4.5.10 Connection Details

This section shows typical details for some of the more commonly used connections for cladding panels and loadbearing precast concrete walls, as well as other connections that may be useful in special applications. The details included are not exhaustive. They should not be considered as "standard," but rather, as concepts on which to build. Detailed design information, such as component sizes, weld and anchorage lengths, joint sizes, and bearing pad thicknesses is purposely omitted.

There are many possible combinations of anchors, plates, steel shapes, and bolts to form various connection assemblies. The details and final assemblies selected should be optimized considering design criteria, production and erection methods, tolerances, and economy. Common practice by precast concrete manufacturers in a given area may also influence the final selection of details on a particular project. The connection details are not numbered in any order of preference.

It is not the intent to limit the type of anchorage of any connector to the precast concrete to that shown in the figures. A variety of anchors are shown in Fig. 4.5.65, which are generally interchangeable and must be integrated with the reinforcement. This is an engineering task required for each individual project. The details may sometimes have to be combined to accomplish the intended purposes. For example, Fig. 4.5.15 and Fig. 4.5.17 are often combined, and Fig. 4.5.46 shows how connector anchor loads can be minimized.

All connections must consider tolerances as outlined in Section 4.5.2.3.

The examples shown cover the following broad categories:

Fig. 4.5.15 to 22	Direct bearing	DB 1-8
Fig. 4.5.23 to 28	Eccentric bearing	EB 1-6
Fig. 4.5.29 to 36	Welded tieback	WTB 1-8
Fig. 4.5.37 to 44	Bolted tieback	BTB 1-8
Fig. 4.5.45 to 51	Shear plate	SP 1-7
Fig. 4.5.52 to 55	Panel to panel alignment	PPA 1-4
Fig. 4.5.56 to 61	Column cover	CC 1-6
Fig. 4.5.62	Beam cover	BC 1
Fig. 4.5.63	Soffit hanger	SH 1
Fig. 4.5.64 to 69	Special conditions	SC 1-7
Fig. 4.5.70 to 74	Bearing wall to foundation	BWF 1-5
Fig. 4.5.75 to 77	Slab to bearing wall	SBW 1-3
Fig. 4.5.78	Slab to side wall	SSW 1
Fig. 4.5.79	Wall to wall	WW 1

Bearing (direct and eccentric) connections are intended to transfer vertical loads to the supporting structure or foundation. Bearing should be provided at no more than two points per panel, and at just one level of the structure. Bearing can be either directly in the plane of the panel along the bottom edge, or eccentric using continuous or localized reinforced concrete corbels or haunches, cast-in steel shapes, or attached panel brackets. Transfer of forces perpendicular to the panel is provided by various tieback arrangements. Adjustability in the support system generally necessitates the use of shims, leveling bolts, bearing pads, and oversized or slotted holes.

Direct bearing connections are used primarily for panels resting on foundations or rigid supports where movements are negligible. This includes cases where panels are stacked and self supporting for vertical loads with tieback connections to the structural frame, floor, or roof to resist forces perpendicular to the panel.

Eccentric bearing connections are usually used for cladding panels when movements of the support system are possible. Cladding panels are, by definition, fastened to and/or supported by a structure located in a different plane. Eccentric bearing connectors (corbel or panel bracket) cause permanent bending stresses in the supported panel that must be accommodated. Concrete haunches or corbels also provide a solution for heavy bending within the panel. Bending combined with tension, shear, and torsion may have to be resisted by the connection and, in turn, the structure, depending on the type of connection and load transfer details.

If leveling bolts and shear plates are used, the shear plates are proportioned for all lateral loads (Fig. 4.5.25).

The leveling bolt is usually left in place to carry the vertical load. If shims are used instead of leveling bolts, and lateral loads are to be carried, a weld plate is recommended, because the welding of shim edges is usually unreliable for transmitting significant forces. The erector's individual preference for shims or leveling bolts should be allowed.

Bearing connections are usually, but not always, combined with tiebacks.

Tieback (welded or bolted) connections are primarily intended to keep the precast concrete unit in a plumb position and to resist wind and seismic loads perpendicular to the panel. Welded tiebacks often require temporary bracing during alignment. Tiebacks may be designed to take forces in the plane of the panel, or isolate them to allow frame distortions independent of the panel and allow movement vertically and/or horizontally.

Shear plates are generally welded and serve primarily to provide restraint for longitudinal forces in the plane of the panel. They usually also carry loads perpendicular to the panel, acting as a tieback connection as well. Because seismic force is the most common in-plane force, these plates are sometimes referred to as seismic shear plates. It is, in many cases, uneconomical to carry longitudinal forces on longer panel brackets of eccentric bearing connections because their anchorage loads become very high. In such cases, the shear plate connection is used to reduce the load on the anchors (Fig 4.5.46). Longitudinal force transfer on spandrels, for example, can be accomplished near mid-length of the member to minimize volume change restraint forces that would otherwise be additive to the longitudinal seismic forces.

Panel-to-panel alignment connections are used to adjust precast concrete units' relative positions with respect to adjacent units; they do not usually transfer design loads. Out-of-plane alignment of panels is sometimes necessary, especially if they are very slender and flexible and have warps or bows prior to erection.

Column and beam cover connections are used when precast concrete panels serve as covers over steel or cast-in-place concrete columns and beams. The cover units are generally supported by the structural column or beam and carry no load other than their own weight, wind, and seismic forces. The weight of a column cover section is normally supported at one level. Tieback connections for lateral load transfer and stability occur at multiple levels. Connections must have sufficient adjustability to compensate for tolerances of the structural system. Column cover connections are often difficult to reach, and once made, difficult to adjust. For thin flat units, when access is available, consideration should be given to providing an intermediate connection for lateral support and restraint of bowing. "Blind" connections, made by welding into joints between the precast concrete elements, are sometimes necessary to complete the final enclosure.

Soffit hanger connections can be made by modifying many of the tieback connections previously discussed. If long, flexible hanger elements are used, a lateral brace may be provided for horizontal stability.

Special conditions are presented in Figs. 4.5.64 through 4.5.69. These are suggested to help solve unique or difficult situations.

Bearing wall connections are divided into categories: those that support the bearing wall and floor or roof slabs, and those with (non-supported) edges of floor or roof slab running alongside them. These conditions are not the same as the connection of an architectural panel to the structure like the others in this section. They are included because they often occur in loadbearing wall panel systems. Many of the tieback, shear plate, and panel-to-panel alignment connections in Figs. 4.5.29 to 4.5.45 could be used in bearing walls.

Bearing wall to foundation connections and the direct bearing connections in Figs. 4.5.15 to 4.5.19 are primarily intended to transfer their gravity loads to the panel below or to the foundation, although they can usually carry lateral loads, as well. The connections should provide a means of leveling and aligning the panel. The attachment method should be capable of accepting the base shear in any direction. In cases where an interior core carries lateral loads, this may be accomplished with a simple welded connection.

Slab to bearing wall connections are used to join precast or cast-in-place concrete floor or roof members to precast concrete bearing walls. They transfer any vertical load from the horizontal system and, sometimes, diaphragm action and on rare occasions provide moment resistance.

