

Why Does Your Building Leak???

With water dripping on his head, a building owner immediately thinks his roof is leaking and he is probably right. Yet, a dilemma arises when the cause for the leak is investigated. In many cases, the bituminous or rubber roof is just old and in need of normal replacement (like on my landlord's roof).

In other cases it is not nearly so clear, particularly on relatively new construction.

Examples of Metal Roof Failings

Buildings Breathe

That is they move, expand and contract, to the seasonal temperature variations. They also move due to environmental loads such as wind, snow, and earthquake events. Most of the time these movements are barely noticeable and not a problem. This is the way it should be for a properly engineered building. Yet, this design office investigates projects every year that don't perform as intended. The first clue is often a roof leak!



The Deflecting Roof

A common problem reported in the winter, is sudden high volume roof leak(s) that occur after repeated snow and ice storms, interspersed with thawing periods. This often leads to a condition known as ice damming and a related problem of water ponding. These are serious and dangerous problems that can lead to a catastrophic collapse.



The first clue is almost always an unexpected roof leak. The roof can perform flawlessly in heavy spring rains only to fail in the winter due to underlying structural weaknesses. And this weakness may not be discovered for years. Owners are advised to be especially wary of these conditions.

The Unheated Building

Metal standing seam roofs on pre-engineered buildings are particularly vulnerable to unheated building conditions.

These "standardized" structures are not usually engineered to undergo the large seasonal temperature variations. These variations lead to large thermal expansion and contraction stresses in the continuous frame and purlins. The resulting large movements can inadvertently stress the metal standing seam roof beyond its movement capacity and the result is a big leak. Beware of unheated construction!

The Mismatched Wall

E.F.I.S. and veneer style construction problems are well known by the construction industry.

Veneer cracks, fails, and leaks and the owner is justifiably unhappy. The wall may not have been properly matched to the stiffness of the supporting structural system. This mismatch is one of the most common problems in construction today. No amount of repairs seems to correct the problem for good.

Construction Manager Mentality

Problems such as those mentioned are exacerbated by the "Construction Manager Mentality" to break the project into numerous bid packages and give no one-entity the responsibility for ensuring product and design compatibility. Owners are strongly advised to retain a single Architect and Engineer of Record for their project and resist the temptation to try to extract a few more pennies out of the design and construction process.

The Answer Is!

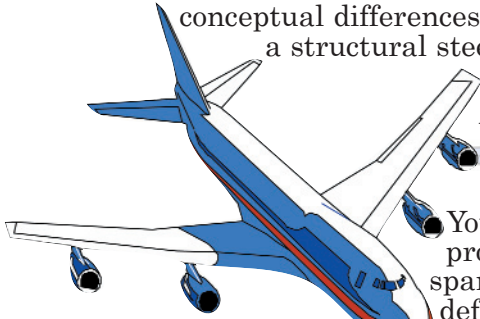
The answer to all of the problem scenarios discussed is a well-designed building. Good buildings don't have these leak problems. A building owner may need to pay more up-front to get a suitable design and quality construction, but is always worth it. After all, a leaky, cracked, and failing building is no bargain.
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Part II: Aircraft Hangars: The Conceptual Design and Selection Process

The next steps will be conceptual layout, arrangement, elevations, and cost budgeting process. You will need professional help. If it is a large span hangar or complex design, we highly recommend that an experienced structural designer of hangars be a part of the initial team. This is because the selection of a poorly conceived, difficult or inefficient structural arrangement will be problematic and costly to the very end. You want to avoid this mistake. Do not ignore the structure. All other costs from foundations to sprinkler systems are dependent on structural selection. Let us show you the choices or options.

Know the kind of architectural and structural building features you are seeking. There are major conceptual differences in a low profile clean front look vs. a high roof pitched barn. We recommend a structural steel approach with the least floor area, height, and volume for housing the aircraft. This is because the least structural profile will yield savings in other categories such as electrical, mechanical, and fire suppression. Why buy a building that is wider and taller only because it has the lowest steel cost? Those extra square feet and cubic feet will cost you initially and forever.



You also want the structure to be properly laid out and represented in the proposal drawings. You do not want a shallow rafter portrayed for a large span, when deep trusses are required. We will discuss this kind of problem and deflection issues in a later article.

Again we emphasize the experience factor. Paying a small fee to get efficient and well-planned layouts and arrangement of the facility early will be the best-spent money. You will not get accurate budgeting and construction costs without advice and assistance from experienced professionals.

At Needham and Associates, we have several structural designers with many years of experience in different hangar sizes and styles. In fact, if you call us about parking your 747 – 400, we can show you a structural schematic, all pertinent data, and building shell costs for a variety of building shapes and arrangements for that particular size of airplane. We do this right down to the square foot of floor area, clearance, building height, and steel tonnage. We do not re-invent the wheel when you come to us. We most likely have already conceived and designed for the structural requirements of your new hangar.

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Terra Tech College—interior view of lobby of the engineering building—
Ohio— 1994—Needham & Associates

