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2LifeCommunities
30 Wallingford Road
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Project 190203.00 - Additional Investigation for Façade Repairs and Maintenance – Coleman Houses I and II, 677 Winchester Street, Newton, MA
Subject Summary Report

Dear Mr. O'Toole:

At your request, we performed a facade investigation of the exterior elevations of the Coleman I and Coleman II buildings at the above address. We visited the site between December 2019 and January 2020 to make close-up observations of the facade and to document existing conditions in masonry probe openings made by our contractor assistant. Our field observations, findings, and preliminary recommendations are included herein.

Our report documents the significant observations we performed that provide pertinent information on the current conditions and causes of distress and material damage we observed. The amount of detailed information presented, especially of concealed conditions, will be useful for the design / construction team in addressing the feasibility of different repair options including repair scope and costs. We identify many concealed conditions and explain the likely mechanisms causing the distress and provide recommendations for repairs to address the current conditions.

1. BACKGROUND

Based upon our recent meetings with you, we understand that a new site development and existing building refurbishment program is planned for the near-term at the Coleman site. In preparation for this work, you have asked us to perform a follow-up investigation and condition survey of the facades of Coleman I and II (we performed an initial survey in 2013, refer to our 24 August 2013 letter report). Our objective is to identify conditions that will require repairs and / or maintenance that should be performed either during or before the upcoming planned construction phase(s).

2. DOCUMENT REVIEW

We reviewed the original construction drawings that you provided to determine the general building layout and typical wall construction details of both buildings (Appendix A). Our review of existing construction drawings is summarized below:

Coleman I (Review of Original Building Drawings)

The Construction Drawings for Coleman I show that the exterior walls typically consist of 3-5/8" face brick, 1-1/2" cavity with asphalt felt paper on ½" gypsum sheathing and 6" steel stud backup (Figure 1). The exterior brick wythe is shown connected to the steel studs with steel wire ties at 16" on center vertically and horizontally (Figure 1). Where the exterior brick wythe clads the lateral load resisting shear walls, the construction is shown consisting of a 2" cavity, which includes 1" of rigid insulation and 7-5/8" concrete block masonry backup. The brick wythe is shown connected to the concrete block (CMU) with steel wire ties at 16" on center vertically, no horizontal spacing is shown (Figure 2).

The parapet section detail shows a precast concrete cap bridging between 8" nominal CMU backup and 4" nominal face brick with a 1-1/2" cavity. Through-wall flashing is shown installed in the bed joint eight courses down from the cap stone (Figure 3). We understand that during previous roofing work the original precast capstone was removed and the current metal cap flashing on wood blocking was installed.

The masonry expansion joint detail is detailed on the wall plan section showing a 3/8" wide joint filled with compressible filler and sealant (figure 4).

The drawings show aluminum-framed sash windows attached to the backup structure at the head, sill and jambs, with an extruded aluminum sill supported on the brick exterior wythe. A floating steel lintel is shown at the window head supporting the brick above. The lintel is shown covered by fabric flashing and the cavity above the lintel is shown filled with pea gravel (Figures 5 to 7).

Coleman II (Review of Original Building Drawings)

The Construction Drawings for Coleman II show the exterior walls consist of 3-5/8" face brick, 2" air space, 1" rigid insulation with asphalt felt paper on ½" gypsum sheathing and 6" steel stud backup. The exterior brick wythe is shown connected to the steel studs with adjustable ties. Where the exterior brick wythe clads CMU shear walls, the wall construction consists of a 1" air space, 2" rigid insulation and 7-5/8" concrete block masonry backup. The exterior brick wythe is noted as connected to the concrete block backup with adjustable ties. No spacing for the wall ties is provided (Figures 8 and 9).

The parapet section detail shows 4" nominal face brick with three courses of soldier-laid brick with a single stretcher course between the top two soldier courses and lower soldier course (Figure 10). The parapet backup is 8" nominal CMU with 2" of polyiso insulation, an air space (no dimension shown) and 4" nominal face brick. Through-wall flashing is shown installed in the bed joint one course up from the loose window head lintel (Figure 10).

The elevation drawings that we reviewed show both horizontal and vertical expansion / control joints in the masonry walls. The horizontal control joints are indicated at relieving angle locations at the fourth and first floor slab levels. Vertical expansion joints are shown at approximately 23' on center in the field of the wall but not at the building corners. No details for the horizontal or vertical expansion joint construction are shown on the drawings but both the architectural and structural drawings show a 6"x6" relieving angle detail (Figures 11 and 12). A note on the As Built Drawing elevations SKA3.1 and SKA3.2 refer to Drawings SKA-17, SKA-27 and SKA-29 for revised locations of relieving angles and control joints. We do not have these drawings and have not reviewed their content.

The drawings show aluminum-framed windows framed by wood blocking at the sill and jambs, but no attachment to the backup structure is shown. A break metal aluminum sill is shown supported on the brick exterior wythe that extends under the window frame and noted to turn up at the jambs. A floating steel lintel is shown at the window head supporting the brick above. Through-wall flashing is shown one course above the floating steel head lintel and the cavity above the flashing is shown filled with pea gravel (Figures 13 to 15).

3. FIELD OBSERVATIONS

Simon F. Shipley, PE was the lead investigator for Tripi Engineering Services, LLC (TES). The investigation, which included both exterior and interior wall opening observations, was performed between December 2019 and January 2020. We performed our observations at Coleman I using an aerial lift and on Coleman II using swing staging. Our mason assistant made probe openings in the walls for us to observe concealed conditions at selected locations on the two buildings. We made a limited number of general interior observations in the hallways linking Coleman I and Coleman II at the 4th and 5th floors, and we noted leak damage at window sills. We also observed several leak locations on the ceiling of the top floor of Coleman II in the hallway below the roof and water damaged windowsills in Unit 434. We noted the following during our inspection:

3.1 Coleman House I

3.1.1 Masonry

The exterior walls are clad in brick and block masonry with rectangular windows below the top floor. The top floor windows are arched with brown precast window head trim and semi glazed square brick jambs and sill trim. All windows below the top floor have semi glazed square brick head, jamb and sill trim. Air conditioning units with louvers are typically set into masonry openings below the window sills (Photo 1). Below the first floor there are alternating bands of split face block and brick masonry. General observations from our investigation are noted below:

- The mortar in the top six courses at the North Elevation at parapet level has freeze-thaw damage and is displacing the masonry vertically and horizontally (Photos 2 to 4).
- There is some brick movement and cracking at the parapet level adjacent to the chimney at the Northwest corner (see EWO-04 notes below).
- The masonry below window jambs and sill is stained from water runoff.
- The vertical expansion joints extend from ground level to the top of the parapet and range from 1/4" to 1/2" wide. Joints extend through the full width of the brick except at each floor where the flashing crosses the joint and mortar bridges the gap.

3.1.1.1 Exterior Wall Openings

We made three exterior wall openings on the West Elevation outside the living room of Unit 202 (Photo 5) and a single opening below the roof parapet adjacent to the chimney on the East Elevation above Unit 501 (Photo 6)

<u>EWO-01</u> – Window Sill, Unit 202 (Photo 7)

- Copper fabric flashing is visible behind the brick and extends over the loose lintel supporting the brick above the A/C unit below (Photo 8).
- Flashing does not extend to the lip of the shelf angle or exterior face of brick.

- The cavity between the brick and vertical leg of the shelf angle is 3/4". Above the shelf angle the cavity increases to 1" (Photos 9 and 10). The bricks above the A/C unit are not tied to the backup.
- The aluminum window sill is supported between wood blocking above the turned up fabric flashing on the interior and brick masonry on the exterior. No sill pan flashing is visible below the window (Photo 11).

EWO-02 – Window Head, Unit 202 (Photo 12)

- Copper fabric flashing extends above the loose head lintel behind brick and up to the floor slab. The flashing does not extend to the face of brick but continues horizontally across the face of the building at this level (Photo 13).
- The cavity between the brick and vertical leg of the shelf angle is 3/4". Above the shelf angle the cavity increases to 1" (Photo 14).
- Flashing does not extend to exterior face of brick.
- Loose head lintel extends approximately 7" beyond the jamb (Photo 15).
- We observed an extra layer of rigid insulation in the cavity at the jamb of the window which is covered with felt paper.

EWO-03 – Vertical Expansion Joint, Unit 202 (Photo 16)

- The vertical expansion joint to the left of the window is approximately ½" wide and typically extends full depth of the exterior wythe (Photo 17). We removed the sealant and open cell foam backer rod behind. The sealant is stiff and no longer pliable and has failed cohesively.
- The copper fabric flashing at the window head level extends across the wall and is continuous across the vertical expansion joint. The bed joint mortar at this location is also continuous across the joint (Photo 18).
- We had limited visibility in the narrow cavity at the sides of the wall openings, but we were able to identify locations of wall ties concealed behind the exterior brick using a metal detector. Generally, the detector registered readings at 16" on center both vertically and horizontally in the field of the wall.

EWO-04 – Unit 501 (Photo 19)

- The six courses of brick below the parapet cap flashing sit on a layer of copper fabric through-wall flashing that turns up and is adhered to the backup behind (Photo 20). The flashing does not extend to the exterior face of the brick (Photo 21).
- The wall cavity is approximately 3" wide and contains pea gravel and mortar debris. We observed an adjustable wall tie at one location that is corroded where it is embedded in the brick (Photo 22). At another location the wire tie is not fully restrained laterally (Photo 23).
- In the wall cavity below the copper fabric flashing we observed felt paper weather barrier that is not attached to the exterior sheathing of the unit below (Photo 24). We observed some minor water staining at this location.
- To the left of the opening, the top six courses of brick have moved out of plane approximately 1/8 to 1/4" (Photo 25).

- Above the opening there is a vertical crack extending six courses down from the parapet to the bed joint and propagates horizontally into the cracked bed joint below the displaced brick seen in Photo 25.

3.1.2 Sealant

- The sealant in all of the vertical expansion joints is typically crazed, hardened, and has failed both cohesively and adhesively. Some of the joints have compressed to ¼" squeezing the sealant.
- Sealant covering the mortared brick-to-arched precast stone window head joint and is crazed and has separated in several locations.
- Sealant between window frames and masonry surround has separated in many locations.
- The sealant at many of the air conditioning louvers is crazed, separated or missing (Photo 26).