Blockouts in wall panels or spandrels as in Figs. 4.5.75(e), 4.5.75(f), and 4.5.76 decrease eccentricity and bending in the wall panel. Using blockouts in a spandrel would reduce the torsion stresses and twist during erection. If discontinuous pockets are used, they require substantial draft on their sides ($^1/_2$ in. [13 mm] every 6 in. [150 mm] depth to allow blockout stripping) and should have at least $2^1/_2$ in. (63 mm) cover to the exposed face. More cover (3 in. [75 mm] minimum) is required if the exterior surface has an architectural finish. In the case of a fine textured finish, there may be a light appearing area (the approximate size of the blockout) that shows on the face of the panel due to differential drying. This may be quite noticeable, despite the uniformity of the finish. The initial cure of the $2\ ^1/_2$ to 3 in. (63 to 75 mm) of concrete versus 8 to 9 in. (200 to 225 mm) in the surrounding area will make the difference.

When the slab functions as a diaphragm, the connections must transmit diaphragm shear and chord forces to a structural core, thus reducing the load on individual exterior walls or spandrel units and their connections. When the slab-to-wall connection is accomplished with composite topping, temporary connections or bracing may be necessary during erection.

Most designs result in some degree of fixity for these connections. However, a fully fixed connection is generally not desirable. The degree of fixity can be controlled by a judicious use of bearing pads or weld plates.

Slab-to-side wall connections along the (non-bearing) sides of floor or roof slabs may be required to transmit lateral (diaphragm) loads and should either allow some vertical movement to accommodate camber and deflection changes in the floor units, or be designed to develop forces induced by restraining the units.

Wall-to-wall connections are primarily intended to position and secure the walls, although with proper design and construction, they are capable of carrying lateral loads from shear walls or frame action as well. The two locations of wall-to-wall connections are horizontal joints (usually in combination with floor construction) and vertical joints.

The most practical connection is one that allows realistic tolerances and ensures immediate transfer of load between panels.

Fig. 4.5.15 Direct bearing (DB1).

- Lateral restraint not provided
- Has large tolerance
- Finish joint with drypack or sealant

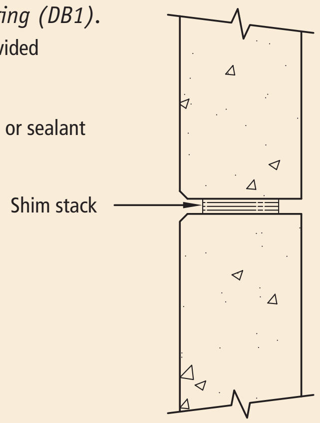


Fig. 4.5.16 Direct bearing (DB2).

- Insert must be jigged plumb
- Allows vertical adjustment without crane
- Finish joint with drypack or sealant
- Bolt head may be welded for tensile or shear capacity
- Plate may be eliminated, but adjustment becomes more difficult
- May be inverted with insert below.

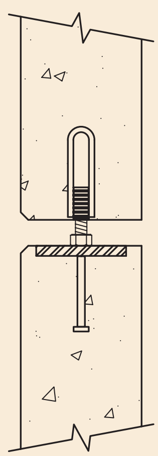


Fig. 4.5.17 Direct bearing (DB3).

- Reasonable tolerance
- Provides lateral restraint
- Realignment not possible after connection complete
- Requires shims until grouting or drypacking is done
- Cold weather may be a problem with grouting or drypacking
- Grout could be injected through tubes, allowing more time for alignment
- Void may be formed or field drilled
- Finish joint with drypack or sealant

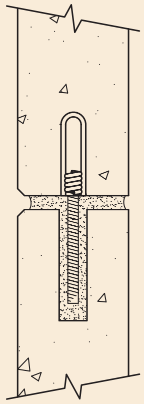


Fig. 4.5.18 Direct bearing (DB4).

- Reasonable tolerance
- Provides lateral restraint
- Realignment not possible after connection complete
- Requires shims until grouting or drypacking is done
- Cold weather may be a problem with grouting or drypacking
- Grout could be injected through tubes, allowing more time for alignment
- Upper void difficult to fill
- Upper void could be continuous or intermittent
- Finish joint with drypack or sealant

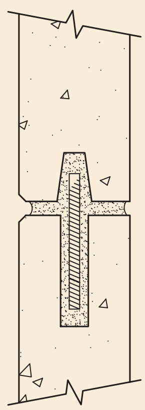


Fig. 4.5.19 Direct bearing (DB5).

- Full strength of bar can be achieved with proprietary grouted sleeve
- Small tolerance requires jigging
- Requires shims until grouting or drypacking is done
- Joint may be drypacked or grouted at same time as sleeve
- Smooth or corrugated sleeve could replace proprietary sleeve for lower capacity
- Finish joint with drypack or sealant
- Sleeve can be in either panel

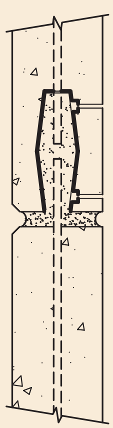


Fig. 4.5.20 Direct bearing (DB6).

- For shaped panels: can eliminate dead load overturn if shims in line with panel center of gravity
- Complex forming, especially if location of haunch changes
- Forming simplified if a bolt-on steel haunch is used

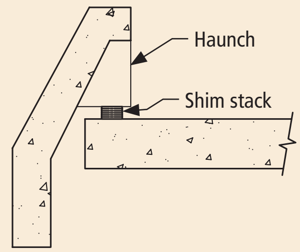


Fig. 4.5.21 Direct bearing (DB7).

- Preferable if column bearing bracket shown on contract drawings and shop-installed
- Cost substantially more if bracket field-installed, which also requires field layout
- Leveling bolt could be used in lieu of shims
- Can be used in pocket farther up panel away from joint

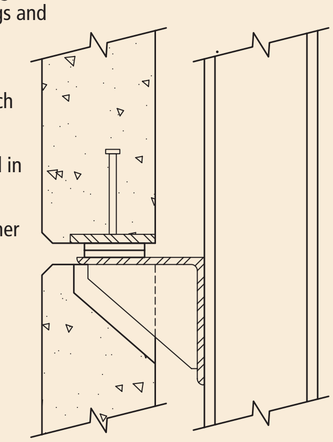


Fig. 4.5.22 Direct bearing (DB8).

- Lateral restraint could be provided by welding bolt head to seat
- Could use threaded insert in lieu of angle assembly

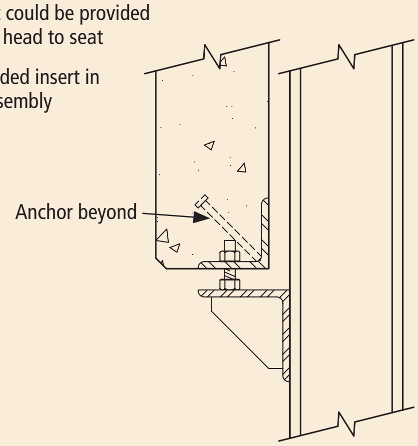


Fig. 4.5.23 Eccentric bearing (EB1).

