



Arch 1240 Methods of Construction in Architecture
Professor Jason Montgomery

Designing Exterior Wall Systems with Masonry & Concrete (Chapters 19)

Exterior Wall Systems

Primary Function: Controlling the Interior Environment

Water, Air, Light, Heat, Sound

Secondary Functions:

Wind, Vapor, Movement, Fire, Weathering,

Installation

Watertightness: Barrier Walls and Rainscreens

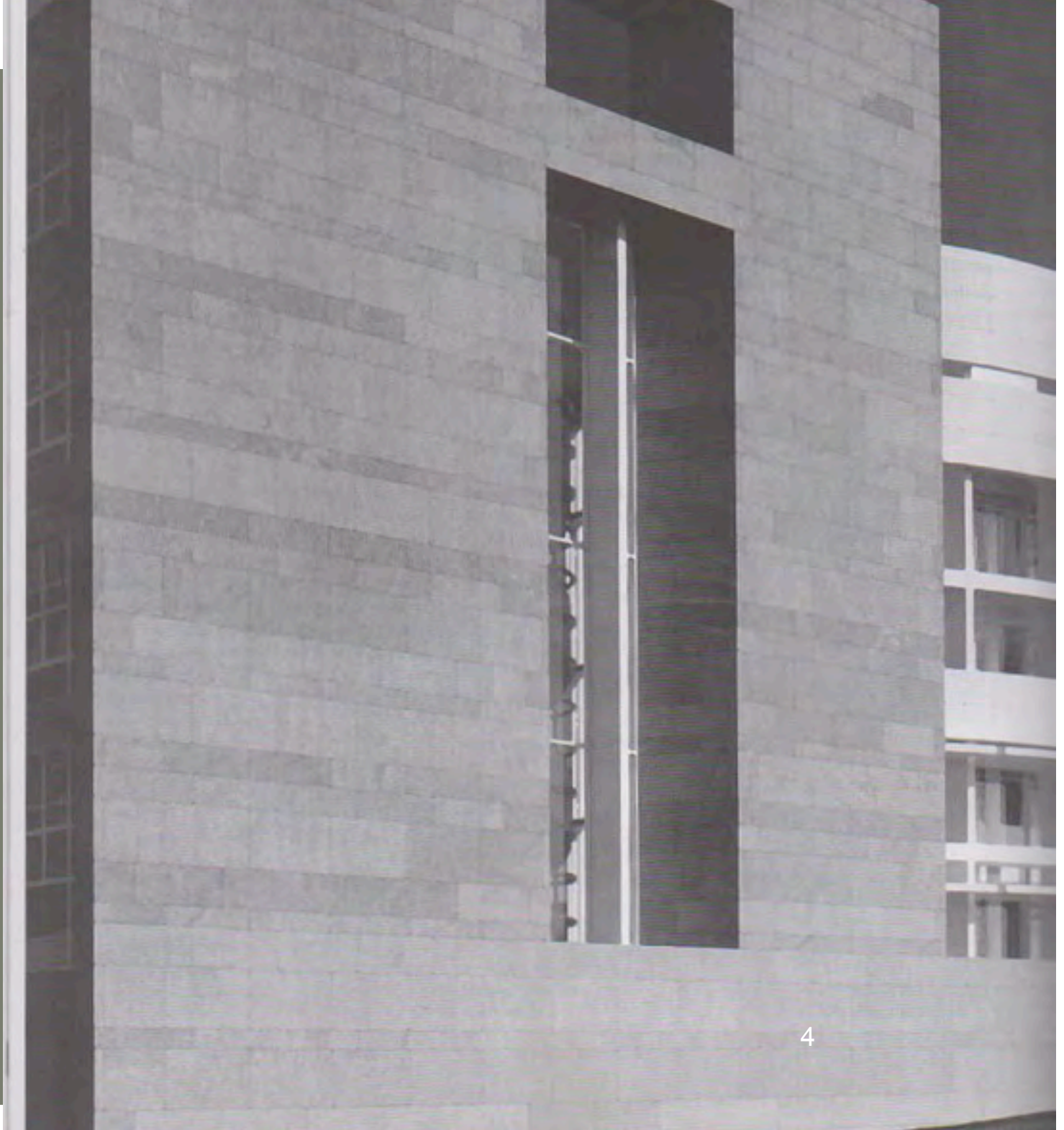
Development of Steel Frame and Curtain Wall Systems



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Stone Veneer

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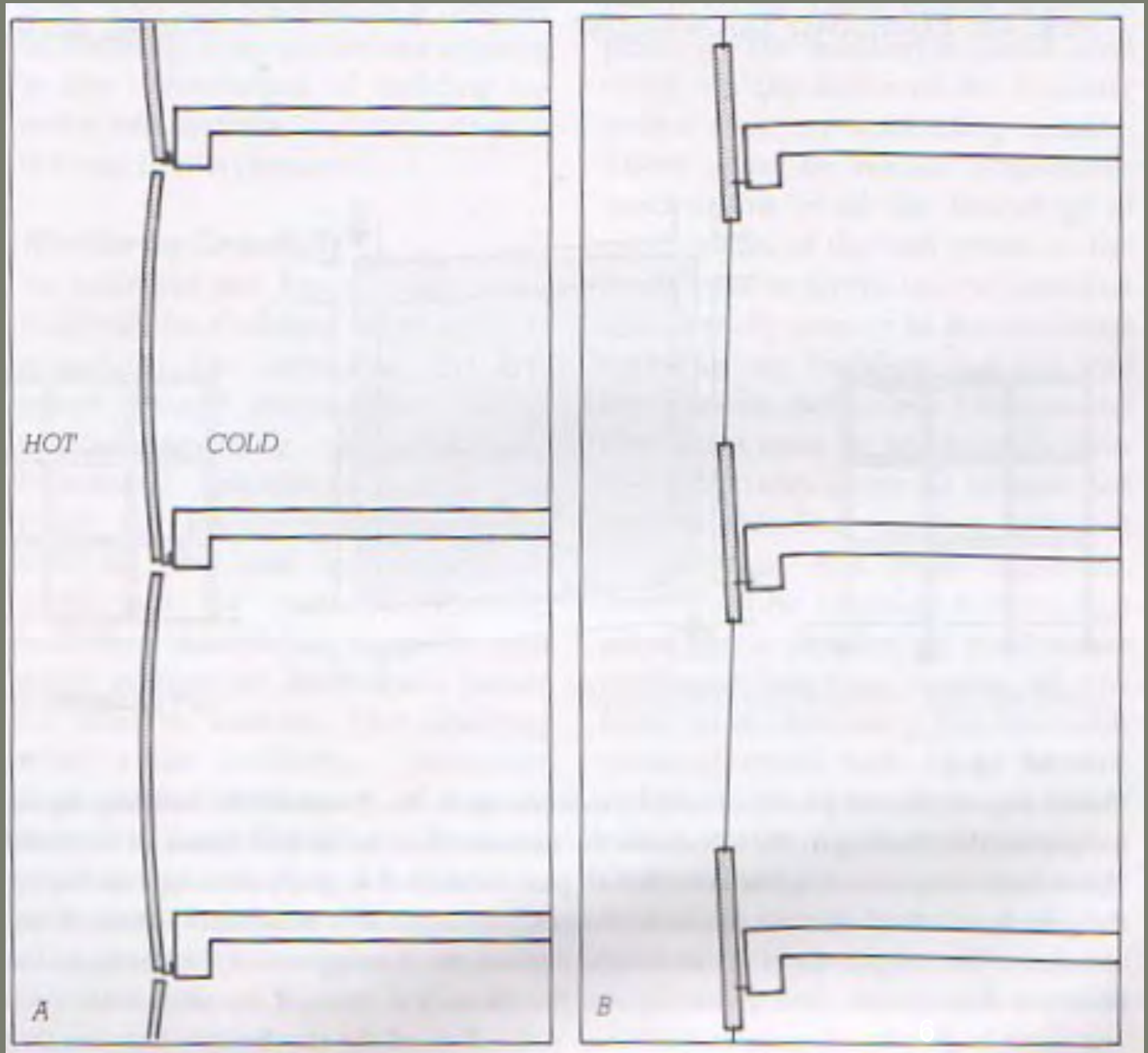


Glass Curtain Wall

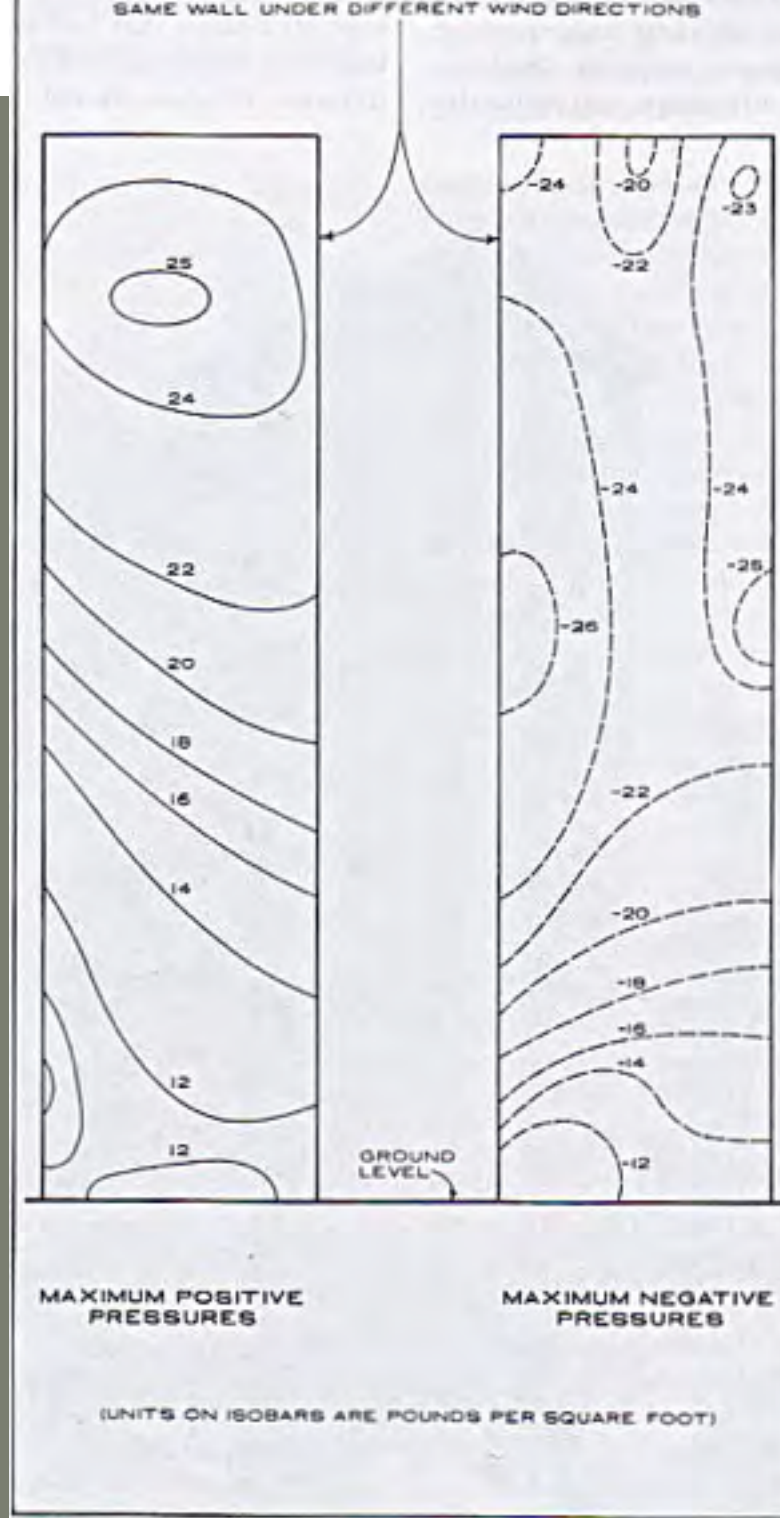
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Movement and Forces on the Exterior Wall System