3.1.3 Windows and Louvers

- Maintenance staff report that several interior glass panes have cracked and the failed IGU's are replaced on a regular basis.
- The extruded aluminum frames do not appear to have a thermal break within the frame section and some of the frames are not square.
- Some of the aluminum window frame corner miter joints have opened up.
- Many of the exterior window sills slope towards the building interior and the sealant under the sill has separated. The sills do not have end dams and terminate short of the brick jamb. Where the sealant has separated at this joint, any water that ponds on the sill runs into the wall. Some of these joints have been caulked over with newer looking sealant.
- Windows appear not to have a sill pan flashing under their sills (Photo 11).
- Window frames are set back approx. 3" to 3-1/2" from the face of the brick (Photo 27).
- The perimeter joints at the louvers are typically open and the sealant has deteriorated and most have failed either adhesively and/or cohesively. There doesn't appear to be any flashings under the A/C units (Photo 28).

3.2 Coleman House II

We made six exterior wall openings on the South Elevation outside and adjacent to the living room window of the 34 stack of Units (Photo 29) and two openings on the East Elevation at the southeast corner above the gymnasium stack of units, one below the roof parapet and one at the fifth floor slab level (Photo 30).

3.2.1 Masonry

The exterior walls are clad in brick masonry with rectangular windows. The south and west elevations extend eight floors from ground level to the roof and five floors on the east and north elevations where the building joins Coleman I. The brick measures approximately 3-1/2" x 3-1/2"x 11-5/8" and is laid mainly in stretcher bond with bands of dark brick laid in soldier courses at the parapet and fourth floor. There are bands of dark colored brick laid in stretcher bond at the two lowest floors on the south face (Photo 31). The top two floor windows at the east and west ends of the south face are three bays wide with all other windows either single or double bay widths. Air conditioning units with louvers are typically set into masonry openings below many of the windows. General observations of the masonry from our investigation are noted below:

- The mortar head joints at the top band of soldier course brick at the roof parapet are cracked (Photo 32).
- The masonry at the top of the southeast corner of the east wall is displaced out of plane by approximately 1/2” (Photo 33). In 2013, at the same location, this displacement measured only 1/4”.
- The bed joint one course above the window head lintel at Unit 334 is open, the brick appears to have dropped and rotated out of plane (Photo 34) (see EWO-04 below). The brick at this location also appears to have moved out of plane approximately 1/4” to 3/8” away from the toe of the shelf angle supporting it (Photo 35).
- The masonry at the vertical expansion joint on the southwest corner of the south face is displaced out of plane approximately 3/4" (Photo 36).
- The vertical expansion joints on the South elevation extend from ground level to the top of the parapet and range from less than 1/4" to 1/2” wide. Joints extend through the full width of the brick except at each floor where the flashing crosses the joint and mortar bridges the gap. The sealant has squeezed out of many of the joints that have closed up.
- There is a significant amount of cracking in the dark colored bands of masonry at the lower floors on the South face with vertical cracks spaced every 4 to 6 feet along the curve of the building (Photo 37).

3.2.1.1 Exterior Wall Openings

Southwest Corner

EWO-01 – Parapet South Face, Unit 534 (Photo 38)

- The cavity behind the soldier course is approximately 4” wide (Photo 39).
- Copper fabric flashing extends over the edge of the roof plank and counter flashes the through-wall fabric flashing that tucks into the exterior masonry one course above the window head lintel below (Photo 40).
- The expansion joint at the left of the wall opening is ½” wide with backer rod and sealant with no hard material present in the joint (Photo 41). The expansion joint above the opening at the two parapet soldier courses is less than ¼” and the sealant has squeezed out of the joint.
- A single layer of 1” foil faced polyisocyanurate (ISO) insulation is loosely attached to the backup with gaps between the insulation board and the backup (Photo 42).
- Eye and pintle wall ties are installed at the top of the stretcher course between the two bands of soldier course brick. Insulation board in the cavity has been pushed over the wire eyes and the pintles are near the end of their travel in the eyes. It appears the pintles are prying open and are under outward lateral load (Photo 43). We observed a single level of ties vertically within the height of the parapet. The ties are spaced approximately 16” on center horizontally and all the pintles are near the end of their travel within the eyes.

EWO-02 – Window Head, Unit 434 (Photo 44)

- The copper fabric flashing does not extend into the exterior brick and instead lies flat against the vertical leg of the loose head lintel. The lintel shows signs of corrosion (Photo 45).
- The loose lintel measures 4x7x3/8” and has approximately 8” of bearing on the left side with shims embedded in mortar. The brick supporting the lintel at the jamb of the window is fractured at the back edge (Photo 46).
- The return wall (West elevation) has a load-bearing CMU shear wall behind the brick outer wythe. The CMU is covered with a black fluid applied coating and faced with 2” thick foil faced rigid ISO insulation. The cavity is approximately 4” wide (Photo 47).

EWO-03 – Window Jamb, Unit 434 (Photo 48)

- West face wall cavity is 5” wide with 2” thick ISO insulation, no moisture barrier is visible on the face of the CMU backup (Photo 49).
- Eye and pintle ties are installed at regular intervals on the West face. The pintle legs are near the end of their travel (Photo 50).

EWO-04 – Shelf Angle at 4th Floor, Unit 334 (Photo 51)

- The masonry relief (load bearing) shelf angle measures 6x6x5/16 and is bolted to the 4th floor concrete edge beam with ¾” bolts spaced at 16” on center. The nut of one of the two bolts we could reach in this location is loose (Photo 52).
- The cavity behind the brick is approximately 5-1/4” wide and the shelf angle extends approximately 1” into the brick. The distance from the edge of the concrete slab to face of brick is approximately 8-1/2” (Photo 53).
- The shelf angle is tight to the brick below but does not appear to provide any support to the brick above (Photo 54).
- The exterior brick appears to have moved upwards 9/16” relative to the horizontal leg of the shelf angle below (Photo 55).
- The copper fabric flashing does not cover the shelf angle but is placed into the bed joint one course above the lintel. The flashing does not extend to the face of the bed joint and is concealed behind the pointing mortar (Photo 56).
- A portion of the vertical expansion joint adjacent to the wall opening is filled with mortar where a brick has fractured (Photo 57).

EWO-05 – Window Head and Shelf Angle at 4th Floor (Photo 58)

- This opening is at the same level as EWO-04 and the same shelf angle observed there extends over the window head and is bolted to the concrete floor edge beam behind (Photo 59). The bolts are spaced at 16” on center and the angle appears to follow the curve of the facade.
- The copper fabric flashing does not cover the shelf angle but is placed into the bed joint one course above the lintel. The flashing does not extend to the face of the bed joint but is

concealed behind the pointing mortar. Sash chord wicks have been used as weeps. The shelf angle is galvanized and does not show signs of corrosion (Photo 60).

- The masonry appears to have moved up and outwards relative to the shelf angle by approximately ¼" in in both directions (Photo 61). The sealant in the joint below the shelf angle at the left window jamb has compressed and squeezed out of the joint (Photo 62).

EWO-06 – Shelf Angle at 2nd floor slab, Unit 134/234 (Photo 63)

- Bent metal backup plate and wire pintle masonry ties are installed over the building felt paper and screwed into the light gage metal studs at 16" on center horizontally and vertically. The plates extend 2" into the cavity and support 1" thick loosely attached foil faced ISO insulation board. One anchor is missing the wire pintle section that should be embedded in the masonry veneer (Photo 64). Other anchors we observed have pintle hooks that are not fully engaged or not engaged (Photos 65 and 66).
- The shelf angle follows the curved surface of the face brick which has moved outwards approx. 1/2" relative to the toe of the angle (Photos 67 and 68).
- The South face of brick is 8-1/4" from face of concrete (Photo 69). The brick measures 3-1/2" deep and the shelf angle measures 6x6x5/16 and overlaps the back 1-1/2" of the brick and the bed joint at the toe of the shelf angle is filled solid with mortar (Photo 70). The wall cavity measures approximately 4-3/4" to 5" wide.
- West face of brick is 8-1/2" from face of CMU with a 5" cavity including 2" rigid foil faced ISO insulation that is not attached to backup. There is a black fluid applied coating on the face of the CMU (Photo 71).
- Two of the shelf angle bolts are loose and we were able to unscrew them by hand.
- The shelf angle is bolted to the edge of the concrete floor slab since there does not appear to be a down-turned edge beam at this location.
- The gap between the shelf angle and brick below is approximately 1/8" to 3/16" (Photo 72) and there is a small gap (approximately 1/16") between the top surface of the horizontal leg of the angle and bottom of the brick (Photo 73). The bed joint at the toe of the angle is filled with mortar.

Southeast Corner

EWO-07 – Parapet East Face, Unit 526 (Photo 74)

- The copper fabric through-wall flashing does not extend to the southeast corner of the building nor to the face of the brick face. The copper fabric counter flashing extends approximately 12" to16" up the CMU parapet backup and is sealed with black mastic.
- The single line of eye and pintle wall ties along the East face parapet are spaced 16" on center but none of the pintle legs are engaged in the wire eyes (Photo 75).
- The East Elevation has a load-bearing CMU shear wall behind the brick outer wythe. The CMU below the copper fabric flashing is covered with a black fluid applied coating and covered with 2" thick foil faced rigid ISO insulation. The cavity is approximately 5" wide (Photo 76).

EWO-08 – Fifth Floor Level, Unit 426/526 (Photo 77)

- The East Elevation CMU shear wall behind the brick outer wythe is coated with a black fluid applied coating and generally covered with 2" thick foil faced rigid ISO insulation. In several locations the insulation board is damaged or missing. The cavity is approximately 5" wide and the face of brick is 8-3/8" from the face of the CMU backup (Photos 78 to 80).
- The wire pintle wall ties on the East Elevation are typically engaged in the eyes but the legs have moved upwards more than 1/2" leaving an indentation in the ISO insulation below (Photo 81).
- The South Elevation foil faced ISO insulation measures 1" thick and is loosely laid against felt building paper adjacent to the gypsum sheathing backup (Photo 82).

