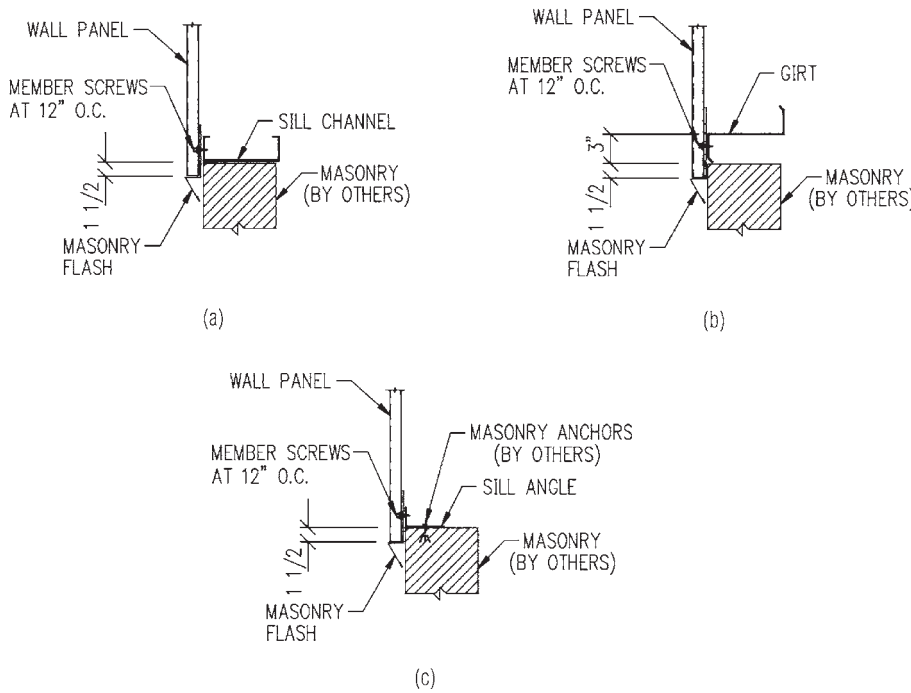

FIGURE 7.33 Details at top of partial-height masonry wall: (*a*) with sill channel; (*b*) with base girt; (*c*) with sill angle. (*Metallic Building Systems.*)

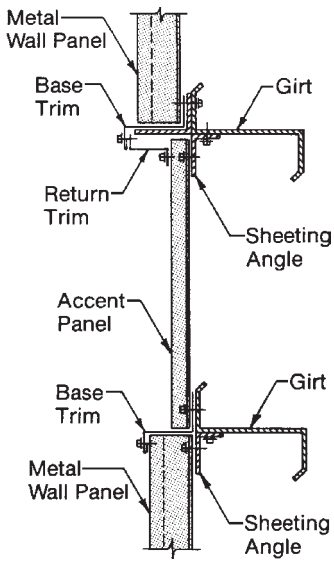

FIGURE 7.34 Detail of accent band. (*Star Building Systems.*)

Designers increasingly opt to give the panels an exposed-aggregate finish. ACI 533R, *Guide for Precast Concrete Wall Panels,* by the American Concrete Institute[23] differentiates among light, medium, and deep aggregate exposure for a variety of visual effects. The architect's arsenal of surface treatments for precast concrete also includes form liners, which can produce finishes ranging from wood board to split-face masonry, and the use of white and pigmented cements.

Structural design of precast concrete is governed by ACI 318[24] and is similar to cast-in-place concrete except as specified in ACI 533R. Typically, concrete with a 28-day compressive strength of 5000 psi or higher is specified for durability. The reinforcement may consist of deformed bars, welded wire fabric, or prestressing tendons; epoxy coating or galvanizing is common to safeguard against corrosion.

A typical loadbearing panel spans the distance from the foundation to the roof. The bottom connection is made by welding embedded plates in the panel to those in the foundation, with any voids grouted and sealed. The top connection, which supports roof purlins, is made by field welding of clip angles to embedded plates (Fig. 7.17). Panel joints are handled in a similar manner.

The minimum thickness of conventionally reinforced precast panels ranges between one-twentieth and one-fortieth of the unsupported length.

Non-loadbearing precast panels can be laterally braced by heavy wall girts at their tops. Although reinforced concrete exhibits a larger degree of ductility than masonry, careful consideration of the required girt and frame stiffnesses is required, especially if the bottom panel connection is close to fixity. If the bot-

FIGURE 7.35 Precast wall panels add depth to the façade. (*Photo: Maguire Group Inc.*)

tom connection is pinned, the forces acting on the girt can be found by the straightforward procedure outlined in Example 7.1. The girt design could follow Example 7.2.

One manufacturer's detail of the top girt connection can be seen in Fig. 7.36. In this detail, the girt is attached to the plates embedded into the panels by means of H-shaped welded clips. This very schematic detail does not elaborate on how the bracket is welded to the girt and the plate, how (and if) the roof diaphragm is attached to the precast panel, and how the girt flanges are braced. Some of this information is shown in Fig. 7.23.

Design and detailing of precast concrete panels is a rather specialized field; it is best performed by the panel suppliers. Still, the information necessary to communicate the design intent should be specified in the contract documents. The extent of this information varies widely among design firms: at some, every panel is designed and detailed by the architect-engineer; at others, only the panel layout is shown on the building elevation drawings. One common approach is to have a typical panel designed and detailed in-house, the design including the panel thickness, joint size, and a general method of attachment. The rest could be left to the precaster, who should be required to submit complete shop drawings and calculations, including structural analysis for handling, transportation, and thermal stresses.

Architects are frequently concerned with acceptability of panel finishes and with casting or installation tolerances. The specifiers would be wise to review the relevant provisions of ACI 533R and *PCI Design Handbook*[25] and to be familiar with realistic visual and dimensional variations of plant-produced panels.

7.7.2 Tilt-Up Panels

While precast concrete is shop-formed and transported to the site, tilt-up panels are often cast right on top of the building's slab-on-grade. After a week's curing, panels are "tilted up"—lifted by a crane into proper locations—and braced. "Tilting up" normally occurs prior to erection of pre-engineered framing to avoid interference with the steel.