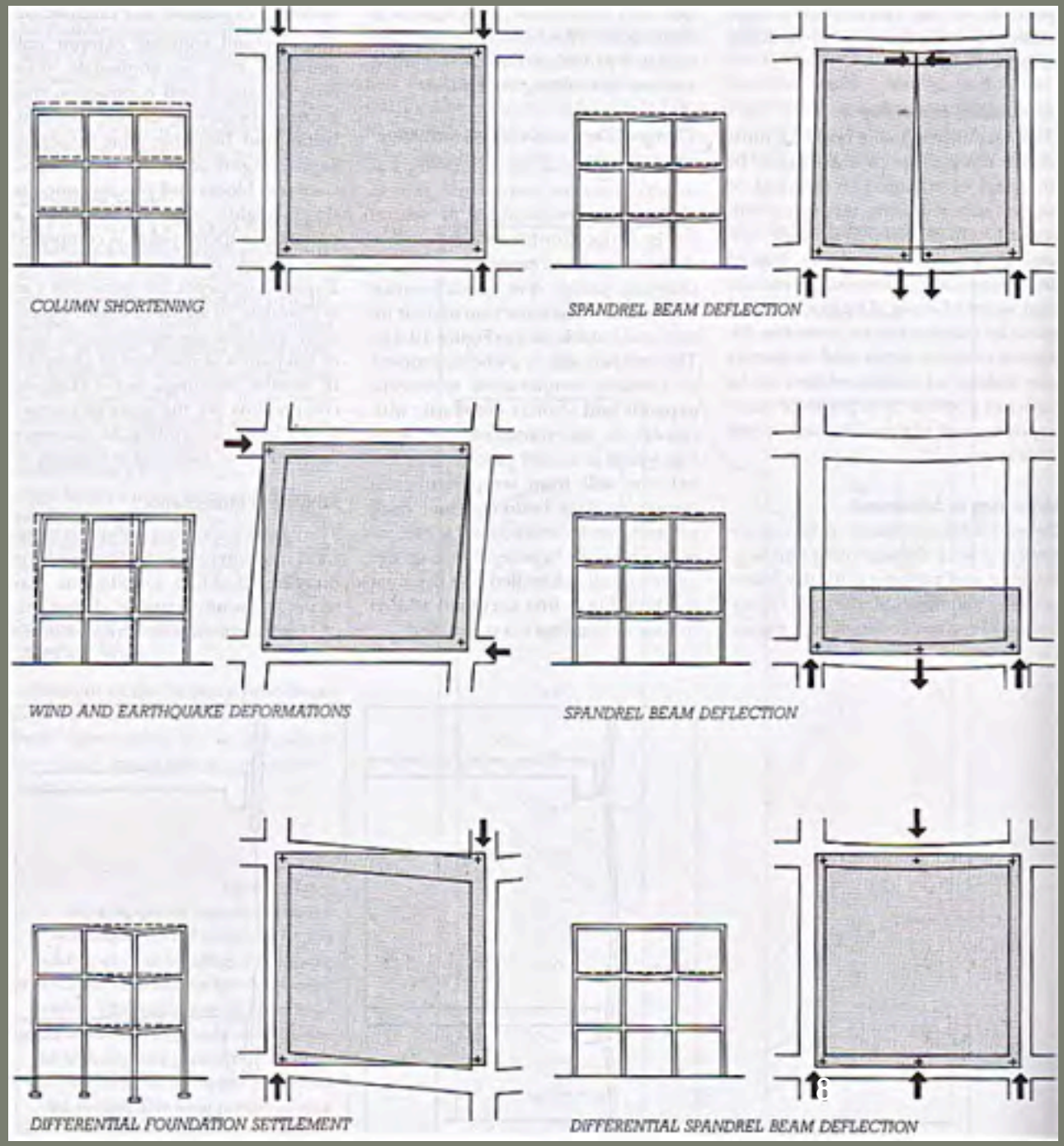


Wind Loads:
Significant
Positive and
Negative
Forces
especially on
Tall Buildings



Movement and Deflection on the Frame

Impact on the Curtain Wall



Joint Design

Potential for Water Penetration must be anticipated at every Joint

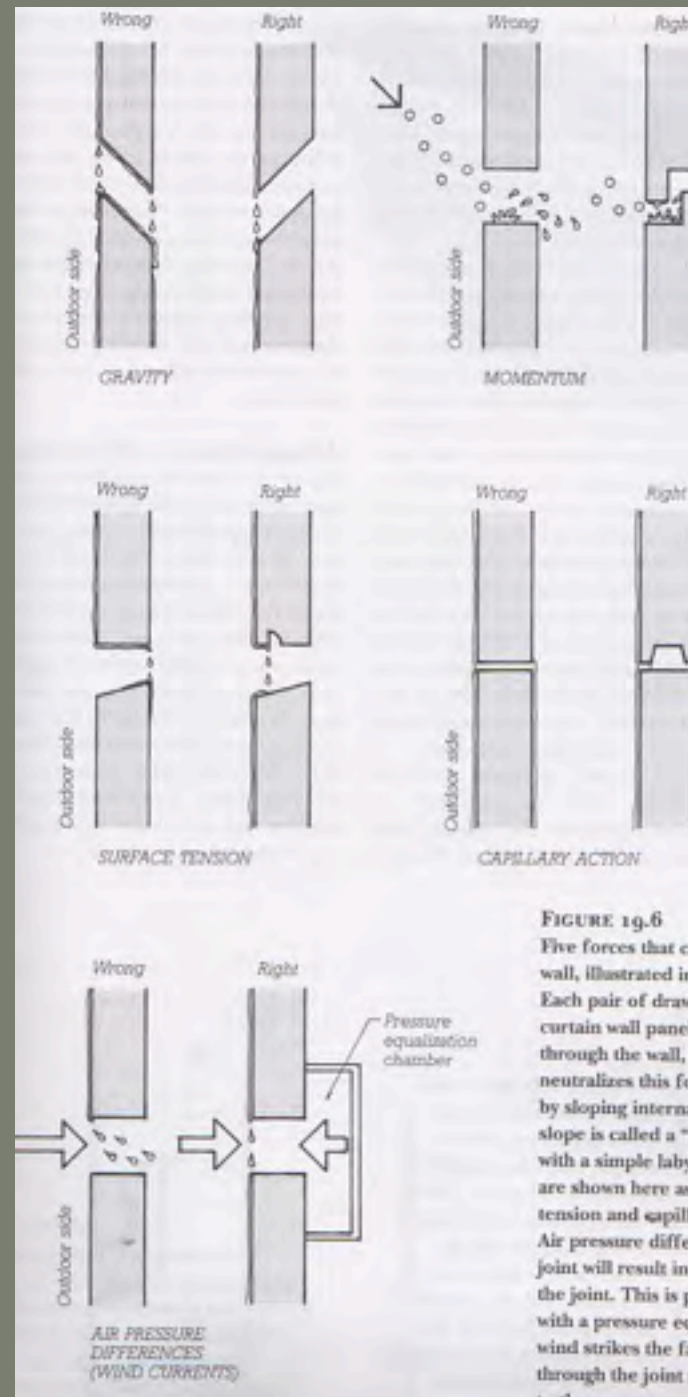


FIGURE 19.6

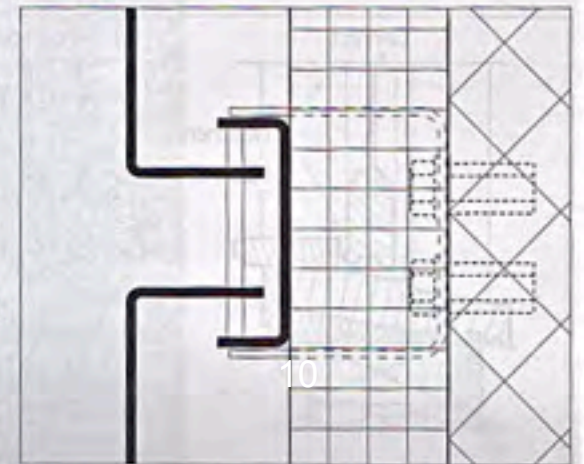
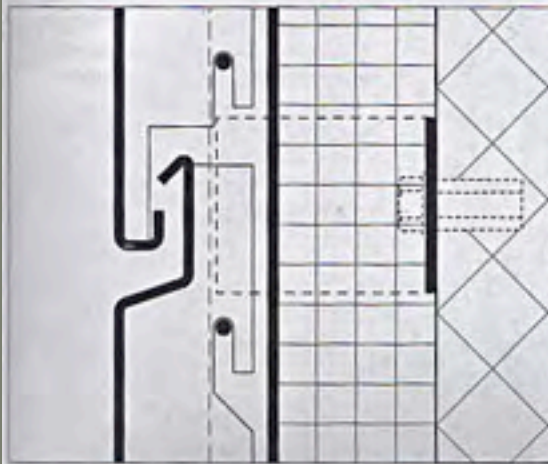
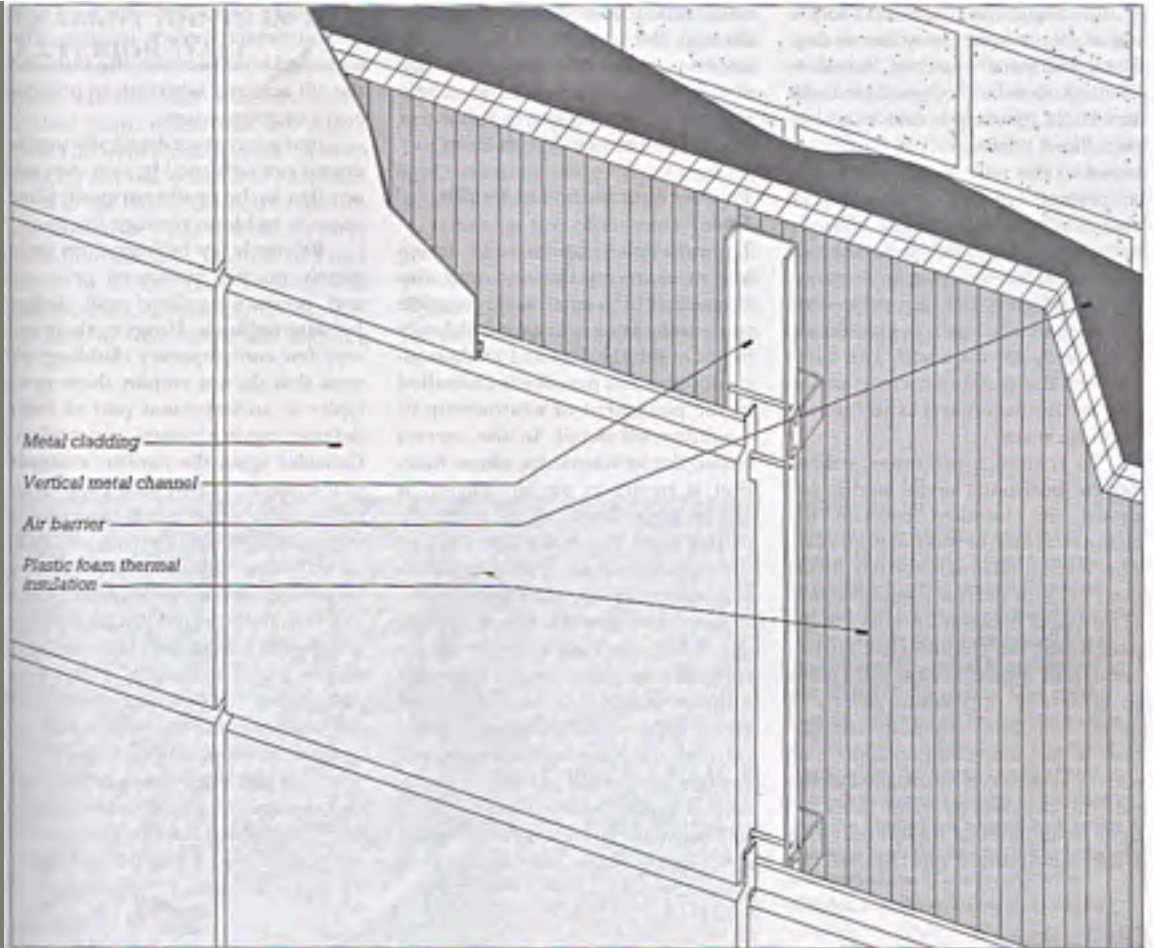
Five forces that can move water through an opening in a wall, illustrated in cross section with the outdoors to the left. Each pair of drawings shows first a horizontal joint between curtain wall panels in which a force is causing water leakage through the wall, then an alternative design for the joint that neutralizes this force. Leakage caused by gravity is avoided by sloping internal surfaces of joints toward the outside; the slope is called a "wash." Momentum leakage can be prevented with a simple labyrinth, as shown. A drip and a capillary break are shown here as means for stopping leakage from surface tension and capillary action, which are closely related forces. Air pressure differences between the outside and inside of the joint will result in air currents that can transport water through the joint. This is prevented by closing the area behind the joint with a pressure equalization chamber (PEC), as shown. When wind strikes the face of the building, a slight movement of air through the joint raises the pressure in the PEC until it is equal to the outside pressure.