- Coordinate with GC for placement of seat
- Could use leveling bolt or shims
- Could use thicker angle and delete gusset
- Could eliminate projection from panel by attaching angle with inserts or welding to flush plate

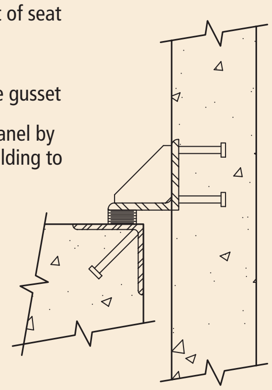


Fig. 4.5.26 Eccentric bearing (EB4).

- Coordinate with GC for placement of seat
- Any structural shape could be used for projecting bracket—if unsymmetrical, consider torsion
- Many types of panel bracket anchorage could be used

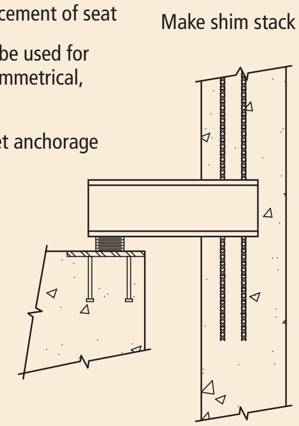


Fig. 4.5.24 Eccentric bearing (EB2).

- Coordinate with GC for placement of seat
- Complex haunch reinforcement
- Complex forming, especially if location of haunch changes
- Haunch could be cast first and set in form
- Haunch could be intermittent or continuous
- Plate washer may require welding for lateral loads

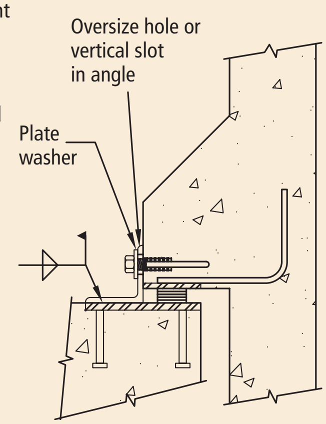


Fig. 4.5.27 Eccentric bearing (EB5).

- Same panel bracket can be used with any column size
- Any structural shape could be used for projecting bracket
- Many types of panel bracket anchorage could be used

Any of the members shown could be other structural shapes.

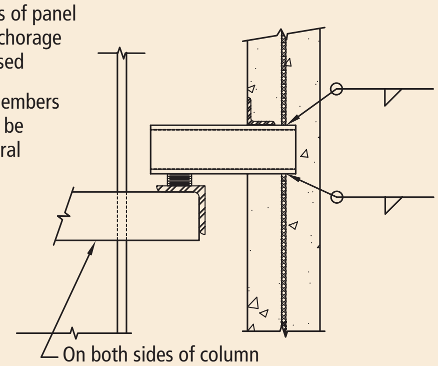
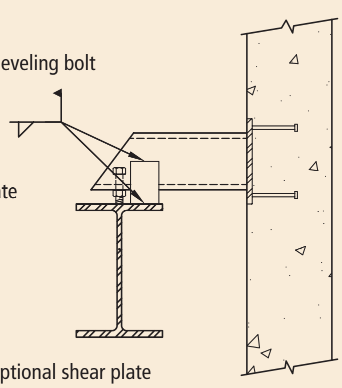


Fig. 4.5.25 Eccentric bearing (EB3).

- Keep bearing at center of beam to avoid torsion
- Leveling bolt saves time
- Could use shims in lieu of leveling bolt
- May require blockout in floor slab
- Different tieback could be used in lieu of shear plate



Shown with optional shear plate

Fig. 4.5.28 Eccentric bearing (EB6).

- Same panel bracket can be used with any column size
- Thin tube may require reinforcing plate at bearing

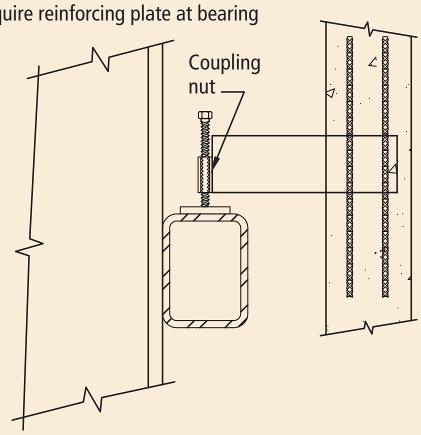


Fig. 4.5.29 Welded tieback (WTB1).

- Consider beam deflection
- Stagger anchor studs to minimize magnification of force on them due to variation of shear plate location
- Requires bracing until welded
- May also serve as shear plate

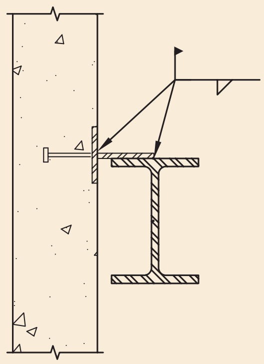


Fig. 4.5.30 Welded tieback (WTB2).

- Requires bracing until welded
- Alignment and welding must be done before upper panel is erected
- Difficult to inspect
- May also serve as shear plate

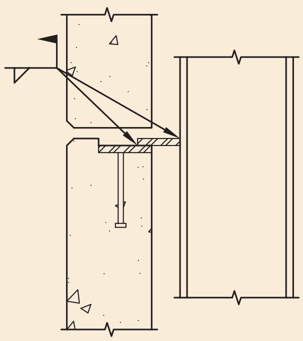
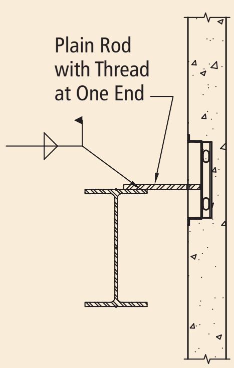


Fig. 4.5.31 Welded tieback (WTB3).

- Buckling of rod must be considered if compression load is expected
- Requires bracing until welded
- Do not over-tighten threaded rod if movement in slotted insert to be allowed
- Slotted bar may be used to fit proprietary slotted embedment



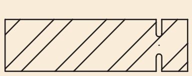


Fig. 4.5.32 Welded tieback (WTB4).

- Consider deflection of support
- Slots and bolts allow fast erection—weld after alignment

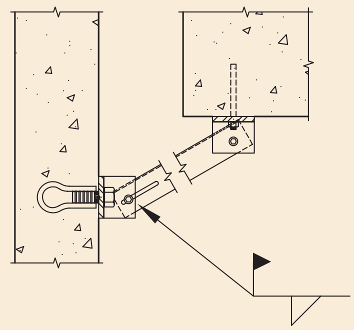


Fig. 4.5.33 Welded tieback (WTB5).

- Consider deflection of support
- Slots and bolts allow fast erection—weld after alignment

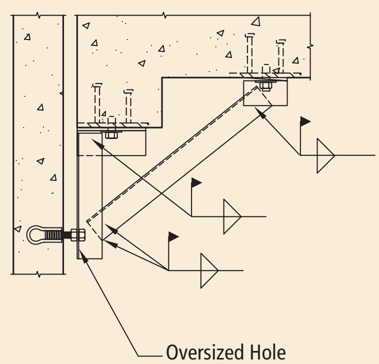


Fig. 4.5.34 Welded tieback (WTB6).

