MINNESOTA STATE

Exterior Masonry Design Standards Manual

Second Edition

September 2017

Use only the most current copy of these Design Standards.
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http://www.minnstate.edu/system/finance/facilities/design-construction/resources.html

Exterior Masonry Design Standards

2nd Edition

Revised September 2017

Section	Article	Title	Rev. Date
Part II	W-2.15	Transitions to Windows and Curtainwall Opening	6/20/2023
Part IV	SP-1	SS Drip Tray Detail	6/20/2023
Part IV	SP-2	SS Drip Tray Splice Joint Detail	6/20/2023
04 01 0	2.05 J.	Embedded Flasing Material	6/20/2023
04 20 00	2.04, CVI.	Embedded Flasing Material	6/20/2023
04 20 00	3.07	Curtain Wall Stainless Steel Drip Tray Flashing	6/20/2023

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INTRODUCTION

The Exterior Wall Masonry Standards Manual is intended to outline the standards required of the Architect/Engineer for the design and construction of masonry exterior walls of Minnesota State new construction, renovation, or repair projects with materials and details to last the lifetime of masonry: 100 years or more. This guide parallels the design principles and requirements of the current edition of the Minnesota State Facilities Design Standards.

Topics included in the Exterior Wall Masonry Standards Manual are: New construction, existing construction, design, document preparation and examples, and an Appendix.

Minnesota State will issue any changes, in writing, to the Exterior Wall Masonry Standards Manual. See the Appendix for the Standards Revision Form to submit recommended changes to Minnesota State for review and inclusion.

Limits

The Exterior Wall Masonry Standards Manual is not intended to cover, but only to dovetail into; aesthetics historic restoration (as it applies), wall-related structural features, and adjacent building systems (i.e., air barriers, waterproofing, roofing, and openings).

Designer Prerequisites

The prerequisites for the Architect/Engineer that designs masonry exterior walls for Minnesota State are:

- Registered professional in the State of Minnesota
- Knowledge and understanding of the Minnesota State Facilities Design Standards
- Documented previous design and construction observation project experience with masonry buildings and materials
- Practiced knowledge of adjacent building systems (air barriers, waterproofing, roofing, and openings)
- Registration and/or accreditation with a professional organization related to the design and construction of building enclosure systems.

Building Codes

The following standards are to meet or exceed current building code requirements for both new construction and renovation, but this does not preclude the Architect/Engineer's responsibility to check and meet those requirements. If conflict arises between these standards and current building code requirements, then the more stringent will apply.

Key Minnesota State Principles and Goals

Design, construct, and maintain state owned higher education facilities for maximum performance with the least cost to the taxpayer over the life of the building.

Minnesota State's goals for masonry exterior walls include:

I. Long-term performance of masonry exterior walls for the life of the building is developed by:

- Selecting materials and accessories with long service life

- Detailing redundant moisture management and complete system transitions
- Designing to eliminate vapor drive and heat transfer
- Performing thorough construction observation

II. Well-developed transitions from masonry exterior walls to adjacent building systems by:

- Compatible material selection
- Comprehensive detailing and overlap

New Construction

New construction projects incorporate several adjacent building systems; vapor retarders, air barriers, waterproofing, roofing, and openings. The transition and compatibility of these systems are critical to the long-term performance and low-cost maintenance of Minnesota State facilities. The newest system to be incorporated into new construction of exterior walls is the air barrier system. To design a wall system with an air barrier system may require an analysis of the vapor drive and heat transfer with the specific wall system materials.

Air Barriers

In general, an air barrier system must include several key characteristics:

- Continuity from foundation to exterior wall, exterior wall to roof, exterior wall to openings, and at all penetrations and projections through the wall assembly.
- Transitions from one building component to another and at construction joints is critical to maintain a continuous air barrier; not allowing any breach in the system or any air flow.
- Compatibility of materials within the air barrier system and in transition to adjacent systems. Incompatibility results in loss of continuity and air barrier effectiveness.
- Flexibility to move with thermal and differential movement of adjacent and differing substrates.
- Durability to withstand the construction process.

The Architect/Engineer is required to identify and complete details that adhere to these key characteristics; overlapping at transitions to different building components and verifying compatibility of materials in the details. Before designing the details, however, the Architect/Engineer must analyze the wall system vapor drive to identify which type of air barrier (sheet membrane, fluid applied, vapor permeable or impermeable, etc.) will be used in the design. For non-standard wall conditions or systems, analysis of the air barrier, vapor retarder, heat transfer, and wall system shall be proven with a hygrothermal analysis or heat-transfer analysis.

Hygrothermal Analysis

If the Architect/Engineer contemplates a non-standard exterior wall system, they shall submit a variance which includes hygrothermal analysis. A simple dew-point analysis may no longer be an adequate moisture-control analysis tool, since it demonstrates a single view of condensation for one-moment in time. The hygrothermal analysis should be in conformance with

ANSI/ASHRAE Standard 160-2016, Criteria for Moisture-Control Design Analysis in Buildings in order to evaluate the moisture performance of a wall system inclusive of moisture accumulation or dissipation from materials' inherent moisture, weather events, and time. To properly analyze vapor drive, hygrothermal analysis using computer software is required. A design variance request shall be accompanied by a hygrothermal analysis of the proposed wall system materials during Schematic Design phase or prior to the end of Design Development phase. See the Appendix for a sample report. The parameters of a hygrothermal analysis of a wall system should include the following:

- 5 or more years of lapsed time
- Each wall system type with each of the applicable exposures or orientations (north, east, south, and west)
- Meet the ANSI/ASHRAE Standard 160-2009 reporting requirements

Acceptable results of the hygrothermal analysis must prove that original construction moisture dissipates and subsequent moisture from weather or occupancy does not accumulate in any one element of the wall system over the time period in the evaluation.

Heat Transfer Analysis

A non-standard exterior wall variance may require a heat transfer analysis by computer modeling to understand the thermal gradient within the wall system and at the window or curtain wall connection. Modeling the thermal gradient in a non-standard exterior wall provides insight to heat transfer and condensation potential that lead to moisture damage and possible structural integrity loss.

Structural Systems

In addition to the air barrier system, the structural system can impact the exterior wall details. The Architect/Engineer is responsible to understand what the structural system is composed of and how it affects the masonry wythes and through-wall flashing systems. As an example, when a structural engineer designs a steel beam to be installed over an opening, the Architect/Engineer should understand the size and reinforcement, if any, of the steel beam to

- Determine the through-wall flashing installation above the opening (vertical and horizontal substrates, height of vertical leg needed for top termination, etc.).
- Detail continuity of the air barrier at the opening.
- Check for and address thermal conductance issues.

Existing Construction

When a new addition abuts existing construction or the project consists of exterior wall repairs or through-wall flashing replacement (as a part of a reroofing project) at an existing building, additional concerns arise. Since the existing building stock of Minnesota State ranges from early 1900s to present day, these buildings have withstood several generations of building techniques and materials. Also, these buildings are typically occupied during the construction project, which poses heightened occupant safety and comfort concerns.

Initially the Architect/Engineer is faced with how to connect the new addition, perform exterior wall repairs, or replace through-wall flashing in existing construction. Overall, the project must

join flawlessly with the existing building while maintaining Minnesota State key exterior wall concepts. Additional critical pre-design steps require reviewing existing documents and conducting field verification to successfully join the new to the existing construction. Further discussion of these additional steps is outlined in Part I, Field Verification in this manual.

Hazardous Materials

Existing buildings are commonly known to contain materials that are deemed today as hazardous. While in a static state, these hazardous materials do not pose a safety concern until disturbed during the construction process. Existing materials in exterior walls that are considered hazardous when disturbed are asbestos and lead. Asbestos is found in joint sealant (or caulking) and vermiculite insulation. Lead is found in exterior paint on window frames, exposed steel lintels, and other painted building features. Each campus maintains records of hazardous material surveys that include these materials. The Architect/Engineer must check with the campus facilities personnel for the exact location of hazardous materials in the existing exterior walls. Then, contact the hazardous material consultant to prepare specifications and provide construction monitoring during the project as required by regulations.

Protection

Typically an existing building that undergoes a construction project will be occupied and contain interior finishes furniture and equipment; which all must be well protected. The project manual must not rely on a broad statement about protection in the General Conditions. Rather, the specifications, drawings, and construction observation must highlight all protection issues with special detail to the specific building and scope of work during Schematic Design phase or prior to the end of Design Development phase of design.

Safety

First and foremost, safety of the building occupants during a construction project at an existing building must be addressed, as they apply to the specific project, in the specifications under the topics of: egress, ingress, barricading, signage, and times that occupants cannot be in spaces adjacent the work due to safety risk. In addition to addressing these topics, communication with the building occupants, beyond barricades and signage, must be identified at a level appropriate with the project size and scope; through progress meetings or other Owner- or Campus-approved methods.

Weather and Dust

Protection of the building and its contents must be expanded in the specifications and, at times, detailed to include watertight conditions and dust control. Watertight conditions to prevent moisture from entering the building through an exterior wall opening (i.e.; through-wall flashing replacement) should at a minimum include specifying seal-off materials and describing the acceptable detail or method. A complete watertight detail including roof membrane seal-off must be shown if the exterior wall opening involves roofing (i.e.; parapet rebuilding). As for dust control, protection can range from specifying covering louvers and coordinating air intake shutdown with the site personnel to requiring shop drawings for providing and maintaining a more elaborate protection of an air intake on a science lab. The level of dust control must be discussed with the Owner and Campus to identify expectations that must be met during construction on an existing building.

PART I

FIELD VERIFICATION

EXTERIOR MASONRY DESIGN STANDARDS

2rd Edition

PART I: FIELD VERIFICATION

Field verification is critical for projects involving repair and renovation of existing construction. However, field verification requires preparation well before setting foot on the site. In addition to preparation, thoroughness of field verification is equally important. The following guidelines or recommendations delineate the field verification process: Visual observations and destructive test openings.

A. Set-up (Pre-Field Verification)

Guideline W-1.01: Obtain and use original building documents, any associated building addition documents, and any associated exterior wall repair or window replacement documents.

Understanding the exterior wall construction, including related structural elements, is very important prior to conducting field verification. Review the exterior elevations, building sections, wall sections, and corresponding details for the exterior wall and adjacent system materials and construction. Identify the air barrier location, if present, and material type. Look for notes that would indicate potential hazardous materials; like the terms “vermiculite or loose insulation” or any notes containing the words “asbestos” or “lead”. Also review the structural sheets for structural elements at openings and within back-up walls. Identify coordination issues between structural and architectural drawings as well as locations where structural elements may affect the continuity of the back-up wall assembly.

Previous exterior wall repair or window replacement documents may have a more accurate depiction of the exterior elevations with masonry infills or newer features shown. Review the list of repairs from these previous projects to identify possible areas to closely observe.

Copies of the exterior elevations and wall sections are useful tools for field verification. All field notes from the visual observations can be written on the elevation copies that would be translated into design documents.

Guideline W-1.02: Obtain and use, if applicable to the exterior wall scope of work, the current Minnesota State Roof Management Pre-design Report.

This report is obtained from Minnesota State. The Pre-design Report is focused mainly on reroofing projects and will provide initial information to start roof design. The Report is generated by visual observation and roof system test cuts. No destructive test openings are conducted at the exterior walls. However, any exterior wall issues directly related to the reroofing project will be discussed. The exterior wall scope and opinion of probable construction costs will be initially identified, but not to a schematic level. Since this report is focused on reroofing projects, it may not contain a complete scope of work for the exterior walls that will address all repairs or maintenance.

Guideline W-1.03: Obtain and use the most recent exterior wall survey and investigation reports, if they exist.

These types of reports are obtained from the campus facility personnel because typically the campus will have contracted directly with the consultant for the exterior wall survey or investigation, not Minnesota State. Not all campuses have exterior wall surveys of all campus buildings or investigations of problematic exterior wall issues. If an exterior wall survey or investigation report exists, use it to confirm deficiencies and to note any additional development of the deficiencies during field verification. The information contained in these reports may also be valuable for the Design Phase.

Guideline W-1.04: Obtain and use the most recent hazardous materials reports.

The campus facility personnel keep records of the most recent hazardous materials reports. Review the reports to identify possible hazardous materials in the exterior walls, such as asbestos-containing joint sealant or lead paint. If hazardous materials are present in the scope of work area, be prepared to contact the hazardous materials sub-consultant for direction as it relates to the scope of work.

Guideline W-1.05: Obtain and use building history from a site personnel interview and work orders.

Interview site personnel for their recollection of the building history and any generated work orders related to exterior walls. The building history may consist of the original construction, additions, remodeling, leaks, and their concerns regarding any visual observations. Site personnel may also have written documentation, such as work orders, that can provide insight to leaks or other exterior wall history.

Guideline W-1.06: Determine and select sub-consultants for field verification work.

When sub-consultants are required for the project, discuss the project needs (i.e., structural, hazardous materials) and confirm with Minnesota State. A sub-consultant or in-house approved expert is required to provide the same high level of thoroughness as the Architect/Engineer. Therefore, sub-consultants must perform set-up and any necessary field verification activities related to their scope. They cannot eliminate these steps and assume any information unless Minnesota State approves otherwise.
The cost of the sub-consultant through all phases is to be included in the Architect/Engineer's fees.

Guideline W-1.07: Determine and select a masonry contractor for field verification work.

When the scope of masonry work comprises of through-wall flashing replacement or large-scale exterior veneer rebuilding, destructive test openings are required at key locations at each affected vintage of the building. A masonry restoration contractor is recommended for cutting and repairing destructive test openings in the existing masonry for field verification of detail conditions. The repair must match the masonry unit, mortar, and coursing; the masonry units should be "toothed-in". The repair must also be neat, no mortar smears; to avoid an additional return trip to clean the cured repair.
If sub-consultants will be performing field verification, verify if they will need contractor assistance for access and destructive test openings. Then, coordinate and schedule the field verification with the sub-consultant and masonry restoration contractor.
The cost of the masonry restoration contractor assistance for field verification is to be included in the Architect/Engineer's fees.

Guideline W-1.08: Coordinate and schedule upcoming field verification work with the campus personnel.

Field verification work requires thorough coordination with campus personnel for several reasons: security, schedule, access, and collection of project-related information. Campus personnel and security must be aware of the extent of field verification work (i.e., location, number of days, start and end times, number of people involved, type of work) in case unknowing building occupants report this activity as a concern. Discuss with campus personnel when to best schedule field verification that considers building occupancy of adjacent spaces

and the potential for interruption and noise. Campus personnel must also be available to provide access to the adjacent rooms, the roof, if necessary, and to see firsthand what their concerns are regarding the exterior walls. Schedule a time with campus personnel immediately prior to field verification work to discuss the field verification process and the upcoming project to uncover any campus issues that need to be addressed in the project.

Follow through by communicating to all those participating in field verification (co-workers, sub-consultants, contractors) what the campus expectations are while at the site. All field verification participants must exercise safety, cleanliness, and professionalism.

Guideline W-1.09: Finalize the approach and assess the general impact and risk of test openings based upon information gathered.

Plan the order of events during the field verification process to consider the best use of time and staffing. However, do not allow disruption of building occupancy for small economies in field verification.

Plan the location of destructive test openings and hazardous material sampling in least noticeable areas that still provide typical detail information.

B. Visual Observations during Field Verification

Visual observations are either the only component of field verification or a large component of field verification that integrates destructive test opening(s). Spend plenty of time making and noting visual observations to ensure that every detail pertinent to the scope of work is documented thoroughly. These notes will most likely be referred to later in the design process or even during construction of the project.

Guideline W-1.10: Document interior conditions.

The scope of work for the exterior walls will determine the extent of interior observations. Minimally, interior observations should include understanding the space layout and use. Knowing details about the interior space may influence project specific conditions regarding noise and dust. When the scope of work involves resolving interior leakage, then a more advanced approach to interior observations must be completed. Document the interior finishes, leak location, (i.e., measurements, window jamb, ceiling tile) and extent of the damage (i.e., stains, deterioration). Broaden the visual observations to removing ceiling tiles or window treatments, if necessary, to pin point or narrow down the leakage source(s) and to understand existing construction. Documentation of interior observation includes written field notes and photographs. Written field notes are most helpful on copies of floor plans to verify or show interior dimensions related to key features or leakage areas. Ultimately the interior dimensions can be linked to structural elements and exterior features. Photographs are very important of the overall space, the walls on the exterior perimeter, and specific details as they relate to the scope of work. Don't hesitate taking several photographs since repeated site visits are not typically planned or economical for good project management.

Guideline W-1.11: Document exterior conditions.

Similar to documenting the interior, the exterior conditions must be thoroughly documented with written field notes and photographs. Written field notes on copies of site plans, exterior elevations, and floor plans will assist greatly in the design process. Record observations on the site plan such as landscaping, pavements, adjacent buildings, connecting links, service spaces (i.e., loading dock, delivery entrances, public entrances), and utility equipment and connections.

Photograph overall exterior elevations and exterior features. Note on copies of exterior elevations all exterior features, including:

- Bonding (i.e., running, Flemish, 6th course header tie-in),
- Special patterns (i.e., dog-toothing, corbel, recess),
- Materials (i.e., brick, stone, concrete, precast concrete),
- Multiple colors of one specific material (i.e., 5-color brick blend, brick color A and B in a pattern),
- Sizes of materials (i.e., actual brick size, width of mortar joint, width of stone band),
- Location and sizes of architectural features (i.e., width and depth of pilasters, actual size of windows, doors, and louvers; stone medallions, downspouts, overflow scuppers, exterior lighting, signage),
- Locate and identify potential obsolete features (i.e., fasteners, vents, cable, conduit)
- Location of joints (i.e., masonry and building expansion, stone band),
- Confirm overall width and height of exterior elevations

In addition to the exterior features, photograph and note deficiencies, including:

- Broken, cracked, damaged, and deteriorated materials, joints, and finishes
- Spalling (i.e., locate spalled units, depth of spall in concrete, coverage of reinforcing or anchors)
- Cracks (i.e., map or draw out on elevation drawings, measure width if needed)
- Displacement (i.e., out-of-plane or rotated masonry, deflected lintels, compressed masonry expansion joints)
- Efflorescence (i.e., describe degree, photograph overall and close-up)
- Other staining (i.e., rust, biological growth)

When noting deficiencies, include quantity and actual location on exterior elevation drawings. If there are deficiencies that may indicate structural performance issues, a structural engineer should minimally review photos, and drawings, to determine if further investigation or structural repair recommendations are necessary to the scope of work. Include the outcome of this minimal review in the design report.

C. Destructive Test Openings

Guideline W-1.12: Perform, or supervise, and document exterior wall system test openings.

Schedule the destructive test opening(s) with the campus personnel during a time that noise, usually short and intermittent, can be permitted in the adjacent spaces. Discuss the scope of the destructive field verification; such as: quantity of test openings, roof access, staging of aerial lift, scaffolding, and vehicles, etc. Coordinate the destructive work with the assisting masonry contractor and any other sub-consultants participating in the destructive opening(s) (i.e., architect, structural engineer, abatement contractor or consultant). The assisting masonry contractor should provide any access by ladder, scaffolding, or aerial lift; in addition to providing

matching replacement units, mortar, and any other materials to repair the destructive test opening.

Arrive to the site with copies of pertinent drawings, quadrille sketchpad, camera, and any personal tools that may help during the destructive test openings.

Direct the assisting masonry contractor as to the location of the destructive test opening(s). Typically for cavity wall construction of brick and CMU back-up, each test opening should be approximately 18" wide by 18" high minimum to view any existing through-wall flashing, masonry tie system, and cavity details. Mark the cut locations with a construction crayon, allowing the masonry contractor to cut without direct oversight. To eliminate safety risk and hazards, avoid close observation of the cutting process. Direct the assisting masonry contractor to salvage the cavity insulation and, if possible, masonry units for repairs after documenting the test openings.

When the cutting is complete, brush away any additional dust. Photograph the test opening overall and close-up for cavity details, including a tape measure in the photo. Compare the test opening with the wall section in the original construction documents. Document the existing wall section on a quadrille sketchpad using the scale of 1/4" square = 1". Include the date, project name, and location on the sketch. Also identify the test opening location(s) on the exterior elevation drawings. Sketch any additional details in exploded view or larger scale, if necessary. Note on the sketch all materials and necessary measurements to duplicate the detail in drafted drawings (i.e., thickness of insulation, total cavity space, height from roof membrane).

When test opening documentation is complete, instruct the assisting masonry contractor on rebuilding the opening(s) as cleanly and neatly as possible with salvaged insulation, salvaged or replacement masonry units, and mortar. Observe the rebuilding until it is complete and document the finished work with a photograph. Be sure that all debris is removed from the area of work and the site is returned to original conditions. Finally, contact campus personnel that the work is complete and all staff is off-site.

Guideline W-1.13: During anytime of the visual observation phase that life safety concerns are discovered, immediately photograph, contact campus personnel, and follow-up with a letter.

Since the visual observation phase has the opportunity for close-up observation and destructive test openings, unsafe conditions may be discovered. Unsafe conditions may include, but are not limited to, severely deteriorated mortar, out-of-plumb masonry, cracked architectural features, or corroded or missing tie systems that risk the facade falling to the ground.

As a matter of Good Samaritan practice and for minimizing liability risk, a discovery of an unsafe condition or life safety concern must be immediately communicated to campus personnel so they can take urgent action to correct or eliminate the hazard. This communication should be a phone call and, if possible, sending a photograph via text messaging or email. Discuss with campus personnel the location, extent, and possible immediate remedies (i.e., repairs, barricades, etc.). It is also strongly recommended that this event be followed by documentation in a letter with a photograph and sent to the campus personnel. Not only does this documentation address liability risk, but assists in securing emergency funding for immediate repairs. Therefore, the letter should contain a description of existing unsafe conditions, options for eliminating the hazard, and possible costs.

D. Follow-up (Post-Field Verification)

Guideline W-1.14: Organize photos and field documentation in preparation for design.

Typically, digital photos can be organized in file folders for each exterior elevation face (i.e., north, south, east, or west). However, for complex projects, the Level 1 file folders may be a certain part of the building (i.e., classroom, pool, gym, penthouse, roof-level clerestory) with subfolders for each exterior elevation face. Organizing digital photos is as important for the design process as it is for the construction process. Others may need to access the photos during any phase of the project. Simple organization lends itself to easy access.

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The field documentation should be in a folder and include all sketches of the details and drawing copies marked with field notes. The sketches and marked drawing copies should be dated the field verification date.

Guideline W-1.15: Follow-up with campus personnel on determining obsolete features.

Place photos of potential obsolete features and a plan view sketch into an electronic format (PDF) to forward to campus personnel. Send the information and ask campus personnel to verify if these features are still used or if they can be eliminated and exterior wall repairs completed. Include the campus personnel response in the design report.

Guideline W-1.16: Follow-up with sub-consultants and reports from field verification.

Request that the sub-consultants forward their reports for inclusion into the design report. Their report must include recommendations for repair, remediation, or abatement; plus an estimate of construction cost, if possible. It's important to get the report as quickly as possible since their recommendations may greatly influence the project.

After **Field Verification**, documentation of the work occurs in the Schematic Design phase with the Schematic Design (SD) Phase Report and Drawings. Refer to the latest edition of the Minnesota State Facilities Design Standards for the SD requirements. Also see the following Part III Document Preparation and Submission for additional requirements.

PART II

DESIGN

EXTERIOR MASONRY DESIGN STANDARDS

2rd Edition

PART II: DESIGN

Masonry design, whether for new or existing construction, must strictly adhere to the Minnesota State Mission Statement:

Design, construct, and maintain state owned higher education facilities for maximum performance with the least cost to the taxpayer over the life of the building.

"Maximum performance with the least cost" means specifying materials that have long service life and designing a complete system with details that address moisture management, system transitions, vapor drive, and thermal conductance. Therefore, a masonry exterior wall system with cavity wall construction and masonry or concrete back-up wall is expected, with the exception of specialty buildings (i.e., greenhouses, aviation hangars). Minnesota State standard wall system shall consist of exterior clay masonry units (brick), a cavity with minimum 2" air gap and insulation to comply with current state energy standards, air barrier and masonry or concrete backup wall. Depending on the insulation thickness, special detailing may be required at various conditions such as jambs. A/E shall perform brick tie analysis per ACI 530 for cavities greater than 4½ inches.

Masonry, as an exterior wall construction material, inherently has a long service life of 100 years or more; therefore, masonry exterior walls should be constructed with long-life accessory materials and attention to details. Accessory materials are limited to highly corrosion-resistant metals for anchors, ties, and flashings at inaccessible details (i.e., stainless steel, brass, copper); and high quality materials at accessible details (i.e., mortar for masonry joints, joint sealant for masonry expansion joints). Details should be redundant for moisture management and include complete system transitions to other adjacent systems.

A. Material Selection and Compatibility

Standard W-2.01: Specify clay or stone exterior masonry units to meet ASTM standards and review all manufacturer's or quarry's test data to meet the related ASTM standards.

The exterior masonry units must meet all physical requirements identified in the corresponding ASTM standard. Refer to the pre-construction and construction requirements and tests outlined for each masonry material in Section IV., of the Minnesota State Facilities Design Standards. Where manufacturer's test data is to be reviewed, the third party report cannot be dated any older than 18 months from the review date and must be signed by a professional engineer.

Clay brick masonry units must meet all ASTM C216 requirements for Grade SW, Type FBS or FBX; which includes compressive strength, absorption, saturation coefficient, initial rate of absorption (IRA) and freeze-thaw. The saturation coefficient for Grade SW is 8%. In our region, it is recommended to limit the saturation coefficient to 5%.

Efflorescence testing is not required by ASTM C216-10, but must be separately specified. Minnesota State includes efflorescence testing as a requirement, therefore the test data must indicate "not effloresced" according to test method ASTM C67 and must be included as a material performance criteria in the project masonry specifications.

Freezing and thawing testing will not be required during design or pre-construction unless directed and approved by Minnesota State. The freeze-thaw testing method requires several months before results are obtained and can be costly. Minnesota State will consider this as a requirement for large projects that have sufficient lead-time. Otherwise, review and approval of the manufacturer's test data, dated no older than 18 months, indicating that the selected clay brick meets the ASTM requirement for Grade SW durability.

If a variance is granted for the use of stone exterior masonry units on a project, each type of stone has different ASTM requirements for the unit properties. Pertinent ASTM standards for natural stone include C503 (marble), C568 (limestone), C615 (granite), C616 (quartz-based), and C629 (slate). For mass stone or solid stone features, the quarry's test data for unit properties of absorption and density must meet the corresponding ASTM requirements for that stone type.

Standard W-2.02: Specify mortar type using the three main components: cement, lime, and aggregate according to ASTM C270. No additives (other than color), masonry cement, or mortar cement is allowed. The mortar type specified must be compatible with the masonry units and appropriate for the application.

Mortar mixed with only the three main components of cement, lime, and aggregate is specified for Minnesota State projects; no additives or proprietary blends are allowed. Mortar is specified by ASTM C270, Proportion; except where compressive strength is required by the Project Structural Engineer, then mortar is specified by Property. The mortar may be site-mixed or pre-blended dry mortar mix; each having subtle differences in submittals, testing, and action required when testing criteria are not met.

The primary submittals required for both site-mixed and pre-blended dry mortar mix are the mix design and material certificates of each component meeting the ASTM C270 requirements. The site-mixed mortar submittals are largely developed by the masonry contractor, whereas, the pre-blended dry mortar mix submittals are initially generated by the manufacturer and forwarded to the contractor. The pre-blended mortar manufacturer will need to supply the mix design and certificates of each component, including the aggregate test data meeting ASTM C144, to be used in a Minnesota State project. When a mortar is specified by Property for compressive strength, the mortar compression test results data, no older than 18 months and signed by a professional engineer, must also be submitted.

Testing mortar during pre-construction and construction is to check the gradation and quality of sand, and mortar aggregate ratio for the Proportion requirement. Testing the gradation and quality of sand for site-mixed mortar requires sampling the sand pile at the site for each delivery. For pre-blended dry mortar mix, the sand may not be available to sample, therefore, the pre-blended mortar manufacturer will need to resubmit test data for aggregate to meet ASTM C144 every six months during construction with reports dated no older than 6 months.

The mortar aggregate ratio test method is the same for site-mixed or pre-blended dry mortar mix. However, when the results indicate the testing criteria is not met, the action is different. For site-mixed mortar that fails the mortar aggregate ratio test, the material measurement or batching needs to be improved upon. Checking the tested volume proportions against the measurement method used at the site may help identify the problematic batching procedures. For pre-blended dry mortar mix, the mix may be rejected during pre-construction, but data is reviewed for further action during construction.

When the Project Structural Engineer specifies mortar by Property, then mortar compression tests need to be specified to meet a certain compressive strength range. Property specified mortar needs to be tested with a laboratory prepared mix and limited water content. The test should include the results of three properties: compressive strength, air content, and water retention. When the laboratory mix for Property specified mortar is approved, the proportion of that laboratory mix is the defined mix for use in the field.

Compression testing for Proportion specified mortar can be conducted, but only for quality control, not to meet the ASTM C270 strengths listed in the Proportion tables. Proportion specified mortar, such as Type N, will average between 1,000 to 2,200 psi at a 28-day break with three 2" x 4" cylinders. For an average above this range, the next action is to be discussed with the testing agency. Generally, 10% beyond this range is not much concern, but, averages that are reaching 4,000; 5,000; or more should

have a petrographic analysis completed to identify the ratio of the mortar ingredients to determine if it meets the Proportion specified.
Generally, the mortar type specified for above grade exterior walls is Type N. However, Type S or O can even be used in specific masonry applications. The mortar type should always be researched and confirmed for use with the specified exterior masonry units, the application, and if there are structural considerations. If the mortar type will be used in restoration or rehabilitation, then testing of the existing mortar according to ASTM C1324 and testing of the existing units would be prudent during the design phase prior to selection of the new tuck pointing or rebuilding mortar.

Standard W-2.03: Specify flexible sheet metal through-wall flashing of 2 mil stainless steel with polymeric fabric on one side or 5 oz. copper with polymeric fabric on both sides.

In keeping with the mission for "maximum performance with the least cost to the taxpayer over the life of the building", specifying flexible sheet copper for the through-wall flashing membrane pairs up a long-term material (sheet metal) with the longevity of the masonry exterior. In certain details, the through-wall flashing membrane will lap over a stainless steel drip above openings. Rare exceptions to this rule are: 1) a full stainless steel through-wall flashing system, if required to eliminate copper in contact with a specific masonry unit; or 2) the laminated copper may lap onto a color-coated sheet metal in limited locations. Both exceptions would need approval by the Minnesota State system office. Otherwise, there are no substitutes allowed for the through-wall flashing membrane.

Standard W-2.04: Specify metal masonry accessories as stainless steel, Type 304.

Metal masonry accessories, including joint reinforcement, brick ties and anchors, stainless steel drip tray flashing, and through-wall flashing drip edges and termination bar; are to be specified as stainless steel, Type 304. Galvanized metal is not allowed for these accessories. Exceptions to this rule are lintels and reinforcing steel. Hot dipped galvanized metal is allowed for lintels and other exposed steel elements (roof ladders) where stainless steel is cost prohibitive. Reinforcing steel should be specified by the Project Structural Engineer as uncoated and with the proper ASTM designation for the required bars.
Stainless Steel drip tray under curtain wall systems shall be specified as 18 gauge. This is the thinnest allowable gauge that can be successfully welded; particularly at the vertical end dam corners of the sill pan flashing.
Stainless steel sheet metal drip edges used in conjunction with composite copper through-wall flashings shall be minimum 24 gauge. Provide a thicker gauge when the drip edge is used as a support for the through-wall flashing in the cavity or at grade. Drip edge should exit the wall and turn down immediately 45º at the exterior surface of the masonry wall and extend out 3/8". Length and gauge of drips shall be clearly indicated on drawings and specifications. Corners of exposed drips at grade shall be rounded (no sharp edges) and soldered/welded.
Through-wall flashing termination bar is specified at 1/16" (16 ga.) and 1" width; which allows the termination bar to conform to substrate irregularities. In order to both conform to the substrate irregularities and maintain compression along the through-wall flashing top edge, fasteners and holes spaced apart 6" on-center with the holes no more than 2" from the termination bar ends.
Fasteners for the veneer anchors and through-wall flashing termination bar are specified as a stainless steel bolt or nail pin with a brass expansion sleeve for the veneer anchor and a metal alloy body for the termination bar. The nylon body fasteners previously specified for termination bar fasteners have been known to crack upon installation, rendering very little holding capacity for the required compression of the termination bar.

Standard W-2.05: Specify air barriers as vapor permeable or impermeable, based upon the new wall system and, if it applies, any existing wall system. Confirm compatibility with the surrounding systems, i.e.; through-wall flashing, joint sealants, waterproofing, windows, roofing, etc.

Air barriers in new construction were adopted into Minnesota building code and have been enforced since June 1, 2009. With this code requirement, the designer must identify if the air barrier needs to be vapor permeable or impermeable depending upon the application. In Minnesota State construction, impermeable may be the answer more often than not. In existing construction where the exterior is being replaced, the designer needs to be even more cautious about the existing location of air barriers and the importance of vapor permeability in the system. Hygrothermal analysis maybe required during Schematic Design and will provide direction for the designer in this issue.
Continuity of air barriers is a key system characteristic that is required by Minnesota building code. To achieve continuity means the air barrier and accessory materials are in direct contact with surrounding systems. Therefore, air barriers and their accessory materials (sealants, detail membranes, etc.) must be checked for compatibility with through-wall flashing systems that are installed over the air barrier, and with joint sealants, waterproofing, windows, and roofing system materials that are in direct contact. Securing letters from manufacturer's regarding compatibility is prudent during the design phase, but does not exclude the General Contractor from submitting similar letters during the submittal process.

Standard W-2.06: Specify multi-component urethane joint sealant and bi-cellular backer rod or bond breaker for clay masonry wall joints, except at window systems where the manufacturers require certain joint sealant for the system warranty. For dimension stone, verify the acceptable joint sealant type with the stone quarry or fabricator. At masonry expansion joints, include compressible joint filler behind the backer rod.

Multi-component urethane joint sealants chemically cure when the components are mixed and cure faster than moisture-curing, one-part joint sealants. They also permit a wider range of joint movement. Specify the joint sealant to meet ASTM C920 with the correct grade, class, and use for the application. The bi-cellular backer rod required is non-gassing. Out-gassing can be problematic with closed cell backer rod. Confirm with the joint sealant manufacturer which backer rod is compatible with the specified joint sealant. The compressible joint filler must be closed cell neoprene and meet ASTM D1056, RE41. The combination of the joint sealant, backer rod, and compressible joint filler allow movement in the joint and multiple layers of moisture protection (EJ-1).

Standard W-2.07: During construction, masonry units, assemblies, mortar, grout, and joint sealant must continue to meet ASTM standards with periodic testing. Specify the testing schedule in the appropriate Division 01 section in large projects or the appropriate technical section in smaller restoration or repair projects.

During construction, all masonry materials in the wall system must be periodically tested as units and as an assembly to monitor quality of the products and workmanship. Refer to the schedule of tests as required by Section V. in the Facilities Design Standards for the Minnesota State Colleges and Universities.

B. Details

Clear and complete exterior wall details are extremely important. Clear details must show all of the exterior wall elements, perhaps in an exploded view, if necessary. Clear details certainly help during the design process to foster good transitions and coordination; but also minimize questions during

construction and risk for change orders. Complete details must show fully addressed transitions, material compatibility, constructability, and liquid and vapor moisture control.
See Part IV, Document Examples for actual drawings and details that are described below. The Part IV, Document Examples detail name is in the parenthesis in each of the following standards.

Standard W-2.08: Single through-wall flashing

Single through-wall flashing is detailed at the heads of windows, doors, and louvers. The single through-wall flashing membrane of either a 2 mil stainless steel with a polymeric fabric on one side or 5 oz. copper with polymeric fabric on both sides, lapped onto a stainless steel drip (TWF-1A and TWF-1B).
At the base of walls and transitioning to the waterproofing system, a heavier 0.030 inch thick or 22 gauge two-piece stainless steel sheet metal flashing should be considered. Two-piece flashing at base of wall will facilitate kick-plate removal and replacement without removing masonry (WP-1).
Typical characteristics of through-wall flashing include:

- Extended vertical leg up the backer 12" minimum
- Continue through masonry expansion joints
- Installed lap sealant on the backer from the top of the flashing to a minimum 2" below the veneer anchor
- Sealed 6" flashing membrane laps
- Installed continuous bead of lap sealant between the laminated copper through-wall flashing and stainless steel drip
- Installed continuous bead of lap sealant between the stainless steel drip and substrate
- Folded hem on the stainless steel drip, angled 45 down, extending out 3/8”
- Sealed veneer anchor backplates
- Sealed termination bar fastened 6" on-center
- Continuous, interlaced rope weeps at 16" on-center, extended 1/2" (TWF-3)
- Folded and sealed end dams (TWF-5)
- Folded, lapped, reinforced, and sealed corners (TWF-6 and TWF-7)

Standard W-2.09: Double through-wall flashing

Double through-wall flashing is detailed above roof systems, including over parapets and above steep roofs. The double through-wall flashing system is incorporated into the details for the roof base flashings (TWF-2A) and parapet sheet metal counter flashings (TWF-2B).

Typical characteristics of double through-wall flashing are the same as the single through-wall flashing system with the following additions:

- Lapped first layer (or lower layer) a minimum of 8" over roof base flashing
- Installed shims centered between weeps and between sheet metal flashings and counter flashings
- Filled cores in exterior masonry course below the second layer
- Installed bead of lap sealant between the second layer and masonry course below
- Extended and trimmed second layer (or upper layer) to 1/4" beyond the masonry face
- Extended first layer a minimum of 8" past the roof edge (TWF-4)
- Extended second layer a minimum of 12" past the roof edge (TWF-4)
- Lapped layers, in succession, moving up the step flashing and maintained laps over roof base flashing along the slope (TWF-8)

Standard W-2.10: Masonry expansion joints, vertical and horizontal

Vertical masonry expansion joints in clay brick masonry are required at a maximum spacing of every 25 linear feet of the exterior wall and at a minimum of one side of each opening at the end of lintels. Place vertical masonry expansion joints a maximum of 10 feet and a minimum of 4 feet from both sides of each exterior building corner. For parapets, provide continuous relief angle at roof deck level with soft joint blow relief angle. For other features; consult clay brick masonry resources (professional associations and local manufacturer's representatives). A typical detail for a vertical expansion joint (EJ-1) is shown in Part IV, Document Examples.

Vertical control and building expansion joints for CMU back-up wall: Install backer rod and sealant in all back-up wall joints to prepare to receive air barrier transition membrane. Sealant specified shall be compatible with the specified air barrier.
Horizontal masonry expansion joints in clay brick masonry are required below shelf angles and below the roof edge blocking. The designer must identify the required width of the joint on the detail. Refer to typical details (EJ-2 and EJ-3) shown in Part IV, Document Examples.
In existing construction, new masonry expansion joints may need to be installed or existing masonry expansion joints may need to be widened. Before specifying to install new masonry expansion joints, the existing masonry tie system must be verified as in place between the corner and the new masonry expansion joint. Earlier construction may have voids or areas of missing masonry tie system close to the corner. In that case, cutting in a new masonry expansion joint may have disastrous results unless retrofit anchors through the veneer are installed prior to cutting. Detail new masonry expansion joints to be 1/2" wide and specify that vertical joints are cut with a straight edge in-place. Show in elevation and plan view like details (EJ-4 and EJ-1) in Part IV, Document Examples. Without explicit details and instructions, a contractor may try to simply follow the head joints, which will likely result in a crooked masonry expansion joint that is expensive to fix. Note that the final location of new masonry expansion joints must be verified with the Owner's Representative or Masonry Observer at the site.
For dimension stone jointing, consult with the corresponding stone resource (professional association and stone quarry or fabricator).

Standard W-2.11: Openings

Detail through-wall flashings and air barrier continuity at the perimeter of all openings, i.e.; windows, doors, louvers, soffits, etc. Typically, the through-wall flashing extends past the opening a minimum 6" and beyond the end of the lintel a minimum 4". Some openings, such as a hose bib for exterior water service, cannot be flashed above; but must have the proper seal on the exterior (neoprene gasket or joint sealant) and an air barrier seal-off in the cavity.

Where window or other openings are relatively close together, show the through-wall flashing extending from one opening to another (EL-1) to eliminate frequent and close end dams that create a considerable amount of bond break within the masonry system.
The bottom of roof access doors shall be a minimum of 24" above the high point of the roof membrane and include through-wall flashings from the base of these openings that overlap the roof base flashing system.
The bottom of exterior window openings, roof monitors and clerestories shall be a minimum of 30" above the high point of the roof membrane and include double through-wall flashings that overlap the roof base flashing system.

Standard W-2.12: Coordination with sub-consultants

Coordinate with sub-consultants so that the design is complete and coordinated with fully detailed transitions and verified compatibility of materials. For example, on the drawings, referring from the architectural sheets to the structural sheets is an important link for the General Contractor and subcontractors. Check that the structural element identified and shown on the structural sheet is correctly drawn in the architectural details. In particular, lintels are critical to be drawn correctly in the architectural details to ensure that the through-wall flashing system and air barrier transitions are detailed correctly; avoiding change orders and cost overruns.

In addition to checking the coordination of structural elements between structural and architectural drawings, check the coordination of structural elements and mechanical penetrations. Specifically look for mechanical penetrations that may inadvertently penetrate load-bearing piers or steel beams and verify that lintels are designed and shown for louver openings.

As a final item to coordinate with sub-consultants, the air barrier continuity needs to be verified as it transitions from one substrate to another, at mechanical penetrations, across structural elements and joints, and as it ties into roofing, waterproofing, and windows.

Standard W-2.13: Transitions to roofing

Exterior wall transitions to roofing include the connection between the through-wall flashing and the base flashing, the transition between the through-wall and perpendicular parapet, the proper horizontal expansion joint detail between the brick and the parapet blocking (EJ-3), and the continuous air barrier seal from the exterior wall to the roof system. Close coordination with the roof consultant on the details will be necessary to lap the proper materials and ensure material compatibility.

The first layer of the double through-wall flashing is detailed to lap a minimum of 8" over the roof base flashing (WTR-1A). Include a shim between the sheet metal flashing and counterflashing to maintain a clear space for the through-wall flashing membrane and weeps to operate. The shim must also be centered between the weeps.

The double through-wall flashing layers need the required laps and extension beyond the roof edge when detailed over the parapet (WTR-1B). At times, the parapet condition is close to a building corner where additional detailing is required (WTR-2).

The air barrier seal to the roof system will vary substantially due to the variety of roof edge conditions. Simplistically said, the exterior wall air barrier must be lapped minimum of 3" by the roof air barrier. What complicates the detail is the roof edge conditions and how to connect the two air barriers successfully (ABT-1A and ABT-2A).

Standard W-2.14: Transitions to below-grade waterproofing

Exterior wall transitions to below-grade waterproofing include the through-wall flashing and waterproofing membrane lap, and a stainless steel counterflashing extending below grade. Coordinate this transition with the waterproofing consultant.

Lap the through-wall flashing over the waterproofing membrane a minimum of 6" (WP-1). The through-wall flashing continues onto the horizontal to lap onto the stainless steel counterflashing that extends below grade.

Standard W-2.15: Transitions to windows and curtain walls

Exterior wall transitions to windows include a self-adhering membrane flashing system, a joint sealant detail between the masonry and backer wall at the jamb, and a complete air barrier seal to the window system primary seal. Coordinate these transitions with the window and air barrier consultants.

The joint sealant detail between the exterior masonry veneer and backer wall at the jamb (similar to ABT-2C) is intended to provide not only moisture resistance, but an air stop for the cavity. When joint sealant is installed between the exterior finish and window jamb face, but is not the primary seal; it will prevent air from infiltrating into the window system through the jamb framing and the wall cavity.
To complete the air barrier seal, an air barrier detail membrane that is compatible with the window system joint sealant is necessary to wrap into the opening of the window system.
However for curtain walls, no detail membrane or air barrier materials are allowed to be on the backer wall opening. The air barrier system can only be applied to the exterior surface of the backer wall and the curtain wall primary seal is immediately adjacent on the backer wall jamb and in contact with the air barrier.
Exterior wall transition to curtain walls includes a stainless steel drip tray flashing and eliminates the self-adhering membrane flashing detail.
The stainless steel drip tray flashing should be shown on the project drawings as in isometric (SP-1) and with a splice detail (SP-2), if the curtain wall openings exceed 10 feet in width(SP-2). Required material is 18 gauge Type 304 stainless steel with .048" radius 90 degree bends with welded end dam corners. Although the depth of the pan is initially detailed by the designer, the General Contractor will need to verify the depth based upon the approved window shop drawings. The lower flange of the stainless steel drip tray flashing functions as the termination bar for the sub-sill flashing (through-wall flashing) below the curtain wall and should be the same length as the sub-sill flashing; terminating at the end dams.

Standard W-2.16: Tuck pointing existing construction requires a minimum cutting depth of 3/4", cutting to be done with the vacuum dust collection (VDC) method, and lay in new mortar in layers not more than 3/8'.

In existing construction, some level of exterior masonry wall repairs may be necessary. Tuck pointing, or repointing (a term used in other regions), is most frequently a part of the scope of exterior masonry wall repairs; in addition to spot brick replacement and joint sealant replacement. Always insert a detail (TP-1) into the drawings and insert language in the technical section for proper tuck pointing methods. The VDC method is required to minimize exposure to respirable crystalline silica and to prevent the fine silica dust from mortar joint cutting from enter a building through the air make-up intake, windows, and many other avenues. The dust from tuck pointing is more than a nuisance for keeping an office or room clean, but can result in damage to computer equipment and elevators. Damages from dust are a needless problem and preventable expense. The required precaution of the VDC method for tuck pointing cannot be debated.

Standard W-2.17: Other existing construction concerns

Any projects involving existing construction certainly will have unique features; especially building occupancy and use during the project. However, there are some issues that are typical to exterior masonry wall repairs that are common to many of these types of projects. The following issues need to be identified during design and coordinated with the Campus:

- Fenced area for material storage and mixing that can withstand construction traffic.
- Protected or limited use of doorways for building occupants.
- Barricaded areas and fenced walkways for pedestrian and building occupant safety, including overhead protection where work will be performed above areas that pedestrians and vehicles must pass below.
- Protected existing roof at area of work and at walkway paths to the work.
- Protected shrubbery and landscaping or anticipated replacement.
- Allowed hours or amount of time for noise-producing work.

- Coordinated mechanical systems shutdown or protected from dust.
- Shoring openings from demolition until new masonry has cured for 24 hours or more.
- Specified watertight precautions and weatherproof details during the work.
- Required cleaning of the adjacent windows, louvers, sills, and other projections after completed work.

PART III

DOCUMENTATION PREPARATION & SUBMISSION

EXTERIOR MASONRY DESIGN STANDARDS

2rd Edition

PART III: DOCUMENT PREPARATION AND SUBMISSION

Refer to Part IV, Drawing Examples for the drawings (name in parenthesis) and documents referenced in the standards below. That tabbed section is a collection of drawings that illustrate various drawing standards and exterior masonry design standards in this Manual, and the Minnesota State Facilities Design Standards.

A. Drawing Standards

Standard W-3.01: Minimum plan view scale of 1-1/2" = 1'0" for detailing exterior walls.

Aside from floor plans and reflected ceiling plans, the drawing may include an expanded plan view of a portion of the exterior wall. In order to adequately show the exterior wall detail, a minimum scale of 1-1/2" is required (JR-1 and TWF-4). The complexity of some wall systems and transitions may require a larger scale for clearer communication.

The masonry ties, joint reinforcing, and through-wall flashing must be shown. In particular, the spacing away from openings and corners needs to be illustrated to ensure the correct placement and not leave those to the decision of the installer.

Standard W-3.02: Preferred minimum exterior elevation scale of 1/8" = 1'0" for showing overall exterior features and through-wall flashing locations.

Although some larger projects may resort to a smaller scale for economy in drawing sheets, 1/8" = 1'0" should be used for exterior elevations to clearly show the overall features (EL-1). The exterior elevations should include identifying the masonry expansion joints and showing the through-wall flashing with end dam locations.

For new construction and recladding projects, wall sections should be identified with the wall cut line and balloon on the elevations.

For repair and restoration projects, exterior elevations may contain detail cut and balloon (EJ-4) in lieu of a full wall section cut.

Standard W-3.03: Wall sections must include the joint reinforcement, masonry ties, stone anchors, and through-wall flashings.

Completeness of the wall sections in drawings includes showing the locations of the rows of joint reinforcement, head joint vents, mortar control device, veneer and stone anchors, air barrier, and through-wall flashings and rope weeps. Showing the location of the rows of the joint reinforcement, masonry ties, and stone anchors communicates where and how many rows are expected and does not leave it up to the contractor's discretion. At times, the rows of joint reinforcement and masonry ties may need to be adjusted to less than 16" o.c.; which needs to be clearly communicated to the contractor.

Standard W-3.04: Minimum detail scale of 3" = 1'0" is required for details within the wall section.

The scale of 3"=1'0" brings clarity to the finer details in exterior walls. At times, an exploded view added off this detail can further define and communicate details that may have several lines close together (air barrier, through-wall flashing, rope weep, waterproofing, etc.)

Standard W-3.05: Isometric details are required for the drip tray flashing (SP-1) and for the continuous, interlaced rope weep and end dam in the through-wall flashing system (TWF-3A and TWF-3B). Isometric details for step flashing are strongly recommended (TWF-8).

The isometric view is required to completely communicate the three-dimensional relationship that cannot be gained from plan and elevation views of these features or language within the technical section.

The complexities of step flashing in a double through-wall system cannot be adequately conveyed by drawings or language. Aside from an isometric detail, the technical section should require a meeting at the site to layout the actual steps. This meeting should be attended by the A/E, roofing and masonry observers, General Contractor, roofing subcontractor, and masonry subcontractor so that all parties understand the layout and all that design standards are employed.

Standard W-3.06: For masonry repair or restoration projects, include the scope of masonry work in the project notes with a symbol. The symbol is used to note the exterior elevation or plan view for the location of the masonry work.

Using symbols on the exterior elevation or plan reduces "wordiness" or visual clutter and risk of error. Symbols keep the drawings clean and centralizes any verbiage to describe the work.

B. Specification Standards

Refer to Part IV, Specifications for examples of technical sections for exterior masonry.

Standard W-3.07: Follow the most current publication of "Building Code Requirements and Specification for Masonry Structures" by The Masonry Society's Masonry Standards Joint Committee (MSJC) as a minimum. The standards outlined in this Manual and the Facilities Design Standards, if more stringent, will prevail.

IBC references or incorporates the masonry building code requirements developed by the MSJC. The revisions of the masonry building code requirements by the MSJC intentionally precede the revisions by IBC. Therefore, the most current publication by the MSJC will be the most reliable resource.