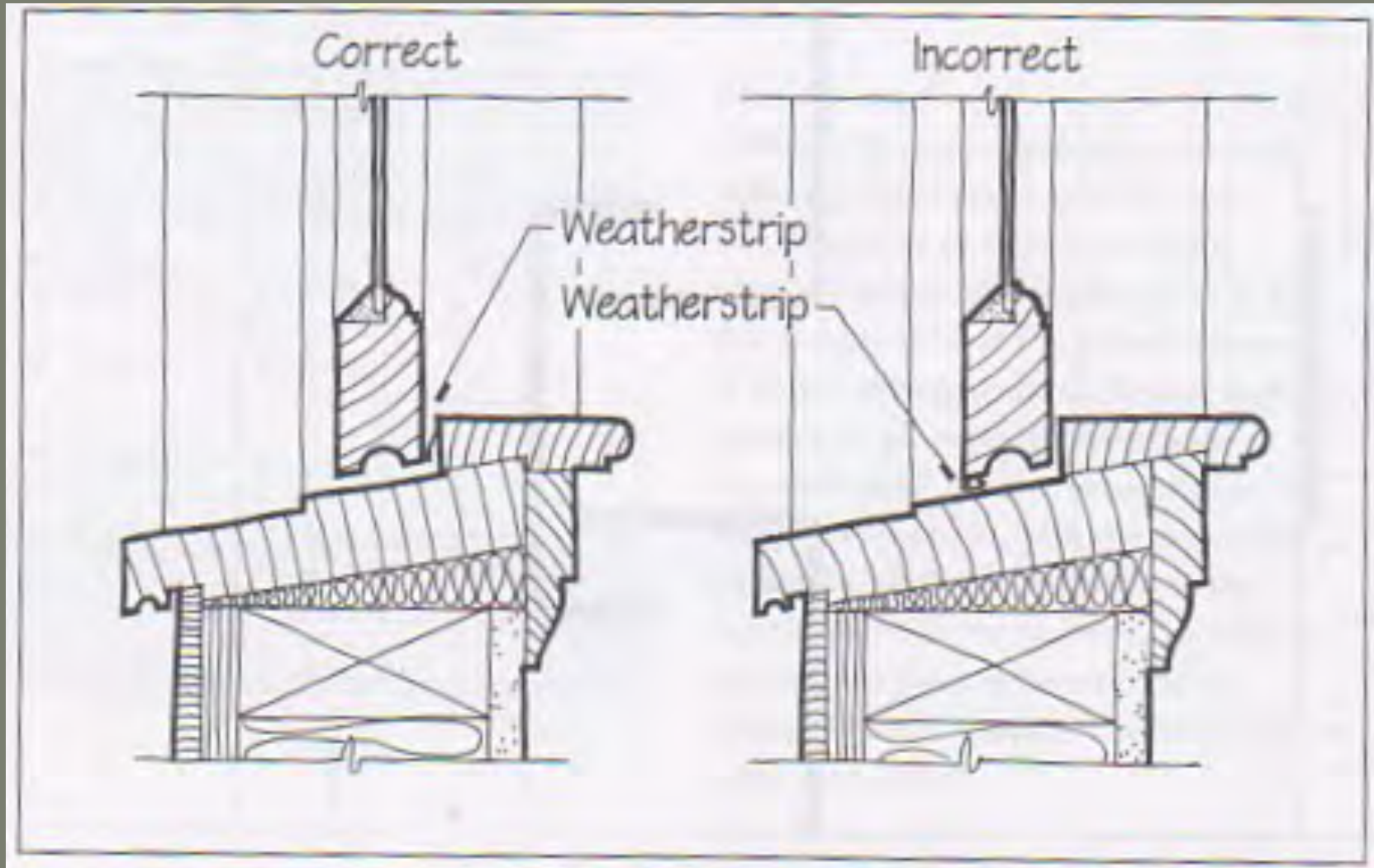
Rainscreen:

Equalizes the Pressure at Exterior and Interior Faces of Curtain Wall

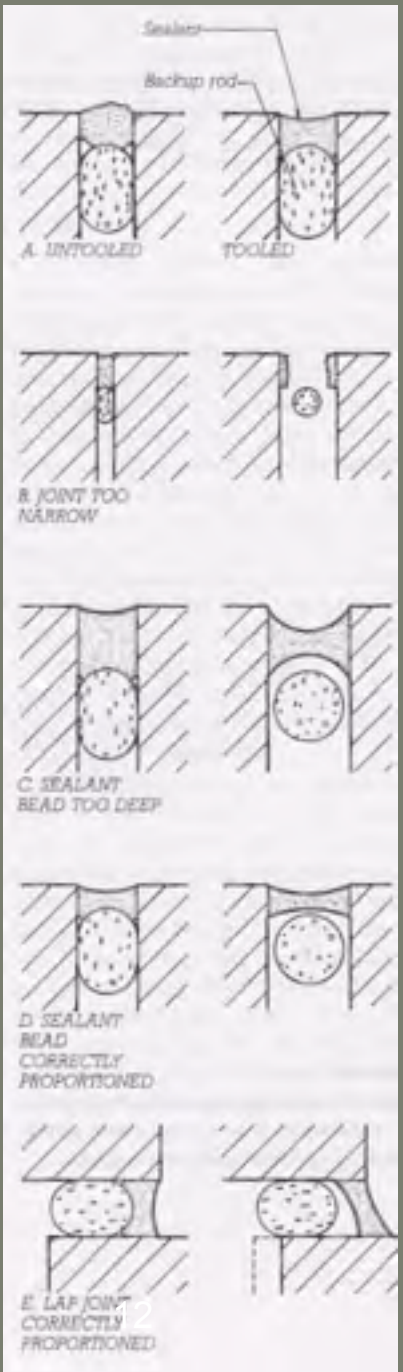
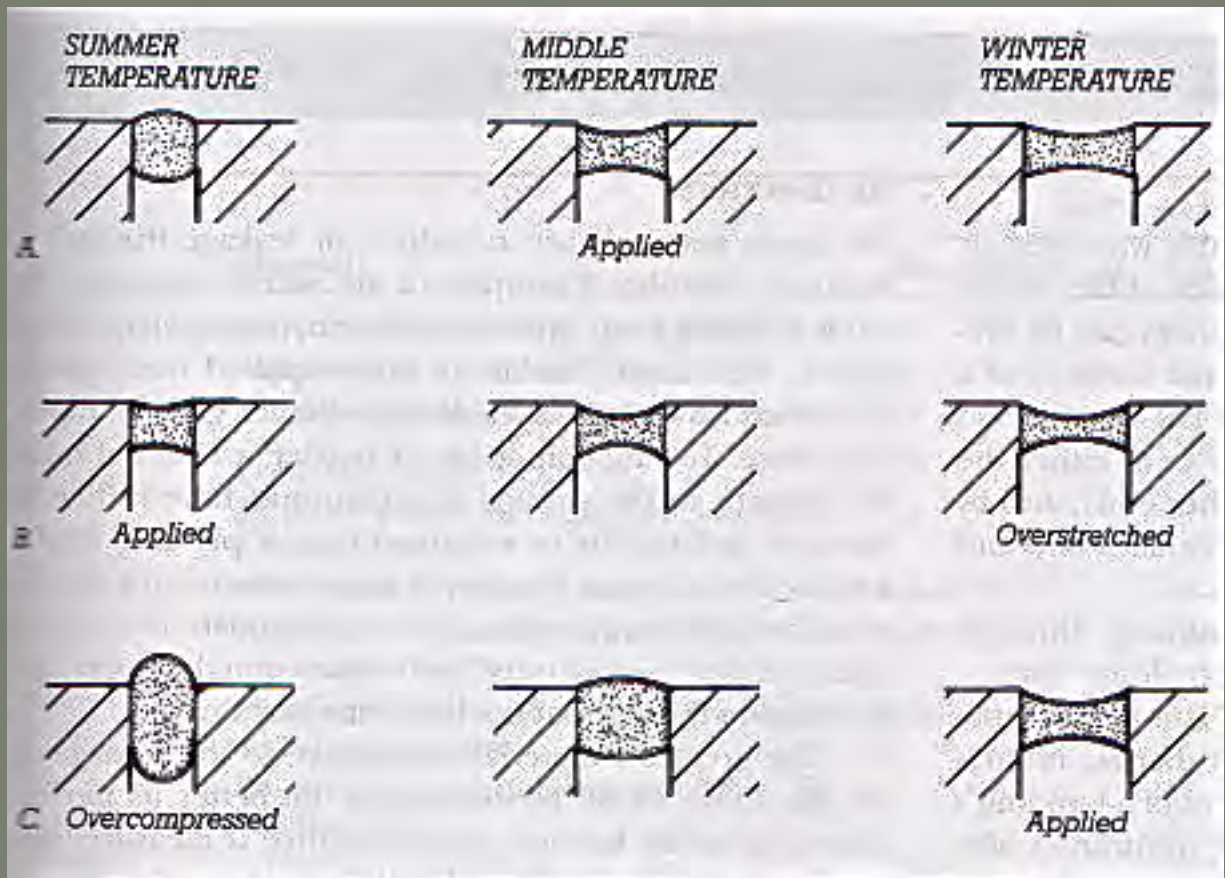
Goal:

