

Water Management

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Abstract:

This is a concise overview of the principles and steps to follow when dealing with water from the foundation to the roof.

Water Management

Controlling rain and ground water are the single most important factors in the design and construction of durable buildings and in the control of mold.

Water management techniques are used in the design and construction of building enclosures to control rain and ground water.

Fundamental Principle

The fundamental principle of water management is to shed water by layering materials in such a way that water is directed downwards and outwards out of the building or away from the building. The key to this fundamental principle is drainage.

Gravity is the driving force behind water management and drainage. The “down” direction harnesses the force of gravity and the “out” direction gets the water away from the building enclosure assemblies, openings, components and materials. In general, the sooner water is directed out the better.

The most elegant expression of this concept is a flashing. Flashings are the most underrated building enclosure component and arguably the most important.

Drainage also applies to materials. Water that is absorbed in a material can not be drained away. We paint and stain wood siding so that water is not absorbed by the wood siding and can be drained from the siding surfaces. We damp-proof concrete foundations for the same reason.

Drainage applies to assemblies such as walls, roofs and foundations, as well as to the components that can be found in walls, roofs and foundations such as windows, doors and skylights. It also applies to the openings for the windows, doors and skylights. And it applies to assemblies that connect to walls, roofs and foundations such as balconies, decks, railings and dormers.

Finally, it also applies to the building as a whole. Overhangs can be used to drain water away from walls. Canopies can be used to drain water away from windows, and site grading can be used to drain water away from foundation perimeters.

Drainage is the key to water management:

- Drain the site
- Drain the building
- Drain the assembly
- Drain the opening
- Drain the component
- Drain the material

Drain everything.

Drain the Site

Site grading is used to direct surface water away from building foundations and walls. The steeper the slope away from the building perimeter the better. Floor levels should always be above the surrounding grade - the higher the better. Standing water beside a building is a bad idea. Driveways and walkways should drain away from the building and be lower than floor levels. Patios and decks should also be lower than floor levels and should drain away from the building.

Layer the site. Floors on top – higher than the surroundings. Patios, stoops and garages lower than floors. Driveways and walkways lower than patios, stoops and garages. And finally, driveways and walkways should slope with the grade away from the building.

Nothing should be flat and level except the floor of the building. Slope everything away from the building. Slope the garage slab, the patio, the stoop, and the walkway. Slope everything.

Remember: “down and out”. Direct the water down and away from the building.

Drain the Building

Sloping roofs should be used to drain water away from the top of buildings. The steeper the slope the better. Overhangs, canopies and porch roofs should be used to drain water away from the side of buildings – away from the walls. The bigger the overhang the better. The bigger the canopy the better.

Flat roofs should never be flat. All “flat” roofs should be tilted and sloped to drains. Remember, the roof should be higher than the drain.

Roofs can concentrate rainwater at building perimeters. Danger! Danger! Collect the roof run-off with a gutter system and direct it away from the building – or use a really big overhang and slope the grade away from the building foundation. Do not put this roof water into the ground near the building. Do not connect the gutter system to a perimeter foundation drain. It’s okay to infiltrate rainwater into the ground, just don’t do it next to the building.

Drain the Assembly

Assemblies such as walls, roofs and foundations are constructed from materials such as sheathings, claddings, insulations and components such as windows and doors.

Some assemblies have more than one layer dedicated to water management and are called “screens”. Other assemblies have only one layer dedicated to water management and are called “barriers”.

Screen Assemblies

Screen assemblies have a secondary line of defense for water entry inboard of the exterior cladding. This secondary line of defense is called a drainage plane. A space between the cladding and the drainage plane promotes drainage and ventilation. Screen assemblies are typically used with water sensitive building materials such as wood framing, steel studs, wood based sheathings and gypsum based sheathings.

Barrier Assemblies

Barrier assemblies rely on the exterior cladding to be the drainage plane. Barrier assemblies are typically used with water resistant building materials such as masonry, concrete, brick and stone.

Water Entry

Both barrier assemblies and screen assemblies rely on flashings to control water entry and to direct penetrating water back to the exterior at critical areas such as connections between materials, at openings and penetrations.