- Coordinate with GC for placement of insert
- Adjustment limited by thread length of insert and bolt
- Need adequate clearance for welding
- Weld not required for compression only
- Could reverse with plate in structure, and insert in panel

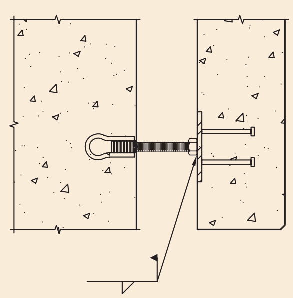


Fig. 4.5.35 Welded tieback (WTB7).

- Anchorage of plate and angle could vary
- Shear plate configuration to be determined by load type

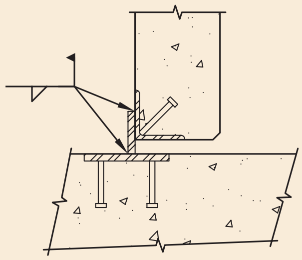


Fig. 4.5.36 Welded tieback(WTB8).

- Oversize hole in angle
- Plate washer could be welded and slotted to control directional movement See Fig. 4.5.14 for reference

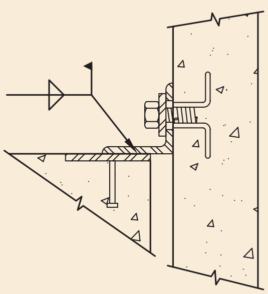


Fig. 4.5.37 Bolted tieback (BTB1).

- High-strength rod is advantageous
- Rod flexes for in-plane movement
- Bucking of rod must be considered if compression load is expected
- Oversize hole primarily for tolerance

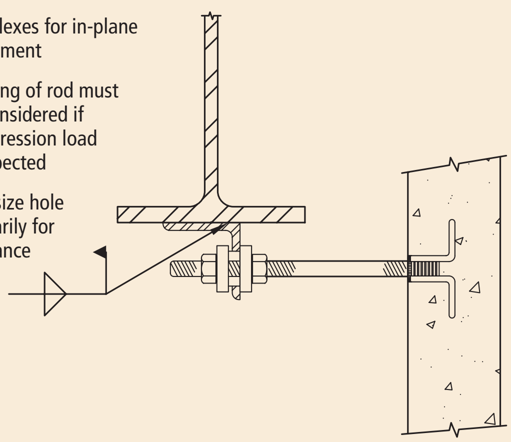


Fig. 4.5.39 Bolted tieback (BTB2).

- Alignment can be completed after release from crane
- Slots in embedment and angle to be perpendicular to each other for three-way adjustment
- Threaded insert can be used if angle has oversize hole and plate washers

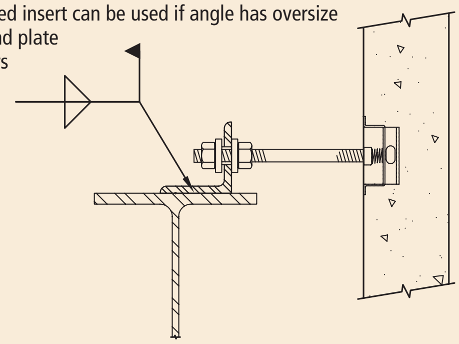


Fig. 4.5.39 Bolted tieback (BTB3).

- Horseshoe shims allow adjustment perpendicular to panel
- Oversize hole and plate washer allows adjustment parallel to panel
- Do not over-tighten bolt if movement to be allowed
- Plate washer could be welded and slotted to control directional movement. See Fig. 4.5.14

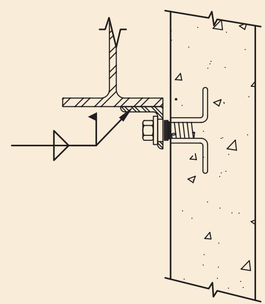


Fig. 4.5.40 Bolted tieback (BTB4).

- Coordinate with GC for placement if insert is used
- Edge distance and reinforcing in floor/foundation must be considered
- Angle has slotted holes

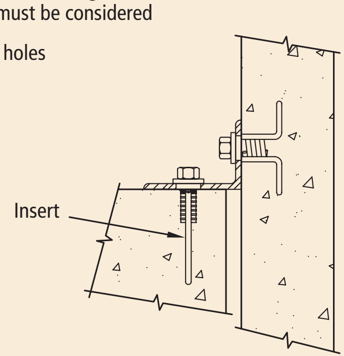


Fig. 4.5.41 Bolted tieback (BTB5).

- Basically an alternate to BTB1 where long rod cannot be accommodated
- Oversize hole both for tolerance and movement allowance
- Tieback rod receiver could be many configurations

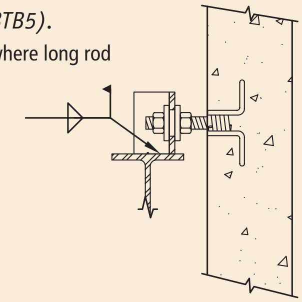


Fig. 4.5.42 Bolted tieback (BTB6).

- Sleeve in concrete column or wall must be large enough for adjustment
- Bearing pad need not be adjacent to tieback rod
- Special care required to maintain tolerance

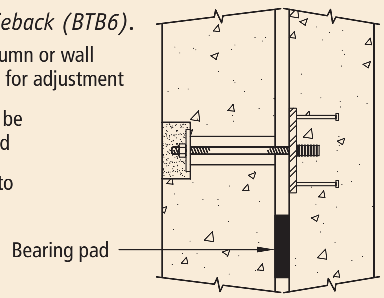


Fig. 4.5.43 Bolted tieback (BTB7).

- May require bracing until floor is cast

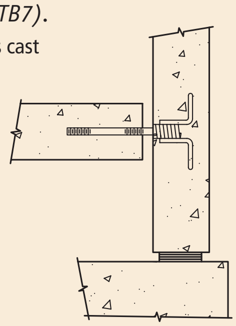


Fig. 4.5.44 Bolted tieback (BTB8).

- Blind connection
- Panel face does not need patching
- Large opening required for access
- If angle is field welded, smaller access hole allowed, but temporary bracing required
- Field tolerances critical

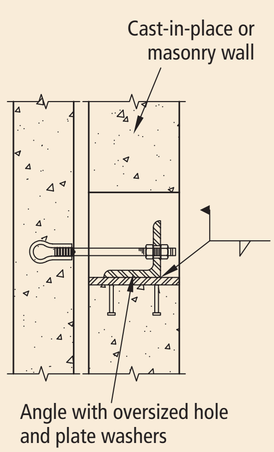


Fig. 4.5.45 Shear plate (SP1).

- Primarily for in-plane lateral force
- Also takes out-of-plane force
- Normally one used near center of panel, with larger panel to beam dimension, so force needn't be restricted by long panel brackets
- Trapezoidal plate may be assumed fixed at beam and pinned at panel to minimize panel plate anchorage
- Installed after panel fully aligned, so temporary tieback may be required
- Thin plate allows some vertical movement

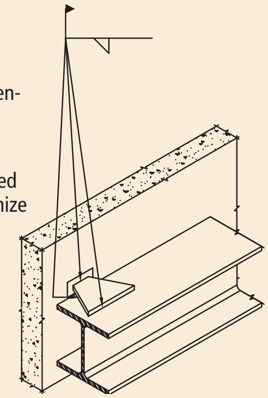


Fig. 4.5.46 Shear plate (SP2).

