



WARREN

Crane Tipover

By R. John Phillips, P.E., CFEI

A truck mounted crane traveled to a bridge construction site to conduct several lifts. It made the first lifts successfully. On the second day at the site, the crane tipped onto its side while making a steel reinforced concrete panel lift that was believed to be safely within its capacity.

The first questions raised were whether there was a defect in the crane structure, its lifting mechanism, or its ground support (outrigger) system.

The lift involved a load and lift radius that were within the capacity of the permanent load chart mounted in the operator's cab. The crane Load and Moment Indicating (LMI) system, a computerized system that prevented the crane from being loaded beyond its safe capacity and warned the operator of impending overloads, did not prevent the lift or warn the operator of the impending tipover.



Inspection of the crane revealed that it had been operating on a stable surface with good bearing capacity and that the crane outriggers had been fully extended with crane mats underneath the outriggers to further stabilize the crane.

Additional inspection of the crane and review of the crane manual stored in the operator's cab revealed that the crane had been set up without its full set of counterweights. The posted load chart in the operator's cab was based on crane operation with a full set of counterweights. The crane LMI system had been set to the standard lifting algorithm, which is meant for level operation with a full set of counterweights.

The LMI system required the operator to enter several parameters that could not be sensed by the system, including whether there is a boom extension attached, the crane hoisting cable reeving diagram, and the amount of counterweights. This crane, as do many similar mobile cranes, had both a permanent counterweight and removable counterweights that allowed the crane to meet load restrictions for over-the-road travel. If needed at the jobsite, the removable counterweights could be shipped in by a separate tractor-trailer and installed using a smaller assist crane at additional cost.

The investigation concluded that the crane tipped onto its side because it was loaded in excess of the appropriate load charts in the crane manual and the load charts were improperly programmed into the crane LMI system for full counterweight operation although less than the full counterweight load was actually in place.



The base counterweight of a mobile crane without the removable counterweights that should be mounted to develop the full crane lifting capacity without tip over.

The crane operator should have been trained and familiar with the reduced loads in the crane manual charts and have properly set up the crane LMI system for operation with only partial counterweights. Proper counterweights would have balanced the crane against tipping in response to the lift load and radius. This condition would have been readily identifiable and prevented if the crane operator had used the proper load chart in the crane manual or had properly set up the crane LMI system.