

CHAPTER 27

Exterior Wall Cladding-I (Principles of Rainwater Infiltration Control)

CHAPTER OUTLINE

27.1 RAINWATER INFILTRATION CONTROL— GENERAL PRINCIPLES

27.3 RAIN-SCREEN EXTERIOR CLADDING

27.2 RAINWATER INFILTRATION CONTROL AND EXTERIOR WALLS

Exterior walls are one of the major determinants of the appearance of a building. They convey images such as strength or solidity (brick- or stone-clad walls), lightness or openness (glass-metal curtain walls), or a sense of movement or activity (bright, glistening metal curtain walls). In terms of the building's performance, the importance of exterior walls is even greater. Together with the roof, they constitute the building's envelope, providing the separation between inside and outside and serving to maintain an acceptable interior environment.

The exterior walls can serve the envelope function only if they are able to perform well under a range of environmental conditions. They must

- (a) Prevent water infiltration from rain and snow
- (b) Control heat loss and heat gain
- (c) Control air leakage and water vapor transmission
- (d) Resist fire
- (e) Control sound transmission
- (f) Accommodate movement due to thermal, moisture, and other causes

Factors (b) to (f) are covered in Chapters 5–9. Water infiltration is, however, the most critical of all concerns. Its importance is universal because no building can be considered a shelter unless its envelope is water resistant. Additionally, a water-resistant envelope has been the fundamental requirement of buildings throughout the ages—well before other environmental factors emerged as design concerns.

This chapter focuses on the principles of water-infiltration control in exterior-wall assemblies. The construction and detailing of a variety of these assemblies is covered in Chapters 28 (Exterior Wall Cladding-II), 29 (Exterior Wall Cladding-III) and 32 (Exterior Wall Cladding-IV). The principles of water-infiltration control in basement walls are covered in Chapter 12, and roofs are discussed in Chapters 33 and 34.

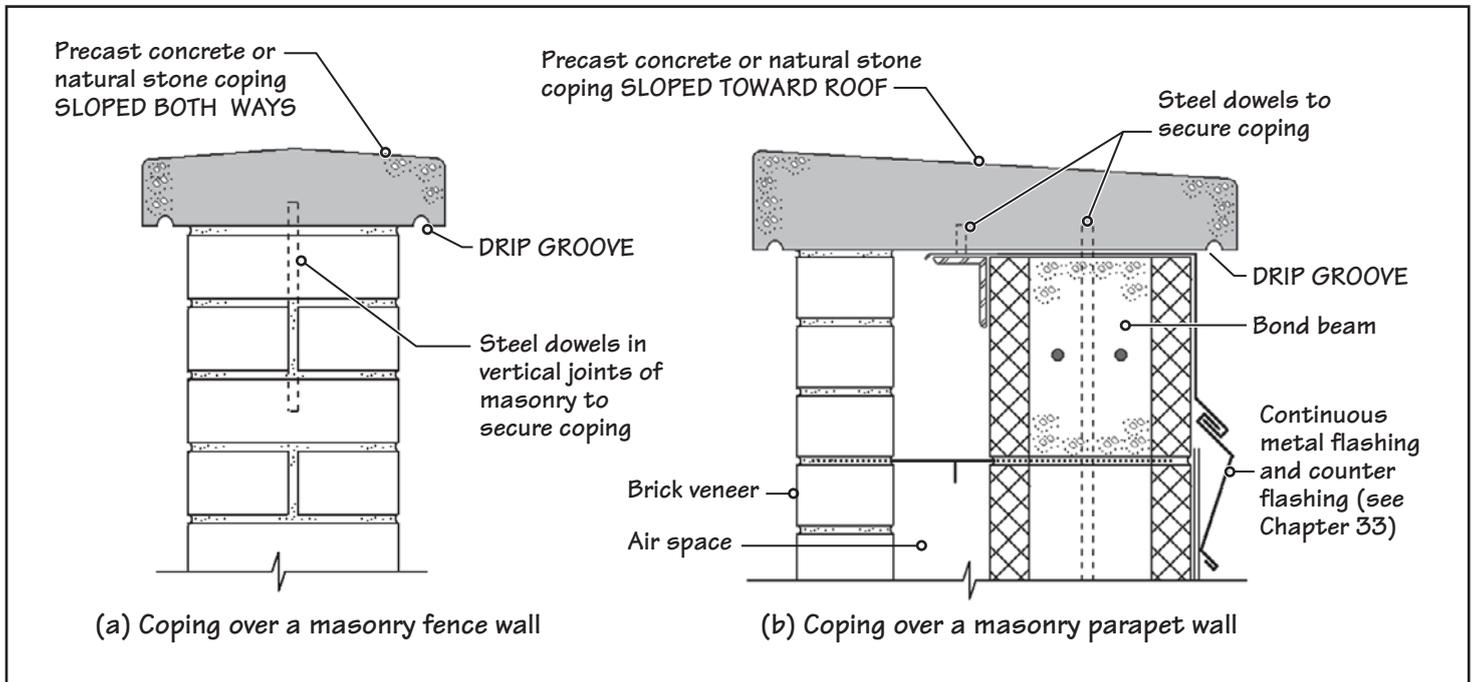


FIGURE 27.1 The importance of sloping the exposed horizontal surfaces of a wall.

27.1 RAINWATER INFILTRATION CONTROL—GENERAL PRINCIPLES

Three major forces that affect water infiltration through exterior walls are gravity, the capillary effect, and wind. Because these forces frequently act on an assembly simultaneously, multiple strategies must be used in the same assembly to counter water infiltration.

GRAVITY-INDUCED INFILTRATION

Gravity generally affects water penetration through an exposed horizontal surface of a wall and can be countered by providing a nominal slope in the surface. The purpose of slope (usually 1:12) is to drain water away from vulnerable parts of a building. Thus, a roof overhang protects the upper portion of a wall, and the coping on the top of a masonry fence wall is sloped on both sides of the wall, Figure 27.1.

The coping over a roof parapet is generally sloped toward the roof so that the water drains on the roof. In exterior window sills and thresholds under entrance doors, the slope is directed away from the building.