- Similar to SP1 except combined on bearing connector anchor plate
- Eliminates need for shear plate on bearing bracket
- Panel plate anchorage requirement is lower than if in-plane force were resisted by bracket

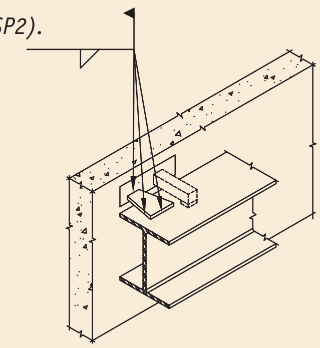


Fig. 4.5.47 Shear plate (SP3).

- Convenient at mid-height of column covers
- Can be used for rocking or translating unit, depending on balance of connection system
- Use in pairs or weld to column

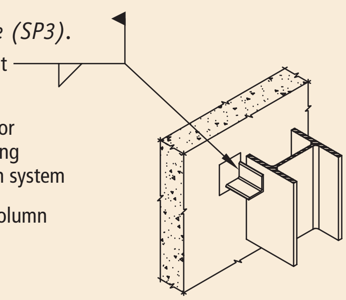


Fig. 4.5.48 Shear plate (SP4).

- Shims carry full weight of panel
- Shims should be adjacent to shear plate (angle)
- Angle orientation gives high capacity in all three axes
- Cannot be installed until after alignment, so temporary tieback may be required
- If leveling bolt were recessed into sill for ease of alignment, patching might be required

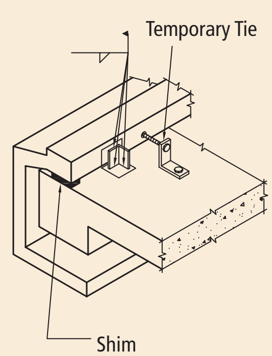


Fig. 4.5.49 Shear plate (SP5).

Shown at bearing bracket

- A few of the variety of shear plates used at bearing connectors
- Shape and location of plate or angle tailored to suit conditions and forces to be resisted

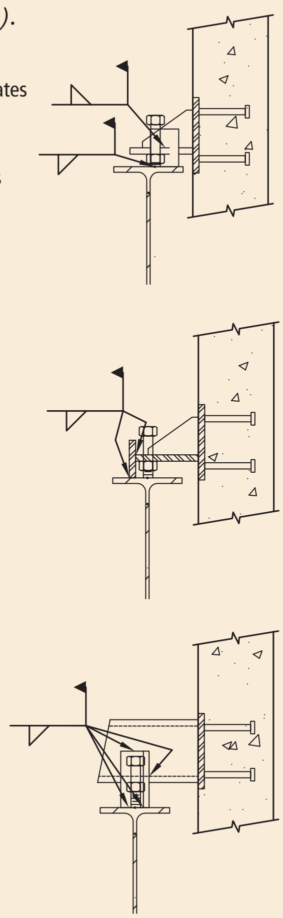
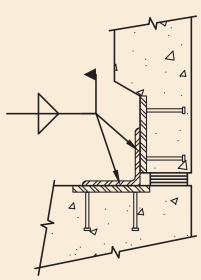


Fig. 4.5.50 Shear plate (SP6).

- Common at foundations
- May be flush or recessed
- Shape and location of plates or angles vary to suit conditions and forces to be resisted



Plan section of variation

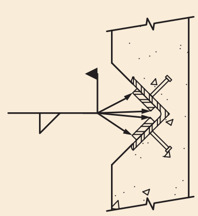


Fig. 4.5.51 Shear plate (SP7).

- (a) and (b) are sections at horizontal joint. For vertical joint, modify to eliminate overhead weld.
- (c) is section at vertical joint
- May be flush or recessed
- Shape and location of plates or angles vary to suit conditions and forces to be resisted
- Can also resist uplift

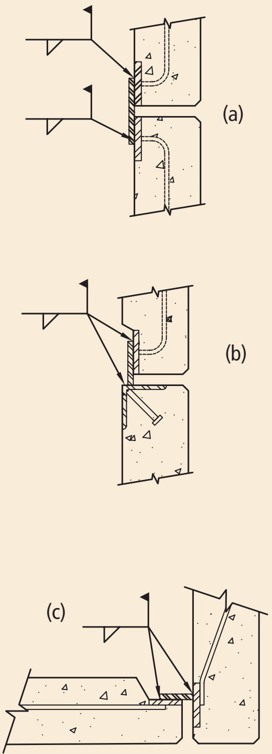


Fig. 4.5.52 Panel to panel alignment (PPA1).

- Not intended for required out-of-plane force resistance, but can be adapted to serve as tieback, as in Fig. 4.5.68
- Dimension to face of panel is critical
- Good solution when slightly bowed panels are not accessible after erection
- If panels are accessible after erection, finger plates can be field welded and shimmed if necessary

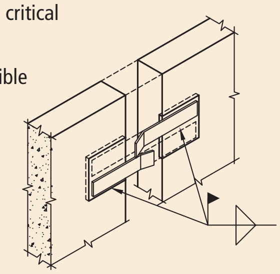
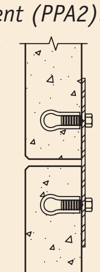
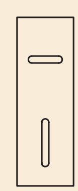


Fig. 4.5.53 Panel to panel alignment (PPA2).

- Not intended for required out-of-plane force resistance, but can be adapted to serve as tieback
- Shim thin panel if necessary





slotted plate

Fig. 4.5.54 Panel to panel alignment (PPA3).

- Not intended for required out-of-plane force resistance, but can be adapted to serve as tieback
- Panels must be aligned before welding
- Option (a) requires vertical weld, inside narrow joint
- Option (b) allows downhand weld, inside narrow joint

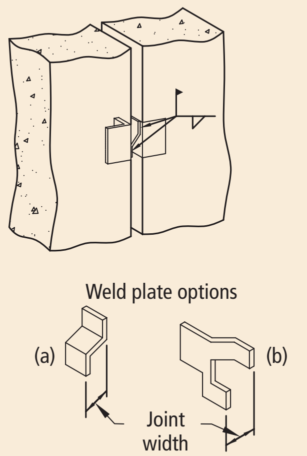


Fig. 4.5.55 Panel to panel alignment (PPA4).

- Not intended for required out-of-plane force resistance
- A few of the variety of alignment connectors
- Shape and location of embeds and loose slugs tailored to suit conditions

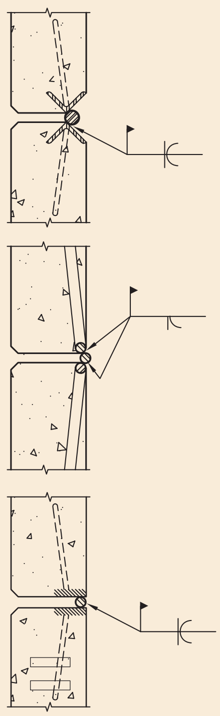
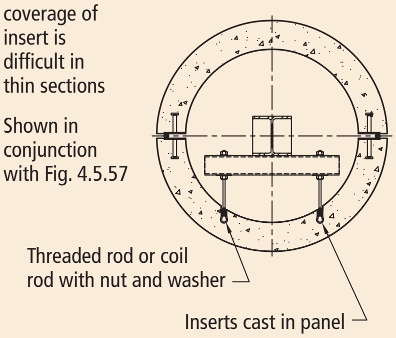


Fig. 4.5.56 Column cover (CC1).