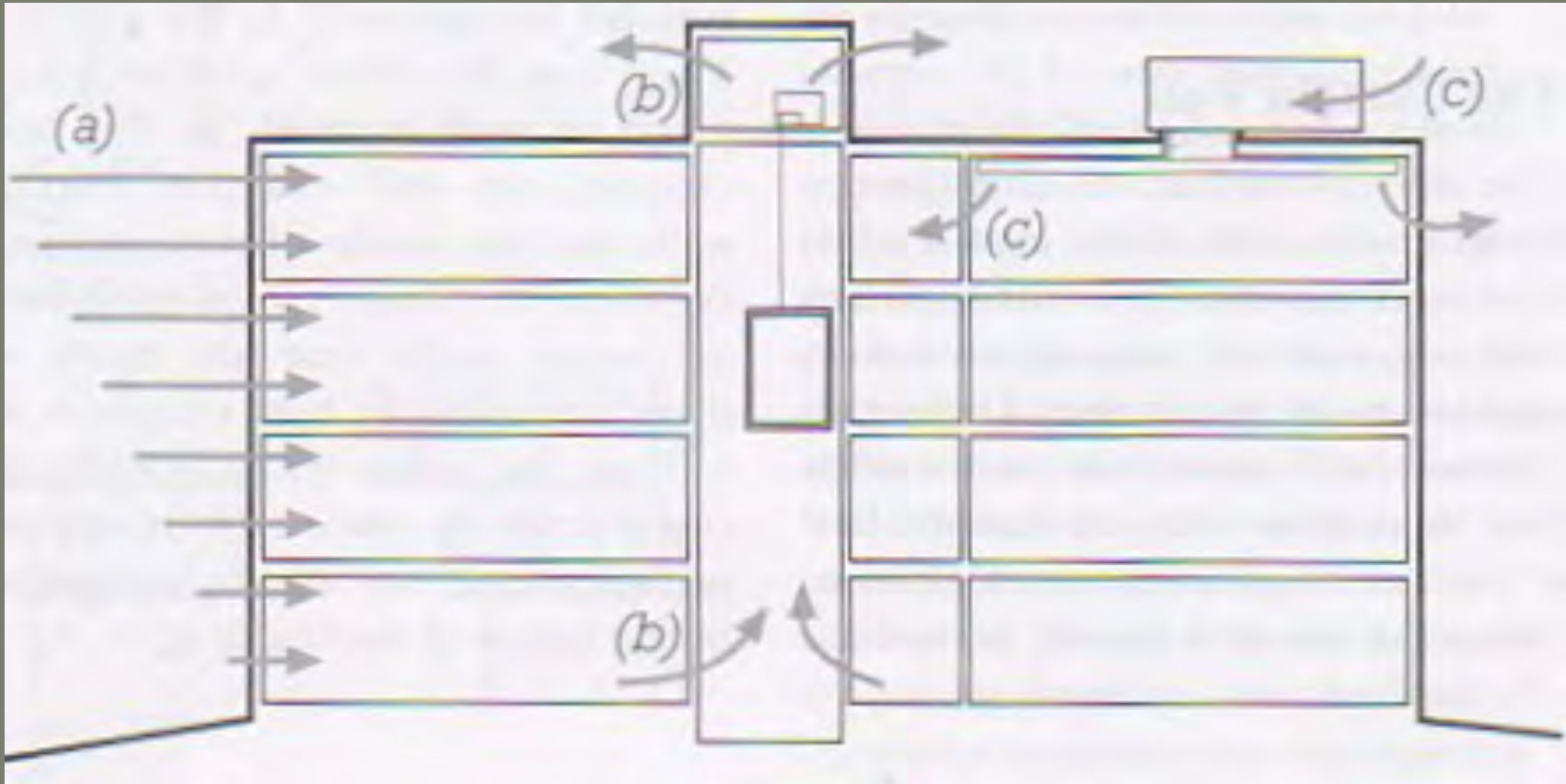
Prevent Water Penetration





Sealant Detail at Typical Window Sill





Wind Pressure and Movement Through the Building

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Fire Safety:

Sealing the
Gap between
the Curtain
Wall and the
Floor Slab

(Prevent flame
spread floor to
floor)



Designing Exterior Wall Systems with Masonry & Concrete (Chapters 20)

Cladding

Masonry Veneer Curtain Walls

Prefabricated Brick Panel Curtain Walls

Stone Curtain Walls:

Stone Panels on Steel Subframe

Monolithic Stone Cladding Panels

Stone Cladding on Steel Trusses

Post tensioned Limestone Spandrel Panels

Thin Stone Facings



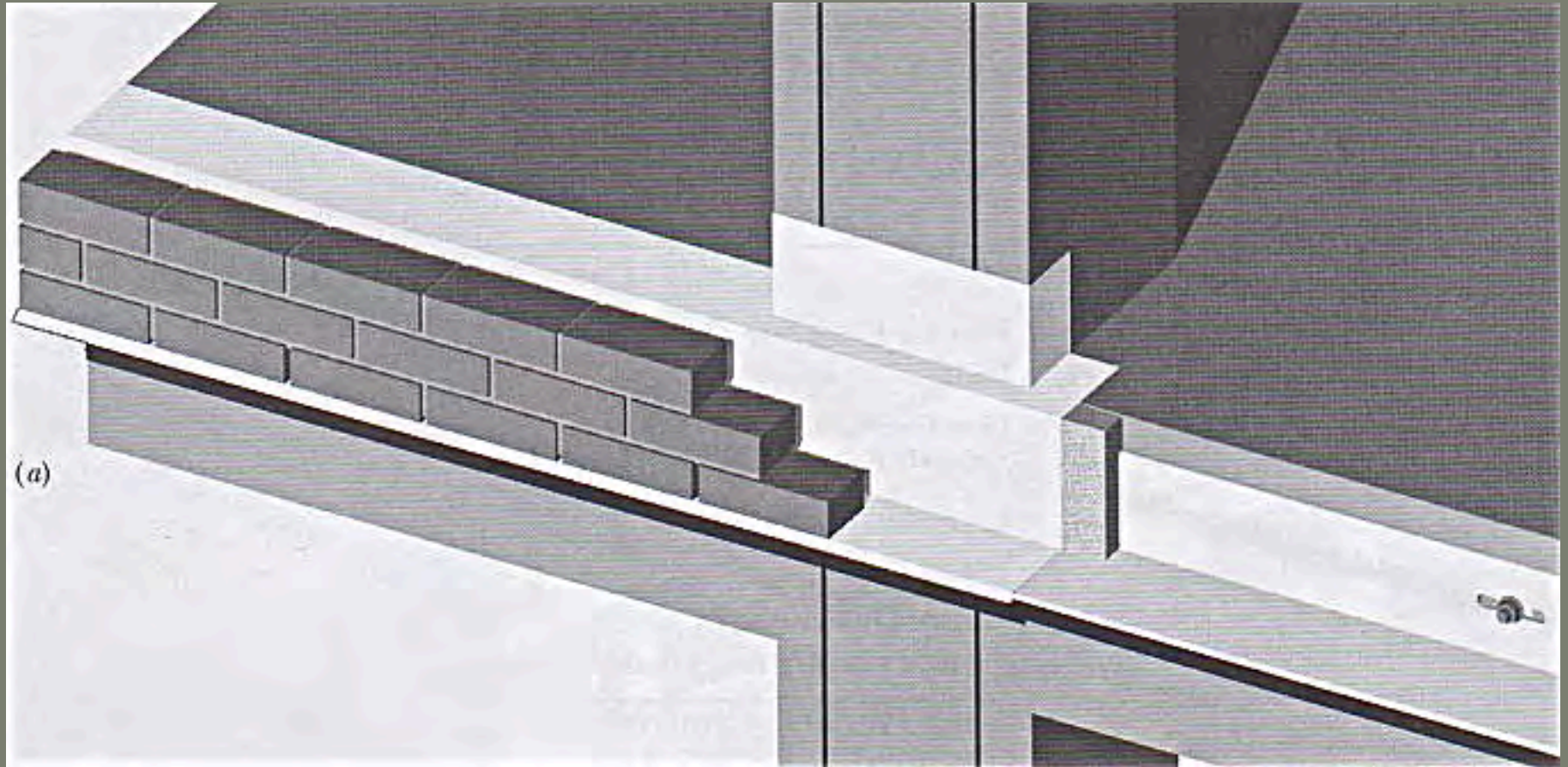
Designing Exterior Wall Systems with Masonry & Concrete (Chapters 20)

Cladding

Precast Concrete Curtain Walls

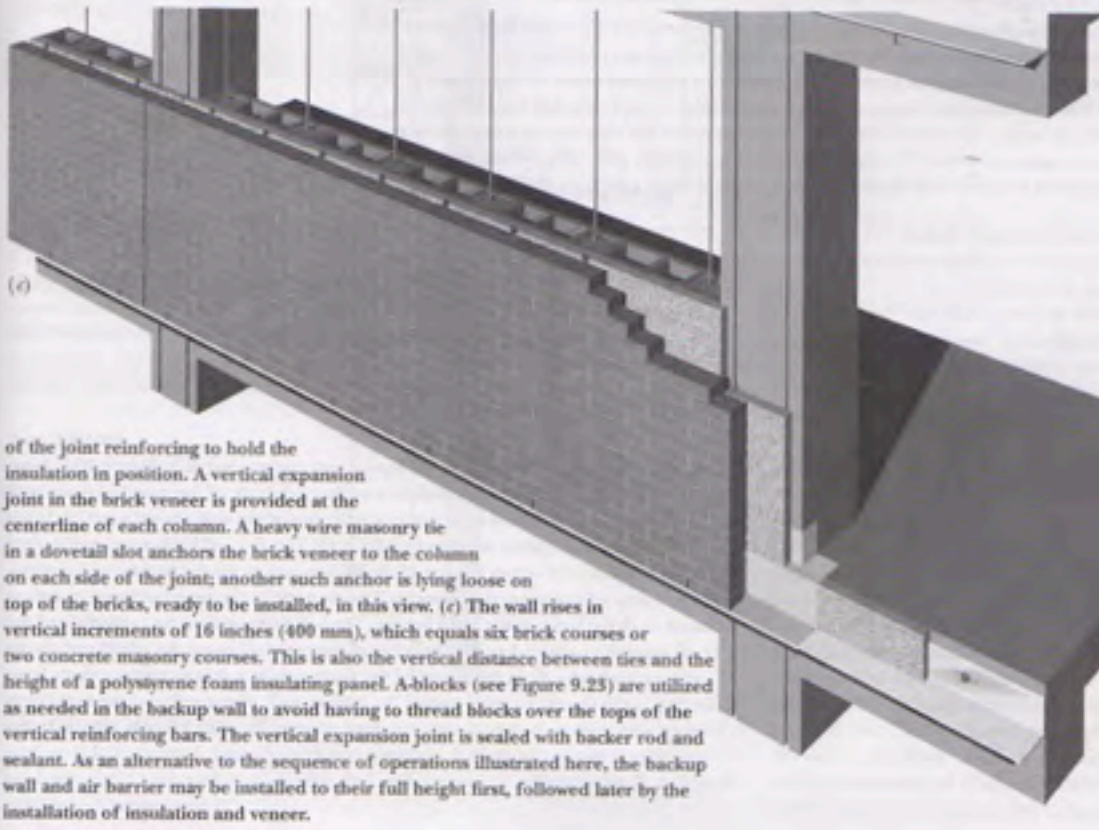
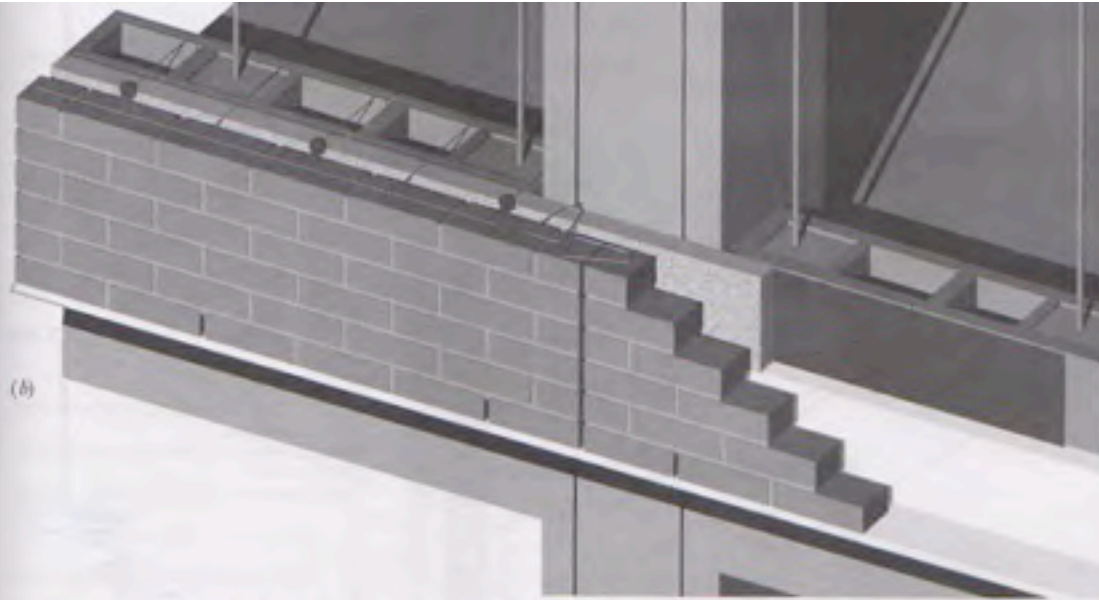
Glass Fiber Reinforced Concrete Curtain Walls

Exterior Insulation and Finish System (EIFS)



Masonry Veneer Curtain Wall Construction

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of the joint reinforcing to hold the insulation in position. A vertical expansion joint in the brick veneer is provided at the centerline of each column. A heavy wire masonry tie in a dovetail slot anchors the brick veneer to the column on each side of the joint; another such anchor is lying loose on top of the bricks, ready to be installed, in this view. (c) The wall rises in vertical increments of 16 inches (400 mm), which equals six brick courses or two concrete masonry courses. This is also the vertical distance between ties and the height of a polystyrene foam insulating panel. A-blocks (see Figure 9.25) are utilized as needed in the backup wall to avoid having to thread blocks over the tops of the vertical reinforcing bars. The vertical expansion joint is sealed with backer rod and sealant. As an alternative to the sequence of operations illustrated here, the backup wall and air barrier may be installed to their full height first, followed later by the installation of insulation and veneer.