The specification included in the MSJC publication incorporates the minimum construction requirements for masonry buildings. This can be mirrored as a basis for developing a masonry section, but not write the entire section. With the specification section of the MSJC publication, there are two checklists for writing a masonry specification: one is mandatory requirements and the other is optional requirements. These checklists will aid in maintaining at least building code requirements within the specification, but will not cover any Minnesota State Facilities Design Standards. The A/E of record has the responsibility to incorporate the Minnesota State Facilities Design Standards within the construction documents.

Standard W-3.08: Follow the current practices of Construction Specifications Institute (CSI) for formats, method of specifying, and language.

The recommended methods of specifying for Minnesota State are Descriptive or Performance Specifications. Proprietary Specifications may be used on a limited basis as long as they are open to substitution. Closed Proprietary Specifications cannot be used in the public bidding

forum unless there are extenuating circumstances such as special Owner requirements or an unavoidable, unique product or system.

Standard W-3.09: The quantity of masonry technical sections will depend upon the extent of masonry work. Limited masonry repair may be contained within one technical section while construction of whole buildings may have several technical sections referring to the exterior wall construction; including stone, clay brick masonry, reinforced masonry, mortar, joint sealants, insulation, vapor retarders, air barriers, structural steel, sheet metal, and others.

Limited masonry repair should minimally have one technical section addressing unit masonry and mortar. Additional sections may be needed for joint sealant, stone repair, sheet metal, and painting. The Section 04 01 00, Maintenance of Masonry, is included in Part IV, Document Examples, in this manual as a technical section for a limited masonry repair project.

Whole building construction should minimally have technical sections for reinforced masonry, unit masonry, mortar, and air barriers. Exterior joint sealants required for the exterior masonry construction may be contained in one section that includes all joint sealants used in the project (i.e.; interior, sidewalk, waterproofing, roofing, etc.). The same applies to the exterior masonry wall insulation, structural steel, and sheet metal.

Two sections (Section 04 05 13, Masonry Mortaring; and Section 04 02 00, Unit Masonry) are included in this manual as examples to use as a basis for a project. They are not intended to include every possible masonry condition and should be edited to reflect project specifics.

Standard W-3.10: Specify the hot and cold weather requirements according to MnSCU design standards. The cold weather requirements include the contractor performing periodic visits of the heated enclosure while in operation during non-work days, overnight, and on weekends. Contractor-generated reports of the periodic visits are a required submittal.

Hot weather requirements for MnSCU masonry construction are:

- Follow hot weather requirements according to MSJC Specification for Masonry Structures (TMS 602).
- When ambient temperatures exceed 90F, fog spray newly constructed masonry until damp, at least three times a day until masonry is three days old.

Cold weather requirements for Minnesota State masonry construction are:

- When daytime ambient temperatures are at or above 40F, but anticipated to drop below 40F overnight; cover newly construction masonry to maintain a minimum of 40F for a minimum of 48 hours after construction.
- Provide a heated enclosure when ambient temperatures are anticipated to be below 40F during batching of mortar, laying of new masonry units, tuck pointing mortar joints, and cleaning masonry.
- Maintain masonry materials, equipment, mortar batching area, and the newly completed masonry work above 40F prior to, during, and for 48 hours after completion of masonry work.
- Do not heat water or materials above 140F.

- Maintain the heat source on both sides of the masonry wall, interior and exterior, of the Work.
- Monitor the carbon monoxide levels at all times. Immediately correct the environment and heating equipment when levels become unacceptable.
- Conduct periodic safety checks of the heated enclosure and contents during non-work days, overnight hours, weekends, and holidays. Submit a weekly report with dates and times of safety checks, temperatures outside, temperatures inside the heated enclosure, and descriptions of the status of the enclosure and contents.
- Periodic safety checks must occur two times overnight; approximately 5-6 hours apart, after the end of a work day, and before a work day.
- Periodic safety checks during non-work days, weekends, and holidays must occur three times during the day; approximately four hours apart in the morning, at noon, and in the afternoon.

Standard W-3.11: Specify the level of masonry construction observation for each masonry activity. Through-wall flashing requires observation of all installed flashing membrane and accessories prior to installing covering materials (i.e.; insulation, masonry units). Through-wall flashing observation in new construction projects requires well-timed and scheduled periodic site visits. Whereas in replacement or reroofing projects, through-wall flashing requires daily full-time construction observation since hidden conditions arise that need immediate resolution and newly installed materials are covered rapidly. Other masonry activities, such as laying masonry units and repairing, require periodic observation at project-specific key points.

Observation of through-wall flashing installation is critical to a project's success. In new construction, observation requires close coordination and scheduling of periodic site visits during key activities, such as: mockup construction, initial installation of each through-wall flashing material at the start of masonry construction, all installed through-wall flashing membranes and accessories at each location prior to installing covering materials, and at complex detailing (i.e.; over parapets, step flashing). Site visits must be coordinated with the general contractor and installing contractor to observe during these key activities.

In through-wall replacement projects, daily full-time construction observation is necessary to address hidden conditions immediately and to verify the new work is constructed properly before covered with the next layer of materials. Starting with the pre-installation meeting, the exact demolition location in the existing brick coursing must be identified. In a project that includes reroofing, this requires attendance by the roofing contractor to review the approved insulation layout drawings as they relate to the exterior wall and through-wall flashing detail. Daily full-time construction observation for through-wall flashing replacement occurs all day, every day new materials are installed, but not during demolition.

Aside from through-wall flashing, periodic observation of masonry includes mortar batching, masonry unit laying, and tuck pointing cutting and mortar installation.

Refer to Part IV, Construction Observation Report for more detail of the construction observation activities of material verification, field notes, and photos required for all levels of

masonry observation. Field reports must be generated for each site visit and submitted on a weekly basis to the required parties.

Standard W-3.12: For masonry repair or restoration projects, include the scope of masonry work in either Division One, Summary of Work; or the major corresponding technical section.

The masonry repair or restoration scope of work should be delineated not only on the Drawings, but in the project manual. This becomes a coordination issue that warrants close attention during the quality control of the document preparation.

Standard W-3.13: Specify quantities and unit prices for brick replacement and other items necessary to masonry repair or restoration projects. Quantities should be noted in the scope of masonry work on the Drawings and in the project manual. Unit Prices should be noted in Division One and the bid form in the project manual.

Compared to new construction, masonry repair or restoration projects can only specify or "forecast" the estimated quantities of replacement based upon visual observation and repair project experience. During the development of the scope of masonry work, the quantities are derived from the actual count from visual observation, must be tempered by experience in similar masonry work, and be increased for an adequate contingency during construction. During and at the end of construction, the unit prices assist in adjusting the contract if hidden conditions are uncovered during the Work.

Standard W-3.14: Specify that the masonry contractor shall submit a two year workmanship warranty for masonry repairs and restoration.

System warranties do not apply to projects of masonry repair or restoration. Since Minnesota State requires high quality materials, details, and specifications for these types of projects, it is the workmanship that can be the weakest link. Therefore, the contractor must be able to stand behind the workmanship and be willing to provide a two-year workmanship warranty for masonry repair or restoration projects.

C. Hygrothermal and Heat Transfer Analysis Reporting Standards

Standard W-3.15: Follow the most current edition of ANSI/ASHRAE Standard 160, Criteria for Moisture-Control Design Analysis in Buildings, for hygrothermal analysis and reporting.

When a hygrothermal or heat transfer analysis report is generated for a Minnesota State project, the report should include a description of the building envelope assembly, data on each of the materials, general information about the building, additional information for indoor design humidity (if required by the standard), criteria used, and results. Refer to Part IV, Hygrothermal Report for an example of a portion of the hygrothermal report.

D. Construction Cost Estimating

Standard W-3.16: Figure a contingency of 10-20% for masonry repair and restoration projects for construction cost estimating.

When embarking upon any project with an existing building, an ample contingency must be included. Since many of the existing Minnesota State building stock does not have as-built drawings or an archive of construction change directives from original construction, the risk for

hidden conditions is elevated. In the case of masonry repair or restoration, the risk for hidden conditions can be even more exaggerated due to any hidden or unknown damages. Therefore, the A/E should consider 10% as a minimum for masonry repair or restoration contingency, but the scope of work and A/E's experience should dictate if the contingency should be greater than 10%.

E. Schematic Design (SD) Phase

Standard W-3.17: Incorporate the hygrothermal or heat transfer analysis of the exterior wall systems and report into the Schematic Design Report.

When a hygrothermal or heat transfer analysis is required, a copy of the report must be included with the Schematic Design Report. Also, there must be reference to the results and how the design will incorporate the preferred wall system.

Standard W-3.18: For masonry repair or restoration projects, or projects that contain that scope of work, include a description of the existing wall construction, exterior wall deficiencies, leaks, and repair history in the Schematic Design Report. Discuss the repair or restoration options, provide construction cost and contingency, and identify the amount of construction time required. Include estimated fees for State Plan Review, if required, and construction observation.

A complete Schematic Design Report will include all of these items to a certain level. The level of existing building repair or renovation will direct to what level each item is addressing.

F. Construction Documents (CD) Phase

Standard W-3.19: If changes occurred in the exterior wall system from the last submitted hygrothermal or heat transfer analysis and report, submit a revised version of the analysis as a part of the Statement of Changes in the Construction Document Report

A revised version of the hygrothermal or heat transfer analysis must be included to demonstrate that the external wall system changes do not adversely affect the moisture control. The Statement of Changes should include discussion of the results from the revised hygrothermal or heat transfer analysis.

Standard W-3.20: For masonry repair or restoration projects, or projects that contain that scope of work, include revised construction cost and contingency, estimated fees for State Plan Review and construction observation, and amount of construction time.

The scope of repair and restoration projects is frequently revised during the design process as decisions are made starting with the Schematic Design Phase. Accurately conveying the revised scope and related costs is important for project budget management.

G. Bid Documents (BD) Phase

Follow the direction given in the Facilities Design Standards.

PART IV

DETAIL EXAMPLES

EXTERIOR MASONRY DESIGN STANDARDS

2rd Edition

The details, graphics and related information shown in the following examples is intended to illustrate the intent of the Minnesota State Exterior Masonry Design Standards. The information contained herein is not intended for actual construction and is subject to revision based on changes and/or refinements in local, state and national building codes. The actual design and configuration of these and similar details will vary based on design parameters, existing conditions, and other factors unique to each project. The designer is responsible for the final exterior masonry wall conforming to the intent of these standards and any variance must be submitted by written request to the Minnesota State Facilities Design and Construction Department.

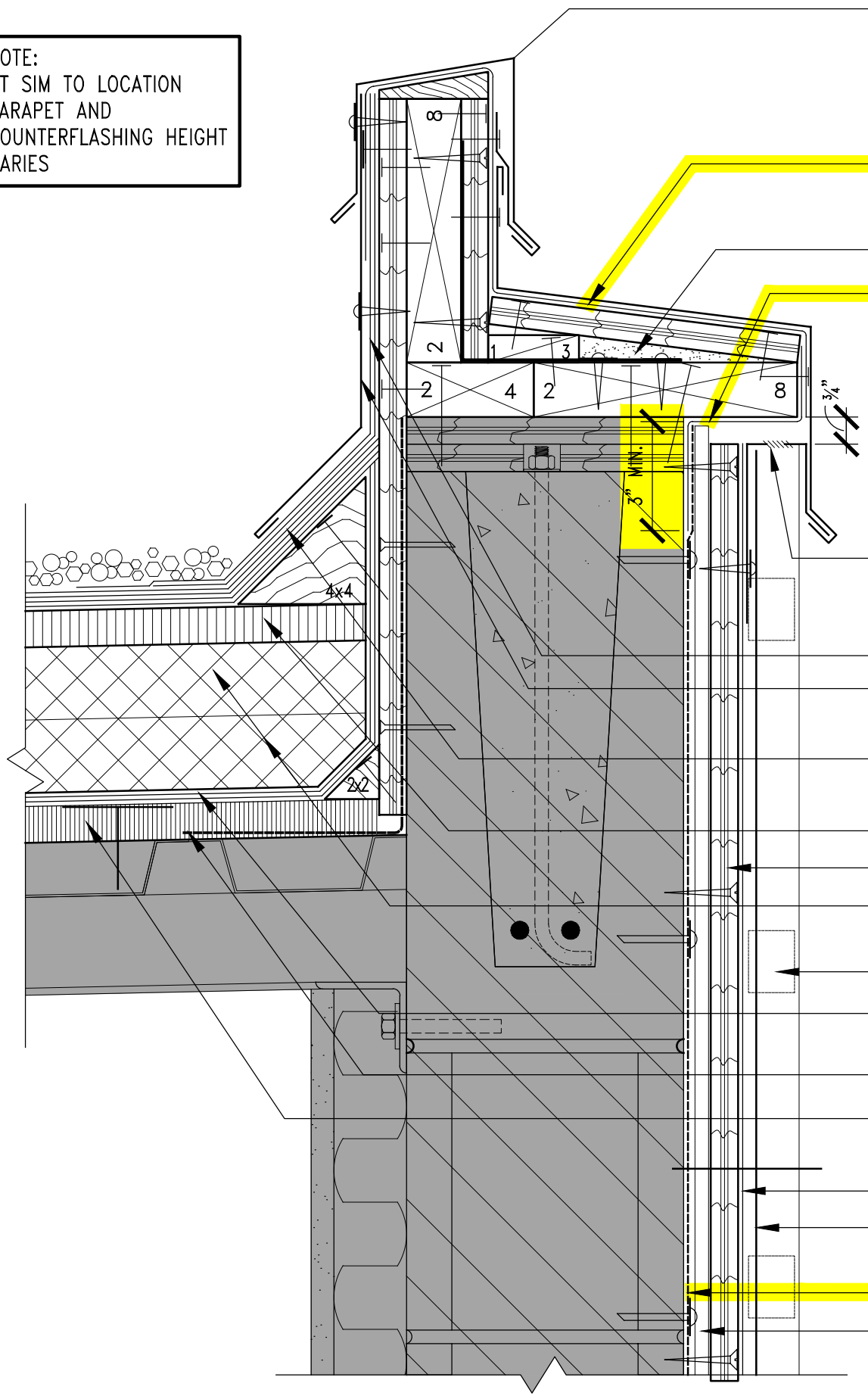
Drawing Examples
Table of Contents

Waterproofing Transition

Wall-to-Roof Transition

EXAMPLE

NOTE:
AT SIM TO LOCATION PARAPET AND COUNTERFLASHING HEIGHT VARIES



SHEET METAL CAP AND FASCIA FLASHING WITH CONTINUOUS KEEPER STRIPS. HEM TOP EDGE OF FASCIA FLASHING AND NAIL THROUGH SLOTTED HOLES AT 30" O.C. PROVIDE COVER PLATES (SEE DETAIL X/X)

CONCEALED FLASHING TO LAP TRANSITION MEMBRANE AT FACE OF WOOD BLOCKING

SPRAY POLYURETHANE FOAM INSULATION

TRANSITION MEMBRANE LAPPED MIN. 3" ONTO CMU

22 GA VENTED SHEET METAL J CHANNEL WITH INTEGRAL KEEPER STRIP (ADHERE INSECT SCREEN TO NON EXPOSED SIDE OF VENT

TWO-PLY BASE FLASHING

SHEET METAL COUNTERFLASHING (HEIGHT VARIES)

FOUR-PLY ASPHALT MEMBRANE WITH GRAVEL SURFACING

1" RIGID INSULATION

3/4" PLYWOOD

TWO LAYERS 2" ISOCYANURATE INSULATION

PANEL CLIPS AT 12" O.C.

TWO-PLY ASPHALT VAPOR RETARDER

UNCURED FLASHING (SHOWN DASHED) (TYP.)

1" HIGH DENSITY PERLITE INSULATION MECHANICALLY FASTENED TO STEEL DECK

No 30 BUILDING FELT

PRE-ENGINEERED STANDING SEAM SHEET METAL WALL PANEL WITH SEAMS @ 16" O.C. MAX

FLUID-APPLIED* AIR BARRIER

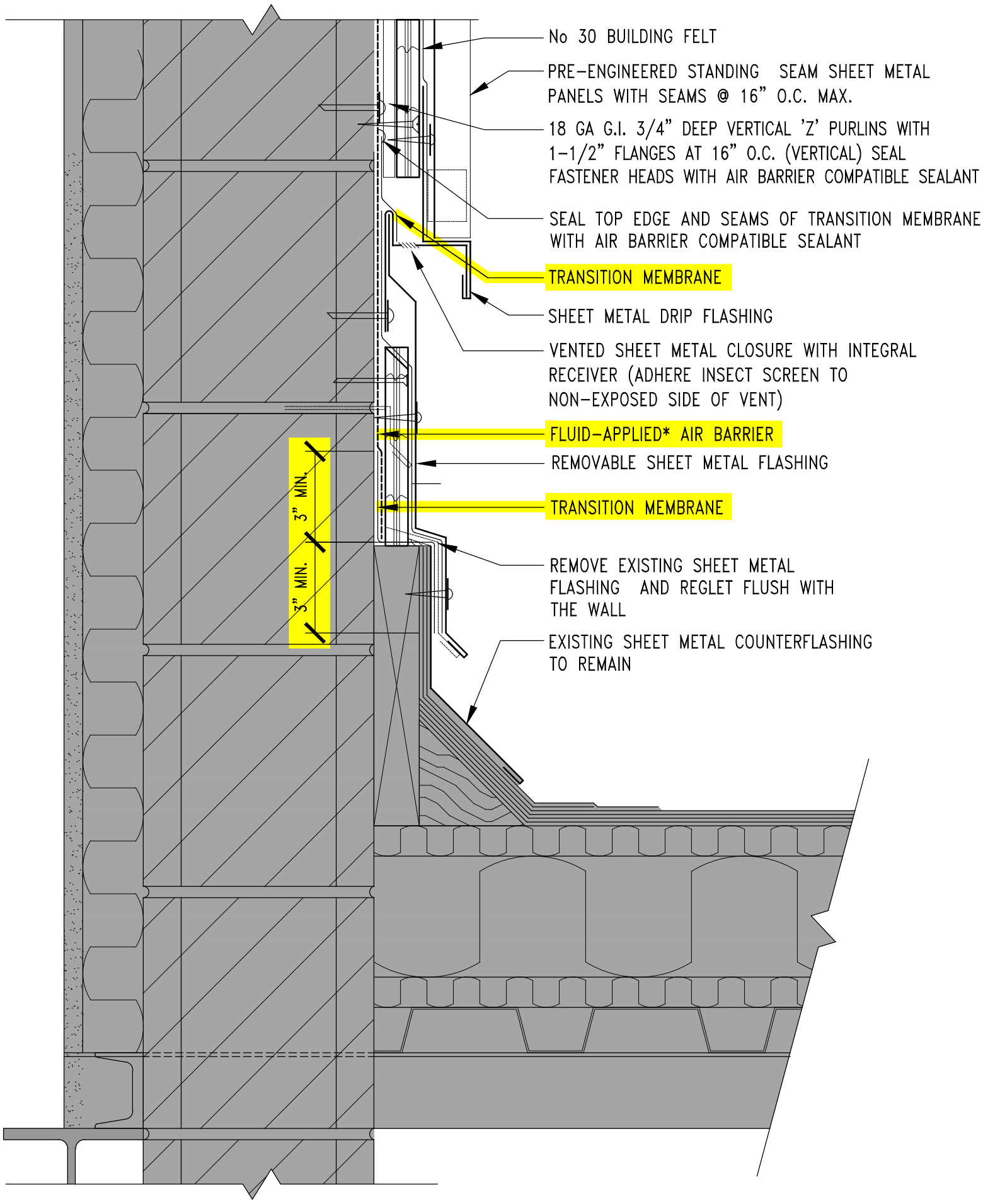
18 GA G.I. 3/4" DEEP VERTICAL 'Z' PURLINS WITH 1-1/2" FLANGES AT 16" O.C. COVER ALL FASTENER PENETRATIONS WITH AIR BARRIER COMPATIBLE SEALANT

*AIR BARRIER MEMBRANE MAYBE FLUID-APPLIED OR SELF-ADHERING.

DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

ABT-1A PARAPET DETAIL
SCALE: 3" = 1'-0"

EXAMPLE

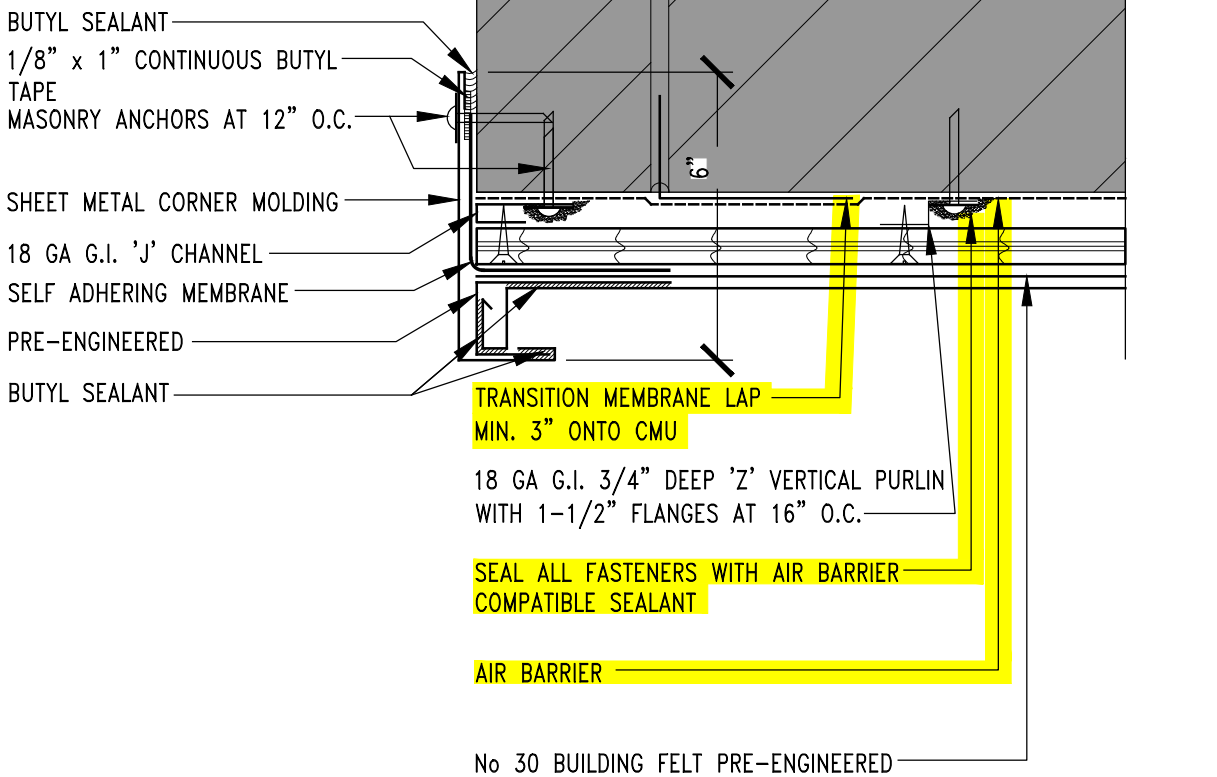


*AIR BARRIER MEMBRANE MAYBE FLUID–APPLIED OR SELF–ADHERING.

DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

ABT–1B WALL BASE DETAIL
SCALE: 3" = 1'–0"

EXAMPLE



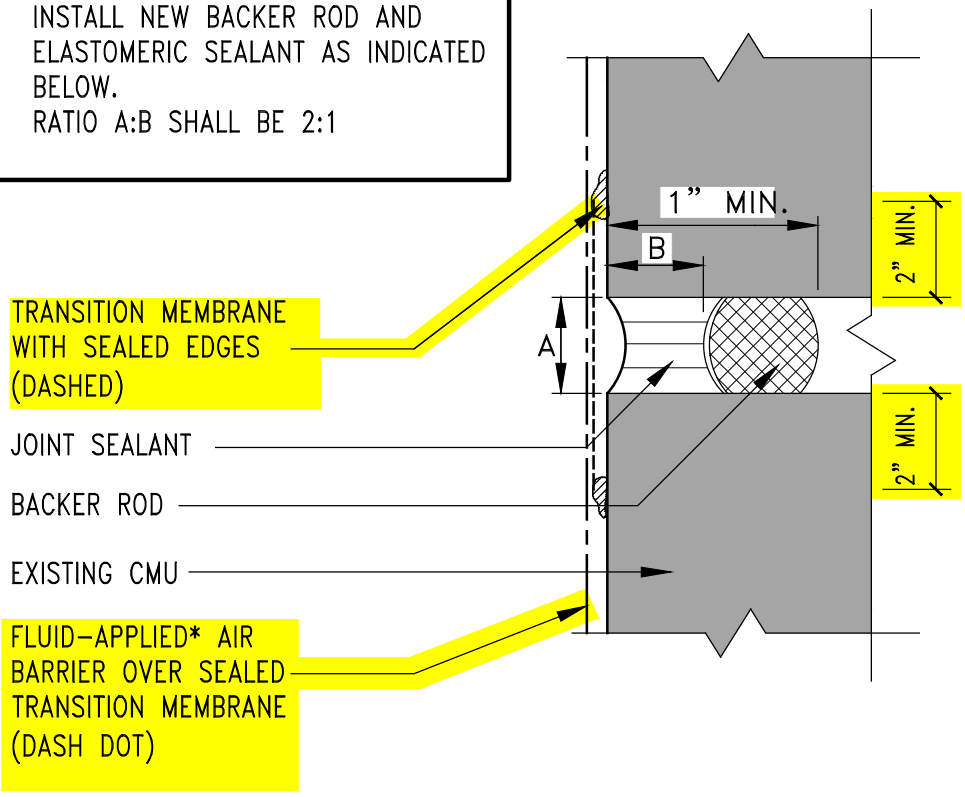
DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

ABT-1C CORNER DETAIL

SCALE: 3" = 1'-0"

EXAMPLE

NOTES:
1. REMOVE ALL EXISTING SEALANT, BACKER ROD AND ANY MORTAR MATERIALS TO 1" DEPTH.
2. INSTALL NEW BACKER ROD AND ELASTOMERIC SEALANT AS INDICATED BELOW.
3. RATIO A:B SHALL BE 2:1

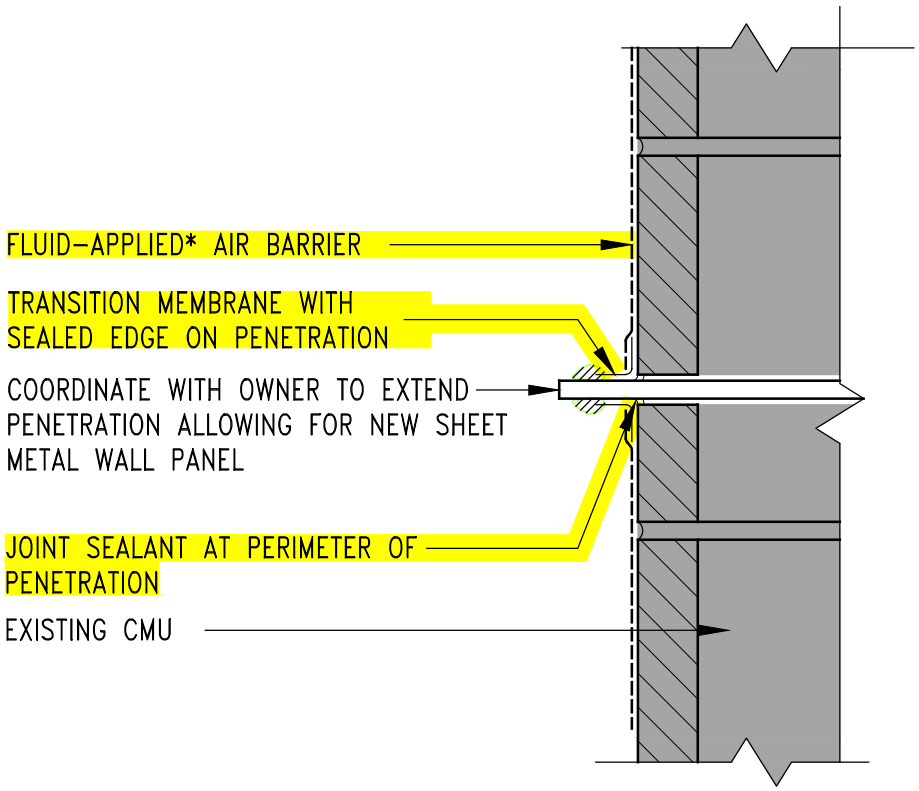


*AIR BARRIER MEMBRANE MAYBE FLUID-APPLIED OR SELF-ADHERING.

DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

ABT-1D JOINT SEALANT DETAIL
SCALE: 3" = 1'-0"

EXAMPLE



*AIR BARRIER MEMBRANE MAYBE FLUID–APPLIED OR SELF–ADHERING.

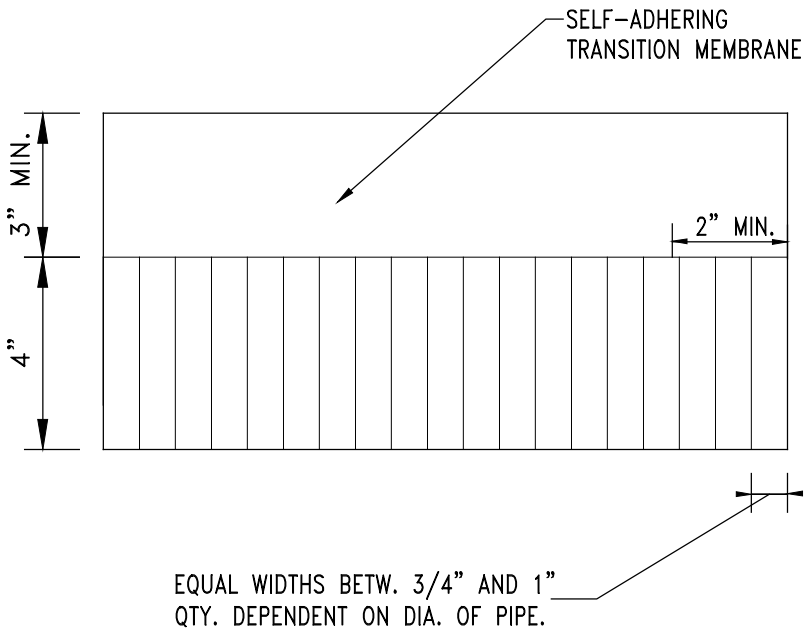
DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

ABT–1E

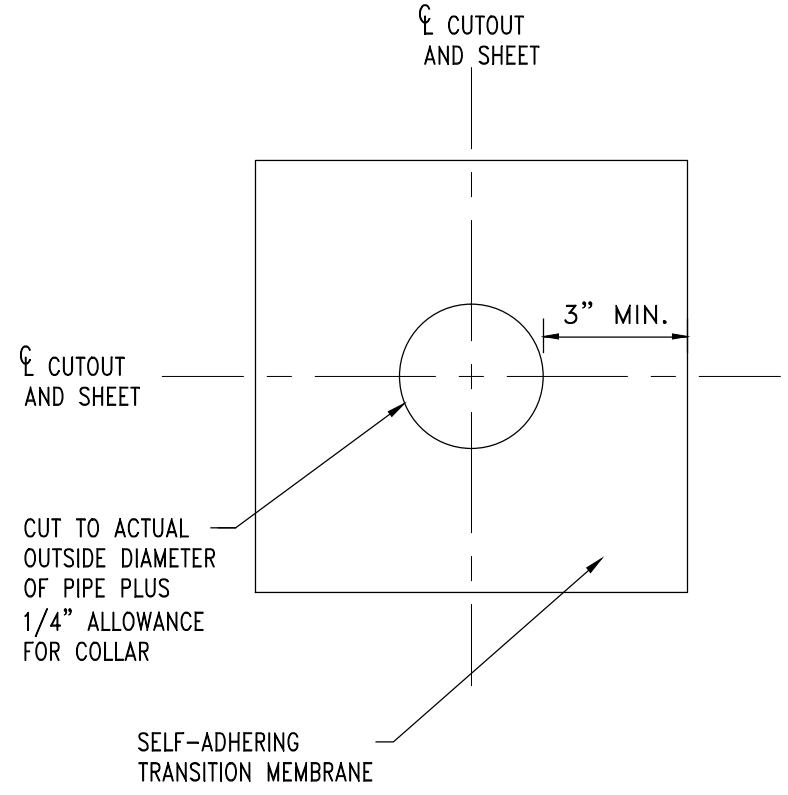
PENETRATION DETAIL

SCALE: 3" = 1'–0"

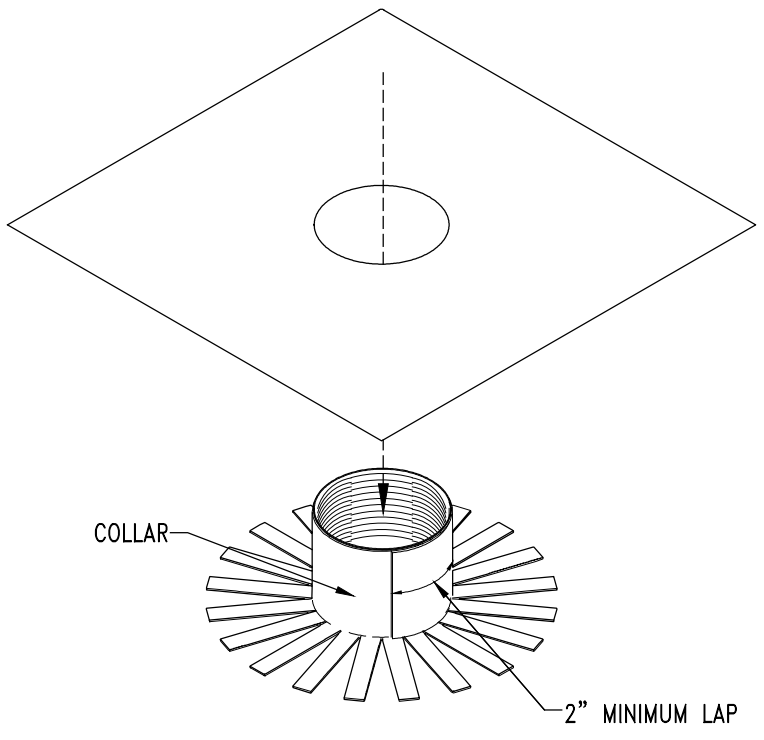
EXAMPLE



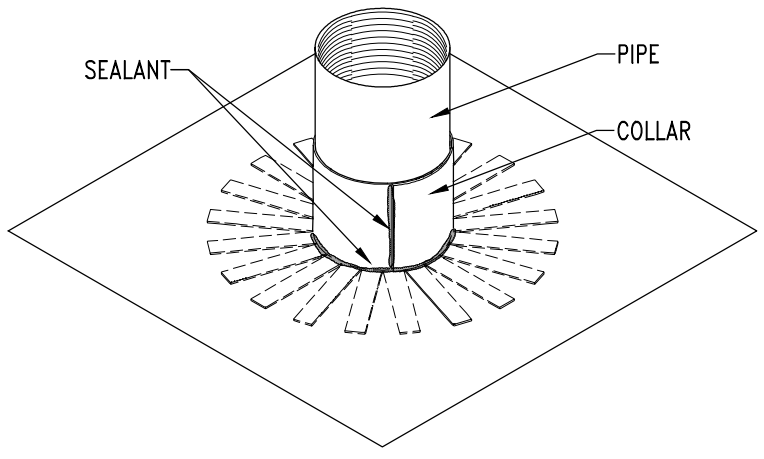
1



2



3



4

FABRICATE/INSTALL AS FOLLOWS:

1. CUT SELF ADHERING TRANSITION MEMBRANE STRIP NO LESS THAN 7" WIDE AS SHOWN. LENGTH OF STRIP IS TO BE DIAMETER OF PIPE PLUS AT LEAST 2" TO ALLOW FOR OVERLAP. SLIT MATERIAL EVENLY AS SHOWN, THEN FOLD 90° AT END OF SLITS.

2. CUT ROUND HOLE AT CENTER OF SELF ADHERING TRANSITION MEMBRANE AS SHOWN. DIAMETER OF HOLE IS OUTSIDE DIAMETER OF PIPE, PLUS 1/4" TO ALLOW FOR COLLAR.

3. ROLL THE SLIT/FOLDED SHEET TO FORM COLLAR AS SHOWN. APPLY SEALANT AT JOINT AND UNDERSIDE OF FLAT SHEET.

4. SLIDE OVER PIPE AND ADHERE TO SURFACE

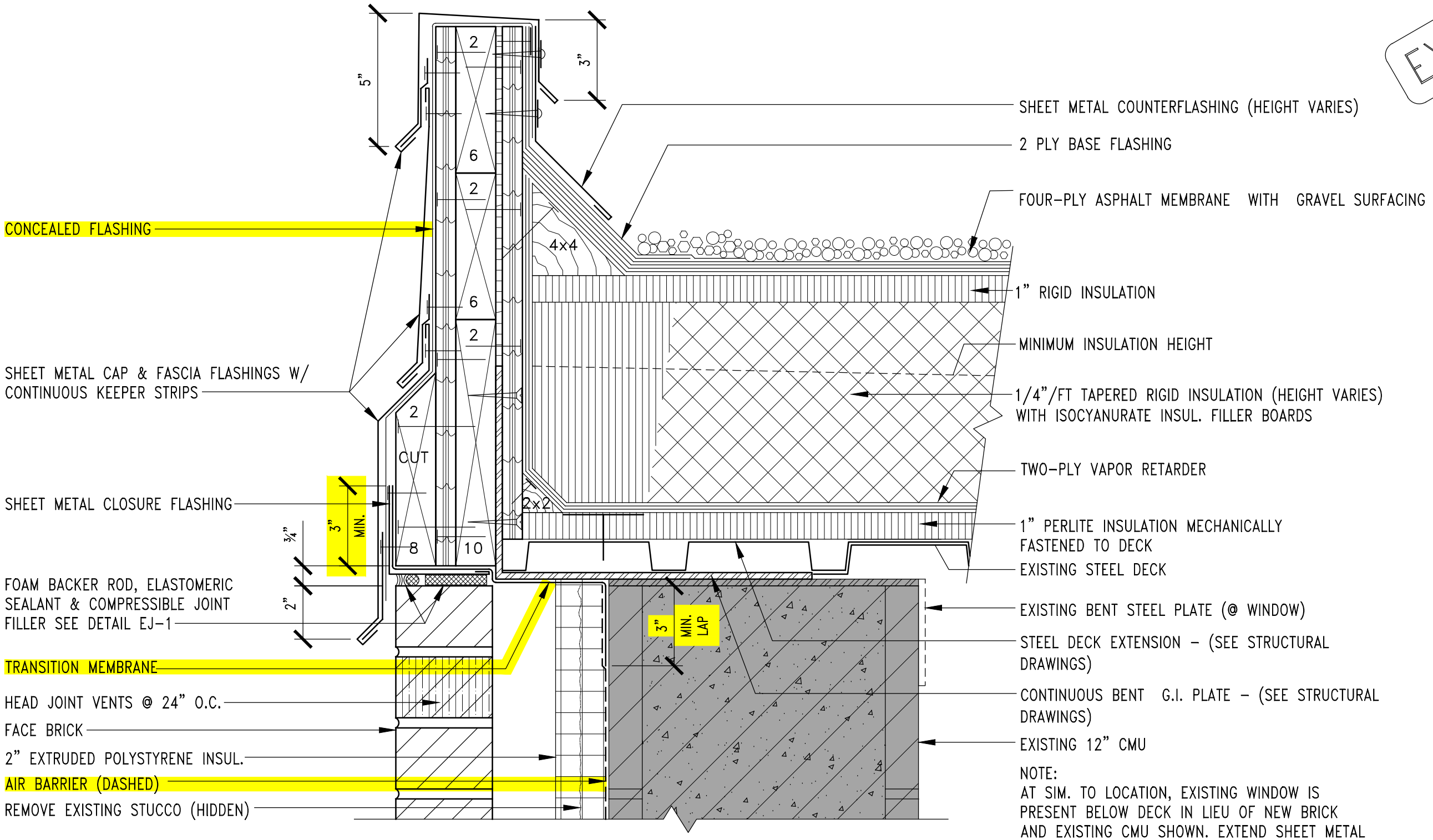
MATERIALS:

SELF–ADHERING TRANSITION MEMBRANE
FLASHING LAP SEALANT

DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

ABT–1F PIPE PENETRATION SCALE: NONE

EXAMPLE



NOTE:
AT SIM. TO LOCATION, EXISTING WINDOW IS PRESENT BELOW DECK IN LIEU OF NEW BRICK AND EXISTING CMU SHOWN. EXTEND SHEET METAL CLOSURE FLASHING AND FASTEN TO BENT STEEL PLATE.

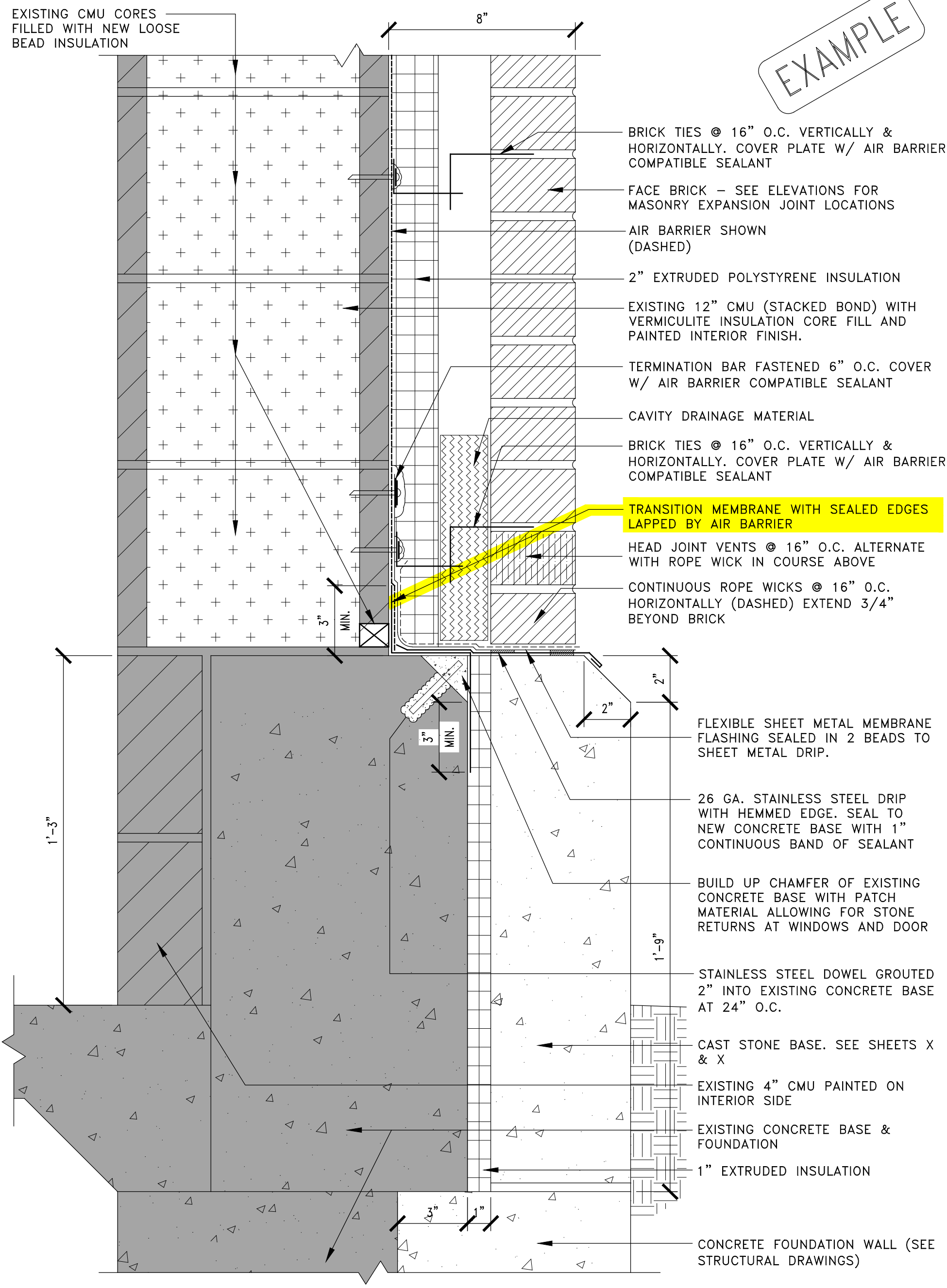
DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

PART IV
DOCUMENT EXAMPLES

ROOF EDGE DETAIL
SCALE: 3" = 1'-0"

ABT-2A

EXAMPLE

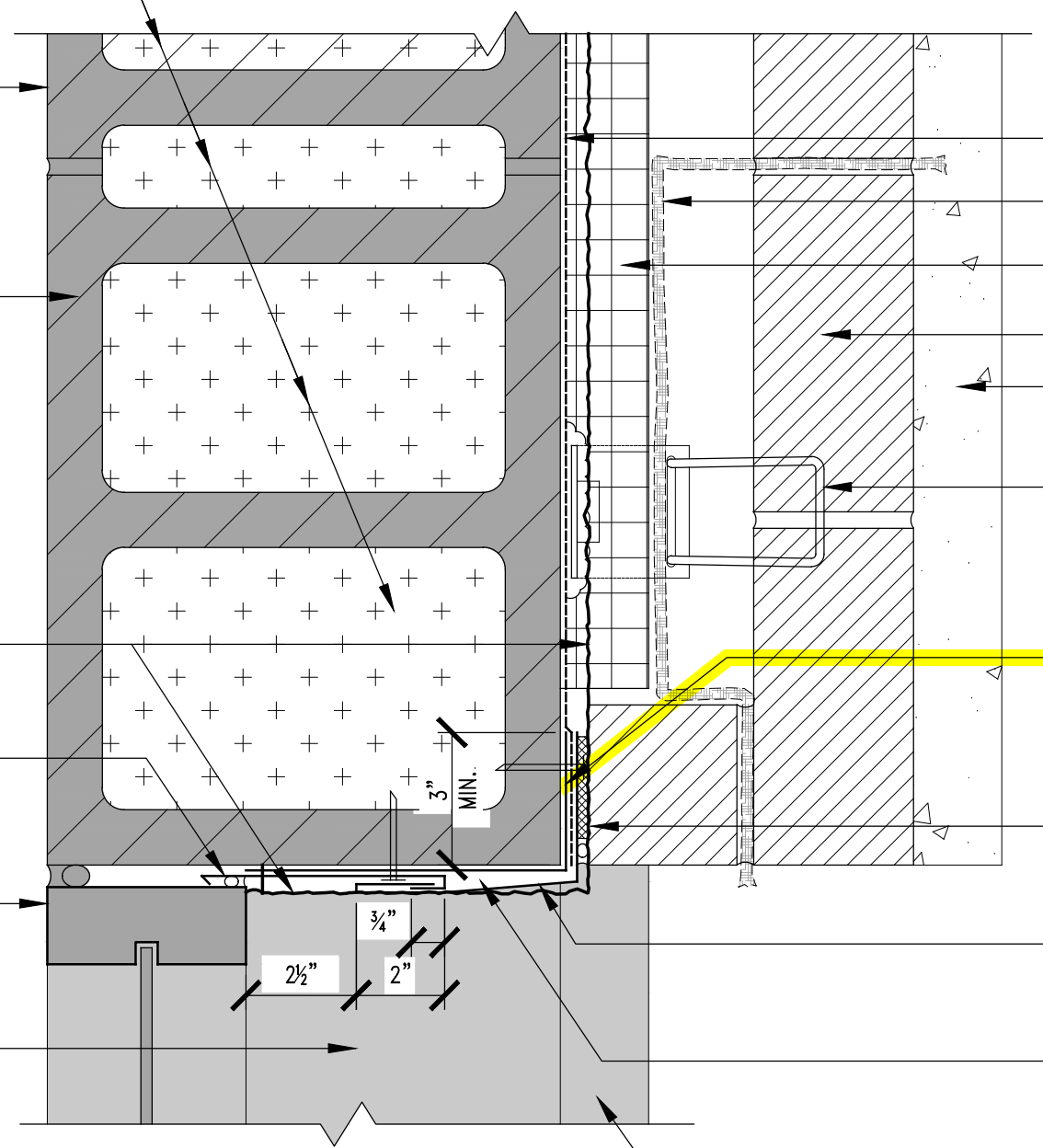


DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

ABT–2B EXISTING WALL BASE DETAIL

SCALE: 3" = 1'–0"

EXAMPLE



EXISTING CMU CORES FILLED W/ NEW LOOSE BEAD INSULATION.

EXISTING PAINTED INTERIOR FINISH

EXISTING 12" CMU (STACKED BOND) W/ VERMICULITE INSULATION CORE FILL

EXISTING STUCCO TO BE REMOVED (DOTTED)

NEW SEALANT & BACKER ROD

EXISTING WINDOW & FRAME TO REMAIN

EXISTING CONCRETE BASE BELOW TO REMAIN

NEW THROUGH–WALL FLASHING NOT SHOWN.

AIR BARRIER (DASHED)

CONTINUOUS ROPE WICKS

NEW 2" EXTRUDED POLYSTYRENE INSULATION

NEW FACE BRICK

NEW CHAMFERED CAST STONE BASE BELOW. SEE SHEETS X & X

NEW BRICK TIE MAX. 8" FROM CORNER AND 16" O.C. VERTICALLY & HORIZONTALLY COVER BACK PLATE WITH AIR BARRIER COMPATIBLE SEALANT

TRANSITION MEMBRANE LAPPED BY AIR BARRIER AND COVERED BY ANODIZED ALUMINUM

NEW SEALANT, BACKER ROD & COMPRESSIBLE JOINT MATERIAL SIMILAR TO DETAIL EJ–1

NEW TWO PIECE .040" ANODIZED ALUMINUM COVER. FASTEN EACH LEG W/ MASONRY ANCHORS @ 16" O.C.

JOINT SEALANT AT TRANSITION MEMBRANE – TO COVER PLATE JOINT AT TOP AND TO EXISTING SILL BELOW.

EXISTING CHAMFERED CONCRETE BASE BELOW

DETAIL INTENDED TO SHOW AIR BARRIER DETAIL CONCEPTS ONLY.