- Serves as tieback
- Length and diameter of rod may limit capacity
- First element of column cover must be aligned prior to placing second
- Could be used for both halves if located at top
- Placement and coverage of insert is difficult in thin sections
- Shown in conjunction with Fig. 4.5.57



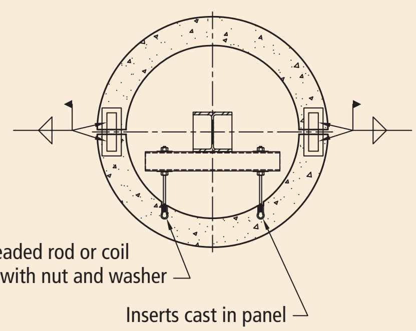


Fig. 4.5.57 Column cover (CC2).

- Use where access is limited
- Exercise caution to prevent weld stain and cracking from excess heat
- Minimum recommended joint size is 3/4 in. (19mm)

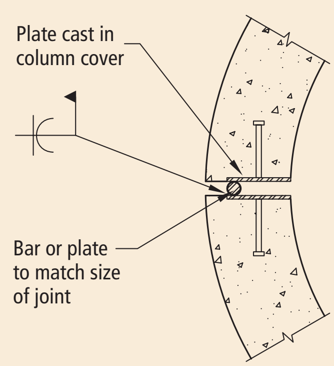


Fig. 4.5.58 Column cover (CC3).

- Serves as tieback
- Used only at top for welding access
- Could be changed to bolted

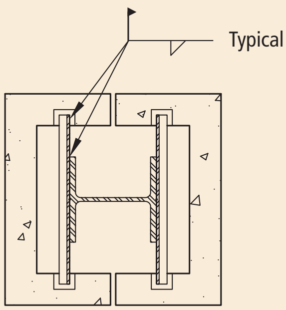


Fig. 4.5.59 Column cover (CC4).

- Can be both a loadbearing and tieback connector
- Lower panel must be aligned and welded prior to placing upper portion
- Good with limited access
- Could modify to insert and bolt if ample space

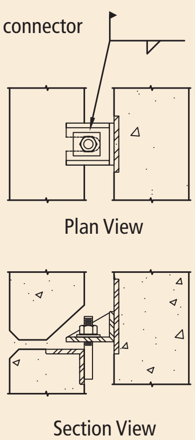


Fig. 4.5.60 Column cover (CC5).

- Top connector
- Align with tieback rods prior to welding angle

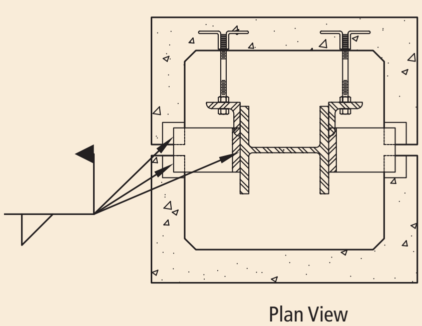


Fig. 4.5.61 Column cover (CC6).

- Bottom connector
- Support unit on shims
- Joint width sets thickness of vertical plate on knife assembly
- Align and weld first unit prior to setting second
- Welding of second half difficult in narrow joint
- Allows units to rock if bent plate (or angle) legs long enough

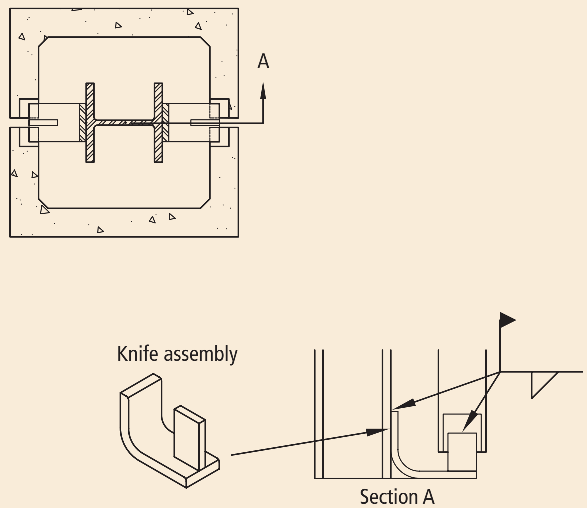


Fig. 4.5.62 Beam cover (BC1).

- Erection sequence critical
- Beam must be adequate to prevent excessive rotation when first element is placed
- Top right connector (alternate) requires tight tolerance
- Sealant at top left connector (alternate) is critical
- May require combination of grouting, bolting, and welding
- Preferably, use one type of alternate top connector
- Joint locations optional

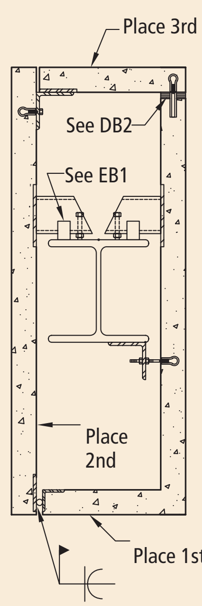


Fig. 4.5.63 Soffit hanger (SH1).

- Allows alignment after in place
- May require separate tiebacks for lateral forces
- Access for bolting may be difficult

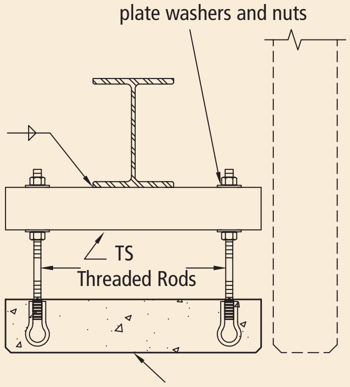
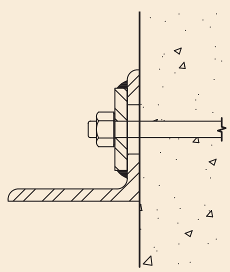


Fig. 4.5.64 Special conditions (SC1).

Oversize hole considerations

(a) Bolt subject to bending



(b) Loose plate under angle, welded after adjustment eliminates bending in bolt

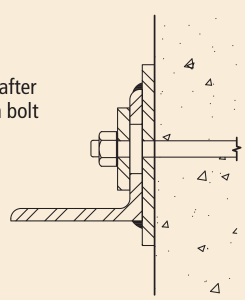


Fig. 4.5.65 Special conditions (SC2).

Concrete Anchors

(a) National Coarse or coil thread loop insert

(b) National Coarse or coil thread wing nut

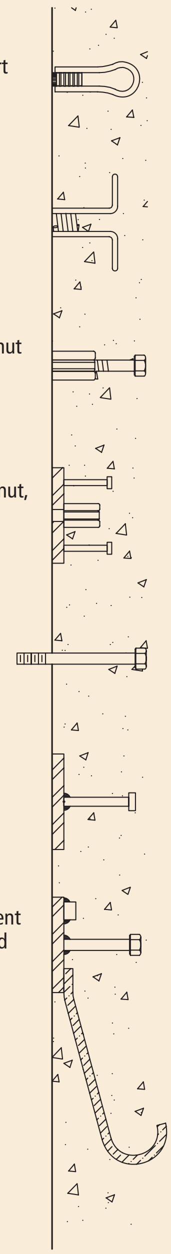
(c) National Coarse or coil thread coupling nut and bolt

(d) National Coarse or coil thread coupling nut, plate, and studs

(e) Projecting National Coarse or coil bolt

(f) Flush plate with studs or hand welded bolt blanks

(g) Bearing lug and/or tension bar supplement on flush plate with studs or hand-welded bolt blanks



(h) Proprietary threaded embedment. Available with one- or two-way adjustability.