CAPILLARY-INDUCED INFILTRATION

Water molecules are subjected to forces of attraction between them, creating an intermolecular cohesive bond between them. In addition to the cohesive bond, water molecules experience forces of attraction from the molecules of the surface with which they are in contact. These forces create an adhesive bond. For most building surfaces, the adhesive bond is stronger than the cohesive bond. It is because of the stronger adhesive bond that a thin film of water is able to travel horizontally along the soffit instead of dropping vertically by gravity. A drip mechanism, which consists of either a continuous groove or a vertical projection, counteracts this phenomenon, as shown in Figures 27.1 and 27.2.

Cohesive and adhesive forces also create the capillary effect, which is responsible for suction forces that occur in tiny spaces between two surfaces (surfaces in very close proximity to each other). In this case, the water is sucked between the surfaces.

Water can also be sucked into the tiny pores of porous materials such as brick, CMU, or stone. Coating the surface of a porous material with a sealer helps close the pores. Because the sealer degrades rapidly due to ultraviolet radiation, abrasion, and other physical processes, the use of sealers is not a durable means of waterproofing a porous surface. To be effective, seals on exterior walls need frequent reapplication.

Capillary suction can also occur in a joint between two nonporous materials if the joint is narrow. In narrow joints, capillary suction can be prevented by introducing a larger space,

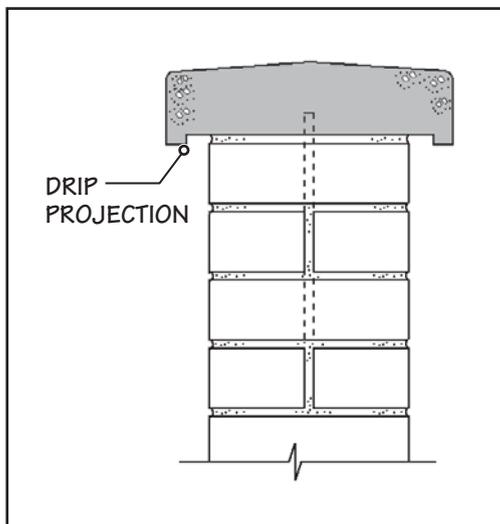


FIGURE 27.2 Detail of Figure 27.1(a) redrawn with a drip projection in the coping instead of a drip groove.

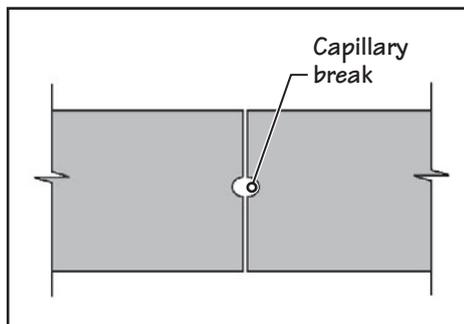


FIGURE 27.3 A narrow space can be made more water-resistant by providing a capillary break.

nearly $\frac{1}{4}$ in. or wider, immediately beyond the capillary space. This space is referred to as the *capillary break*, Figure 27.3.

WIND-INDUCED INFILTRATION

Providing an *overlap* between members meeting at a joint is another commonsense measure. The force of wind can impart kinetic energy to water, causing the water to travel horizontally as well as vertically in the joint. Therefore, the overlap must be sufficiently large to present a reliable baffle against wind-driven rain, Figure 27.4. A lapped horizontal joint performs better than a lapped vertical joint, because water has to work against the force of gravity to get across the overlap in a horizontal joint. Capillary breaks can also be included in a lapped joint.

A horizontal butt joint can be made infiltration resistant by incorporating L- or Z-flashing, Figure 27.5. L- or Z-flashing consists of an impervious membrane that provides a barrier to water and directs it to the exterior surface. Various types of sheet materials—galvanized steel, stainless steel, copper, lead, and polyvinyl chloride (PVC)—are used as flashing materials. Other uses of flashing are shown in Figures 27.6 and 27.8.

THE IMPORTANCE OF JOINT SEALANTS

Filling joints with sealants (see Chapter 9) is another commonly used strategy to keep water from penetrating through joints between building components. Because sealants degrade

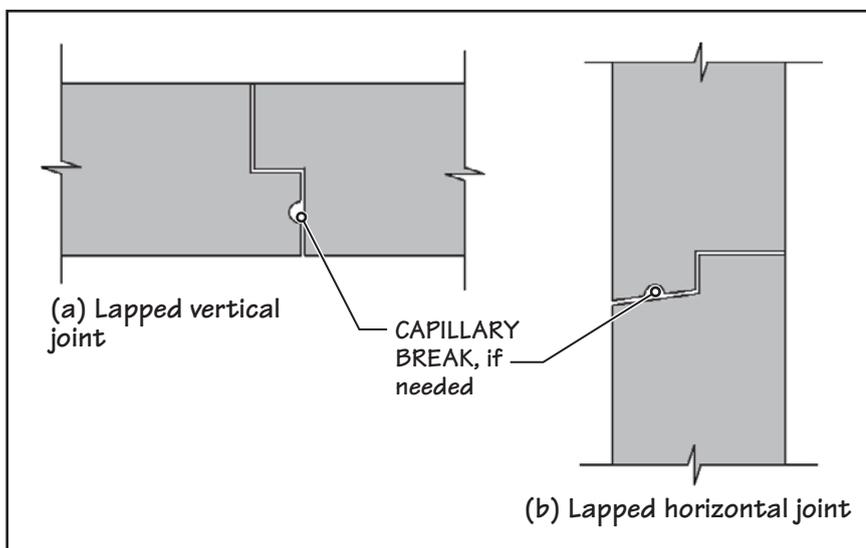


FIGURE 27.4 Lapped vertical and horizontal joints.

