A Piece of Sustainability: Moisture Control

Benoit Cushman-Roisin
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with abundant credit to Lew Harriman D’71

Water in a building can cause significant problems that are capable of shortening the life of a building.

There are two types of water issues:
- Condensation of humidity by reaching the dew point
- Rain water damage

Some facts

1. Buildings don’t collapse very often.
2. More frequently, buildings get destroyed by mold and rot.
3. Mold claims in commercial buildings were estimated to range between $3 and $12 billion in 2003.
The process of mold growth: It requires **moisture** (liquid water, not humidity)

... and the multiplication goes on as long as there is water.

The bad news: Mold spores are ever present. You can’t avoid them.

In addition to serious building damage, dampness and mold are the causes of serious health problems:

In a 2003 National Institute of Medicine report titled “Damp Indoor Spaces and Health”:

- “Sufficient evidence of an association with upper respiratory tract symptoms, asthma symptoms in asthmatic persons and hypersensitivity pneumonitis in sensitized persons”;

- “Limited evidence of an association with lower respiratory illness in otherwise healthy children” (development of asthma).
Typical mold growth sequence in buildings:

1. Water finds its way into the building:
   - Rain or groundwater gets inside through cracks,
   - Humidity is generated in the kitchen and bathrooms,
   - In hot weather, humid outdoor air condenses in the cold wall,
   - In cold weather, humid indoor air condenses in the cold wall.

2. The HVAC system fails to keep indoor humidity in check.

3. Indoor moisture migrates into organic materials, such as wood and cardboard (on sheetrock)

4. Mold grows wherever moisture collects.
**Design flaw:** Conditioned air in delivered to room through ducts (as it should), but the return air is sucked in from wherever, including from the outside.  
**Correct design:** Both conditioned air and return air need to be conveyed in ducts.

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**A Florida motel that had a serious mold issue**

**Design flaw:** Bathroom fan was sucking air out without having asked where the air would come from. It turns out that air was sucked in from outside around window and made its way to the bathroom through wall cavities.  
In warm humid summer with air conditioning on, this outside air reached the dew point once inside, and moisture accumulated in the walls.
Another cause of water intrusion into a building is inadequate protection against rain.

There are two practical features to pay attention to:
1. Building corners
2. Drainage from windows

Rain load on buildings - Depends on the overhang

Overhang
No overhang
How overhangs govern annual rain deposition

**Overhang**
Rolling air acts as a bumper, forcing rain-laden wind up and over the building.

**No overhang**
Sharp turns deposit more rain on the edges and top of the building.

Water damage follows rain deposition pattern
With and without roof overhang

Wide overhang reduces rain contact to nearly zero for many rain events

No overhang ≈ 2x lifetime rain load

Overhangs - A sustainability feature

Wide Overhang... Sustained for more than 2,000 years Roof overhangs have protected the structure and the sculptural details on this Roman institutional building for 2,000 years—end counting. Overhangs keep rain from hitting and flowing down the walls. They greatly improve the durability—and therefore the sustainability—of any building.

Wide Overhang... Sustained for more than 200 years Roof overhangs have protected the covering and the sculptural detail on this North American Colonial revival for 200 years—and counting. The material is wood, not stone. Still, the overhangs have protected the exterior walls for more than 200 years. The photo provides compelling evidence of the feasibility (sustainability) improvement made possible by roof overhangs.

Wide Overhang... Rebuilt after fewer than 20 years No roof overhangs on this nursing home. The architect's design preference did not have roof overhangs and gutters. Roof overhangs would have reduced the wall's rain contact volume by more than 50%. Less water contact would have reduced the leakage volume, improving the sustainability of its thermal excellence, but moisture-fugitive exterior insulation and finish system.
Pan flashing - "Diapers for windows"

Why? - Rain water concentrates at the base of windows
Glass does not absorb water - it sheds it
All of the water which contacts the window flows down to the bottom.
Sill pan flashing catches the inevitable leaks and redirects the water safely out onto the drainage plane.

Without sill pans or drainage plane..

"Two kinds of windows: those that leak now... and those that will leak later." (Joe Lstiburek)
With a sill pan integrated into window flashing, these problems are avoided.
Conclusions

Rain loads can be very damaging, and it is important to reduce them to increase the longevity of the building.

There are two main ways to keep the water out of a building during rain:
  - Roof overhangs
  - Pan flashing below windows.

This is definitely not rocket science, but it is extremely important.