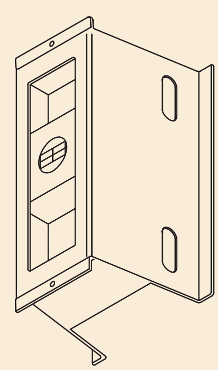
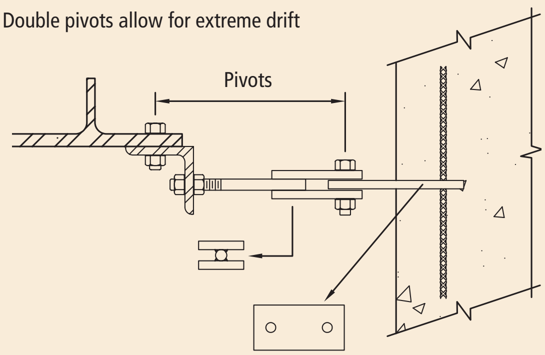
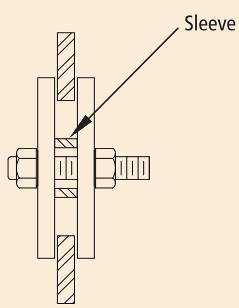


Fig. 4.5.66 Special conditions (SC3).
Special tiebacks

(a) Double pivots allow for extreme drift



(b) Sleeve eliminates possibility of binding when oversize hole provides for drift



(c) Small diameter tieback rods desired for flexing can be prevented from buckling in compression with loose pipe sleeve

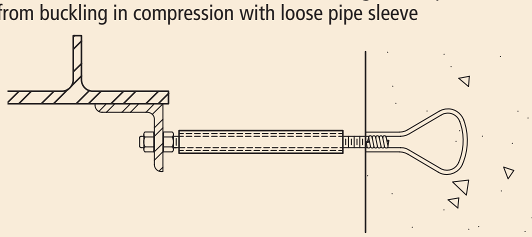


Fig. 4.5.67 Special conditions (SC4).
Special shear plates that allow lift-off for rocking

(a) Use in pairs. Allows movement perpendicular to panel

(b) Use in pairs. Round bars shop welded to bearing bracket.

(c) Use in pairs. Round bar shop welded to bearing bracket.

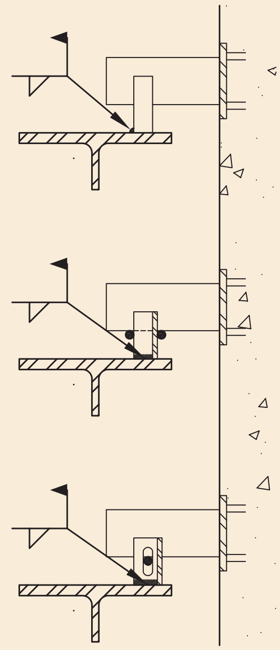


Fig. 4.5.68 Special conditions (SC5).

- Figure 4.5.52 can be supplemented to become a tieback
- Lower panel with insert and bolt must be aligned and welded prior to placing upper panel
- Limited bolt head weld length could be mitigated by shop welding a plate to it

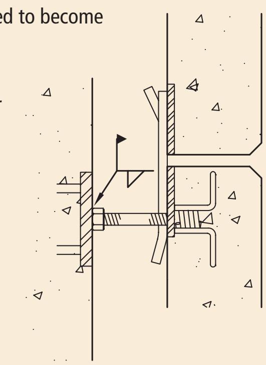


Fig. 4.5.69 Special conditions (SC6).
Anchor load control shown at bearing bracket.

- Upper bolts carry shear
- Lower bolts carry tension

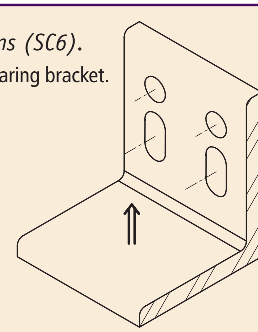


Fig. 4.5.70 Bearing wall to foundation (BWF1).

- Can be designed for shear and uplift
- Could develop moment resistance by placing a connection on each side of wall
- Shim prior to drypack

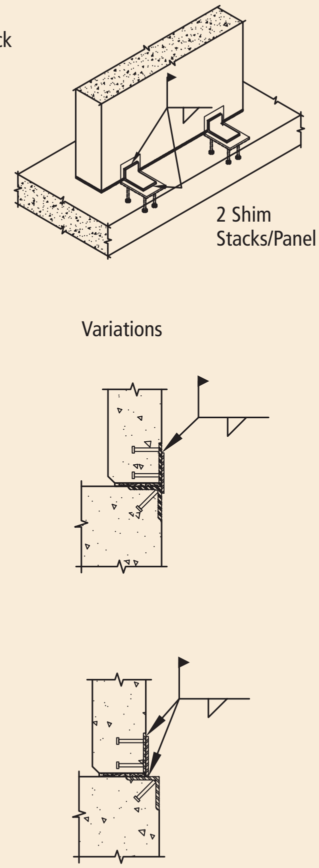


Fig. 4.5.71 Bearing wall to foundation (BWF2).

- Insert must be jigged plumb
- Allows vertical adjustment without crane
- Finish joint with drypack or sealant
- Bolt head may be welded for tensile or shear capacity
- Plate may be eliminated, but adjustment becomes more difficult
- May be inverted with insert below

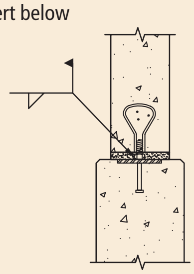


Fig. 4.5.72 Bearing wall to foundation (BWF3).

- Has shear, uplift, and moment capacity
- Location and alignment of dowels critical
- Capacity can be increased with confinement reinforcing
- Dowels projecting from panel create storing and shipping problems
- Requires bracing until grouted
- Grouting could be done after alignment if injection tube used
- Could be inverted with sleeve and injection tube in panel

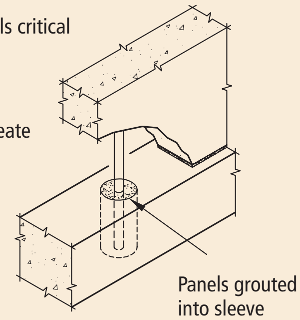


Fig. 4.5.73 Bearing wall to foundation (BWF4).