Example:

Columbia School
of Social Work

Steel Frame with
Brick Masonry
Veneer Curtain
Wall

on CMU backup



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Example:

Columbia School
of Social Work

Steel Frame with
Brick Masonry
Veneer Curtain
Wall

on CMU backup

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Example:

Steel Frame

Precast Floor
Slab

CMU backup



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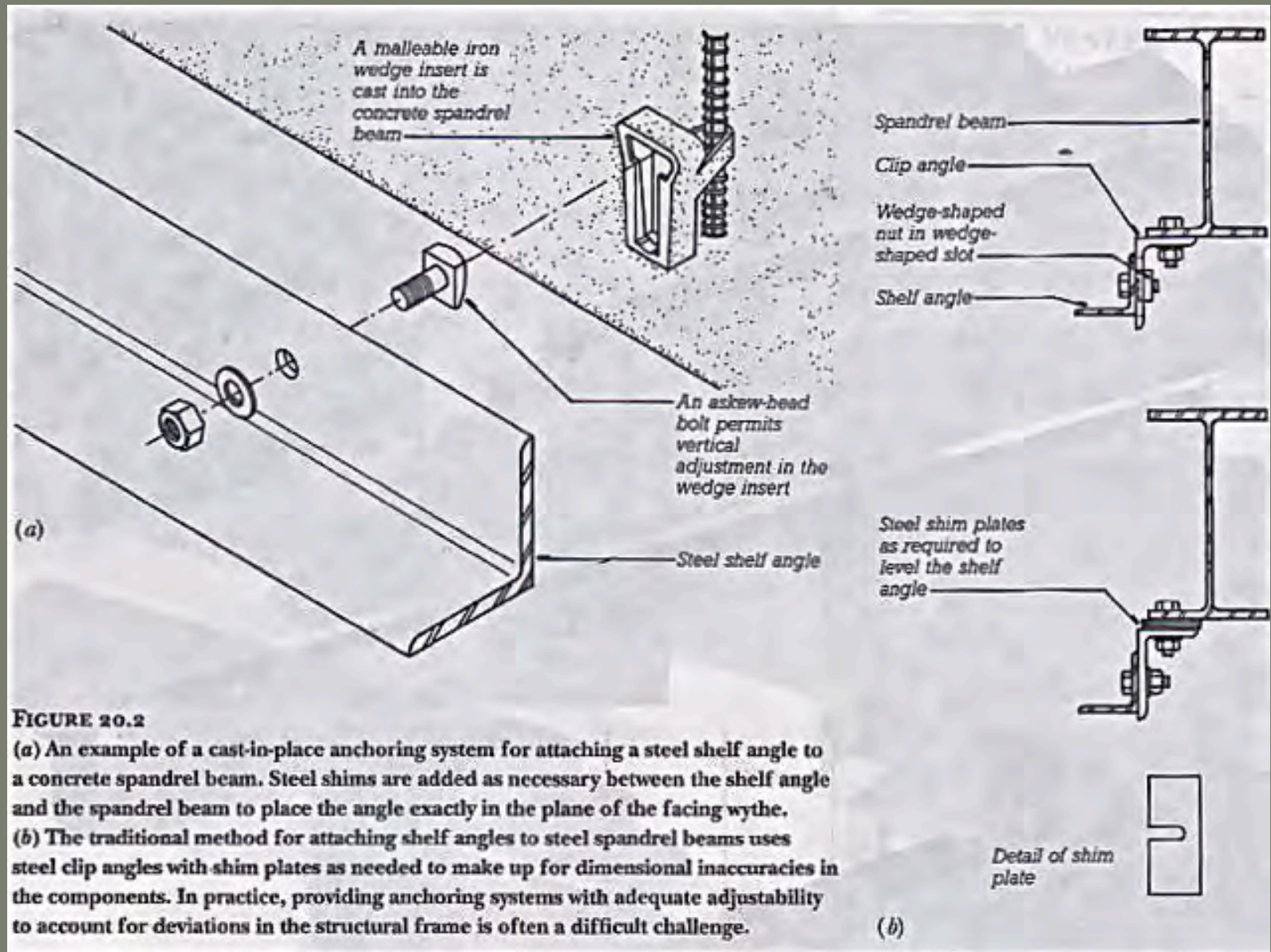


FIGURE 20.2

(a) An example of a cast-in-place anchoring system for attaching a steel shelf angle to a concrete spandrel beam. Steel shims are added as necessary between the shelf angle and the spandrel beam to place the angle exactly in the plane of the facing wythe.
 (b) The traditional method for attaching shelf angles to steel spandrel beams uses steel clip angles with shim plates as needed to make up for dimensional inaccuracies in the components. In practice, providing anchoring systems with adequate adjustability to account for deviations in the structural frame is often a difficult challenge.

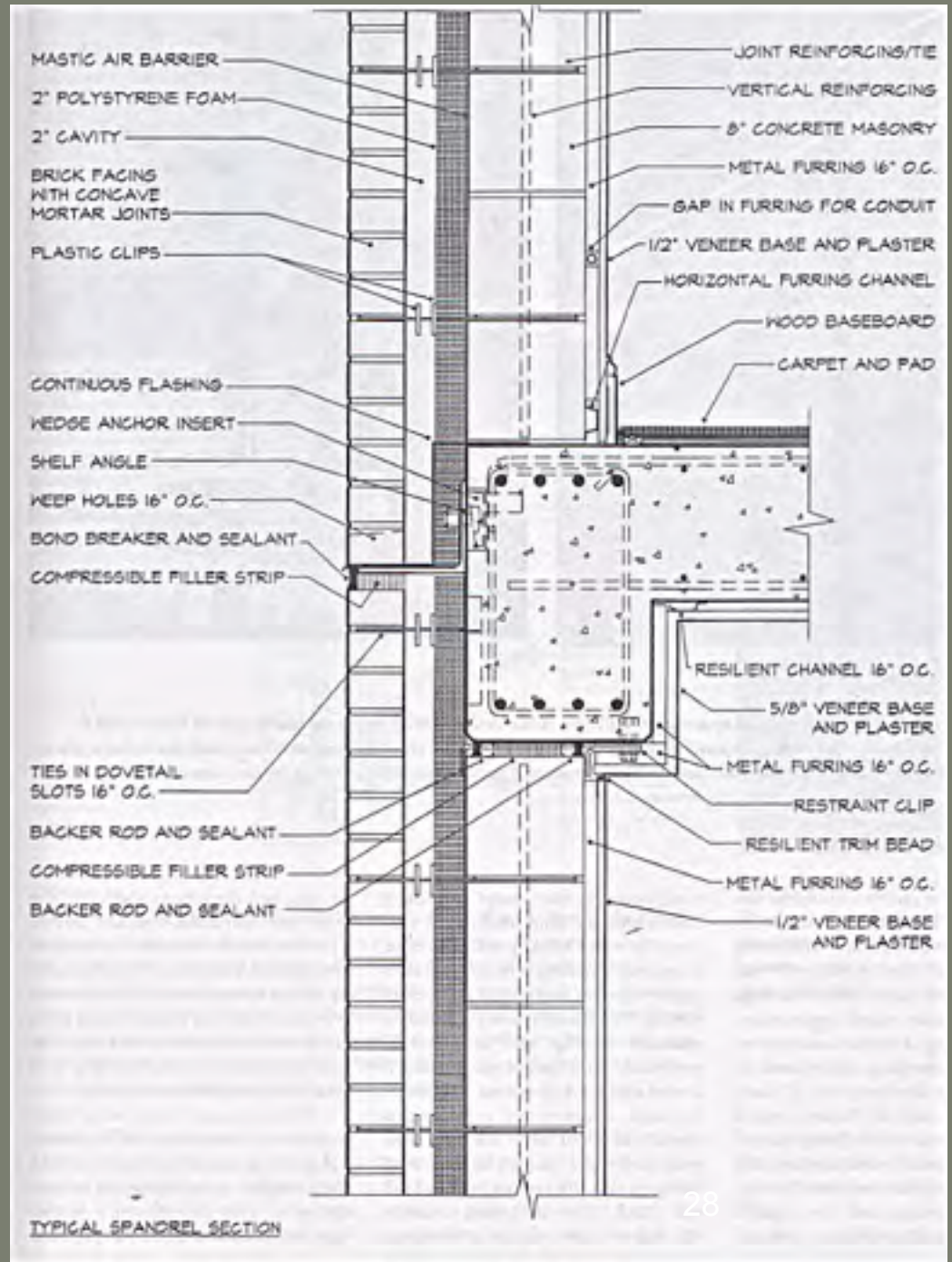
Adjustable Attachments for Masonry Veneer

