

CHAPTER 9

MOISTURE

SECTION 901

SURFACE WATER

This section presents requirements to prevent local drainage and storm water runoff from entering buildings or moving across property lines and causing damage to properties. Because water may become contaminated, streams and other bodies of water must be protected from water suspected of being exposed to hazardous materials stored at building sites.

The prescriptive code does not contain a section dealing with water runoff from one property to another. However, many local ordinances contain sections dealing with this problem. Water leaving property comes not only from rain but also from other sources such as irrigation or fire fighting. Water used in fire fighting can mix with hazardous materials, causing pollution of streams and lakes. Sections in the *International Building Code* and *International Fire Code* address this concern along with the secondary containment requirements for hazardous materials.

Another problem arising from uncontrolled water runoff is property damage and nuisance. Unless water is controlled when leaving a property, serious damage can result to property on the outfall side. Proper grading can alleviate this problem.

Surface drainage must be constructed to prevent the formation of a blockage, and in the event of a blockage, the obstruction must be able to be easily removed.

901.1 Objective

The object of this section is to protect people from injury or illness who have been affected by improper surface water damage from pollution. It is also meant to protect property from damage occurring from accumulated surface water.

901.2 Functional statements

Surface water damage is prevented through approved methods of construction and site layout.

901.3 Performance requirements

Compliance with the performance requirements of this section is the responsibility of the design engineer. It is the engineer's responsibility to design the site grading so storm water and local drainage are safely conveyed from the site without causing damage to adjacent properties or erosion of drainage paths.

SECTION 902

EXTERNAL MOISTURE

The intent of this section is to prevent moisture originating at the exterior of the building from adversely affecting the occupants' health and safety and the structural and functional performance of the building. This section deals with both the liquid and vapor forms of water. If liquid penetrates through condensation or as a liquid, such moisture may cause the decay and corrosion of building elements. Also, the damp climates created by the penetration of moisture into the building may promote bacteria growth and be harmful to the occupants. The main mechanism to achieve this goal is the prevention of water and water vapor from entering the building envelope. However, should water vapor penetrate the exterior skin, it may be dealt with in several ways to achieve the intended performance. For example, a hygroscopic insulation may be installed within the exterior wall cavity such that the condensed vapors are sufficiently absorbed and do not adversely affect the building components. Or, the wall may be ventilated to remove the vapor before it can cause damage.

The prescriptive code shows moisture provisions in the *International Building Code*, Chapter 14: Exterior Walls, Chapter 15: Roof Assemblies and Rooftop Structures, and Section 1806: Dampproofing and Waterproofing. The concepts are much the same as the current prescriptive code, though the aspect of occupant protection is probably more apparent in the performance provisions. The prescriptive code appears to address only property.

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There was some discussion that this particular section should be combined with the surface water provisions as generally, the intent is to avoid water contact with and penetration into the interior of the building. However, there is a significant difference in how water vapor is handled to avoid damage or mold.

902.1 Objective

This objective specifically protects the building occupants from the effects of moisture penetrating the building envelope. This penetration can be leaks that cause slip hazards, or moisture promoting the growth of mold and mildew within the building. An additional objective is to protect property from damage. More specifically, the concern is with water reaching building elements and material being destroyed through direct contact with liquid or vapor. In the case of wood, contact with moisture can result in rotting and possible structural failure. Property protection also extends to nonstructural elements.

902.2 Functional statement

The functional statement dictates that to achieve the objective, the building needs to provide a specific function. It must be constructed in a manner that will prevent penetration into and accumulation of water or water vapor in or on the building. Penetration can be avoided by the use of techniques such as weather-resistant barriers and flashing, or vapor retarders. The function can simply be to reduce the amount of water remaining in contact with the building surface. This may include good drainage through sufficient slope of the roof and appropriate soils located underneath a structure to remove moisture.

902.3 Performance requirements

There are several performance requirements for this section to cover all areas of possible moisture contact with the building envelope. Basically, these provisions break down the functional statement into more specific components.

902.3.1 Water penetration

The roof and exterior walls in contact with moisture are protected from initial precipitation and from vapor with moisture barriers and flashing. Water accumulation on roofs is avoided through proper slope and/or drainage (IBC Chapters 14 and 15).

902.3.2 Building elements in contact with the ground

The protection of elements in contact with the ground, including walls, floors, and structural elements, must be provided. Depending on the water level, these components are to be waterproofed or dampproofed as required in the current codes (IBC Section 1806).

902.3.3 Concealed spaces and cavities

Moisture within a concealed space must be contained so as to prohibit contact with structural elements. Such contact can be through liquid or vapor. This may be caused by an inappropriately sealed soffit (IBC Chapters 14 and 15).

902.3.4 Moisture during construction

The construction process itself should not allow moisture from the building materials or the atmosphere to cause any permanent damage to structural or nonstructural building elements.

SECTION 903

INTERNAL MOISTURE

Generally, this section of the code is concerned with water sources within the building having a negative effect on the safety of the occupants or the structural stability of the building and causing general property loss within the interior of the building. Again, as with external moisture, this includes both liquid and vapor forms of water.

