



### C42 Improper Programming of a Load Moment Indicator on a Truck Crane

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After attending this presentation attendees will learn about data stored on a vehicle other than a passenger vehicle.

This presentation will impact forensic science by showing unlikely places to find data saved by vehicles.

Accident Scenario: Construction was being done on a two-lane bridge over a deep canyon. A truck crane was brought in to move some equipment on the canyon floor. The Department of Transportation did not want to close both lanes of the bridge. This forced the truck crane to operate with its outriggers partially retracted. The crane successfully moved the first two loads. For the third load, which was the same as the first, the end point was altered to a point farther away from the bridge. As the operator was moving the third load, the truck crane's moment shifted, and the crane flipped over the side of the bridge. No warning lights came on in the cab of the crane to indicate to the operator that he was approaching an unstable crane configuration.

The subject truck crane was equipped with a programmable load moment indicator (LMI). This LMI did not have the capacity to record the crane's position during its operation; however, it contained tables of data that outlined the safe parameters for the crane's operation with different outrigger positions based on ANSI B30.5 requirements. If the crane was positioned into a space outside these defined safe parameters, a warning light illuminates in the cab. The operator uses an interface in the cab to input the crane's current operating configuration. The table below shows the selections available to the operator.

Table 1: LMI Operating Codes (from operating manual)

Setting	Crane Configuration	Outrigger Configuration
#1	Main Boom	Fully Extended
#2	Fixed Jib	Fully Extended
#3	Telescopic Jib – Retracted	Fully Extended
#4	Telescopic Jib – Extended	Fully Extended
#5	Main Boom	Intermediate
#6	Fixed Jib	Intermediate
#7	Telescopic Jib – Retracted	Intermediate
#8	Telescopic Jib – Extended	Intermediate
#9	Main Boom	Fully Retracted
#10	Personnel Lifting Platform on Main Boom	Fully Retracted
#11	Personnel Lifting Platform on Fixed Jib	Fully Retracted
#12	Personnel Lifting Platform on Telescopic Jib – Retracted	Fully Retracted
#13	Personnel Lifting Platform on Telescopic Jib - Extended	Fully Retracted

After the accident, the chips from the LMI were removed and brought to the manufacturer to be downloaded. Three sets of chips were downloaded. Set 1 were test chips from the LMI manufacturer used to test the LMI's functionality. Set 2 were dated May/June 2000 and were the original chips from the LMI. The third set was dated December 2000 and were the chips in the crane at the time of the accident. By comparing the data stored on these chips to each other and to the LMI Operating Codes, it was determined that the chips on the crane during the accident were programmed for the main boom with fully retracted outriggers to be setting #13. However, the parameter selection list the crane operator was given conformed to Table 1, which indicated that the main boom with fully retracted outriggers was setting #9. Therefore, the LMI was operating under the parameters set for intermediate outriggers instead of fully retracted outriggers.

Unfortunately, since the second drop point was farther from the truck crane it increased the moment of the crane causing it to flip over the bridge.

#### Black Box, Data Downloaded, Truck Crane