3.2.2 Sealant

- All the joint sealant at the vertical expansion joints is typically compressed, hardened, crazed and separated.
- All the sealant covering the two horizontal expansion joints is typically hardened, crazed and separated. The sealant covers and is adhered to mortar that fills the joint directly behind the sealant.
- Window frame to masonry perimeter sealant is crazed and separated providing a direct path for water to enter the wall (Photo 83).
- Window head sealant below the steel lintels is typically separated leaving large (up to an inch was observed) gap between the frame and angle (Photo 84). The separation appears larger towards the top of the building than at the base.

3.2.3 Windows and Louvers

- The window frames are set back from the face of the brick approximately 3" (Photo 85).
- The width of the joints at the window jambs vary from 0" on one side to up to 1-1/2" on the opposite side of the window. The larger of the gaps occurs on the jamb closest to the building corner on that face (Photos 86 and 87).
- Many of the window frame head receiver channels are distorted and bowed (Photo 88).
- Separation of the window head sealant joints above the third floor are larger than 1/2" (Photo 89). In one location we removed nesting material concealed behind the open sealant joint (Photo 90).
- Some window frames have separated at their spliced mullion connection and the metal frame is beginning to tear apart at the sill (Photo 91).
- The longer metal sills are two-piece bent aluminum and lapped near the center. The laps are unsealed (Photo 92).
- The exterior sills do not have end dams and are not tight to the masonry jambs. Typically there are gaps between the ends of sills and brick jambs, including Unit 434 (Photo 93).
- Many of the sills have a pronounced slope towards the building that directs water into the window frame and building interior (Photos 94 and 95).
- The base of the A/C louvers have a drip edge flashing strip that directs water away from the brick below (Photo 96).
- The top of the A/C units have a loose shelf angle lintel that supports the single course of brick above.

3.2.4 Interior

3.2.4.1 Interior Wall Openings Unit 434

We performed wall openings at the interior sheathing and wood blocking adjacent to the two windows in the living room in Unit 434 to observe the condition of the blocking, light gage metal framing and window attachment. We noted the following:

- The wood blocking below the sills at both the triple and double windows in the living room has significant water damage (Photos 97 to 100).
- The metal sills of both windows have lifted off the sill blocking by 7/16" (Photo 101). We could observe daylight through the gap under the sill and through an open head joint in the exterior masonry at one location (Photo 102).
- Sill pan flashing has been installed at the base of the windows, however it has been punctured by drywall screws used to secure the frame of the window to the wood blocking below. The screws have corroded and pulled out of the blocking and the blocking has significant water damage and rot in these locations (Photo 103). None of the three screws in the west facing double window are engaging the blocking below and none of the ten screws in the south facing triple window are fully engaged in the sill blocking (Photo 104).
- The interior drywall on the West face is furred out approximately 2-1/2" from the CMU shear wall behind (Photo 105). Fiberglass batt insulation fills the cavity (removed for the photograph).
- The interior drywall assembly on the South face consists of 5/8" interior gypsum sheathing attached to 6" deep 20 gage stud framing spaced at 16" on center with fiberglass batt insulation and a plastic sheet vapor barrier (Photo 106).
- The 6" wide sill track below the south facing triple window has been cut in several places to allow it to curve and follow the line of the facade (Photo 107). We observed moisture stains in the exterior sheathing at the openings below the window sill.
- The left jamb of the south facing window is framed with a single 6" light gage steel stud with 2x blocking (Photo 108) that is attached to track at the floor and the soffit of the drop beam of the floor above (Photo 109). The track at the bottom connection is not attached to the floor, is cut through most of its width and the exterior flange is significantly deformed outwards (Photo 110). The top connection has a 4"x3" clip with slotted vertical holes adjacent to the web of the stud with a single fastener near the base of one of the slots (Photo 111). The horizontal leg of the clip is fastened to the concrete drop beam with two shot-in fasteners, the top track is cut in this location (Photo 112).
- The right jamb of the south facing window is framed with a single 2x12 stud blocking. We observed two aluminum plates securing the window frame to the wooden blocking. The blocking is not pressure treated and the base has rotted (Photo 113). We could see daylight through the interior wall opening at the jamb (Photo 114).

4. DISCUSSION / FINDINGS

Many of the findings we described in our 2013 report are still valid and are included herein where applicable. Our most recent observations made during this investigation, as described above, provide additional useful information and a better understanding of the cause(s) of the most significant distress that has occurred at both Coleman I and Coleman II.

4.1 Coleman I

4.1.1 Masonry

The masonry is generally in good to fair condition, however there are several locations that require repair work. Generally, the mortar around Coleman I is intact and slightly weathered. Some areas of brick, however, have significant cracks due to both in-plane and out-of-plane movement. There are many small cracks and splits in the brick and mortar, including local spalls typically under window lintel supports. These are likely the consequence of small thermal movements causing localized stress concentrations sufficient to fracture the masonry. Some mortar joints have deteriorated near the roof level, which may be the result of freeze-thaw action and moisture in the brickwork.

The lateral movement in the plane of the wall is likely to be the result of inadequate or ineffective expansion joints. Our probe opening at an expansion joint reveals that there is a potential load path through mortar bridging the vertical joints where the flashings cross. We also determined that many of the vertical joints have closed up or are narrower than 3/8” wide, and this will affect the future ability of the facade to expand and contract without impacting adjacent wall components. Care will be needed during construction when cutting or enlarging joints to avoid damaging the existing flashings. We anticipate that several additional vertical expansion joints will be necessary in locations where the masonry has cracked near a corner.

The probe openings at the parapet level reveal that the masonry anchors, through-wall flashing, and backup waterproofing are not reliable or adequate to prevent long-term out-of-plane movement or moisture intrusion. The top six courses can be made more weather tight by installing new metal through-wall flashing, complete with a properly designed backup weather barrier and lateral masonry tie system and new brick.

The existing copper fabric flashing at the window head and A/C unit lintels appears to be functioning adequately given the lack of leak reports, however for better long-term reliability and longer useful life, a zinc/tin coated copper metal flashing should be installed in these locations that extends to the outside face of the brick complete with weeps, end dams and a turned down drip edge to direct water away from the masonry. Currently, moisture that enters the wall remains in the wall due to the flashing directing water into the hollow cores in the brick.

We expect that masonry movement will continue if left unrepaired and will allow water to continue entering the wall reducing the useful life of the brick.

4.1.2 Sealant

The sealant at masonry-to-masonry joints is likely the original sealant. All of the sealant that we observed in the masonry has deteriorated past its useful life and needs to be replaced. Before new sealant is installed in the vertical expansion joints, the joints will need to be widened to accommodate anticipated future thermal movement of the brick masonry. Special attention will need to be made where the existing flashing crosses the expansion joints to avoid cutting the flashings. In addition to cleaning out all the existing sealant and backer rod, the bed joint mortar supporting the brick at the flashing level will need to be carefully removed too. After all the existing sealant in expansion joints has been removed, the surfaces should be prepared prior to new sealant and backer rod being installed. All of the sealant around the window and louver perimeters is also failing and will need to be replaced.

4.1.3 Windows and Louvers

The windows have reached the end of their useful life, are thermally inefficient and many are damaged and / or difficult to operate. The gaskets are typically hardened and pulling away from the corners of the IGU's and some continue to have broken glass. We expect more IGUs and gaskets to fail over time. We expect that significant amounts of water have entered the wall due to the reverse slope of the sills that pond water against the frame and jambs of the window. Because many of the joints at the ends of the sills are open and there is no functional sill pan flashing installed, any water that accumulates and runs off the sill will enter the wall. The sills may have been installed sloped this way or it may be the result of movement of the masonry below the sills. Ideally any window replacement decision should include installing sill pan flashings with end dams that ideally should terminate behind the first jamb brick on each side of the window opening. The new windows should have a sill installed with a slope away from the window.

If the A/C units are to be replaced with new equipment, they should be installed in a metal sleeve with slope to drain and a drip edge that directs water away from the building. Alternatively, if the option is to abandon the A/C equipment, the masonry opening should be bricked in and the interior LGMF and sheathing repaired including AVB and brick ties to the new masonry.

4.2 Coleman II

4.2.1 Masonry

The movement and distress that we observed in the brick masonry is most pronounced at the corners and at the upper floors of Coleman II. This is due to the lack of effective vertical and horizontal expansion joints. Although the vertical expansion joints are spaced at approximately 25', they have closed up and squeezed the sealant out of the joints in many locations. On the south elevation, the corners have moved out of plane approximately ¾" in places. The extent of movement has already compromised the integrity of the masonry wall ties attaching the brick veneer to the backup. Due to both the thermal and long-term moisture growth characteristics of the brick used for Coleman II, the brick has grown in length both horizontally and vertically. At the top three floors this is pronounced to such an extent that the masonry has displaced upwards relative to the window frames sufficiently to pull the sealant off the top of the window head and create a gap wide enough to insert one's hand. Although the drawings do not show how the windows are attached to the backup, we documented windows being forced upwards pulling their sill's anchors out of the support blocking which has not only compromised their attachment to the framing but also distorted the window frame and damaged the IGU's and insect screens.

Despite the Construction Drawings calling out for horizontal control joints, none were provided, primarily due to the condition that the bed joint at the toe of both levels of shelf angle has been packed with mortar. Consequently, the relative movement between the brick and backup structure / shelf angles from thermal expansion and long-term moisture growth in the brick results in the greatest masonry displacements at the upper floor levels. This is confirmed by the observation of the brick lifting off the shelf angles and of wall tie pintles lifting up in their support eyes and in several locations becoming completely detached, resulting in a reduced lateral capacity of the wall.

Horizontal brick growth has caused the vertical control joints to close up, especially on the curved south face. Once the joint is closed, the curvature causes stresses in the brick that cause it to move outward radially from the building and this is consistent with our observations. The outward movement causes additional unintended loads and stresses in the masonry ties and the steel stud framing.

The significant amount of vertical cracking in the brick on the curved face may be a consequence of a combination of the additional horizontal and vertical stresses in the wall.

