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Failure of a Rolling Scaffold

A department store needed some maintenance work done inside of a hung ceiling space, but this work needed to be done within a limited time frame on a single day after normal business hours. For this purpose, the department store hired a contractor it used for gardening, cleanup, and general maintenance. The contractor intended to use his own scaffold, but the time involved to setup and dismantle the scaffold would not have left sufficient time to perform the maintenance task within the specified time frame. The contractor therefore agreed to use the department store's rolling lightweight scaffold, with the stipulation that the department store setup the scaffold where the work needed to be done. The contractor sent two of his laborers to do the work and the department store setup the scaffold as agreed.

Figure 1 is a photo of the scaffold. It is designed so that it can be readily assembled and disassembled quickly. The framing is thin wall aluminum tubing and the platform is plywood. The legs are adjustable, and the scaffold was used at its maximum height. The wheels have locks and the wheels were locked before use. The width of the scaffold is 2'-2½" and the length is 6'-3½", center to center of the legs. The height of the platform from the floor, as used, was 8'-6". The weight of the scaffold is 108 pounds.

The laborers climbed onto the scaffold both by using the rungs of an end frame and by using a step ladder setup next to the scaffold. They went up and down the scaffold two times. When they had finished their maintenance task, one of the laborers stepped onto the stepladder and proceeded to the floor; however, when the second laborer tried to leave the scaffold, the scaffold tipped over and that second laborer was severely injured.

Figure 1. Lightweight rolling scaffold with adjustable height platform.

The injured worker sued the department store for negligence for providing an unsafe scaffold. There was a conflict in testimony among the witnesses as to how the injured worker tried to leave the scaffold. The injured worker testified that he walked to one of the end frames, grabbed one of the legs, ducked down and

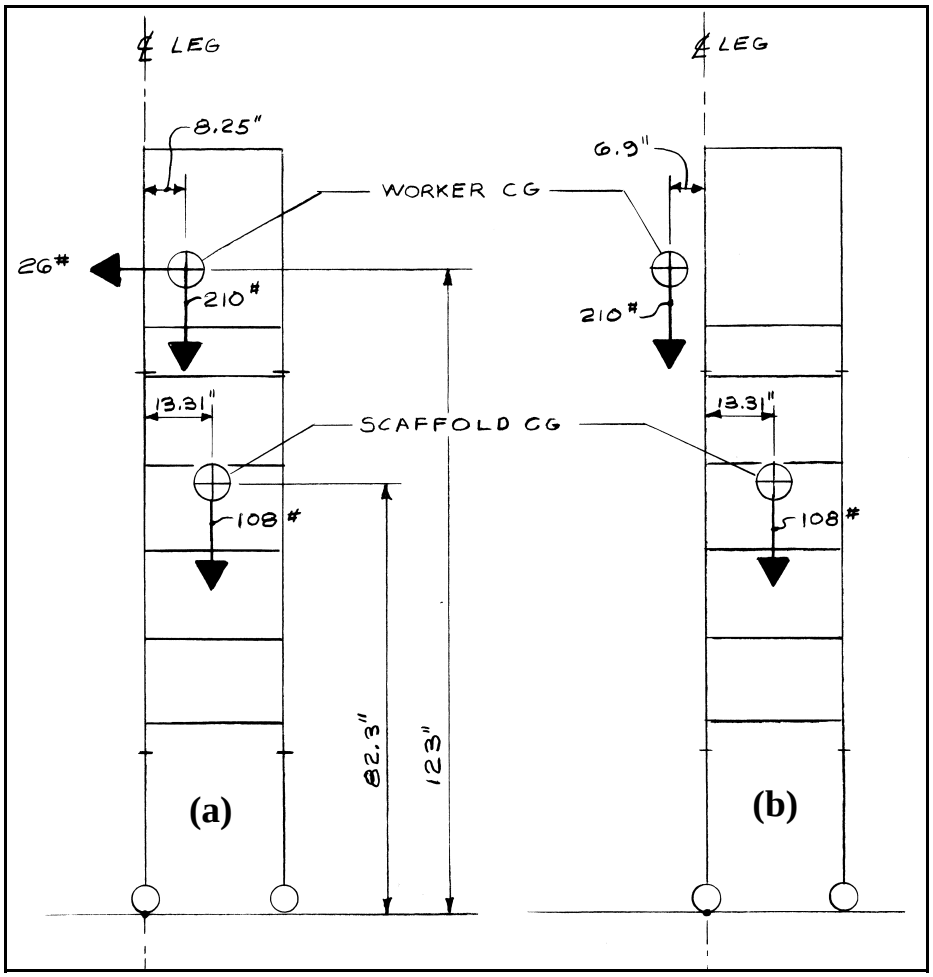

Figure 2. Schematic view of end of scaffold. (a) scenario where the worker exited the scaffold through the end frame and rotated himself about the leg on the left; (b) scenario where the worker exited the scaffold under the long side railing, while holding onto the railing.