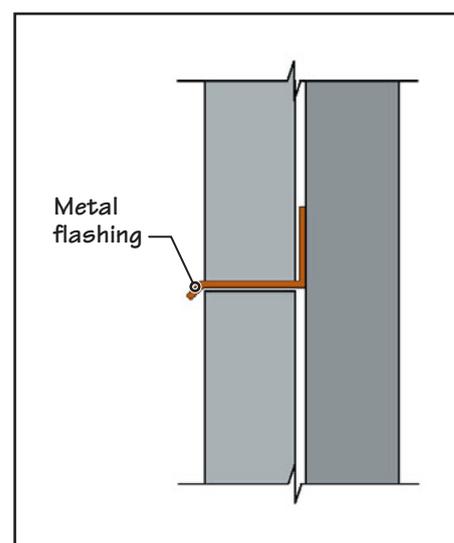


FIGURE 27.5 L-flashing at a horizontal butt joint. If the projecting part of flashing is turned down at a 90° angle instead of a 45° angle, it is referred to as Z-flashing.

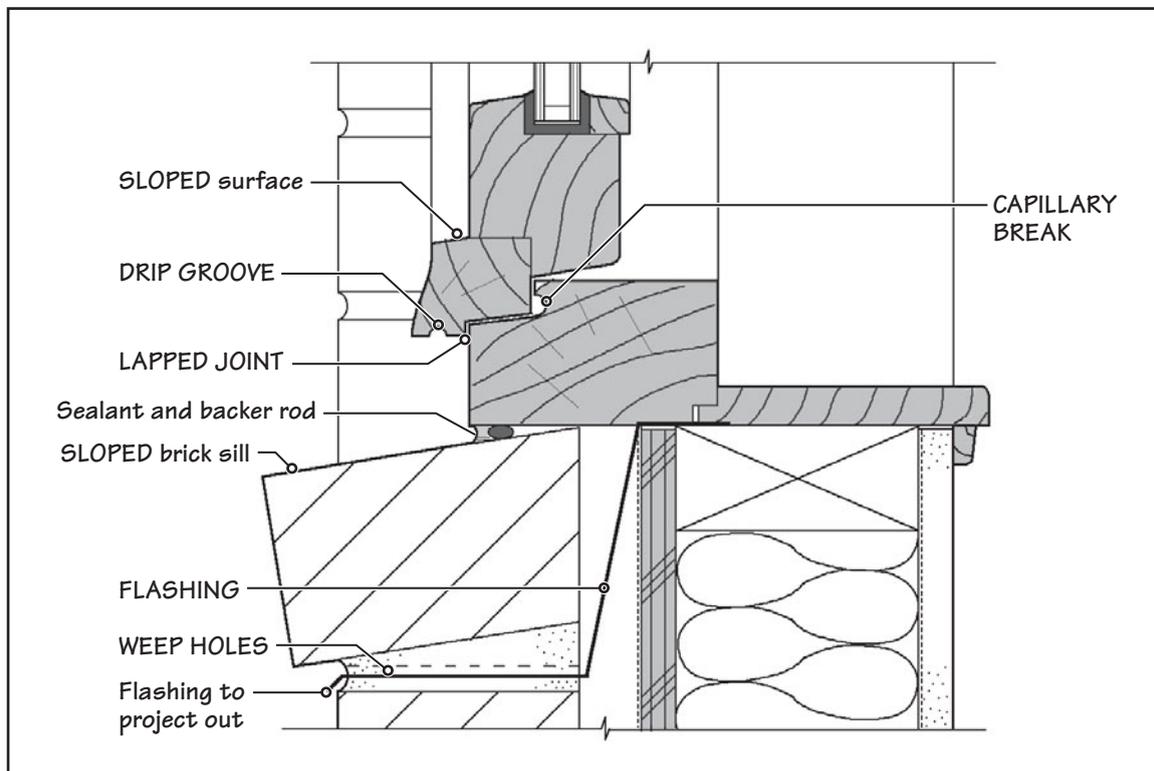


FIGURE 27.6 A section at a window sill showing various rainwater leakage control strategies used in one detail.

over time from exposure to environmental factors, particularly solar radiation and water, they should not be relied upon as the only water-resisting element. A certain amount of redundancy must be built into the detail in case the sealant fails. Usually all or most of the strategies previously discussed are used in a single detail, as shown in a section at the sill level of a typical wood window, Figure 27.6.

27.2 RAINWATER INFILTRATION CONTROL AND EXTERIOR WALLS

Water-resistant exterior walls may be divided into three types:

- Walls with overhangs
- Barrier walls
- Drainage walls

WALLS WITH OVERHANGS

This type of wall system depends on protective floor and roof overhangs to prevent water infiltration, Figure 27.7. It has limited application because the overhangs are required to shield the wall completely from wind-driven rain and, therefore, must be quite deep. In addition, the overhangs impose economic as well as design constraints on the exterior envelope, particularly that of a multistory building. However, a shallow roof overhang is commonly used in a low-rise building (eave projection) and can provide substantial protection from water penetration at the wall-roof junction.

BARRIER WALLS—FACE-SEALED WALLS AND RESERVOIR WALLS

A barrier wall is a wall that functions as the primary structure and, at the same time, performs as the building envelope. Historic buildings such as the Monadnock Building (see Chapter 26) and some contemporary CMU load-bearing structures are examples of this wall type. This wall type resists water infiltration either (a) by providing an impervious barrier to water, referred to as a *face-sealed wall*, or (b) by functioning as a water reservoir—a *reservoir wall*.

An example of a face-sealed wall is a CMU or concrete wall system with an applied water-resistant veneer, such as EIFS or stucco (see Chapter 29). On the other hand, an

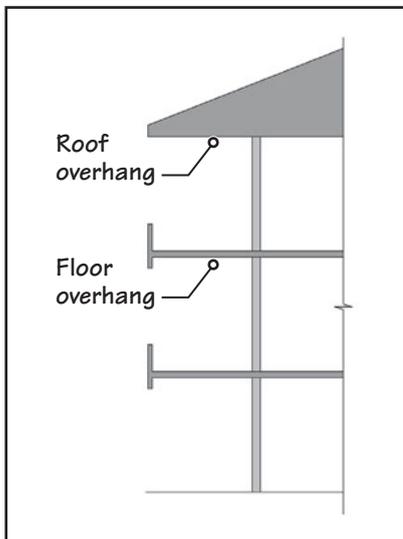


FIGURE 27.7 Deep roof and floor overhangs can substantially reduce water leakage from wind-driven rain through walls.

