

Solving the Right Problem - Finding the True Cause of Structural Failure

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Structural engineers are key members of most building design teams. We work with owners, engineers, architects and contractors to ensure new and remodeled structures are strong enough to withstand the loads we expect to see with an acceptable factor of safety. Structural engineers seek to exercise the current standard of care for our profession and ensure designs reflect applicable building code requirements.

Unfortunately, the world is not a perfect place. What happens when something goes wrong? Structural failures occur despite the best efforts and the best intentions of the most competent design engineers.

What should you do when an insured's structure fails? The first rule is to resist the temptation to make premature conclusions. Structural failures present symptoms just like human diseases do. When we treat the obvious symptoms but do not address the underlying causes, we risk identifying and solving the wrong problem. The real problem can surface later, often causing more damage and costing more to fix.

During a failure investigation, a big part of our task is to determine what the original designer/builder intended. This is not so easy because we are often dealing with older structures. We usually don't have engineering drawings and specifications for reference. To complicate matters, we often need to discriminate between the many additions and modifications which have accumulated over the years. What was the designer/builder's intent? Why did they use certain materials over others? What was the standard of care 80 years ago when the structure was built? What load combinations were considered? These are all important questions which must be addressed.

When investigating a structural failure, we look for critical changes in the applied forces, support conditions and material strength/stiffness which may have combined to cause the failure. We rarely have a case in which failure is attributed to a single factor. Structural failures usually occur when an unexpected overload is applied to an underdesigned or otherwise inherently weak structural member.

The critical combination may not appear for years, but when it does, it can be catastrophic. For example, a roof failed during the March 2003 blizzard in Denver. The snow load certainly exceeded the local building code design requirement. However, a thorough investigation revealed a previous owner removed a bearing wall under the roof truss supports to expand the living room space. Amazingly, the home survived for many years with this modification. It took the combination of a critical design error plus an unusually high snow load to actually cause the failure.

Solving the right problem helps save everybody money. From an insurance perspective, properly identifying the cause can reduce your exposure to fraudulent and misdirected insurance claims. The insurance company reduces claims by correctly categorizing the failure and the insured gets their claim resolved quickly.