A masonry repair scheme will need to establish properly constructed soft joints both horizontally and vertically. Current practice is to provide soft joints at every floor using shelf angles to support the veneer loads and allow sufficient space below the angle to allow for expected thermal and moisture movement of the brick and backup structure. This will involve installing many levels of steel angle around Coleman II and pre-fabricated curved angles for use on the south face. The size of angle used in the original construction is too small for the intended purpose and so will need to be replaced or modified. The load path(s) of new or modified construction will need to be reviewed and the structure supporting them checked.

The copper fabric flashing installed at the brick course above the floating lintels and shelf angles is not in an ideal location because it does not directly protect the steel from moisture. All new flashing at window heads and shelf angles should be part of the scope of repairs and include metal flashings that cover the steel lintels and extend to the face of brick with a drip edge.

4.2.2 Sealant

All the sealant is hardened and either crazed or separated from the joint and needs to be replaced. Masonry-to-masonry as well as window frame-to-masonry sealant joints will need to be replaced to provide a more reliable and functional joint.

4.2.3 Windows and Louvers

The windows have reached the end of their useful life, are thermally inefficient and many are damaged and / difficult to operate. The amount of exterior masonry movement has caused window frame joints to open up and to distress the window frames. We found that the amount of movement has seriously compromised the window attachment to the backup structure.

The ends of the window sills have separated from the jambs and the sealant joints are typically open. New sill pan flashing below the sill should be included in any future repair work.

The sealant joints around the louvers are also damaged from the masonry movement and will need to be replaced.

We expect future damage (racking of frames) and the potential for glass breakage if the brick movement is not isolated and controlled.

5. RECOMMENDATIONS SUMMARY

Our investigation of exterior wall components has revealed significant deterioration and distress to wall components of both Coleman House I and Coleman House II. Table 1, below, provides a summary of our recommendations based on a repair approach that addresses the significant conditions observed. We understand this information will be used to establish an initial pricing scope to evaluate different options for addressing the facades of these buildings as part of the forthcoming construction project at the Coleman campus.

Table 1 – Recommendations Summary

Component	Coleman I	Coleman II
Masonry	• Repair / repoint deteriorated and open mortar joints. • Replace cracked and spalled brick. • Widen existing vertical expansion joints that are less than 3/8" wide to accommodate expected thermal movement of masonry. Carefully remove mortar debris at bed joint where flashings cross the expansion joint. • Install new vertical expansion joints where required. • Remove existing top six courses of brick below roof cap flashing. Install new waterproof weather barrier and new metal through-wall flashing with exposed drip edge. Install new brick with masonry wall ties. • Install new metal flashings at window heads with exposed drip edge and weeps. Counter flash with existing weather barrier. • If A/C units are to remain, install new metal flashings at lintel and sills with exposed drip edge and weeps. • If A/C units are to be removed, install LGMF backup with sheathing and air and vapor barrier and install new brick with metal ties. • Clean stains on masonry below window jambs.	• Install horizontal expansion joints at each floor to accommodate expected vertical expansion of masonry. • Widen existing vertical expansion joints that are less than 3/8" wide to accommodate anticipated thermal movement. • Install additional vertical expansion joints at the South Elevation. • Rebuild parapet level brickwork and install new weather barrier and wall ties. • Repair / repoint deteriorated and open mortar joints. • Replace cracked and spalled brick. • Remove and clean moss and algae from masonry and brick shelfs • Install new metal flashings at window heads with exposed drip edge and weeps. Counter flash with existing weather barrier. • If A/C units are to be removed, install LGMF backup with sheathing and air and vapor barrier and install new brick with metal ties
Sealant	• Remove existing sealant and install new sealants at all existing and new facade expansion joints. • Replace all deteriorated sealant at window frame-to-masonry perimeter joints. • Replace all deteriorated and missing sealant at louvers (if they are to remain). • Repair sealant joints at roof parapet scuppers.	• Replace all deteriorated and missing sealant in vertical and horizontal expansion joints. • Replace all deteriorated sealant at window frame perimeter. • Replace all deteriorated and separated sealant at louvers.
Windows and Louvers	• Replace all windows with new. • Correct reverse slope of window sills. • Install new sill pan flashings with end dams. • If A/C units remain, install A/C sleeves with slope to drain and edge flashings.	• Repair / replace damaged window frames. • Install sill pan flashing with end dams below bent metal sills. • Replace bent or overstressed window head lintels.

Component	Coleman I	Coleman II
Additional Investigation / Testing	• Review interior wall conditions at top floor to establish leak locations (if any) prior to removing top 6 courses of brick.	• Investigate condition of LGMF at window openings at different elevations and determine extent of damage to studs and track.

We would be glad to assist you in planning a repair program and conducting any additional investigation and / or testing necessary to develop a repair scope for the facade. If requested, we can then develop construction documents suitable for bid.

Sincerely yours,

Simon F. Shipley, PE
Staff Consultant

J. Matthew Tripi, PE
Principal

FIGURES

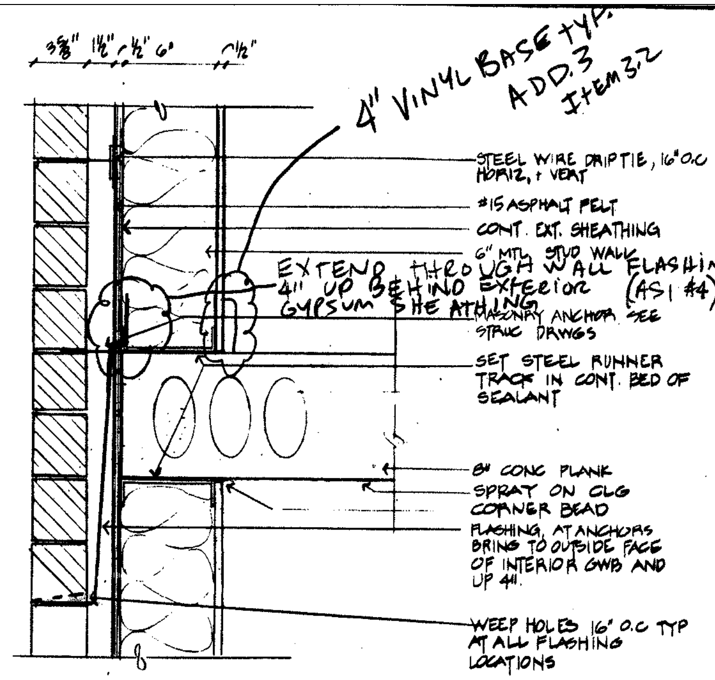

Figure 1 - Typical Non-Bearing Exterior Wall Detail (Drawing A-13, Coleman I)

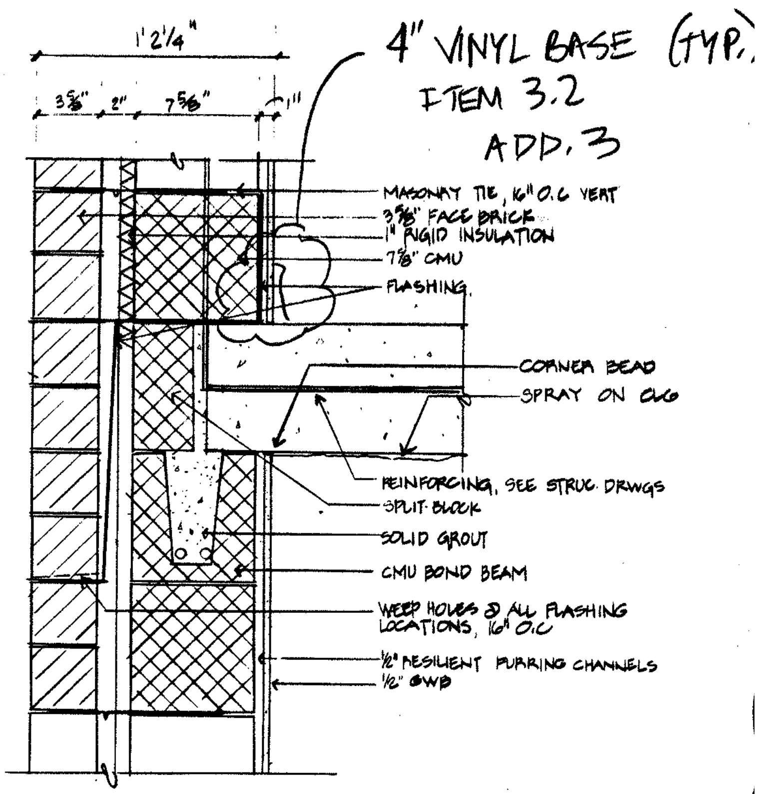

Figure 2 - Typical Load-Bearing Exterior Wall Detail (Drawing A-13, Coleman I)

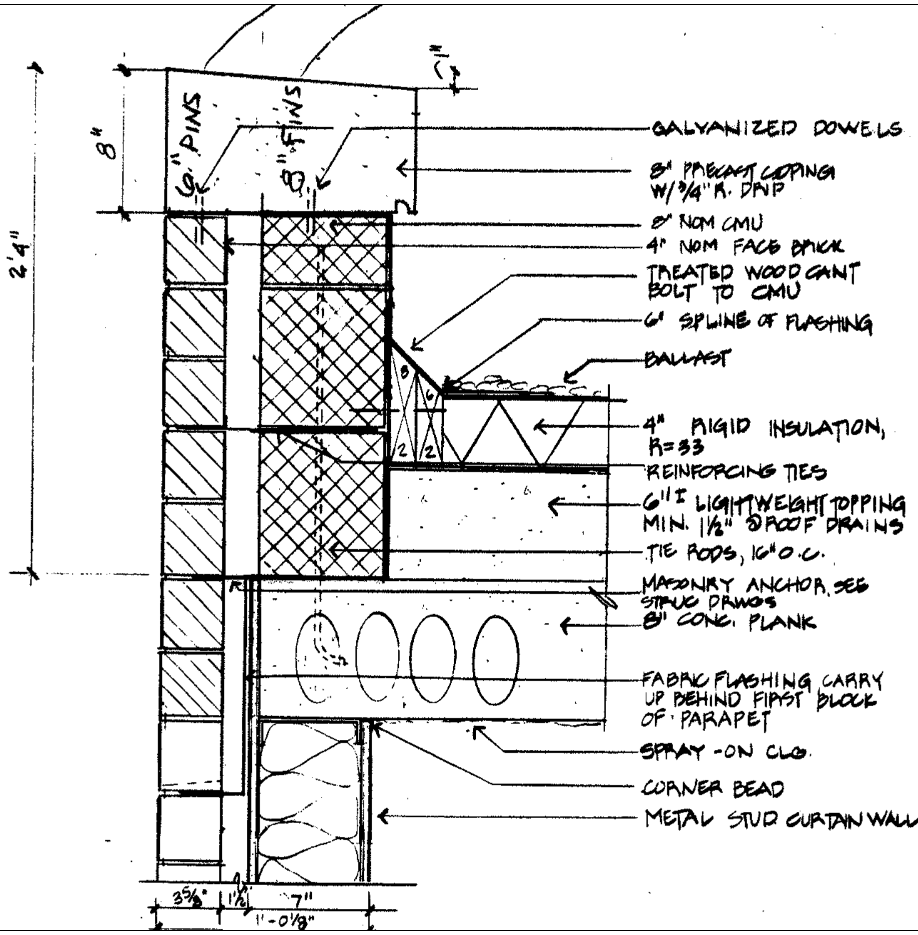

Figure 3 - Typical Exterior Wall Parapet (Drawing A-13, Coleman I)

