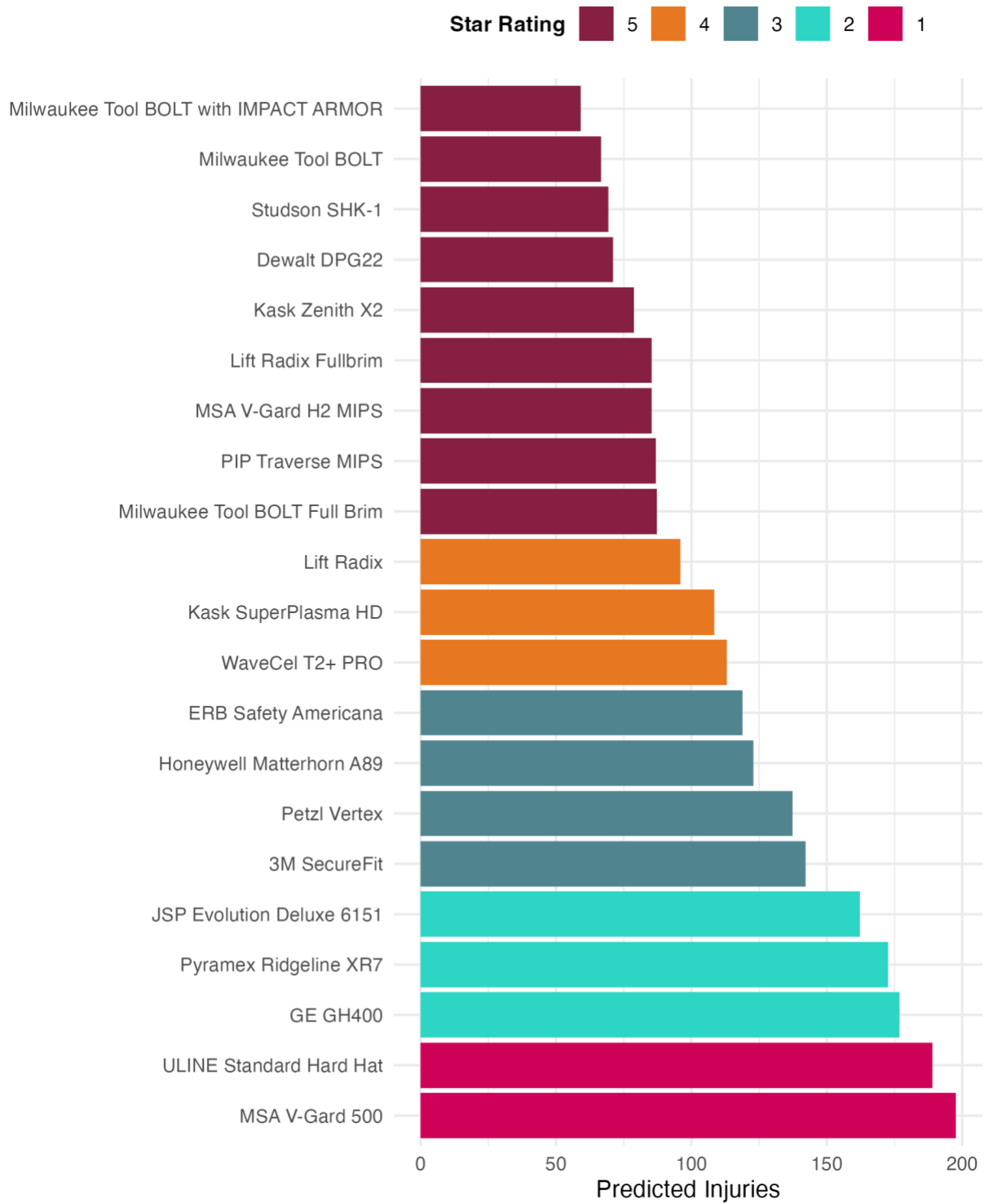
Scope and independence

These ratings evaluate helmet performance in fall-representative head impacts. They provide supplemental comparative data on helmets that pass existing safety standards to enable informed purchasing decisions. They do not evaluate other impact scenarios, electrical class, falling-object penetration, or comfort. Testing is independent of manufacturers.

Funding and contact

This project was funded by the John R. Gentille Foundation, ELECTRI International, the American Society of Concrete Contractors, and The Association of Union Constructors. Contact the Virginia Tech Helmet Lab for methods, current model ratings, and questions.

Helmet-specific results

As of November 15, 2025, we have evaluated 21 safety helmets using the STAR method.

For the most recent ratings, visit: https://helmet.beam.vt.edu/construction-helmet-ratings.html