- Can be designed for shear, uplift, and nominal moment capacity
- Requires bracing until welded

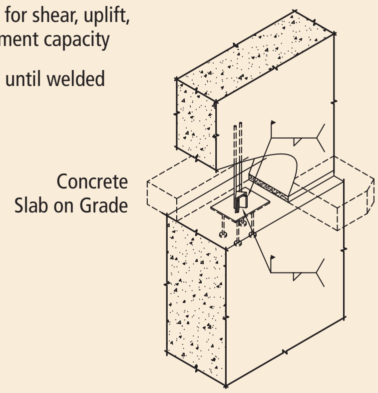


Fig. 4.5.74 Bearing wall to foundation (BWF5).

- Bar could be prestressed or mild steel
- Substantial shear, uplift, and moment capacity
- Tolerance for placement of bars and sleeves critical
- May require grout tubes and vents
- Preferably grout from bottom to eliminate voids
- Bracing required until drypacked and grouted
- Void in foundation at bar essential for field alignment
- Foundation void can be formed with EPS (expanded polystyrene) or foam pipe insulation

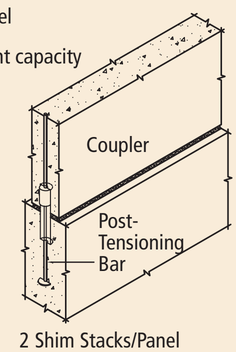


Fig. 4.5.75 Slab to bearing wall (SBW1).

- Welding at bottom of tee or slab is NOT recommended as excessive restraint results
- Load is eccentric to wall panel
- Top connection for shear can provide some torsional restraint of spandrel
- Corbel requires special forming
- Could replace corbel with inverted EB type assembly
- Variations (d) through (g) could be used either in topping or hollow-core joints

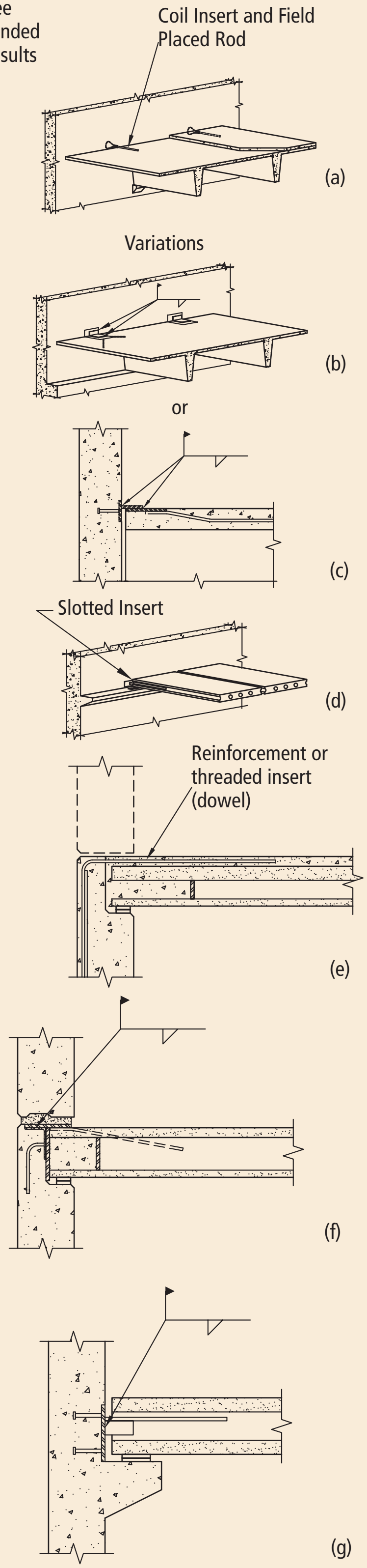


Fig. 4.5.76 Slab to bearing wall (SBW2).

- Pocket and tee end must be planned so slab can be swung into place
- CANNOT be used at both ends of slab
- Consider volume change shortening of slab
- Pocket may telegraph through and show on outside of wall
- DO NOT drypack pocket so it restricts tee stem
- If slab at top of wall, as in (b), pockets could be replaced with continuous dap

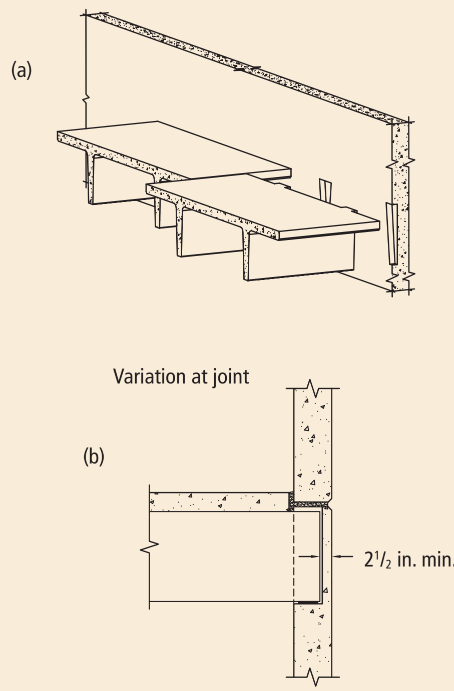


Fig. 4.5.77 Slab to bearing wall (SBW3).

- DO NOT use at both ends of slab to prevent excessive restraint
- Develops a rigid moment connection
- Effect of moment, rotation, and volume changes in wall and slab must be considered
- Welding must be completed before placing upper panel
- Avoid overhead welding if possible
- Could use wall corbel in lieu of angle seat

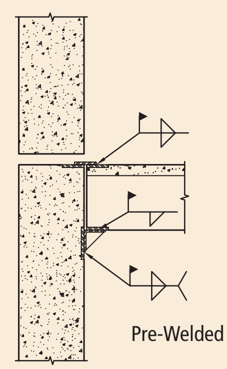
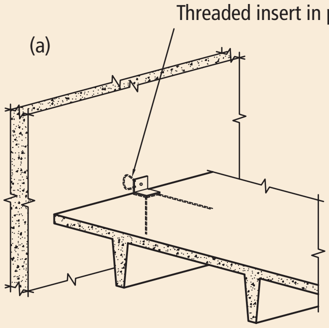


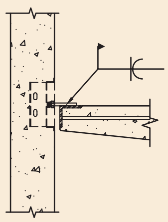
Fig. 4.5.78 Slab to side wall (SSW1).

- Allows for slab deflection
- Transfers horizontal forces
- Do not over tighten bolt in (a)
- Proprietary or fabricated slot embedment in (b)
- Vertical movement accommodated by flexing plate and welds in (c)
- Vertical movement accommodated by flexing tee flange in (d)
- (c) and (d) could be underneath, for less roofing interference, but field labor would be more expensive

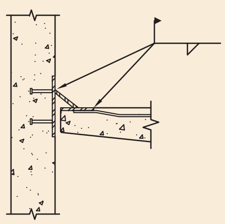
(a)



(b)



(c)



(d)

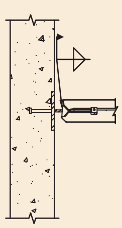
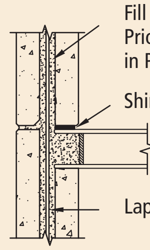


Fig. 4.5.79 Wall to wall (WW1).

- Can be used to withstand uplift forces
- Connection is hidden and protected
- Connection is not developed until tensioning is completed (bars are anchored)
- Temporary bracing is required
- Drypack, tensioning, grouting sequence may limit erection to one story at a time
- Grouting requires care to ensure complete filling



Variations