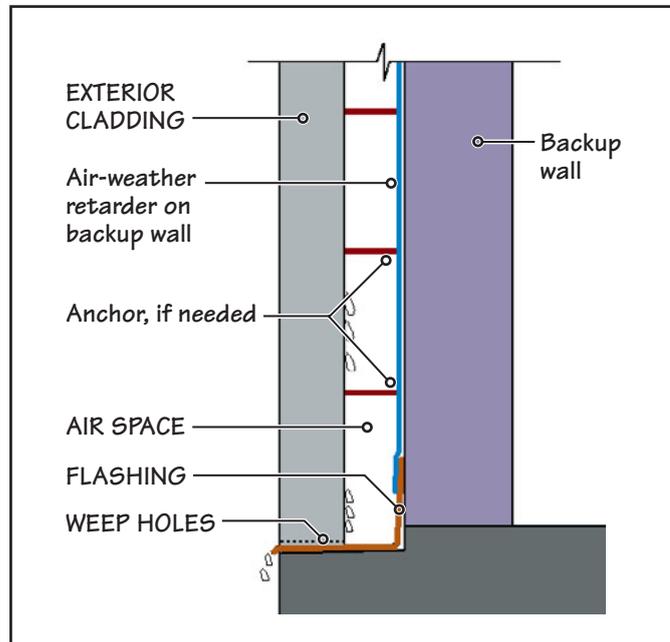


FIGURE 27.8 A section through a drainage wall showing its important water infiltration control features. (Note that the air space in a drainage wall may also have insulation, which is not part of water infiltration control.)

example of a barrier wall that acts as a reservoir is a porous masonry or concrete wall that is so thick that any absorbed water is unable to migrate to the wall's interior surface. The thicker the wall, the larger the reservoir. In this type of wall, only the outer layer of the wall gets wet, even during a long rainy spell; given a long dry spell, the entire wall will dry again.

It is very important that a barrier wall does not develop through-wall cracks that may be caused by weathering, expansion or contraction, foundation settlement, and so on. If cracks develop, water infiltration will result. Careful detailing and attention to water resistance in materials are, therefore, essential to the long-term performance of a barrier wall.

DRAINAGE WALL

A relatively more water-resistant exterior wall is a drainage wall. It is a wall that consists of an exterior cladding, an inner backup wall, and an intervening air space between the cladding and the backup.

In a drainage wall, the exterior cladding is the first defense against water infiltration. Therefore, it is made as water resistant as possible. However, some water will inevitably penetrate through the cladding. Any water that leaks through the cladding collects in the air space and is drained out through small openings at the bottom of the cladding called *weep holes*, Figure 27.8.

IMPORTANT FEATURES OF A DRAINAGE WALL

A drainage wall must have sufficient built-in redundancy to remain infiltration-free for the entire life of the building and includes the following features:

- Exterior cladding
- Air space
- Flashing
- Water-resistant backup
- Weep holes

Flashing in a drainage wall is a continuous waterproof membrane providing a continuous barrier that originates at the backup wall and penetrates through the air space and cladding. The purpose of flashing is to collect and channel any water that gets into

the air space back to the exterior. It is attached to the backup wall at the bottom of a section of a drainage wall and works in conjunction with weep holes, which allow water to escape.

The *water-resistant layer* on the backup wall protects it from water that may accidentally reach the backup wall by traveling over metal anchors (where used) or unintentional obstructions in the air space. It also functions as an air barrier (retarder). Thus, this layer is an air-weather retarder. Because the water-resistant layer is shielded by the cladding, it does not degrade as rapidly as an exposed surface.

Although the drainage wall concept was initially introduced with reference to a porous exterior cladding consisting of brick, CMU, concrete, or stone, it applies equally to an impervious exterior cladding, such as one of glass or metal. Note that the underlying philosophy of the drainage wall is the redundancy of its two water-resistant layers. If the exterior layer is made of an impervious material, the redundancy is that much greater.

EXPAND YOUR KNOWLEDGE

Exterior-Wall Cladding Systems: Curtain Wall, Veneer Wall, and Infill Wall

The primary exterior-wall types in use today are curtain walls, veneer walls, and infill walls.

Curtain Walls

As the name suggests, a *curtain wall* forms a curtain on the exterior face of a building. It is used with a frame structure, covers the building's structural frame, and is directly suspended from it. In a curtain wall, the wind loads are transferred directly from the curtain wall to the building's structural frame.

A 2-in. minimum separation is generally required between the curtain wall and the building's structural frame to accommodate unintended dimensional irregularities in the frame.

A typical example of a curtain wall is a *glass-aluminum curtain wall* (see Chapter 32). *Opaque curtain walls* consist of precast concrete panels, glass fiber-reinforced panels, metal panels, and so on. A backup wall may be used in an opaque curtain wall to provide an interior wall finish and to incorporate insulation, electrical, and other utility conduits within the wall. Because the wind load is resisted by the curtain wall, the backup wall in this assembly (if provided) does not experience any wind loads.

Veneer Walls

Another exterior wall cladding, which is similar to an opaque curtain wall is a *veneer wall*. A veneer wall can be used with both a frame structure and a bearing wall structure. A backup wall is always required in a veneer wall. The wind loads that act on the veneer wall are transferred to the backup wall. The backup wall then transfers them to the building's structural frame. A veneer wall may be of two types:

- Anchored veneer
- Adhered veneer

In an *anchored veneer*, the anchors connect the veneer to the backup; therefore, they participate in transferring the wind loads from the veneer to the backup wall. An anchored veneer wall is typically designed as a drainage wall with a minimum 2-in. air space between the veneer and the backup wall.

A veneer may also be applied without anchors, in which case it is adhered to the backup wall. Such a veneer is called an *adhered veneer*. An adhered veneer wall is a face-sealed (barrier) wall, unlike the anchored veneer. Stucco and EIFS wall assemblies are examples of face-sealed barrier walls.

Infill Walls

Like a curtain wall and a veneer wall, an infill exterior wall is a non-load-bearing wall assembly. It occupies the space between

the building's columns and beams, leaving the structural frame exposed to the outside. An infill wall can be used only with a frame structure. It can be designed as either an anchored infill wall or an adhered infill wall.