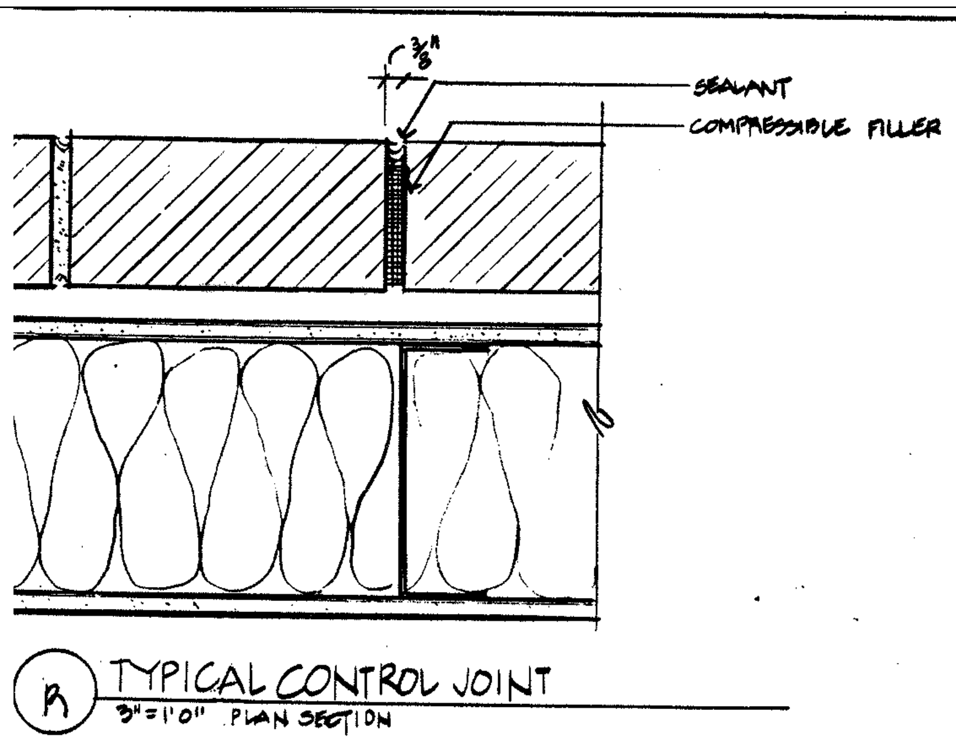

Figure 4 - Typical Expansion Joint Detail (Drawing A-13, Coleman I)

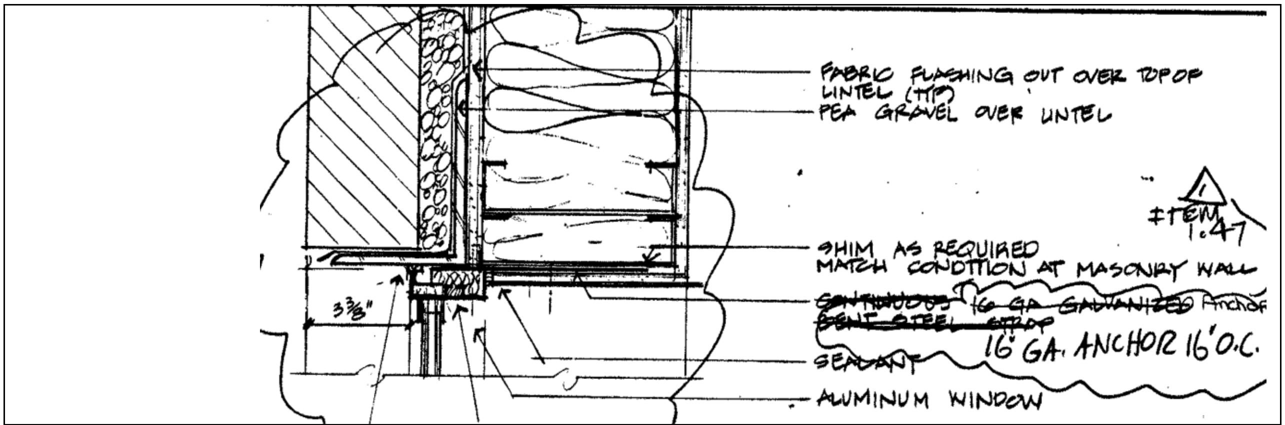

Figure 5 - Window Head Detail (Drawing A-14, Coleman I)

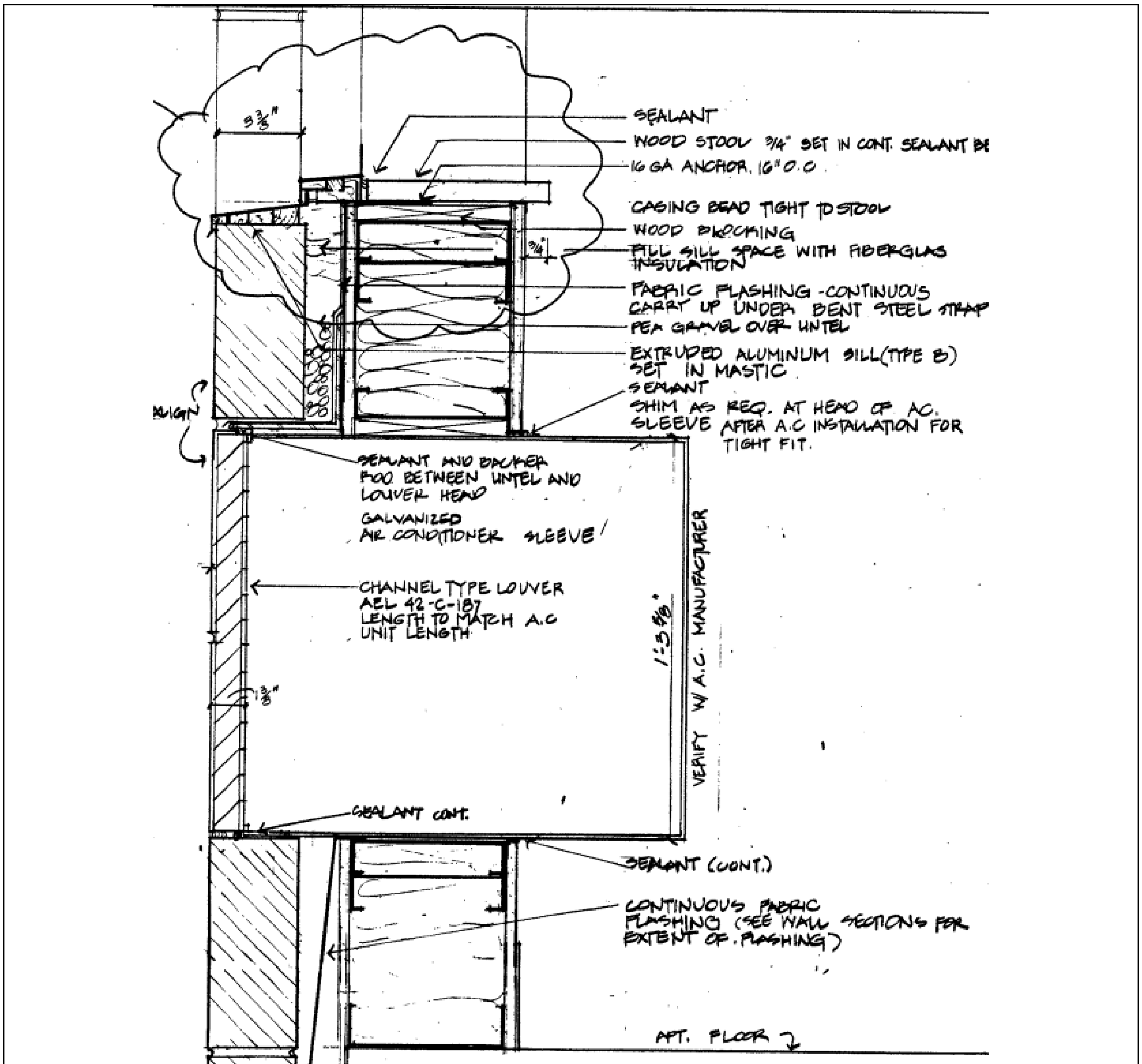

Figure 6 - Typical Window Sill and A/C Unit (Drawing A-14, Coleman I)