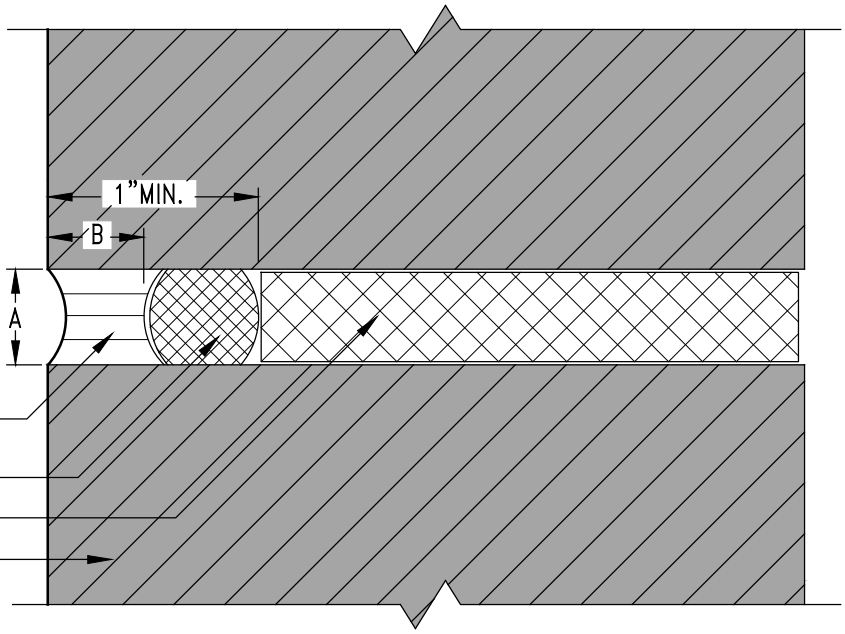
PART IV
DOCUMENT EXAMPLES

EXTERIOR WALL AT WINDOW
SCALE: 3" = 1'–0"
PLAN VIEW

ABT–2C

EXAMPLE

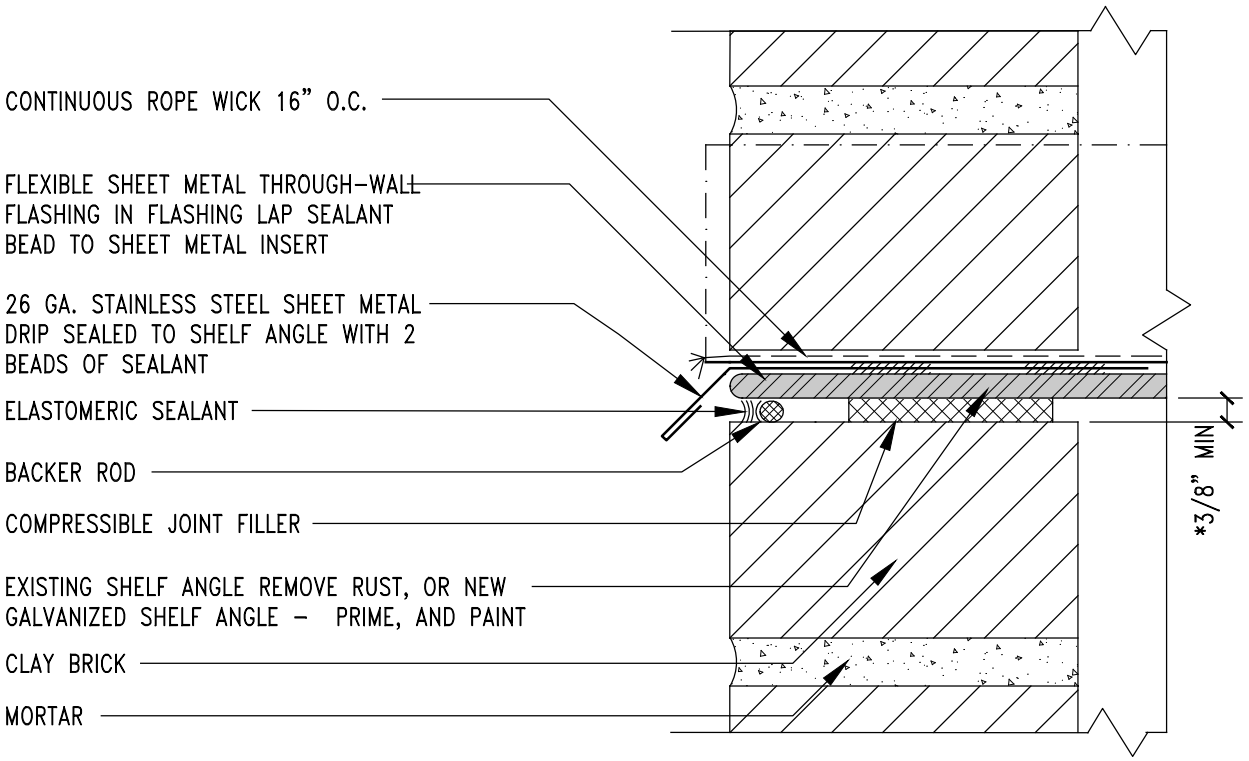
NOTE
1.) REMOVE ALL EXISTING SEALANT, BACKER ROD AND ANY MORTAR MATERIALS FOR THE DEPTH OF THE MASONRY VENEER
2.) INSTALL NEW COMPRESSIBLE JOINT FILLER, BACKER ROD, AND JOINT SEALANT AS INDICATED BELOW.
3.) RATIO A:B SHALL BE 2:1



A/E TO VERIFY NECESSARY WIDTH OF VERTICAL MASONRY EXPANSION JOINT.

EJ-1 VERTICAL MASONRY EXPANSION JOINT
NO SCALE

EXAMPLE



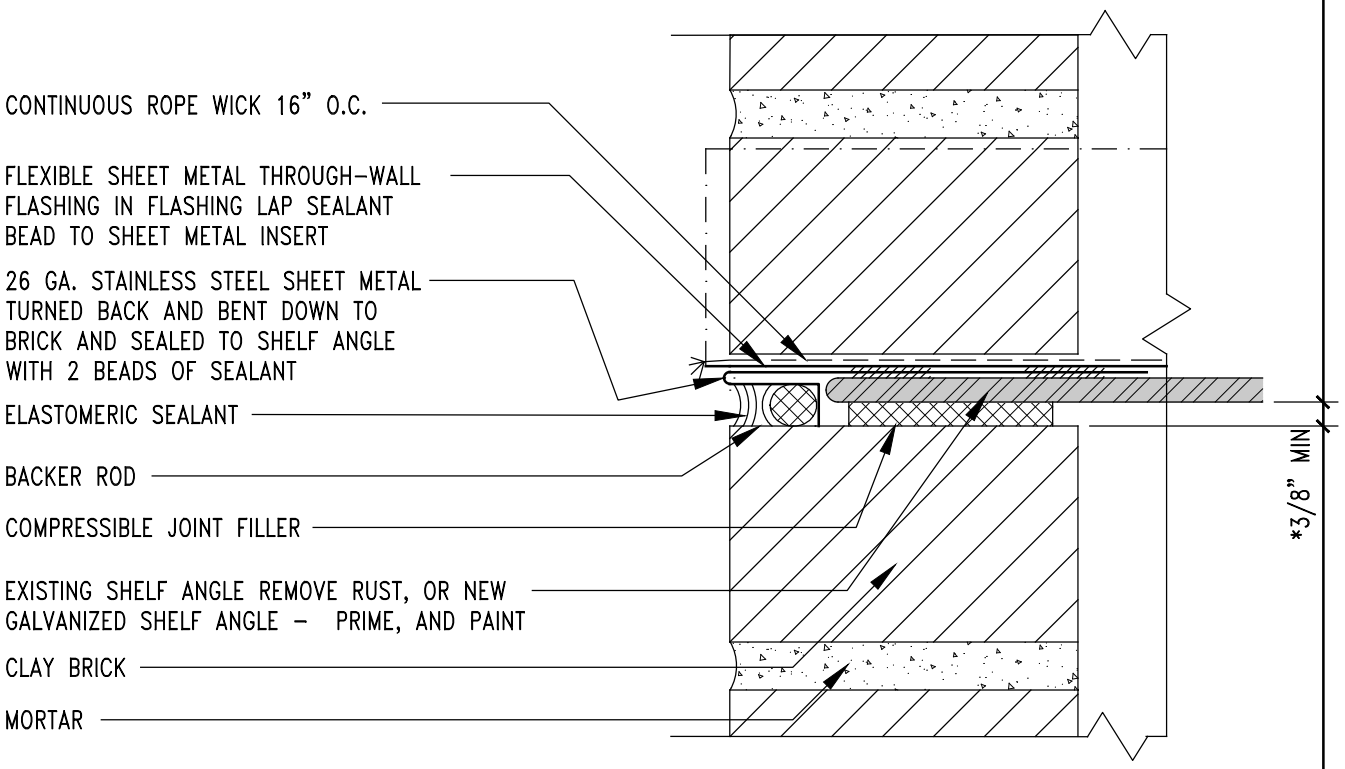
NOTE: A/E TO VERIFY SIZE OF HORIZONTAL EXPANSION JOINT BASED ON CALCULATIONS FOR EXPANSION OF THE BRICK AND DEFLECTION OF THE SHELF ANGLE.

HORIZONTAL MASONRY EXPANSION JOINT AT SHELF ANGLE

EJ-2A

SCALE: 6" = 1'-0"

EXAMPLE



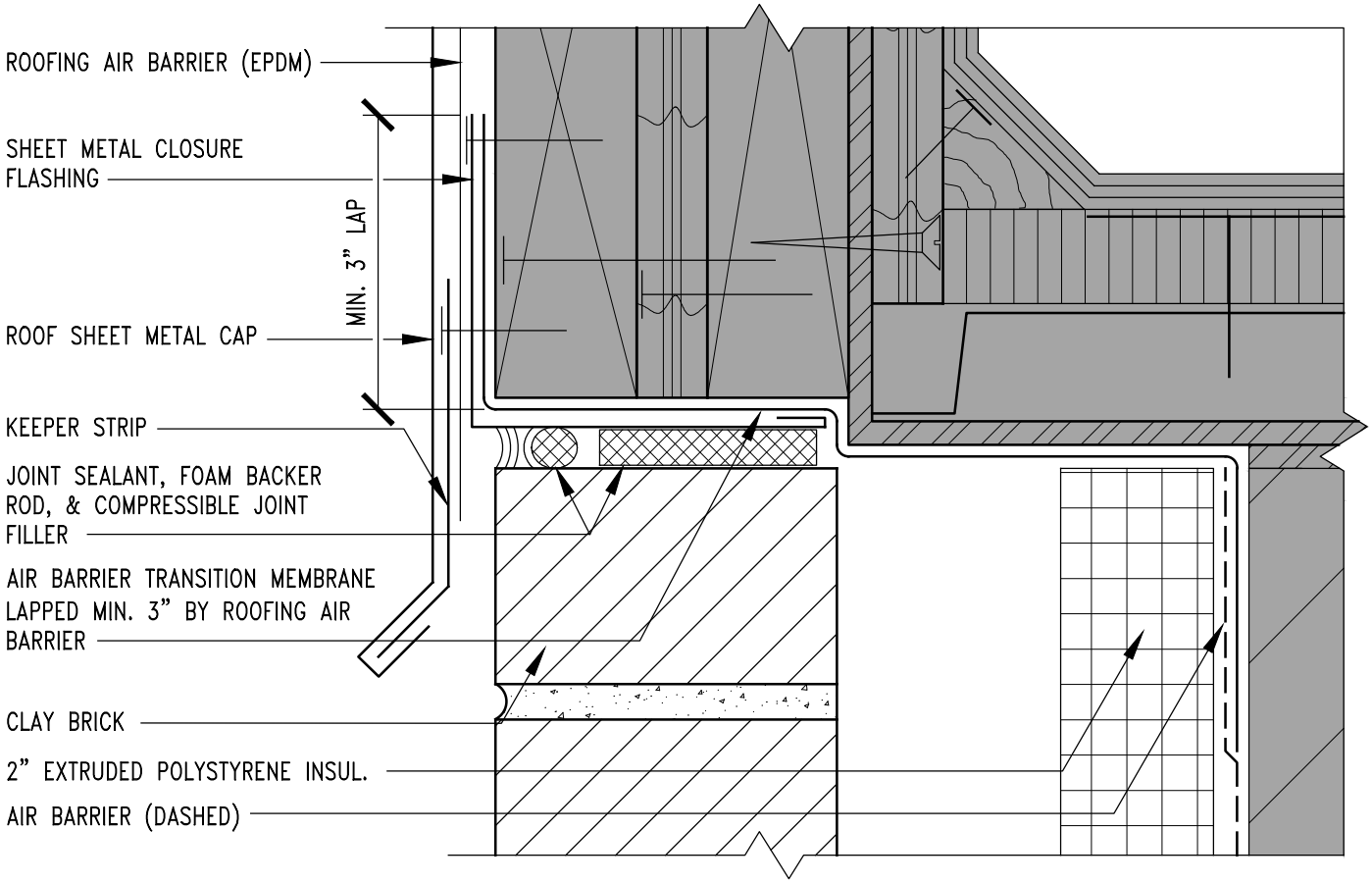
NOTE: A/E TO VERIFY SIZE OF HORIZONTAL EXPANSION JOINT BASED ON CALCULATIONS FOR EXPANSION OF THE BRICK AND DEFLECTION OF THE SHELF ANGLE.

EJ-2B

ALTERNATE HORIZONTAL MASONRY EXPANSION JOINT AT SHELF ANGLE

SCALE: 6" = 1'-0"

EXAMPLE



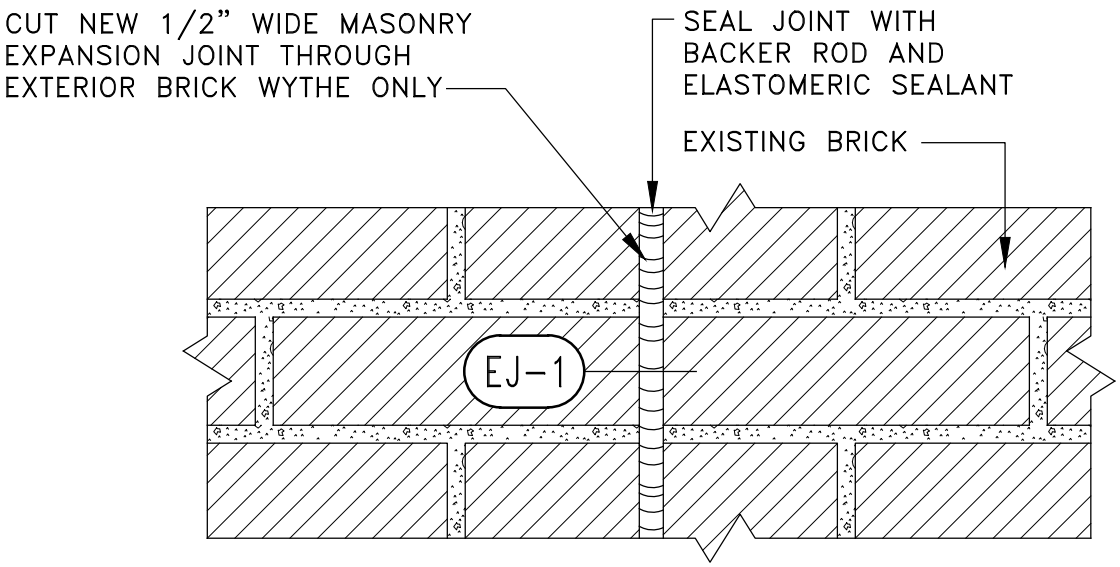
NOTE: A/E TO VERIFY THICKNESS OF HORIZONTAL MASONRY EXPANSION JOINT REQUIRED FOR THE PROJECT.

EJ-3

HORIZONTAL MASONRY EXPANSION JOINT AT ROOF EDGE

SCALE: 6" = 1'-0"

EXAMPLE

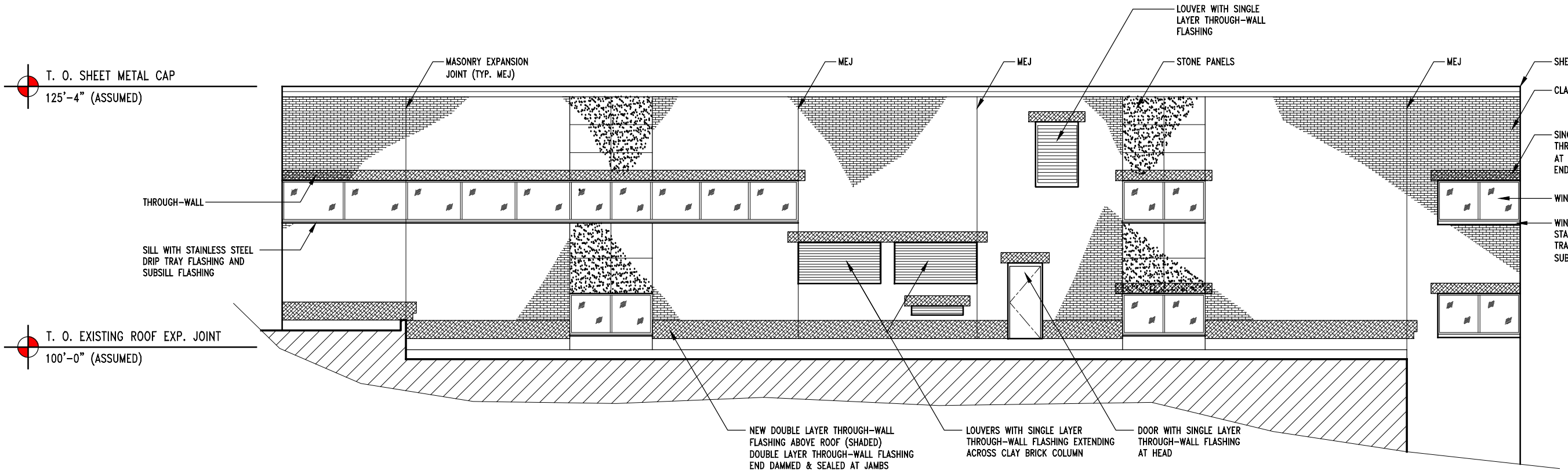


DETAIL IS TYPICALLY USED IN EXISTING CONSTRUCTION PROJECTS.

EJ-4 NEW MASONRY EXPANSION JOINT

NO SCALE ELEVATION VIEW

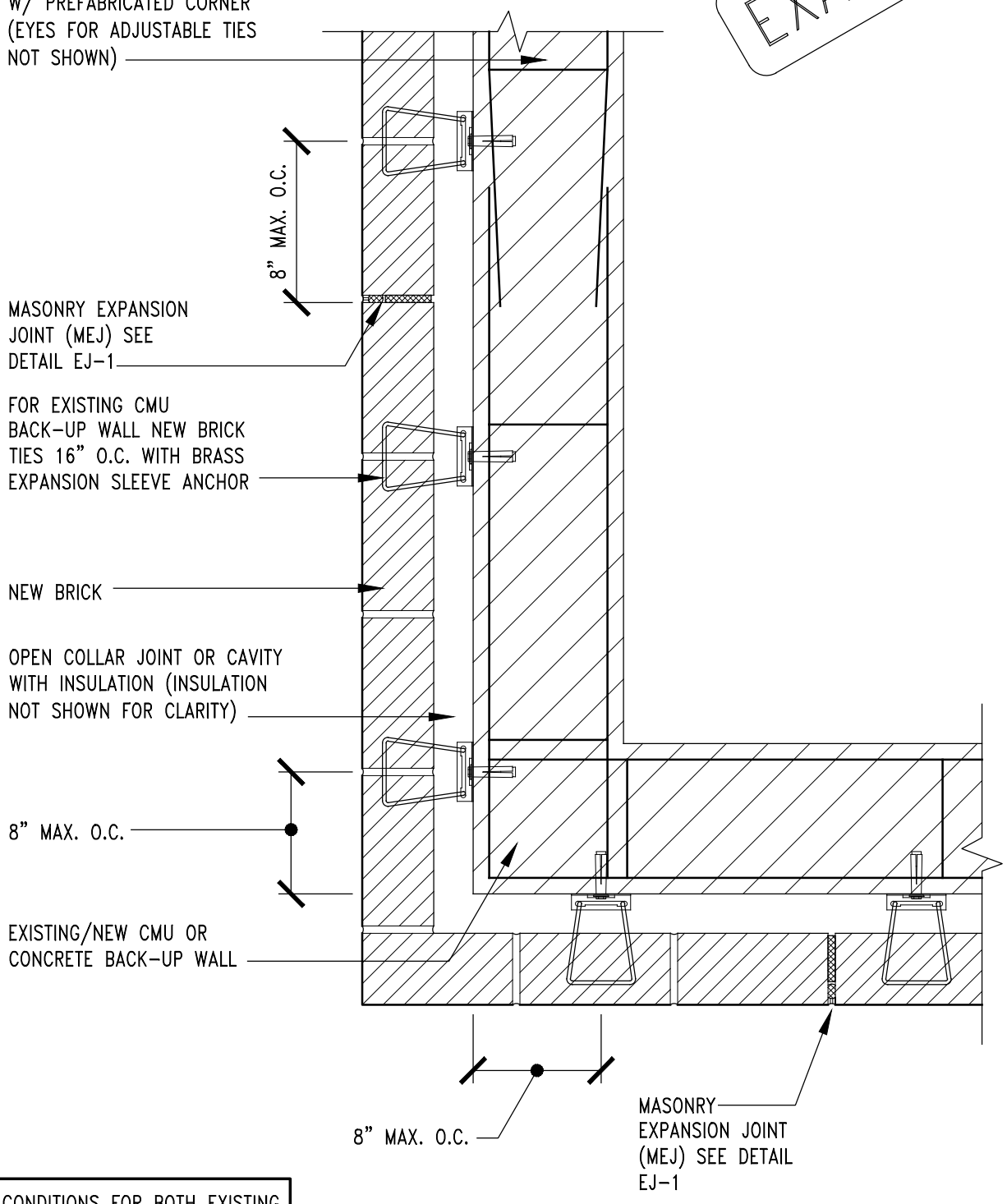
EXAMPLE



1/1 EAST ELEVATION
1/8" = 1'-0"

EXAMPLE ELEVATION
NO SCALE
EL-1

EXAMPLE

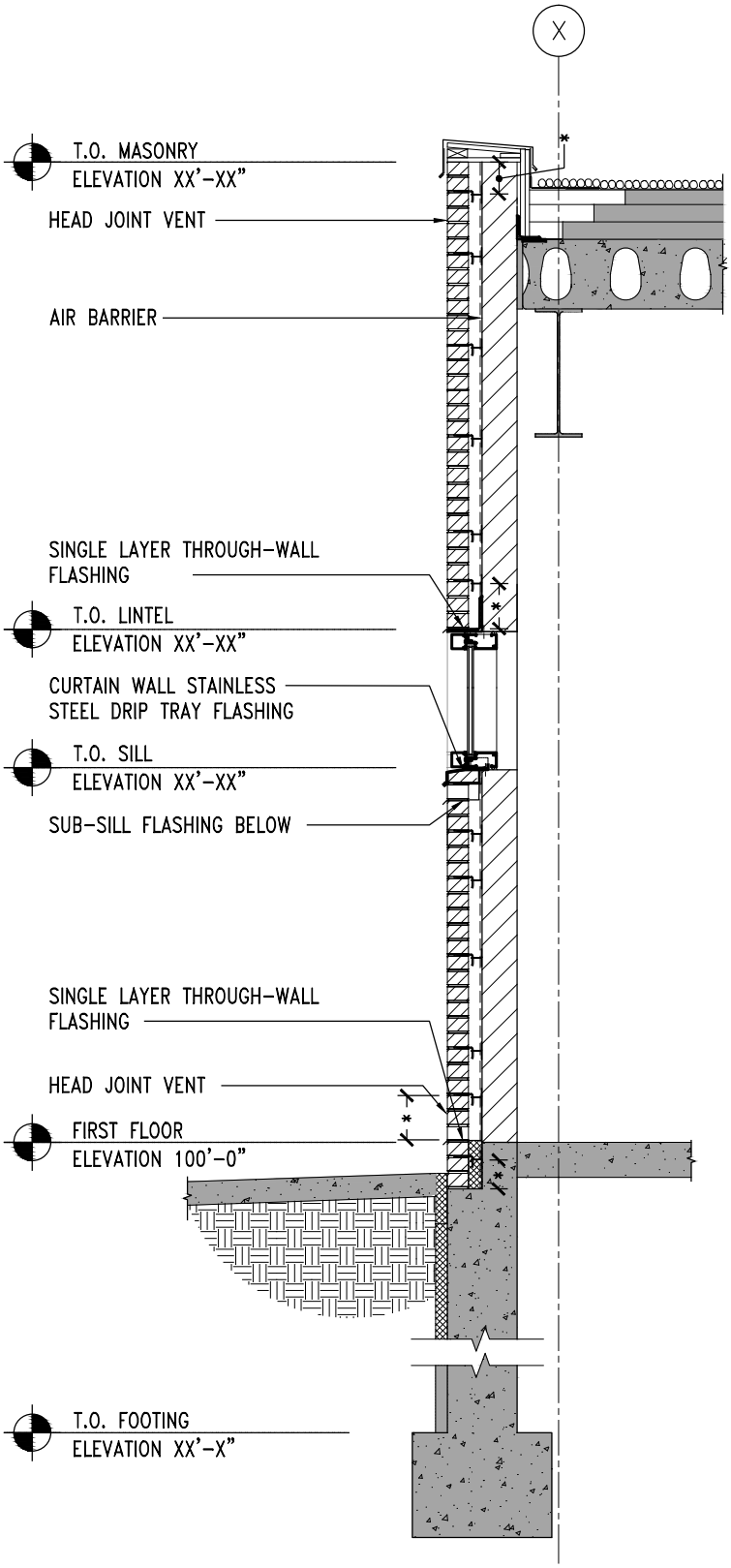


NOTE: CONDITIONS FOR BOTH EXISTING AND NEW CONSTRUCTION ARE SHOWN. A/E TO EDIT FOR SPECIFIC PROJECT.

JR–1 JOINT REINFORCEMENT AND TIES

SCALE: 1–1/2" = 1'–0" PLAN VIEW

EXAMPLE

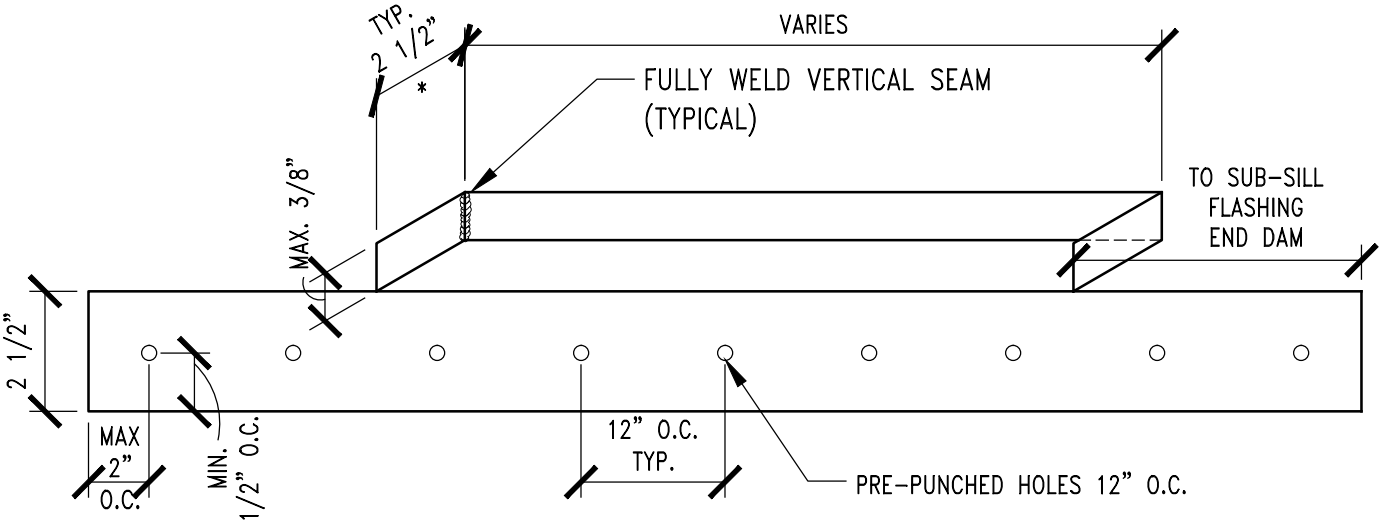


NOTE: EXISTING CONSTRUCTION CONDITIONS SHOWN. A/E TO EDIT FOR SPECIFIC PROJECT.

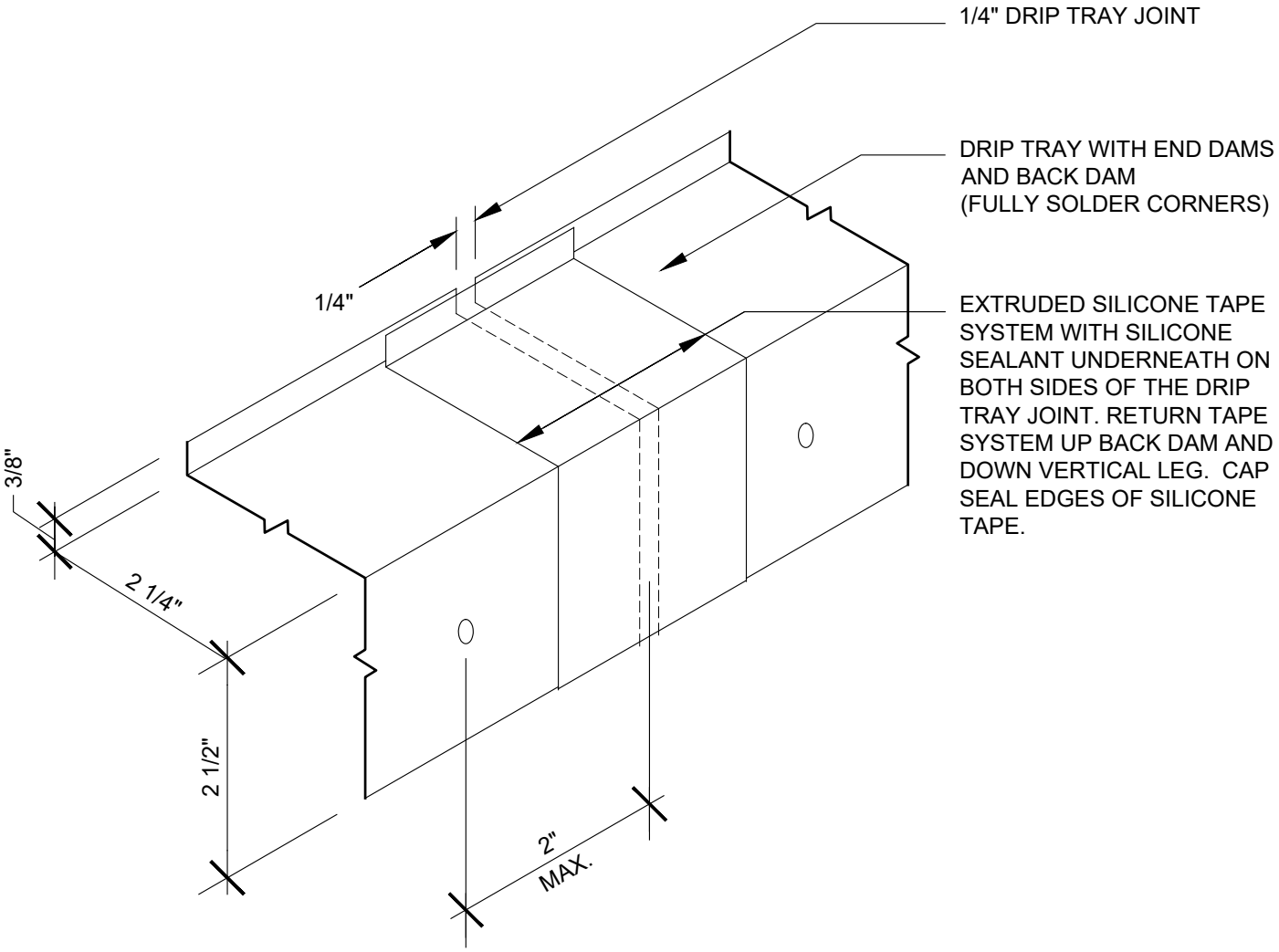
JR–2 WALL SECTION
NO SCALE

EXAMPLE

NOTES:
1. CONTRACTOR TO VERIFY DRIP TRAY FLASHING DEPTH AS REQUIRED FOR WINDOW SYSTEM (*)
2. ONE PIECE CONTINUOUS FLASHING IS REQUIRED IF R.O. IS LESS THAN 10'–0"
3. REFER TO STAINLESS STEEL SPLICE DETAIL IF R.O. IS GREATER THAN 10'–0"
4. Material - 18 GA. 304 SS, bend radius - .048"



SP–1 DRIP TRAY FLASHING DETAIL
NO SCALE



SP-2 DRIP TRAY SPLICE DETAIL

NO SCALE

ISOMETRIC

THIS LINE SCALES 1" ON FULL SIZE SHEETS

9/20/2022 11:27 AM KEN PELZEL
\\HAGRID\Files\WA\2.0 Projects\0 Temp\Misc\drip tray splice detail.dwg

Project title:
DRIP TRAY SPLICE DETAIL

Client:

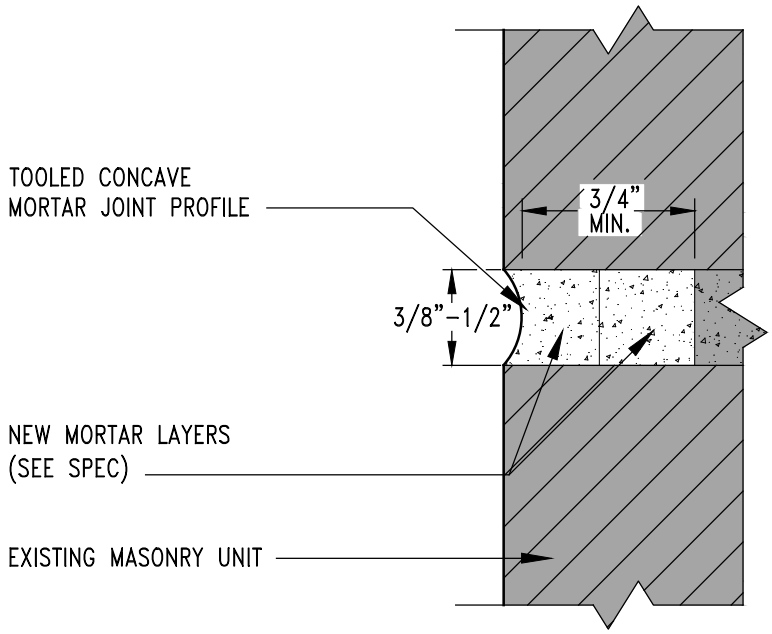
DATE:	09/20/2022
CLIENT PROJECT No.:	
INSPEC PROJECT No.:	
PROJECT MGR:	DC
DRAWN BY:	KP
CHECKED BY:	DC

INSPEC
5901 Duluth Street
Minneapolis, MN
55422
Ph. 763-546-3434

MINNEAPOLIS | ROCHESTER | MILWAUKEE | CHICAGO

EXAMPLE

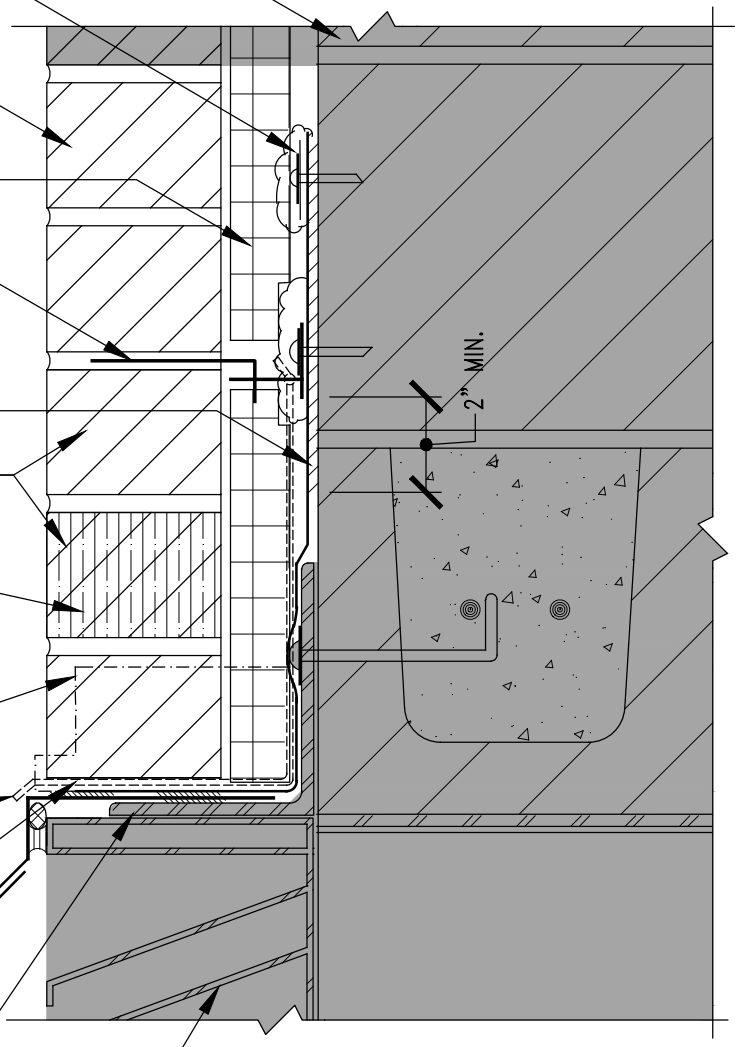
NOTE:
RAKE BACK EXISTING JOINTS WITH A VACUUM DUST COLLECTION (VDC) METHOD.



NOTE: FOR DEEPER TUCK POINTING, A/E TO CHANGE CUTTING DEPTH AND NEW MORTAR LAYERS WITH EACH LAYER NO MORE THAN 3/8" DEEP.

TP–1 TUCK POINTING
NO SCALE

EXAMPLE



EXISTING CONSTRUCTION (SHADED)

TERMINATE THROUGH–WALL FLASHING WITH CONTINUOUS TERMINATION BAR ANCHORED AT 6" O.C. COVERED WITH FLASHING LAP SEALANT

REMOVE 5 COURSES OF EXISTING CLAY BRICK

EXTRUDED POLYSTYRENE INSULATION

NEW BRICK TIE AT 16" O.C. COVER BACK PLATE WITH FLASHING LAP SEALANT

NEW FLEXIBLE SHEET METAL THROUGH–WALL FLASHING SET IN FLASHING LAP SEALANT ON BACK–UP WALL MIN. 2" BELOW BRICK TIE

NEW FACE BRICK

IN NEW CONSTRUCTION, INSERT HEAD JOINT VENT IN ALTERNATING HEAD JOINT FROM ROPE WICKS, ONE COURSE ABOVE

PROVIDE FOLDED END DAMS AT ALL FLASHING TERMINATIONS (DOT/DASHED) SEAL TO ADJACENT BRICK SEE DETAIL TWF–5

CONTINUOUS INTERLACED ROPE WICKS AT 16" O.C. (DASHED) AND EXTEND 3/4" FROM FACE

THROUGH–WALL FLASHING TRIM 1/2" FROM SHEET METAL INSERT CORNER

26 GA. STAINLESS STEEL SHEET METAL INSERT

EXISTING SHELF ANGLE, REMOVE RUST, OR NEW GALVANIZED, PRIME AND PAINT

PROVIDE TWO BEADS OF FLASHING LAP SEALANT BETWEEN THROUGH–WALL FLASHING AND SHEET METAL INSERT, AND ONE BEAD BETWEEN SHEET METAL INSERT AND SHELF ANGLE

EXISTING OR NEW LOUVERS

NOTE: EXISTING CONSTRUCTION SHOWN. A/E TO EDIT DETAIL FOR NEW CONSTRUCTION.

TWF–1A

SINGLE THROUGH–WALL FLASHING

SCALE: 3" = 1'–0"

EXAMPLE

FASTEN W/ CONTINUOUS TERM. BAR, ANCHOR @ 6" O.C. COVER TERM. BAR COMPLETELY W/ FLASHING LAP SEALANT

SET THROUGH–WALL FLASHING IN CONTINUOUS BED OF FLASHING LAP SEALANT FROM THE TOP EDGE OF THE FLASHING TO 2" BELOW THE BRICK TIE PENETRATION

BRICK TIES @ 16" O.C. MAX. – COVER PLATE & ANCHOR W/ FLASHING LAP SEALANT

CONTINUOUS ROPE WICKS – TIED TO BRICK TIES SEE DETAIL TWF–3

NEW RIGID INSULATION

THROUGH–WALL FLASHING W/ END DAMS MIN. 8" BEYOND END OF LINTEL SEE DETAIL TWF–5

SET THROUGH–WALL FLASHING IN TWO CONTINUOUS BEADS OF FLASHING LAP SEALANT

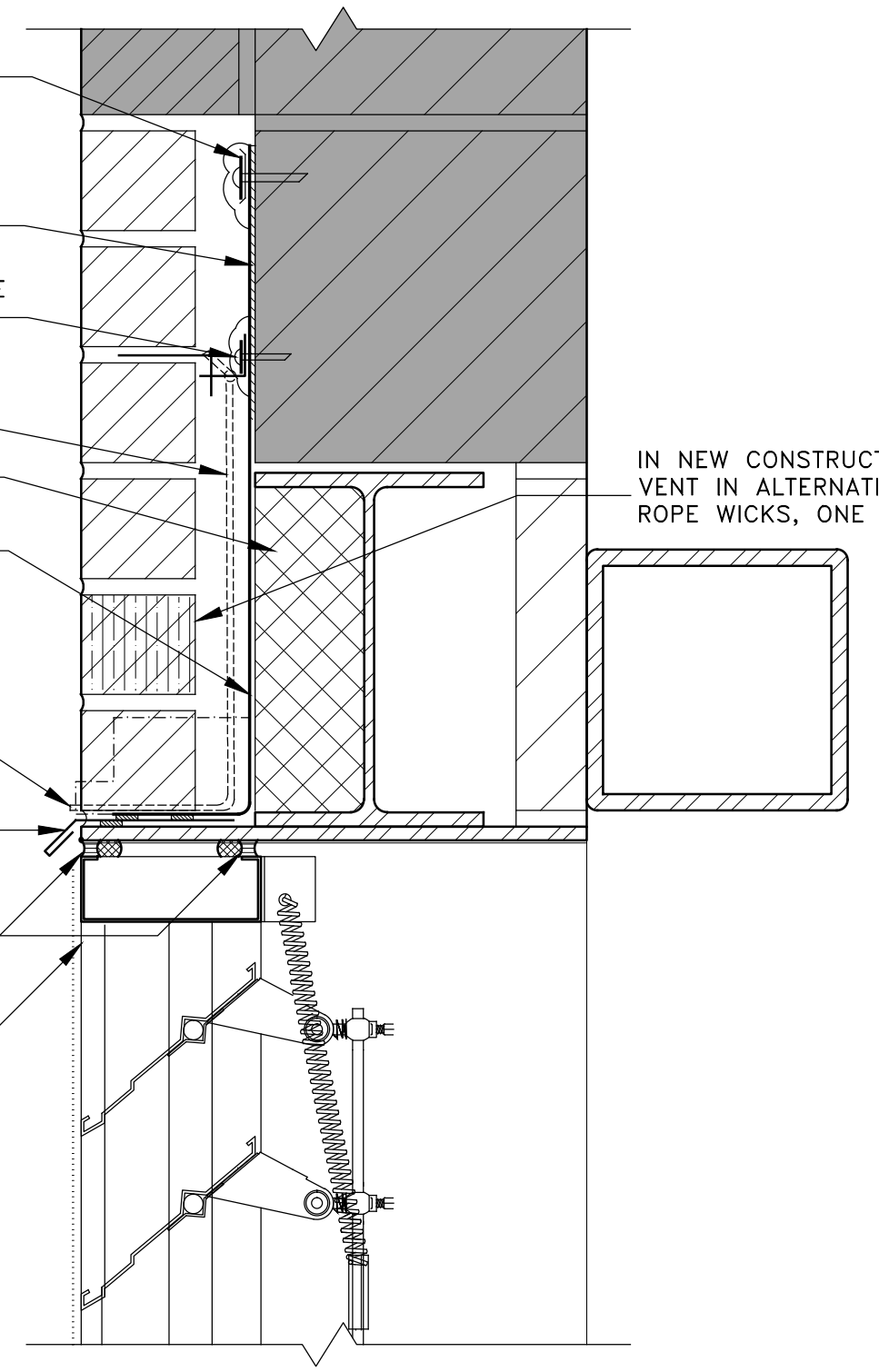
TRIM EXTERIOR ROPE WICK TO 3/4" MIN.

STAINLESS STEEL DRIP EDGE SET IN ONE CONTINUOUS BEAD OF FLASHING LAP SEALANT

BACKER ROD & SEALANT

NEW LOUVER

IN NEW CONSTRUCTION, INSERT HEAD JOINT VENT IN ALTERNATING HEAD JOINT FROM ROPE WICKS, ONE COURSE ABOVE



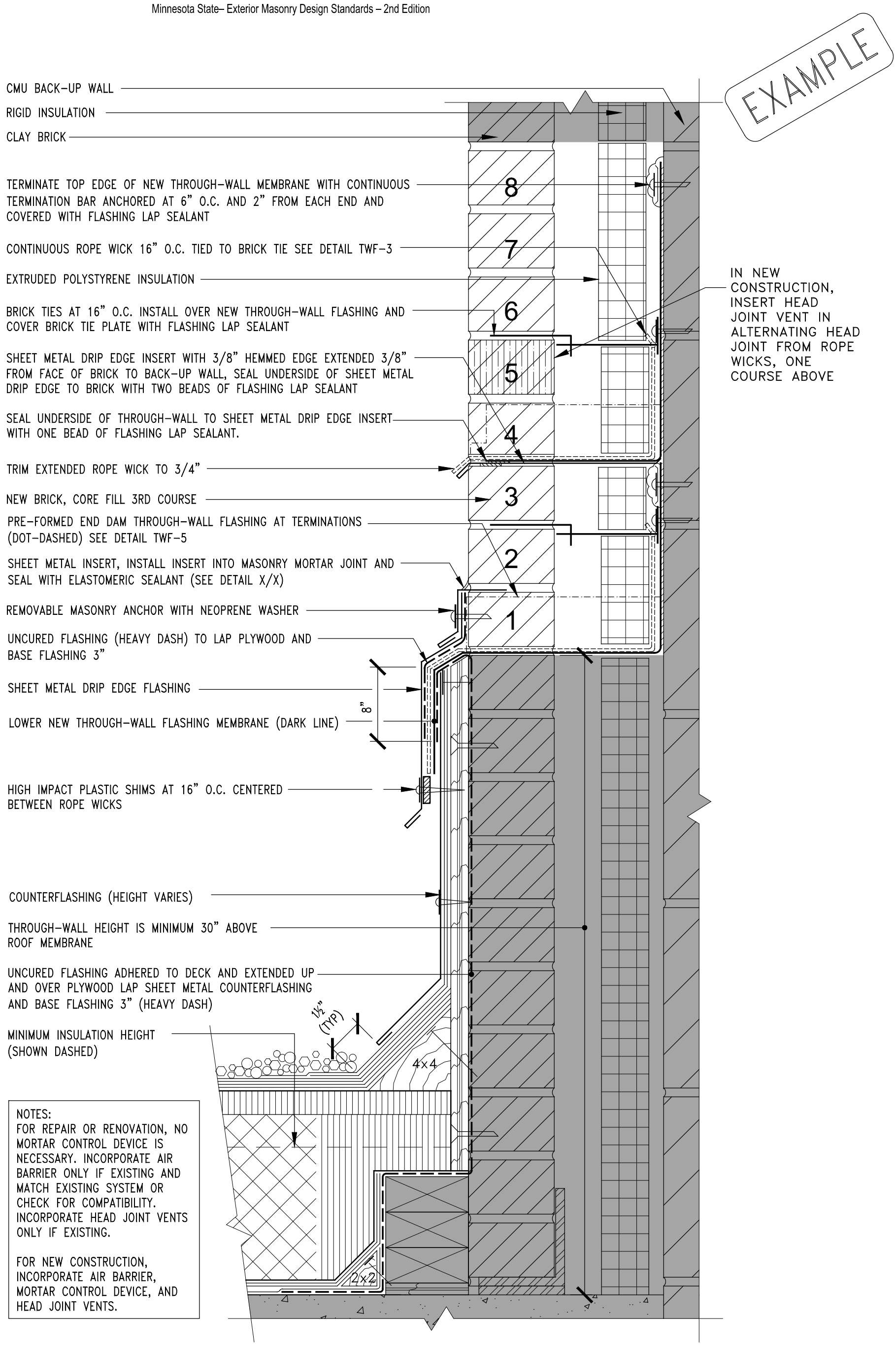
NOTES FOR REPAIR OR RENOVATION:
1. CONTRACTOR TO SHORE REMAINING BRICK ABOVE THROUGH–WALL FLASHING WORK AREA TO PREVENT DAMAGE TO THE EXISTING CONDITIONS.
2. CUT BACK OF BRICK AS REQUIRED FOR INSTALLATION OF NEW FLASHING SYSTEM.

NOTES FOR NEW CONSTRUCTION:
1. INCORPORATE MORTAR CONTROL DEVICE IN CAVITY SPACE– SIZED AS ALLOWS.
2. INCORPORATE AIR BARRIER DETAIL AND MATERIALS.

NOTE: EXISTING CONSTRUCTION SHOWN. A/E TO EDIT DETAIL FOR NEW CONSTRUCTION.