Before energy-use concerns became critical, most exterior-wall assemblies were designed as infill walls, Figure 1. In these buildings, the steel or concrete structural frame, having an extremely low R-value, contributed to substantial thermal short-circuiting. In contemporary buildings, the use of curtain walls or veneer walls is the norm because they cover the building's structural frame and, therefore, can be designed with greater thermal efficiency.

Exterior Cladding

The term *exterior-wall cladding* (or simply *cladding*) is a general term that is used for all exterior wall finishes.

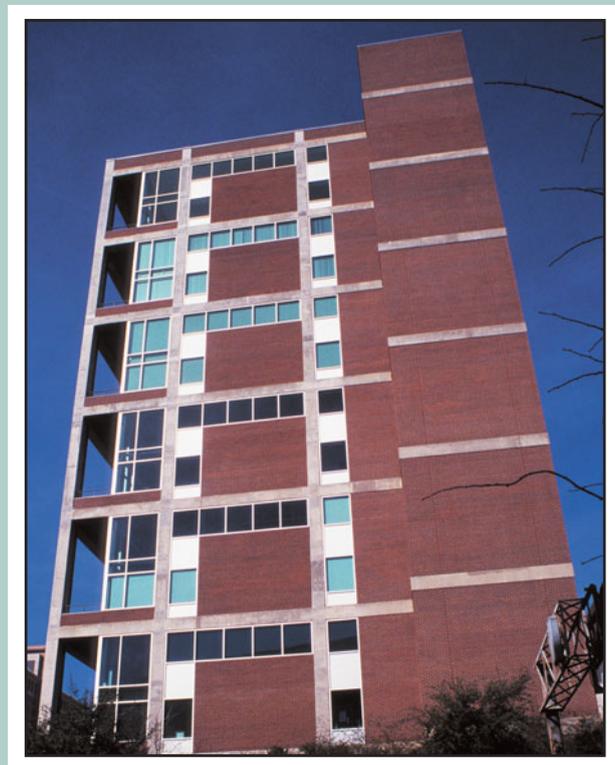


FIGURE 1 A typical example of an exposed structural frame and exterior infill walls.

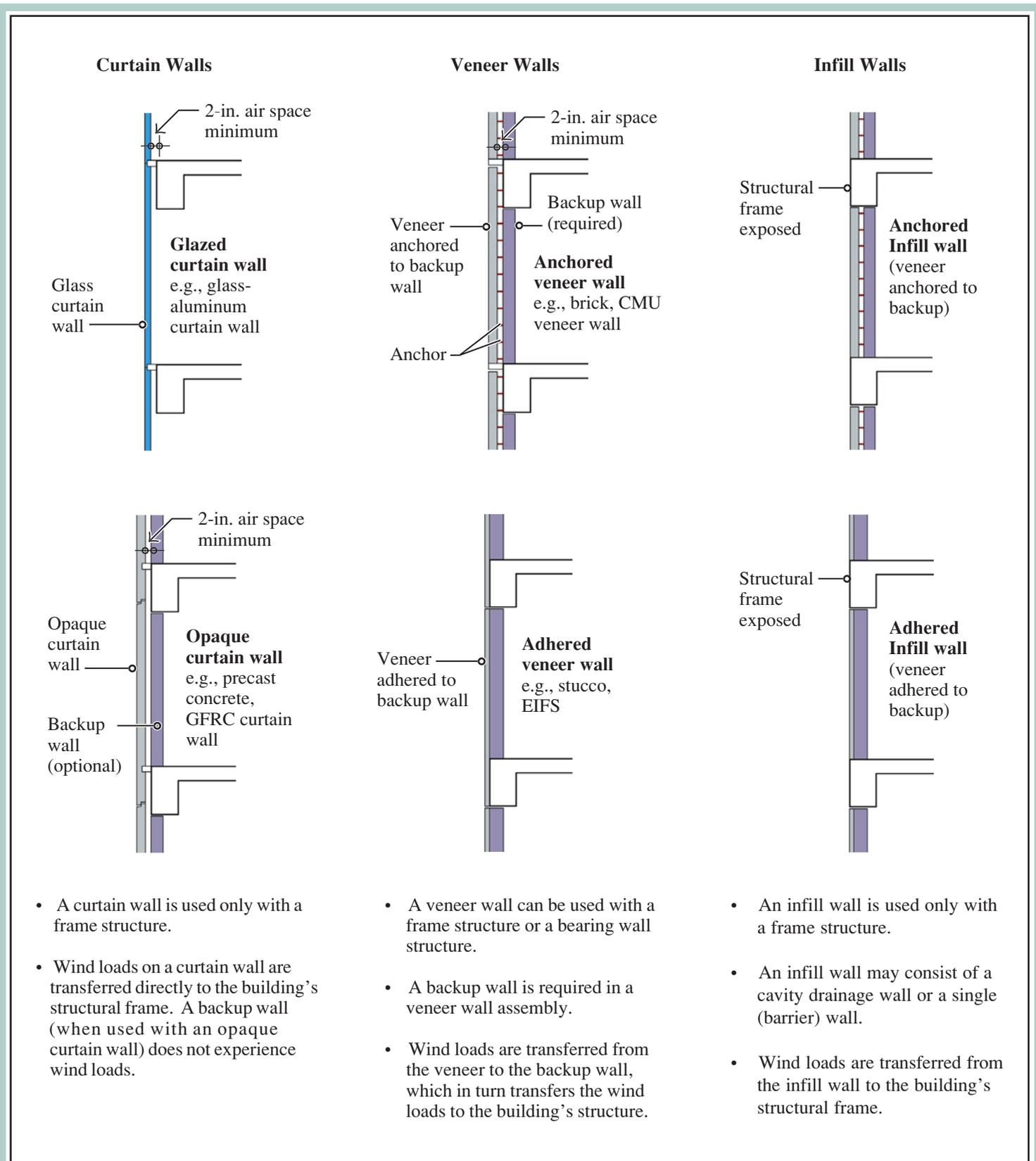


FIGURE 2 Curtain wall, veneer wall, and infill wall defined.