In terms of occupant safety, the concern is with vapor buildup as a result of improper ventilation and with surfaces such as showers where fungal growth can affect the health of the occupants. Surfaces which come into contact with water must not promote the growth of mold or mildew. This requires such surfaces to be impervious and easily cleanable. Property loss occurs, for example,

when a sink overflows and water damages structural and nonstructural elements of a building. Also, such overflow can lead to the growth of mold and mildew because of contact with inappropriate surfaces.

The current codes cover such issues within the *International Plumbing Code (IPC)*, Chapter 4: Fixtures, Faucets and Fixture Fittings; the *International Building Code*, Chapter 12: Interior Environment; and the *International Mechanical Code (IMC)*, Chapter 4: Ventilation.

Chapter 4 of the IPC provides the requirements for allowed plumbing fixtures and how they are to be installed. This includes specifying elements such as impervious and easily cleanable surfaces. In addition, the IPC requires walls above built-in tubs with installed showerheads to be constructed of smooth, non-corrosive, nonabsorbent, and waterproof materials.

In addition to the type of surfaces, IPC Chapter 4 has requirements for drain sizes to avoid overflow of water beyond the plumbing fixture, which can lead to damage or unwanted moisture.

The use of ventilation is another way to combat internal moisture. Chapter 12 of the IBC requires ventilation in accordance with the IMC. Chapter 4 of the IMC sets specific exhaust rates for particular use groups and areas within those use groups. For example, for toilet rooms and bathrooms within one- and two-family dwellings, 50 cfm (923 L/s) intermittent or 20 cfm (9.4 L/s) continuous airflow is required. This serves to remove odors and moisture from the enclosure.

903.1 Objective

The objective reflects the overall intent of the provisions, which is to protect the occupants from the negative effects of internal moisture related to the buildup of bacteria and to protect against potential property damage caused by water overflow and splashing.

903.2 Functional statement

The functions of the building must include the avoidance of moisture accumulation on surfaces, which can lead to contaminants and fungus. If such accumulation cannot be avoided, then the surfaces must not promote such growth. In addition, prolonged exposure to a moist atmosphere can affect the integrity of both structural and nonstructural elements. Water that overflows must not cause property damage to the neighboring occupancy. Therefore the building, or more specifically the fixtures and surrounding areas, must be able to contain the water in an appropriate manner. Another aspect covered by internal moisture is splashing. Any area surrounding a plumbing fixture where water may come in contact with a surface on a regular basis is susceptible to the growth of mold and mildew, and thus the surface must be appropriate.

903.3 Performance requirements.

To perform the necessary functions called for in the functional statement, several performance requirements have been set forward.

903.3.1 Excess moisture removal and protection

This section requires both thermal resistance and ventilation to control moisture in any space within the building. The level provided depends on the use of the space. This is done by the prescriptive code through the breakdown of ventilation flows per the use of the space. Each space will need evaluation because prolonged exposure to moisture can cause permanent damage. For example, wood tends to rot if exposed to excessive moisture.

903.3.2 Overflow

This requirement pertains to overflow from fixtures such as sinks or bathtubs flowing into areas where damage may occur to adjacent occupancies. The strategy is to avoid an overflow rather than manage the effects of an overflow. Avoiding overflow involves utilizing a particular size drain and an overflow drain.

903.3.3 Floor surfaces

Floor surfaces in areas where sanitary fixtures or laundry facilities are located should be impervious and easily cleaned. This requirement protects occupants from the growth of fungus or the accumulation of contaminants in areas subject to water overflow or to splashing resulting from use. Such growth can also lead to foul odors

903.3.4 Wall surfaces

As with floor surfaces, wall areas in contact with water from sanitary fixtures and laundry facilities must be made of impervious materials and linings and be easily cleanable. The same reasons as noted for floors apply to this section.

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903.3.5 Surfaces and building elements

This requirement emphasizes the negative effect splashing fixtures may have. It includes walls, floors, and any other elements of a building likely to come in direct contact with splashing. An example beyond walls and floors is a cabinet adjacent to a sink.

903.3.6 Water splash

In addition to having surfaces that resist the effects of splashing, areas must be designed to prevent water from penetrating behind the lining or entering into other confined spaces.

ACCEPTABLE METHODS

Surface Water. Acceptable methods to prevent problems from surface water runoff fall mainly into the realm of good engineering practice. In terms of contaminated runoff, the prescriptive fire, building, and plumbing codes address this issue indirectly through requirements for spill control and secondary containment and requirements for release of waste.

Exterior Moisture. As noted, the acceptable methods for protection against external moisture are found in IBC Chapters 14 and 15, and Section 1807. These provisions offer prescriptive methods that encompass the entire outer building envelope. IBC Chapter 14 provides measures to prevent moisture penetrating the walls; IBC Chapter 15 provides measures to prevent moisture penetrating the roof; and IBC Chapter 18 provides protection from water originating beneath the structure.

One issue not addressed in the current prescriptive documents is the construction process, specifically, moisture content of the construction elements.

Interior Moisture. As noted, the main methods of the prescriptive codes include Chapter 4 of the IPC, Chapter 12 of the IBC, and Chapter 4 of the IMC.

Chapter 4 of the IPC specifically provides nationally recognized standards for plumbing fixtures such as sinks and bathtubs.