PART IV
DOCUMENT EXAMPLES

TWF–1B LOUVER HEAD DETAIL
SCALE: 3" = 1'–0"

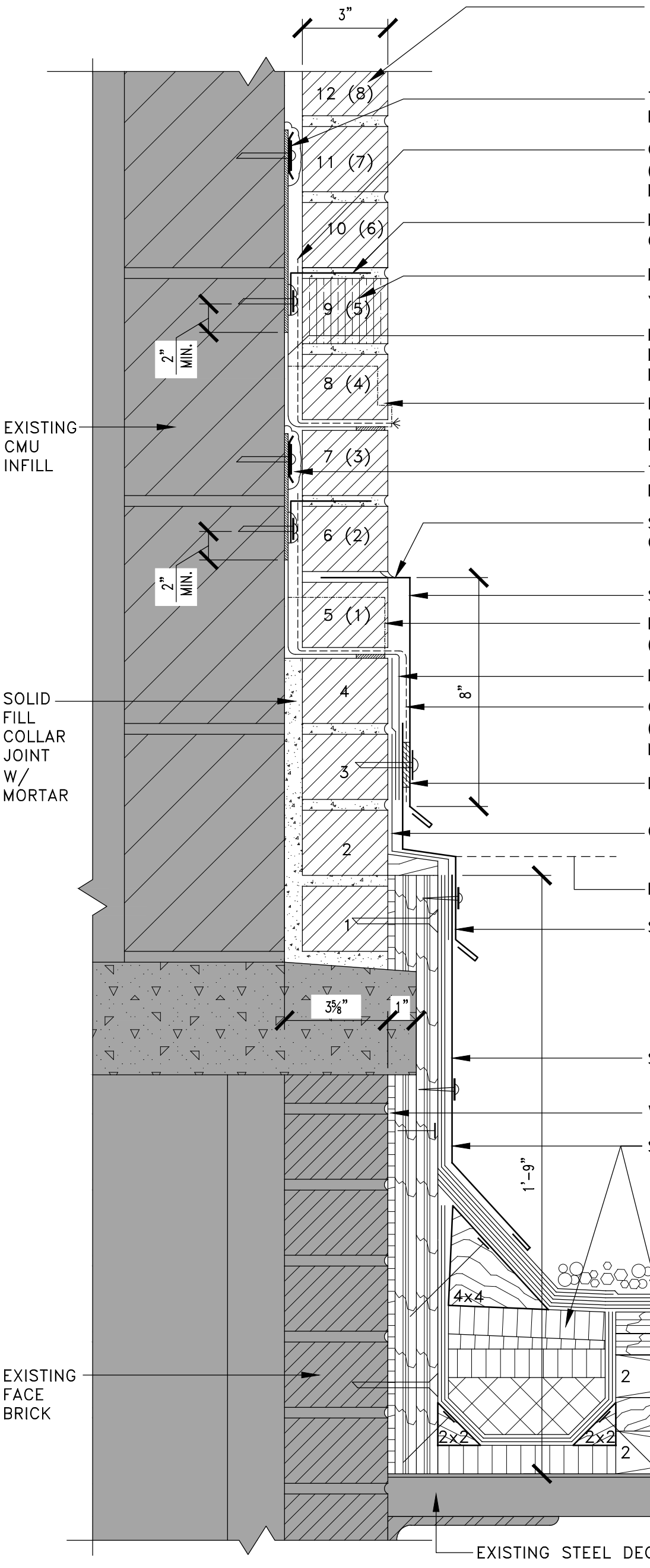


NOTES:
FOR REPAIR OR RENOVATION, NO MORTAR CONTROL DEVICE IS NECESSARY. INCORPORATE AIR BARRIER ONLY IF EXISTING AND MATCH EXISTING SYSTEM OR CHECK FOR COMPATIBILITY. INCORPORATE HEAD JOINT VENTS ONLY IF EXISTING.

FOR NEW CONSTRUCTION, INCORPORATE AIR BARRIER, MORTAR CONTROL DEVICE, AND HEAD JOINT VENTS.

TWF–2A DOUBLE THROUGH–WALL FLASHING
SCALE: 3" = 1'–0"

EXAMPLE



TERMINATION BAR FASTENED 6" O.C. COVER W/ FLASHING LAP SEALANT

CONTINUOUS ROPE WICKS @16" O.C. HORIZONTALLY (DASHED). TIE TO BRICK TIES AND EXTENDED 1/2" SEE DETAIL TWF-3

BRICK TIES @ 16" O.C. VERTICALLY & HORIZONTALLY. COVER PLATE W/ FLASHING LAP SEALANT

HEAD JOINT VENT INSERTED IN ALTERNATING HEAD JOINT FROM ROPE WICKS

LAMINATED THROUGH-WALL SEALED IN TWO BEADS TO BRICK BELOW & EXTEND 1/2". PRESS INTO AIR BARRIER COMPATIBLE SEALANT ON BACK-UP

FOLDED AND SEALED END DAM MIN. 8" BEYOND ROOF EDGE WITH ROPE WICK TAB (DOT DASH) SEE DETAIL TWF-5

TERMINATION BAR FASTENED 6" O.C. COVER W/ FLASHING LAP SEALANT

SHEET METAL INSERT W/ JOINT SEALANT. LAY IN BRICK COURSING TO ALLOW COUNTERFLASHING INSTALLATION.

SHEET METAL COUNTERFLASHING

PREFORMED END DAM MIN. 8" BEYOND ROOF EDGE (DOT-DASHED) SEE DETAIL TWF-5

LAMINATED THROUGH-WALL FLASHING

CONTINUOUS ROPE WICKS @16" O.C. HORIZONTALLY (DASHED) AND EXTENDED OVER ROOF BASE FLASHING MIN. 6"

PLASTIC SHIMS @ 24" O.C.

CONCEALED FLASHING

ROOF EDGE CAP FLASHING BEYOND

SHEET METAL COUNTERFLASHING

SHEET METAL COUNTERFLASHING (HEIGHT VARIES)

WOOD SHIMS AS REQUIRED

SEE DETAIL X/X FOR ROOF INFORMATION

NOTES:
1. REMOVE EXISTING STUCCO AND INSTALL NEW BRICK INFILL W/ BRICK TIES.
2. REMOVE EXISTING 8 BRICK COURSES (IN PARENTHESIS) ADJACENT INFILL TO EXTEND THRU-WALL BEYOND ROOF EDGE. EXISTING SILL STOPS SHORT OF ROOF EDGE.
3. NO AIR BARRIER SHOWN IN THIS DETAIL ONLY.

NOTE: EXISTING CONSTRUCTION SHOWN. A/E TO EDIT DETAIL FOR NEW CONSTRUCTION.

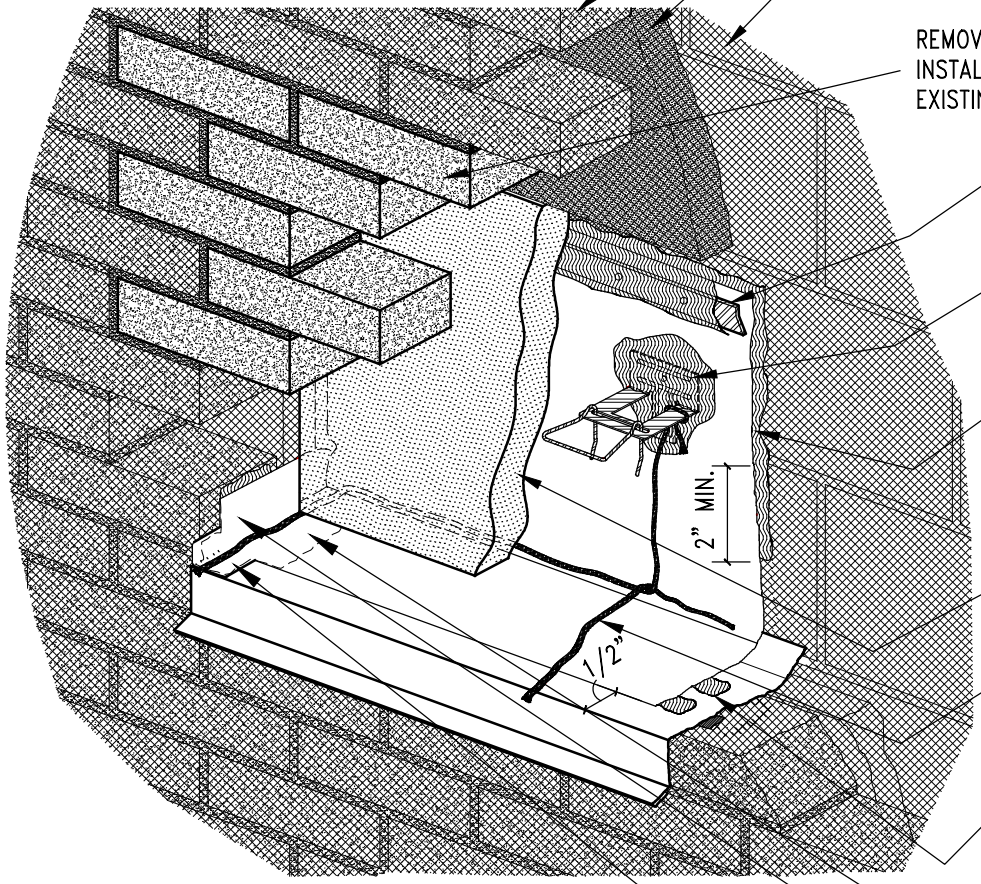
TWF-2B

DOUBLE THROUGH-WALL AT SOLID WALL CONSTRUCTION

SCALE: 3" = 1'-0"

REPAIR OR RENOVATION

EXAMPLE



EXISTING CLAY BRICK, INSULATION, AND CMU BACK–UP WALL

REMOVE SPECIFIED CLAY BRICK COURSES AND INSTALL REPLACEMENT CLAY BRICK TO MATCH EXISTING COURSING

TERMINATION BAR FASTENED 6" O.C. AND COVERED IN FLASHING LAP SEALANT

BRICK TIE AT MAX 8" FROM END AND 16" O.C., COVERED IN FLASHING LAP SEALANT

NEW FLEXIBLE SHEET METAL THROUGH–WALL FLASHING SET IN FLASHING LAP SELANT FROM ABOVE TOP EDGE TO MIN. 2" BELOW BRICK TIE

NEW RIGID INSULATION AS REQUIRED

CONTINUOUS INTERLACED ROPE WICKS AT 16" O.C. AND AT EACH END DAM. TIE TO BRICK TIE

TWO BEADS OF FLASHING LAP SEALANT BETWEEN THROUGH–WALL FLASHING MEMBRANE AND SHEET METAL DRIP EDGE INSERT. ONE BEAD OF FLASHING LAP SEALANT BETWEEN SHEET METAL DRIP EDGE AND CLAY BRICK

SEALANT

PRE–FORMED END DAM AT TERMINATION SET IN FLASHING LAP SEALANT ON ADJACENT CLAY BRICK. SEE DETAIL TWF–5

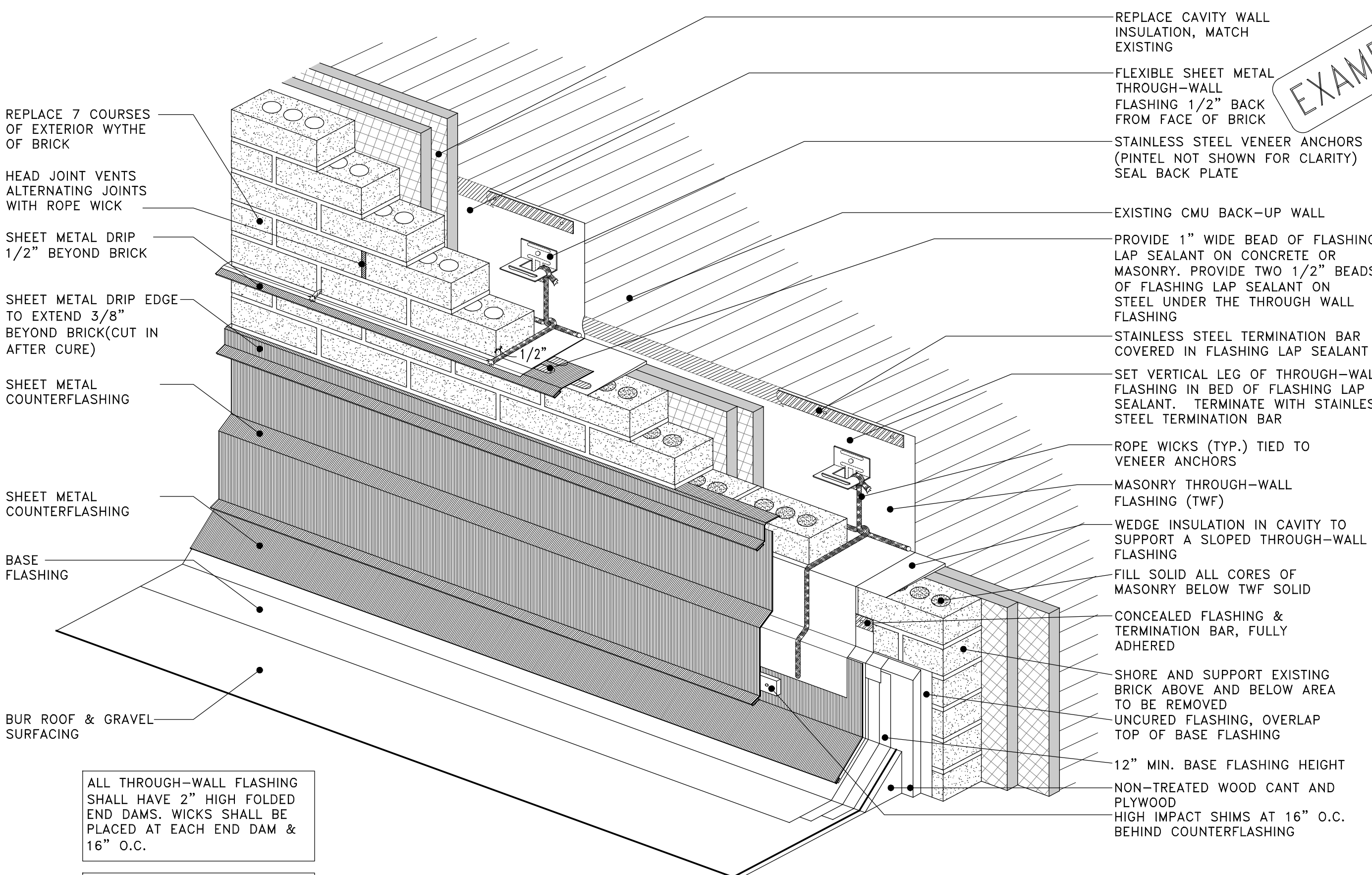
TAB EXTENSION 1" HIGH, 1" WIDE AT ROPE WICK CORNER, FLUSH WITH BRICK FACE

NOTES:
NOT ALL MATERIALS OR ADJACENT DETAILS ARE FULLY SHOWN FOR CLARITY.

FOR NEW CONSTRUCTION, INCORPORATE AIR BARRIER, MORTAR CONTROL DEVICE, AND HEAD JOINT VENTS AS REQUIRED.

TWF–3A SINGLE THROUGH–WALL FLASHING ISOMETRIC

NO SCALE



EXAMPLE

ALL THROUGH-WALL FLASHING SHALL HAVE 2" HIGH FOLDED END DAMS. WICKS SHALL BE PLACED AT EACH END DAM & 16" O.C.

NOTE: EXISTING CONSTRUCTION SHOWN. A/E TO EDIT DETAIL FOR NEW CONSTRUCTION.

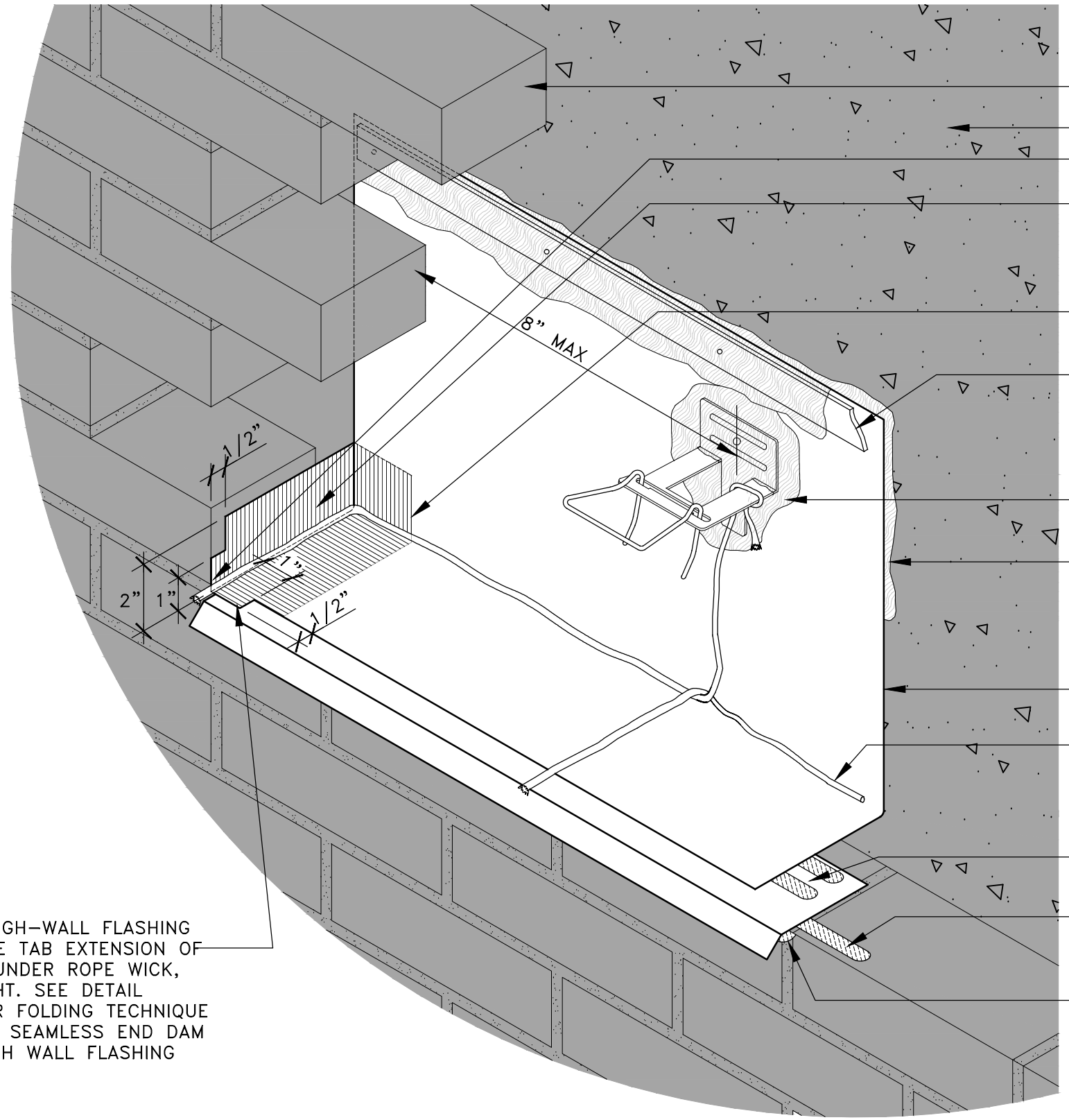
PART IV
DOCUMENT EXAMPLES

DOUBLE THROUGH-WALL FLASHING ISOMETRIC

NO SCALE

TWF-3B

EXAMPLE



EXISTING BRICK

EXISTING CONCRETE BACK–UP WALL

ROPE WICK TAB EXTENSION

PROVIDE FULL BED OF FLASHING LAP SEALANT ON VERTICAL BACK OF END DAM AND CONTINUE 2" UNDERNEATH FLASHING

PREFORMED END DAM – PLACE BEHIND VERTICAL LEG OF FLASHING

TERMINATE NEW THROUGH–WALL MEMBRANE WITH CONTINUOUS TERMINATION BAR ANCHORED AT 6" O.C. AND COVERED WITH FLASHING LAP SEALANT

VENEER ANCHORS, AT 16" O.C., MAX 8" FROM ENDS, COVERED IN FLASHING LAP SEALANT

SET THROUGH–WALL FLASHING IN CONTINUOUS BED OF FLASHING LAP SEALANT FROM THE TOP EDGE OF THE FLASHING TO 2" BELOW THE LOWEST PENETRATION

THROUGH–WALL FLASHING, MIN. 12" HIGH W/ 2" HIGH END DAMS

CONTINUOUS ROPE WICKS @ EA. HEAD JOINT TIED TO VENEER ANCHORS

SET THROUGH–WALL FLASHING IN TWO 1" WIDE CONTINUOUS BEADS OF FLASHING LAP SEALANT

NEW STAINLESS STEEL SHEET METAL DRIP EDGE – SEAL UNDERSIDE TO BRICK WITH A 1" WIDE CONTINUOUS BEAD OF FLASHING LAP SEALANT

JOINT SEALANT INSTALLED AT STAINLESS STEEL SHEET METAL DRIP EDGE TO BRICK

CUT THROUGH–WALL FLASHING TO PROVIDE TAB EXTENSION OF FLASHING UNDER ROPE WICK, TO DAYLIGHT. SEE DETAIL TWF–5 FOR FOLDING TECHNIQUE TO CREATE SEAMLESS END DAM AT THROUGH WALL FLASHING

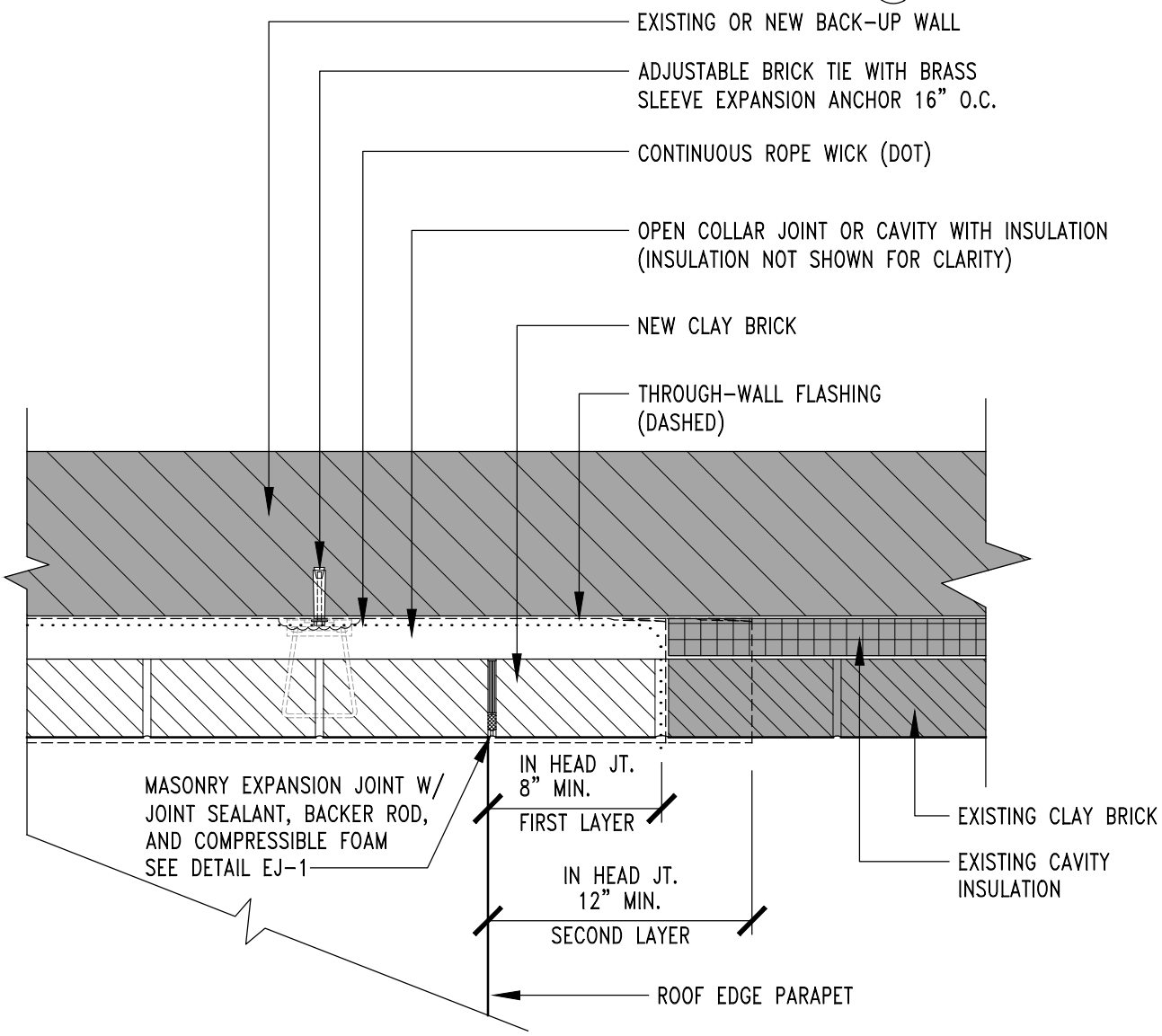
NOTE: NOT ALL MATERIALS OR ADJACENT DETAILS ARE FULLY SHOWN FOR CLARITY

NOTE: EXISTING CONSTRUCTION SHOWN. A/E TO EDIT DETAIL FOR NEW CONSTRUCTION.

ROPE WICK TAB EXTENSION ISOMETRIC DETAIL

TWF–3C NO SCALE

EXAMPLE



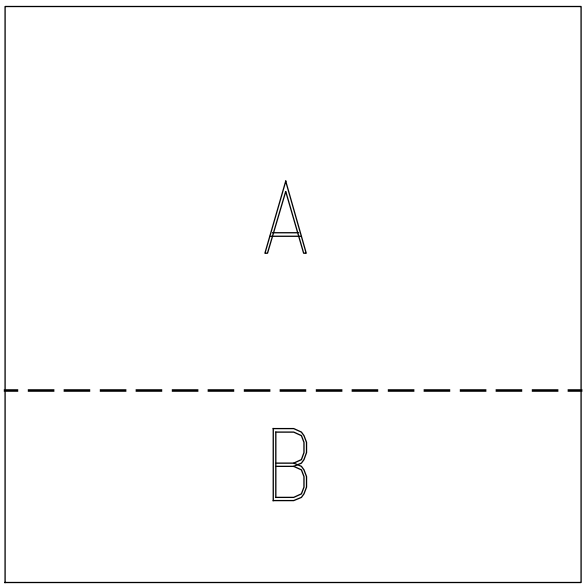
NOTE: FOR NEW CONSTRUCTION, SHOW JOINT REINFORCEMENT W/ADJUSTABLE TIES AND AIR BARRIER.

NOTE: EXISTING CONSTRUCTION SHOWN. A/E TO EDIT DETAIL FOR NEW CONSTRUCTION.

TWF–4

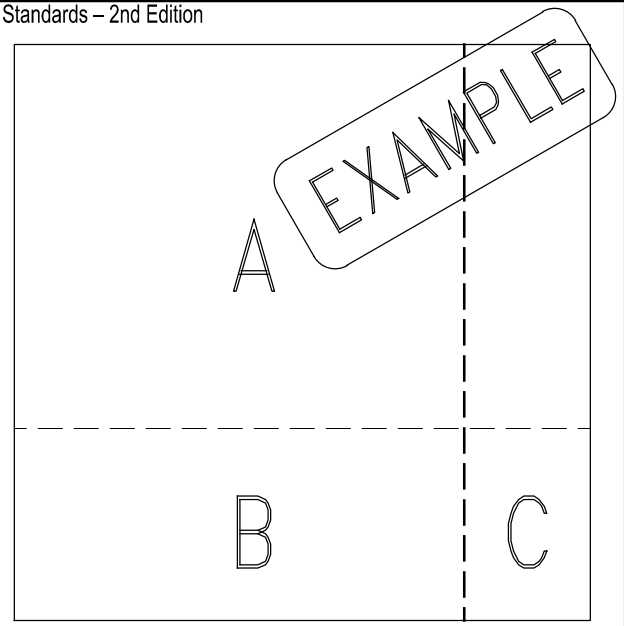
END DAM LOCATIONS

SCALE: 1–1/2" = 1'–0" PLAN VIEW



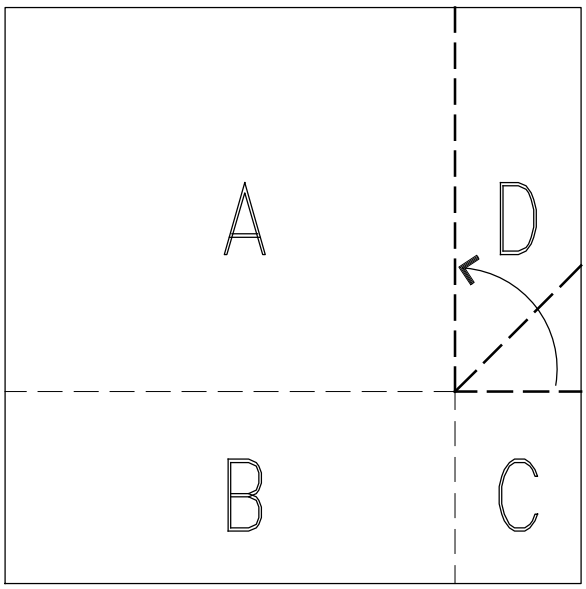
STEP #1

FOLD THROUGH–WALL FLASHING TO CREATE THE UPPER LEG (A) OF THE THROUGH–WALL FLASHING (TYPICALLY 8" MINIMUM) AND THE LOWER LEG (B) OF THE FLASHING (TYPICALLY THE DISTANCE BETWEEN THE BACK–UP WALL TO 1/2" PAST THE FACE OF CLAY BRICK)



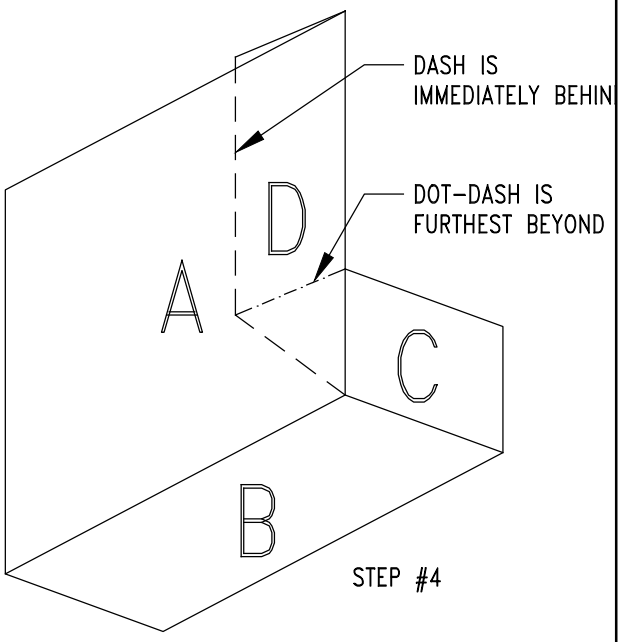
STEP #2

FOLD THROUGH–WALL FLASHING PERPENDICULAR TO THE FIRST FOLD TO CREATE THE UPPER LEG (C) OF THE END DAM (TYPICALLY THE HEIGHT OF CLAY BRICK)



STEP #3

CREATE A 45 DEGREE FOLD IN THE THROUGH–WALL FLASHING (AREA D) AS SHOWN BY MATCHING LINE A–D WITH LINE C–D.



STEP #4

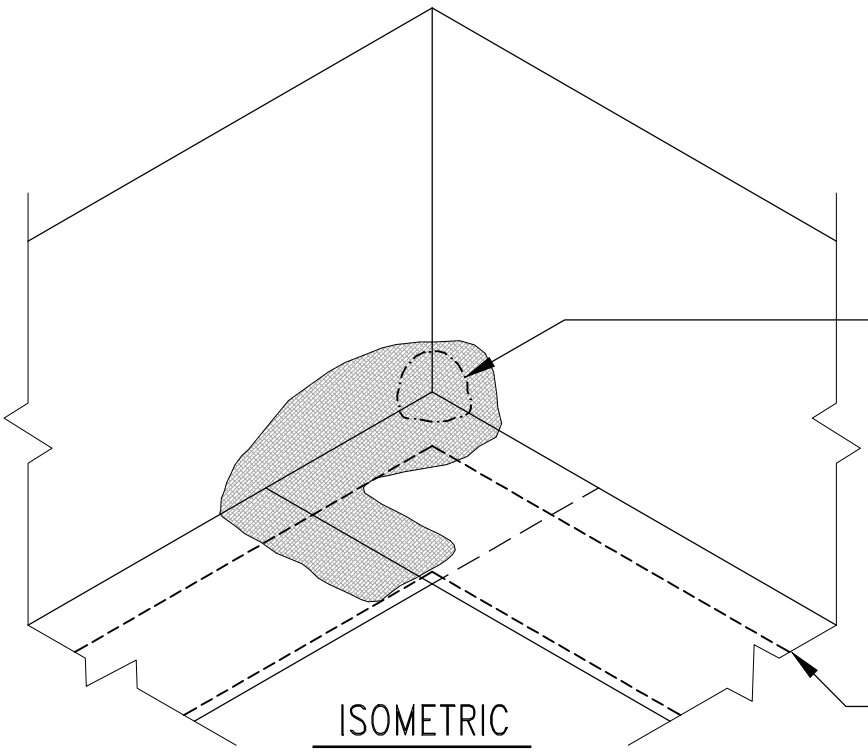
AFTER ALL FOLDS HAVE BEEN MADE. FOLD THE FLASHING AT THE 45 DEGREE BEND AND FOLD BEHIND SURFACE AREA A. THIS WILL CREATE INSIDE FOLDS BETWEEN A–B, B–C, & C–D AND AN OUTSIDE FOLD BETWEEN A–D.

TWF–5

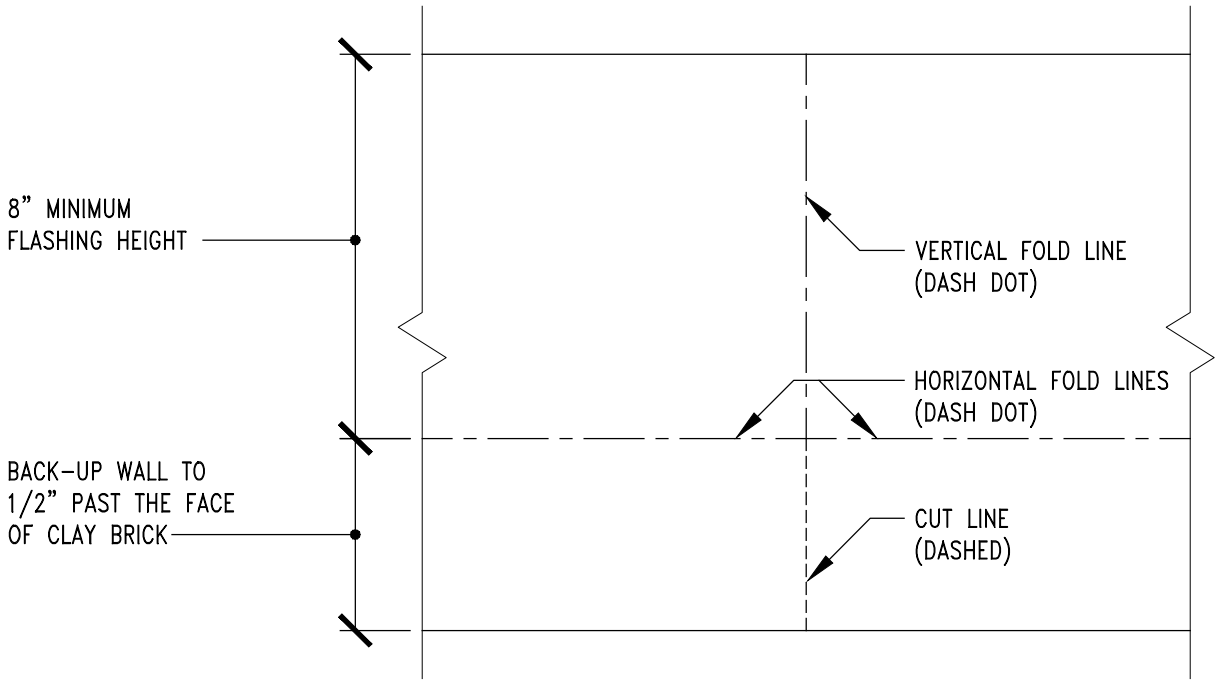
END DAM FOLDING TECHNIQUE

NO SCALE

EXAMPLE



ISOMETRIC



SHEET VIEW

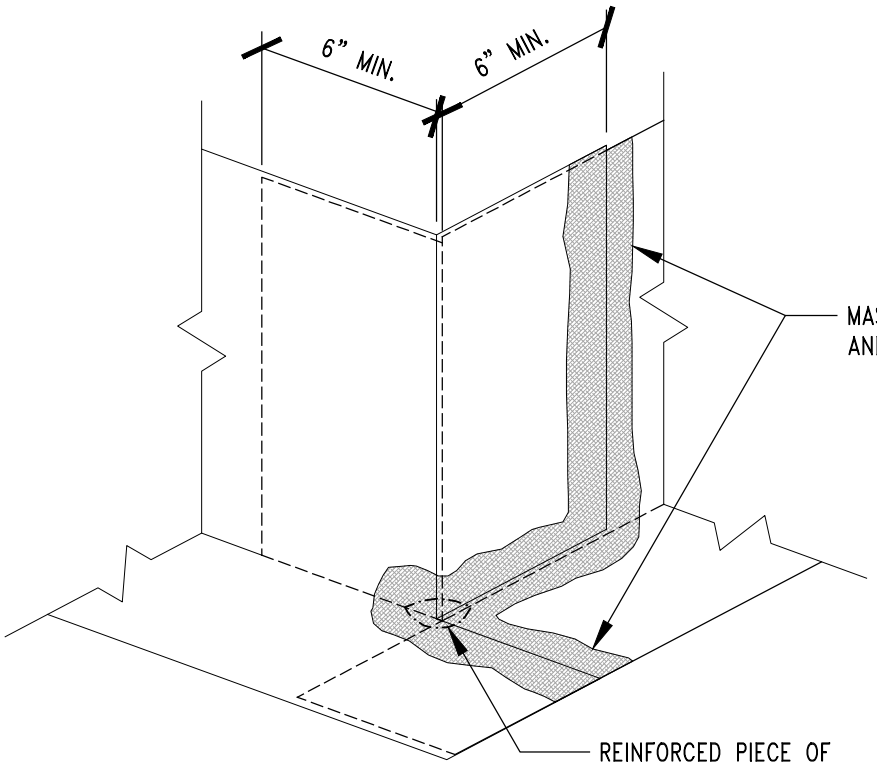
NOTE: ONLY SINGLE LAYER THROUGH–WALL FLASHING OR UPPER LEVEL OF DOUBLE THROUGH–WALL IS SHOWN. FOR LOWER LAYER OF DOUBLE THROUGH–WALL FLASHING, MEMBRANE IS EXTENDED TO TIE–IN TO ROOF BASE FLASHING.

TWF–6

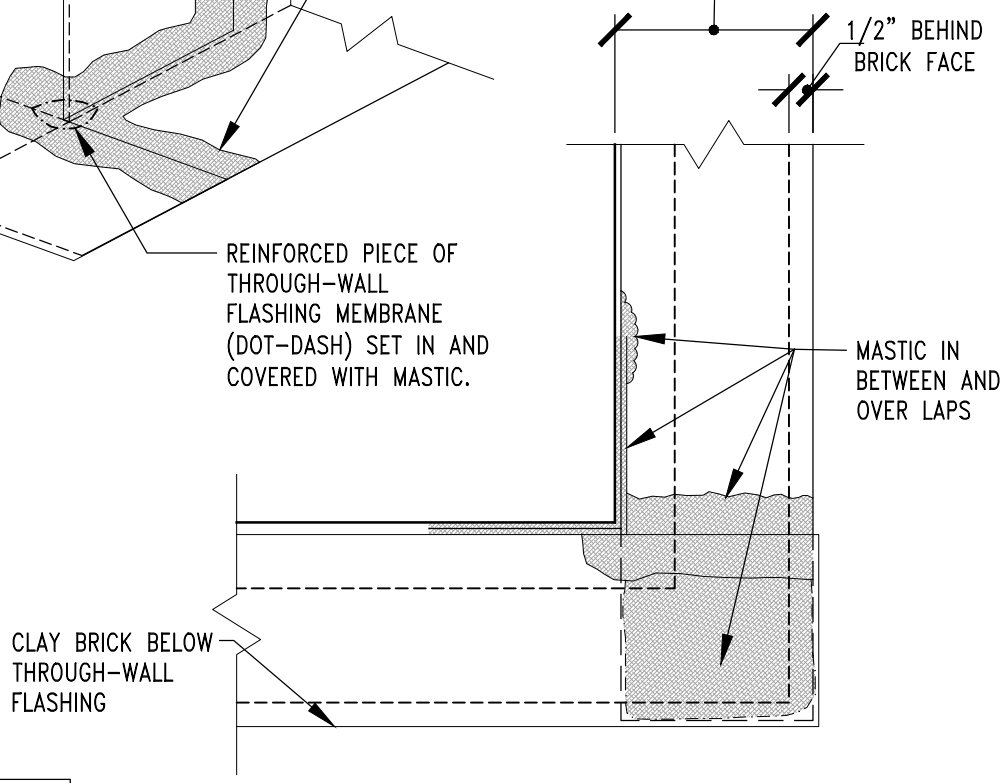
INSIDE CORNER THROUGH–WALL FLASHING

NO SCALE

EXAMPLE



ISOMETRIC



PLAN VIEW

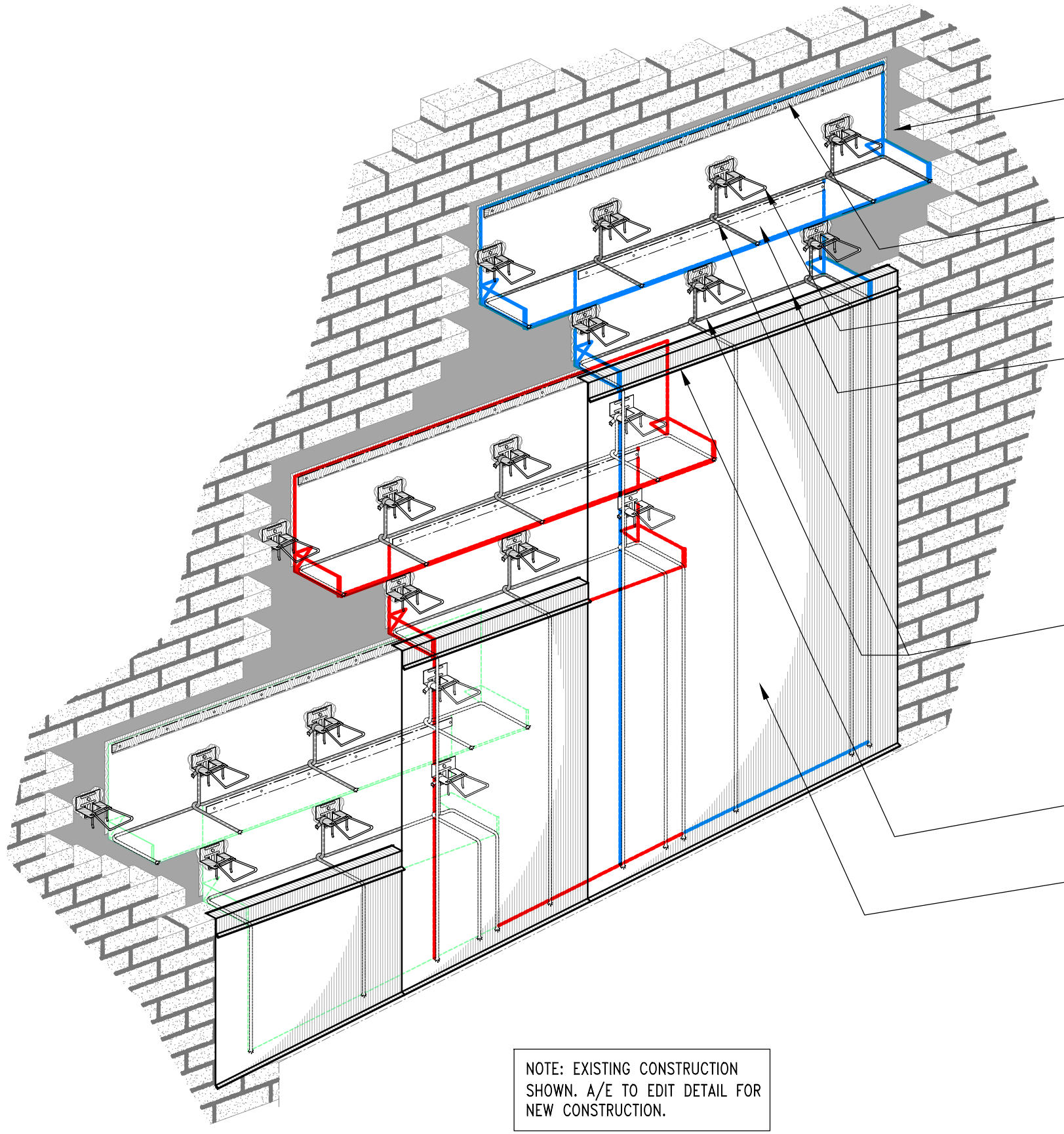
NOTE: ONLY SINGLE LAYER THROUGH–WALL FLASHING OR UPPER LEVEL OF DOUBLE THROUGH–WALL IS SHOWN. FOR LOWER LAYER OF DOUBLE THROUGH–WALL FLASHING, MEMBRANE IS EXTENDED TO TIE–IN TO ROOF BASE FLASHING.

TWF–7

OUTSIDE CORNER THROUGH–WALL FLASHING

NO SCALE

EXAMPLE



EXISTING/NEW BACK–UP WALL, INSULATION MAY NOT EXIST AT ALL LOCATIONS REPLACE WITH NEW INSULATION WHERE NEEDED

TERMINATION BAR FASTENED 6" O.C. AND 2" FROM ENDS, COVER IN FLASHING LAP SEALANT

BRICK TIES AT 16" O.C. COVERED IN FLASHING LAP SEALANT

INSTALL FLEXIBLE SHEET METAL THROUGH–WALL FLASHING WITH END DAMS, SET IN BED OF FLASHING LAP SEALANT ON BACK–UP WALL AND A 3/4" BEAD OF SEALANT ON CLAY BRICK. FILL CORES IN CLAY BRICK WITH MORTAR UNDER FLASHING. AT UPPER LAYER, EXTEND FLASHING 1/2" FROM FACE OF BRICK. ON LOWER LAYER, EXTEND FLASHING TO ROOF DECK.

INSTALL CONTINUOUS INTERLACED ROPE WICKS 16" O.C. TIE ROPE WICKS TO BRICK TIE BASE PLATES, TRIM EXTENDED ROPE WICKS TO 3/4" ON UPPER LAYER FLASHING AND EXTEND ROPE WICKS TO ROOF DECK ON LOWER LAYER FLASHING

SHEET METAL INSERT COORDINATED WITH ROOF SHEET METAL COUNTERFLASHING.

ROOFING SHEET METAL COUNTERFLASHING STEPPED, LAPPED MIN. 4" TO SHEET METAL BELOW AND EXTEND MIN. 4" BEYOND LOWER THROUGH–WALL FLASHING END DAM

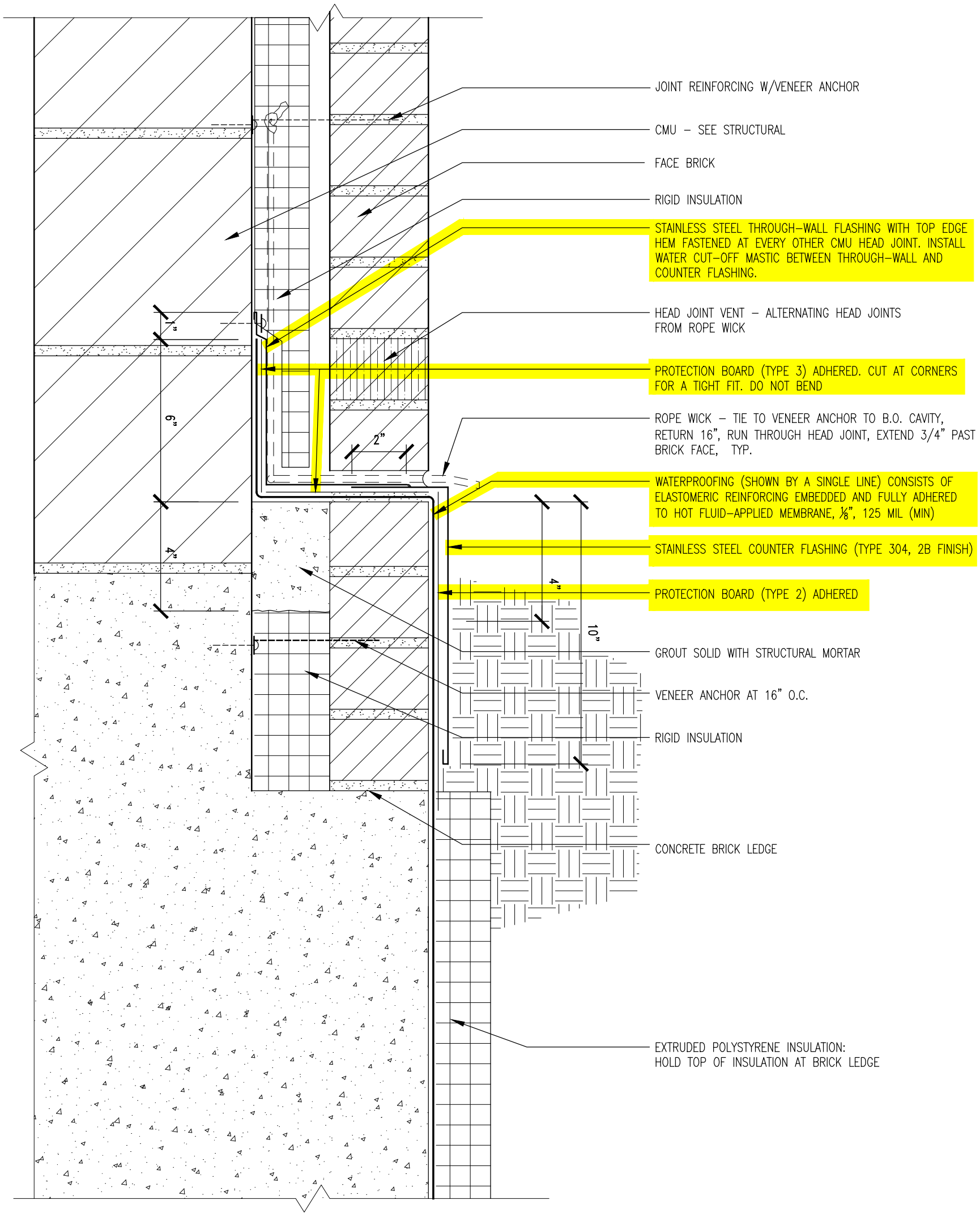
NOTE: EXISTING CONSTRUCTION SHOWN. A/E TO EDIT DETAIL FOR NEW CONSTRUCTION.

NOTE:
- NOT ALL MATERIALS OR LAYERS ARE SHOWN FOR CLARITY.
- MAINTAIN CONSISTENT STEP FLASHING SIZE EXCEPT WHERE EXISTING SHELF ANGLES DO NOT ALLOW.
- BEFORE DEMOLITION OF EXISTING (OR BUILDING NEW) LAYOUT STEPS AT THE SITE WITH THE A/E, OWNER'S REPRESENTATIVE, MASONRY & ROOF OBSERVERS, MASONRY CONTRACTOR, AND ROOFING/SHEET METAL CONTRACTOR.

