LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

LLNL-TR-608694

Stepping on Computer Floor Stringer Leads to Ankle Fracture

J. A. Horning

December 18, 2012

Disclaimer

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Stepping on Computer Floor Stringer Leads to Ankle Fracture

LL-2012-LLNL-17
LLNL-AR-XXXXXX
December 17, 2012

Subcontractor workers were engaged in cutting out a heel of an elbow pipe inside the interstitial space below a raised computer floor area. While accessing the space, a worker stepped on the cross member (stringer) of a computer floor system. The stringer connection tabs broke and the employee fell approximately 30 inches to the ground, sustaining a fracture to his ankle.

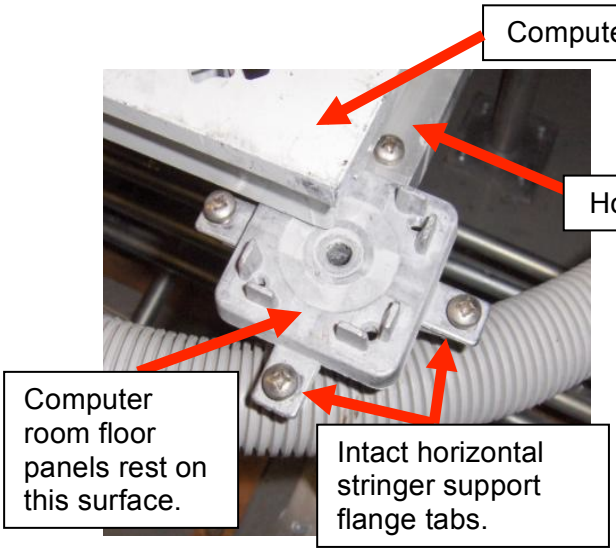

Figure 1: Overhead view of vertical support column showing intact horizontal stringer connections.

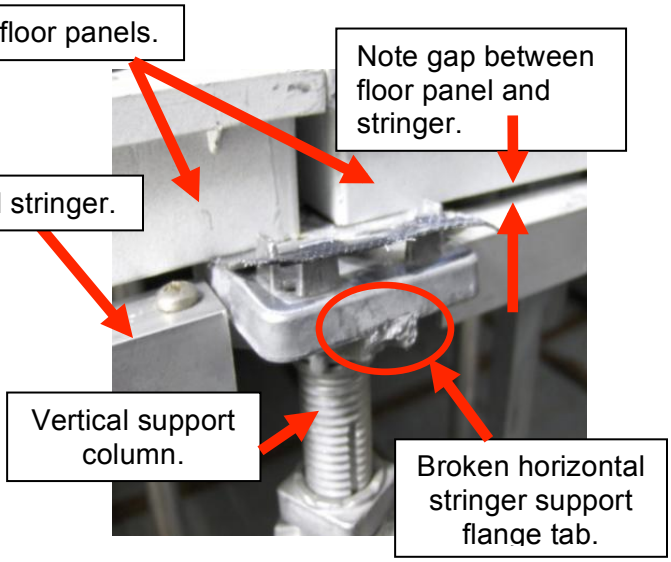

Figure 2: Side view of vertical support column showing broken horizontal stringer support flange tab.

Analysis

The raised computer floor support system is composed of vertical support columns held at the base by four bolts. Horizontal aluminum stringers between the vertical support columns provide lateral stability for the columns. The stringers are bolted to the tabs of flanges at the top of each column. Stringer support flange tabs can't support the large direct loads placed upon the floor, nor are they or their connections to the columns designed to support these direct loads. The worker's weight exceeded the vertical load-bearing capacity of the stringer support flange tab, and the tab failed suddenly and catastrophically. This allowed the worker to fall approximately 30 inches.

Flawed Defenses:
Pre-job Briefings-Neither the approved Integrated Worksheet (IWS) #16490, nor the morning pre-job briefing addressed the hazard associated with walking on the raised computer floor's stringers or the requirement to not walk on the stringers. The potential hazard had not been identified because walking on the stringers was not anticipated.

Environmental – walking/working surfaces – The stringers and their support flange tabs are not designed to support large direct loads placed on them. The working area inside the interstitial space was congested with utilities that made it difficult to maneuver around (and under the raised computer

floor). Neither the approved IWS nor the morning pre-job briefing anticipated or addressed the hazard associated with walking on the raised computer floor's stringers or the requirement not to walk on the stringers.

Error Precursors:

Lack of knowledge – The computer floor in the building was built with cast aluminum stringer supports. These stringers and the cast aluminum connection tabs on the support flanges are not designed to accept large direct loads such as an employee standing in the center of the stringer. This information was not communicated to workers at the worksite because there was no knowledge of stringer tab failures.

Habit Patterns – Post-event interviews with employees revealed that it has been common practice to walk on computer floor stingers while working on open computer floors. There were never prior reports of stringer tab failures.

Recommended Action

LLNL has many different types of raised computer floors on site. Raised computer floors may vary in their configuration and composition of materials utilized to construct them. A raised computer floor should be considered structurally intact only when it is completely installed (all components correctly installed in their proper locations) and not when floor tiles or portions of the floor are removed.

Therefore, when accessing the space beneath a computer floor, workers should not stand or step on any exposed cross members.

Where to Get Help or More Information

- Your supervisor.
- Your Facility Point of Contact (FPOC).
- Your Assurance Manager
- To search for other LLNL Lessons Learned, go to the "Lessons Learned" web site (https://cao-int.llnl.gov/lessons_learned/) and select the topic of interest or click on "Search" and enter a keyword.

Work/Function Categories (HSS entry): Conduct of Operations – Work Planning,
Hazard (HSS entry): Personal Injury/Exposure - Other
ISM Category (HSS entry): Analyze the hazards, develop controls, perform the work with controls in place
Keywords (HSS entry): computer room floor, interstitial space, stringer
Subject Category (LLNL LL web page): Conduct of Operations, Construction/Equipment/ Working Surfaces

Please Post

LessonsLearned@llnl.gov