27.3 RAIN-SCREEN EXTERIOR CLADDING

A rain-screen cladding system includes the basic principles of the drainage wall system, but it also addresses the issue of water penetration due to unequal distribution of air pressure on the exterior of the wall and in the air space between the cladding and the backup wall. The equalization of pressure is required when gaps and breaches in exterior cladding (such as weep holes, cracks, and apertures between masonry units and mortar joints) become sources of water penetration by suction under conditions of wind-driven rain.

In order to reduce the suction of water in a drainage wall, the pressure between the air space and the outside should be equalized as much as possible. Pressure equalization is accomplished by not completely sealing the cladding. In fact, providing weep holes and purposely incorporating other openings in the cladding help to create pressure equalization.

If the openings in the cladding of a drainage wall, such as weep holes, are few and small in area, the pressure between the air space and the exterior cladding will not be equalized. In such a wall, although the air space is under atmospheric pressure, the outside surface of the cladding is subjected to a pressure greater than the atmospheric pressure. This will cause the water to be sucked into the air space through the weep holes. Water will also be sucked into the air space through joints in cladding that are inadequately sealed or have become leaky over time.

Water suction will take place on the windward facade only because at this facade, the pressure in the air space is lower than the outside pressure. On the other facades, the air space pressure is higher than the outside pressure. Hence, no suction takes place through nonwindward facades.

EXPAND YOUR KNOWLEDGE

Rain-Screen and Pressure Equalization

To fully appreciate the phenomenon of the suction of water into the air space in a drainage wall, the fundamentals of wind loads on buildings must be reviewed. When there is no wind (zero wind speed), the air pressure on the inside and outside surfaces of the walls of an enclosure is the same, equal to the atmospheric pressure—2,100 psf. Because atmospheric pressure works on both sides of a wall equally, the wall is under perfect equilibrium, and there is no wind load on the wall, Figure 1.

Equilibrium is disturbed by wind, which creates additional pressure on the outside surface of a windward wall, whereas the pressure in the enclosure is equal to the atmospheric pressure. For example if the wind speed is 100 mph, the wind load on the wall is nearly 25 psf (see Section 3.5). This means that the outside surface of the windward wall is under a pressure of 2,125 psf, but the enclosure is under a pressure of 2,100 psf, Figure 2.

It is this difference between the inside and outside air pressures that we refer to as the *wind load* (see Section 3.5). It is also this pressure difference that causes suction of water through the windward cladding because the pressure in the (drainage) air space is atmospheric pressure, whereas the pressure on the exterior face of cladding is greater than the atmospheric pressure.

If the windward wall has large openings and the rest of the enclosure has no openings at all, the wind will move into the enclosure and the air pressure inside the enclosure will be equal to the outside pressure, as shown in Figure 3. In the case of perfect equalization of pressures, the windward wall will not be subjected to any wind load, and no suction will be created at the windward wall.

Atmospheric Pressure Equalization and Human Bodies

Atmospheric air pressure is due to the weight of a column of air on the earth's surface. This equals the pressure that a 29.92-in. (say, 30 in. = 2.5 ft) column of mercury exerts at the column's bottom. It equals 14.7 psi, or approximately 2,100 psf.

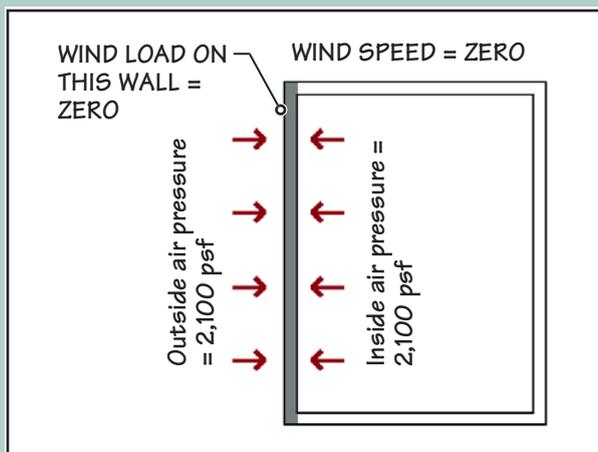


FIGURE 1 Outside and inside air pressures on a wall under zero wind speed.

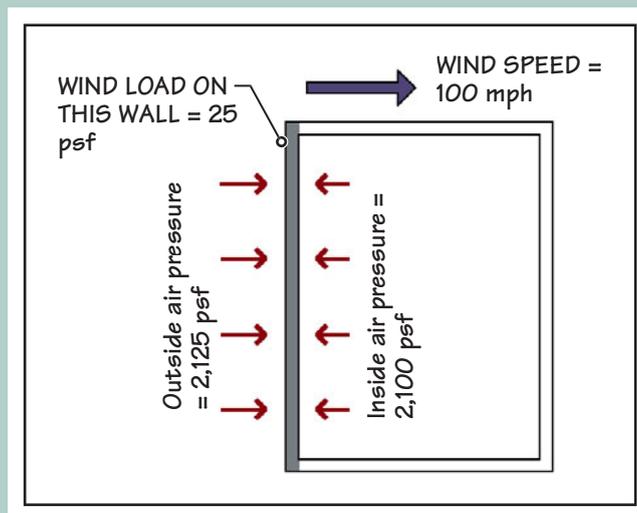


FIGURE 2 Outside and inside air pressures on a windward wall of a fully enclosed building.

A pressure of 2,100 psf is the same pressure that a 14-ft-thick concrete slab will exert at its base. In other words, human bodies are subjected to the same pressure that is exerted by a 14-ft-thick concrete slab at its base. We are not squashed by this pressure (i.e., there is no wind load on our bodies) because the interior of our bodies also contains air, and there is air pressure equalization between the inside and outside of our bodies. (Because concrete weighs about 150 pounds per cubic foot [pcf], a 14-ft-high concrete column exerts a pressure of about 2,100 psf at its base. Mercury weighs approximately 850 pcf. Therefore, only a [30-in.] 2.5-ft-high mercury column exerts the same pressure.)