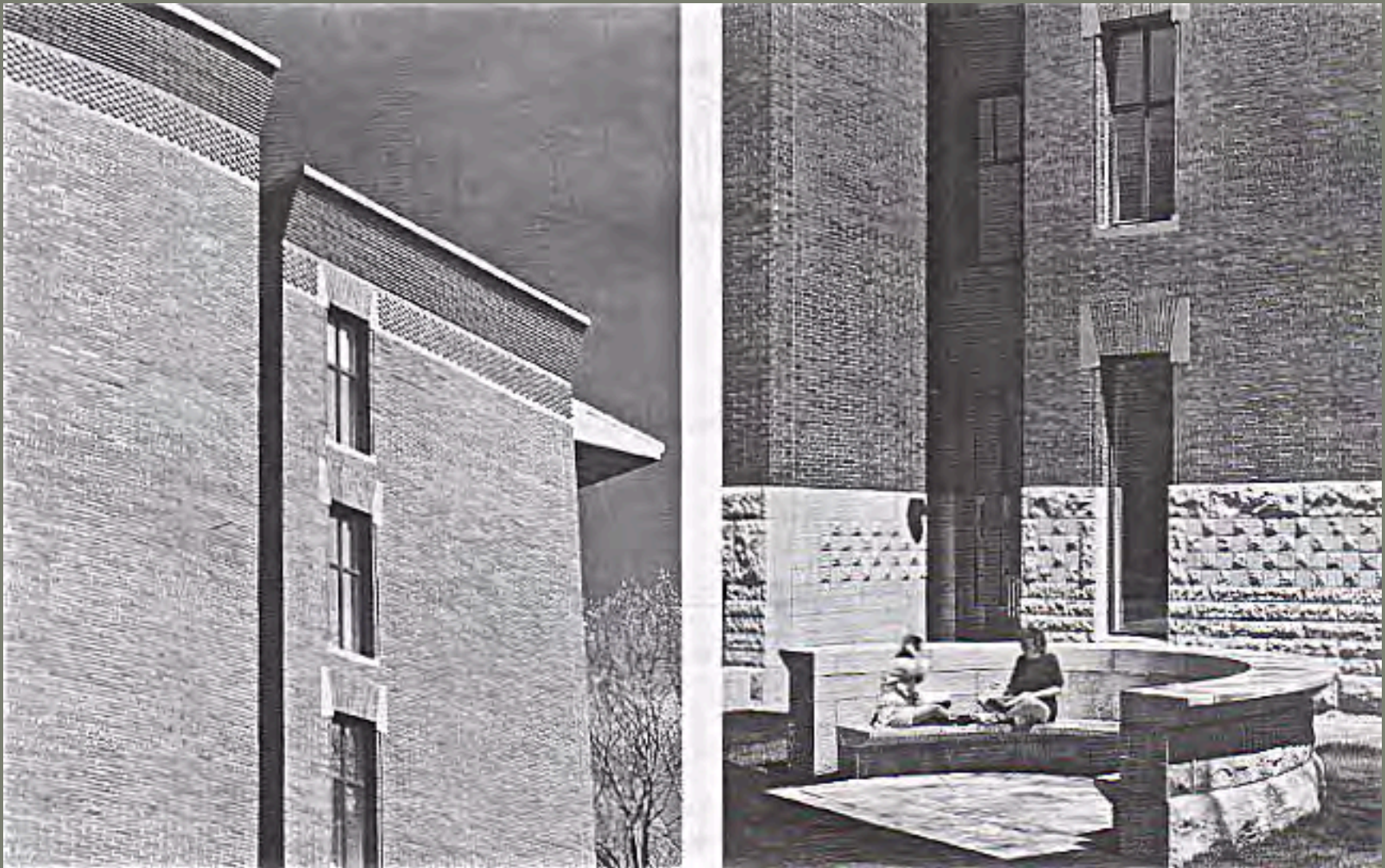
Concrete Frame

Brick Masonry
Veneer Curtain
Wall

on CMU backup

Rigid Insulation
in the Cavity





Disguising a Brick Veneer Curtain Wall

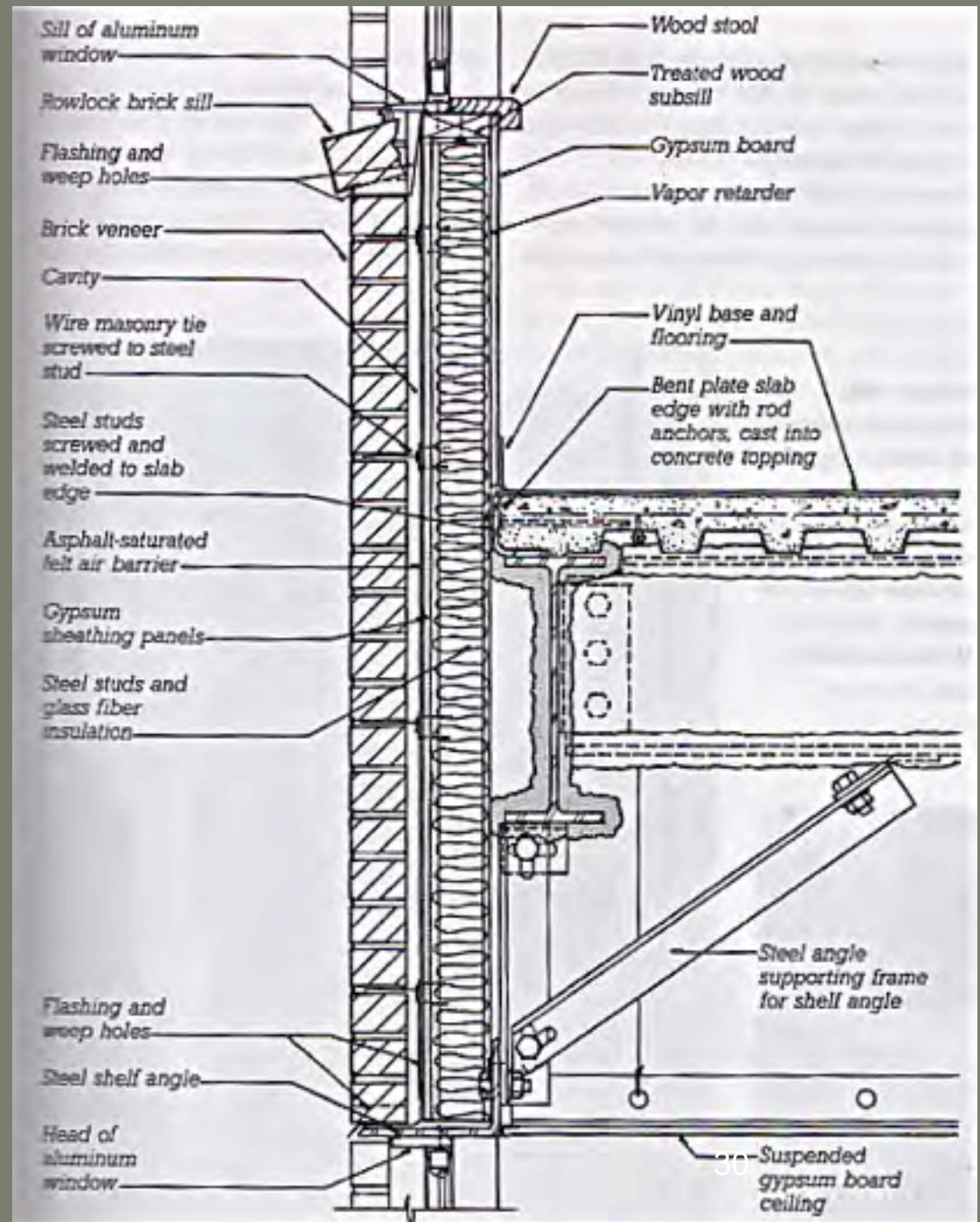
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Steel Frame

Brick Masonry
Veneer Curtain
Wall

on Steel Stud
backup

Batt Insulation b/
w Studs



Pre-Fabricated Brick Veneer Panels with Steel Armature

FIGURE 20.7

Fabrication and installation of a brick panel curtain wall.

(a) Masons construct the panels in a factory, using conventional bricks and mortar. Both horizontal and vertical reinforcing are used, the vertical bars being grouted into the hollow cores of the bricks. (b) Brick panels are stored to await shipment, complete with thermal insulation. The welded metal brackets are for attachment to the building; the structural strength of the panel comes primarily from the reinforced masonry, not the brackets. (c) A crane lifts a parapet panel to its final position. (d) Corners can be constructed as single panels. (Panelized masonry by Vit-O-Vitz Masonry Systems, Inc., Brunswick, Ohio)



(a)



(b)

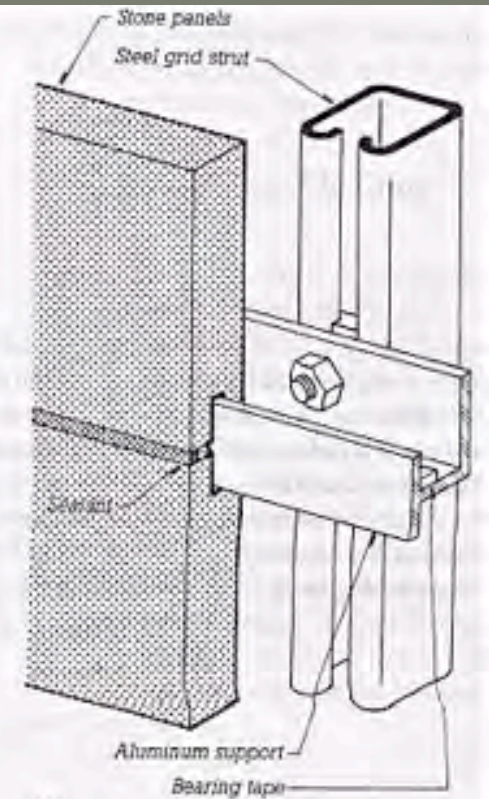
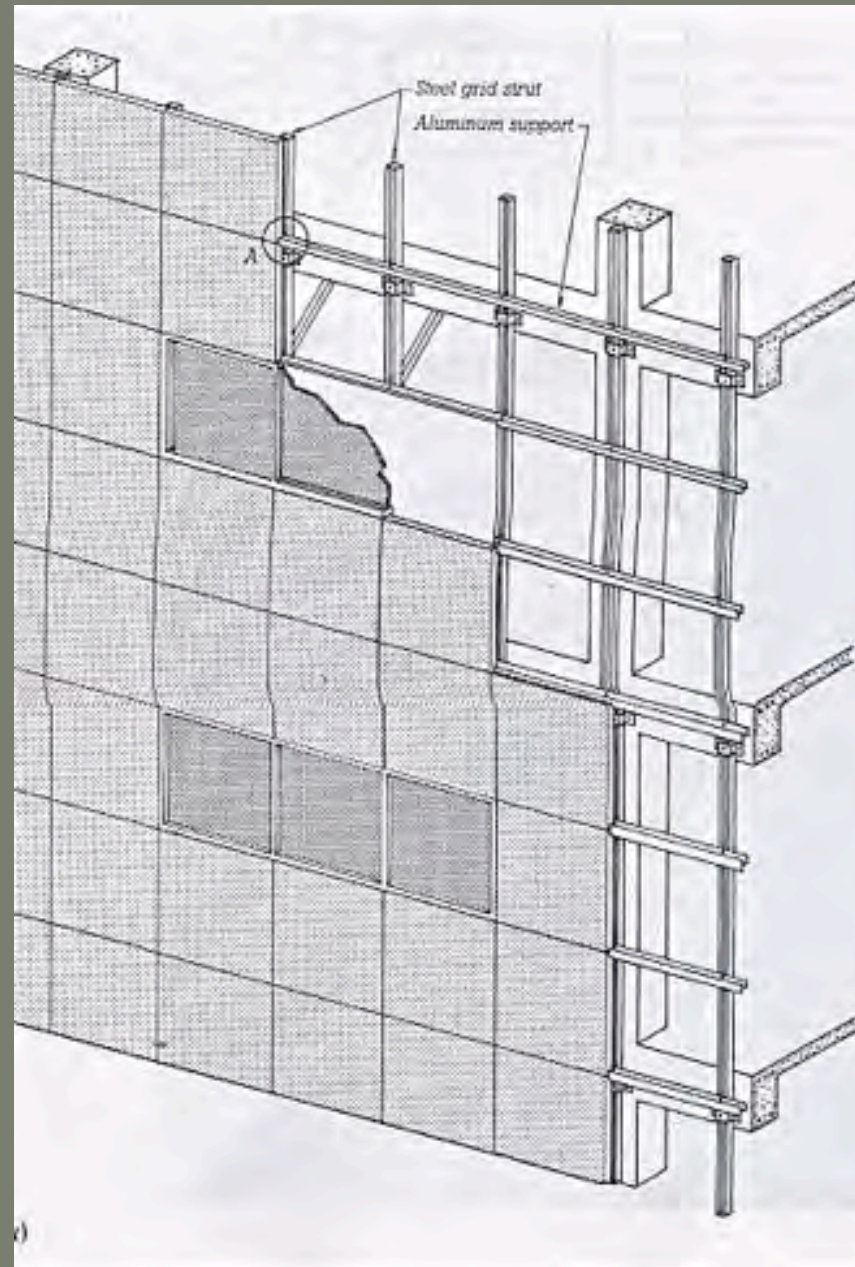


(c)



(d)