passed through the opening in the end frame, and as he did so, rotated himself around the leg he had grabbed. He further testified that as he was rotating, the scaffold tipped over. A maintenance man for the department store testified, on the other hand, that the injured worker exited the scaffold by ducking under the long side railing and attempted to step onto the step ladder while holding on to the railing, at which time the scaffold tipped over. Figure 2 is a schematic end view of the scaffold showing the forces on the scaffold for the two scenarios, just at the point where the scaffold would start to tip over. Figure 2a is for the scenario of the worker exiting through the end frame; Figure 2b is for the scenario of the worker exiting under the long side railing. In the first scenario, only a lateral force slightly more than 26# would be required to tip the scaffold; in the second scenario, the worker would only need to be slightly more than 6.9 inches beyond the centerline of the legs to tip the scaffold. With regard to the first scenario, the 26 pound lateral force could be readily attained by the worker moving at 1 to 2 feet per second and stopping short as he completed his rotation. The 1 to 2 feet per second is very slow; 4 feet per second is slow walking. Thus for both scenarios, the scaffold was dangerous and prone to tipping. *(Continued on Page 3)*

The department store knew that the scaffold was prone to tipping, but did not inform the maintenance contractor or his laborers of this fact. As the above mentioned maintenance worker testified, the department store's "safety" rule for using the scaffold was that a second person had to hold the scaffold from tipping when someone was on the scaffold. Further, the department store ignored the instructions that were posted on two of the legs of the scaffold: that outriggers are required when the height of the platform is more than three times the width of the scaffold. Figure 3 shows a schematic end view of the scaffold with outriggers; the loading shown is that of the second scenario. The outriggers are on each end frame; the wide base created by the outriggers prevents the scaffold from tipping. However, regardless of height, the scaffold is prone to tipping when a worker enters or exits the scaffold from under the long side railing; thus some form of outrigger should be used at all times.

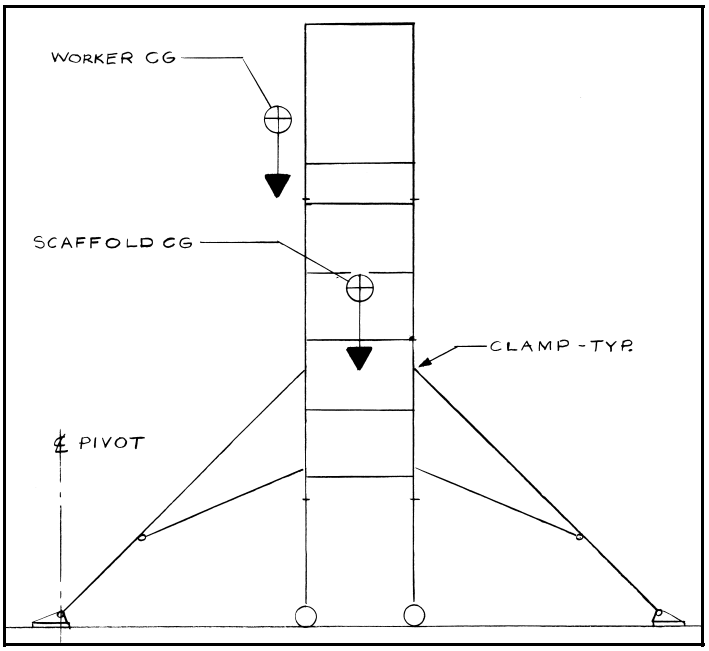

Figure 3. Schematic view of end of scaffold with outriggers.

Principal Rubin M. Zallen, P.E. investigated this failure, and has investigated other scaffold failures. He is a member of the ASCE 37 Standards Committee *Design Loads on Structures During Construction* of the American Society of Civil Engineers. Mr. Zallen is the subcommittee chairman on Chapter 1 of ASCE 37, Purpose and Scope.

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