Building Failures and Successes in Hot and Humid Climates

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ABSTRACT

Designing and constructing buildings in hot and humid climates is difficult for two main reasons: the miserable climate and the lack of information relevant to the South. It's hot and wet outside and cold and dry (hopefully) inside. This is precisely the opposite condition most code, manufacturer, supplier, and professional literature assumes.

This presentation deals with the impact of design, construction, and operation on the ultimate performance of buildings in hot and humid climates. The presentation will identify and evaluate solutions and recommend remedial measures to alleviate performance, durability, and indoor environmental problems.

Design of walls, claddings, roofs, mechanical systems, and interior finishes will be discussed as they relate to moisture control, durability, and indoor air quality. Diagnostic procedures and remediation techniques will also be discussed.

Building problems and their solutions will be related to operational concerns and monetary constraints. Case studies will be utilized to illustrate the key issues.

The building envelope and mechanical systems interact with and influence interior environmental conditions with serious consequences. In this presentation, industry practices are challenged and turned on their head. Delivered by an engineer with a sense of humor, this session will prove to be highly interactive and relevant.

AGENDA

Introduction

Key Concepts to Be Covered

Changes to Building Technology

Why We Don't Build the Way We Used To

Where Were the Adults When We Decided to Build with Steel Studs and Gypsum Board?

Building in the South once was very easy. Blocks and stucco and plaster and concrete were known entities and trades knew how to build with them. We didn't have problems until we introduced thermal insulation, EIFS, paper-faced gypsum board, high-efficiency cooling systems, and "hollow" assemblies constructed out of steel studs. The basic laws of physics will be used in this section in conjunction with the principles of geography and climate to explain the problems now common in the building industry.

Keeping the Rain Out of Buildings

Drainage Planes

Rain, Holes, and Forces

Traditional Stucco, EIFS, and Brick Veneer

Face Seal, Barrier Walls, and Rain Screen

Pressure Equalization and Water Managed Systems

Rain control was traditionally accomplished with mass walls – masonry sometimes several feet thick – that provided a "hygric" buffer. Water was absorbed and released without damage to interior and exterior surfaces. Things changed when wall assemblies began to be constructed out of water-sensitive materials and were hollow and filled with insulation

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or air. This section will cover the principles of rain control for "water managed assemblies."

Vapor Diffusion Retarders, Air Flow Retarders and Roof/Attic Ventilation

Thermal Gradients and Condensing Surfaces

Difference Between Vapor Diffusion and Air Transported Moisture

Impermeable and Permeable Sheathings

Insulating and Non-Insulating Sheathings

The Only Reason You Vent in the South is the South Lost the Civil War

Where do you put a vapor barrier in the South? Isn't vinyl wallpaper a vapor barrier on the wrong side of the assembly? This section will address the fundamentals of wall and roof design for the South. How to design walls to dry to both the inside and outside will be covered. Material choices will be presented.

Mechanical Systems and Controlled Ventilation

Do you suck? Do you blow? Do you suck and blow at the same time?

Exhaust vs. Supply Ventilation vs. Balanced Ventilation

Preconditioning of Makeup Air

Negative Air Pressure Fields

It has become a dirty little secret that it is not possible to simultaneously meet ASHRAE Standard 62 (the outside air requirements), ASHRAE Standard 55 (the temperature and relative humidity requirements), and ASHRAE Standard 90.2 (the energy efficiency requirements) using traditional design and equipment. It has also become clear that it is necessary to separate the sensible load from the latent load and handle each independently. In other words, lumping ventilation with humidity control in a stand-alone manner independent of temperature control – taking the "V" away from HVAC and leaving H with AC yielding "HAC." When we add "M" to the "V" we need a vowel. This section will cover equipment and envelope strategies addressing the new realities.