Stone Curtain Wall

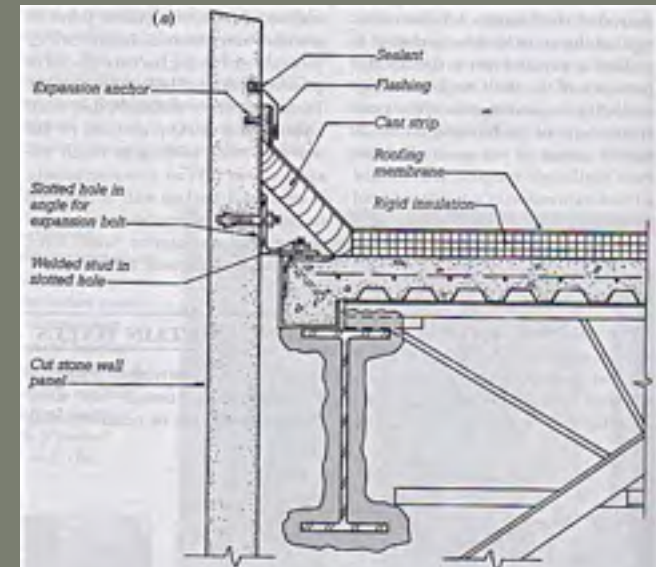
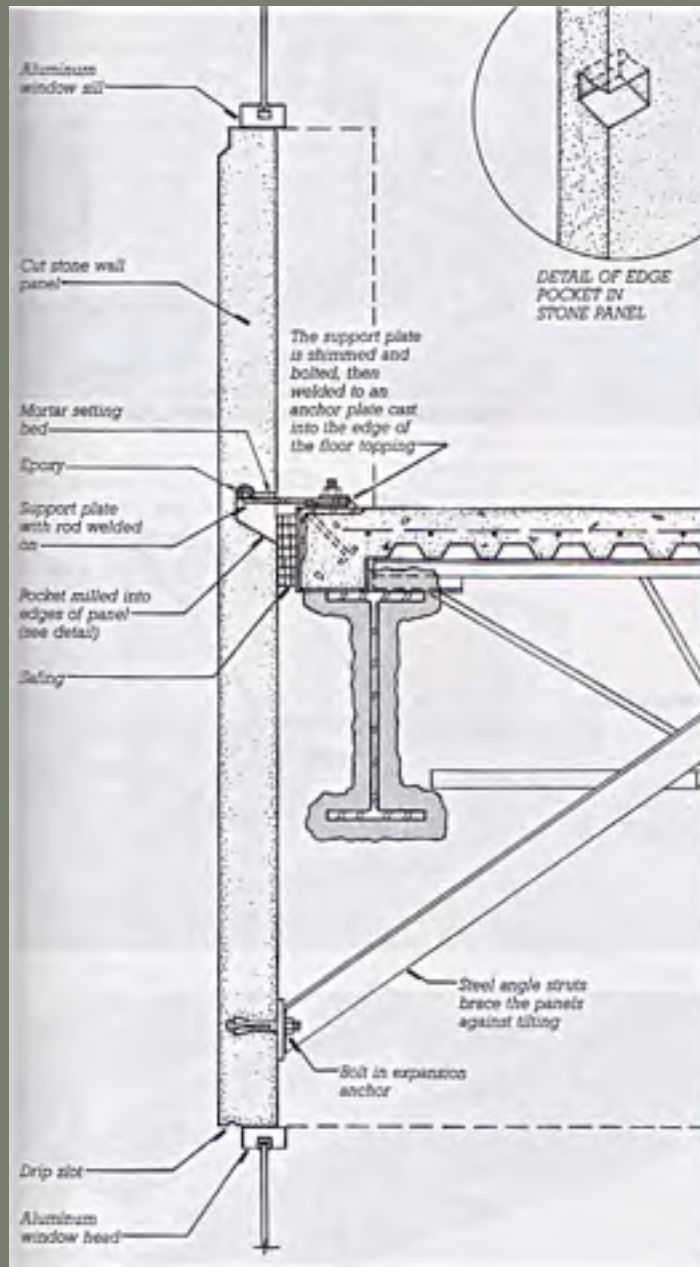


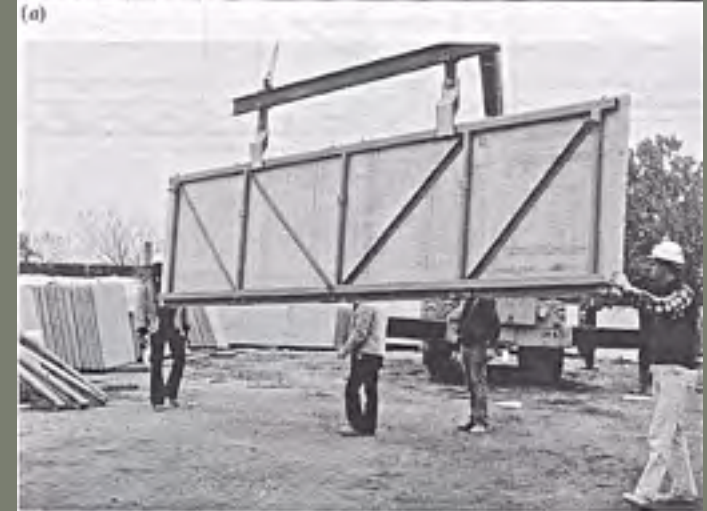
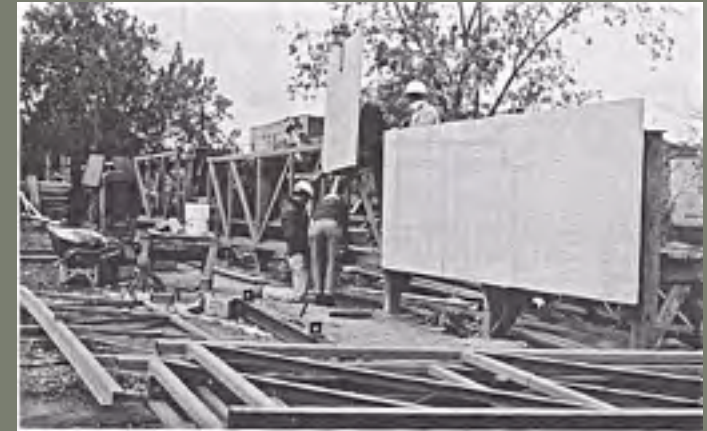
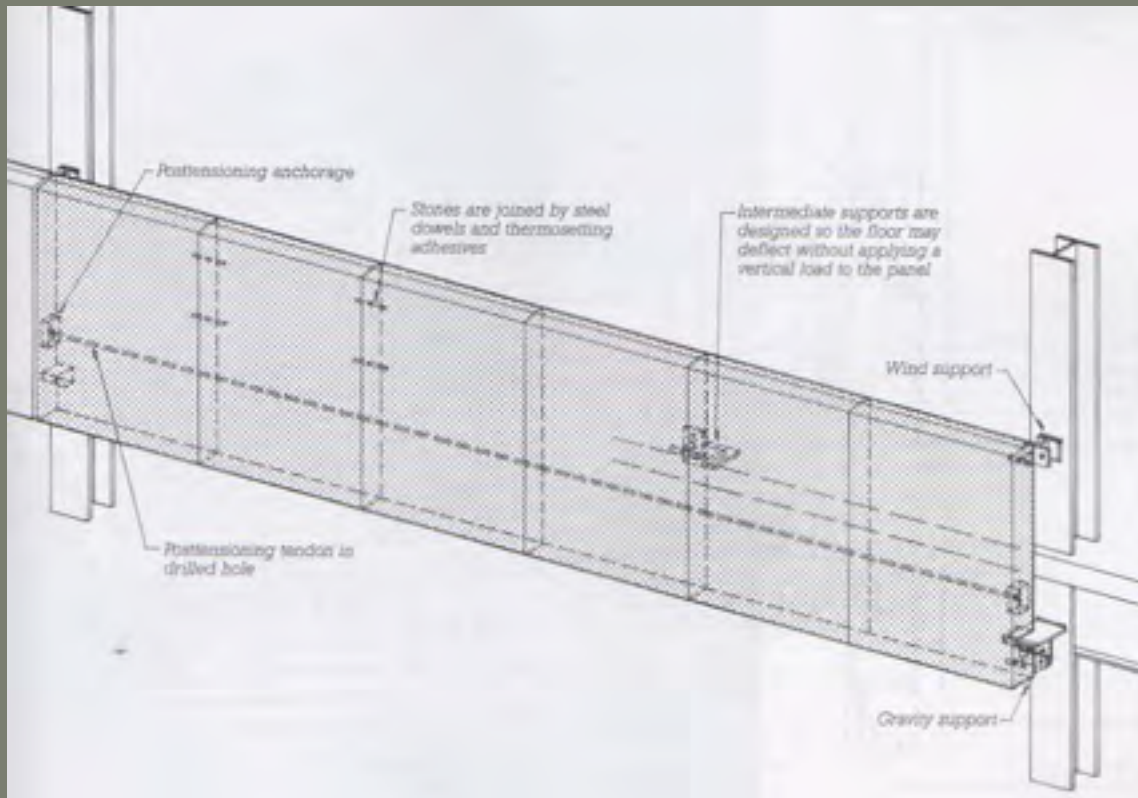
(b)

FIGURE 20.8

A subframe of vertical steel struts supports a facing of stone panels by means of horizontal metal clips that engage slots in the upper and lower edges of the panels. In order to avoid corrosion and staining problems, the steel struts should be galvanized, and the clips should be made of a nonferrous metal (aluminum or stainless steel) that is chemically compatible with the type of stone that is used.