DOUBLE THROUGH–WALL STEP FLASHING

TWF–8

NO SCALE



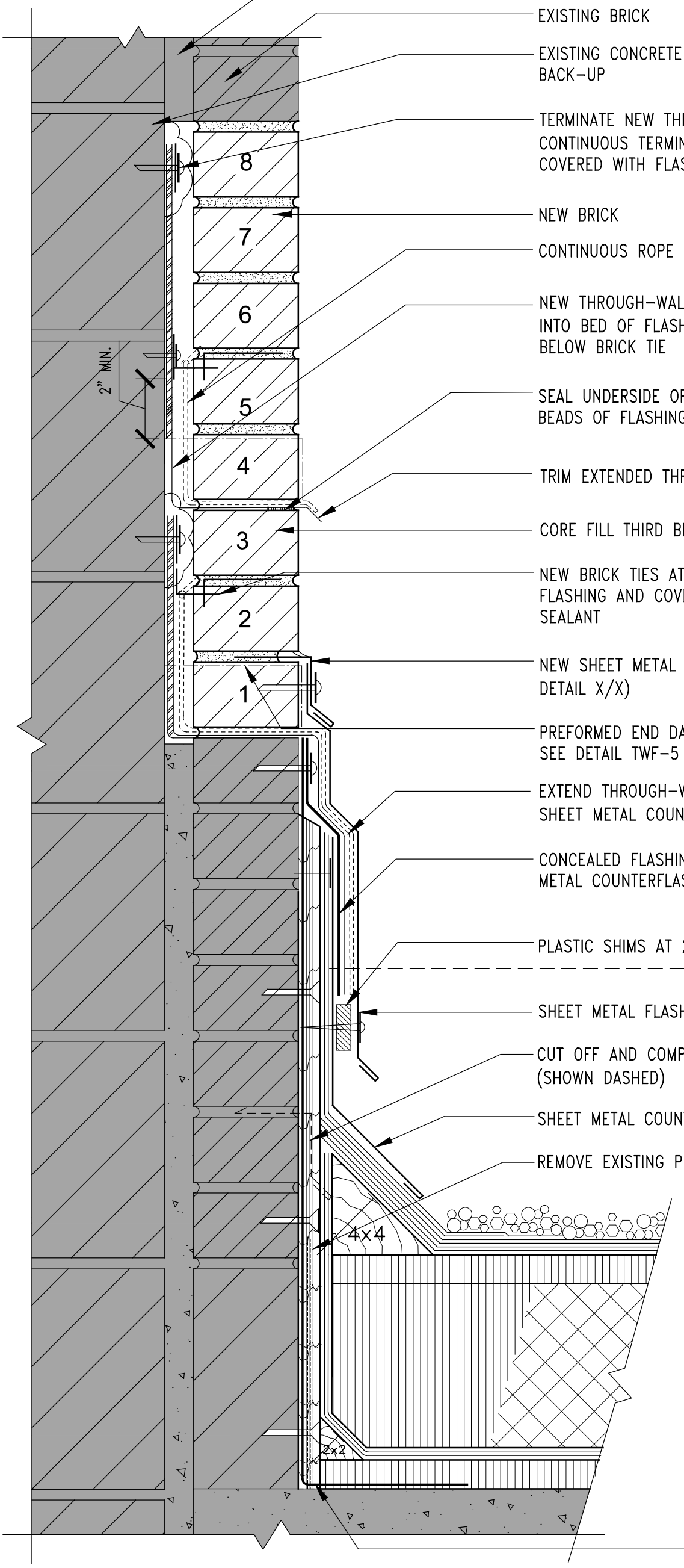
DETAIL INTENDED TO SHOW WATERPROOFING DETAIL CONCEPTS ONLY.

EXAMPLE

WP–1 THROUGH–WALL FLASHING AT WATERPROOFING

SCALE: 3" = 1'–0"

EXAMPLE



EXISTING 1" GROUTED COLLAR JOINT

EXISTING BRICK

EXISTING CONCRETE MASONRY BACK–UP

TERMINATE NEW THROUGH–WALL MEMBRANE WITH CONTINUOUS TERMINATION BAR ANCHORED AT 6" O.C. AND COVERED WITH FLASHING LAP SEALANT

NEW BRICK

CONTINUOUS ROPE WICK AT 16" O.C. TIED TO BRICK TIE SEE DETAIL TWF–3

NEW THROUGH–WALL FLASHING MEMBRANE. SET BOTH LAYERS INTO BED OF FLASHNG LAP SEALANT ON CMU BACK–UP FOR 2" BELOW BRICK TIE

SEAL UNDERSIDE OF THROUGH–WALL TO BRICK WITH TWO BEADS OF FLASHING LAP SEALANT

TRIM EXTENDED THROUGH–WALL AND ROPE WICK TO 3/4"

CORE FILL THIRD BRICK COURSE

NEW BRICK TIES AT 16" O.C. INSTALL OVER NEW THROUGH–WALL FLASHING AND COVER BRICK TIE PLATE WITH MASTIC OR LAP SEALANT

NEW SHEET METAL INSERT LAID WITH MASONRY, MIN. 1–1/2" DEEP (SIM. TO DETAIL X/X)

PREFORMED END DAM THROUGH–WALL FLASHING AT TERMINATIONS (DOT DASH) SEE DETAIL TWF–5

EXTEND THROUGH–WALL FLASHING AND ROPE WICK DOWN WALL AND OVER NEW SHEET METAL COUNTERFLASHING MIN. 8"

CONCEALED FLASHING STRIPPED–IN OVER TWO PLY BASE FLASHING AND SHEET METAL COUNTERFLASHING TERMINATED AT TOP WITH TERMINATION BAR

PLASTIC SHIMS AT 24" O.C.

TOP OF PARAPET BEYOND

SHEET METAL FLASHING

CUT OFF AND COMPLETELY REMOVE EXISTING SHEET METAL REGLET INSERT (SHOWN DASHED)

SHEET METAL COUNTERFLASHING (HEIGHT VARIES)

REMOVE EXISTING PLYWOOD (SHOWN DASHED)

NOTES:

1.) AT SIM TO LOCATION, 2" RIGID INSULATION AND 2" AIRSPACE EXIST IN LIEU OF 1" GROUTED COLLAR JOINT. INSTALL 2" REPLACEMENT INSULATION AT THROUGH–WALL FLASHING DETAIL.

2.) FOR NEW CONSTRUCTION, INCORPORATE AIR BARRIER, MORTAR CONTROL DEVICE, AND HEAD JOINT VENTS AS REQUIRED.

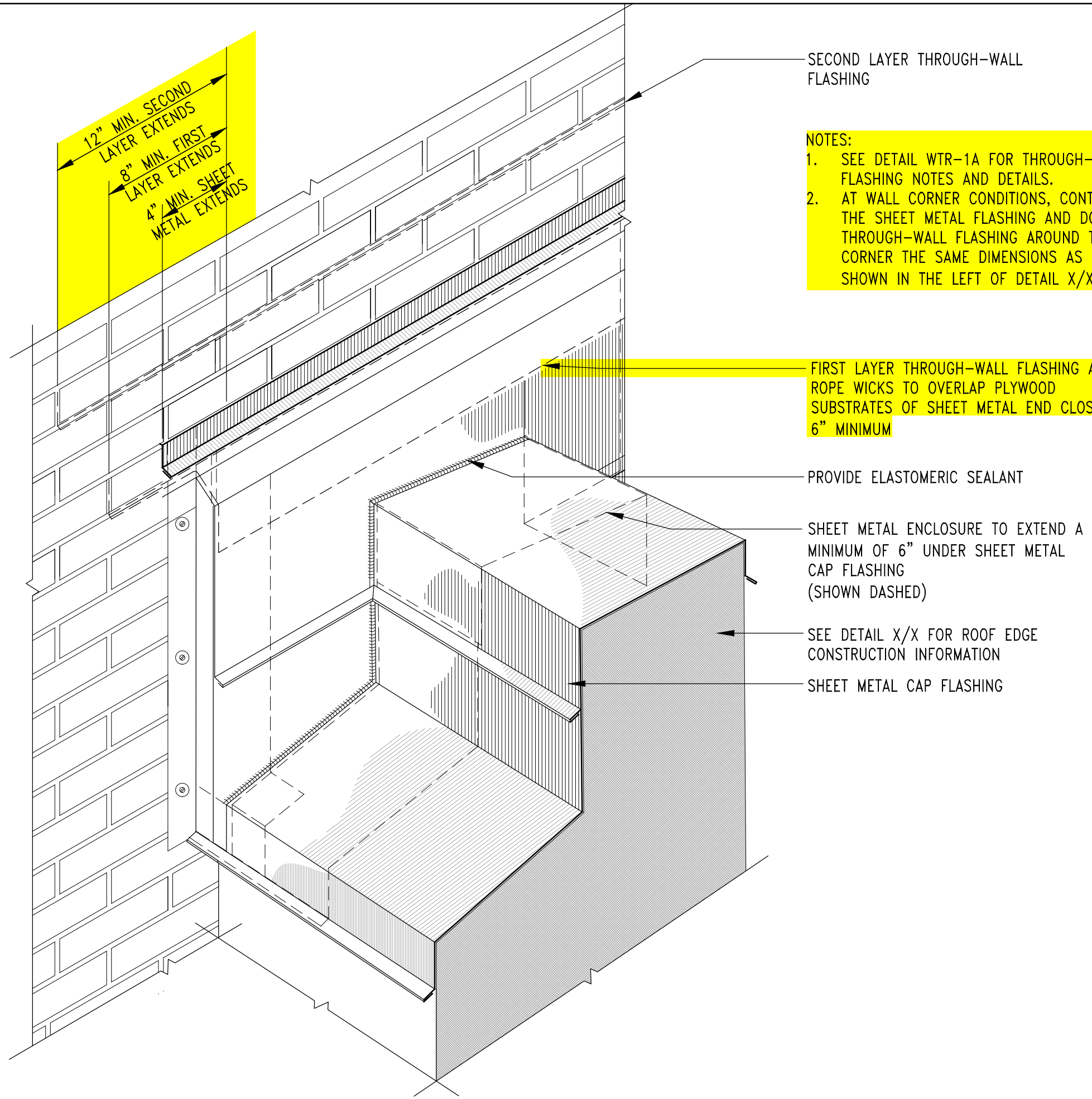
UNCURED FLASHING (SHOWN DASHED)

WTR–1A

THROUGH–WALL FLASHING DETAIL

SCALE: 3" = 1'–0"

REPAIR OR RENOVATION



SECOND LAYER THROUGH–WALL FLASHING

NOTES:
1. SEE DETAIL WTR–1A FOR THROUGH–WALL FLASHING NOTES AND DETAILS.
2. AT WALL CORNER CONDITIONS, CONTINUE THE SHEET METAL FLASHING AND DOUBLE THROUGH–WALL FLASHING AROUND THE CORNER THE SAME DIMENSIONS AS SHOWN IN THE LEFT OF DETAIL X/X.

FIRST LAYER THROUGH–WALL FLASHING AND ROPE WICKS TO OVERLAP PLYWOOD SUBSTRATES OF SHEET METAL END CLOSURE 6" MINIMUM

PROVIDE ELASTOMERIC SEALANT

SHEET METAL ENCLOSURE TO EXTEND A MINIMUM OF 6" UNDER SHEET METAL CAP FLASHING (SHOWN DASHED)

SEE DETAIL X/X FOR ROOF EDGE CONSTRUCTION INFORMATION

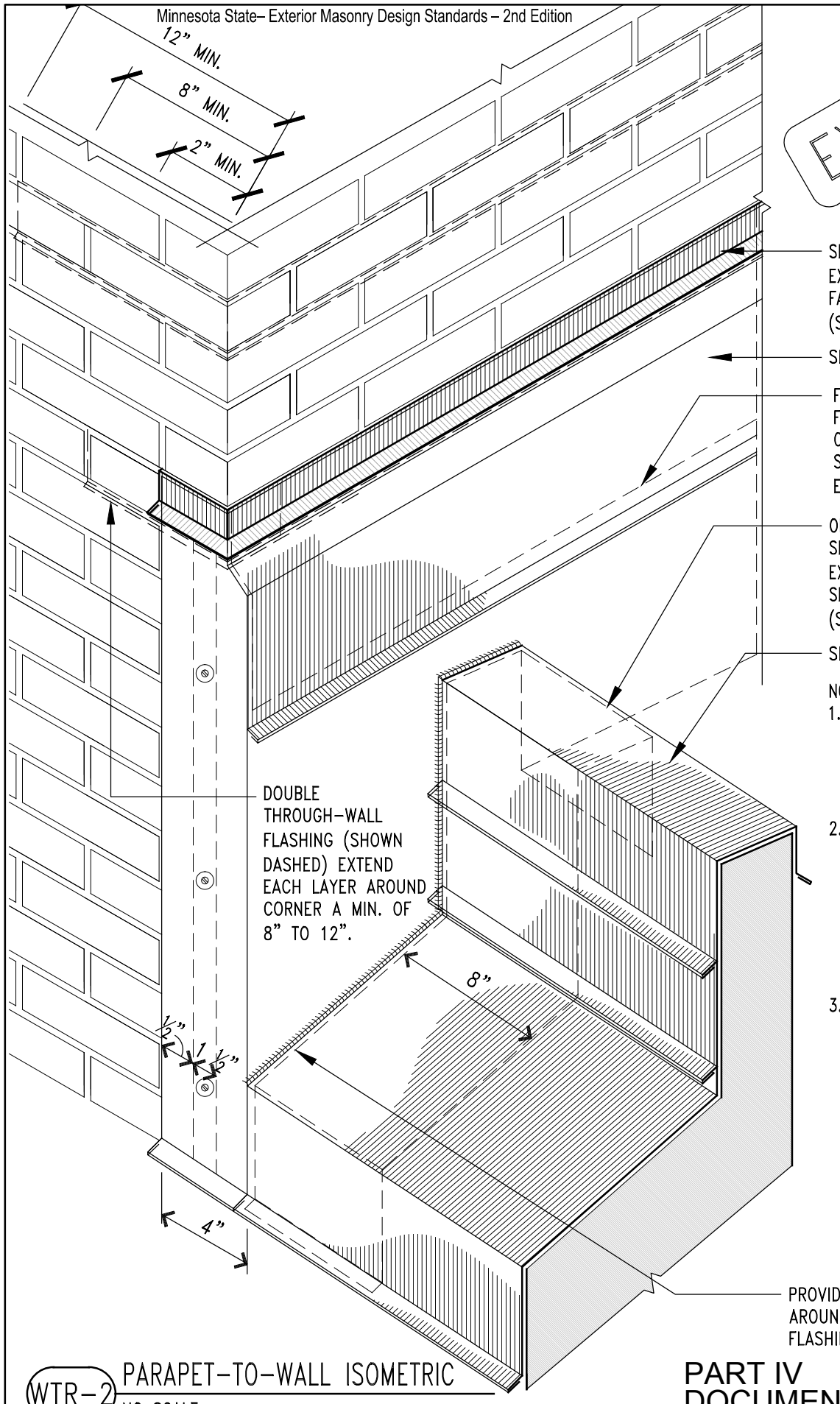
SHEET METAL CAP FLASHING

EXAMPLE

PART IV
DOCUMENT EXAMPLES

WTR–1B PARAPET JOINING TYPICAL CAVITY WALL CONDITION

SCALE: 3" = 1'–0"



NOTES:

1. THROUGH-WALL FLASHING TO CONTINUE THROUGH AND ABOVE PARAPET. NOT BY ROOFER (SEE ARCH. DWGS.)
2. AT WALL CORNER CONDITIONS CONTINUE THE FLASHING & DOUBLE THROUGH-WALL FLASHING AROUND THE CORNER THE SAME DIMENSIONS AS SHOWN TO THE LEFT OF THIS DETAIL.
3. TERMINATE REGLET & SHEET METAL FLASHINGS 4" BEYOND ROOF EDGE CONNECTION TO WALL & SEAL VERTICAL SHEET METAL EDGES WITH ELASTOMERIC SEALANT. FASTEN SHEET METAL THROUGH 1 ½" WIDE TWO SIDED BUTYL TAPE SET ½" FROM EDGE OF SHEET METAL

WTR-2 PARAPET-TO-WALL ISOMETRIC
NO SCALE

PART V

SPECIFICATIONS EXAMPLES

EXTERIOR MASONRY DESIGN STANDARDS

2rd Edition

The specifications and related information shown in the following examples are intended to illustrate the intent of the Minnesota State Exterior Design Standards. The information contained herein is not necessarily intended to be used for a particular project, but will need to be edited to work with a specific project based on the uniqueness of that project. The designer is responsible to ensure compatibility of all materials used on the project. The actual design and configuration of the masonry wall will vary based on design parameters, existing conditions, and other factors unique to each project. The designer is responsible for the final exterior masonry wall design conforming to the intent of these standards and any variance must be submitted by written request to the Minnesota State Facilities Design and Construction Department.

SAMPLE SECTION 04 01 00

SECTION 04 01 00
MAINTENANCE OF MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Replacement and rebuilding of unit masonry
2. Tuck pointing
3. Through-wall flashing
4. Lintel replacement
5. Expansion joints

B. Related Sections:

1. Section 07 27 26 – Fluid-Applied Membrane Air Barriers
2. Section 07 92 00 - Joint Sealants

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination

<Add first paragraph for historic restoration and identify how many samples to be collected>

1. Coordinate with the Owner to collect <XX> samples of the original mortar (not rebuilding or tuck pointing mortar) for testing according to ASTM C1324 prior to finalizing the mortar mix and starting the work.
2. Coordinate with the Owner and the Owner's Representative for the location of the mortar color samples.
3. Coordinate with the Owner's representative and the Owner's testing agency for the sampling during the work according to ASTM C780.
    a. Mortar aggregate ratio test <Used for mortar specified by Proportion>
    b. Compressive strength test <Used for mortar specified by Property>
4. All written submittals must be approved prior to the preconstruction and pre-installation meetings, and mock-up construction.
5. Prior to demolition cutting for through-wall flashing replacement, schedule a meeting with the roofing contractor, masonry contractor, and Owner's Representatives for the roofing and masonry observations to verify the new roof insulation thickness and counterflashing heights coordinate with the masonry demolition at the through-wall flashing replacement locations.

B. Pre-installation meeting

1. Schedule to occur the same day as the preconstruction meeting and a minimum of two weeks prior to the masonry work.
2. Attendance by the General Contractor, installing contractor, material supplier, Owner, Owner's testing laboratory, and the Owner's Representative is required.
3. The meeting agenda will include the masonry scope of work and testing. The proposed mortar mixing and sampling for the pre-installation meeting will be observed and documented.
4. Supply all materials necessary to collect three mortar aggregate ratio test samples for each mortar mix and to install the required mortar color samples.

5. Supply all other required color samples for selection during the preconstruction and pre-installation meetings.

1.03 SUBMITTALS

A. Submittals must be reviewed and approved prior to preconstruction testing and mock-up construction.

B. Product Data - Provide for the following specified products:

1. Flashings
2. Flashing lap sealant
3. Weeps
4. Termination bar
5. Termination bar fasteners
6. Concrete mortar patch and admixture
7. Masonry cleaner

C. Samples

<Edit paragraph for single color, three-color blend, or five-color blend>

1. Clay unit masonry: Sample board or strap of full-sized unit masonry, a minimum of three proposed choices <of 3- or 5-color blends> for spot replacement or high concentration at rebuilding areas containing a minimum of five units <nine or fifteen for blend>.
2. Stone: Three samples exhibiting extremes of the full range of color and other visual characteristics expected (grade and finish).
3. Aggregate: One sand aggregate sample proposed for site-mixed mortar prior to the start of construction. <OR One sand aggregate sample proposed from the preblended dry mortar mix manufacturer prior to the start of construction. >
4. Mortar: Install and clean a minimum of four samples for color match to existing mortar, a minimum of two weeks prior to the start of the work.

D. Mix design

1. Site-mixed mortar: Submit mix design to the Owner's Representative for approval.
2. Pre-blended mix:
   a. Submit the pre-blended dry mortar mix proposed batch weights and reduced mix proportions to the Owner's Representative prior to batching for review and written approval.
   b. Mix design shall be designed and signed by a professional engineer employed by a qualified independent laboratory.

<Add the next paragraph for a large project >

   c. <During construction using silo mixing production, submit records of batch weights and reduced mix proportions for each batch delivered to the project.>

E. Certifications - Submit manufacturer's certificate of compliance to specified material standards

1. Clay unit masonry
2. Concrete masonry units (CMU)
3. Mortar materials for site-mixed or pre-blended mix

<Add other materials individually in "Miscellaneous Materials", if necessary>

4. <Other miscellaneous materials>

F. Test Results:

1. Pre-construction testing results must be approved in writing by the responsible designer prior to masonry work occurring at the site.
2. Clay brick masonry: Submit manufacturer's test results for each type of clay brick masonry according to ASTM C67 test method for the following characteristics:
   a. Compressive strength, absorption, saturation coefficient, initial rate of absorption (IRA), and efflorescence.

<Add the next paragraph for large project using several pallets or cubes of brick>

3. Clay brick masonry:
   a. Prior to the preconstruction meeting, submit test results by the Owner's testing laboratory for one set of 10 of each type of clay brick masonry according to ASTM C67 test method for the characteristics of: Compressive strength, absorption, saturation coefficient, initial rate of absorption (IRA), and efflorescence.

<Add the next paragraph if approved/required by Minnesota State System Office for a specific large project>

   b. Freezing and thawing
4. Stone: Submit manufacturer's test results according to ASTM C97 test method for the following characteristics:
   a. Limestone: ASTM C568, Absorption, density, compressive strength, and modulus of rupture.
5. CMU: according to ASTM C140 test method for the characteristics of: Compressive strength, absorption, and density.
   a. Prior to the preconstruction meeting, submit manufacturer's test results for each type and size of CMU.

<Add the next paragraph for large project using several pallets of block. Include the "Field Quality Control" paragraphs>

   b. During construction, submit Owner's testing laboratory's test results as specified in "Field Quality Control".

<Add the next paragraph for historic restoration>

6. Original mortar: Submit test result of original mortar for material proportions according to ASTM C1324 test method. Modify specified mortar mix as directed by the Architect/Engineer to assure a suitable mortar for this Project.
7. Sand aggregate test results:
   a. Site-mixed mortar: Submit test results of sample collected as described above and during construction to meet by all requirements of ASTM C144 for mortar aggregate.
   b. Pre-blended mix: Submit manufacturer's test results for ASTM C144 test method and criteria for mortar aggregate to Owner's Representative for review. Test results cannot be older than 6 months and may need to be resubmitted depending upon the length of the construction schedule. <OR Submit test results of sample collected from the pre-blended dry mortar mix manufacturer to Owner's Representative for review.>

8. Mortar aggregate ratio test results:
    a. Submit the pre-installation mortar aggregate ratio test results and compressive strength test results<For Property mortar>according to the specified mortar type criteria in ASTM C270 for review by the Owner's Representative prior to the start of work.
    b. Owner's testing laboratory to submit all mortar aggregate ratio test and compressive strength test results<For Property mortar>reports directly to the Owner's Representative.

G. Contractor's Reports:
1. Proposed construction procedures for hot and cold weather
2. Heated enclosure safety check reports on a weekly basis to the Owner's Representative

1.04 QUALITY ASSURANCE

A. Work not specifically noted on the Drawings or in the specifications shall be in accordance with current recommendations of:
1. Masonry Standards Joint Committee (MSJC)
2. Brick Industry Association
3. National Concrete Masonry Association
4. Marble Institute of America
5. Indiana Limestone Institute of America, Inc.

B. Contractor shall have a minimum of five years successful experience in comparable masonry restoration projects with similar scope and type of unit masonry, and shall employ personnel skilled in the restoration process, handling of this specific unit masonry, and operations indicated.

C. Obtain materials from same source throughout.

D. A competent foreman shall be in charge of the Work at all times. The same foreman shall be in charge from start to completion of the Project.

E. A mixer-batching operator must be trained and experienced in the batching and mixing fundamentals of producing consistent mortar batches.

F. Proportions of mortar, site-mixed or pre-blended mix, will be tested during construction per the mortar aggregate ratio method in ASTM C780. If results do not meet ASTM C270 specified mortar type proportion, additional mortar aggregate ratio tests will be conducted at the contractor's expense after one of the following:
1. Site-mixed mortar: Improve material measurement and demonstrate to the Owner's Representative satisfaction prior to conducting additional tests and continuing the work.
2. Pre-blended dry mortar mix: Review results and site batching methods with the Owner's Representative and manufacturer. Follow recommendations as determined from the review.

G. To verify color match of the mortar samples or the work, Architect/Engineer may request test panels of restored masonry be cleaned 14 days after mortar placement.

H. Mockup*<For a small project, if needed. >*
1. Construct a 3' x 3' freestanding wall section to serve as a mockup panel for Architect/Engineer's approval of workmanship, including installation of units, unit color, color blending, mortar color, tooling of mortar joints, and installation of head joint vents (if applicable), mortar control device (if applicable), veneer anchors, flashing, flashing end dams, and continuous rope weeps.

2. When accepted, the mockup shall become the project standard for quality of work, methods of installation, and appearance. Leave mockup in place until masonry work is complete and has been accepted.
3. Complete all written submittals before scheduling mockup construction.
4. Notify Architect/Engineer one week in advance of time when mock-up construction will begin. Coordinate mockup location with Owner and Architect.

I. Mockup*<For a large project. Needs editing for project specifics.>*

1. Complete all written submittals before scheduling mock-up construction.
2. Construct a mockup of new masonry wall construction using CMU backup, vapor retarder, air barrier, stone base, one masonry expansion joint, head joint vents (if applicable), mortar control device (if applicable), veneer anchors, insulation, through wall flashing, weeps, approved face brick blend, and approved mortar color.
3. Size: Minimum 4' wide on one side of the corner by 2' wide and 3' high above stone base. Construct of a size to show layers of materials adequately for review and testing.
4. Preparation: Construct and cure concrete foundation ready to receive mockup.
5. Location: Approved by Owner prior to construction.
6. Purpose of mockup is to illustrate construction and workmanship including unit installation and color, face brick color blending, mortar color, mortar joint tooling, vapor retarder and air barrier installation and detail, stone base anchor and veneer anchor installation, through wall flashing with sheet metal and end dams, joint sealant and backer rod installation, head joint vents, mortar control device, and continuous rope weeps for approval by Architect/Engineer.
   a. Testing: Air barrier to be tested as specified in Section 07 27 26.
7. When accepted, the mockup shall become the project standard for quality of work, methods of installation, and appearance. Leave mockup in place until masonry work is complete and has been accepted.

J. During all aspects of the masonry work, the Contractor is responsible for selection, providing, proportioning, and performance of all mortar materials; and the Owner's testing laboratory is responsible for sampling and testing materials for compliance with Contract Documents.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Masonry units shall be delivered and handled, strapped or tied together on pallets or other suitable cartons, to prevent chipping and breakage. Units shall be covered from wetting by waterproof tarp.

<Add paragraph and two subparagraphs below for stone in lieu of above paragraph>

B. Masonry units shall be delivered and handled, on pallets or other suitable wood skids, to prevent deterioration and damage due to moisture, temperature changes, chipping, and breakage. Units shall be covered from wetting by a non-staining waterproof tarp or membrane.

1. Lift stone using wide-belt type slings. Do not use wire rope or ropes containing tar or other substances that may cause staining. Do not use pinch or wrecking bars on stone. Move stone using dollies with wood supports.
2. Store stone panels vertically on edge.

<Select paragraph 1 or 2>

C. Deliver pre-blended dry mortar mix for:

1. Restoration and repairs, in full, unopened bags weighing 80 pounds or greater.

2. New construction or additions, in full, unopened bags weighing 2,000 pounds or greater.

D. Protect masonry restoration materials during storage from wetting by rain or ground water.

E. Protect mortar components from deterioration by moisture and temperature. Store in dry location or in covered containers. Keep containers tightly closed. Follow material manufacturer's recommendations for storage. Protect mortar components from contamination by intermixture with earth or other materials. Cover sand aggregate stockpile.

F. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

1.06 PROJECT CONDITIONS

A. Hot and Cold Weather Requirements: According to MSJC Specification for Masonry Structures (TMS 602). Additionally, when ambient temperature:

1. Exceeds 90°F: Fog spray newly constructed masonry until damp, at least three times a day for 72 hours after completing masonry work.
2. At or above 40°F during the day and will drop below 40°F at night: Cover area of work to maintain a minimum of 40°F.
3. Below 40°F or will drop below 40°F within 48 hours: Do not lay masonry units, tuck point mortar joints, wash down or wet surfaces without a heated enclosure set-up and operational. The temperature of the enclosure shall be maintained above 40°F for a minimum of 48 hours after completing any of this Work.
4. Below 40°F: Maintain area of work, masonry materials, equipment, and mortar batching area in a heated enclosure prior to and during the Work. Do not heat water or components for mortar or grout to above 140°F.
5. Masonry must be cured a minimum of 14 days and warmed to 40F prior to cleaning. Maintain the heated enclosure after cleaning for 48 hours, including safety checks.

B. Heated enclosure

1. Monitor carbon monoxide levels. Immediately correct the environment when carbon monoxide is beyond a safe level for workers.
2. Periodically conduct safety checks of the enclosure and contents and continuous, safe operation of the heat source during overnight hours on work days and during daytime hours on non-work days, weekends, and holidays. Include two checks overnight and three checks during the daytime, at equally spaced intervals. Report the date, time, inside and outside temperatures, weather conditions, and status of the site for each safety check.

C. Do not proceed with through-wall flashing work during inclement weather, or when weather forecasts are unfavorable, unless manufacturer's requirements and instructions will be complied with, and unless the applicator is willing to guarantee the Work as required and without any additional reservations.

D. Protection:

1. Protect areas of removed and newly installed masonry from moisture penetration at the completion of each day's work. Secure coverings against wind.
2. Protect trees, shrubs, lawns, and other features remaining as a portion of final landscaping.
3. Protect surrounding surfaces from damage by covering, masking, sealing, or other means of protection. Immediately remove mortar that contacts surfaces, which are not to receive mortar.

4. Provide 3/4" plywood over 1" expanded polystyrene insulation and loose EPDM membrane for protection of the existing roof membrane a minimum of 12' from adjacent walls; on traffic paths; and under staging equipment.
5. Provide EPDM membrane over newly installed roof for directing the runoff from the masonry cleaning process. Direct the runoff to the roof drains or scuppers with a temporary downspout.
6. Immediately report any damage to the Owner and Architect/Engineer.

1.07 WARRANTY

<For repair or restoration projects only>

A. Provide a signed warranty covering all workmanship and materials specified herein for a period of two years from the date of final completion, as indicated in the General Conditions. Refer to the form at the end of this Section.

PART 2 - PRODUCTS

2.01 MASONRY UNITS

A. Face brick:
1. ASTM C216, Grade SW, Type FBS, <OR or FBX,> regarding dimensions and defects. Meets compressive strength, absorption, saturation coefficient, initial rate of absorption (IRA), efflorescence, and freeze-thaw under ASTM C67. Rated “not effloresced”.
2. Match existing unit masonry in size, color, <color blend,> and texture.
3. Approved by Owner

<For large projects only. Include the submittal requirement in Part I>

4. Units shall pass preconstruction testing for above requirements, prior to use.

B. Stone masonry: Domestic limestone matching the existing stone in size, color, and texture; and approved by Owner.

<For medium-sized Mankato limestone projects only. Include the submittal requirement in Part I. >

C. Limestone: ASTM C 568, Classification II Medium-Density, dolomitic limestone
1. Match existing surrounding stone for color, finish, and other stone characteristics relating to aesthetic effects. Samples as approved by Owner.
2. From one of the following quarries:
   a. Vetter Stone Company, 1-507-345-4568
   b. Other quarry or fabricator as approved as a substitution during the bid process.

D. CMU:
1. Concrete block: ASTM C90, load bearing, modular size. Meets compressive strength, absorption, and density under ASTM C140.

<For large projects only. Include the submittal requirement in Part I>

   a. Units shall pass preconstruction testing for above requirements, prior to use.
2. Concrete brick: Building, non-facing, utilitarian, ASTM C55, modular size.

2.02 MORTAR AND GROUT MATERIALS

A. Verify mortar materials with the independent testing agency.
1. Portland cement: ASTM C150, Type I

2. Hydrated lime: ASTM C207, Type S
3. Aggregate for mortar: ASTM C144, fine mortar sand from Camas Company of Minneapolis, Lakeland pit, unless indicated otherwise
4. Water: Potable water, clean, free of oils, acids, alkalis, salts, organic matter, or other substances in amounts that may be harmful to mortar, grout, or embedded materials.
5. Match size, texture, and gradation of existing mortar
6. Colored mortar pigment: Inorganic material or synthetic iron oxides. Owner shall approve color match of mortar.
    a. DCS Mortar Color manufactured by Dynamic Color Solutions, Inc., Milwaukee, Wisconsin; phone 800-657-0737, website www.dynamiccolorsolutions.com .
    b. Mortar Color, Solomon Colors, Inc., Springfield, Illinois; 800-624-0261, website www.solomoncolors.com
    c. True Tone Davis Colors distributed by Concrete Materials, Sioux Falls, South Dakota, 605-357-6065, website www.daviscolors.com
    d. Bayferrox distributed by Empire Blended Distributors, Inc., Bayville, New Jersey, 732-269-4949, website www.bayferrox.us .

B. Mortar proportions:
1. Mortar for tuck pointing and rebuilding brick shall be ASTM C270, Type N. Exact proportions will be as determined from the mortar aggregate test results of the mortar pre-installation meeting. The average mortar aggregate ratio of the three samples taken during the pre-installation meeting must meet Type N proportions.
2. If colored mortar pigments are necessary to match existing, do not exceed pigment to cement ratio of 1:10 by weight.

C. Pre-blended dry mortar mix: Pre-batched, pre-bagged mortar with cementitious materials and aggregates as described above, SpecMix manufactured by TCC Materials, 651-688-9116.

D. Grout: ASTM C476 with aggregate that meets ASTM C404

2.03 JOINT REINFORCEMENT

A. Stainless steel Type 304, 9 gauge wire
1. Multi wythe: Ladder type with adjustable ties 16” o.c.
    a. 270-2X Ladder Eye-Wire with pintles manufactured by Hohmann & Barnard, Inc. Hauppauge, New York, 800-645-0616, www.dur-o-walh-b.com
    b. Series 800 Level Eye Ladder (Hook & Eye) with pintles manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com
2. Single wythe: Ladder type
    a. 220 Ladder Mesh Reinforcement manufactured by Hohmann& Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com
    b. Series 200 Ladder 2 Wire Mesh Reinforcement manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

2.04 VENEER ANCHORS

A. Clay brick veneer
1. To existing masonry with cavity: Stainless steel Type 304, adjustable brick replacement anchors with brass expansion sleeve anchors

a. HB-213-2X manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com

b. 2401 RJ-711 Adjustable Veneer Anchor with 2402 pintle manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

2. To existing masonry without cavity: Stainless steel, base and vee tie with brass expansion sleeve anchors:

a. DW-10HS with VBT - Vee Byna-Tie manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com

b. 1004 Type III Screw-on Veneer Anchor with 1100 series triangular tie, manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

3. To existing steel channel:

a. Wire anchor for welding to steel: 1/4" diameter wire, stainless steel Type 304

(1) 359 Weld-on Tie and VBT - Vee Byna-Tie manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com

(2) 1000 Type I Weld-on Anchor with 1100 series triangular tie, manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

b. Plate:

(1) 359-FH Weld-on Tie with VBT - Vee Byna-Tie manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com

(2) 1001 Type II Screw-on Anchor with 1100 series triangular tie, manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

4. For connecting replacement masonry to new masonry back-up (small area): 3/16" diameter, stainless steel; 362 Gripstay™ Channel with 363 - Flexible Gripstay™ Anchor manufactured by Hohmann & Barnard, Inc,; Hauppauge, New York, 800-645-0616, www.dur-o-walh-b.com

2.05 EMBEDDED FLASHING MATERIALS

A. Flashing: Full sheet of stainless steel, Type 304, 2 mil, laminated with polymer or fiberglass fabric on one side

1. Multi-Flash SS with premanufactured corners and end dams, manufactured by York Manufacturing, Inc., Sanford, Maine, 800-551-2828, www.yorkmfg.com

2. R-Guard SS Thru-wall with premanufactured corners and end dams, manufactured by PROSOCO, Inc.; manufacturer's representative is Tri-G Products, Inc., Anoka, MN, phone 763-413-1778, www.prosoco.com

3. Wall Guardian Stainless Steel TWF, manufactured by STS Coatings, Inc.; Comfort, TX, phone 830-995-5177, www.stscoatings.com

B. Flashing: Full sheet of copper weighing 5 oz./sq. ft., laminated with non-asphaltic polymer or fiberglass fabric on both sides

1. Multi-Flash 500 with premanufactured corners and end dams, manufactured by York Manufacturing, Inc.; Sanford, Maine, 800-551-2828, www.yorkmfg.com

2. Copper Sealtite 2000, manufactured by Advanced Building Products, Inc.; Springvale, Maine, 800-252-2306, www.advancedflashing.com

C. Flashing lap sealant: As recommended by flashing membrane manufacturer.

1. UniverSeal US-100, polyether sealant manufactured by York Manufacturing, Inc., Sanford, Maine, 800-551-2828, www.yorkmfg.com

2. MasterSeal NP 150, polyether sealant, for use with York flashing, manufactured by BASF Construction Chemicals, Shakopee, Minnesota, 800-433-9517, www.master-builders-solutions.basf.us
3. Sealtite Sealant, acrylic urethane sealant, manufactured by Advanced Building Products, Inc.; Springvale, Maine, 800-252-2306, www.advancedflashing.com
4. R-Guard FastFlash, silyl-terminated-polymer sealant, manufactured by PROSOCO, Inc.; manufacturer's representative is Tri-G Products, Inc., Anoka, MN, phone 763-413-1778, www.prosoco.com
5. GreatSeal LT-100 Liquid Tape, polyether sealant, manufactured by STS Coatings, Inc.; Comfort, TX, phone 830-995-5177, www.stscoatings.com

D. Flashing splice material: As recommended by flashing membrane manufacturer:
1. York 304 self-adhering stainless steel, 6 in. width, manufactured by York Manufacturing, Inc., Sanford, Maine, 800-551-2828, www.yorkmfg.com

<Use next two paragraphs only for tie-into with direct contact to existing asphalt coated through-wall flashing>

E. Flashing: Full sheet of copper weighing 3 oz./sq. ft. coated with asphalt on both sides.

F. Flashing mastic: Asbestos-free asphaltic mastic, compatible with asphalt-coated flashing, manufactured or as recommended by flashing membrane manufacturer.

G. Termination bar: (1/16") or 16 gauge by 1" stainless steel with pre-drilled holes 6" on-center, holes shall be no more than 2" from ends of termination bar.

H. Termination bars fasteners: Drive nail anchor, stainless steel nail with an alloy body, 1/4" diameter by min. 1-1/2" long.
1. Zamac Nailin, manufactured by Powers Fasteners, Brewster, New York, phone 800-524-3244, www.powers.com
2. Nail-in Anchor, manufactured by Fastenal, Winona, Minnesota, phone 877-507-7775, www.fastenal.com

I. Sheet metal drip edge: ASTM A167, Type 304, 0.018 inch thick (26 gauge) stainless steel, soft temper, mill finish, extend a minimum of 3/8" beyond face of exterior wall with a hemmed edge.
1. Drip Edge Flashing, FS1012, manufactured by MASONPRO, Inc.; Northville, Michigan, phone 800-659-4731, www.masonpro.com

J. Stainless steel drip tray flashing: ASTM A240, Type 304, 0.048 inch thick (18 gauge), bend radius = .048", prefabricated with welded corners.
1. Maximum 3/8” high upturned leg for continuous back dam, 2-1/2” high downturned leg to function as a continuous termination bar for the sub-sill flashing, and preformed end dams at each corner.
2. Contractor to verify depth of drip tray flashing and coordinate with the curtain wall sill framing.
3. Downturned leg: holes for fasteners at 12” o.c., a maximum of 2” o.c. from the ends and 1/2” o.c. from the bottom edge, and flanges on each end terminate at the sub-sill flashing end dam location.

K. Weeps: 3/8" diameter 100% cotton fiber rope, including core, lengths as indicated.

2.06 MISCELLANEOUS MATERIALS

A. Mortar control device: High density polyethylene or nylon, 90% open woven mesh, dovetail notched shape, verify thickness for cavity size.
   1. Mortar Net manufactured by Mortar Net USA Ltd., Burns Harbor, Indiana, 800-664-6638, www.MortarNet.com
   2. Mortar Trap, manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com
   3. Cavity Net DT (#3611), manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

B. Vents: Polyester fiber mesh vent
   1. Mortar Trap Weep Vents, manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com
   2. Mortar Break Weep Vents, manufactured by Advanced Building Products, Inc.; Springvale, Maine, 800-252-2306, www.advancedflashing.com

C. Epoxy grout:Two component, moisture tolerant, 100% solids, high modulus epoxy gel adhesive, Sure Anchor I J-51, Dayton Superior, Miamisburg, Ohio, phone: 888-977-9600, www.daytonsuperior.com

D. Existing steel lintel primer for refurbishment: Two-component, moisture-cured, zinc-rich primer Tneme-Zinc Series 90-97, manufactured by Tnemec Company, Inc., available from Coating Resources, Inc., Minneapolis, Minnesota, phone 952-746-1909, www,tnemec.com

E. Existing steel lintel coating for refurbishment: Chemical-resistant urethane coating, Series 290 CRU, 2-3 dry mils top coat, manufactured by Tnemec Company, Inc., available from Coating Resources, Inc., Minneapolis, Minnesota, phone 952-746-1909, www.tnemec.com

F. Extruded polystyrene: ASTM C578, Type IV, minimum 1.6 pcf density
   1. Diversifoam Certifoam
   2. Dow Styrofoam
   3. Owens Corning Foamular

G. Insulation: Expanded polystyrene, nominal 1.5 pcf, minimum 1.3 pcf density, ASTM C578, Type II, thickness as indicated

H. Insulation: Expanded polystyrene, pourable bead insulation for replacement of existing vermiculite insulation.

I. Color-coated steel: Kynar 500 fluoropolymer coating factory applied to 24-gauge galvanized steel, ASTM A653. Owner shall select color. Acceptable materials are ColorKlad by Integris Metals, Pac-Clad by Petersen Aluminum Corporation, Una-Clad by Copper Sales, Inc., and Ultra-Clad by Coated Metals Group.

J. Concrete mortar patch: fast-setting, non-sag cement-based repair mortar material MasterEmaco N 424, manufactured by BASF Construction Chemicals, Shakopee, Minnesota, 800-433-9517, www.master-builders-solutions.basf.us, or approved equal

K. Concrete mortar patch admixture: Acrylic polymer admixture, MasterEmaco A 660 manufactured by BASF Construction Chemicals, Shakopee, Minnesota, 800-433-9517, www.master-builders-solutions.basf.us, for use with MasterEmaco N 424

L. Steel reinforcement primer: one-component, zinc-rich, epoxy primer, MasterProtect P 8100AP manufactured by BASF Construction Chemicals, Shakopee, Minnesota, 800-433-9517, www.master-builders-solutions.basf.us, for use with MasterEmaco N 424

M. Seal-offs only: (These materials are not acceptable for finished wall construction)

1. Plastic flashing: 20-mil thickness; Nervastral by Rubber and Plastics Compound Company, Inc., or B.F. Goodrich Company
2. Lumber: 1" x 3" standard light framing grade
3. Fasteners: Tapcon specially threaded anchors, 1/4" minimum diameter, length to penetrate masonry minimum 1"

2.07 CLEANING MATERIALS AND EQUIPMENT

A. Cleaners: Use sparingly and only where required for newly tuck pointed and restored masonry surfaces. Minimum 14 day setting time required for new mortar prior to use. Protect roof membrane as necessary in the area of cleaning to prevent cleaner from contacting the roof membrane. Use one of the following as recommended by the clay brick manufacturer:

1. Manufacturer: PROSOCO, Inc., manufacturer's representative is Tri-G Products, Inc., Anoka, MN, phone 763-413-1778, www.prosoco.com.
   a. Sure Klean No. 600
   b. VanaTrol
2. Manufacturer: Diedrich Technologies, division of Hohmann & Barnard, Inc.; Schenectady, NY, phone 800-283-3888, www.diedrichtechnologies.com.
   a. 202 New Masonry Detergent
   b. 202V Vana-Stop
   c. 200 Lime-Solv

<For Mankato limestone only>

3. Limestone masonry: VanaTrol
   a. Test for affect on color of existing salvaged and new replacement stone prior to full-scale use.

B. Water: Potable, clean, free of oils, acids, alkalis, salts, organic matter, or other substances in amounts that may be harmful to mortar, grout, or embedded materials.

C. Brushes: Fiber bristles only.

D. Spray equipment: Provide necessary equipment for the controlled spraying of water at the required pressure.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that surfaces to be cleaned and restored are ready for Work of this Section.

B. Beginning of installation means acceptance of existing surfaces and conditions.

C. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.02 WETTING BRICK

A. IRA greater than 1 gram/sq. in./min.: Wet brick with clean water 24 hours prior to placement until units are nearly saturated. Permit units to surface dry before laying.

B. During cold weather, sprinkle units with warm or hot water and protect from freezing as specified in “Project Conditions”.

3.03 MORTAR MEASUREMENT AND MIXING

A. Site-mixed mortar:
   1. Method of measurement shall be by dry volume or equivalent weight.
   2. Measurement by shovel shall not be permitted.

B. Pre-blended dry mortar <or grout> mix:
   1. Follow manufacturer’s written instructions for batching and mixing.
   2. No on-site mixing of mortar <or grout> materials other than adding water to pre-blended dry mixture is allowed. Mix in quantities as large as economically possible. Use same measuring method and personnel throughout the Project.

C. Mixing:
   1. Mix in a clean mechanical batch mixer.
   2. Thoroughly mix cementitious and aggregate materials together before adding any water.
   3. Mix materials again from 3 to 7 minutes using only enough water to produce a damp, workable mix that retains its form when pressed into a ball.
   4. Only tuck pointing and rebuilding mortar must stay in this condition for one to 1-1/2 hours prior to adding remaining water.
   5. Add the remaining water in small portions and mix to obtain the desired consistency.
   6. Add colored mortar pigment to mortar only if required to match existing.
   7. Admixtures shall not be used in the mortar, unless otherwise indicated.
   8. Ordinary mortar may be re-tempered as needed in the first 2-1/2 hours after mixing. Do not re-temper colored mortars.

< For large projects of rebuilding.From TMS Annotated Guide to Masonry Specifications >

3.04 CONSTRUCTION TOLERANCES

A. Dimension of elements
   1. Variation in cross-section or elevation: -1/4", +1/2"
   2. Variation of mortar joint thickness
      a. Bed joint: ± 1/8", maximum joint thickness 1/2"
      b. Head joint: -1/4", +3/8"
   3. Variation of cavity width: -1/4", +3/8"

B. Elements
   1. Variation from level
      a. Bed joints: ±1/4" in 10 feet, ±1/2" maximum
      b. Top surfaces of bearing walls: ±1/4" in 10 feet, ±1/2" maximum
   2. Variation from plumb: ±1/4" in 10 feet, ±3/8" in 20 feet, ±1/2" maximum
   3. True to a line (straightness of the wall in plan): ±1/4" in 10 feet, ±3/8" in 20 feet, ±1/2" maximum
   4. Alignment of columns and walls (bottom versus top):± 1/2" for bearing walls, ± 3/4" for non-bearing walls

C. Location of elements
   1. Indicated on plan: ± 1/2" in 20 feet, ± 3/4" maximum
   2. Indicated on elevations: ± 1/4" in story height, ± 3/4" maximum

D. Reinforcement placement
   1. Specified distance from centerline of steel to the opposite face of masonry
      a. ≤ 8": ± 1/2"
      b. > 8", but < 24": ±1"
      c. > 24": ±1-1/4"
   2. Vertical bars placement along the length of the wall: ± 2"
   3. Consult with the Architect/Engineer and Structural Engineer for a bar that must be moved more than one bar diameter or a distance that exceeds the permitted tolerance to avoid interference with other reinforcement, conduits, or other embedded items.

E. At exterior elevations with curtainwall openings
   1. Maximum variation from unit to adjacent unit: 1/16”
   2. Maximum variation from plane of wall: 1/8” in 10 feet, 1/4" in 40 feet; non-cumulative
   3. Maximum variation from plumb: 1/8” in 10 feet, 1/4" in 40 feet; non-cumulative
   4. Maximum variation from level coursing: 1/8” in 10 feet, 1/4" in 40 feet; non-cumulative
   5. Maximum variation of joint thickness: 1/8” in 3 feet
   6. Maximum variation from cross sectional thickness of walls: 1/4"

<For smaller repair or restoration projects. >

3.05 CONSTRUCTION TOLERANCES

A. Mortar joint thickness
   1. Bed joints: ±1/8 in.
   2. Head joints: -1/4 in., +3/8 in.

B. Variation from level: Bed joints ±1/4 in. in 10 feet, ±1/2 in. maximum

C. Variation from plumb: ±1/4 in. in 10 feet

D. Across face of adjacent unit: ±1/16 in.

3.06 REMOVAL AND REBUILDING

A. Removal:
   1. Carefully remove by hand at required locations units that are cracked, broken, damaged, spalled, or deteriorated.
   2. Cut out full units from joint to joint in manner to permit replacement with full size units.
   3. Support and protect remaining masonry that surrounds removal area.

<Salvaging is VERY RARELY allowed. Only in special circumstances. Typically delete salvage references in next two paragraphs.>

   4. Salvage as many whole, undamaged units as possible.
   5. Remove mortar, loose particles and soil from remaining units at edges of removal areas <, and from salvaged units> by cleaning with brushes and water.<Store salvaged units for reuse.>

B. Rebuilding:

1. Fit replacement units into bonding and coursing pattern of existing units, uniformly blending multiple brick colors to match existing color blend.
2. If cutting is required, use motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
3. Install brick ties to existing backer at a maximum of 16" on-center, as indicated.
4. Do not install replacement units that are cracked, broken, or chipped in excess of ASTM C216 allowances for facing brick.
5. Lay replacement units with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place.
6. Do not permit mortar droppings to fall into cavity. Keep cavity clear of mortar droppings by back beveling the mortar bed or other approved method that demonstrates the ability to prevent excess from extruding into cavity.
7. Maintain joint width to match existing.
8. Tool mortar joints in repaired areas to match concave joint profile of surrounding work.
9. At completion of masonry work, remove defective joints, holes, and cracks in new mortar joints to a depth of 3/4" and repoint.

3.07 TUCK POINTING EXISTING MORTAR

A. Solid tuck pointing includes all mortar joints for removal and repointing in a specified area.

B. Spot tuck pointing includes removal and repointing of only cracked or deteriorated mortar joints as determined by the Architect/Engineer, in specifically designated areas for a specified amount (i.e.; linear feet, square feet, or percentage of elevation).

C. Raking Mortar Joints:

1. Vacuum dust collection methods are required.
2. Rake out mortar from joints, as shown on the Drawings, to a minimum depth of 3/4", but not less than that required to expose sound, un-weathered mortar.
3. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar.
4. Brush, vacuum, or flush joints with water to remove dirt and loose debris.
5. Do not spall edges of masonry units or widen joints. Replace units that become damaged (not to be included in brick replacement allowance).
6. If power driven tools damage existing brick in any way, cut out old mortar by hand with chisel and mallet.
7. Power operated rotary handsaws and grinders will be permitted based on a satisfactory quality control program and demonstrated ability of operators to use tools without damage to masonry. Quality control program shall include provisions for supervising performance and preventing damage due to fatigue.