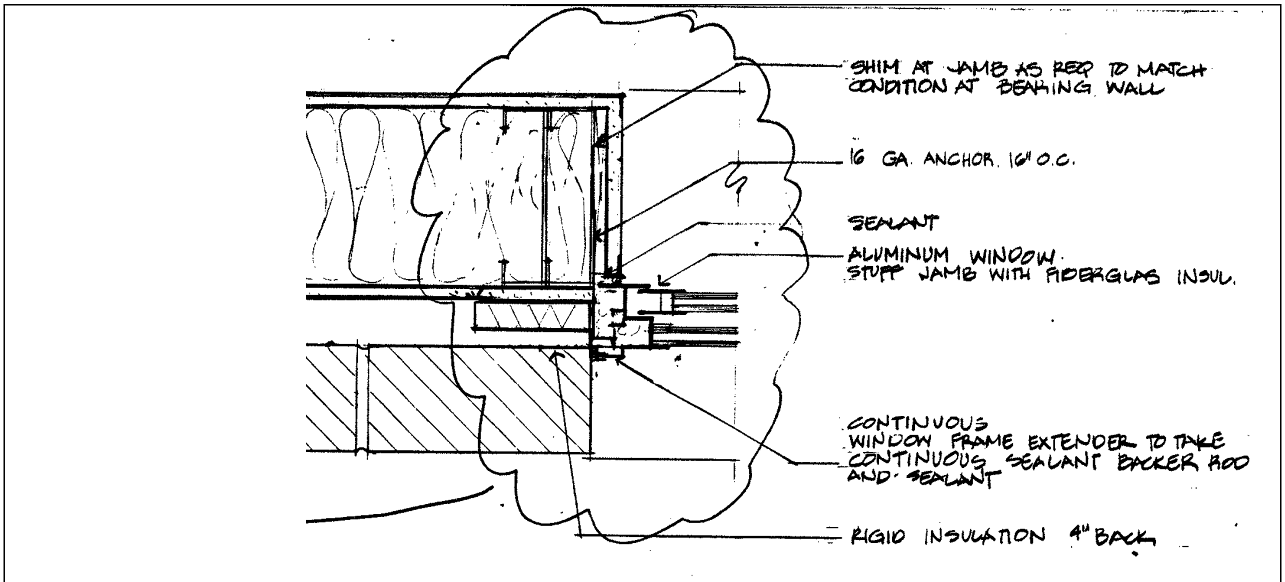

Figure 7 – Window Jamb Detail (Drawing A-14, Coleman I)

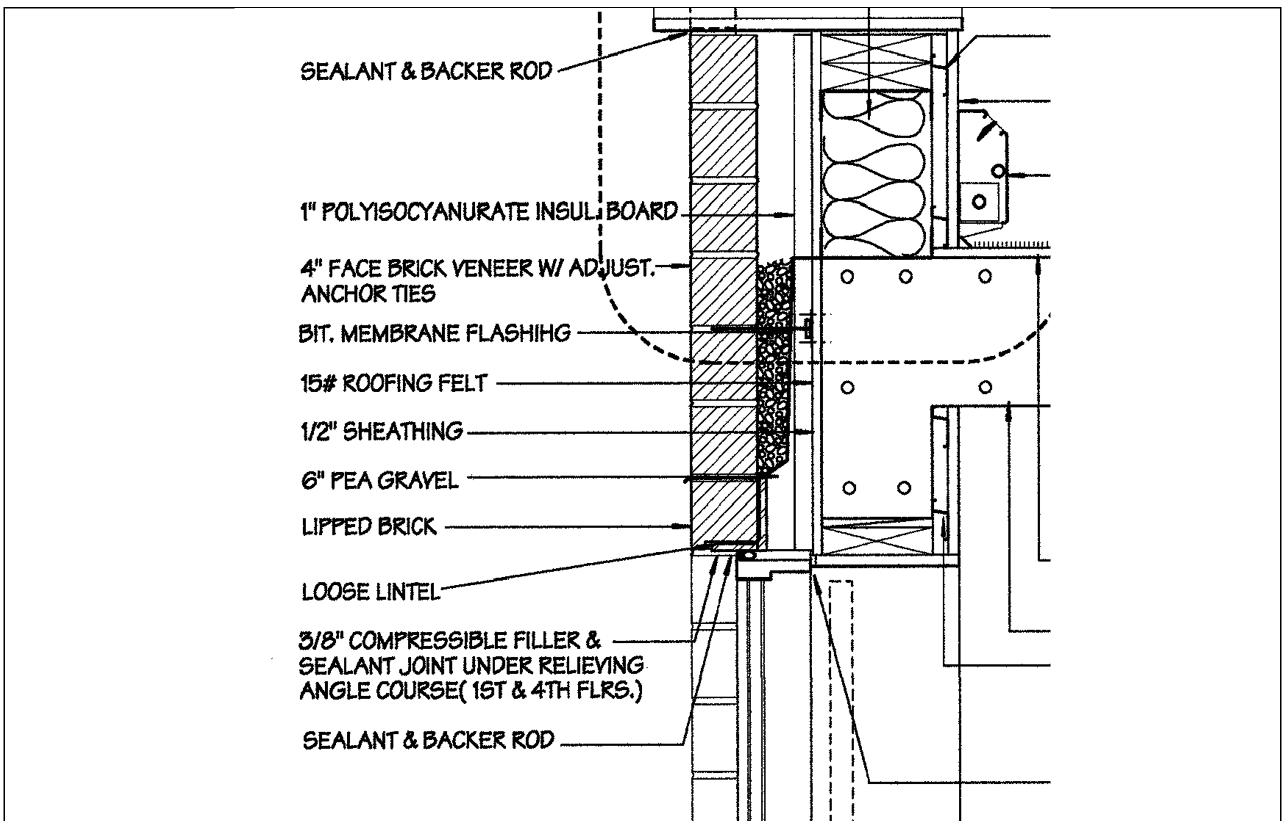

Figure 8 - Typical Non-Bearing Exterior Wall Detail (Drawing SKA6.2, Coleman II)

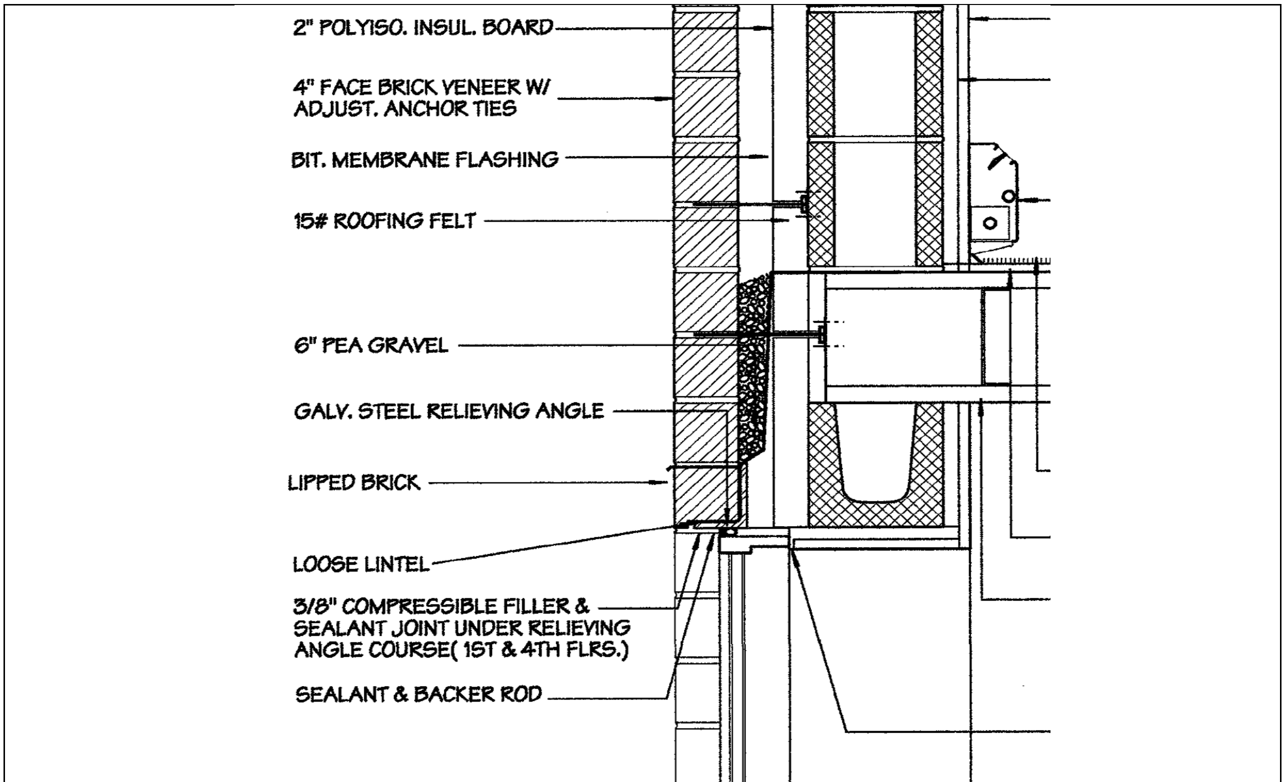

Figure 9 - Typical Bearing Wall Detail (Drawing SKA6.2, Coleman II)

