

ICC-ES Recognizes Innovative Solutions to Industry's Stair Rail Safety Concerns

ICC-ES recently issued [ESR-2295](#) to EZ Stairs® for a newly redesigned stair bracket. Designed specifically for stair construction and code compliant rail post support, the standard stair bracket was modified and tested for lateral load stair rail post support for cut stringers, angle stringers and for other applications. Current IBC® and IRC® codes require guard rails to withstand a lateral load of 200 pounds, applied 36 inches above the nose of the stringer. In more than twelve individual tests, all brackets withstood a load of 500 pounds applied 42 inches above the nose of the tread (an IBC requirement for non-residential applications), with some tests approaching 600 pounds before failure. The bracket provides an innovative solution to stair rail safety concerns.

“In addition to prescriptive materials, products, and practices, the code provides for innovations that leverage the latest information available in every area of construction,” stated Bart Berneche, P.E., ICC-ES Senior Staff Engineer. “At ICC-ES, we scrutinize research reports from independent testing agencies on innovative products such as the EZ Stairs® bracket, and report on how these products meet the intent of the code in all their relevant properties.”

“One area that is of particular concern to [EZ Stairs®](#) is current stair construction practices,” said Richard Truckner, Director of Engineering, EZ Stairs®. “Much attention has been paid by industry to the more complex construction of stairs in high-rise structures, and new structural solutions have been introduced to prevent deck failures. EZ Stairs® is focused on ensuring that residential construction receives the same level of scrutiny. These are valid concerns. The National Safety Council shows slips and falls on stairs, result in 2,000 fatalities each year, making stairs the most dangerous area of the home. Once the hand grip or hand rail becomes unstable, safety is greatly compromised. This is particularly evident with persons over age 65. NSC statistics show that the leading cause of death and serious injuries for persons over age 65 are slips and falls.”

Secure hand and guardrails are essential for stair safety, and there are many viable solutions for securing handrails.



How Not to Build a Deck

Photo Credit: James Eggert, Building Inspector, City of New Haven, CT

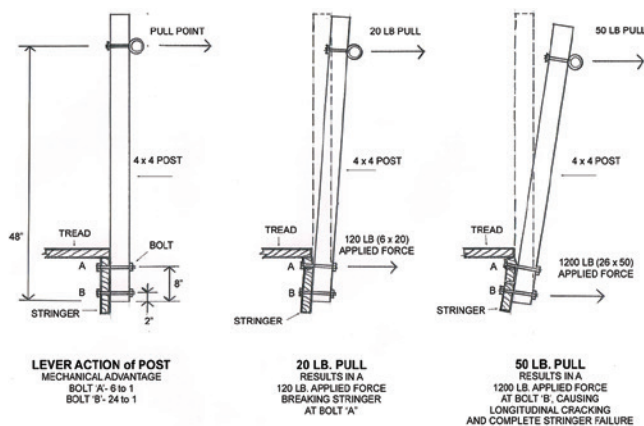
Unfortunately, this is not always the case for guardrails, specifically when they are attached to wood stairs. Guardrails are normally secured to rail post supports, which in turn are attached to a stringer. Some within the building industry have expressed concern that the standard installation methods used for rail post attachment fall short of meeting the lateral load capacity required by code. Products, such as the bracket evaluated in ESR-2295, help ensure that current and future construction meets this requirement.

“In recent discussions I’ve had with numerous code officials, the topic of ‘stair rail safety’ was discussed,” added Truckner. “The following two questions were asked: ‘What method is generally used to determine and ensure that the guard rail is secure?’ and ‘How do you know it will meet code?’ Far too often, the answers to these questions were ‘tug- or bump-the-rail’ test and ‘if it seems solid, it passes.’”

In some traditional construction, stairs are built with three or more cut stringers. Stairs may have both risers and treads,

or treads only. The guardrail is normally 36 inches high for residential construction and is secured via posts bolted to the cut stringers. Often, the rails themselves are strong enough to meet code, but the attachment of the post to the stringer is the weak link.

An IAS accredited testing facility was engaged by EZ Stairs® to test the load capacity of this traditional construction practice. A stair was constructed, with three 2x12 cut stringers and two 2x6 members for each tread, using dry, #2 Douglas Fir. Three 48-inch-long posts were attached using two 3/8-inch galvanized bolts. The top bolt was attached through the triangular cut portion of the stringer (normal practice) and the bottom bolt passed through the uncut portion of the stringer. A 3/8-inch eye bolt was attached 36 inches above the nose of the tread as the load point. The load was applied to each post and measured using a dynamometer. In each case, the bolt pulled through the cut, triangular rise/tread tip of the stringer at a load of just 20 pounds. As the load was increased to 50 pounds, severe longitudinal cracks were seen along the length of the stringers, breaking all triangular tips and resulting in complete failure of both the stringer and the rail post support.



“The results were surprising,” said Truckner. All three tests consistently showed significant structural failure occurring at minimal loads and several reasons for the early failure were identified. The post acted as a lever against the stringer, magnifying the load on each bolt. A 20-pound pull at the guardrail level resulted in a 120-pound force at the base of the post and caused the top bolt to pull through the stringer. Once the top bolt had broken through, the bottom bolt was left to resist the entire load. The mechanical advantage was further amplified by the lower position of the bottom bolt, and the final 50-pound pull on the guard rail became a 1,200-pound force at the base. This was enough to twist the stringer and cause it to crack longitudinally. “It must be pointed out that these tests



were conducted on isolated posts without railing,” Truckner explained. “Often, a continuous rail is used, which can help to distribute the load to other posts, decreasing the load effects on the bolts at a single post attachment. However, the test was designed for worst case scenarios, which were correctly reflected in the above testing.”

Guardrail failure is unnecessary and the consequences can be tragic. The new ICC-ES evaluated EZ Stairs® rail post attachment technology affords a simple and efficient, code-compliant solution to this very serious issue.

All ICC-ES Evaluation Reports can be accessed and downloaded free of charge at www.icc-es.org/evaluation_reports/index.shtml, and are readily searchable based on attributes such as product type, manufacturer or report number. For more information, please visit www.icc-es.org.



*This article is intended to provide information about industry concerns of stair rail safety and on a product for which an ICC-ES Evaluation Report has recently been issued. It should not be construed as a product endorsement or a recommendation for use.