D. Tuck Pointing Mortar Joints:

1. Rinse masonry joint surfaces with water to remove dust and mortar particles. Time application of rinsing so that, at time of pointing, excess water has evaporated or run off, and joint surfaces are damp but free of standing water.
2. Apply first layer of pointing mortar to areas where existing mortar was removed to depths greater than 3/4". Apply pointing mortar in layers not greater than 1/4" to 3/8" until a 3/4" uniform depth is formed. Compact each layer thoroughly and allow to become thumbprint-hard before applying next layer.

3. After joints have been filled to a uniform depth, place remaining pointing mortar in 1/4" to 3/8" layers. Fully compact each layer and allow to become thumbprint-hard before applying next layer.
4. Recess final layer slightly from face where existing bricks have rounded edges. Take care not to spread mortar over edges onto exposed masonry surfaces, or to featheredge mortar.
5. Tool joints to concave joint unless otherwise indicated, when mortar is thumbprint hard.
6. Brush excess mortar from edges of joint.
7. Cure mortar by maintaining a damp condition for not less than 72 hours.
8. At completion of masonry work, remove defective joints, holes, and cracks in new mortar joints to a depth of 3/4" and repoint.

3.08 THROUGH-WALL FLASHING

A. Remove dust, dirt, debris, grease, oils, and other contaminants from surface to receive new materials.

B. Existing construction
   1. Remove brick courses as indicated. Provide shoring of the remaining masonry as necessary.
   2. Remove excess mortar and patch holes, voids, or spalls on the concrete block back-up wall to provide a smooth and dry substrate to receive the through-wall flashing.
   3. Carefully fit flashing around projections and columns in the cavity.
   4. Existing construction without weather barrier: Coat backer wall with flashing lap sealant for the entire vertical leg of the flashing from 2" below the brick tie plate to slightly beyond the top edge of the flashing.

C. Form flashing membrane to profile shown in the Drawings, without wrinkles or buckles. Protect from punctures and tears.

D. Single layer: Located at shelf angles, above doors and louvers, above and below windows, wall-to-foundation waterproofing tie-in, and other specified locations.
   1. Extend flashing membrane 12" minimum up vertical wall. Install top edge of flashing set in flashing lap sealant.
   2. Install preformed corners or fold inside and outside through-wall flashing corners. Limit cutting or trimming through-wall flashing membrane. Install additional membrane at outside corner, lapping 6” over adjacent pieces. Install a reinforcement piece at the corner between the horizontal and vertical legs. Seal in-between the lap of the additional membrane and reinforcement piece to the through-wall flashing membrane.
   3. Install termination bar over top edge of flashing membrane. Mechanically fasten 6" on-center. Coat the termination bar and fasteners with flashing lap sealant.
   4. Install flashing membrane 1/2" from brick face. Seal the bottom horizontal termination to the sheet metal drip edge with two beads of flashing lap sealant. Seal the sheet metal drip edge to the lintel or brick below with a bead of flashing lap sealant.
   5. Extend the sheet metal drip edge out 3/8” from the face of the wall as shown. Lap sheet metal drip edge 4” and seal lap.
   6. Install flashing membrane in one piece, wherever possible, to eliminate laps. Where laps must occur, provide minimum 6" laps to adjacent flashing pieces. Seal in-between flashing laps and over the cut edge with flashing lap sealant.

7. Install preformed end dams or turn flashing up 2" minimum or one brick course height at terminations to provide folded end dams. Seal end dams with flashing lap sealant. Install flashing lap sealant at adjacent substrate and embed end dam.
8. Install brick ties at 16" on-center horizontally, maximum 8” from terminations or corners, and cover plates with flashing lap sealant as indicated.
9. Install and extend rope weeps at end dam corners with tab extension of flashing membrane and through head joints at a maximum of 16” on-center. Lay approximately 16" horizontally along cavity, interlacing with adjacent rope weep, and extend up to and tie to brick ties. See detail isometric on Drawings.
10. Install vents, mortar control device, and insulation.
11. Reinstall brick over flashing.

E. Double layer: Located above roof systems including roof edges, parapets, and steep roofs.

1. Fully embed top edge of first (or lower) layer of flashing membrane in flashing lap sealant, with lower edge extending over roof base flashing as shown on the Drawings.
2. Install in longest lengths possible. Provide minimum 6" laps to adjacent flashing pieces. Seal in-between flashing laps and over the cut edge with flashing lap sealant.
3. Install preformed corners or fold inside and outside through-wall flashing corners. Limit cutting or trimming through-wall flashing membrane. Install additional membrane at outside corner, lapping 6” over adjacent pieces. Install a reinforcement piece at the corner between the horizontal and vertical legs. Seal in-between the lap of the additional membrane and reinforcement piece to the through-wall flashing membrane.
4. Fasten the termination bar at 6" on-center. Coat termination bar and fasteners with flashing lap sealant.
5. Install preformed end dams or turn flashing up 2" minimum or one brick course height at terminations to provide folded end dams. Seal end dams with flashing lap sealant. Install flashing lap sealant at adjacent substrate and embed end dam.
6. Install brick ties at 16" on-center horizontally, maximum 8” from terminations and corners, and cover plates with flashing lap sealant as indicated.
7. Install and extend rope weeps at end dam corners and through head joints at a maximum of 16” on-center. Lay approximately 16" horizontally along cavity, interlacing with adjacent rope weep, and extend up to and tie to veneer anchors. See detail isometric on Drawings.
8. Install replacement insulation and lay one brick course.
9. Install sheet metal insert at bed joint indicated on the Drawings, lapping 4" minimum and spot adhere laps with flashing lap sealant.
10. Lay next brick course, install veneer anchor wires and replacement insulation, lay the third brick course and core fill. Allow to cure overnight before proceeding with the second layer.
11. Fully embed top edge of second (or upper) layer of flashing membrane in flashing lap sealant.
12. Install flashing membrane 1/2" from brick face. Seal the bottom horizontal termination to the sheet metal drip edge with two beads of flashing lap sealant. Seal the sheet metal drip edge to the brick below with a bead of flashing lap sealant.
13. Extend the sheet metal drip edge out 3/8” from the face of the wall as shown. Lap sheet metal drip edge 4” and seal lap.
14. Provide minimum 6" laps to adjacent flashing pieces. Seal in-between flashing laps and over the cut edge with flashing lap sealant.
15. Install preformed corners or fold and reinforce inside and outside corners as described above.

16. Fasten and coat the termination bar at as described above.
17. Provide preformed or folded end dams as described above.
18. Install veneer anchors, rope weeps, vents, cavity drainage material, and insulation as described above.
19. Install brick over second layer of flashing membrane.
20. Provide temporary 45-mil EPDM flashing extending up from existing flashing to one brick course below new sheet metal reglet. Bond to wall and to existing EPDM flashing.
21. Install new sheet metal counterflashing over temporary EPDM flashing, as detailed. Lap intersecting counterflashings, except fascia counterflashings, minimum 3", and securely fasten with pop rivets or screws and seal with sealant.

F. Trim rope weeps to 1/2" past the exterior face.

3.09 LINTEL REPLACEMENT

A. Remove brick courses above lintels as detailed and approximately 150 mm (6 in.) beyond ends of existing lintels. Shore remaining masonry above opening. Remove lintel.

B. Install new steel lintel 8" minimum past opening.

C. Install sheet metal drip edge on lintel with a 1" bead of flashing lap sealant between the sheet metal drip edge and lintel, just behind the lintel leading edge.

D. Install flashing membrane over the sheet metal drip edge and press into backer with flashing lap sealant down to 2” below the brick tie location. Install two 1" bands of flashing lap sealant between the flashing membrane and sheet metal drip edge.

E. Fasten termination bar maximum 6” o.c. and 2” o.c. from end of the termination bar at the top of the vertical termination of the flashing membrane. Coat termination bar with flashing lap sealant.

F. Install brick ties maximum 16 o.c. and maximum 8” from ends. Cover back plate with flashing lap sealant.

G. Extend flashing membrane 4" minimum past end of lintel and turn flashing up one brick course 2" minimum to provide folded end dams or install preformed end dams.

H. Lap flashing membrane minimum 6” and seal with flashing lap sealant in-between laps and over the cut edge.

I. Lap sheet metal drip edge minimum 4” and seal with flashing lap sealant in-between laps.

J. Install and extend rope weeps at end dam corners with tab extension of flashing membrane and through head joints, maximum 16” on-center and lay horizontally along cavity, interlacing with adjacent rope weep, and extend up to and tie to brick ties.

K. Install replacement insulation and brick above lintel and flashing membrane, toothing into existing masonry.

3.10 EXPANSION JOINTS

A. Cut expansion joints using a saw designed to cut masonry with clean, sharp, unchipped edges. The equipment must have a vacuum dust collection system.

B. Verify exact locations at the site with Owner’s Representative as indicated on the Drawings,

C. Provide a sample cut at a location agreed upon by the Owner prior to cutting the new expansion joints. Upon approval by Owner, complete cutting of new joints.

D. Cut expansion joints 1/2" wide only through the exterior wythe of masonry, ±1/4" in 10' maximum variation from plumb, and ±1/8" thickness.

E. Install compressible filler, backer rod, and sealant as shown on the Drawings.

3.11 CLEANING

A. Clean windows on exterior elevations shown on the Drawings and adjacent elevations to remove construction soil prior to masonry cleaning.

B. Clean minimum 4' by 4' test panel of each type of masonry material prior to beginning full scale cleaning operation to determine effectiveness of cleaning compound and manufacturer's cleaning procedures. Test panels shall be available for inspection and approval by the Architect/Engineer.

C. Clean restored masonry in an orderly manner, making sure that all surfaces are clean and a uniform appearance is obtained.

D. Clean only after mortar has cured to its full strength, not less than 14 days. If a new roof is installed, protect the roof from the area of work to the drains with EPDM during the cleaning and rinsing process.

E. Remove mortar particles with water, nonmetallic scrapers, and fiber bristle brushes. Sandblasting, wet aggregate blasting, or use of other abrasive materials will not be allowed.

F. Provide an adequate water supply during the cleaning process to assure a thorough presoaking and rinsing of the surfaces.

G. Protect adjacent non-masonry surfaces, including trees, shrubs, plantings, lawn, glass, and metal and painted surfaces, from exposure to cleaning compounds. Use polyethylene sheet to cover and seal window glass and frames.

H. Beware of wind drift onto auto and pedestrian traffic.

I. Use cleaning compounds in strict accordance with manufacturer's printed instructions.

J. Remove mortar from surfaces not specified to receive mortar; such as walls, windows, curbs, sidewalks, etc.

3.12 FIELD QUALITY CONTROL

A. All materials, which are subject to definite specification requirements, may be sampled, tested, and inspected at any time prior to, or during installation of the Work.

B. Construction observation

1. The Owner’s Consultant will conduct full-time observation of the through-wall flashing installation. <and periodic observation of the tuck pointing, including observation of mortar sampling.>
2. The construction observation will be paid for by the Owner, however, any additional construction observation required for the re-testing and the work will be performed by the Owner’s Representative and all additional construction observation costs shall be deducted from the Contract sum by Change Order.

C. Testing during construction:

1. The <clay brick, CMU, and> mortar aggregate ratio testing <and mortar compression testing>will be paid for by the Owner. However, when initial tests find non-compliance with Contract Documents, all re-testing will be performed by the Owner’s testing laboratory and paid for by the Contractor by deducting from the Contract Sum by Change Order.

<Add the next clay brick paragraphs for large project using several pallets or cubes of brick>

2. Clay brick masonry
   a. Submit test results by the Owner's testing laboratory for one set of 10 of each type of clay brick masonry used for every 100,000 units delivered or each manufacturer's run; whichever is less. Test according to ASTM C67 test method for absorption and saturation coefficient.
   b. Owner's representative shall conduct IRA field test daily when ambient temperature exceeds 90°F or weekly during other weather conditions.

<Add the next CMU paragraphs for large project using several pallets of block>

3. CMU
   a. During the first week of masonry construction, submit test results by the Owner's testing laboratory for one set of 6 of each type of CMU according to ASTM C67 test method for the characteristics of: Compressive strength, absorption, and density.
   b. After the first week of masonry construction, submit test results by the Owner's testing laboratory for the same test and characteristics listed above for 6 units from each lot of 10,000 units; 12 units from each lot between 10,000 and 100,000 units; and 6 units for each 50,000 units from lots larger than 100,000 units.
4. Mortar
   a. After the mortar pre-installation, the first observation and construction test sampling shall be conducted on the first 2 days of mortar production.
      (1) Each mortar ratio aggregate test sampling will contain a set of three samples.
      (2) Each compressive strength test sampling will contain a set of nine cylinders.
   b. Sample and test one set of mortar aggregate ratio samples<and compressive strength samples>each calendar week during mortar production for a total of <XX> sets during project construction. <Sample and test a total of two sets of mortar aggregate ratio samples during project construction. *For shorter duration projects.*>
   c. Mortar compression test procedure: Break three cylinders at 7 days and three cylinders at 28 days. Hold any remaining cylinders until the project is closed out.

<Add the next paragraph if approved/required by Minnesota State for a specific large project>

   d. Sample and test one set of mortar aggregate ratio samples each day of mortar production for a total of <XX> sets during project construction
   e. The Owner's testing laboratory to submit the results for each mortar aggregate ratio set the following day.
   f. A minimum of four sand aggregate gradations for site-mixed mortar shall also be conducted.
   g. The Owner's testing laboratory shall review the mortar mix proportions used, the surface preparations, and material application methods on a "spot-check" basis during the time when mortar aggregate ratio samples are secured.
   h. The Owner reserves the right to reject the mortar if the mortar aggregate ratio<or mortar compressive strength test> does not meet the specified mortar type proportions. Contractor shall remove and replace rejected mortar at no additional cost to the Owner.

D. Refer to Articles 1.02 and 1.03 of this Section for pre- installation testing requirements.

END OF SECTION

MASONRY RESTORATION WARRANTY

Owner:		
Street Address:		
City	State	Zip
Project Name:		Project No.
Project Address:		
Date of Final Acceptance:		

Masonry Contractor:		
Street Address:		
City	State	Zip
Phone No. ( )		
Fax No. ( )		
Email:		

This warranty stipulates that the above-named Contractor shall, during a period of two (2) years from the date of final acceptance of the work, repair all defects which result from faulty workmanship or defective materials, without further cost to the Owner.

Exclude from this warranty any damages to the building or the contents.

Before expiration of the above warranty period, the above-named Contractor shall inspect the area of work in the presence of the Owner and make necessary correction of all deficiencies not considered normal. The warranty shall remain in force until the necessary repair work has been done.

MASONRY CONTRACTOR

Signature
Printed Name
Title
Date

SAMPLE SECTION 04 05 13

SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Mortar
   2. Grout<Delete all references if using Section 04 27 31>

B. Related Sections:
   1. Section 04 01 00 - Maintenance of Masonry
   2. Section 04 20 00 - Unit Masonry

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Coordinate with the Owner's representative and the Owner's testing agency
      a. Mortar sampling during the work according to ASTM C780.
         (1) Mortar aggregate ratio test <Used for mortar specified by Proportion>
         (2) Compressive strength test <Used for mortar specified by Property>
      b. Grout sampling during the work according to ASTM C1019.
   2. All written submittals must be approved prior to the preconstruction and pre-installation meetings, and mock-up construction.

B. Pre-installation meeting
   1. Schedule to occur the same day as the preconstruction meeting and a minimum of two weeks prior to the masonry work.
   2. Attendance by the General Contractor, installing contractor, materials supplier, Owner, Owner's testing laboratory, and the Owner's Representative is required.
   3. The meeting agenda will include the masonry scope of work and testing. The proposed mortar and grout mixing and sampling for the pre-installation meeting will be observed and documented.
      a. Mortar aggregate ratio test: Collect three samples for each mortar proportion type.
      b. Mortar compression test: Cast nine 2" x 4" cylinders for each mortar property type. Break three cylinders at 7 days, break three cylinders at 28 days, and holding three cylinders.
      c. Grout compression test: Cast four samples in the field with masonry pinwheels for each grout strength. Break one cube at 7 days and break three cubes at 28 days.
      d. Owner's testing laboratory to verify proportions of site-mixed mortar and grout.
   4. Supply all materials necessary to collect mortar and grout test samples for each mix design and to install the required mortar color samples.
   5. Supply all other required color samples for selection during the preconstruction and pre-installation meetings.

1.03 SUBMITTALS

A. Submittals must be reviewed and approved prior to preconstruction testing and mock-up construction.

B. Product data: Mortar pigment

C. Samples:
   1. Color samples prior to Mock-up construction:
      a. Strips of actual colored mortar, 3/8" by 3/8" by 3" long minimum
      b. Samples of every color available for selection by the Owner and Architect/Engineer
   2. Test samples:
      a. Sand aggregate for site-mixed mortar and site mixed grout
      b. Mortar and grout samples required in Section 01 45 23, Required Testing and Inspection Services.

D. Mix Design:
   1. Site-mixed mortar: Submit mix design to the Owner's Consultant for approval.
   2. Pre-blended mortar mix:
      a. Submit the pre-blended dry mortar mix proposed batch weights and reduced mix proportions to the Owner's Consultant prior to preconstruction and batching for review and written approval.
      b. Mix design shall be prepared and certified by a licensed professional engineer employed by a qualified independent laboratory.
      c. During construction using silo mixing production, submit records of batch weights and reduced mix proportions for each batch delivered to the project.
   3. Grout:
      a. Submit mix design prepared and certified by a licensed professional engineer employed by a qualified independent laboratory.
   4. After preconstruction results are received and reviewed, the Owner's Consultant will provide final mix design approval.

E. Certifications: Submit manufacturer's certificate of compliance to specified material standards for each mortar and grout component.

F. Test Reports:
   1. Submit manufacturer's compression test reports for grout mix.
   2. Submit test reports required in Section 01 45 23, Required Testing and Inspection Services.

1.04 QUALITY ASSURANCE

A. Obtain materials from same source throughout.

B. A mixer-batching operator must be trained and experienced in the batching and mixing fundamentals of producing consistent mortar batches.

C. Proportions of mortar, site-mixed or pre-blended mix, will be tested during construction per the mortar aggregate ratio method in ASTM C780. If results do not meet ASTM C270 specified mortar type proportion, additional mortar aggregate ratio tests will be conducted at the contractor's expense after one of the following:

1. Site-mixed mortar: Improve material measurement and demonstrate to the Owner's Representative satisfaction prior to conducting additional tests and continuing the work.
2. Pre-blended dry mortar mix: Review results and site batching methods with the Owner's Representative and manufacturer. Follow recommendations as determined from the review.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver pre-blended dry mortar mix in:
   1. 80 pound or greater unopened bags for small scale project.
   2. 2,000 pound or greater unopened bags for large scale projects with silo mixing operations.

B. Protect mortar and grout materials during storage from wetting by rain or ground water. Store in dry location or in covered containers. Keep containers tightly closed. Follow material manufacturer's recommendations for storage. Protect mortar components from contamination by intermixture with earth or other materials.

C. Cover sand aggregate stockpile.

PART 2 - PRODUCTS

2.01 MORTAR

A. Verify mortar materials with the independent testing agency.
   1. Portland cement: ASTM C150, Type I
   2. Hydrated lime: ASTM C207, Type S
   3. Aggregate for mortar: ASTM C144, fine mortar sand from Camas Company of Minneapolis, Lakeland pit, unless indicated otherwise
   4. Water: Potable water, clean, free of oils, acids, alkalis, salts, organic matter, or other substances in amounts that may be harmful to mortar, grout, or embedded materials.
   5. Match size, texture, and gradation of existing mortar
   6. Colored mortar pigment: Inorganic material or synthetic iron oxides. Owner shall approve color match of mortar.
      a. DCS Mortar Color manufactured by Dynamic Color Solutions, Inc., Milwaukee, Wisconsin; phone 800-657-0737, website www.dynamiccolorsolutions.com.
      b. Mortar Color, Solomon Colors, Inc., Springfield, Illinois; phone 800-624-0261, website www.solomoncolors.com
      c. True Tone Davis Colors distributed by Concrete Materials, Sioux Falls, South Dakota, phone 605-357-6065, website www.daviscolors.com
      d. Bayferrox distributed by Empire Blended Distributors, Inc., Bayville, New Jersey, phone 732-269-4949, website www.bayferrox.us .

B. Preblended dry mortar mix: Pre-batched, pre-bagged mortar with cementitious materials and aggregates as described above, SpecMix manufactured by TCC Materials, 651-688-9116.

2.02 GROUT

A. Grout: ASTM C476<Fine or Coarse> grout, Strength Specification with ASTM C404 aggregate.
   1. Compressive strength: Minimum <per Structural Engineer> psi at 28 days.
   2. Slump: <per Structural Engineer> inches.

2.03 MIX DESIGN

A. Exterior clay brick veneer:
   1. Above grade: ASTM C270, Proportion Specification, Type N. Modify the proportion based upon the mortar test results of the mortar pre-installation meeting. The average mortar aggregate ratio of the three samples taken during the pre-installation meeting must meet Type N proportion specification.
   2. Below grade: ASTM C270, Proportion Specification, Type S.
   3. If colored mortar pigments are necessary to match existing, do not exceed pigment to cement ratio of 1:10 by weight.

B. Reinforced CMU backer:
   1. ASTM C270, Property Specification, Type <per Structural Engineer>. The average compressive strength of the three samples taken during the pre-installation meeting must meet the Structural Engineer's requirements.

PART 3 - EXECUTION

3.01 MEASUREMENT AND MIXING

A. Site-mixed mortar:
   1. Measure by dry volume or equivalent weight method.
   2. Measurement by shovel is not permitted.

B. Preblended dry mortar or grout mix:
   1. Follow manufacturer's written instructions for batching and mixing.
   2. No on-site mixing of mortar or grout materials other than adding water to pre-blended dry mixture is allowed. Mix in quantities as large as economically possible. Use same measuring method and personnel throughout the Project.

C. Control and accurately maintain specified proportions of mortar materials during the entire progress of work.

D. Mixing:
   1. Mix in a clean mechanical batch mixer.
   2. Thoroughly mix cementitious and aggregate materials together before adding any water.
   3. Mix materials again from 3 to 7 minutes using only enough water to produce a damp, workable mix that retains its form when pressed into a ball.
      a. Only tuck pointing and rebuilding mortar must stay in this condition for one to 1-1/2 hours prior to adding remaining water.
   4. Add the remaining water in small portions and mix to produce satisfactory workability.
   5. Add colored mortar pigment to mortar only if required to match existing.
   6. Admixtures are not allowed.
   7. Ordinary mortar may be re-tempered as needed in the first 2-1/2 hours after mixing. Do not re-temper colored mortars.

E. Discard partially set mortar or grout.

F. Discard mortar not used within 2-1/2 hours of initial mixing.

3.02 INSTALLATION

A. Mortar

1. Clay brick masonry: Lay masonry units with completely filled bed and head joints. Butter ends with sufficient mortar to fill head joints and shove into place.
    a. Do not deeply furrow bed joints.
    b. Do not slush head joints.
    c. When masonry units are not the standard height, take care to fill the head joint completely from face to back.
2. CMU: Provide face shell bedding, except at grouted cells where full mortar bedding is required.
3. Do not permit mortar droppings to fall into cavity. Keep cavity clear of mortar droppings by back beveling the mortar bed or other approved method that demonstrates the ability to prevent excess from extruding into cavity.
4. Maintain joint width of 3/8 inch. Construct starting bed joint on the foundation with thickness a minimum of 1/4 inch and a maximum of 3/4 inch.
5. Prevent or remove mortar protruding 1/2 inch or more into cells or cavities to be grouted.
6. Tool mortar joints when thumbprint hard, using a jointer wider than the mortar joint.
    a. Exterior veneer: Concave joint profile.
    b. CMU backer: Compacted, flush joint profile for weather barrier installation.
7. At completion of masonry work, remove defective joints, holes, and cracks in new mortar joints to a depth of 3/4" and repoint.

B. Grout

1. Do not place grout until mortar joints have set sufficiently to withstand grout pressure.
2. Place grout within 1-1/2 hours after introducing water into the mixture and prior to initial set.
3. Confine grout to the areas indicated on the Drawings. Confine grout using a material that permits bond between masonry units and mortar.
4. Keep grout cores clean. When grout pour exceeds 5 feet, provide cleanout holes in bottom course of masonry at location identified by the Structural Engineer. Replace cleanout plugs only after area to be grouted is accepted.
5. Pouring
    a. Do not exceed the maximum grout pour height per MSJC Specification.
    b. Place grout in lifts not exceeding 4 feet.
    c. Do not interrupt grout pours.
    d. Fill bond beams completely, except hold grout 1-1/2 inches below the top of masonry at cores that grout will be placed above the bond beam.
6. Consolidating
    a. Mechanically vibrate at time of placement.
    b. Do not use steel reinforcement to rod grout.
    c. Mechanically vibrate or puddle pours less than 12 inches. Reconsolidate by mechanical vibration after initial water loss and settlement occurred.

3.03 FIELD QUALITY CONTROL

A. Provide mortar and grout samples for testing conducted by the Owner's independent testing laboratory as scheduled in Section 01 45 23, Required Testing and Inspection Services.

B. Construction observation

1. The Owner's Consultant will conduct periodic observation of the reinforcing. <and periodic observation of the grouting, including observation of grout sample preparation.>
2. The construction observation will be paid for by the Owner, however, any additional construction observation required for the re-testing and the re-work will be performed by the Owner's Representative and all additional construction observation costs shall be deducted from the Contract sum by Change Order.

C. Schedule sampling:

1. Mortar sampling with the Owner's independent testing laboratory and the masonry observer.
   a. Masonry observer to observe and document Owner's testing laboratory procedures for each sampling.
2. Grout sampling and placement with the Owner's independent testing laboratory and the structural observer.

D. Mortar Tests:

1. After the pre-installation testing, conduct the first observation and construction test sampling on the first 2 days of mortar production.
   a. Proportion Specification: Each mortar ratio aggregate test sample set will contain three samples.
   b. Property Specification: Each compressive strength test sample set will contain seven 2" x 4" cylinders.
2. Sample and test one set of mortar aggregate ratio samples <and compressive strength samples> each calendar week during mortar production for a total of <XX> sets during project construction.

<Add the next paragraph if approved/required by Minnesota State System Office for a specific large project>

3. Sample and test one set of mortar aggregate ratio samples each day of mortar production for a total of <XX> sets during project construction
4. The Owner's independent testing laboratory to submit the results the following day for each mortar aggregate ratio set.
5. Mortar compression test procedure: Break three cylinders at 7 days and three cylinders at 28 days. Hold any remaining cylinders until the project is closed out.
6. A minimum of four sand aggregate gradations for site-mixed mortar and grout shall also be conducted.
7. The Owner's independent testing laboratory shall review the mortar mix proportions used, the surface preparations, and material application methods on a "spot-check" basis during the time when mortar samples are secured.
8. The Owner reserves the right to reject the mortar if the mortar aggregate ratio <or mortar compressive strength test> does not meet the specified mortar type proportions. Contractor shall remove and replace rejected mortar at no additional cost to the Owner.

E. Grout:
   1. After the pre-installation testing, conduct grout sampling the first day of pouring.
   2. Grout compression sample set will contain four cubes prepared with masonry pinwheels.
   3. Sample and test one set of grout compression samples for every 5,000 square feet of wall for a total of <XX> sets of grout compression samples for the project.

F. Only initial tests will be paid for by the Owner. Any retesting and related construction observer work will be paid for by the Contractor.

END OF SECTION

SAMPLE SECTION 04 20 00

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Clay brick masonry
   2. Concrete Masonry Units (CMU) <Delete all references if using Section 04 27 31>
   3. Joint reinforcement
   4. Anchors and ties
   5. Flashing and accessories
   6. Masonry cleaning

B. Related Sections:
   1. Section 04 05 13 - Masonry Mortaring
   2. Section 04 27 31 – Reinforced Unit Masonry
   3. Section 07 2100–Building Insulation
   4. Section 07 62 00 - Sheet Metal Flashing
   5. Section 07 92 00 - Joint Sealant

1.02 SUBMITTALS

A. Submittals must be reviewed and approved prior to preconstruction testing and mock-up construction.

B. Product data:
   1. Joint reinforcement
   2. Anchors
   3. Ties
   4. Flashing membrane
   5. Flashing lap sealant
   6. Termination bar
   7. Termination bar fasteners
   8. Weeps
   9. Cavity drainage material
   10. Masonry cleaner

C. Shop drawings:
   1. Special shaped masonry units
   2. Stainless steel drip edge
   3. Curtain wall stainless steel drip pan flashing in isometric and showing lap splices
   4. Mockup: Plan and elevations with corresponding detail balloons, dimensions, and all materials and products noted. Elevation to include a graduated cut-away of materials to show the layering of wall system materials.

D. Samples:
   1. Stack of six face brick minimum with artificial mortar joint
   2. Sample board of face brick color blend

E. Certifications: Submit manufacturer's certificate of compliance to specified material standards for each type of clay brick masonry and CMU.

F. Test Results:
   1. Pre-construction testing results must be approved in writing by the responsible designer prior to masonry work occurring at the site.
   2. Clay brick masonry: Test results by the Owner's testing laboratory for one set of 10 of each type of clay brick masonry according to ASTM C67 test method for the characteristics of: Compressive strength, absorption, saturation coefficient, initial rate of absorption (IRA), and efflorescence.

<Add the next paragraph if approved/required by Minnesota State System Office for a specific large project>

      a. Freezing and thawing
   3. CMU
      a. Manufacturer's test results for each type and size of CMU according to ASTM C140 test method for the characteristics of: Compressive strength, absorption, and density.
      b. Assemblages
   4. During construction, submit Owner's testing laboratory's test results as specified in "Quality Assurance" and Section 01 45 23, Required Testing and Inspection Services. The results must be approved in writing by the responsible designer.

G. Contractor's Reports:
   1. Proposed construction procedures for hot and cold weather
   2. Heated enclosure safety check reports on a weekly basis to the Owner's Representative

H. Attic stock of each type of masonry veneer units to the Owner at the completion of the project.

1.03 QUALITY ASSURANCE

A. Work not specifically noted on the Drawings or in the specifications shall be in accordance with current recommendations of:
   1. Masonry Standards Joint Committee (MSJC)
   2. Brick Industry Association
   3. National Concrete Masonry Association

B. Contractor shall have a minimum of five years successful experience in comparable masonry projects with similar scope and type of unit masonry, and shall employ personnel skilled in the masonry work process, handling of this specific unit masonry, and operations indicated.

C. Obtain materials from same source throughout.

D. A competent foreman shall be in charge of the Work at all times. The same foreman shall be in charge from start to completion of the Project.

E. Pre-installation meeting
   1. Schedule a minimum of two weeks prior to the masonry work.
      a. Occur on the same day as the pre-construction meeting
      b. Occur on the same day as the mortar pre-installation testing

2. Attendance by the General Contractor, installing contractor, material suppliers, Owner, Owner's testing laboratory, and the Owner's Representative is required.
3. Meeting agenda: construction schedule and sequence, mock-up construction, product delivery and storage, material compatibility, site restrictions, coordination of testing and observation, and other project specific topics.

F. Mockup

1. All written submittals must be approved before scheduling mockup construction.
2. Construct a mockup of concrete foundation, CMU backer with reinforcing and grout, vapor retarder, air barrier, one masonry expansion joint, head joint vents, mortar control device, veneer anchors, insulation, through-wall flashing and accessories, rope weeps, approved face brick blend, and approved mortar color. Include an outside building corner, wall base-to-foundation waterproofing detail, wall-to-roof system detail, representative window or curtain wall details, roof edge details, and all wall system components shown in layers including the back-up wall, but not interior finishes.
    a. Construct with field personnel that will be installing the materials during the project.
    b. Construct with masonry units from the same production run as the project.
3. Size: Minimum 4' wide on one side of the corner by 2' wide and 3' high. Construct of a size to show layers of materials adequately for review and testing.
4. Preparation: Construct and cure concrete foundation ready to receive mockup.
5. Location: Approved by Owner prior to construction.
6. Coordinate mockup material delivery, construction, and testing with the masonry observer, testing agency, and field personnel installing the materials during the project for the vapor retarder, air barrier, veneer anchors, through-wall flashing and accessories, vents, and mortar control device.
    a. Schedule full-time masonry observation of the mockup construction.
    b. Air barrier to be tested as specified in Section <07 27 00, edit to project>.
    c. Window/Curtain Wall to be tested as specified in Section<08 44 13 or 08 51 13, edit to project>.
7. Purpose of mockup is to illustrate construction and workmanship including unit installation and color, face brick color blending, mortar color, mortar joint tooling, vapor retarder and air barrier installation and details, veneer anchor installation, through-wall flashing with sheet metal and end dams, joint sealant and backer rod installation, mortar control device, vents, and continuous rope weeps for approval by Architect/Engineer and Owner' Consultant.
8. Schedule a mockup review meeting for approval by the Architect/Engineer and Owner's Consultant.
9. When accepted, the mockup shall become the project standard for quality of work, methods of installation, and appearance. Leave mockup in place until masonry work is complete and has been accepted.

G. Testing

1. Clay brick masonry units
    a. ASTM C67, Absorption and saturation coefficient: Test one set of 10 brick for each different brick used, for every 100,000 units or each manufacturer's run; whichever is less.

b. Initial rate of absorption (IRA): Field test using eye dropper and 12 drops of water in a circle the size of a quarter. Field test daily during hot weather; weekly otherwise. If water is absorbed within one minute, brick must be pre-wetted before laying.

2. Clay brick masonry assemblages
   a. Flexural bond, ASTM C1072
      (1) Pre-construction: Test three specimens of six bricks each for each type of mortar and clay brick masonry unit. Mix mortar and construct specimens in the testing facility where the specimens will be tested and using the materials that will be used in construction.
      (2) Construction: Test three specimens of six bricks each for each type of mortar and clay brick masonry unit, twice during the first week of masonry construction and once every 5,000 square feet of wall area or floor level; whichever is greater. Mix mortar and construct specimens in the field, left to cure undisturbed and exposed to similar weather conditions as the project.
   b. Water Permeance, ASTM C1601
      (1) Pre-construction: Test specimen of veneer wythe of a minimum size 5 feet x 5 feet. Mockup may be utilized if sufficient masonry surface is available.
      (2) Construction: Test select wall area(s) at the direction of the Architect/Engineer and the Owner's Representative.
3. CMU: One set of 6 units tested for each type and size during the first week of masonry construction. Follow with testing of 6 units from each lot of 10,000 units; 12 from each lot between 10,000 and 100,000; test 6 units for each 50,000 from lots above 100,000 units.
4. CMU Assemblages: ASTM C1314, Compressive strength of prisms
   a. Pre-construction: One set of 3 prisms for each weight classification of CMU and mortar type. Mix mortar and grout, and fabricate test prisms in the testing facility where the test will occur. Fabricate according to ASTM C1314 and using the materials that will be used in construction. Test at 28 days.
      (1) Where actual construction is partially grouted, two sets of prisms shall be made: one grouted and the other non-grouted.
   b. Construction: One set of 3 prisms for each weight classification of CMU and mortar type, for every 5,000 square feet of wall. Test at 28 days.
      (1) Where actual construction is partially grouted, two sets of prisms shall be made: one grouted and the other non-grouted.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Masonry units shall be delivered and handled, strapped or tied together on pallets or other suitable cartons, to prevent chipping and breakage. Units shall be covered from wetting by waterproof tarp.

B. Keep masonry units, accessories, and reinforcing dry, clean and free of scale, rust, ice, or other harmful coatings.

C. Store masonry units and packaged materials off ground and protected from wetting by capillary action, rain or snow, and protected from mud, dust, or other materials and contaminants.

1.05 PROJECT CONDITIONS

A. Hot and Cold Weather Requirements: According to MSJC Specification for Masonry Structures (TMS 602). Additionally, when ambient temperature:

1. Exceeds 90°F: Fog spray newly constructed masonry until damp, at least three times a day for 72 hours after completing masonry work.
2. At or above 40°F during the day and will drop below 40°F at night: Cover area of work to maintain a minimum of 40°F.
3. Below 40°F or will drop below 40°F within 48 hours: Do not lay masonry units, tuck point mortar joints, wash down or wet surfaces without a heated enclosure set-up and operational. The temperature of the enclosure shall be maintained above 40°F for a minimum of 48 hours after completing any of this Work. The heat source must be on both sides of the Work in new construction or additions.
4. Below 40°F: Maintain area of work, masonry materials, equipment, and mortar batching area in a heated enclosure prior to and during the Work. Do not heat water or components for mortar or grout to above 140°F.
5. Masonry must be cured a minimum of 14 days and warmed to 40F prior to cleaning. Maintain the heated enclosure after cleaning for 48 hours, including safety checks.

B. Heated enclosure

1. Monitor carbon monoxide levels. Immediately correct the environment when carbon monoxide is beyond a safe level for workers.
2. Periodically conduct safety checks of the enclosure and contents and continuous, safe operation of the heat source during overnight hours on work days and during daytime hours on non-work days, weekends, and holidays. Include two checks overnight and three checks during the daytime, at equally spaced intervals. Report the date, time, inside and outside temperatures, weather conditions, and status of the site for each safety check.

C. Protection:

1. Brace walls as necessary during construction.
2. Protect exposed masonry with wind breaks when wind velocities exceed 15 mph.
3. Protect exterior veneer against staining.
4. Cover top of walls continuously with non-staining weighted waterproof coverings when work is not in progress and before precipitation.
5. Protect trees, shrubs, lawns, and other features remaining as a portion of final landscaping.
6. Protect surrounding surfaces from damage by covering, masking, sealing, or other means of protection. Immediately remove mortar which contacts surfaces which are not to receive mortar.
7. Protect all through-wall flashing installations from damage during construction, including at the brick ledge.
8. Provide 19 mm (3/4 in.) plywood over 25 mm (1 in.) expanded polystyrene insulation and loose EPDM for protection of the existing roof membrane a minimum of 3.6 m (12 ft.) from adjacent walls; on traffic paths; and under staging equipment.
9. Provide EPDM membrane over newly installed roof for directing the runoff from the masonry cleaning process. Direct the runoff to the roof drains or scuppers with a temporary downspout.
10. Immediately report any damage to the Owner and Architect/Engineer.

PART 2 - PRODUCTS

2.01 MASONRY MATERIALS

A. Face brick:
   1. ASTM C216, Grade SW, Type FBS or FBX
   2. Initial rate of absorption: Minimum 5 grams/min/bedding face and maximum 20 grams/min/bedding face
   3. Rated “not effloresced”
   4. ASTM C67, Freezing and thawing testing

B. CMU: ASTM C90, <per Structural Engineer> weight classification

2.02 JOINT REINFORCEMENT

A. Stainless steel Type 304, 9 gauge wire
   1. Multi wythe: Ladder type with adjustable ties 16” o.c.
      a. 270-2X Ladder Eye-Wire with pintles manufactured by Hohmann & Barnard, Inc. Hauppauge, New York, 800-645-0616, www.dur-o-walh-b.com
      b. Series 800 Level Eye Ladder (Hook & Eye) with pintles manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com
   2. Single wythe: Ladder type
      a. 220 Ladder Mesh Reinforcement manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com
      b. Series 200 Ladder 2 Wire Mesh Reinforcement manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

2.03 VENEER ANCHORS

A. Clay brick masonry: Stainless steel Type 304, adjustable brick replacement anchors with brass expansion sleeve anchors
   1.
   2. HB-213-2X manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com
   3. 2401 RJ-711 Adjustable Veneer Anchor with 2402 pintle manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

2.04 EMBEDDED FLASHING MATERIALS

A. Flashing: Full sheet of stainless steel, Type 304, 2 mil, laminated with polymer or fiberglass fabric on one side
   1. Multi-Flash SS with premanufactured corners and end dams, manufactured by York Manufacturing, Inc., Sanford, Maine, 800-551-2828, www.yorkmfg.com
   2. R-Guard SS Thru-wall with premanufactured corners and end dams, manufactured by PROSOCO, Inc.; manufacturer's representative is Tri-G Products, Inc., Anoka, MN, phone 763-413-1778, www.prosoco.com
   3. Wall Guardian Stainless Steel TWF, manufactured by STS Coatings, Inc.; Comfort, TX, phone 830-995-5177, www.stscoatings.com

B. Flashing: Full sheet of copper weighing 5 oz./sq. ft., laminated with non-asphaltic polymer or fiberglass fabric on both sides

1. Multi-Flash 500 with premanufactured corners and end dams, manufactured by York Manufacturing, Inc.; Sanford, Maine, 800-551-2828, www.yorkmfg.com
2. Copper Sealtite 2000 , manufactured by Advanced Building Products, Inc.; Springvale, Maine, 800-252-2306, www.advancedflashing.com

C. Flashing lap sealant: As recommended by flashing membrane manufacturer.

1. UniverSeal US-100, polyether sealant manufactured by York Manufacturing, Inc., Sanford, Maine, 800-551-2828, www.yorkmfg.com
2. MasterSeal NP 150, polyether sealant, for use with York flashing, manufactured by BASF Construction Chemicals, Shakopee, Minnesota, 800-433-9517, www.master-builders-solutions.basf.us
3. Sealtite Sealant, acrylic urethane sealant, manufactured by Advanced Building Products, Inc.; Springvale, Maine, 800-252-2306, www.advancedflashing.com
4. R-Guard FastFlash, silyl-terminated-polymer sealant, manufactured by PROSOCO, Inc.; manufacturer's representative is Tri-G Products, Inc., Anoka, MN, phone 763-413-1778, www.prosoco.com
5. GreatSeal LT-100 Liquid Tape, polyether sealant, manufactured by STS Coatings, Inc.; Comfort, TX, phone 830-995-5177, www.stscoatings.com

CI. Flashing splice material: As recommended by flashing membrane manufacturer:

1. York 304 self-adhering stainless steel, 6 in. width, manufactured by York Manufacturing, Inc., Sanford, Maine, 800-551-2828, www.yorkmfg.com

CII. Termination bar: 0.060 inch thick (1/16") or 16 gauge by 1" stainless steel with pre-drilled holes 6" on-center, holes shall be no more than 2" from ends of termination bar.

CIII. Termination bars fasteners: Drive nail anchor, stainless steel nail with an alloy body, 1/4" diameter by min. 1-1/2" long

1. ZamacNailin, manufactured by Powers Fasteners, Brewster, New York, phone 800-524-3244, www.powers.com
2. Nail-in Anchor, manufactured by Fastenal, Winona, Minnesota, phone 877-507-7775, www.fastenal.com

CIV. Sheet metal drip edge: ASTM A167, Type 304, 0.018 inch thick (26 gauge) stainless steel, soft temper, mill finish, extend a minimum of 3/8" beyond face of exterior wall with a hemmed edge.

1. Drip Edge Flashing, FS1012, manufactured by MASONPRO, Inc.; Northville, Michigan, phone 800-659-4731, www.masonpro.com

CV. Weeps: 3/8" diameter 100% cotton fiber rope, including core, lengths as indicated.

CVI. Curtain wall sill drip tray flashing: ASTM A240, Type 304, 0.048 inch thick (18 gauge), radius = .048", pre-fabricated with welded corners.

1. Maximum 3/8” high upturned leg for continuous back dam, 2-1/2” high down turned leg to function as a continuous termination bar for the sub-sill flashing, and preformed end dams at each corner.
2. Contractor to verify depth of drip tray flashing and coordinate with the curtain wall sill framing.
3. Down turned leg: holes for fasteners at 12” o.c., a maximum of 2” o.c. from the ends and 1/2” o.c. from the bottom edge, and flanges on each end terminate at the sub-sill flashing end dam location.

2.05 ACCESSORIES

A. Mortar control device: High density polyethylene or nylon, 90% open woven mesh, dovetail notched shape, verify thickness for cavity size.

1. Mortar Net manufactured by Mortar Net USA Ltd., Burns Harbor, Indiana, 800-664-6638, www.MortarNet.com
2. Mortar Trap, manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com
3. Cavity Net DT (#3611), manufactured by Wire-Bond, Charlotte, North Carolina, 800-849-6722, www.wirebond.com

B. Vents: Polyester fiber mesh vent

1. Mortar Trap Weep Vents, manufactured by Hohmann & Barnard, Inc.; Hauppauge, New York, 800-645-0616, www.h-b.com
2. Mortar Break Weep Vents, manufactured by Advanced Building Products, Inc.; Springvale, Maine, 800-252-2306, www.advancedflashing.com

2.06 MASONRY CLEANER

A. Face brick cleaner: Use sparingly and only where required for newly tuck pointed and restored masonry surfaces. Minimum 14 day setting time required for new mortar prior to use. Protect roof membrane as necessary in the area of cleaning to prevent cleaner from contacting the roof membrane. Use one of the following as recommended by the clay brick manufacturer:

1. Manufacturer: PROSOCO, Inc., manufacturer's representative is Tri-G Products, Inc., Anoka, MN, phone 763-413-1778, www.prosoco.com.
   a. Sure Klean No. 600
   b. VanaTrol
2. Manufacturer: Diedrich Technologies, division of Hohmann & Barnard, Inc.; Schenectady, NY, phone 800-283-3888, www.diedrichtechnologies.com.
   a. 202 New Masonry Detergent
   b. 202V Vana-Stop
   c. 200 Lime-Solv

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that surfaces to be cleaned and restored are ready for Work of this Section.

B. Beginning of installation means acceptance of existing surfaces and conditions.

C. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.02 WETTING BRICK

A. IRA greater than 1 gram/sq. in./min.: Wet brick with clean water 24 hours prior to placement until units are nearly saturated. Permit units to surface dry before laying.

B. During cold weather, sprinkle units with warm or hot water and protect from freezing as specified in “Project Conditions”.

3.03 CONSTRUCTION TOLERANCES

A. At exterior elevations with curtainwall openings
   1. Maximum variation from unit to adjacent unit: 1/16”
   2. Maximum variation from plane of wall: 1/8” in 10 feet, 1/4" in 40 feet; non-cumulative
   3. Maximum variation from plumb: 1/8” in 10 feet, 1/4" in 40 feet; non-cumulative
   4. Maximum variation from level coursing: 1/8” in 10 feet, 1/4" in 40 feet; non-cumulative
   5. Maximum variation of joint thickness: 1/8” in 3 feet
   6. Maximum variation from cross sectional thickness of walls: 1/4"

B. Dimension of elements
   1. Variation in cross-section or elevation: -1/4", +1/2"
   2. Variation of mortar joint thickness
      a. Bed joint: ± 1/8", maximum joint thickness 1/2"
      b. Head joint: -1/4", +3/8"
   3. Variation of cavity width: -1/4", +3/8"

C. Elements
   1. Variation from level
      a. Bed joints: ±1/4" in 10 feet, ±1/2" maximum
      b. Top surfaces of bearing walls: ±1/4" in 10 feet, ±1/2" maximum
   2. Variation from plumb: ±1/4" in 10 feet, ±3/8" in 20 feet, ±1/2" maximum
   3. True to a line (straightness of the wall in plan): ±1/4" in 10 feet, ±3/8" in 20 feet, ±1/2" maximum
   4. Alignment of columns and walls (bottom versus top):± 1/2" for bearing walls, ± 3/4" for non-bearing walls

D. Location of elements
   1. Indicated on plan: ± 1/2" in 20 feet, ± 3/4" maximum
   2. Indicated on elevations: ± 1/4" in story height, ± 3/4" maximum

E. Reinforcement placement
   1. Specified distance from centerline of steel to the opposite face of masonry
      a. ≤ 8": ± 1/2"
      b. > 8", but < 24": ±1"
      c. > 24": ±1-1/4"
   2. Vertical bars placement along the length of the wall: ± 2"
   3. Consult with the Architect/Engineer and Structural Engineer for a bar that must be moved more than one bar diameter or a distance that exceeds the permitted tolerance to avoid interference with other reinforcement, conduits, or other embedded items.

3.04 PLACING UNITS

A. Scaffold to lay face brick from face side.

B. Do not install replacement units that are cracked, broken, or chipped in excess of ASTM C216 allowances for facing brick.

C. Cutting units

1. If cutting is required, use motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
2. Install with cut surfaces and edges concealed.

D. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

E. Pattern: Half running bond, unless noted otherwise

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Stopping and Resuming Work:
1. Rack back one half unit length in each course.
2. Do not tooth unless specifically allowed.
3. Join fresh masonry to set or partially set masonry by removing loose units and mortar. Brush clean and lightly wet exposed surfaces of set masonry prior to laying fresh masonry.

H. Lay units plumb and true to line with a level and accurately spaced courses, with corners plumb and true.

I. Place units in final position while mortar is soft and plastic. If units are displaced after initial set, remove, clean of mortar, and lay new units with fresh mortar.

J. Remove extruded mortar to provide flush mortar joints facing cavity. Minimize mortar droppings from falling in cavity.

3.05 JOINT REINFORCEMENT, ANCHORS, AND TIES

A. Set joint reinforcement in full bed of mortar.

B. Embed brick ties at least 1-1/2" in the mortar bed with a minimum 3/4" mortar cover to the face of wall.

C. Start brick ties a maximum of 8” horizontally and 9” vertically from terminations, such as top of wall, brick ledges, lintels, expansion joints, through-wall flashings, window, door, and louver openings, corners, or other interruptions.

D. At masonry and concrete beams, drill hole in backup and install ties spaced maximum of 16" on-center vertically and horizontally.

3.06 THROUGH-WALL FLASHING

A. Remove dust, dirt, debris, grease, oils, and other contaminants from surface to receive new materials.

B. Existing construction
1. Remove brick courses as indicated. Provide shoring of the remaining masonry as necessary.
2. Remove excess mortar and patch holes, voids, or spalls on the concrete block back-up wall to provide a smooth and dry substrate to receive the through-wall flashing.
3. Carefully fit flashing around projections and columns in the cavity.
4. Existing construction without air barrier: Coat backer wall with flashing lap sealant for the entire vertical leg of the flashing from 2" below the brick tie plate to slightly beyond the top edge of the flashing.

C. Form flashing membrane to profile shown in the Drawings, without wrinkles or buckles. Protect from punctures and tears.