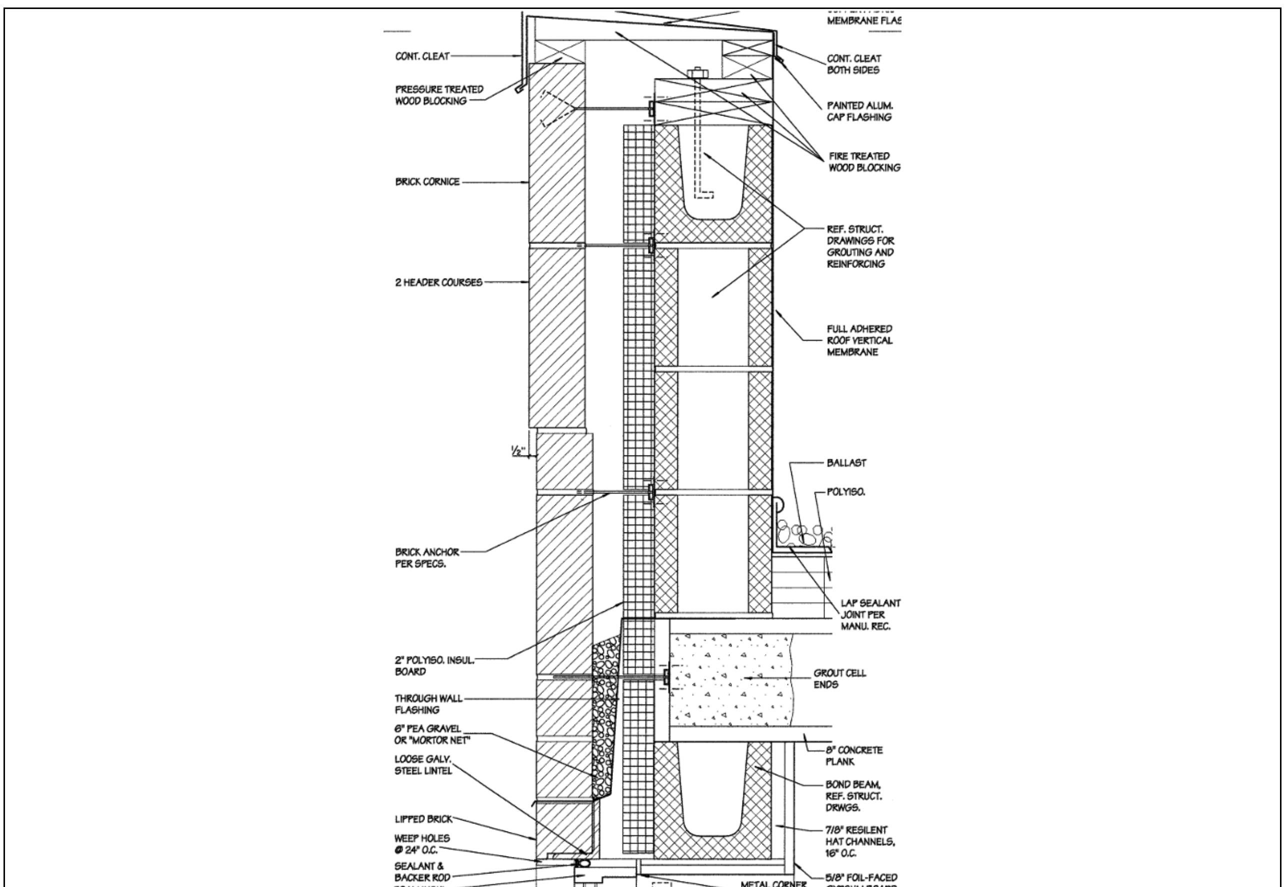

Figure 10 - Typical Exterior Wall Parapet (Drawing SKA6.3, Coleman II)

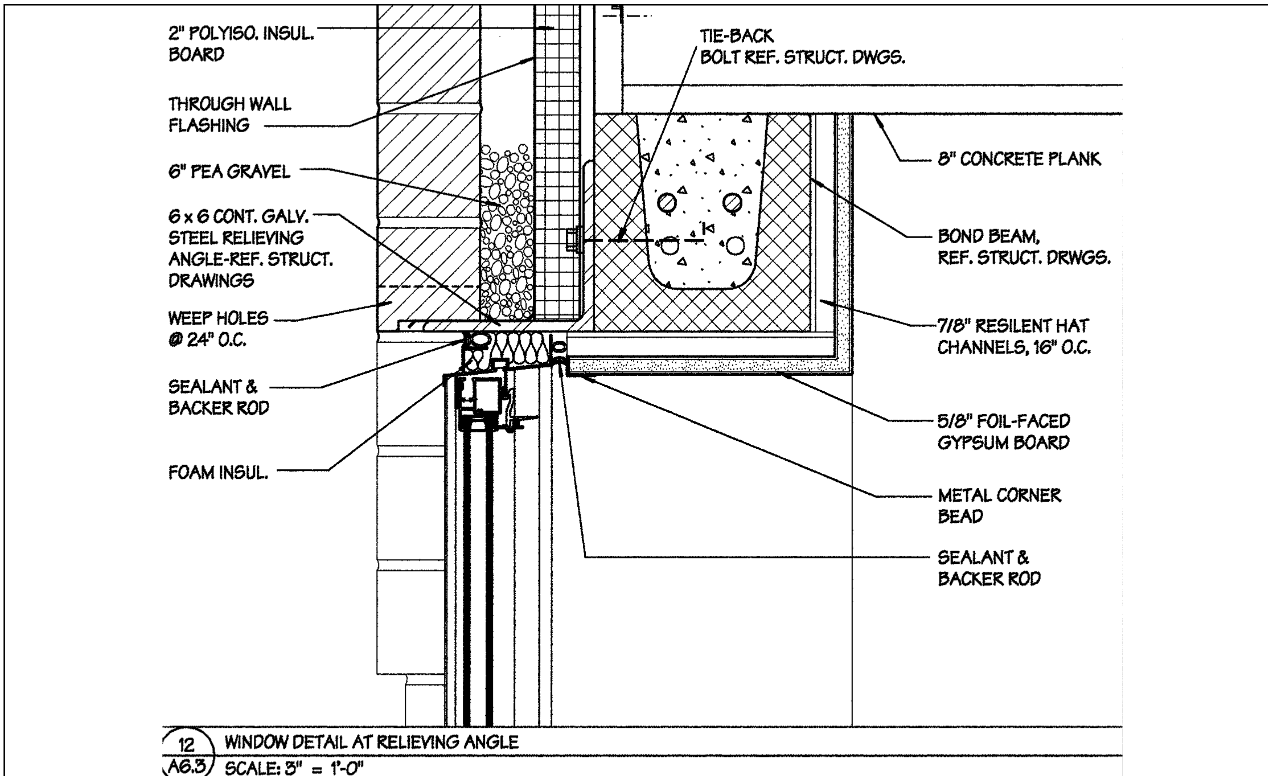

Figure 11 – Window Detail at Relieving Angle (Drawing A6.3, Coleman II)

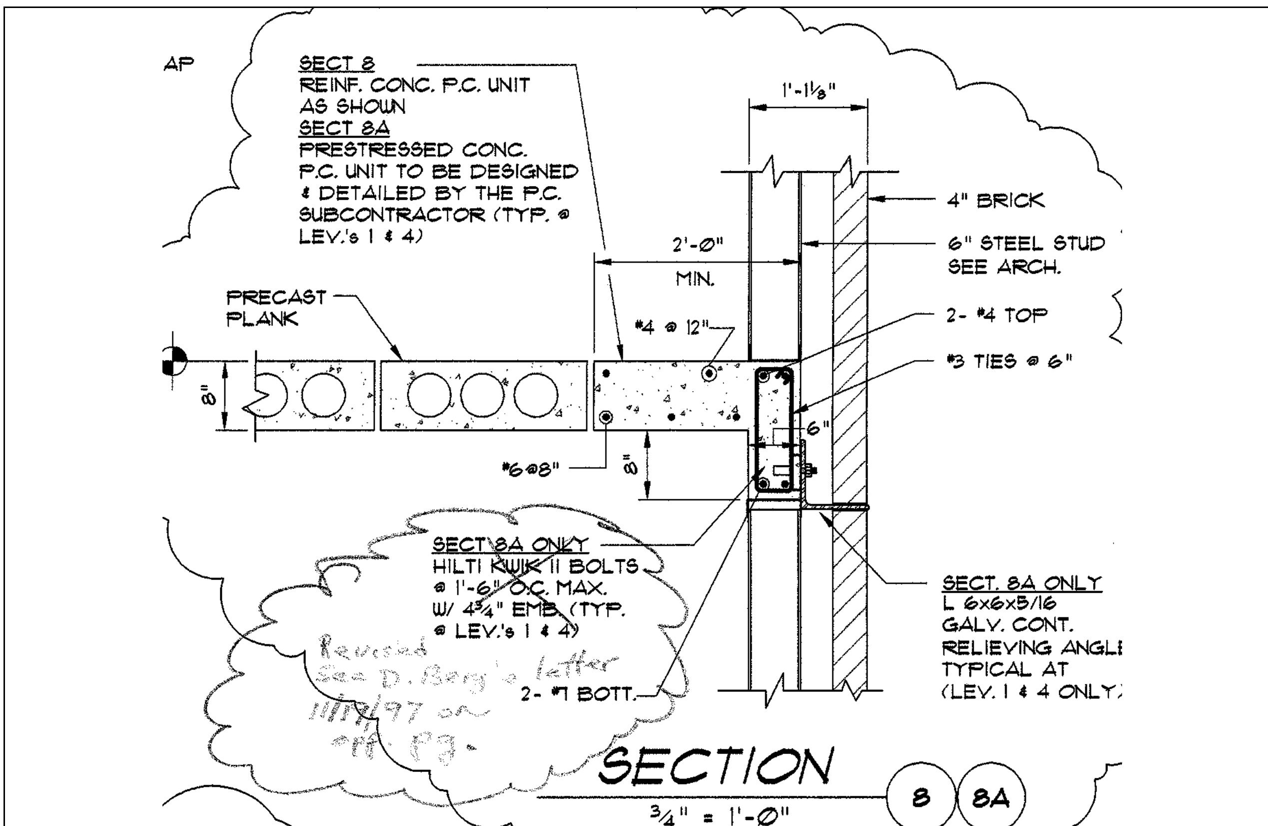

Figure 12 - Non-Bearing Exterior Wall Shelf Angle Support Detail (Drawing S7-1, Coleman II)

