CLM PROFILE

Multiple Failures: The Possible, The Plausible, and the Spaghetti Theory

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Multiple failures are quite common within the practice of failure analysis, whether there are two simultaneous failure conditions culminating in catastrophic failure, or a cascade of failures set forth by a primary one.

Understanding the causality of failures and the division of responsibility among multiple parties is important to claims, litigation, and subrogation. Equally important is determining the characterization of an alleged set of failures as negligent, accidental, and/or fraudulent. Let's take a look at the duty of a qualified failure analysis expert and a firsthand account of a set of failures where the foundation in science came from the theory of breaking spaghetti.

THE POSSIBLE

Within the practice of failure analysis, the core methodology is the scientific method based on the fundamental principles of physics and engineering. An expert with extensive experience may intuitively propose a strong hypothesis for the failure mode(s), and many times the strongest hypothesis is developed in the investigation's earliest stages. However, it is always the duty of any expert to follow the scientific method to develop logical arguments or physical experiments that support or refute a hypothesis until the most probable conclusions are presented.

The scientific method does not guarantee all conclusive findings will be a complete picture of what went wrong, but, many times, merely refuting weak hypotheses is equally as important when protecting a client. When it comes to the "the possible," the ideal scenario amongst qualified experts on opposing sides is a consensus of the most appropriate and probable conclusions given the body of evidence. However, when the opposing experts are unqualified and are peddlers of junk science, they often build their arguments on the layman's intuition, which, to the trained professional, is a house of cards.

THE PLAUSIBLE

The middle ground of scientific intuition and skepticism is comprised of allegations that are plausible. In such scenarios, qualified experts with equal experience are segregated by their level of hubris. Excessively overconfident experts will simply stand by their hardened experience, while curious self-confident experts will lean on the scientific method.

I investigated a case where a conference room had horizontal wood beams pinned across the ceiling. The beams supported a platform of A/V equipment. The allegation was that one beam failed at both ends where it was pinned, causing the supported equipment to crash to the ground. This allegedly occurred at night with no one around. We quickly determined that the wood beams were a low-quality particleboard with wood veneers and were not suitable to hold the weight of the A/V equipment.

To their credit, the opposing experts pointed out the peculiarity of the beam failing at both ends and that the location of the fallen equipment suggested both ends failed at the same time. For this scenario—a failure under static loading—an engineer would expect one side of the beam to fail and drop down diagonally at the failed end like a hinged ramp. The as-found failure would more commonly be tied to an excessive dynamic load dropping onto the beam quickly, overloading it and causing simultaneous failures at each end. The opposing experts used this discrepancy to suggest that there may have been someone working around the beams at the time of failure, or that something fraudulent occurred. It was a case for the scientific method. We had access to exemplar beams and proceeded to set up a physical experiment to slowly load the beam in a similar fashion until it failed.

THE SPAGHETTI THEORY

Flashback: Decades ago, renowned American physicist Richard Feynman was stumped by a seemingly trivial problem. He noticed that if you bend a piece of dry spaghetti at each end it will not break into two pieces. Instead, it breaks into three or four unequal pieces. It was not an easy problem to solve, and it took decades to refine the theory that the initial break sends an impulse wave through the spaghetti and causes a nearly simultaneous break in the spaghetti at another location.

Flash-forward: When the subject exemplar beam was loaded to capacity in our experiment, one frame of the video recording caught a complete fracture on one side of the beam and a second fracture running half-way through the other side in a fraction-of-a-second interval. The beam acted just like a large-scale piece of spaghetti, and the original allegation was shown to be plausible.

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