D. Single layer: Located at shelf angles, above doors and louvers, above and below windows, wall-to-foundation waterproofing tie-in, and other specified locations.
   1. Extend flashing membrane 12" minimum up vertical wall. Install top edge of flashing set in flashing lap sealant.
   2. Install preformed corners or fold inside and outside through-wall flashing corners. Limit cutting or trimming through-wall flashing membrane. Install additional membrane at outside corner, lapping 6” over adjacent pieces. Install a reinforcement piece at the corner between the horizontal and vertical legs. Seal in-between the lap of the additional membrane and reinforcement piece to the through-wall flashing membrane.
   3. Install termination bar over top edge of flashing membrane. Mechanically fasten 6" on-center. Coat the termination bar and fasteners with flashing lap sealant.
   4. Install flashing membrane 1/2" from brick face. Seal the bottom horizontal termination to the sheet metal drip edge with two beads of flashing lap sealant. Seal the sheet metal drip edge to the lintel or brick below with a bead of flashing lap sealant.
   5. Extend the sheet metal drip edge out 3/8” from the face of the wall. Lap sheet metal drip edge 4” and seal lap.
   6. Install flashing membrane in one piece, wherever possible, to eliminate laps. Where laps must occur, provide minimum 6" laps to adjacent flashing pieces. Seal in-between flashing laps and over the cut edge with flashing lap sealant.
   7. Install preformed end dams or turn flashing up 2" minimum or one brick course height at terminations to provide folded end dams. Seal end dams with flashing lap sealant. Install flashing lap sealant at adjacent substrate and embed end dam.
   8. Install brick ties at 16" on-center horizontally, maximum 8” from terminations or corners, and cover plates with flashing lap sealant as indicated.
   9. Install and extend rope weeps at end dam corners with tab extension of flashing membrane and through head joints at a maximum of 16” on-center. Lay approximately 16" horizontally along cavity, interlacing with adjacent rope weep, and extend up to and tie to brick ties. See detail isometric on Drawings.
   10. Install vents, mortar control device, and insulation.
   11. Install brick over flashing.

E. Double layer: Located above roof systems including roof edges, parapets, and steep roofs.
   1. Fully embed top edge of first (or lower) layer of flashing membrane in flashing lap sealant, with lower edge extending over roof base flashing as shown on the Drawings.
   2. Install in longest lengths possible. Provide minimum 6" laps to adjacent flashing pieces. Seal in-between flashing laps and over the cut edge with flashing lap sealant.
   3. Install preformed corners or fold inside and outside through-wall flashing corners. Limit cutting or trimming through-wall flashing membrane. Install additional membrane at outside corner, lapping 6” over adjacent pieces. Install a reinforcement piece at the corner between the horizontal and vertical legs. Seal in-between the lap of the additional membrane and reinforcement piece to the through-wall flashing membrane.
   4. Fasten the termination bar at 6" on-center. Coat termination bar and fasteners with flashing lap sealant.
   5. Install preformed end dams or turn flashing up 2" minimum or one brick course height at terminations to provide folded end dams. Seal end dams with flashing lap sealant. Install flashing lap sealant at adjacent substrate and embed end dam.

6. Install brick ties at 16" on-center horizontally, maximum 8” from terminations and corners, and cover plates with flashing lap sealant as indicated.
7. Install and extend rope weeps at end dam corners and through head joints at a maximum of 16” on-center. Lay approximately 16" horizontally along cavity, interlacing with adjacent rope weep, and extend up to and tie to veneer anchors. See detail isometric on Drawings.
8. Install insulation and lay one brick course.
9. Install sheet metal insert at bed joint indicated on the Drawings, lapping 4" minimum and spot adhere laps with flashing lap sealant.
10. Lay next brick course, install veneer anchor wires and insulation, lay the third brick course and core fill. Allow to cure overnight before proceeding with the second layer.
11. Fully embed top edge of second (or upper) layer of flashing membrane in flashing lap sealant.
12. Install flashing membrane 1/2" from brick face. Seal the bottom horizontal termination to the sheet metal drip edge with two beads of flashing lap sealant. Seal the sheet metal drip edge to the brick below with a bead of flashing lap sealant.
13. Extend the sheet metal drip edge out 3/8” from the face of the wall as shown. Lap sheet metal drip edge 4” and seal lap.
14. Provide minimum 6" laps to adjacent flashing pieces. Seal in-between flashing laps and over the cut edge with flashing lap sealant.
15. Install preformed corners or fold and reinforce inside and outside corners as described above.
16. Fasten and coat the termination bar at as described above.
17. Provide preformed or folded end dams as described above.
18. Install veneer anchors, rope weeps, vents, mortar control device, and insulation as described above.
19. Install brick over second layer of flashing membrane.
20. Provide temporary 45-mil EPDM flashing extending up from existing flashing to one brick course below new sheet metal reglet. Bond to wall and to existing EPDM flashing.
21. Install new sheet metal counterflashing over temporary EPDM flashing, as detailed. Lap intersecting counter flashings, except fascia counter flashings, minimum 3", and securely fasten with pop rivets or screws and seal with sealant.

F. Trim rope weeps to 1/2" past the exterior face.

3.07 CURTAIN WALL STAINLESS STEEL DRIP TRAY FLASHING

A. Substrates must be level and clean. Grouted CMU must be troweled smooth and without voids; including adjacent mortar joints

B. Install drip tray flashing in continuous contact with the top of the backer wall to allow for transfer of curtain wall dead load.

C. Coat vertical face of sub-sill flashing with flashing lap sealant prior to setting the pan flashing. Fasten down turned leg of pan flashing with through-wall flashing termination bar fasteners. Cap seal fastener heads.

D. Apply a continuous bead of flashing lap sealant to the perimeter of the down turned leg bottom edge and flanges. Seal pan flashing in contact with exposed concrete block or concrete surfaces.

E. Curtain Wall openings that require splice joints must be air and water-tight. Silicone sealants and splice tape materials installed must be compatible and bond with sealant used for the window and curtain wall primary sealant joint.

3.08 EXPANSION AND CONTROL JOINTS

A. Expansion joints in clay brick masonry: Open joint full depth of the exterior veneer.
   1. Provide vertical expansion joints as shown in the Drawings.
   2. Provide horizontal expansion joints below shelf angles and roof edges.
   3. Install compressible joint filler, backer rod, and joint sealant.

B. Control joints in CMU:
   1. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
   2. Install backer rod and joint sealant.

C. Do not continue horizontal joint reinforcement through expansion and control joints.

D. Maintain clear expansion and control joints during construction until installing detailed joint materials.

3.09 REPAIR AND CLEANING

A. During masonry work
   1. Remove excess mortar and smears.
   2. Dry brush surfaces after mortar has set at the end of each work day and after final pointing.

B. At completion of masonry work,
   1. Remove and replace masonry units that are loose, damaged, or do not match adjoining units. Install new units to match adjoining units in fresh mortar and tuck point to match surrounding area.
   2. Remove defective joints, holes, and cracks in new mortar joints to a depth of 3/4" with a square back and repoint.

C. Clean minimum 4' by 4' test panel of each type of masonry material prior to beginning full scale cleaning operation to determine effectiveness of cleaning compound and manufacturer's cleaning procedures.
   1. Review test panels with the Architect/Engineer and Owner’s representative for inspection and approval.

D. Clean masonry in an orderly manner, making sure that all surfaces are clean and a uniform appearance is obtained.

E. Clean only after mortar has cured to its full strength, not less than 14 days. If a new roof is installed, protect the roof from the area of work to the drains with EPDM during the cleaning and rinsing process.

F. Remove mortar particles with water, nonmetallic scrapers, and fiber bristle brushes. Sandblasting, wet aggregate blasting, or use of other abrasive materials will not be allowed.

G. Provide an adequate water supply during the cleaning process to assure a thorough presoaking and rinsing of the surfaces.

H. Protect adjacent non-masonry surfaces, including trees, shrubs, plantings, lawn, glass, and metal and painted surfaces, from exposure to cleaning compounds. Use polyethylene sheet to cover and seal window glass and frames.

I. Beware of wind drift onto auto and pedestrian traffic.

J. Use cleaning compounds in strict accordance with manufacturer's printed instructions.

K. Remove mortar from surfaces not specified to receive mortar; such as walls, windows, curbs, sidewalks, etc.

3.10 FIELD QUALITY CONTROL

A. All materials, which are subject to definite specification requirements, may be sampled, tested, and inspected at any time prior to, or during installation of the Work.

B. Construction observation

1. The Owner's Consultant will conduct periodic observation of the through-wall flashing installation. <and periodic observation of the tuck pointing, including observation of mortar sampling.>
2. The construction observation will be paid for by the Owner, however, any additional construction observation required for the re-testing and the work will be performed by the Owner's Consultant and all additional construction observation costs shall be deducted from the Contract sum by Change Order.

C. Testing during construction:

1. The <clay brick masonry, CMU, and> mortar aggregate ratio testing <and mortar compression testing> will be paid for by the Owner. However, when initial tests find non-compliance with Contract Documents, all re-testing will be performed by the Owner's testing laboratory and paid for by the Contractor by deducting from the Contract Sum by Change Order.

D. Masonry observation services

1. Mock-up construction:
   a. Observe and document substrate preparation for each subsequent system, transitions of all systems, and installation of the weather barrier, through-wall flashings, window, masonry details, and roof edge.
2. Verify and document all mortar and masonry materials delivered to the site.
3. Note ambient temperatures at each site visit. During cold weather construction, note heated enclosure and material temperatures.
4. Observe and document masonry unit installation
5. Observe and document through-wall flashing installation prior to installation of masonry veneer:
   a. Substrate prior to flashing membrane installation
   b. Flashing membrane lengths and laps, or if in one piece above an opening
   c. Top termination, end dams, and corners
   d. Brick ties, rope weeps, and cavity drainage material

E. Refer to Section 01 45 23, Required Testing and Inspection Services for additional information.

END OF SECTION

APPENDIX

A. Construction Observation Report
B. Hygrothermal Report Example
C. Exterior Masonry Design Standards Resources
D. Contractor's Exterior Masonry Project Checklist
E. Structural Engineer's Checklist
F. Proposed Revision Form

EXTERIOR MASONRY DESIGN STANDARDS

2rd Edition

The specifications and related information shown in the following examples are intended to illustrate the intent of the Minnesota State Exterior Design Standards. The information contained herein is not necessarily intended to be used for a particular project, but will need to be edited to work with a specific project based on the uniqueness of that project. The designer is responsible to ensure compatibility of all materials used on the project. The actual design and configuration of the masonry wall will vary based on design parameters, existing conditions, and other factors unique to each project. The designer is responsible for the final exterior masonry wall design conforming to the intent of these standards and any variance must be submitted by written request to the Minnesota State Facilities Design and Construction Department.

APPENDIX A

Masonry Construction Observation Report

7/31/17

Project Number:	xxxxxx
Project Name:	Reroofing and Masonry Restoration -
Campus Name:	
Reported To:	MnSCU (Attn:)
	Campus Name (Attn:)
Observer:	Observer's Name
Contractors:	General=
	Masonry=
Architect:	

Crew Type	Crew Size	Approximate Quantity	Start Time	End Time
Masonry	5	72'	7:00 AM	3:15 PM
Observer	1	N/A	6:45 AM	3:30 PM

Weather: Cloudy---55ºF---Light wind (5-10 mph)

PROJECT STATUS

ReportNumber:	**XX**
Work In Progress:	**Demolition on west elevation**
Masonry Working Day:	**3**
Allowed Working Days:	**55**
Completion Date:	

Field Observations

1. Verified materials as specified.
2. Verified roof protection as EPDM, insulation, and plywood as specified.
3. Started cutting wall at 7:30 am.
4. Removed brick (8 courses per detail) on entire west elevation except at EJ. Installed shoring as needed.
5. Removed demolition debris from roof area, as progress was being made.
6. Colors selected for joint sealant (Buff) and brick joint sealant (Baptist Red). Colors approved with Campus.
7. Joint prep completed on south & east elevations.
8. Installed water tight details at end of day.
9. All materials were on pallets and covered at the end of the day.

Note: This report is prepared only for the purpose of recording field data. It is not a final report, nor does it imply either acceptance or rejection of work.

Masonry Construction Observation Report

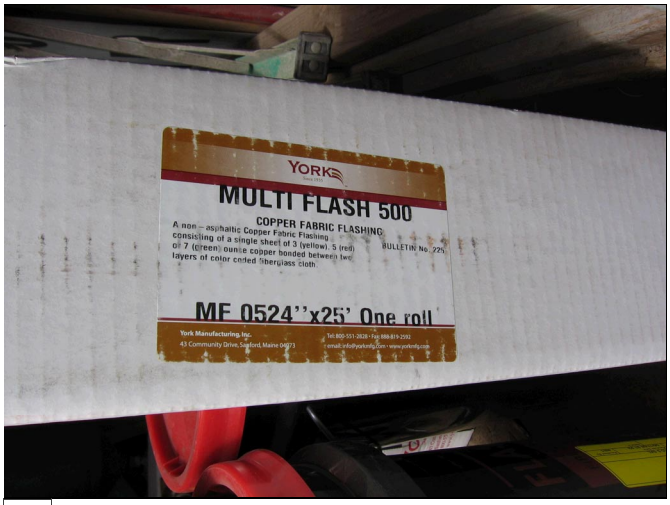
7/31/17

PHOTOS

1 Mortar

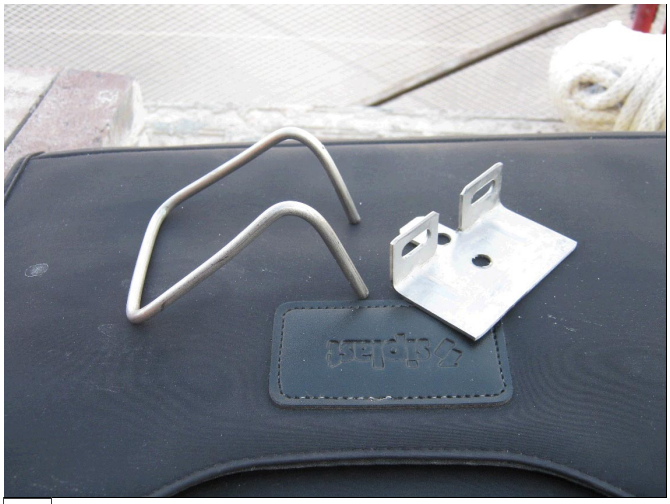
2 Brick

3 Brick



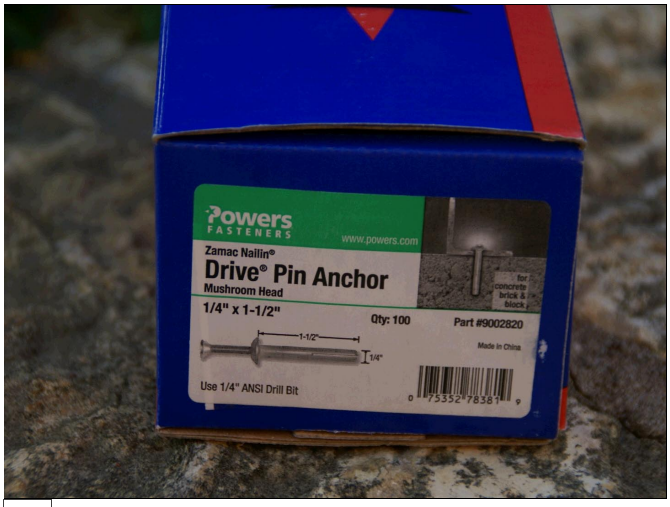
4 Through-wall flashing

5 Flashing sealant



6 Brick tie and pintle

Note: This report is prepared only for the purpose of recording field data. It is not a final report, nor does it imply either acceptance or rejection of work.



7 Termination bar fasteners

8 Weep rope

9 Pathway roof protection

10 Shoring

11 Shoring and roof protection

12 End of day cover

Note: This report is prepared only for the purpose of recording field data. It is not a final report, nor does it imply either acceptance or rejection of work.

Masonry Construction Observation Report

7/31/17

Sample Color Selection ***(Material Type and Description)***

Masonry Units:		**Paint:**	
Mortar:		**Sheet Metal:**	
Joint Sealant:	Stone-Buff, brick-Baptis		

Storage of Materials: materials on pallets and covered, in trailer in stroage area

Materials Remaining to be Identified: Mortar patch, joint sealant, backer rod

MATERIALS ON SITE

Material Type	Material Description	Meets Specification
Masonry Units	Hebron Brick & Souix City Brick	☑
Mortar Material(s)	Spec mix (see photo 1)	☑
Flashing Membrane	York 5 oz. Multi-Flash 500	☑
Flashing Sealant	UniverSeal US-100, polyether sealant manufactured by York Manufacturing, Inc.	☑
Masonry Ties	Eye and Pintle Tie, Veneer Anchor Plate and Pintle DA 5213	☑
Rope Weep	#12 3/8" rope	☑
Cavity Insulation	1" Foamular Owens Corning	☑

Note: This report is prepared only for the purpose of recording field data. It is not a final report, nor does it imply either acceptance or rejection of work.

APPENDIX B HYGROTHERMAL REPORT EXAMPLE

DATE:

PROJECT: Building
St. Paul, Minnesota

REPORTED TO:
Building Owner
St. Paul, Minnesota

EXTERIOR WALL SYSTEM EVALUATION

GENERAL

An exterior wall system evaluation was conducted at the Building in St. Paul, Minnesota. The evaluation included review of the original and the renovation construction drawings and hygrothermal modeling.

BACKGROUND INFORMATION

The building was originally constructed in 1907. The building was renovated and converted. The exterior wall construction consists of solid wall masonry construction, punch-style windows, and decorative stucco, wood cladding, and stone features.

DRAWING REVIEW

The original construction drawings prepared by an Architectural firm dated October 27, 1907, and the record set drawings prepared by another Architecture firm dated June 14, 2006, were reviewed.

Original Construction Drawings

The building section of the original construction drawings identify the exterior wall assembly as a 1'-1" thick masonry wall assembly constructed on top of a 3'-0" deep concrete footing. A complete set of original construction drawings including wall assembly details was not available.

Building Renovation Record Set

The wall section details of the record set architectural drawings show the original exterior wall assembly was modified by furring out the interior side of the wall assembly with a 3" insulated wall panel, a continuous vapor barrier, and gypsum board.

In the wall assembly adjacent to the new elevator and electrical rooms, a 4" block was installed on the interior side of the wall prior to installation of the insulation, vapor barrier, and gypsum board.

The exterior grade detail shows the middle and interior wythe of the original wall assembly extending down below grade behind the decorative stone and set on the foundation.

HYGROTHERMAL MODELING

Hygrothermal modeling is a design and forensic tool that allows the evaluation of moisture control characteristics of building envelopes. The WUFI® hygrothermal modeling software was used for this

evaluation. This program evaluates the transient effects of the climate conditions and material properties of a building section. The climate conditions are based upon the location and orientation of the building section being evaluated. The material properties take into consideration the initial conditions as well as the heat and moisture storage characteristics of each material in the building section.

For the Building, three wall assemblies (component assembly) were analyzed:

Component Assembly 1 – Current Exterior Wall Assembly Conditions

This wall assembly consisted of an exterior wythe of clay brick masonry, a cavity parged with mortar, a middle wythe of clay brick masonry, a cavity parged with mortar, an interior wythe of clay brick masonry, an air space with batt insulation, a polyethylene membrane, and gypsum board.

Component Assembly 2 – Current Exterior Wall Assembly Conditions without Batt Insulation

This wall assembly consisted of an exterior wythe of clay brick masonry, a cavity parged with mortar, a middle wythe of clay brick masonry, a cavity parged with mortar, an interior wythe of clay brick masonry, an air space, a polyethylene membrane, and gypsum board.

Component Assembly 3 – Original Wall Assembly

This wall assembly consisted of an exterior wythe of clay brick masonry, a cavity parged with mortar, a middle wythe of clay brick masonry, a cavity parged with mortar, and an interior wythe of clay brick masonry.

DISCUSSION AND CONCLUSIONS

Hygrothermal Modeling

The hygrothermal modeling results indicate that moisture accumulation within the wall assembly is likely to occur under the current conditions. This moisture accumulation is a separate source from the water absorption source previously discussed. The insulation and continuous vapor barrier that was added during the renovation appear to prevent the wall system from drying to the interior side. As a comparison, the wall assembly was modeled without the furring system's insulation and without the furring system in its entirety. In each of the subsequent models, moisture accumulation was reduced within the wall assembly, but the building's comfort and efficiency would be affected significantly.

The moisture accumulation is a concern for two reasons. As noted previously, the temperature gradient within the wall assembly has been modified as a result of the addition of insulation on the interior side of the wall assembly. Consequently, the combination of moisture accumulation and colder temperature within the masonry components in the wall assembly is likely to result in more deterioration within the wall assembly. The second concern is the moisture accumulation that is shown in the batt insulation of the wall assembly. The combination of moisture accumulation and favorable temperatures within the wall assembly could result in organic growth.

RECOMMENDATIONS

Based upon this investigation, we recommend considering either a short-term rehabilitation approach to address immediate needs, or a long-term rehabilitation approach if funding is available.

Short-term Rehabilitation:

1. To minimize the rate of deterioration in the middle wythe of the wall assembly leading, consult with a structural engineer to install masonry expansion anchor wall ties on the lower section of the wall. Prior to installation of the anchor wall ties, replace all spalled, deteriorated, or cracked masonry. Upon completion of installation of the anchor wall ties, solid tuck-point the lower section of the wall assembly.

2. To minimize the rate of water absorption occurring in the lower half of the wall assembly, install a waterproofing system on the full height of the foundation from the footing to behind the decorative stone. The sections of the stone currently damaged and the sections damaged during removal will need to be replaced. Surface preparation will be needed prior to installing a hot fluid-applied rubberized asphalt waterproofing system. The foundation will need to be evaluated by a structural engineer to assess the overall condition once it is exposed. Structural repairs including partial removal of the degraded concrete and installation of reinforced concrete will be needed.

3. Conduct a periodic monitoring program with a structural engineer for any deficiencies that could indicate deterioration within the wall assembly has begun to affect the structural integrity of the system.

4. Consult with an indoor air quality specialist to determine if moisture accumulation is occurring within the batt insulation of the wall assembly (as shown in the hygrothermal modeling).

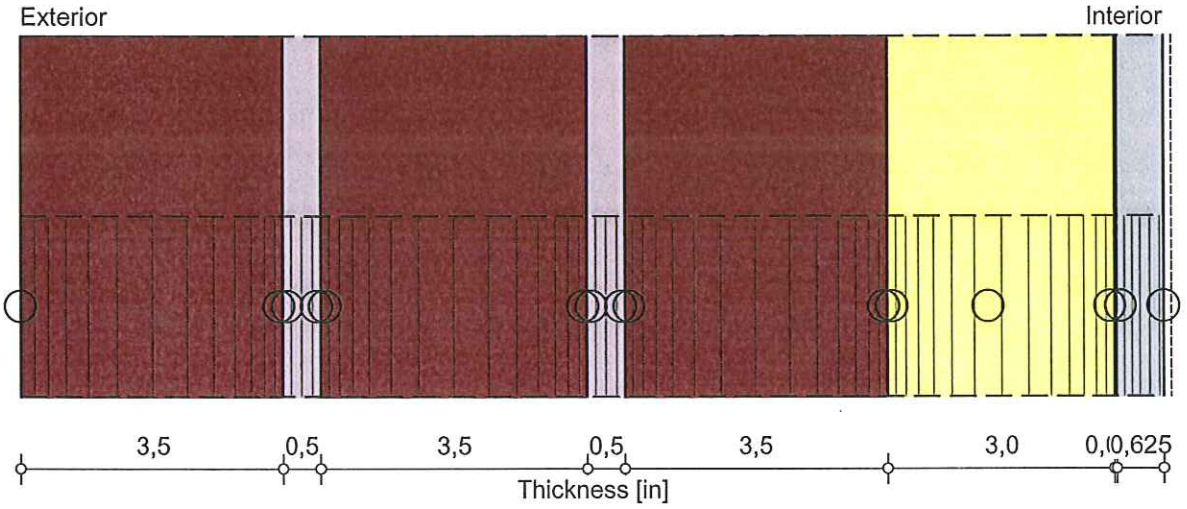
Long-term Rehabilitation:

1. To minimize the rate of water absorption occurring in the lower half of the wall assembly, install a waterproofing system on the full height of the foundation from the footing. Sections of the stone will need to be replaced. Surface preparation will be needed prior to installing a hot fluid-applied rubberized asphalt waterproofing system. Surface preparation includes installation of a skim coat. Structural repairs including partial removal of the degraded concrete and installation of reinforced concrete will be needed.

2. Temporarily support the building while removing and replacing the perimeter exterior masonry wall from the bottom of the wall bearing upon the foundation system.

Component Assembly 1

Case: Brick Masonry Solid Wall/3" batt/PE/Gyp



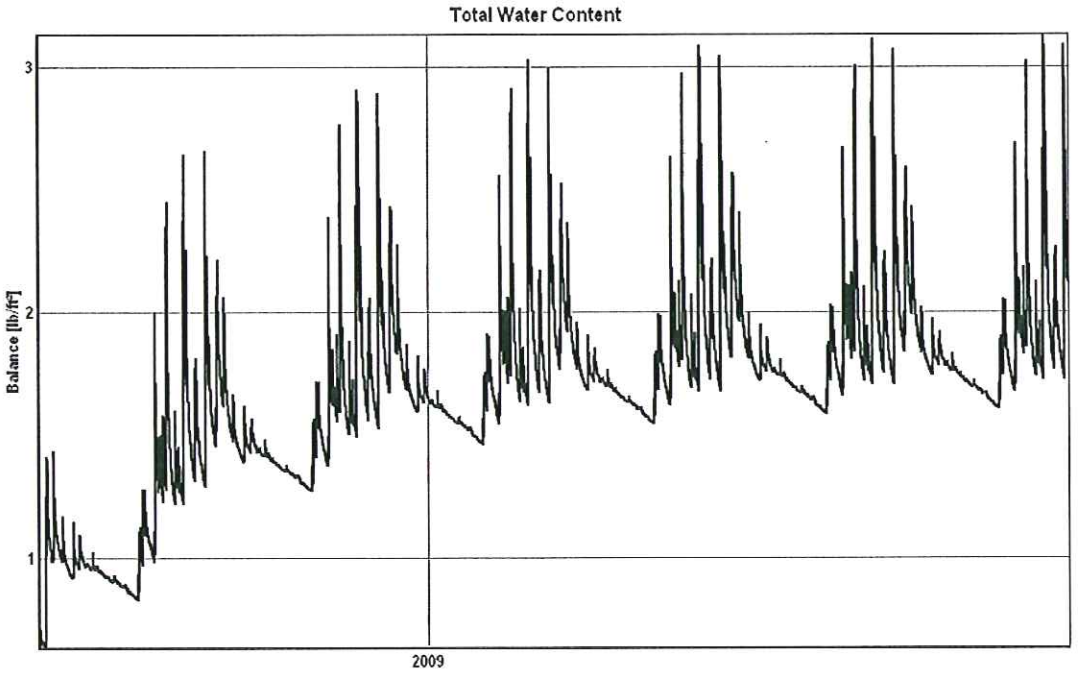
◯ - Monitor positions

Materials :

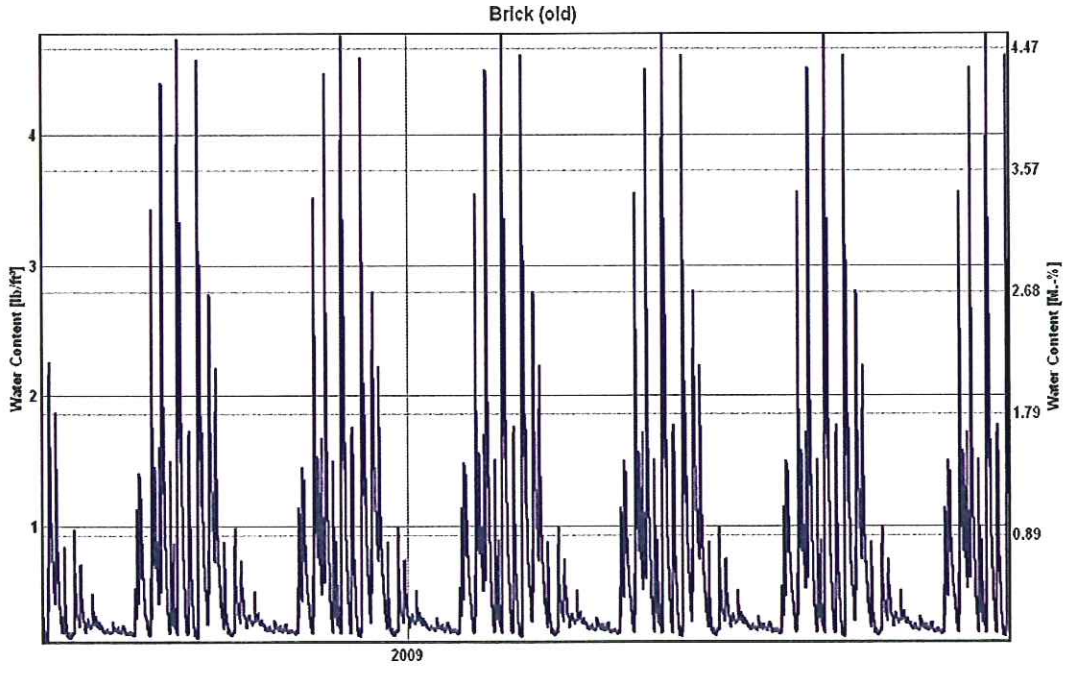
- Brick (old)
- Masonry Cement Mortar - Type N
- Brick (old)
- Masonry Cement Mortar - Type N
- Brick (old)
- Fibre Glass
- PE-Membrane (Poly; 0.07 perm)
- Gypsum Board (USA)

Total Thickness: 15,16 in
R-Value: 17,16 h ft² °F/Btu
U-Value: 0,055 Btu/h ft²°F

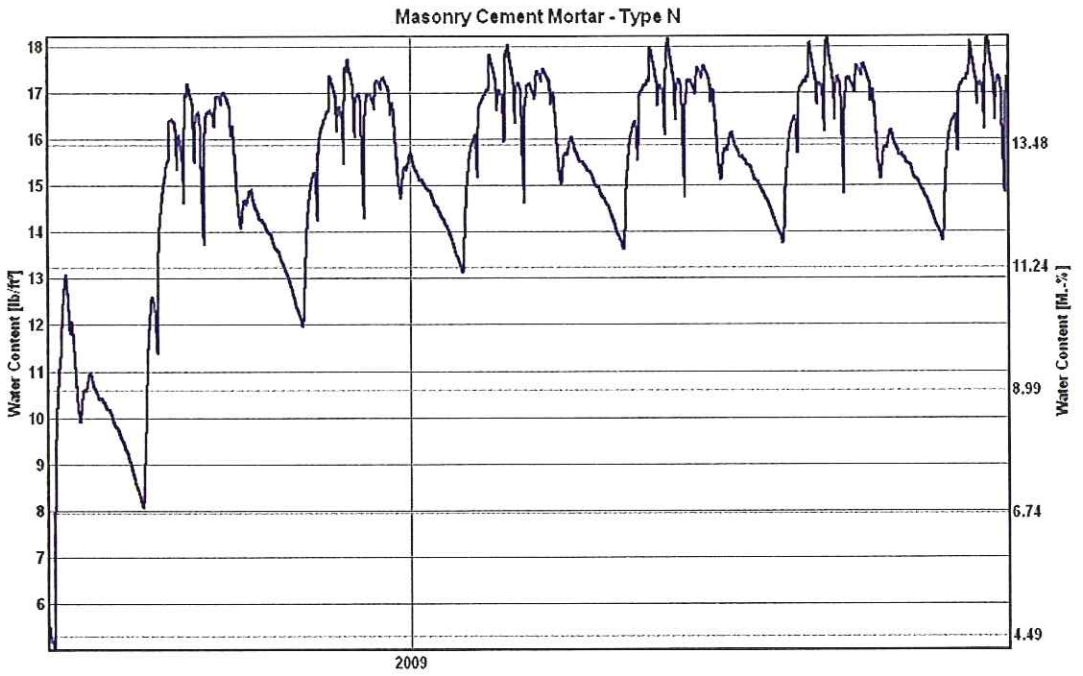
CA 1 – TWC



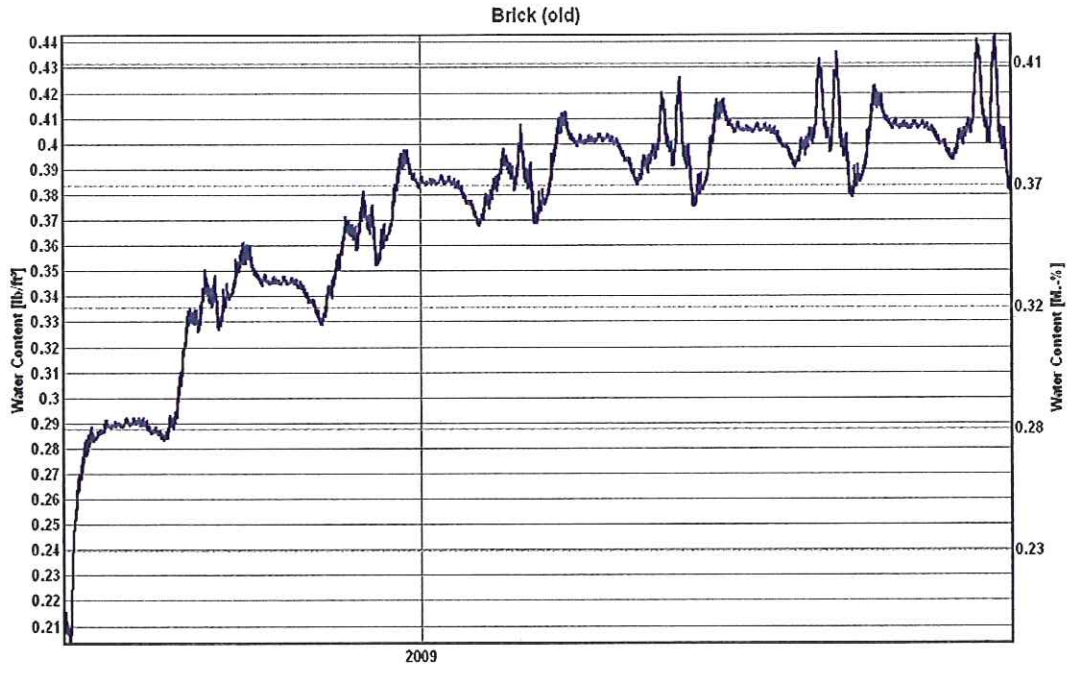
CA 1 – WC – Brick



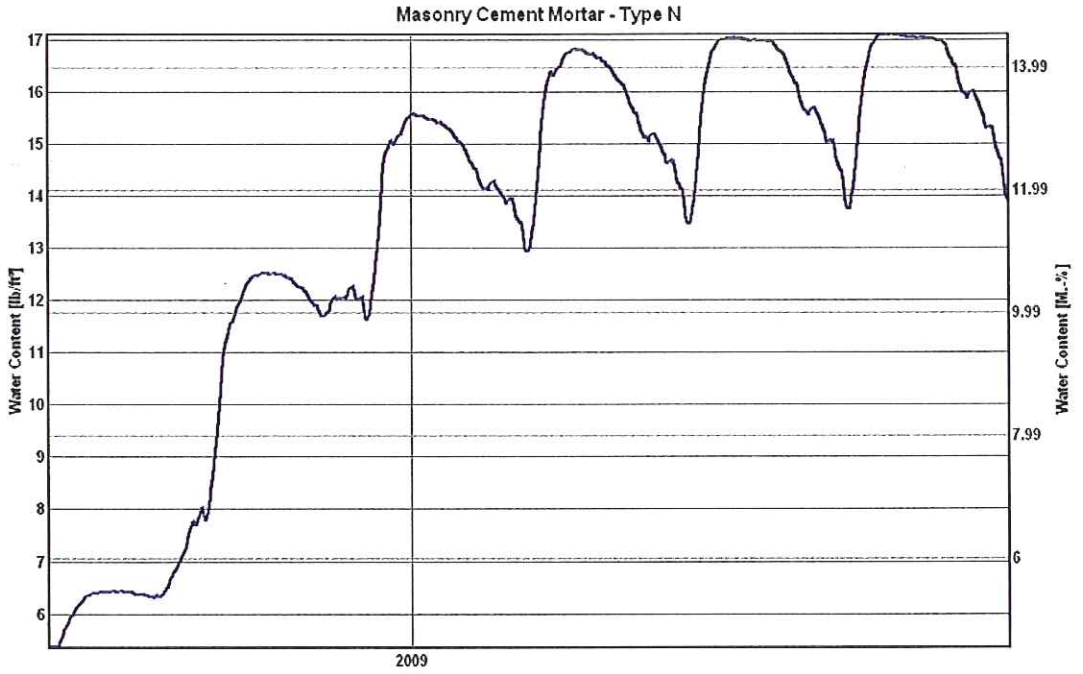
CA 1 – WC – Mortar



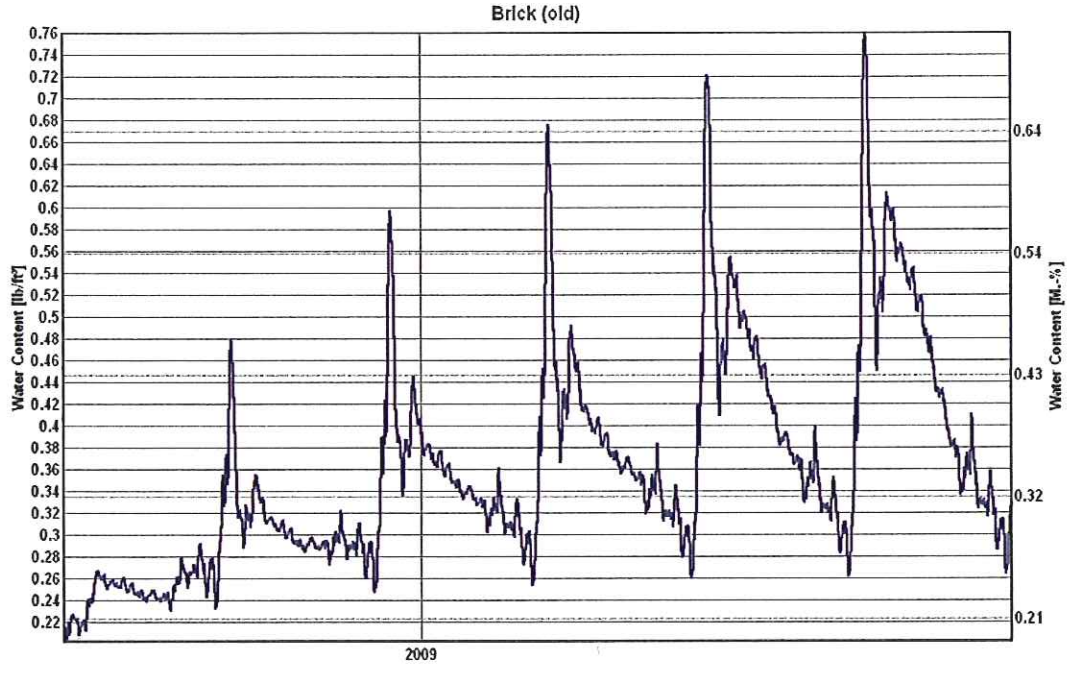
CA 1 –WC – Brick



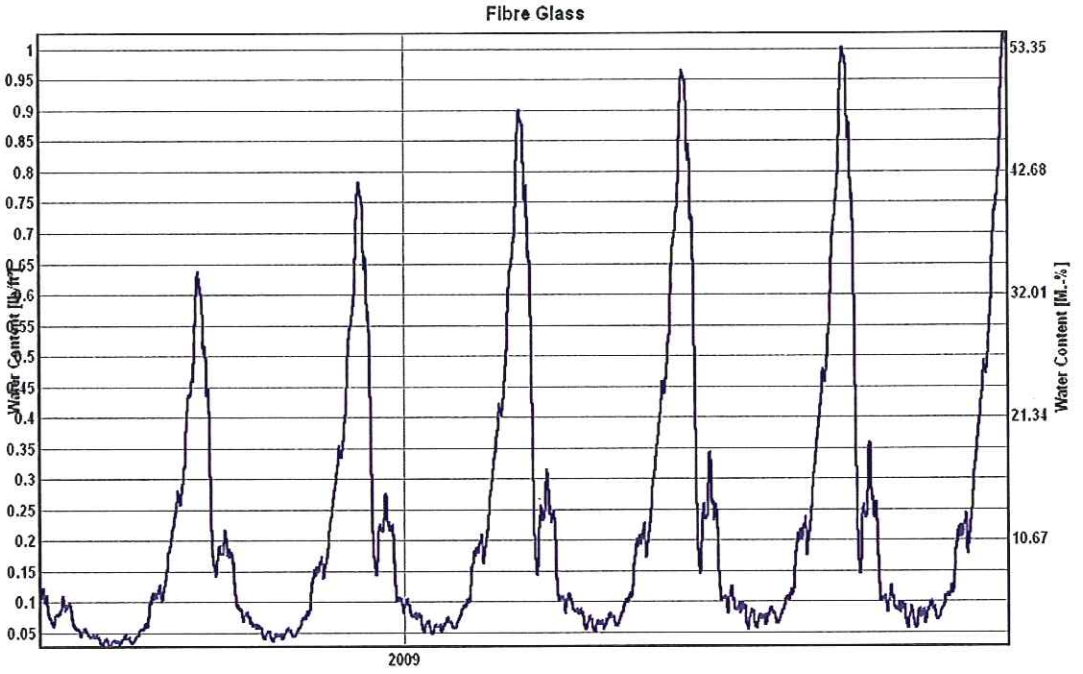
CA 1 – WC – Mortar



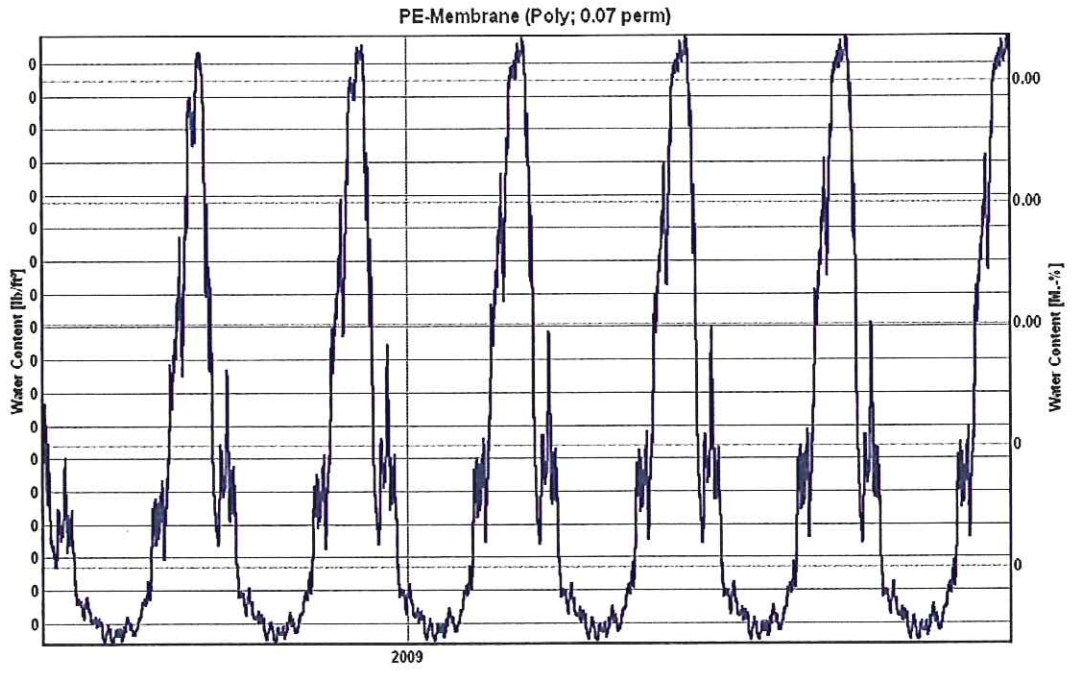
CA 1 – WC – Brick



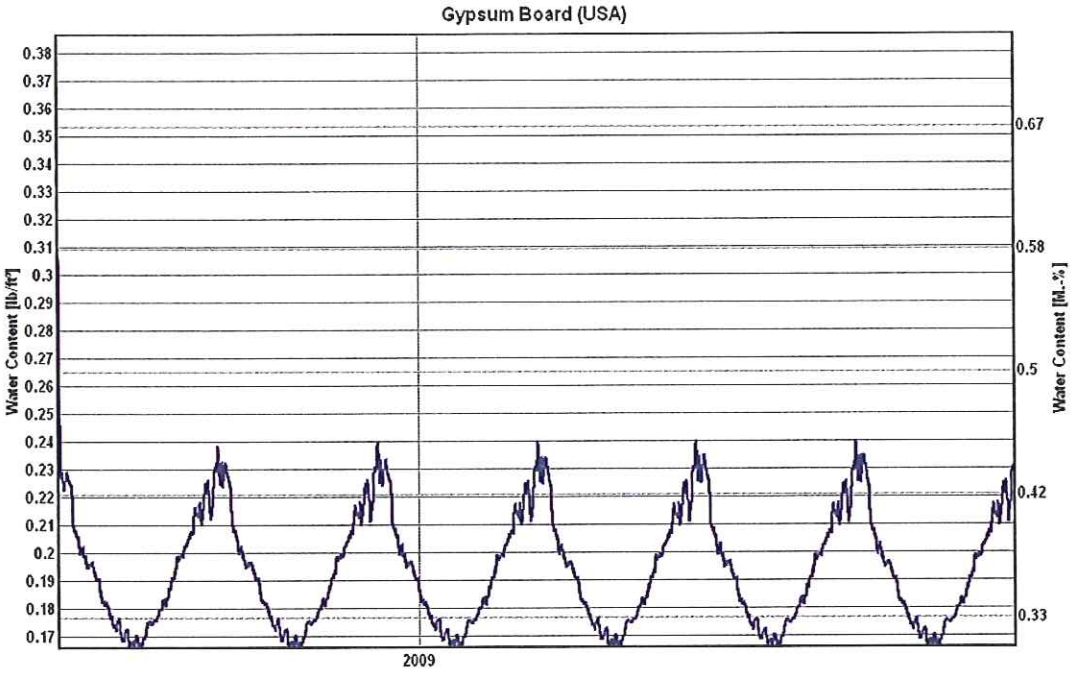
CA 1 – WC – Fiber Glass Insulation



CA 1 – WC – Poly

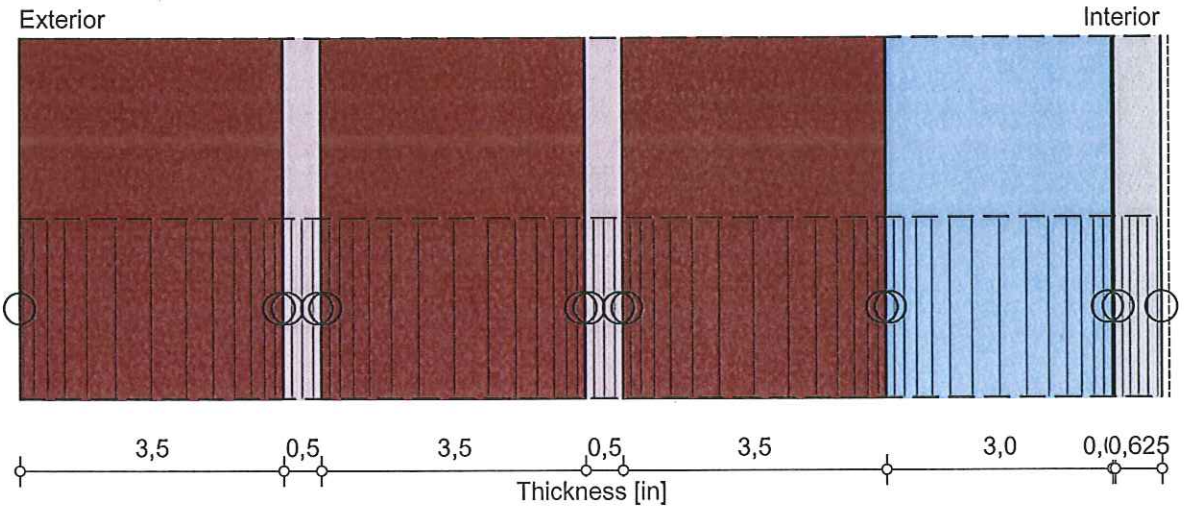


CA 1 – WC – Interior Gypsum



Component Assembly 2

Case: Brick Masonry Solid Wall/3" Air/PE/Gyp



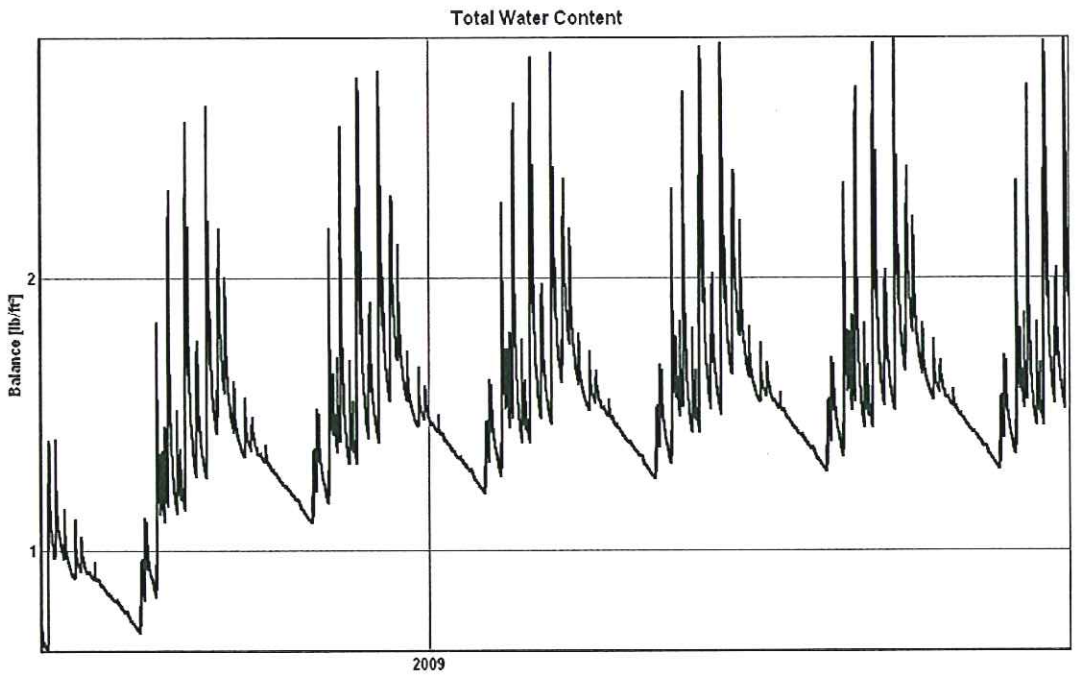
◯ - Monitor positions

Materials :