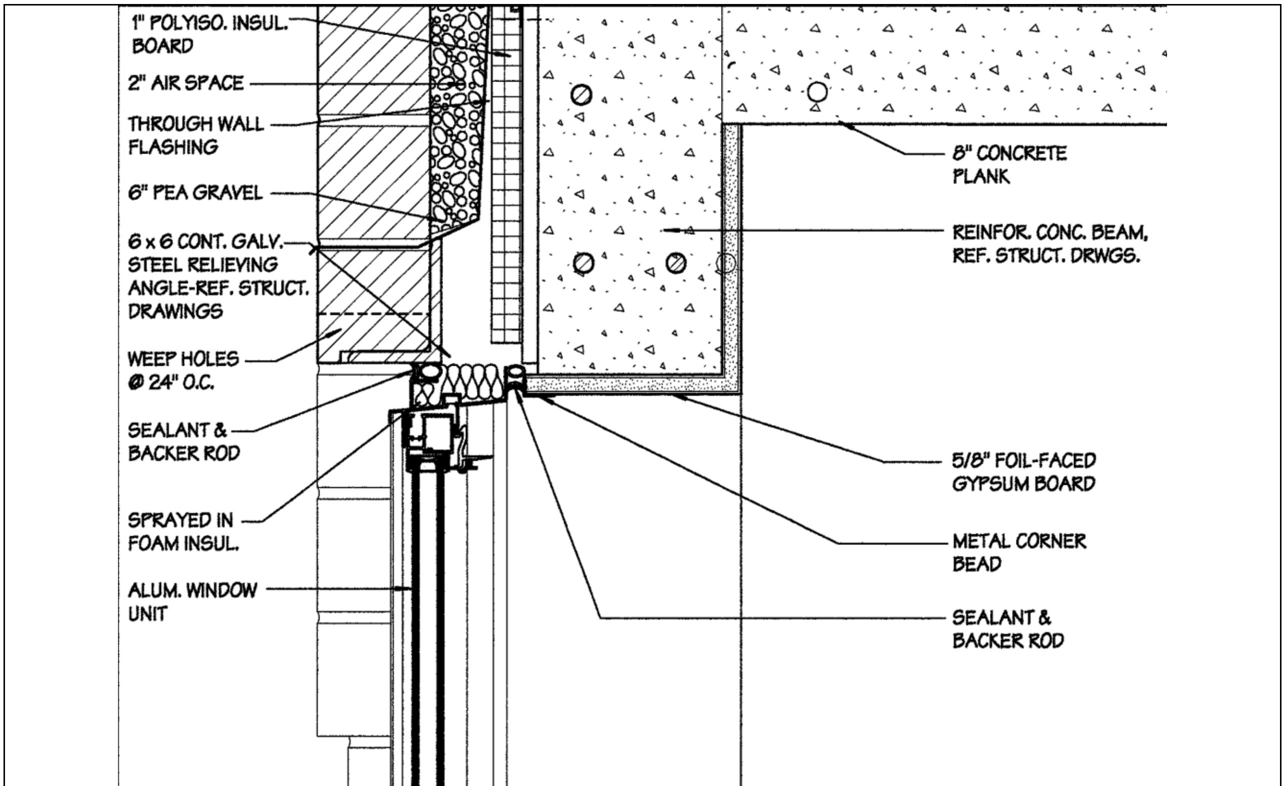

Figure 13 – Typical Window Head Detail at Non-Shear Wall (Drawing SKA6.3, Coleman II)

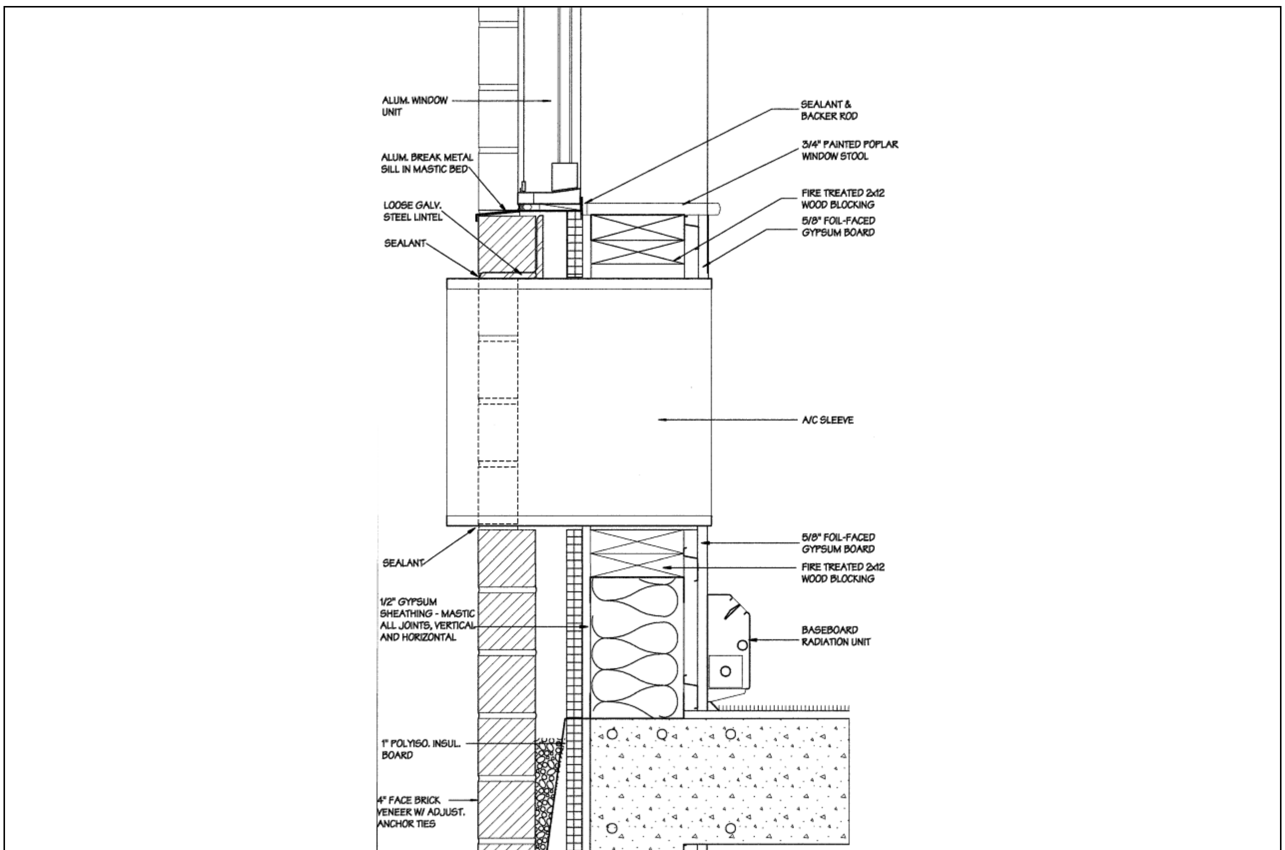

Figure 14 - Typical Window Sill and A/C Unit at Non-Shear Wall (Drawing SKA6.3, Coleman II)

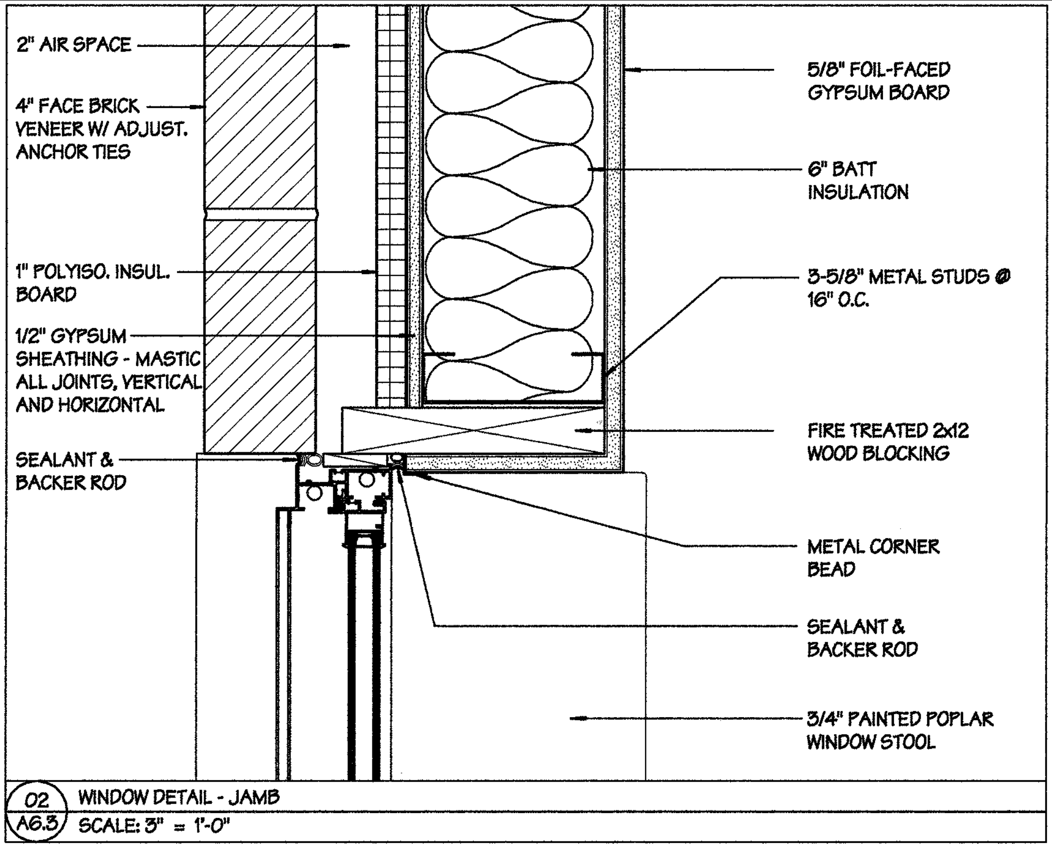

Figure 15 - Window Jamb Detail (Drawing SKA6.3, Coleman II)

Appendix A – Documents

Drawings

Coleman House I

By Ellenzweig, Moore and Associates, Inc.

Dwg. No.	Title	Date
A-1	Ground Floor Plan	7-5-83
A-2	Typical Floor Plan, Room Finish Schedule	7-5-83
A-3	Roof Plan and Details	7-5-83
A-6	Building Elevations North and East	7-5-83
A-7	Building Elevations South and West	7-5-83
A-12	Wall Sections	7-5-83
A-13	Wall Sections and Details	7-5-83
A-14	Window Types and Details	7-5-83

Coleman House II

By Bruner/Cott and Associates, Inc.

Dwg. No.	Title	Date
SKA1.1	“C” Level Plan	8-15-96
SKA1.2	“B” Level Plan	8-15-96
SKA1.4	First Floor Plan	8-15-96
SKA3.2	Exterior Elevations	8-15-96
SKA6.1	Wall Sections	8-15-96
SKA6.2	Wall Sections	8-15-96
SKA6.3	Window Details	8-15-96

Appendix B – Photographs