Stone Curtain Wall



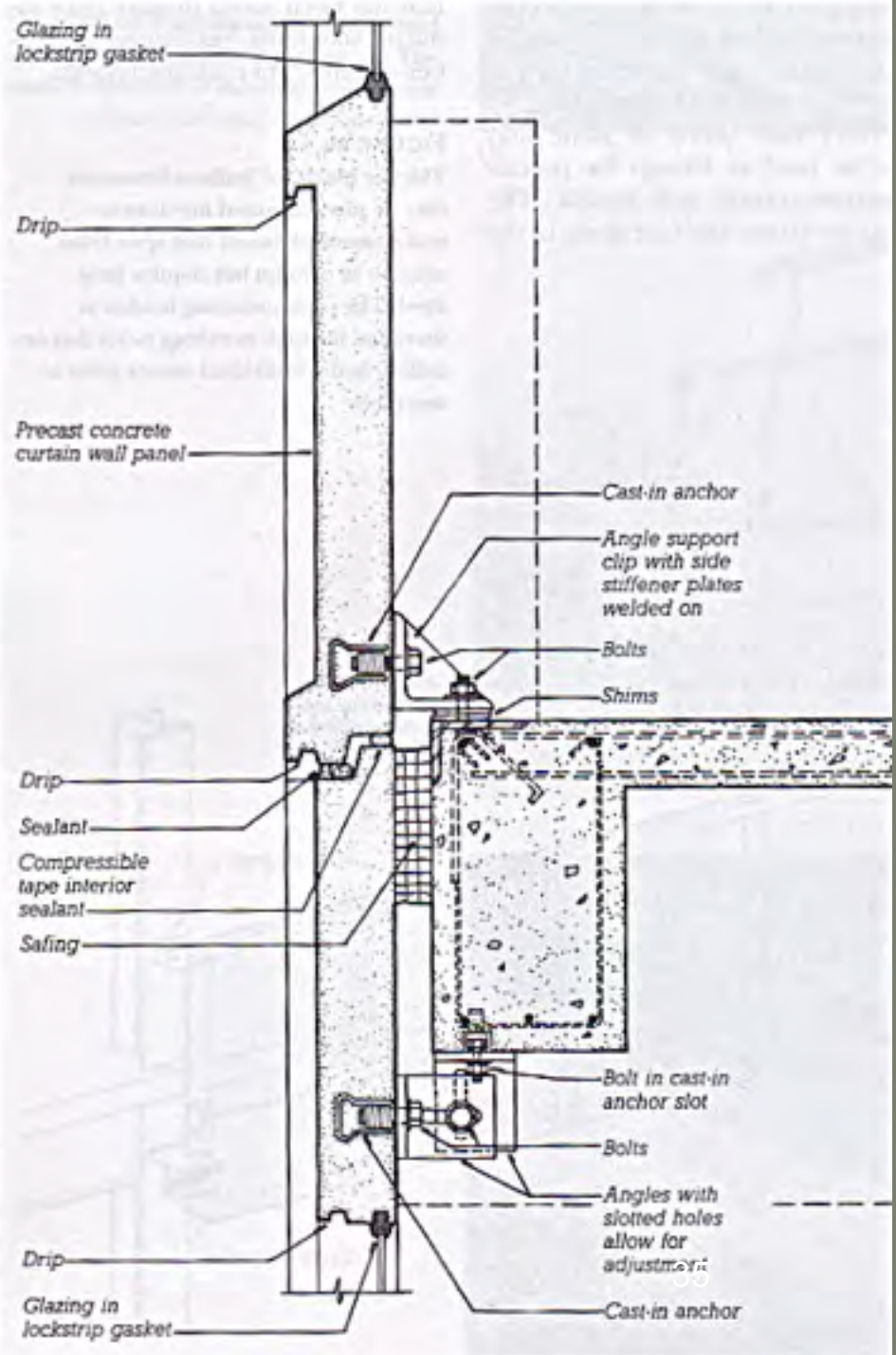


Post-tensioned Stone Spandrel Panel

Concrete Frame

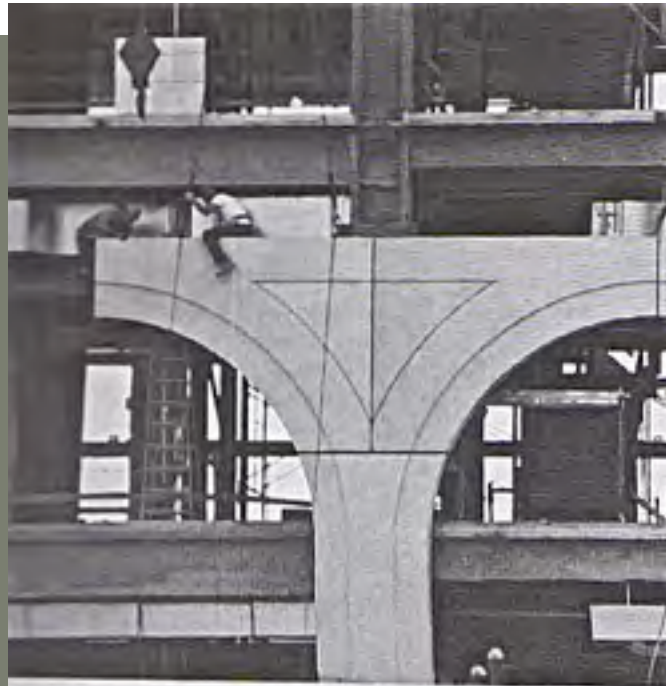
Precast Concrete Veneer Curtain Wall

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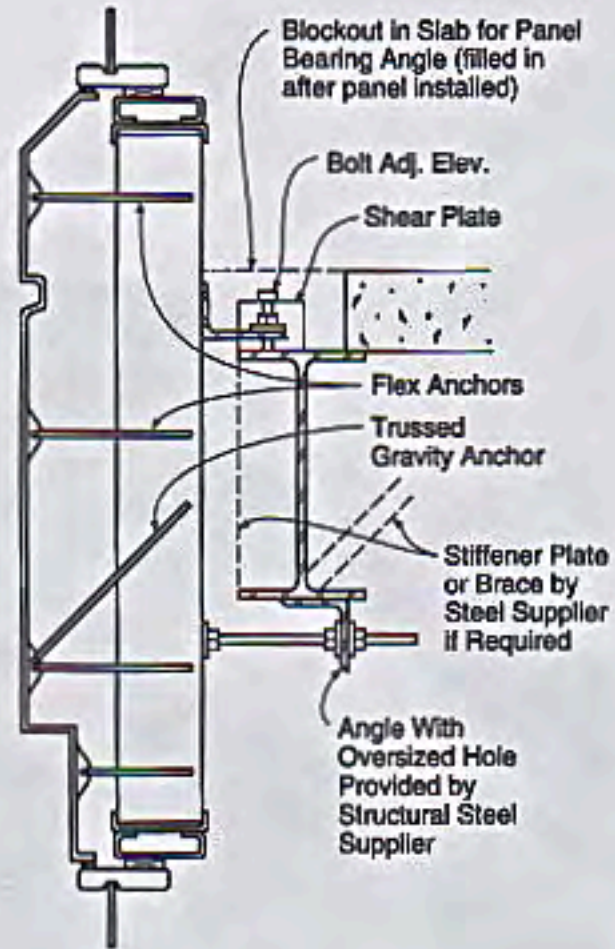
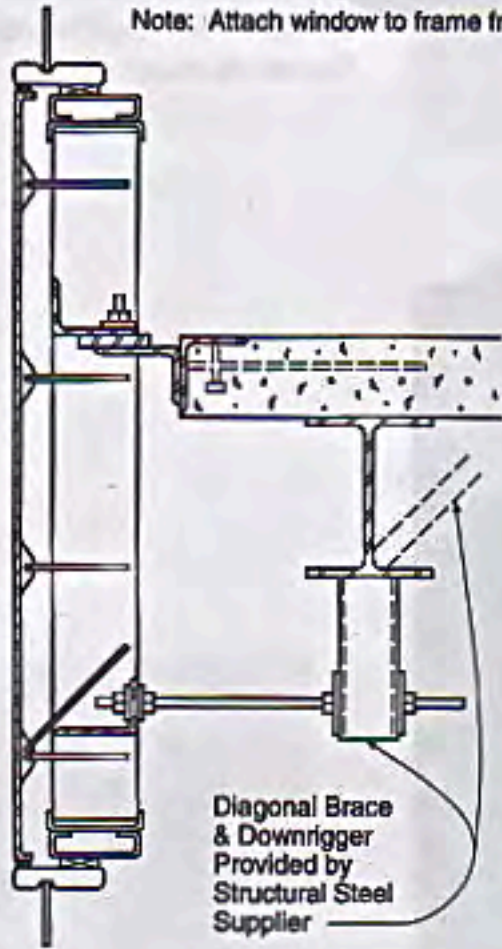
Steel Frame

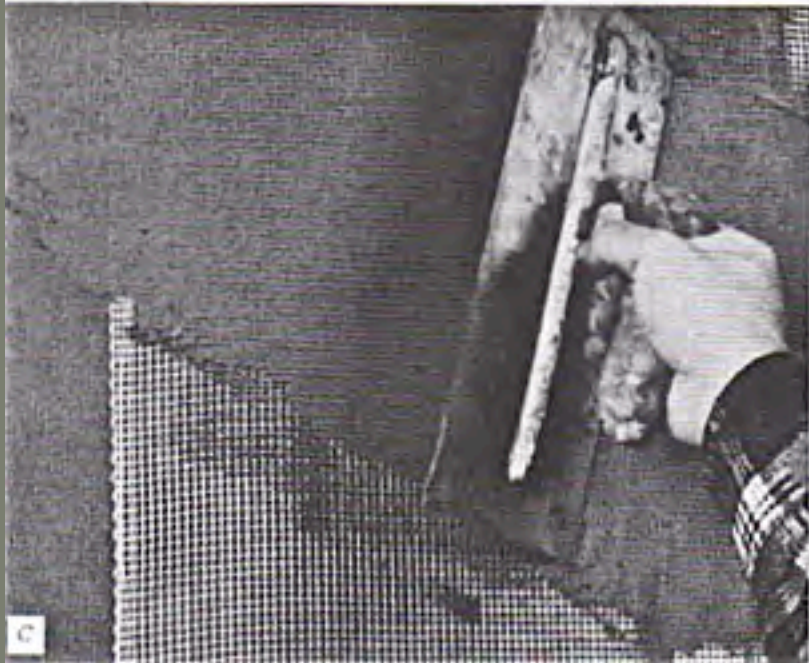
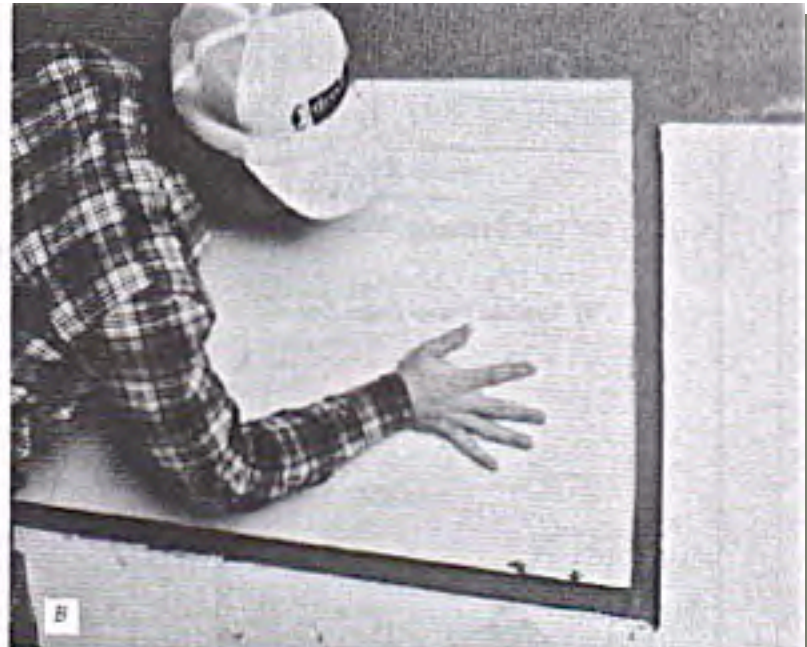
Precast
Concrete
Veneer Curtain
Wall



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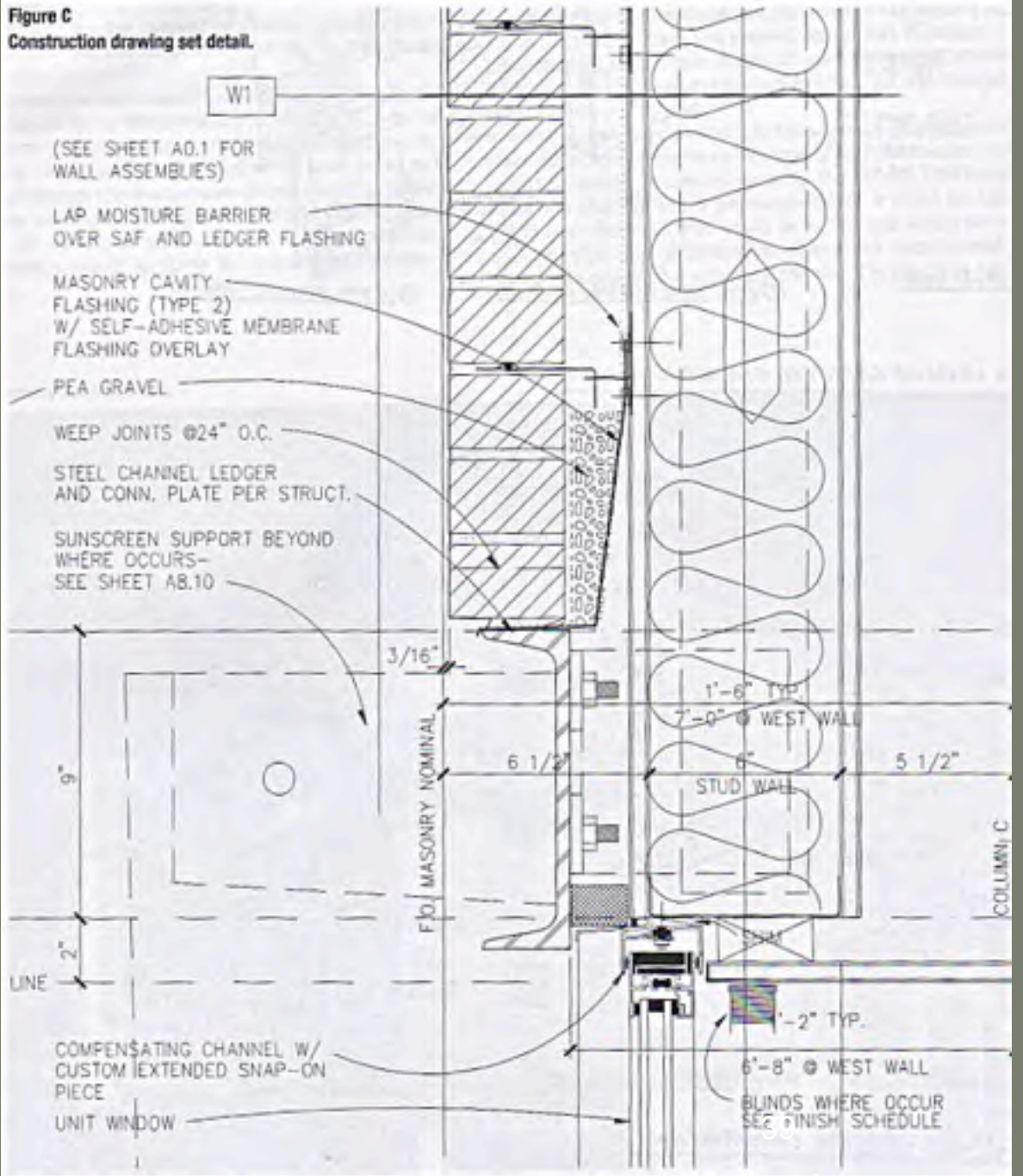
Note: Attach window to frame free of skin





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Figure C
Construction drawing set detail.





Summary:

Exterior Wall as Protective Barrier

Exterior Wall as Fragile System

Exterior Wall as Primary Aesthetic
Element