Both barrier assemblies and screen assemblies anticipate water entry past the exterior cladding. In barrier assemblies this penetrating water is stored and redistributed in the water resistant building materials until it can be released to either the exterior or interior in the vapor form in a controlled manner that does not damage interior or exterior finishes or materials.

In screen assemblies the penetrating water is drained back to the exterior in liquid form along the drainage plane behind the cladding. Some water also penetrates the drainage plane and is stored and redistributed and subsequently released in the vapor form as in barrier assemblies. However, the tolerance for such stored and redistributed water in screen assemblies is typically significantly less than barrier assemblies due to the water sensitive nature of the building materials commonly used with screen assemblies.

Foundations

Most below grade foundation assemblies are a combination of screens and barriers. The “drain screen” foundation involves using a free-draining backfill to direct water downwards to a perimeter drain and away from the building. This free-draining material is installed

outboard of a concrete or masonry foundation barrier wall that is damp-proofed to prevent water absorption. However, some water penetration and absorption is tolerated by the concrete and masonry as long as this penetrating water can be released to the interior or above grade in a controlled manner. This of course is typically complicated by interior basement finishing and insulation.

Drain the Opening

Water should be directed out of building assembly openings – especially openings for windows, doors and skylights. The seal between a window or door component and the building assembly layer dedicated to water management (the “drainage plane”) is rarely perfect – and even if it is perfect at the time of installation it certainly will not be perfect forever.

Furthermore, the window or door component within the opening is rarely perfect – it can and often does leak. This leakage should be managed in the same manner any leakage is managed by drainage to the outside.

Window and door openings should be drained to the exterior using the same principles used in the design and construction of walls, roofs and foundations.

Pan flashings, membranes lining openings, precast sills with seats extending under window and door units, formable flashings, building papers, housewraps and concrete seats in slabs are all methods of providing drained window and door openings.

These techniques allow for sealants to be installed imperfectly or for sealants to age without resulting in catastrophic failure of the assembly. A leak is not truly a leak if it leaks back to the exterior.

Windows and doors should be integrated into water managed walls using water managed installation techniques.

Drain the Component

Windows and doors are components that are assembled from elements. Where elements join together at a joint a potential for water leakage exists. Ideally, elements should be designed and assembled in such a way that each element sheds water to the exterior and each joint connection between elements drains to the exterior.

Sealants and gaskets at joints should not be relied on to provide the only defense against water entry. The principle of water management and drainage applies to the design and construction of window and door components in the same way that it applies to wall, roof and foundation assemblies.

Drain the Material

Water that is absorbed in a material can not be drained away. Assembly materials dedicated to water management or materials that are outboard of drainage planes should not absorb water or should be treated to shed water. Wood trim and wood siding should be coated on all surfaces to repel water. Ideally, these materials should also be “back-vented”.

Claddings that are water absorptive such as stucco and brick should be separated from the rest of the assembly by an airspace or by materials that shed water or do not absorb water or by materials that do not pass water.

Stuccos over barrier wall assemblies should be coated to reduce water absorption. Brick veneers should be “back-vented” using an air space that is open to the atmosphere at both the bottom of the wall and the top.

Window and door elements should also be treated to repel water or coated to repel water or manufactured from materials that do not absorb or transmit water. For wood windows this means that all wood pieces that comprise the window should be coated and treated on all six surfaces – with the most critical surfaces being the ends. End grain surfaces are the most prone to water absorption.

Summary

Walls, roofs and foundations should be designed and constructed to shed or drain water to the exterior. Windows and doors should be designed and manufactured to shed or drain water to the exterior. Window and door openings should be designed and constructed to shed or drain water to the exterior. Building materials should drain or be treated such that they drain.

This logic should encompass the entire building enclosure. Deck, balcony and railing connections should be designed and constructed to shed or drain water to the exterior. Roof-wall connections and roof dormer connections should be designed and constructed to shed or drain water to the exterior. And sites should be graded to shed or drain water away from building perimeters.

About the Author

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