By Charles C. Roberts

Crane Accident Reconstruction

Crane accidents usually occur as a result of overloading or a mechanical deficiency. Reconstructing the accident as to the particular cause involves analysis of the crane configuration immediately prior to the accident as well as the post accident configuration. Information helpful to the analyst includes statements by the crane operator as well as witnesses, photographs or drawings of the crane configuration prior to the accident, photographs of the crane after the accident and possibly the results of a visit to the scene and the remains of the crane. The following case studies illustrate typical data relied upon and resulting conclusions.

Figure 1 shows a mobile crane that

Figure 1

tipped over when the load was swung perpendicular to the long axis of the mobile unit. The load was small, the boom was fully extended but the outriggers were not fully extended. According to the crane operator the vehicle slowly tipped over.

Figure 2 is a view of a typical load-

Figure 2

ing/stability chart required in most cranes. According to the chart, the crane operator had moved the crane outside its stability envelope causing the tipping accident, a common accident.

Figure 3 shows another common ac-

Figure 3

cident with telescoping cranes. According to the operator, he was booming to the right, towing a load from right to left. This causes side loading to the crane boom. Although the crane was being operated within limits for vertical loading, it was not within limits for side loading. In this case, the crane was overloaded, resulting in a buckling failure. It should be noted that many box section telescoping cranes such as this cannot tolerate much side loading, as is typically mentioned in manufacturer's literature.

Figure 4 is a view of a crane lifting a truss system into position. As the truss was placed on the concrete piers, workers tightened bolts to secure the structure. During the lift, one of the sling cables snapped causing severe dynamic

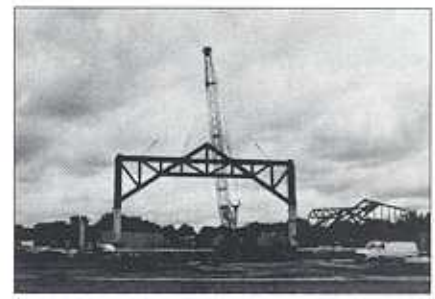

Figure 4

Figure 5

forces to be applied to the crane which collapsed as shown in Figure 5. In this particular case, the crane operator was trying to keep the truss in position while it was secured. Without a load indicator, the crane operator was relying on visual deflection and intuitive feel to prevent overloading. Since the structure offered little deflection during the lift, overloading of the sling occurred, resulting in the accident. Many overloading conditions occur when a crane attempts to pick a load that is secured to some heavy or immobile object.

> "Every case study involved analysis of the loading conditions and comparison of crane lifting envelope parameters."

Figure 6 is a view of a telescoping boom crane that failed while loading material whose weight was well within the crane parameters. Disassembly of the hydraulic cylinders revealed a condition where the nut securing the hydraulic piston backed out causing loss of hydraulic cylinder support (Figure 7). The damaged threads of Figure 7 indicate that the nut loosened and detached when about 4 threads were engaged. It appeared that the nut was improperly torqued.

Figure 6

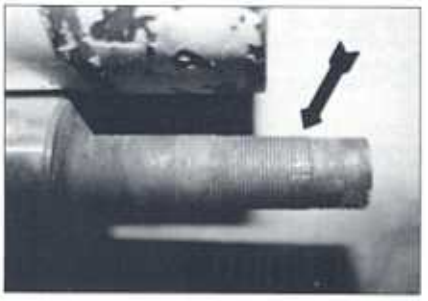

Figure 7

Figure 8 is a view of a transmission used to hoist the load on a crane via a wire rope and drum. Figure 9 is a view of a bolt that backed out of position causing the transmission to release and the load to drop. The load was within the design envelope of the crane. This condition is a deficiency attributed to assembly of the transmission. The bolt was not coated with a frictional compound to retain it in the proper position.

Figure 8

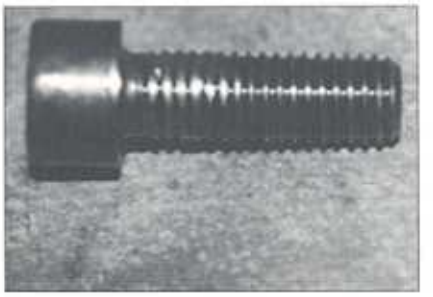

Figure 9

Notice that every case study involved analysis of the loading conditions and comparison of crane lifting envelope parameters. If the accident occurred outside the loading envelope, then overloading is a more likely cause. If the crane configuration is well within loading parameters, then a mechanical or electrical deficiency is a more likely cause. Some crane operators incorrectly rely on electronic load indicators to tell them when they are overloaded. Many electronic load indicators do not indicate side load. Consequently a severe side load can overload a crane even though the indicator reads in the safe loading area. ▲

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