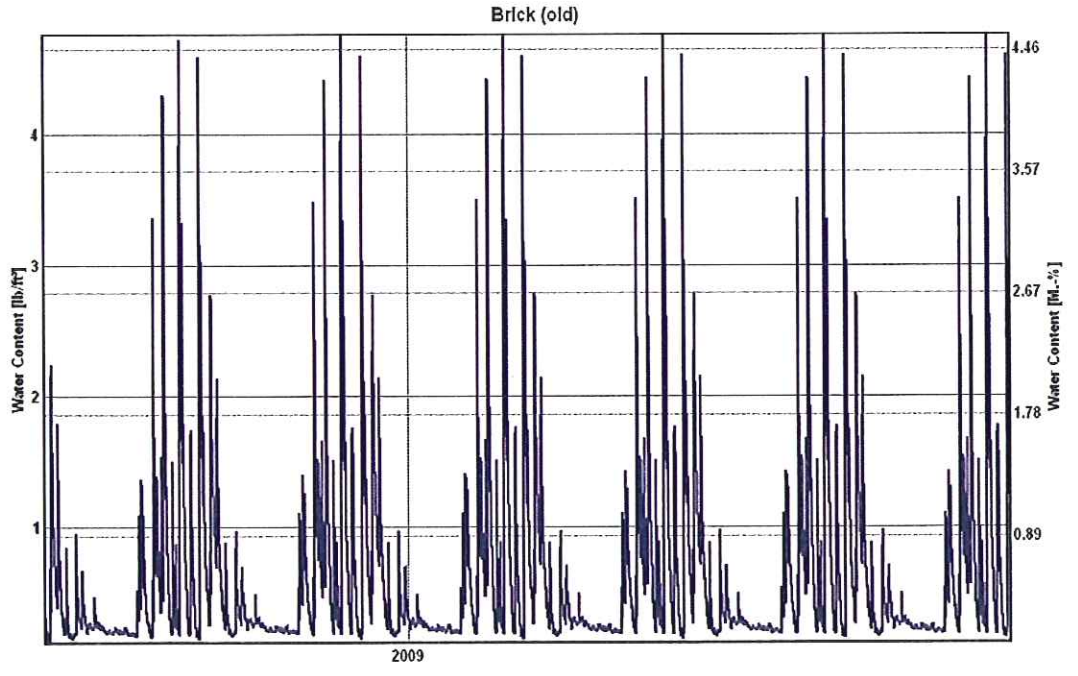
- Brick (old)
- Masonry Cement Mortar - Type N
- Brick (old)
- Masonry Cement Mortar - Type N
- Brick (old)
- Air Layer 50 mm
- PE-Membrane (Poly; 0.07 perm)
- Gypsum Board (USA)

d-Value Int. [perm]: 10
R-Value: 6,2 h ft² °F/Btu
U-Value: 0,138 Btu/h ft²°F

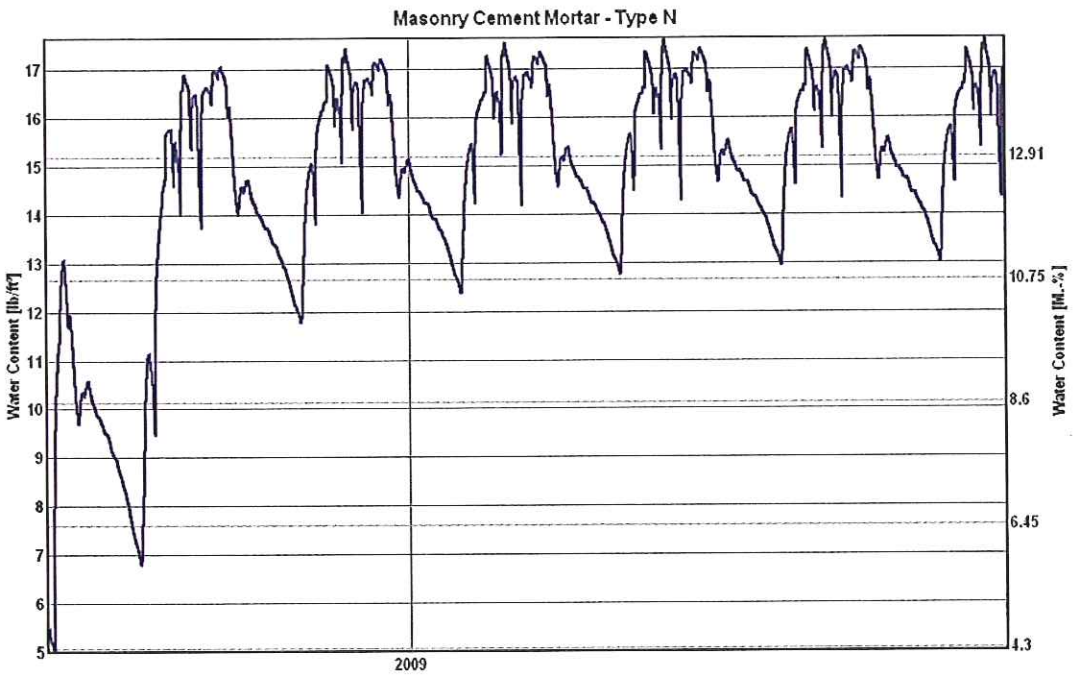
CA 2 – TWC



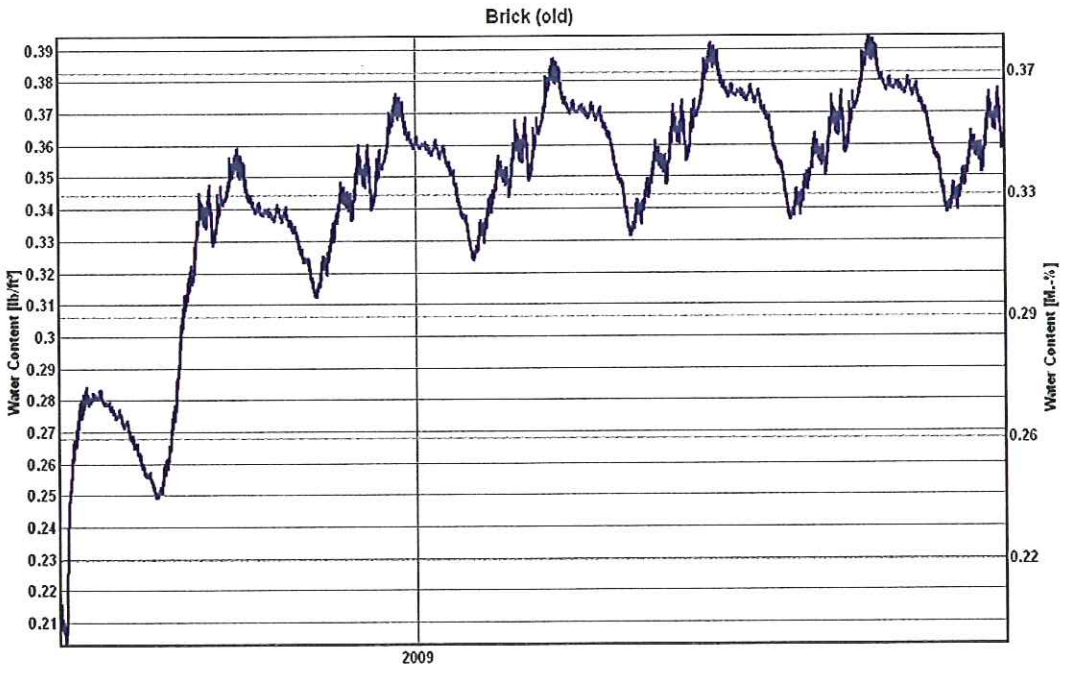
CA 2 – WC - Brick



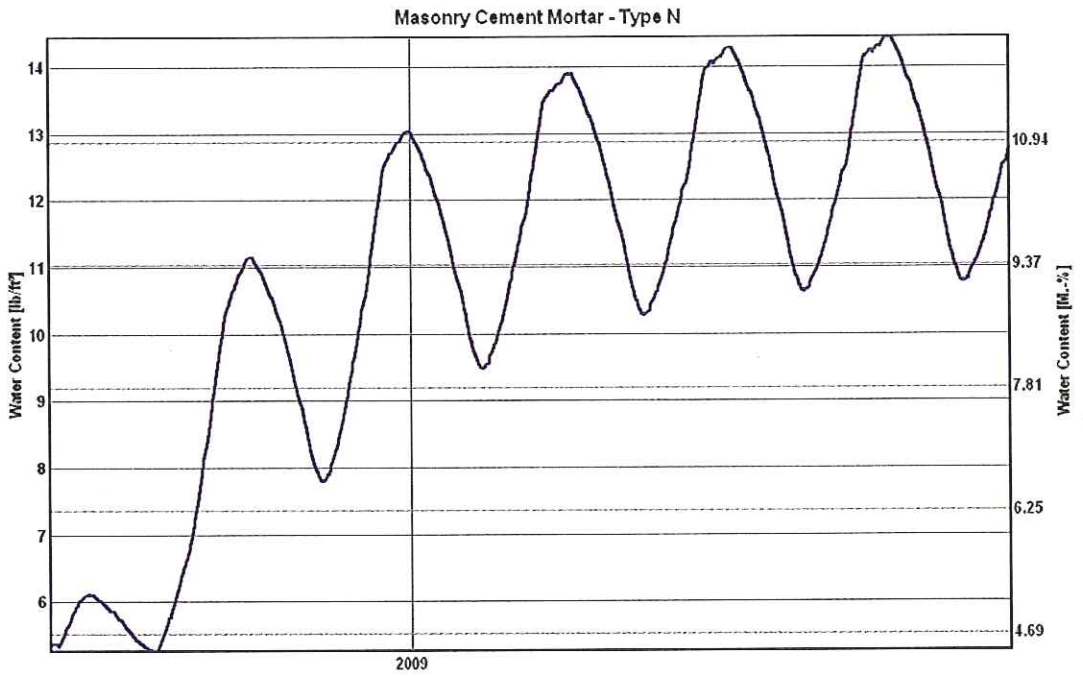
CA 2 – WC - Mortar



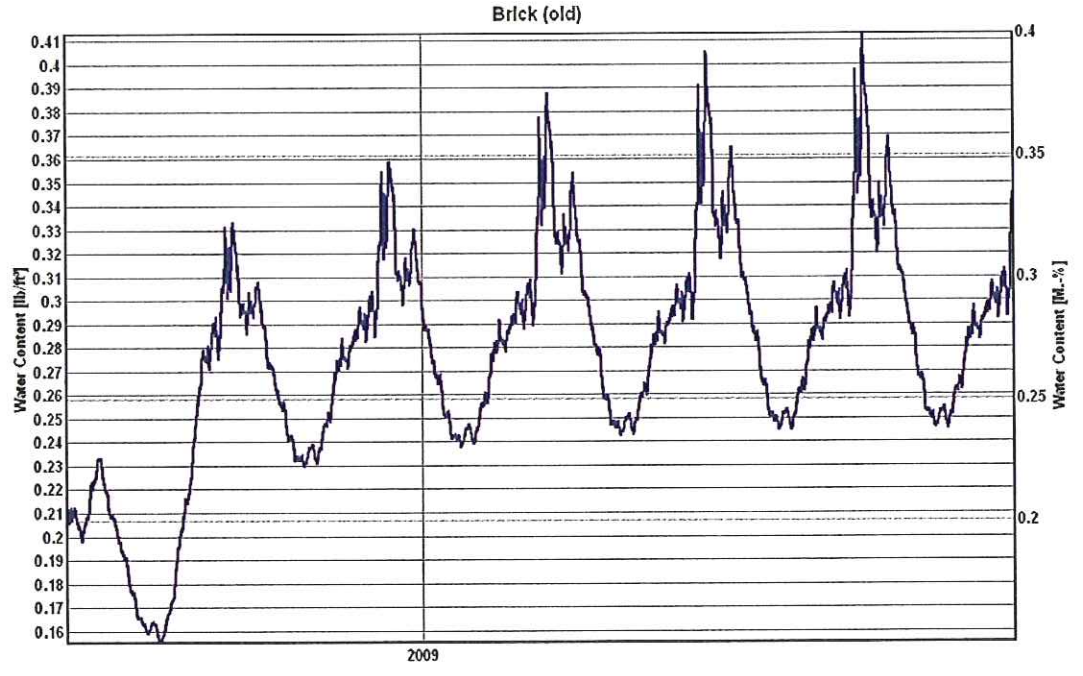
CA 2 - WC – Brick



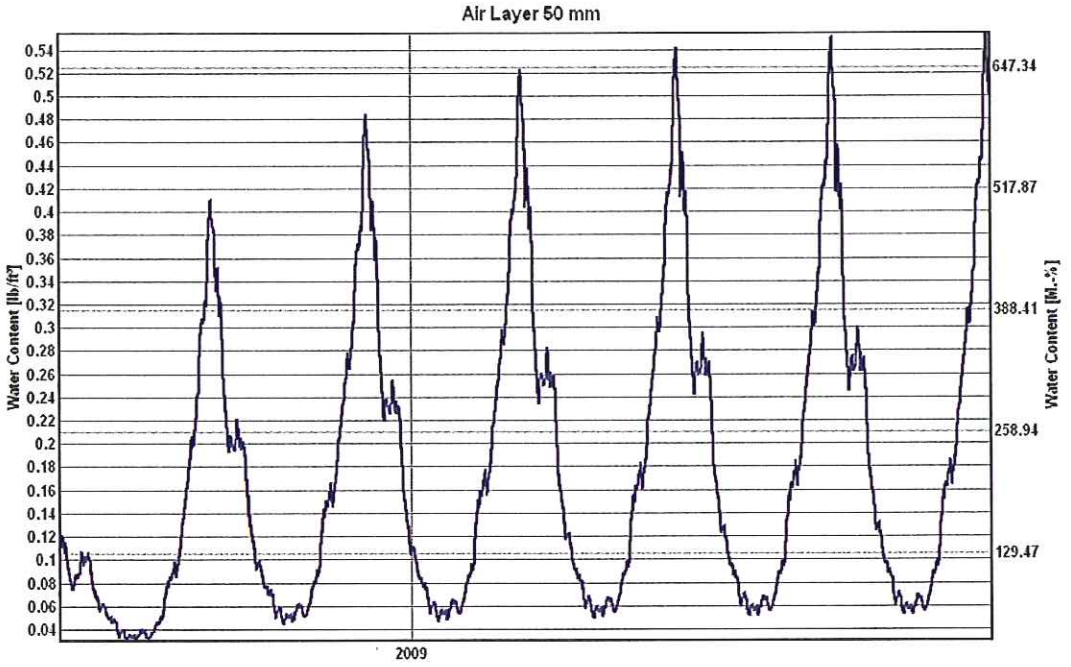
CA 2 – WC - Mortar



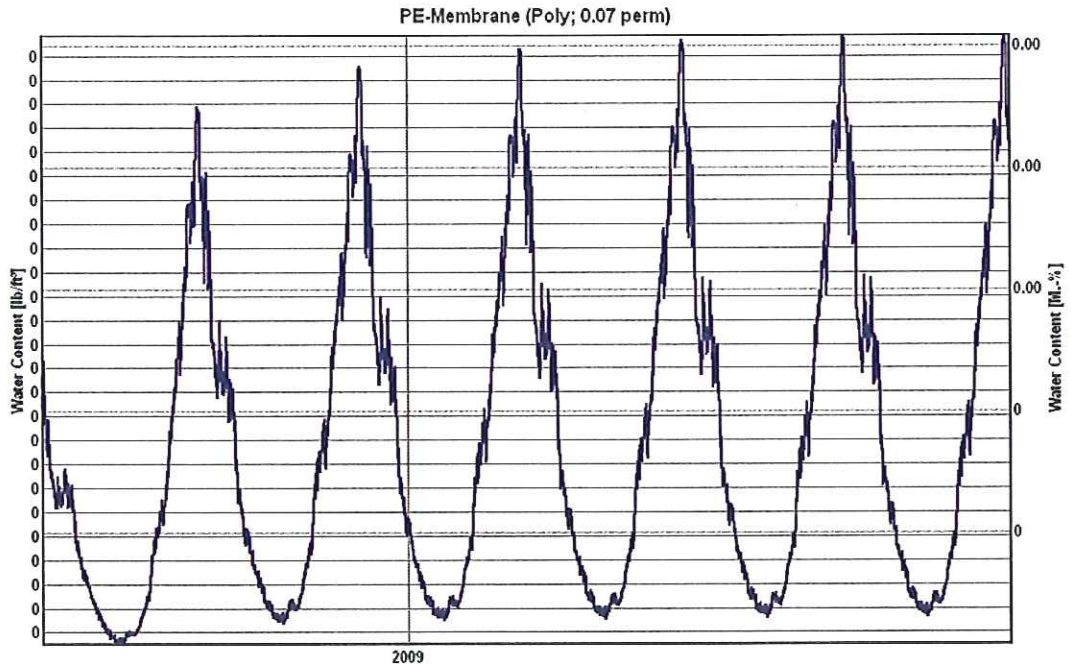
CA 2 – WC - Brick



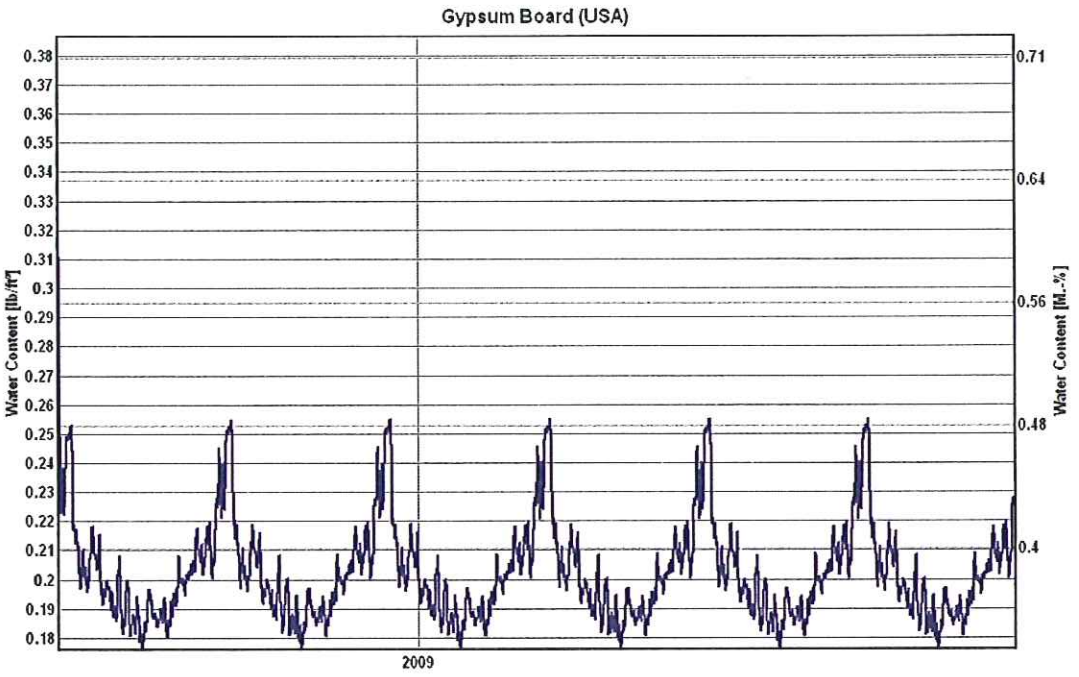
CA 2 – WC – Air Layer



CA 2 – WC – PE Membrane

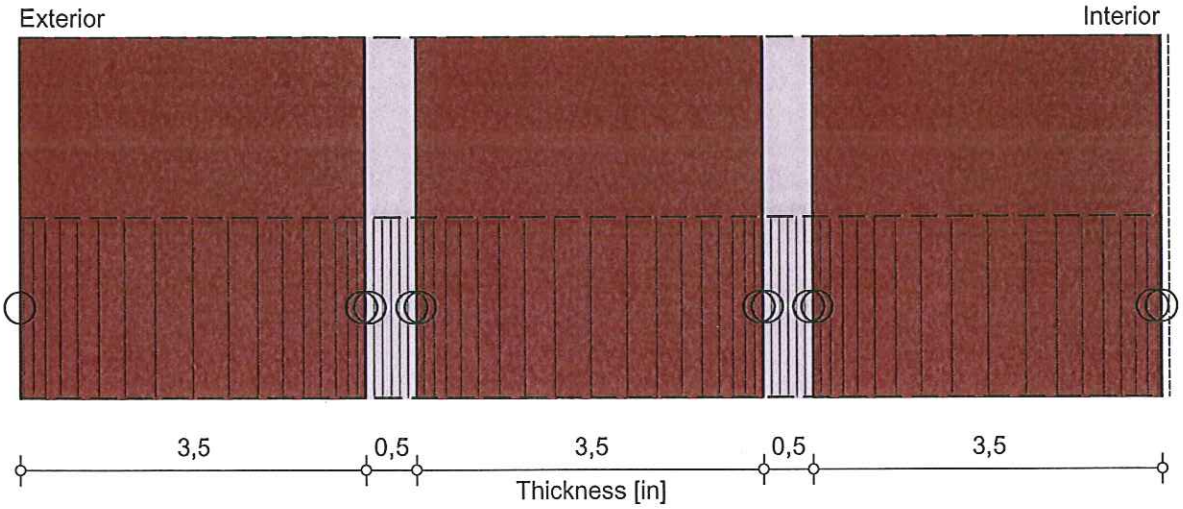


CA 2 – WC – Gypsum Board



Component Assembly 3

Case: Brick Solid Wall



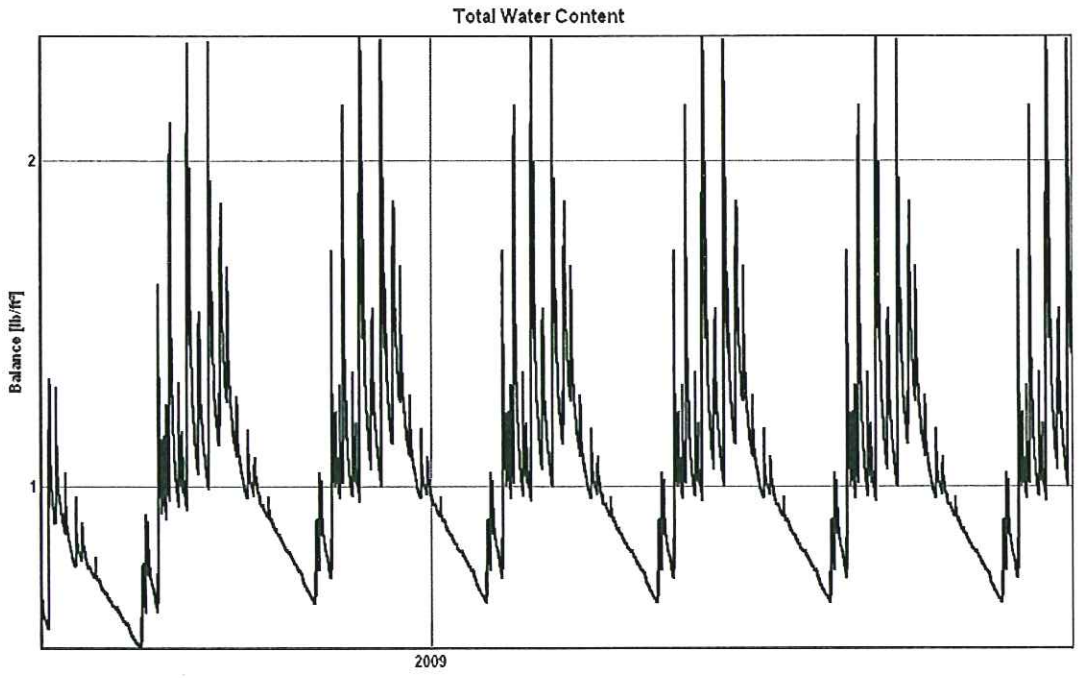
◯ - Monitor positions

Materials :

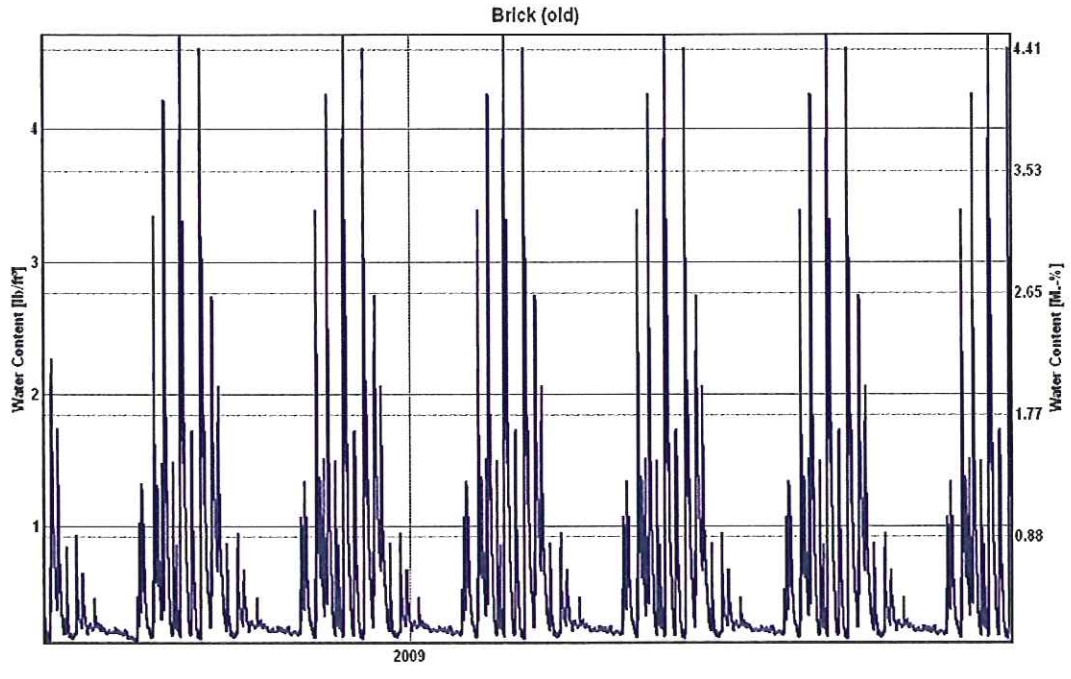
- Brick (old)
- Masonry Cement Mortar - Type N
- Brick (old)
- Masonry Cement Mortar - Type N
- Brick (old)

Total Thickness: 11,5 in
R-Value: 4,1 h ft² °F/Btu
U-Value: 0,194 Btu/h ft²°F

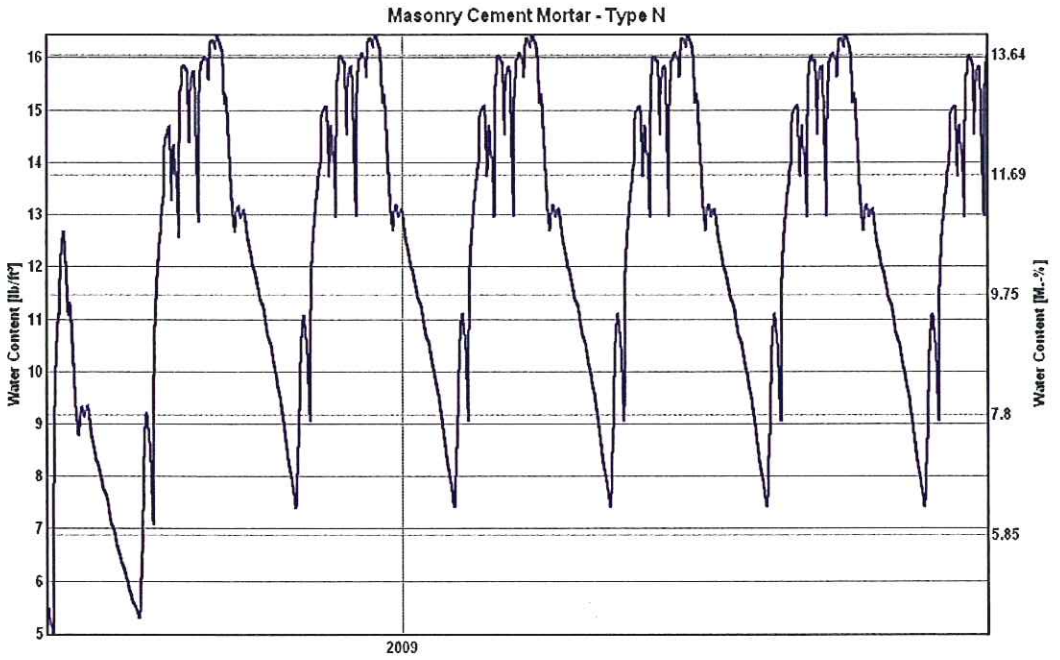
CA 3 - TWC



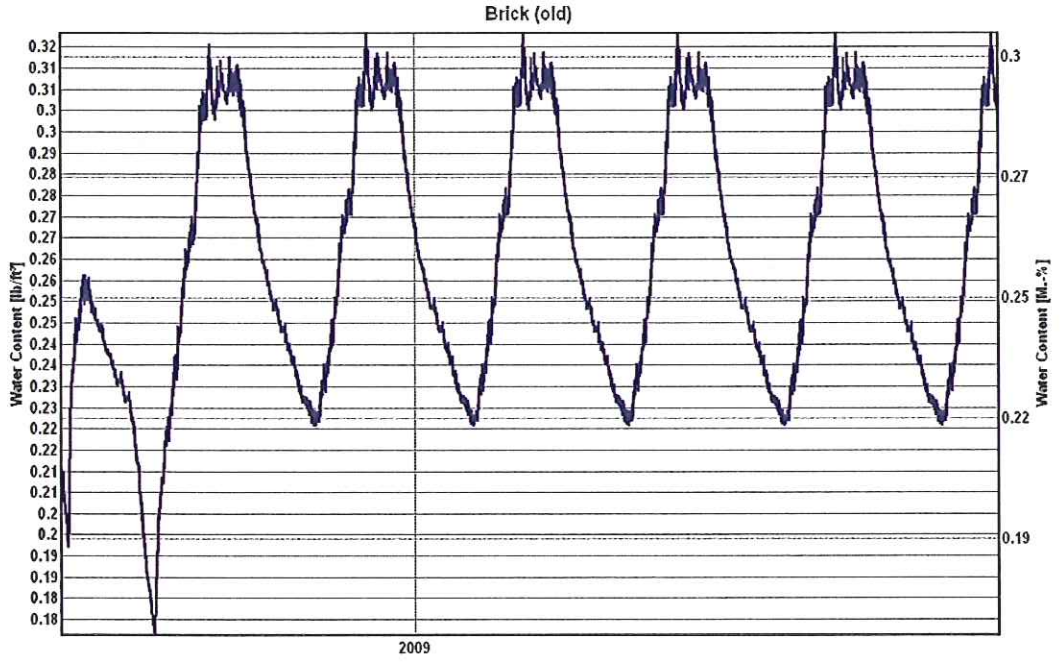
CA 3 – WC – Brick



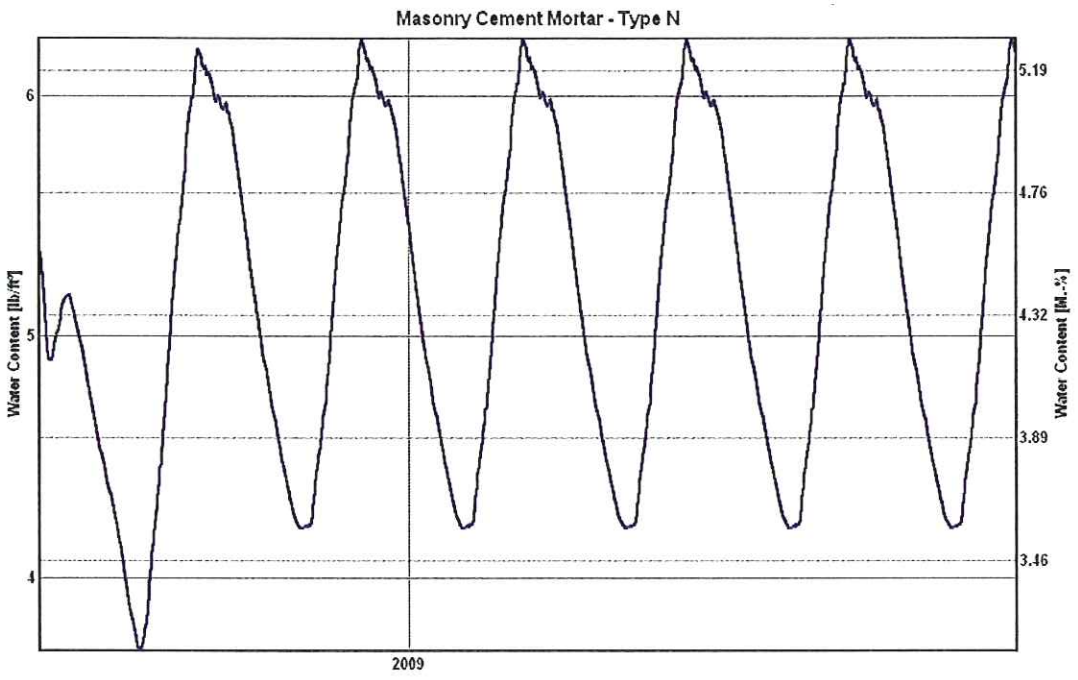
CA 3 – WC – Mortar



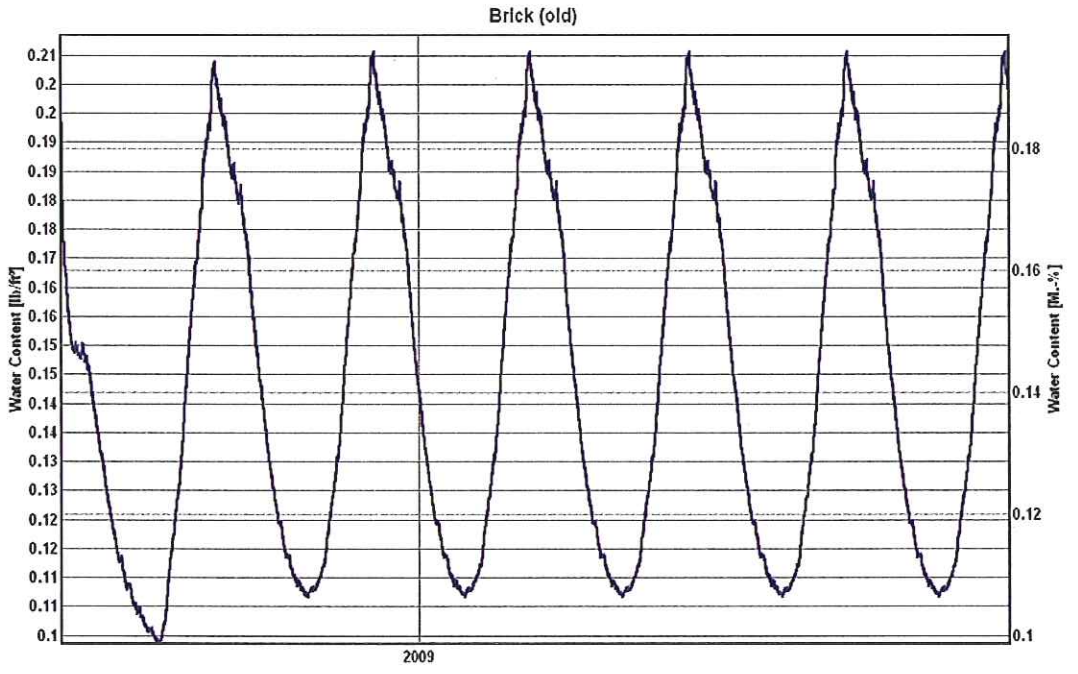
CA 3 – WC – Brick



CA 3 – WC – Mortar



CA 3 – WC – Brick



APPENDIX C

Exterior Masonry Design Standard Resources

The resources listed below are largely websites that also contain publications and other resources not included on this list. The following is not an exhaustive list, but includes the more qualified organizations for current standards and industry practices.

GENERAL STANDARDS

Websites

ASTM International or American Society for Testing and Materials (Pennsylvania)
Standards for materials and testing, as well as design and installation practices.

https://www.astm.org/

ANSI - American National Standards Institute (Washington, DC)

https://www.ansi.org/

ASHRAE - American Society of Heating, Refrigeration, and Air-Conditioning Engineers (Georgia)

https://www.ashrae.org/

GREENGUARD - GREENGUARD Environmental Institute (Georgia)
ANSI authorized standards developer, indoor air standards.

http://greenguard.org/en/index.aspx

Publications

"Standard Guide for Reduction of Efflorescence Potential in New Masonry Walls", ASTM C1400.

"Criteria for Moisture-Control Design Analysis in Buildings", ANSI/ASHRAE Standard 160.

"Environmental Institute Mold and Moisture Management Standard for New Construction", ANSI/GEI – MMS1001.

DESIGN AND BUILDING ENVELOPES

Websites

NIBS - National Institute of Building Sciences (Washington, DC)
Building Enclosure Council National and other councils and projects for the built environment.

https://www.nibs.org/

WBDG - Whole Building Design Guide (Washington, DC)

https://www.wbdg.org/

Buildings Canada - Building Envelope Forum (Canada)
Newsletters and information on building envelopes.

www.buildingscanada.com/

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Building Science Corporation (Massachusetts): a consulting and architecture firm is an industry recognized leader in building technology for commercial, institutional, and residential applications.

https://buildingscience.com /

EXTERIOR WALL SYSTEM MATERIALS

Air Barriers

Websites

Air Barrier Association of America (Massachusetts)

https://www.airbarrier.org/

National Air Barrier Association (Canada)

www.naba.ca/

Masonry (Brick and Block)

Websites

The Masonry Society (TMS, Colorado): is an educational, scientific, and technical society dedicated to the advancement of scientific, engineering, architectural, and construction knowledge of masonry.
Masonry Standards Joint Committee (MSJC)

Develops masonry design and construction standards for adoption into building code.

"Building Code Requirements and Specification for Masonry Structures", TMS 402 / 602.

https://masonrysociety.org/

Brick Industry Association (BIA, Virginia)
Technical notes and resources for clay brick masonry.

www.gobrick.com/

Imiweb -International Masonry Institute (IMI, Maryland)
Design tools and education for masonry.

http://imiweb.org/

NCMA - National Concrete Masonry Association (Virginia)
Technical notes and details for concrete masonry.

https://ncma.org/

Publications

The Masonry Society, "Masonry Designers' Guide - 2013", Eighth Edition, The Masonry Society, 2013.

Beall, NCARB, CCS, Christine; "Masonry Design and Detailing", Sixth Edition, McGraw-Hill, 2012.

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Drysdale, Ph.D., Robert; and Hamid, Ph.D., Almad; "Masonry Structures, Behavior and Design", Third Edition, The Masonry Society, 2008.

Jaffe, Rochelle C. "Masonry Instant Answers", McGraw-Hill, 2004.

Klingner, Ph.D., Richard; "Masonry Structural Design", The Masonry Society, 2012.

Laska, Walter, "Masonry and Steel Detailing Handbook", Hanley Wood, Inc.; 1993.

Stone

Websites

MIA + BSI -Marble-institute - Marble Institute of America (MIA, Ohio) and Building Stone Institute (BSI, New York)

https://www.marble-institute.com/

iliai - Indiana Limestone Institute of America (ILIA, Indiana)

http://iliai.com/

Stucco

Websites

Mnlath-plaster - Minnesota Lath & Plaster Bureau (Coon Rapids, MN)

www.mnlath-plaster.com/

PCA - Portland Cement Association (PCA, Illinois)
Stucco, masonry, and other concrete uses.

www.cement.org/

HYGROTHERMAL AND HEAT TRANSFER ANALYSIS

Websites

WUFI: software and support for hygrothermal computer modeling

https://wufi.de/en/

LBL Windows & Daylighting Group – Lawrence Berkley National Laboratory: Therm software download from Lawrence Berkeley National Laboratory (LBNL) for heat transfer modeling

https://windows.lbl.gov/

ORNL - Oak Ridge National Laboratory, Building Technologies Research and Integration Center (Tennessee)
Other energy calculators, fact sheets, and other resources for all types of buildings.

https://www.ornl.gov/

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Publications

Hill, Duncan. “Review of Hygrothermal Models for Building Envelope Retrofit Analysis”, Technical Series 03-128, Housing Research at CMHC (Canada Mortgage and Housing Corporation).

Kunzel, Hartwig, Karagiozis, Ph.D., Achilles; and Holm, Andreas. “Chapter 9 - A Hygrothermal Design Tool for Architects and Engineers (WUFI ORNL/IBP)”, MNL 40-EB, Moisture Analysis and Condensation Control in Building Envelopes, ASTM, January 2001.

Parker, Philip and Lozinsky, Cara. “Thermal and Hygrothermal Analysis in Building Envelope Commissioning”, BEST2 Conference 2010.

Straube, John, and Burnett, Eric. “Chapter 5 - Overview of Hygrothermal (HAM) Analysis Methods”, MNL 40-EB, Moisture Analysis and Condensation Control in Building Envelopes, ASTM, January 2001.

APPENDIX D

Contractor's Exterior Masonry Project Checklist

Project Name: _____ **Bid Open:** _____

Architect/Engineer: _____ **Notice-To-Proceed:** _____

Owner's Representative: _____ **Fully Executed Contract:** _____

Campus: _____ **Preconstruction Meeting:** _____

Minnesota State Contact: _____ **Pre-installation Meeting:** _____

Third Party Observer: _____ **Substantial Completion:** _____

Testing Agency: _____ **Full Completion:** _____

Instructions: Edit this checklist to fit project specifics as it is general in nature and provided as a basis for any size projects that include exterior masonry.

Date initiated	When occurring ---------- Activity	A/E	Owner's Rep.	Campus	MnSCU Office	3rd party Observer	Testing Agency	Comments
	After Bid Opening							
	Forward list of subcontractors	X						
	Forward subcontractor's references and project experience, if requested	X						
	After Notice-To-Proceed							
	Forward signed contracts, certificate of insurance, bonds, and other requested documents				X			
	Identify 3rd Party Observer and Testing Agencies for coordination of meetings and site visits	X	X	X	X			
	Prepare construction schedule submittal identifying preconstruction and pre-installation meetings, mock-up construction, and testing dates for masonry units, mortar, and air barrier	X				X	X	

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Date initiated	When occurring ---------- Activity	A/E	Owner's Rep.	Campus	MnSCU Office	3rd party Observer	Testing Agency	Comments
	Secure, review, sign, and forward subcontractor submittals of: product data, shop drawings, mix designs, material certifications, and manufacturer's test reports	X				(X)	(X)	
	Prepare and submit hot and cold weather construction procedures for masonry and air barrier work	X				(X)		
	Prepare and submit mock-up shop drawings	X				(X)	(X)	
	Resubmit any requested or required submittals	X				(X)	(X)	
	Confirm all required submittals as approved	X						
	Preconstruction meeting							
	Coordinate preconstruction meeting date, time, and location	X	X	X	X	X	X	
	Contact all subcontractors and require attendance by subcontractor site supervisors							
	Secure and deliver color samples for review during meeting	X	X	X	X	(X)		
	Prepare and distribute emergency phone number list identifying key construction and campus personnel	X				(X)		
	Tentatively set pre-installation meeting date, time, location, attendees, agenda, and testing	X	X			X	X	
	Tentatively set mockup location and meeting date for wall system construction with materials onsite and required attendance by actual installers, 3rd Party observer, and testing agencies	X	X			X	X	May include installers for waterproofing, masonry, air barriers, windows, and roofing
	Tentatively set mockup testing dates and times for masonry, air barrier, and windows	X	X			X	X	
	Tentatively set mockup review meeting after completed	X	X	X	X	(X)		
	Review meeting minutes and forward comments	X						

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Date initiated	When occurring ---------- Activity	A/E	Owner's Rep.	Campus	MnSCU Office	3rd party Observer	Testing Agency	Comments
	Pre-installation meeting							
	Coordinate pre-installation meeting date, time, and location	X	X	X		X	X	
	Contact masonry subcontractor and require attendance by the actual site supervisor and mortar batcher							
	Review and discuss masonry details, schedule, observation, testing, and other items identified in the project manual	X	X			X	X	
	Review meeting minutes and forward comments	X						
	Review and forward pre-installation testing reports	X				(X)		
	Mockup							
	Construct foundation, backer wall, and required bracing							
	Deliver mockup materials to site							
	Conduct mockup construction meeting with actual installers, 3rd Party Observer(s), and Testing Agency to discuss system transitions and tests	X				X	X	May include observers for waterproofing, masonry, air barriers, windows, and roofing
	Construct mockup in a continuous fashion with all actual installers for each system in the project and observation by the 3rd Party Observer					X		
	Complete and clean mockup for review							
	Conduct review meeting of completed mockup	X	X	X	X	(X)		
	Review meeting minutes and forward comments	X						
	Review and forward mockup testing reports	X				(X)		
	Construction							
	Coordinate progress meeting attendance of 3rd Party Observer(s) and Testing Agency		(X)			X		

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Date initiated	When occurring ---------- Activity	A/E	Owner's Rep.	Campus	MnSCU Office	3rd party Observer	Testing Agency	Comments
	Contact and schedule 3rd Party Observer for backer wall installation		(X)			X		
	Contact and schedule 3rd Party Observer for special inspections of structural installations as specified by Structural Engineer		(X)			X		
	Contact 3rd Party Observer for air barrier detailing and installation		(X)			X		
	Contact and schedule 3rd Party Observer for through-wall flashing installation		(X)			X		
	Contact and schedule 3rd Party Observer for exterior masonry installation and testing		(X)			X		
	Contact and schedule Testing Agency for masonry, mortar, and grout testing; and coordinate with 3rd Party Observer		(X)			X	X	
	Review and forward construction testing reports	X				(X)		
	Review 3rd Party Observer field reports							
	Conduct final walkover of exterior masonry with masonry subcontractor and interested parties	X	X	X	X	X		
	Closeout							
	Review completed punchlist items before scheduling final walkover							
	Confirm all testing agency reports were received and forwarded							
	Secure and forward specified workmanship and manufacturer's warranties with specified closeout documents	X						

APPENDIX E

Structural Engineer's Checklist for Exterior Masonry

This checklist is general in nature and intended to address the structural aspect of exterior masonry. All projects must meet, as a minimum requirement, the Masonry Standards Joint Committee (MSJC) "Building Code Requirements and Specification for Masonry Structures". The Structural Engineer will need to edit the following checklist to meet the specific project requirements that meet and exceed the MSJC.

Design – Project Manual

Part 1

1. Compressive strength requirements: Specify f'm, except for veneer and stone construction.
2. Unit strength method: Specify required grout compressive strength if greater than 2,000 psi.
3. Preconstruction testing: Specify the required testing for the project that may include mortar compressive strength, grout compressive strength, masonry unit properties, grout demonstration panel, and mock-up for final cleaning.
4. Services and duties of: Testing agency and special masonry inspection agency for structural elements. Refer to Tables 3, 4, or 5 in MSJC Specification for Masonry for minimum requirements.
5. Specify any unusual or other specific structural details or project requirements and related testing.

Part 2

1. Mortar: Type of mortar for each type of masonry unit for structural elements.
2. Bar reinforcement: Type and grade of bar reinforcement for structural elements.
3. Masonry units: Compressive strength minimum.
4. Joint reinforcement, ties, and anchors: Two longitudinal wires in CMU for joint reinforcement and corrosion protection, typically stainless steel.

Part 3

1. Placement tolerances: Distance for beams and distance from compression to compression (relative to openings) on drawings or as a schedule in the specifications.
2. Anchor: Type of anchor for structural elements.
3. Bar reinforcement: Specify required lap splice length for each size of bar reinforcement.
4. Masonry units: Specify cross-webs of hollow units to be mortared for partially grouting.
5. Corners: Specify if movement joints are required in structural walls or if corners are to be structurally continuous. For structurally continuous, specify 50% unit interlock, grouted-in anchors, or intersecting reinforced bond beams.

APPENDIX E

Design – Drawings

1. Movement joints: Show location and detail each type in structural walls
2. Interior partition walls: Show and detail connection to exterior structural masonry walls.
3. Mechanical and plumbing partitions: Show and indicate limits on size and spacing for these penetrations through structural walls.

Construction – Administration and Observation

Submittals

_____Verify f'm, except for veneer and stone masonry.
_____Review submittals for masonry units related to structural engineer's specifications.
_____Review submittals for mortar and grout related to structural engineer's specifications.
_____Review shop drawings for steel reinforcement when required for the project.
_____Review shop drawings for structural steel specified for use in exterior masonry.
_____Verify welder qualifications.

Pre-installation and Mockup

_____Conduct pre-installation conference with masonry contractor to assure that requirements are understood and all contractor questions are asked and answered.
_____Review requirements for movement joints and construction at wall intersections.
_____Review mockup for grouting cleaning, or as otherwise specified for the project.
_____Verify components of site-mixed mortar and grout for structural applications.
_____Discuss with the masonry contractor's field supervisor the construction of mortar joints and grouting process.
_____Verify slump flow and VSI as delivered for self-consolidating grout.
_____Discuss with the masonry contractor's field supervisor location of reinforcement and anchorage.
_____Review requirements for anchors and ties.
_____Observation formation of grout and mortar samples for specified compression testing.
_____Review results of compression test and any other required tests for structural.

Construction (for the structural engineer or special masonry inspector)

Respond to RFIs regarding structural issues (structural engineer only)
Perform periodic observation of:
_____Size and location of structural elements
_____Anchorage of masonry
_____Size, grade and type of reinforcement, anchor bolts, and anchorage
_____Welding of structural steel
_____Connections to roof, floor, and framing

APPENDIX E

Prior to every grouting, verify compliance of:

_____Clean grout space

_____Placement of reinforcement and anchorages

_____Proportioning of site-mixed grout

_____Construction of mortar joints

During grouting, verify compliance of:

_____Placement of grout

_____Preparation of grout and mortar samples for compression testing

_____Review results of compression test and any other required tests for structural

Refer to MSJC “Building Code Requirements and Specification for Masonry Structures” and The Masonry Society (TMS) “Annotated Guide to Masonry Specifications” for more detail.

APPENDIX F

Masonry Standards Design Manual Proposed Revision Form

Design Standards Revision Process
1. MnSCU will consider bona fide revision proposals to the Masonry Standards Design Manual. Bona Fide revision proposals include thorough research, this completed form, and supporting documentation attached.
2. MnSCU and MnSCU's masonry consultant will review and respond to the proposed revision on this form.
3. After review of the proposed revision, a written response will be returned to the author.
4. Submit one copy of this form for each proposed revision to: Minnesota State Colleges and Universities Office of the Chancellor Construction and Support Services Wells Fargo Place 30 East Seventh Street, Suite 350 St. Paul, Minnesota 55101

Design Standard Reference
List the specific chapter, page, specification article, drawing number from the Masonry Standards Design Manual for the location of the proposed revision:

Type of Proposed Revision	
☐ Language	☐ Drawing
☐ Specification	☐ Other _____

Proposed Revision
State specific language for revision (attach copy of manual page):
Describe drawing revision (attach copy of marked-up drawing):

Basis of Proposed Revision
Explain rationale, constraints, alternatives, and why (attach supporting documentation):

Author		**Date Requested**	
Firm		**Phone number**	
Street Address		**Fax number**	
City, State Zip			
Email			