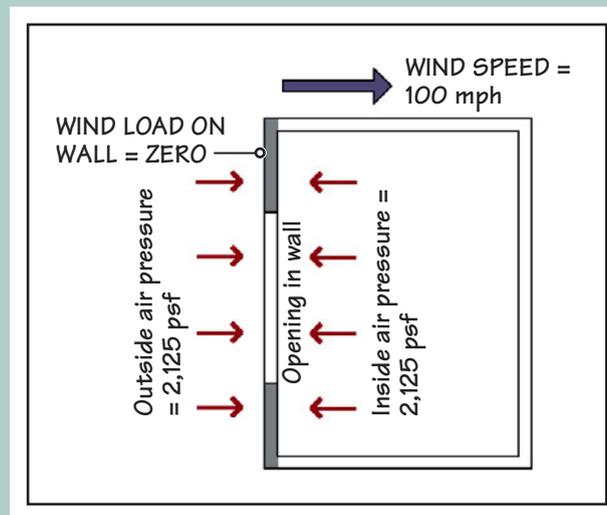


FIGURE 3 Outside and inside air pressures in an enclosure that has a large opening on the windward wall.

WIND LOAD ON THE CLADDING OF A PRESSURE-EQUALIZED WALL

Because there is no pressure differential between the inside and outside faces of cladding in a pressure-equalized drainage wall, the cladding is not subjected to any wind load. In such a wall, all of the wind load acts on the backup, and the cladding functions as a nonstructural element whose primary environmental function is to control water penetration by allowing free movement of air for pressure equalization. Therefore, the exterior cladding in a pressure-equalized wall is referred to as a *screen*—or, more commonly, as a *rain screen*.

PRACTICAL LIMITATIONS OF A RAIN-SCREEN WALL

Theoretically, the exterior cladding in a pressure-equalized drainage wall should not be subjected to any wind load. In practice, however, it is not possible to achieve a completely load-free cladding. The reason is that pressure equalization does not occur instantaneously. It takes some time for pressure equalization to take place, depending on how rapidly the outside air can move into the intervening air space. If the area of openings in the wall is large, pressure equalization will be rapid. In the case of a small opening area, pressure equalization will be slow.

In other words, there is a time lag between a change in the outside pressure and the corresponding change in air space pressure. During this period (when pressure equalization is taking place), the cladding is subjected to wind loads. If there is no further change in the outside pressure, the air space and the outside will continue to be under equal pressures.

However, wind in a storm or hurricane occurs in gusts, so exterior air pressure changes almost continuously. This disturbs pressure equalization in a drainage wall. Therefore, the cladding is constantly subjected to wind loads, although the magnitude of the wind load on the cladding of a pressure-equalized wall is smaller than that on a non-pressure-equalized wall.

AIRTIGHT BACKUP WALL

Once the pressure in the air space is equalized with respect to the pressure on the wall's facade, no air movement will occur in the space (because any movement of air implies the existence of a pressure differential). The consequence of this fact is that the rain-screen principle works only if the backup is completely airtight. If the backup has openings, air will move from the air space into the enclosure, implying the existence of a pressure differential (hence, the absence of pressure equalization).

If the air is able to move into the enclosure through the backup wall, water may be sucked into the enclosure. Therefore, in a pressure-equalized wall, the backup wall must be made airtight. This is usually achieved by sealing all the joints in the backup wall and/or providing an air barrier. The air barrier is usually placed on the outside face of the backup wall so that it can also function as the damp-proofing layer.

COMPARTMENTALIZATION OF THE AIR SPACE

Another cause of air movement in an intervening air space is shown in Figure 27.9. Under the action of wind, the windward facade is under positive pressure and the side facades are under negative pressure. If the air space is continuous from one facade to the other, air will move through the space as shown, negating attempts at pressure equalization.

Therefore, the air space of a pressure-equalized drainage wall must be closed at wall corners. This is usually achieved by using a continuous vertical closure at the corners of the air space, Figure 27.10. A closed-cell compressible filler, such as neoprene sponge, may be used as the closure material.

In addition to providing vertical closures at wall corners, the air space should be closed by horizontal closures. In fact, the air space should be subdivided into independent compartments. The compartmentalization is in response to the variation of wind pressure over the building's facade. Wind pressure is greater at upper floors of a building than at lower floors, and is greater at edges and corners of the building than in the middle (see Section 3.5). If the air space is not compartmentalized, the pressure inequality over the facade will generate air movement inside the space.

Each compartment should have openings in the cladding at the top and bottom so that pressure equalization can take place. The openings should preferably be far enough away

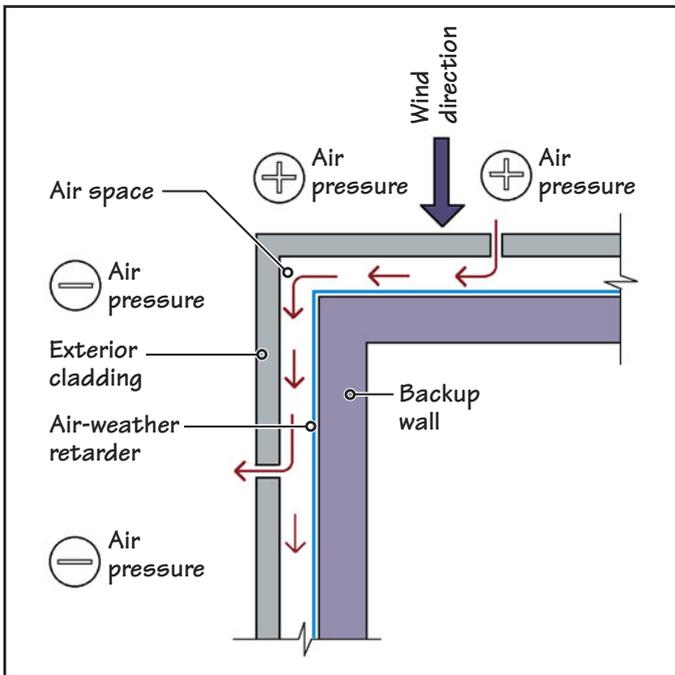


FIGURE 27.9 Because wind produces positive pressure on the windward wall and negative pressure on other walls of a building, the air in a continuous air space will circulate and move in and out through weep holes and other openings (joints, cracks, etc.) in the cladding. This makes it impossible to achieve pressure equalization between the outside and the air space.

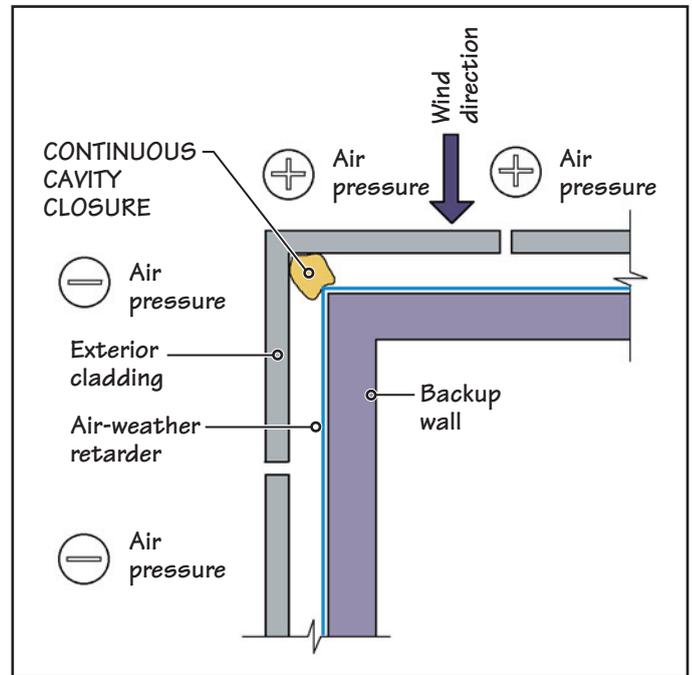


FIGURE 27.10 To prevent air movement within the air space, the air space should be divided into small sections with continuous cavity closures, particularly at corners and floor levels.

from each other to prevent airflow short-circuiting in the compartment. Each compartment should also be relatively small and should be independently drained by weep holes. Although preferable, it is not necessary that air space closures form absolutely airtight compartments. In summary, an ideal rain-screen wall should consist of the following three water-infiltration-control features:

- Voids in cladding for pressure equalization in the air space
- Compartmentalization of the air space
- Airtight backup wall

PRACTICE QUIZ

Each question has only one correct answer. Select the choice that best answers the question.

1. The coping on a roof parapet is generally
 - a. sloped toward the interior (roof).
 - b. sloped toward the outside.
 - c. sloped on both sides.
 - d. either (a), (b), or (c).
 - e. dead flat.
2. The coping on a masonry fence wall is generally
 - a. sloped toward the interior.
 - b. sloped toward the outside.
 - c. sloped on both sides.
 - d. either (a), (b), or (c).
 - e. dead flat.
3. A drip mechanism at the underside of a projecting horizontal surface counters the effect of
 - a. gravity.
 - b. adhesive forces between water molecules and the building surface.
 - c. cohesive forces between water molecules.
 - d. cohesive forces between water molecules and the building surface.
 - e. kinetic energy.
4. A capillary break is a
 - a. vertical barrier between two abutting surfaces of different materials.
 - b. horizontal barrier between two abutting surfaces of different materials.
 - c. wider space in an otherwise narrow joint.
 - d. narrow space in an otherwise wide joint.
 - e. none of the above.
5. Z-flashing is effective in
 - a. a horizontal butt joint in cladding.
 - b. a vertical butt joint in cladding.
 - c. a horizontal lapped joint in cladding.
 - d. a vertical lapped joint in cladding.
 - e. all of the above.
6. In terms of water infiltration, the exterior masonry walls in historic buildings functioned as
 - a. waterproof walls.
 - b. drainage walls.
 - c. face-sealed barrier walls.
 - d. dam walls.
 - e. none of the above.
7. The most important feature of an (exterior) drainage wall is
 - a. exterior cladding.
 - b. waterproofing of the backup wall.
 - c. flashing.
 - d. weep holes.
 - e. all of the above.
8. Metal anchors are needed to transfer lateral loads to the backup wall in
 - a. some veneer walls.
 - b. all veneer walls.

9. A curtain wall is separated from the structural frame of the building by a minimum of
- a. 1 in.
 - b. 2 in.
 - c. 3 in.
 - d. 4 in.
 - e. none of the above.
10. A curtain wall is typically used in buildings whose structural system consists of a
- a. load-bearing masonry wall structure.
 - b. load-bearing reinforced-concrete wall structure or load-bearing masonry wall structure.
 - c. reinforced-concrete frame structure or steel-frame structure.
 - d. steel-frame structure or load-bearing masonry wall structure.
 - e. all of the above.
11. A backup wall is required in a
- a. curtain wall.
 - b. veneer wall.
 - c. infill wall.
 - d. all of the above.
12. Suction that pulls wind-driven rain into the air space of a drainage wall takes place on the windward face of a wall.
- a. True
 - b. False
13. In an ideal pressure-equalized drainage wall,
- a. the cladding resists all of the wind load.
 - b. the backup resists all of the wind load.
 - c. the backup is provided with openings to equalize air pressure in the air space.
 - d. the joints in the cladding are sealed to control water infiltration.
 - e. all of the above.
14. An ideal pressure-equalized drainage wall is also referred to as a
- a. pressure-screen wall.
 - b. wind-screen wall.
 - c. no-pressure wall.
 - d. rain-screen wall.
 - e. all of the above.
15. For a pressure-equalized drainage wall to function effectively, the air space must be continuous from floor to floor.
- a. True
 - b. False

REVIEW QUESTIONS

1. Using a sketch and notes, explain what a capillary break is and where it is commonly used.
2. Explain the differences between a barrier wall and a drainage wall.
3. Using sketches and notes, explain the important features of a drainage-type exterior wall.
4. Using sketches and notes, explain the difference between an anchored veneer and an adhered veneer.
5. Using sketches and notes, explain the salient features of a pressure-equalized drainage wall.
6. Explain why the air space in a pressure-equalized drainage wall must be compartmentalized.